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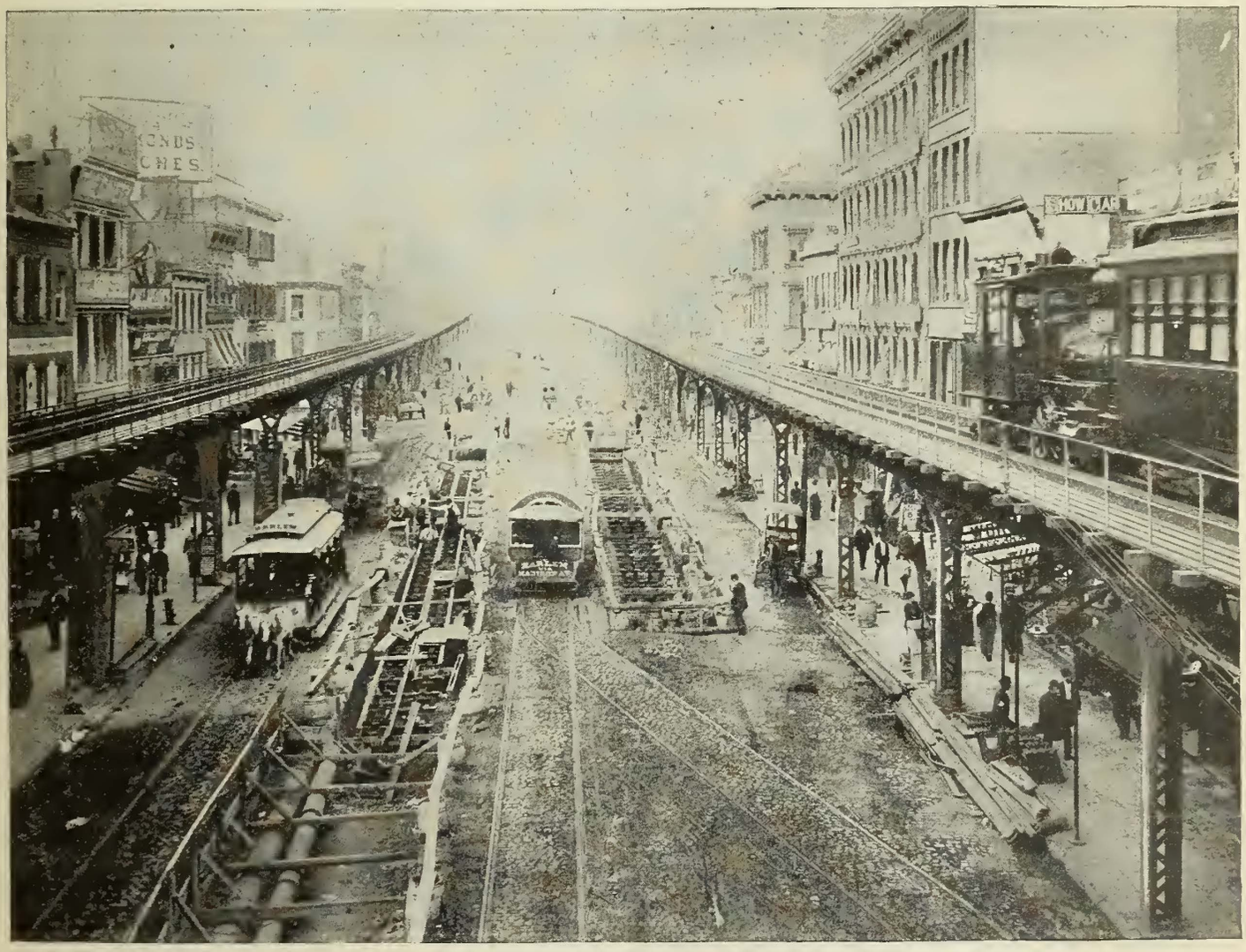
Third Avenue (New York) Cable Construction.

In order to give some idea of the difficulties met with as the work of cabling this important line progresses, we present a view on the Bowery looking north from the elevated railway station at Grand Street. In the foreground a nest of water and gas pipes is shown, and farther along the elaborate crossover switch which has been put in to accommodate the cars of the Fourth Avenue line, which turn into the Bowery at Grand Street and continue parallel to the Third Avenue tracks to Sixth Street. Other interesting details that were referred to in our last issue are shown in the illustration. The work is progressing down the Bowery as fast as circumstances will allow, the excavations having passed Chatham Square and extending nearly to City Hall. The balloon loop and terminal pit at the Post Office are well under way. The excavation for the pit being carried on by means of a shaft and temporary platform, air for the support of the workmen being forced into the excavation by means of Sturtevant fans. An effort is being made to divert all the traffic from Park Row for the present in order that the cable construction may be hastened.



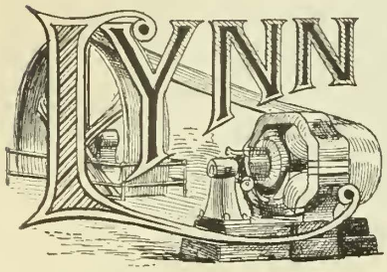
VIEW SHOWING CABLE CONSTRUCTION—BOWERY, NEW YORK CITY.

The contractor, Thomas E. Crimmins, and his engineer, F. S. Washburn, deserve much credit for the manner in which they are conducting the work, and the careful attention given to prevent the obstruction of street traffic as much as possible.

The zone tariff system is to be introduced on the lines of the Vienna Tramway Co. The district is to be divided into three zones, and the fare for one is to be two and a half cents, for two zones about three and three-eighths cents, and for three zones five cents.

RAILWAY DYNAMOS AND THEIR MANUFACTURE.

Part I.—Shop Practice as Found at the Thomson-Houston Electric Co.'s Works, Lynn, Mass.



has become famous as the home of the extensive works of the Thomson Houston Electric Co. This company has a unique history, and in many respects without a parallel in American industries. When we compare its crude beginnings of only a few years ago with its present capacity for manufacturing and developing dynamos and other electrical appliances, the wonderful power of inventive genius, when coupled with skillful financial management, is strikingly illustrated. In order that our readers may share with us the pleasure of a recent visit to this bee hive of industry, and become acquainted somewhat with the details of shop practice and the successive steps in the manufacture of the exceptionally fine railway power appliances which are being turned out, we propose to illustrate and describe, in a series of articles, so so much of the railway department as will accomplish these results. The present article will be confined chiefly to the generator construction, and will be followed with illustrations and a study of motor construction, together with a history of and reference to the future prospects of this remarkably successful manufacturing company, and the system of discipline which it exercises over its 4,000 employes.

A dynamo is a very simple machine, and the relation of all its parts can be readily understood by a novice. We have simply to revolve a loop of wire between the poles of a magnet without touching them, and in some mysterious manner, beats or pulses of electricity will be induced in the wire, which may be collected and sent into a circuit; so we call this a dynamo-electric machine. But it may be further defined as a machine for the conversion of mechanical energy into electrical energy, and *vice versa*. When used for producing an electrical current, it is called a generator; but when it converts electrical energy into mechanical, it is called a motor, and the machine may be employed as a generator or a motor, as the case may be. In fact a good generator is usually a good motor, and will act as a motor when a current of electricity is conveyed to it in a proper manner; but for motor purposes, the shape and weight of its parts are usually modified to suit the class of work for which it is designed. While electricity, as an element in nature, is shrouded in mystery, there is, as stated above, no mystery involved in dynamo construction; so we invite our readers to accompany us on a brief run through the shops while we describe the details of construction, and we have no doubt they will be as interested in what will be seen, as we ourselves were.

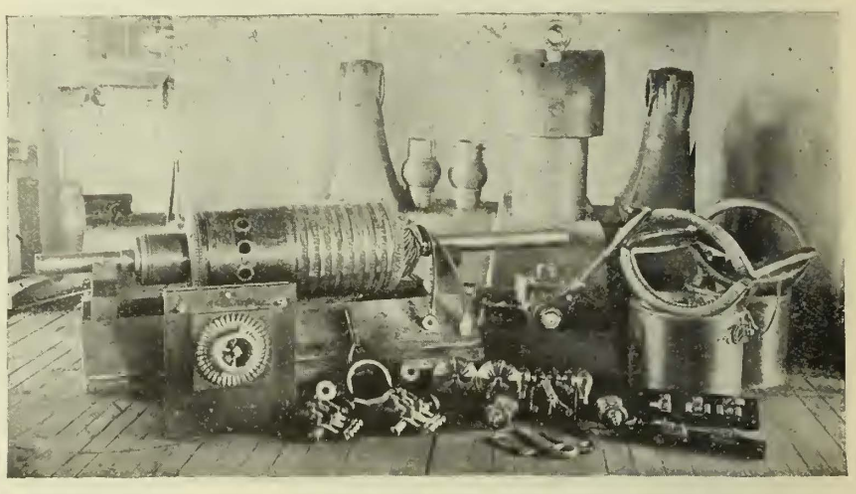


FIG. 1.—BIPOLAR GENERATOR.

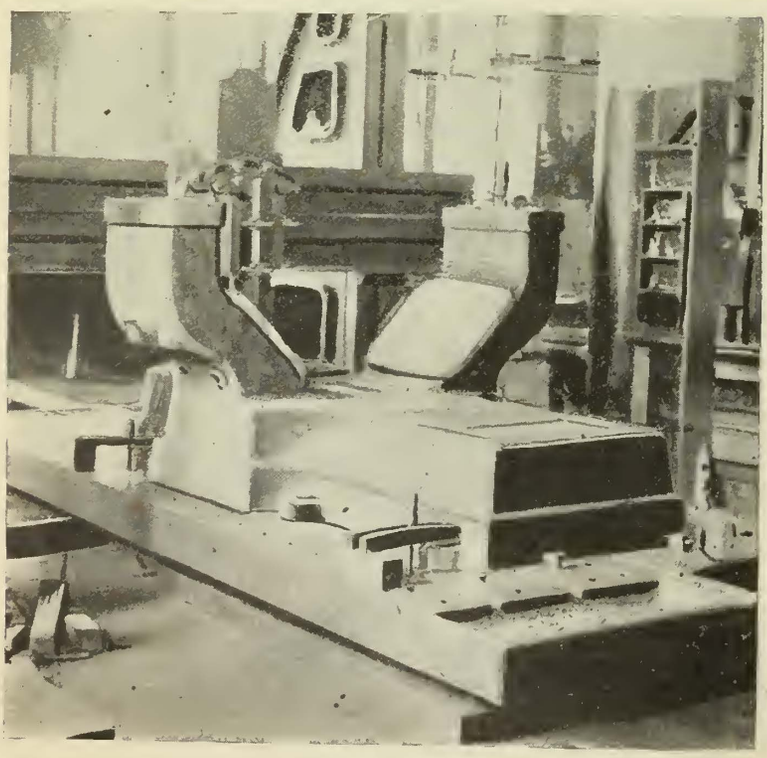


FIG. 2.—PLANING FRAME OF MULTIPOLAR GENERATOR.

It borders on the marvelous to think that bits of metal, iron and copper, when assembled in certain relations to each other, and, when certain parts are put in motion without any previous doctoring or electrifying, an electric current will be generated which may be conveyed by means of a conductor to a long distance and then be converted into power, light or heat, as the case may be. One would suppose that the parts would at least have to be magnetized before the machine would operate successfully, but usually no magnetic qualities are imparted to the iron other than it has picked up, or what has been induced from hammer blows as the frame has progressed through the shop.

If we study a commercial generator we find that it is constructed of a few general parts. We have first the stationary parts, which include the iron frame which supports the magnetic poles, called fields, spools of wire surrounding these and stands for the journal bearings. The armature, or movable part, which consists of a shaft bearing a gun metal spider to which is attached a core of laminated iron which, in turn, is surrounded by coils of wire, each of which is connected by other flexible wires to the bars of a commutator mounted on the shaft

which is designed to collect the beats of electricity which occur in the coils and transfer them to the brushes which are held in position by a yoke attached to the frame and which lead the current into a metallic circuit.

Generators are made bipolar or multipolar. The parts of the former are shown in Fig 1, but for the present we will describe only the multipolar types, as these are the ones now chiefly manufactured, and are now known as the M. P.'s when about 100 H. P. capacity. As we pursue our studies through the shops we hardly know which to admire most, the genius displayed in the design of the generators and motors themselves or that manifested in the construction of the various tools with which the work is accomplished.

The frames, which are cast from soft gray iron, are purchased from commercial foundries, chiefly from Providence, R. I.; the Lynn works at present not being equipped for making heavy castings. The frames are in two parts, and for the M. P., 500 H. P., an extension base is

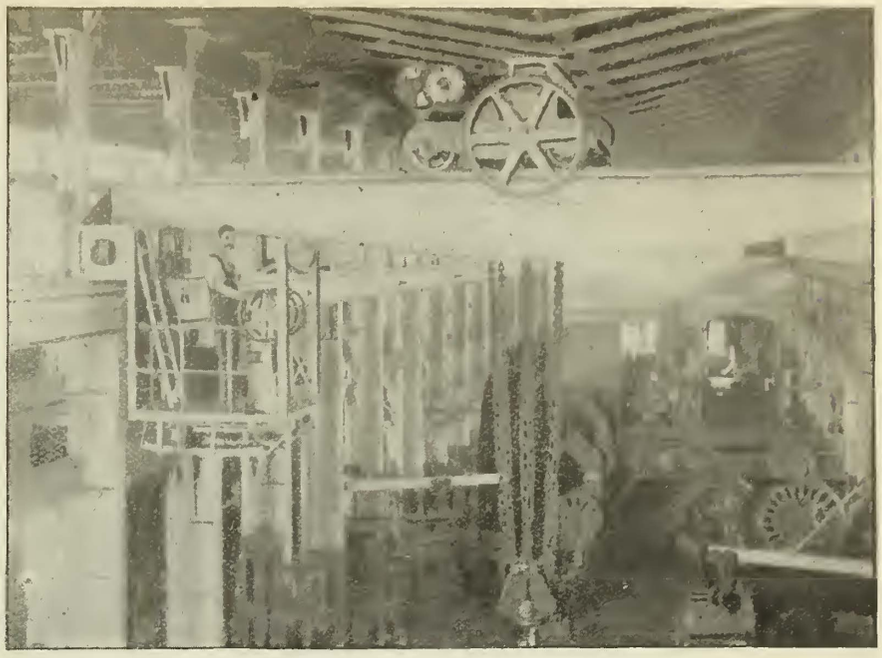


FIG. 5.—THIRTY-TON ELECTRIC CRANE.

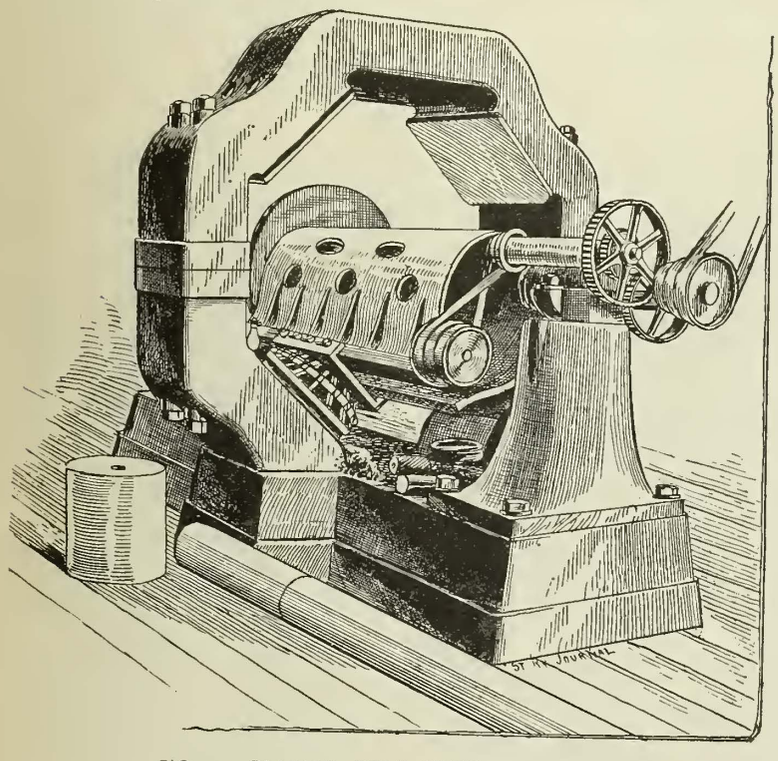


FIG. 3.—PLANING POLE SEATS.

spliced on, so that the castings complete weigh about twenty tons. On being received at the shops, they are stored within convenient reach of the planers, and the first work upon them consists in planing the different faces for joints and stands as shown in Fig. 2, for which purpose a 120 in. planer is employed.

Next, the bolt holes for attaching the stands are drilled, and if an extension is to be added the frame is transferred to a universal drill, and there the abutting ends are drilled for receiving the splicing bolts. The stands and bearings boxes are now attached, and the seats for the pole pieces are planed off on a universal boring mill which, as shown in Fig. 3, is a most interesting process; a rotary cutter (or spider) is operated on the side of a drum containing driving mechanism which is mounted on journal bearings in the position of the armature shaft, upon which it is turned, so that the cutter tool planes each seat in succession and insures their being equally distant from the centre and a uniform distance from the surface of the armature when mounted. This process being completed, the final fitting of the frame consists in chipping off the corners of the joints and other rough places by hand, when the pole pieces are bolted in place. The pole pieces are of soft cast iron with concave inner surfaces to conform to the surface of the armature. These are bolted to their seats, previously prepared, on the inner face of the frame, and surrounding these are the spools which produce the magnetic field.

The method of winding the spools is shown in Fig. 4, and at this work a large number of men are employed. The foundation of the spool consists of a thin casting or shell of gun metal of peculiar shape having flanges to support the wiring. This frame being placed on a winding form, its outer surface is covered with insulating material, when, being made to revolve, 376 turns of No. 10 insulated wire or other size, and number of turns, depending upon the size of the machine, is laid on, the wire being guided in place by the hand of the operator. The leads are soldered to the inner layer and led out at the side of the shell. Being wound the surface is covered with canvas

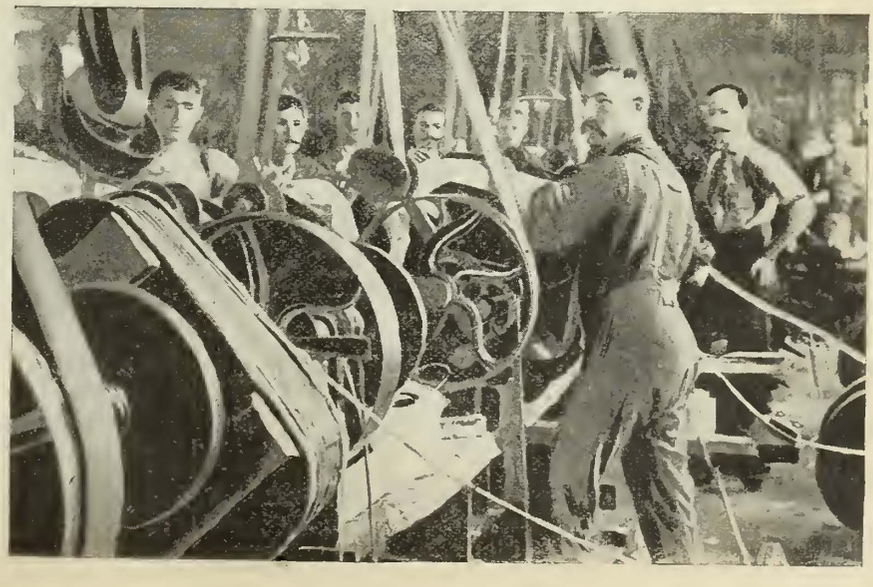


FIG. 4.—WINDING FIELD SPOOLS.

and waterproof paint, rendering the spool practically waterproof. The frame, being completed, is sent to the testing house for assembling and testing. In its journey through the shop the pieces of the heavy frame are transferred from tool to tool by means of an electric traveling, thirty ton crane, illustrated in Fig. 5, which is operated by three double reduction railway motors, and its movements are controlled by the operator from a suspended cab, as shown. Besides the electric crane, the shops are provided with wall cranes and hand hoists and narrow gauge tracks upon which low trucks are run that transport the parts from shop to shop as the case may require.

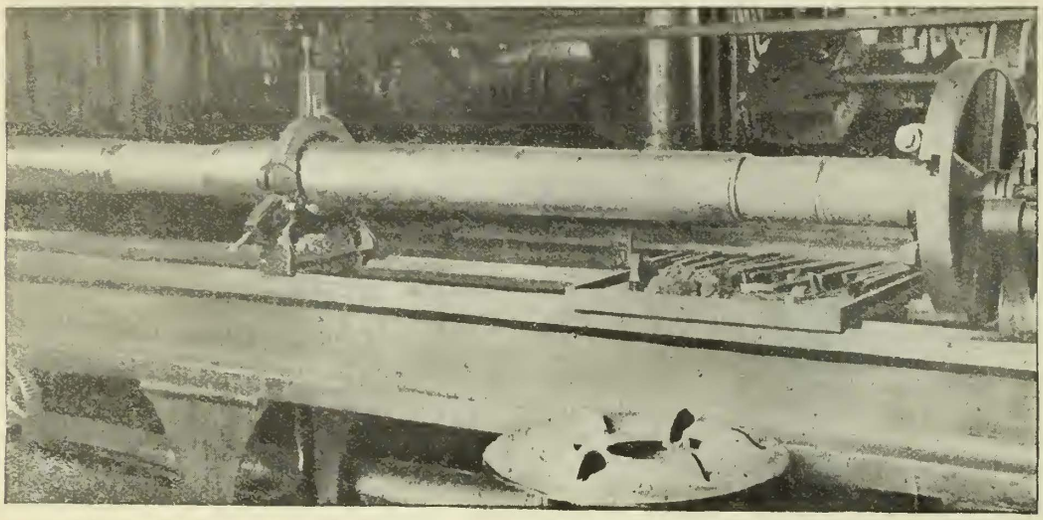


FIG. 6.—DRESSING ARMATURE SHAFTS.

The construction of the armature next claims our attention, and we will begin with the shaft, which is of forged steel, in various lengths, depending upon the size of the machine to be constructed. These are purchased from the steel mills, those for the smaller machines being forged plain, while those for the large generators are rough hammered to shape to save expense in turning. Fig. 6 illustrates the operation of turning off or dressing the shafts, the lathes being so arranged that one man can oversee the work of two machines. The key seats are then cut, and the shafts are ready for the spider which carries the armature core. This is cast of gun metal in two parts (Fig. 7) and is keyed to the shaft. One-half being in place, the process of building up the core will follow, but we must first repair to the punch and press room where thirty or more presses (Fig. 8) are employed in stamping out from sheet iron or mild steel the segments or discs from which the armature cores or rings are constructed. The plates for small armatures are cut round, with notched edges and bolt holes, so that when laid up the completed core has channels for receiving the wiring, thus saving the expense of milling out the channels. The large armatures, such as those for the ten pole generators, are eight feet in diameter, and the plates for these are stamped in segments about four feet long and then notched in a separate press. The plates are then placed in the annealing ovens, where they remain for twenty-four hours, and are then allowed to cool gradually.

The next process is shown in Fig. 9, and consists in laying up the segments about the core and shaft by hand. with tissue paper between the plates, so that the notches come opposite each other and form a continuous channel across the face for receiving the winding. The large armature cores are not built up solid, but about every three or four inches a gun metal grid, one-fourth of an inch in thickness, is inserted between the layers, which provides an air duct for ventilation, and reduces the tendency to heat. A sufficient thickness having been obtained, the second half of the spider is put on, and the plates are pressed firmly together by hydraulic power, an ordinary hydraulic wheel press being employed for the larger generator cores, and an ingenious arrangement of hydraulic pressure is provided for the smaller cores, which will be illustrated in connection with motor armatures. The core being removed from the press and the plates secured by bolts, it is mounted in suitable bearings, and the exposed portions of paper in the channels are burned off by means of a gasoline blow lamp, and the channel surfaces are mechanically smoothed out by means of shuttle files which are operated by a pulley and rocker arm.

The object of building up the armature core from thin plates, or of employing a laminated core, as it is termed, instead of a core of solid metal, is to prevent the induction of eddy or parasitic currents which would cause the core to heat and reduce the efficiency of the machine.

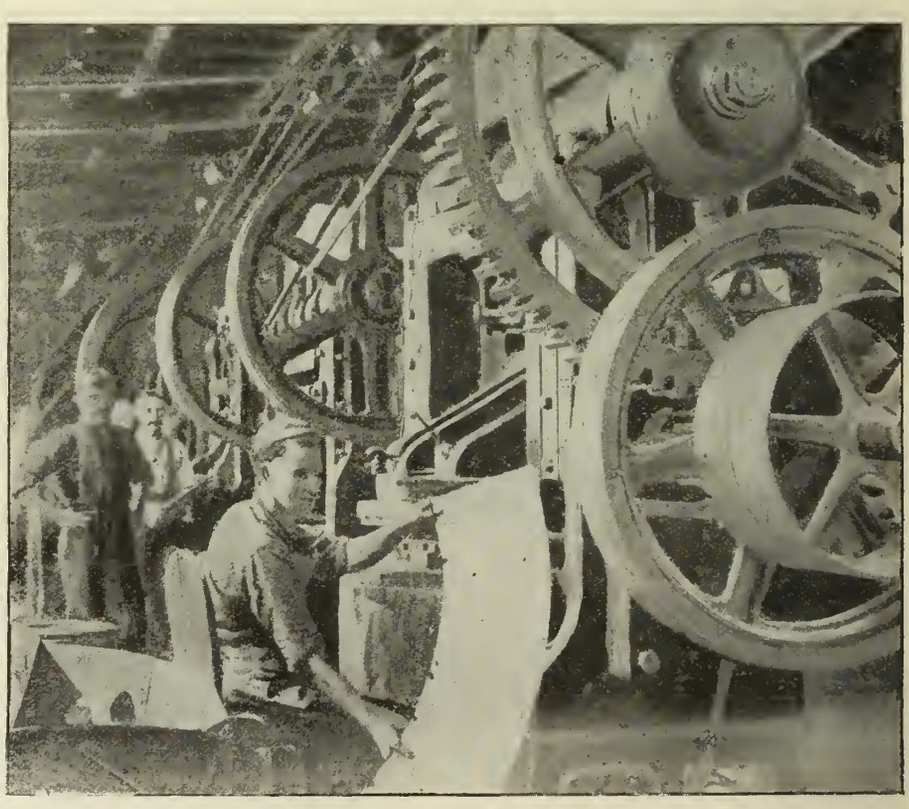


FIG 8.—STAMPING CORE PLATES.

The core is now ready for the winding, and it is transferred to another shop for this purpose. The cross sections of the channels in the face of the core, which are designed to receive the wiring, are of special shape, being larger at the bottom than at the top, so that when the wiring is in place it can be securely held by a wedge shaped wooden rod which is driven in from one end, and

prevents the possibility of the wire being thrown out by centrifugal force. In the manufacture of all the M. P. generators above 100 H. P., flat copper rods are employed instead of wire for the bobbins, and in the armature of the 300 H. P. machines, these rods are about half an inch wide, one-eighth of an inch thick and two feet long. Four of these, separated by insulating material, are placed in each channel, which is first lined with an insulating material about one-sixteenth of an inch thick, but before being put in position, a flat, insulated, ram's horn connection is riveted on, by which connection is readily made with its mate at the adjoining quarter. The bars are connected in series, so that when finished they form one continuous conductor entirely around the core. Suitable connections are attached to one end of each set of bars or bobbins, as they are termed, which serve to lead the current to the bars of the commutator. The commutator—various sizes of which are shown in Fig. 10—is a drum composed of copper bars insulated from each other, which is mounted on the shaft to one

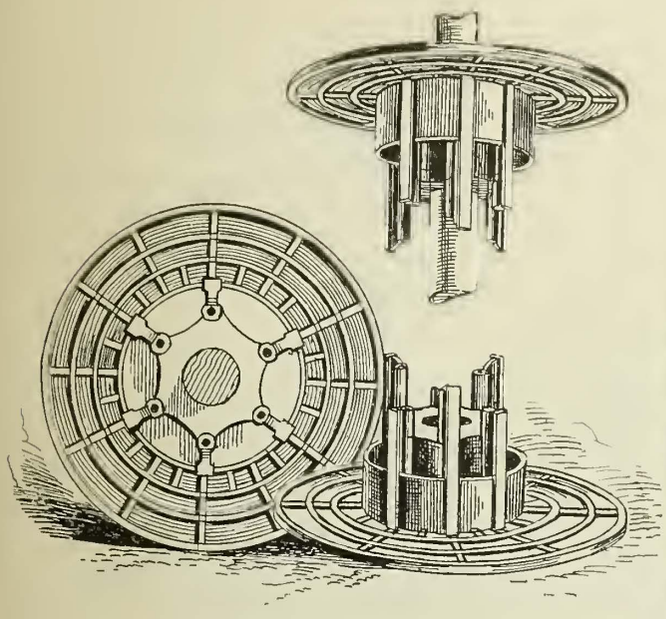


FIG 7.—GUN METAL SPIDER.

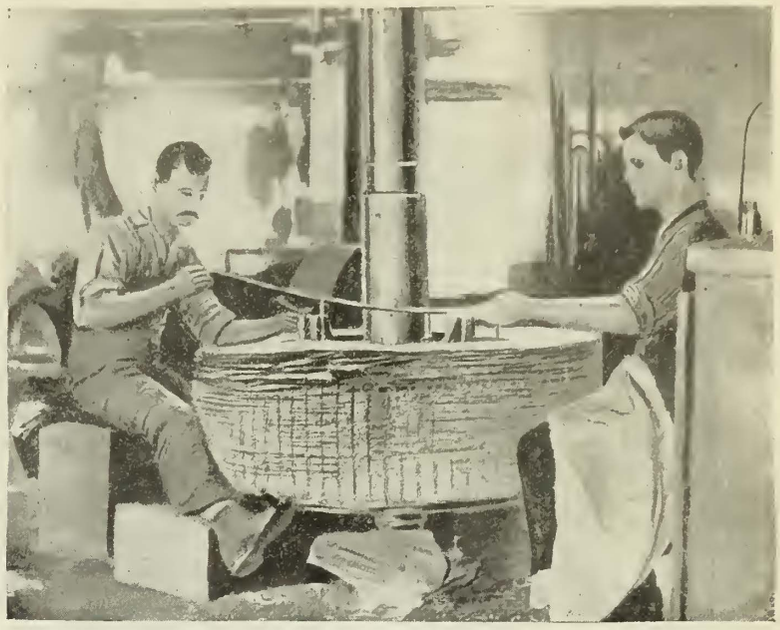


FIG. 9.—BUILDING UP ARMATURE CORE.

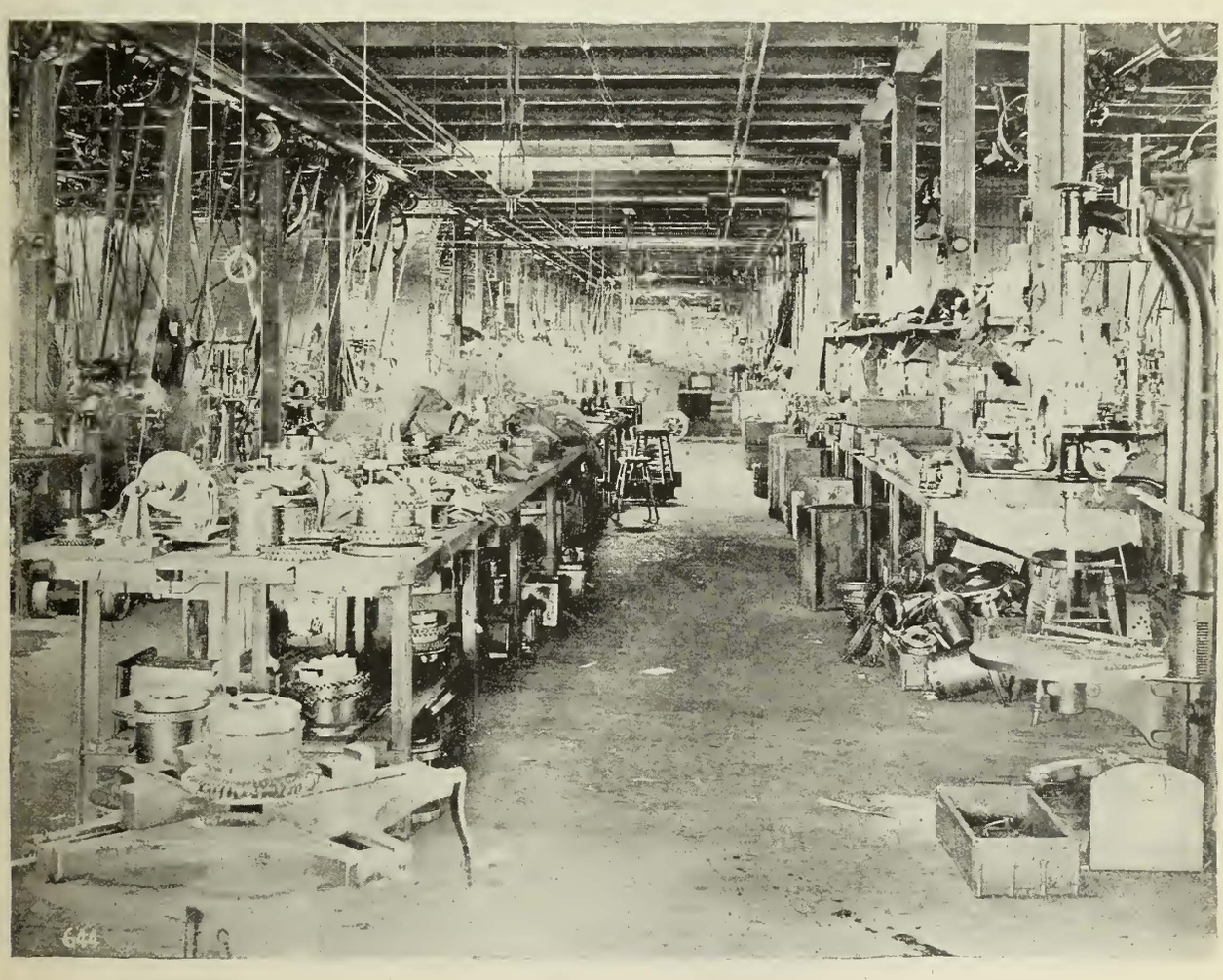


FIG. 10.—COMMUTATOR DEPARTMENT.

side of the core, and serves to collect the currents induced in the individual bobbins, and transmit them to the brushes.

The making of the commutator is a very interesting process, and one never tires of watching the details.

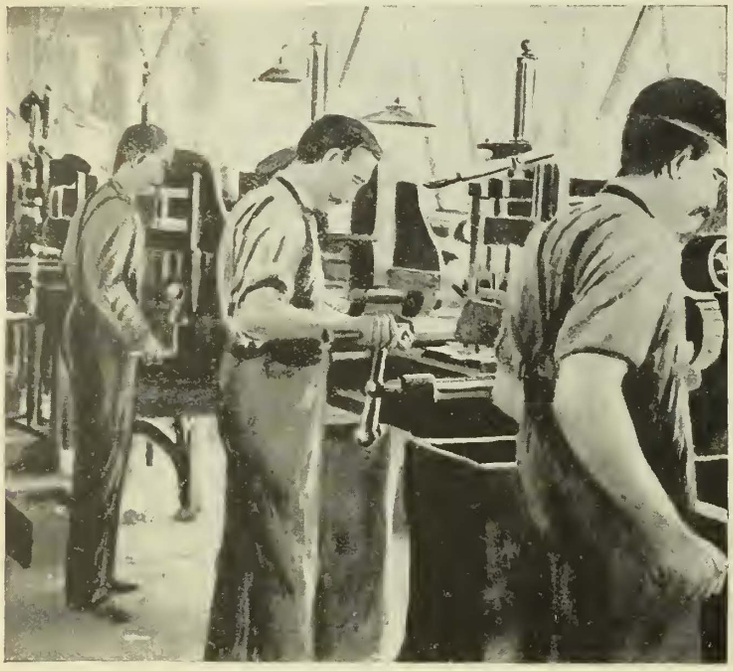


FIG. 11.—FINISHING COMMUTATOR BARS IN PROFILING MACHINES.

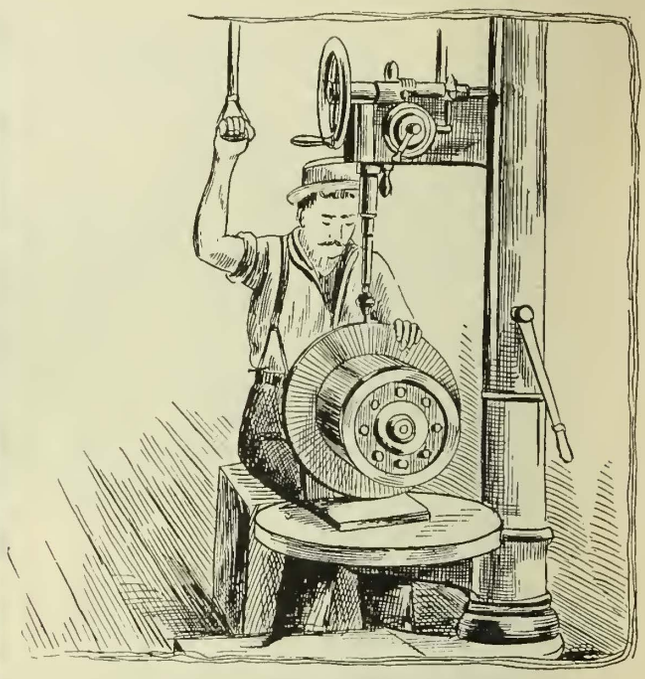


FIG. 12.—DRILLING COMMUTATOR BARS.

Wedge shaped, rolled, copper bars of suitable length are purchased from the manufacturers and on being received at the shop are first inspected and straightened by being placed on a flat steel plate and dealt a few deft hammer blows. A short ear of copper is then riveted on one end of the bar at an obtuse angle, the parts being first halved and consists of placing the bars, separated by mica and shellac insulation, within iron rings which are provided with numberless set screws by means of which the bars are firmly set together when the arc is completed.

The sheets of mica which insulate the bars of the commutator are stamped out to correspond in shape with the bars and ears, the two parts, bar and ear, being joined by trefoil dovetail, a most ingenious arrangement which prevents the mica plates from breaking or pulling asunder. This method of joining the mica plates has been adopted after a good deal of experimenting, and illustrates very

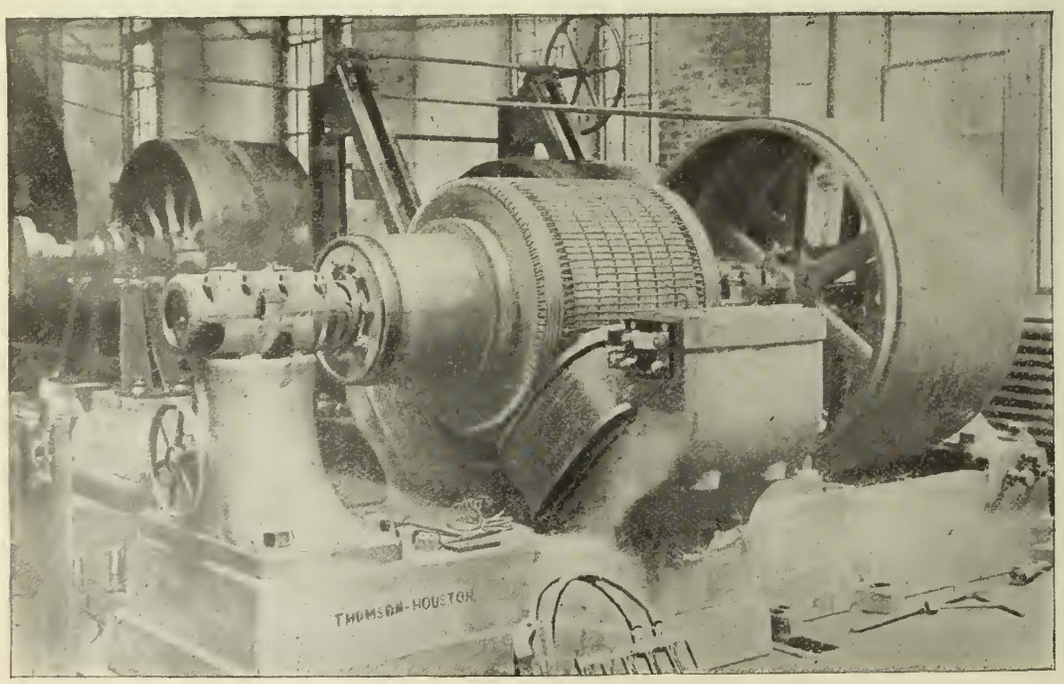


FIG. 13.—ASSEMBLING PARTS OF GENERATOR FOR TESTING.

out on a small milling machine so that they fit closely together. The bars are then passed through a series of profiling machines (Fig. 11) upon which the surfaces are brought to a smooth, uniform plane. The profiling tool consists of a vertical spindle having milling teeth cut in the lower end, which, being made to revolve rapidly, is brought down upon the face of the bars and quickly trims it off. The laying-up process is next in order (Fig. 10) forcibly the care and attention which are given to the minor details in the process of manufacture, thus insuring a reliable product.

It will be noted that mica performs an important office as an insulating material in the manufacture of generators and motors. The supply of this mineral is obtained chiefly from Canada, and is at first carefully sorted, when it is split into its ultimate sheets, young girls being

chiefly employed on this work. A number of sheets are then cemented together by shellac and baked, when they are ready for stamping into the required forms. The object of splitting the mica, mixing and then reuniting the sheets, is to prevent the possibility of a short circuit being formed between the bars by the presence of metallic ore in the mica. The commutator having been formed in the retaining rings, is placed in a lathe, and the ends are turned down for receiving the collars and following rings, which, being put on with mica insulation between, support the bars in place. The retaining rings are then removed and the surface is turned down to a required diameter, guide lines being left on each end to serve as marks for future turning. The ends of the ears are then drilled (Fig. 12) to secure the leads which connect the bobbins with the bars. The parts of the generator are then assembled, and in Fig. 13 we find the machine in the testing room and belted to an engine. The upper half of the frame being removed, the armature is placed in its bearings, and the machine is assembled with the brush holder yoke adjusted in place. The brushes, which consist of small carbon blocks, are inserted, and the adjusting mechanism, which consists of a hand wheel and worm gear, as shown in Fig. 14, is put in place, and the self oiling boxes with their interlaced linings (composed of gun metal and babbit) being adjusted and the poles joined by a metallic circuit, the engine is started, when our assembly of inanimate matter suddenly becomes, apparently, a thing of life, capable of sending forth a mysterious force which may be transformed into power or light, or which may produce a disagreeable shock to the human being who is so unfortunate as to form part of the circuit.

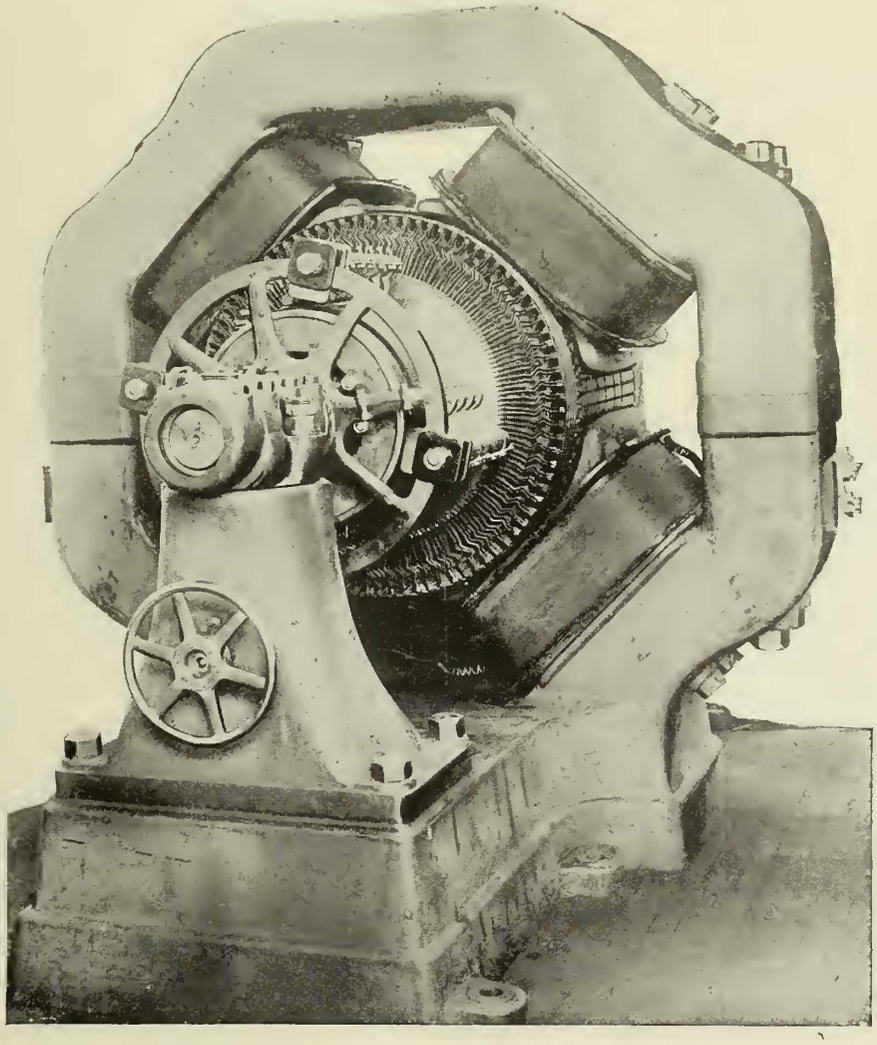


FIG. 14.—500 H. P. MULTIPOLAR GENERATOR.

We have followed our machine through its various stages of development, but have overlooked one of the most important details, and one which has contributed more than any other to the excellence of the product, and that is the rigid inspection and testing to which every part is subjected before leaving its individual department. The journals of the shaft have been callipered, the joints of the frame, etc. have been examined, the wiring has been inspected, and so on with other details. Every defective part has been rejected, and our machine stands as perfect as mechanical skill can make it.

A NEW line of street cars has been constructed at Paris, between the Madeleine church and the manufacturing suburb of St. Denis, especially for electric traction. The trial trips were recently run on a portion of the route between the Place aux Gueldres and the gates of St. Ouen, and with much success. A second service of electrically hauled street cars will be organized shortly between St. Denis and the gates of St. Chapelle.

Progress of Electric Railway Equipment in Brooklyn.

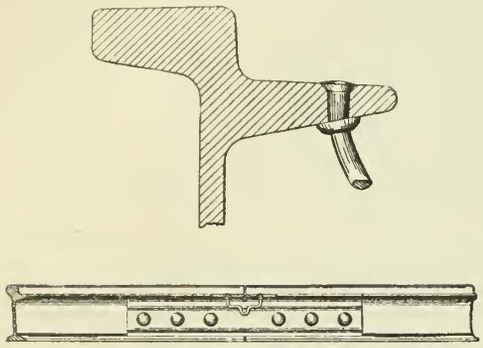
Work on the new power station of the Brooklyn City Railway Co. at the foot of 52d Street, Brooklyn, is being pushed forward as rapidly as possible, and practically all of the foundations have been completed. This part of the station is very substantial and has required in its construction about 10,000 tons of granite. The builders are now at work on the brick chimney, which is to be 213 ft. high, and are advancing in its construction at the rate of about five feet per day. The side walls, which are of brick, are also progressing rapidly, and work is about to be commenced on the iron work, which includes the the elevated gallery in the centre of the power station, about sixteen feet from the ground, upon which the generators will be placed. In the neighborhood of thirty-five miles of track have been prepared for the electric equipment, and about twenty-two miles of overhead system have been erected. This part of the work is also progressing rapidly, and the company expect to have by Christmas fifty miles in operation.

The rolling stock, which is at present being built or remodeled for the electric equipment, consists of 110 cars, each with a length of body of twenty feet five inches. Fifty of these will be new cars, half being supplied by the Lewis & Fowler Manufacturing Co., and half by the J. G. Brill Co. The other sixty will be sixteen foot cars taken from the present stock of the Brooklyn City Railway, but changed over so as to have the length mentioned above. These sixteen foot cars will have new sills, new platforms, new dashboards and new sashes, when necessary, and will be repainted and revarnished. For the interior ornamentation the company will use veneer oak or similar woods, fastening it to the old carlines of the roof, while the roof itself will be strengthened by introducing steel carlines at four different points. Of the sixty cars now being changed, fifty will be remodeled by the Brooklyn City Railway Co., and ten by the Lewis & Fowler Manufacturing Co. New trucks will be furnished for all the cars, the types of trucks selected being the Taylor, the Pearson, the McGuire, the Peckham, the Brill and the Lewis & Fowler.

The engineers of the Atlantic Avenue Railway Co. are also busily engaged in supervising the installation of their electric equipment. The company have laid a considerable amount of new rail, and are at work on the construction of their power station. The first car of those which are being built for the company by the St. Louis Car Co., at St. Louis, Mo., is expected shortly.

The bonding of the rails for an electrical return is being done by the company in a novel manner, as shown by

the accompanying cut, and a patent on the method has recently been secured by the inventor, T. J. McTighe, of Barry & McTighe, of New York, engineers for the Atlantic Avenue Railway Co. The bond, instead of being three pieces of metal, is a single piece with shoulders or rivet heads formed by upsetting the metal, or it may be made from stock, the diameter of the shoulder being swaged down to form the rivet ends, or the ends may be welded to the body piece. The bond is but from nine to ten inches long instead of thirty inches or more, and instead of being connected through the web of the rail is connected through the tram of the rail near its end. In this way the resistance of the rail bonds is reduced about three-fourths, and the whole rail bond system can be inspected frequently without disturbing the pavements in any way. To prevent the head of the rivet wearing off, the hole is countersunk.



METHOD OF BONDING RAILS—ATLANTIC AVENUE RAILWAY, BROOKLYN

Love Electric Railway System in Chicago.

The Love electric underground conduit railway is operating with great success on the Fullerton Avenue loop of the North Chicago Street Railroad Co. A few weeks ago the armature of the generator at the power station was burned out by lightning, and as it was necessary to send East for a new one, the motor cars were not run for a short time. During the interim a number of minor changes were made on the road, and, to quote Superintendent Roach, "It has since been operating without a hitch of any kind." The North Chicago Street Railroad Co. which have accepted the road are greatly pleased with its operation, and it would not be surprising if the system was installed on other lines of the North Side company. The test which was insisted upon by that company was extremely severe. They operated it entirely by "green" men. When an employe learned his work thoroughly he was removed from his position as motorman and a new hand was substituted. During the period of testing there was snow to be encountered, and rain fell on sixty days, flooding the streets through which the road runs, from curb to curb. It is stated that the motor cars now perform the work of seventy-five horses, that the services of nineteen men are dispensed with, that sixty electric lights are fed with current from the generator, and that the expenditure for coal is not over $4 per day.

The Love company have taken a contract for the installation of a road in Washington, D. C., and General Manager Wheeler states that he has been requested to furnish figures for the introduction of the system on more than 150 miles of road.

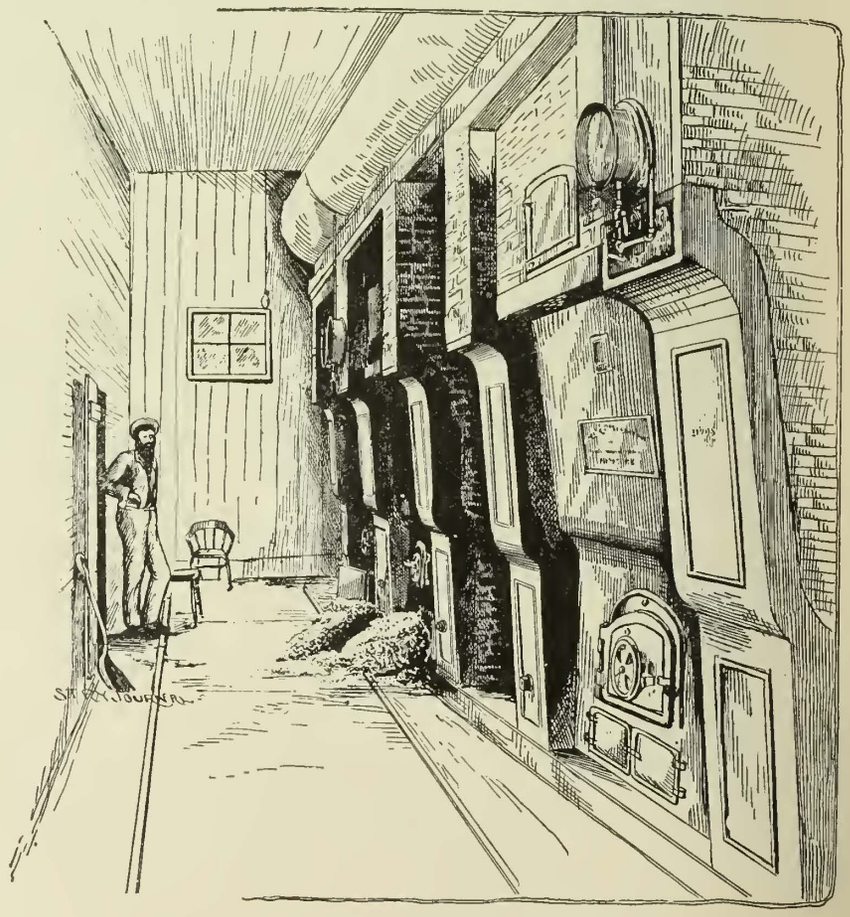
Through the courtesy of Mr. Willard A. Smith, of the Transportation Department of the World's Columbian Fair, we are in receipt of a handsomely engraved invitation to be present at the ceremonies attending the dedication of buildings at Jackson Park, October 11–13, 1892.

The Boiler Equipment at Yonkers, (N. Y.)

The accompanying engraving gives a view of the boiler room of the Yonkers (N. Y.) Electric Railway described in our last issue. The boilers are of the Stirling water tube type, and are three in number, of eighty horse power each. They are built to carry a steady working pressure of 125 lbs., and are carried on iron supports independent of the brickwork. Coal is carried directly to the furnace doors by a hand car running on the track shown in the engraving.

The construction of the Stirling boiler is a departure from that of other water tube boilers, and possesses many excellent features. The boiler consists of three upper drums and one lower or mud drum made of the best flange steel. In one end of each drum is a manhole faced elliptically, against which a manhole is fitted and held in place by wrought steel bolts and arches. The removal of these manhole plates gives access to every tube in the boiler, and the drums, being three feet in diameter, are large enough for a man to work inside conveniently. Expanded into these drums are three and a quarter inch tubes, so bent as to enter the drums at a proper radius, and to allow for unequal expansion and contraction. There is no cast metal of any kind used in the construction of the boiler, which permits a high pressure to be carried with absolute safety.

The water is fed into the rear upper drum, and, during its passage to the mud drum (which requires from twenty to thirty minutes when the boiler is working at its rated capacity), it comes in contact with the ascending gases and becomes heated to a temperature over 300 degs. At this temperature the lime, magnesia and other impurities, are separated from the feed water and deposited in the comparatively cool mud drum, where they are easily blown off. As a result, the front two banks of tubes are filled with chemically pure water and do not scale. This is a very important feature for many localities, for, given a clean heating surface inside and out, fuel economy is a natural result. There is also an absence of handhole plates, which often cause much annoyance from leakages.



BOILER ROOM—YONKERS STREET RAILWAY.

The Safety of New York Elevated Travel.

The New York Elevated Railroad, in many important particulars, affords the most perfect service in the United States. On its ninety miles of track it carried in 1891 over 550,000 passengers for every day in the year, and the business is growing every day.

The value of this elevated structure to the community, in dollars, may be inferred by noting that the tax appriasers of New York for the year 1892, put the increase of real estate in the three wards above Fortieth Street, at $22,000,000 in excess of the year 1891. As this railway service has been in existence for about fourteen years, the total increase in the assessed value of the mentioned districts reaches a colossal figure.

The greatest complaint against this service is that it is insufficient for the wants of the rapidly growing districts, which this service alone has created. Trains are frequently run at minute intervals in the busy hours of the day, made up of five passenger cars holding, when crowded, as they usually are at such times, about 100 passengers each, or 500 for the entire train. The seating capacity, however, is only 300 for each train; the aisles and platforms hold the remainder.

But the astonishing part of the whole business is, that not a single passenger's life has ever been lost (among those remaining on the cars) since the road went into existence. This record is largely due to the ability and management of Col. F. K. Hain, the road's third vice-president and general manager. This safety to human life may be appreciated by a reference to government statistics, regarding the loss of life annually on the steam surface lines. The proportion of passengers carried on the elevated road, to those carried on all the steam surface roads in the United States, is two to five. For the year ending June 30, 1890, on the steam surface lines, there were 286 passengers killed and 2,425 injured, which year is a fair average. On the steam surface roads, one passenger is killed to every 1,727,789 passengers carried, or for every 41,425,823 miles accomplished.

If the elevated road killed and injured as many passengers as the surface lines, counting a three mile trip as the average on the elevated railroads, against an average journey of 24.06 miles for each passenger on the steam surface roads, to maintain the average for that year, fourteen should have been killed and 121 injured on the elevated roads. Multiply these figures by the nearly 2,000,000,000 passengers the elevated roads have carried since they went into existence, and to maintain the country's average loss of life, etc., about 140 passengers should have been killed, and 1,210 injured.

It may be noticed, we do not refer to train hands in either case, but only to passengers; of these, as has been stated, none have ever been killed, who remained aboard the cars on the elevated road, and not half a dozen have ever been injured, and these injuries have been very slight, and of little consequence, comparatively, when the total volume of this vast business is considered.

THE second electric railway using the overhead system in Belgium, will be installed between Jeuseppe and Liège. The Thomson-Houston system will be used.

The Baltimore Belt Line Tunnel.

The announcement that electric locomotives would be used in the Baltimore belt line tunnel has concentrated the attention of electric railway engineers upon that great undertaking now being pushed rapidly forward to completion in the city of Baltimore. The use of electric power upon this underground railway to draw ordinary passenger cars will mark a departure in electric railroading in this country, and seems only the forerunner of a much wider application to trunk line conditions.

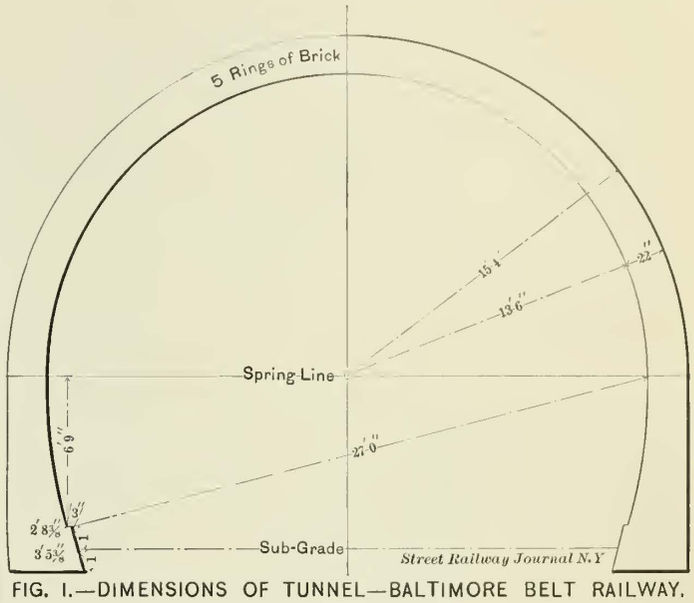


FIG. 1.—DIMENSIONS OF TUNNEL—BALTIMORE BELT RAILWAY.

The main object of the belt line is to afford the Baltimore & Ohio Railroad Co., a shorter and all-rail route to the North and to give this company and the Maryland Central Railway Co. facilities for reaching the heart of the city of Baltimore equal to those enjoyed by the Pennsylvania Railroad Co. At present the trains over the Philadelphia division of the Baltimore & Ohio Railroad enter and leave Baltimore by a ferry transfer, three-quarters of a mile in length.

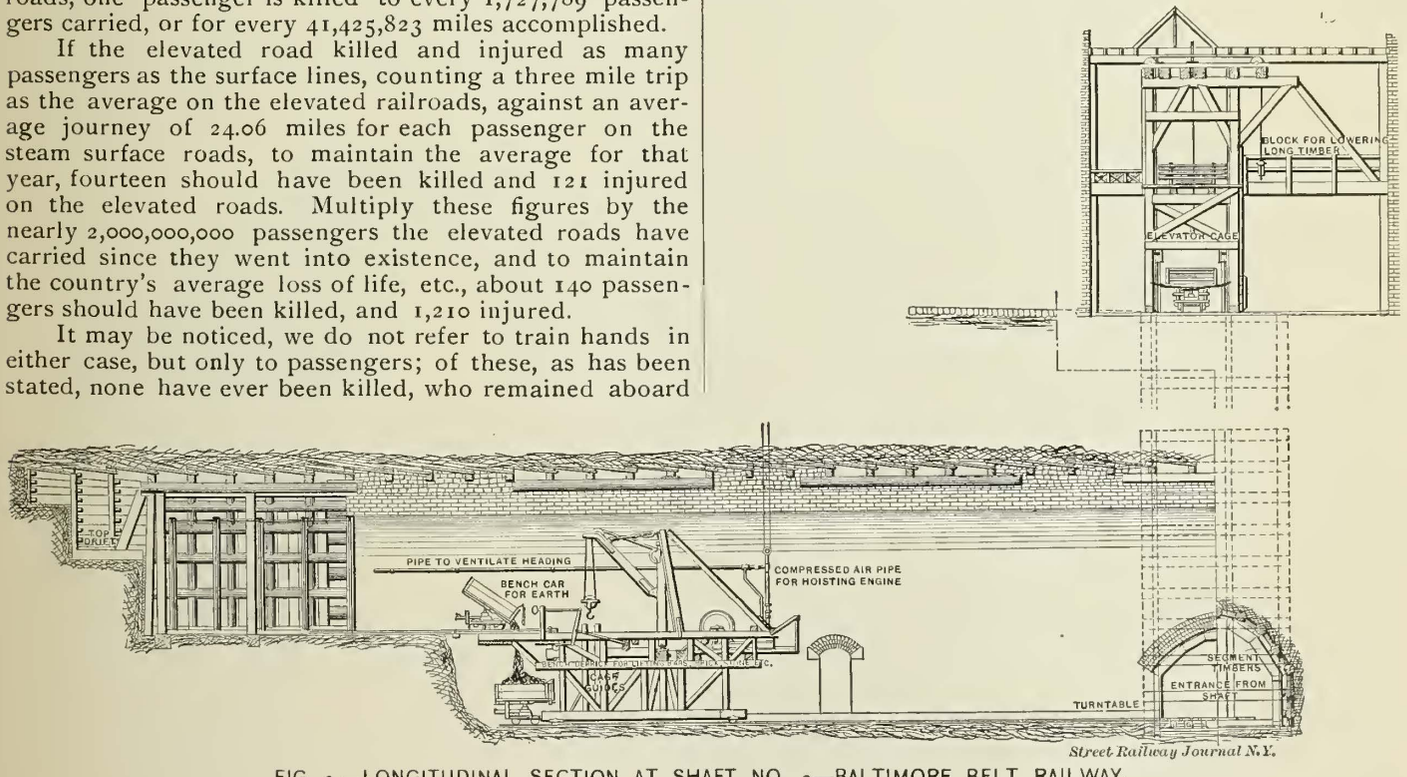


FIG. 2.—LONGITUDINAL SECTION AT SHAFT NO. 3—BALTIMORE BELT RAILWAY.

The work of constructing the tunnel is under the charge of Messrs. Ryan & McDonald, contractors, who have successfully built many of the underground rail-

roads of the country. The belt railway commences on South Howard Street, near Hamburg Street, in the neighborhood of the yard of the Baltimore & Ohio Railroad, and runs out Howard Street beyond Richmond Market, then through open cuttings to the terminal of the Maryland Central Railroad, then along the south side of Seventh Street to the city limits and Bayview station, where it will connect with the tracks of the Philadelphia division of the Baltimore & Ohio Railroad.

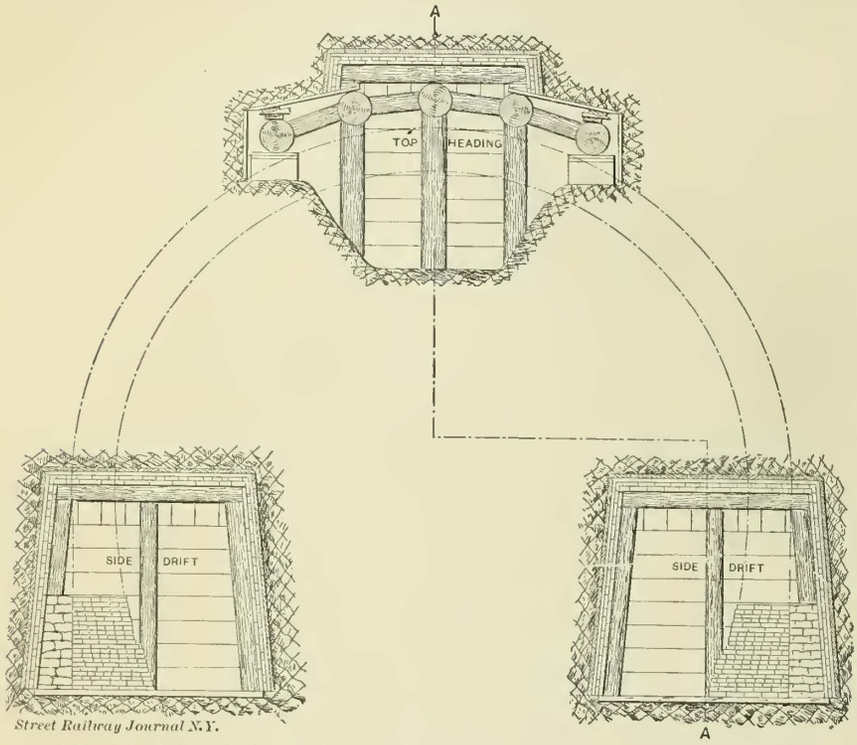
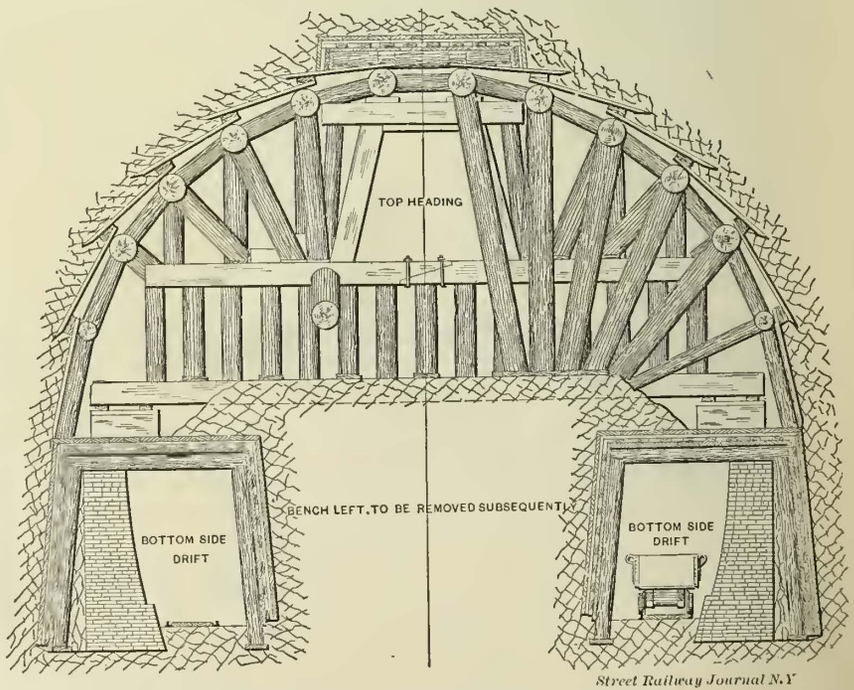


FIG. 3.—TRANSVERSE SECTION OF TUNNEL DURING CONSTRUCTION—BALTIMORE BELT RAILWAY.

To provide capital for the work, the Maryland Construction Co. was organized by officers of the railways interested and Baltimore capitalists, and John P. McDonald, one of the present contractors, was elected president. Work was commenced in September, 1890. The entire length of line is 7.2 miles, of which 8,600 ft. is underground. The estimated cost of the entire line is about $6,000,000 and of the tunnel $1,750,000.

It was in the tunnel, of course, that the chief difficulties were met. The section decided upon is shown in Fig. 1 and is twenty-seven feet wide and twenty-two feet high, maximum dimensions, the excavation necessary being from three to five feet greater than this. The greater part of the soil through which the tunnel is being driven is sand, but there are seams of gravel, clay, etc., with layers of rock, and one section where for about 550 ft. the tunnel will be driven through solid rock. The greatest distance between the crown of the tunnel and the surface is seventy feet, and as the work extends the greater part of its length under Howard Street, one of the principal business streets of the city, excavation had to be carried on without obstructing the street, adding largely to the difficulty of the work.

Five shafts have been sunk from the surface, all on one side of the line of the tunnel, and these are connected to the tunnel at the bottom by horizontal drifts. Fig. 2 shows the details at shaft No. 3, the horizontal dimensions of which are 9 × 14 ft., inside timbers, and total height of hoist, fifty-four feet. The shaft is divided into two compartments, the elevator well and a well in which to lower long timbers. The former contains a cage carrying rails for the dump car, and is operated by a Ryan & McDonald hoisting engine situated at the mouth of the shaft. Here is also placed a second engine for operating a timber derrick, as well as an electric light engine and dynamo, and the boilers for furnishing steam. The material removed from the heading is dragged by mule power in dump cars to the shaft and raised to the surface, when it is dumped into carts and afterwards used for filling on the Baltimore & Ohio Railroad. Fig. 2 also shows section of a heading with bench derrick at work. There is a similar derrick and rigging in the opposite heading. The arrangements at the other four shafts are like those described above, except that at shaft 5 buckets are used to hoist the excavated material instead of elevators, and there is no electric light plant, current for the arc lamps in the drifts being derived from the stations at shafts Nos. 2 or 3. Otis Bros., of New York City, supplied the elevators for shafts Nos. 1, 2 and 3, and Bates & Co. of Baltimore, that at shaft No. 5. Figs. 3 and 4 show sections of headings and method of driving employed. As will be seen, two bottom side drifts and one top drift are driven, the former being kept about twenty-five feet in advance of the latter. By this method the material through which the top drift is being driven is kept drained by the bottom drifts. Considerable water has been met in the construction of the tunnel, and in many of the bottom drifts enough water is constantly flowing to fill a five inch pipe. The bottom drifts are about 8 × 8 ft., affording sufficient room for two miners and a helper. By working it two ten-hour shifts an advance of from fifty to ninety feet per month can be made in each heading. The bottom of each drift is then excavated until a solid foundation is obtained, concrete, if necessary, being laid for a depth of one or two feet; the side walls are then built, and the space between the side walls and the outside lagging is packed with dry rubble or rubble masonry. As the top drift is enlarged its supports are arranged to rest on the side walls, as shown in Fig. 4, leaving the material between the two side drifts to be removed later.



F.G. 4.—TRANSVERSE SECTION OF TUNNEL DURING CONSTRUCTION, TOP HEADING ENLARGED.—BALTIMORE BELT RAILWAY.

The brick work of the arch is built in eighteen foot

sections, a section being commenced as soon as the excavation has been completed, in advance of the finished portion for the necessary distance. The arch is built in most places of five layers of Baltimore brick, but eight

FIG. 5.—INTERIOR OF TUNNEL—BALTIMORE BELT RAILWAY.

layers are used in some portions. Air for ventilation is supplied from the exhaust of the drills and hoisting engines in the headings, and also by special pipes supplied by air from a conductor located at the corner of Park Avenue and Preston Street and which also supplies hoist, drills and pumps. This condenser, the only one used in the work, has cylinder dimensions eighteen and a quarter inches diameter, with twenty four inches stroke, runs at ninety-four revolutions and furnishes 683 cu. ft. of free air per minute. It was manufactured by the Ingersoll-Sergeant Drill Co. who also furnished the three drills employed in the work. Fig. 5 is from a photograph taken by flash light of one of the top headings, and Fig. 6 shows two Ingersoll-Sergeant drills used in the removal of rock. The linear feet of the tunnel completed July 30, 1892, was 5,405.

A description of the electric locomotives to be used, and which are being manufactured by the General Electric Co., at Lynn, Mass., was given in our June issue.

Which Electric Motor?

The following quotation from a letter recently received by us, graphically describes the troubles which one street railway manager had in endeavoring to select the best electric system to use upon his road:

"Before I started on my investigating tour I thought from what I had learned from street railway men and from a good deal of reading in the STREET RAILWAY JOURNAL and elsewhere that I knew something, but what little I did know was knocked out of me by listening to the sweet words spoken in my ears by the representatives of the different motor manufacturers. I admit now that I know nothing. If I could combine the different systems together, that is, if I could pick out of each that part which is so much better than the other fellow's part, I have come to the conclusion that our cars would run without power, and we could dispense with a steam plant.

"After my return from my tour of inspection I wrote about forty letters for information to as many different street railway companies and received answers from nearly all, and I agree with the president of a street railway company who closes his letter as follows: 'I would advise you not to take much stock in the talk of sellers of equipments, but find out your own needs and put in plans to suit yourself.' I agree in part with him Talk is cheap. I am advised to put in a seventy horse power generator for my four cars, and that each car should have a thirty horse power in motors all agreed to that. But one representative motor man said: 'You ought to adopt our system because you can propel your cars with half the current required by the motors of the other manufacturers.' And to verify his statement, he pulled out a book of tables showing this motor really only took half as much power as the other motors. This was good news to me, because I thought that if this motor took only half as much current as the others, a thirty-five horse power would be amply large enough. But what was my surprise when in reply to my inquiry as to what size of generator he would recommend, he smilingly said: 'A 120 H. P. generator will do.'

"Nearly every answer of inquiry closes by saying, 'Be careful; don't believe half what the equipment men say. Make your own plans. Don't build too small a station. We could have saved thousands of dollars if we had to do it over again.'"

THE contractors for the electric road from Alexandria (D. C) to Mount Vernon have been put under bonds to complete their portion of the work by September 1.

THE St. Paul City Railway Co., and the Minneapolis St. Railway Co. will soon be things of the past, and in a very short time the street railway systems of St. Paul and Minneapolis will be opened and operated by the Twin City Rapid Transit Co., which was organized several months ago. As one of the first steps in the movement, General Manager Scott of the City Railway Co. has resigned his position, and the new company will have its headquarters in Minneapolis, and will be in charge of General Manager Goodrich.

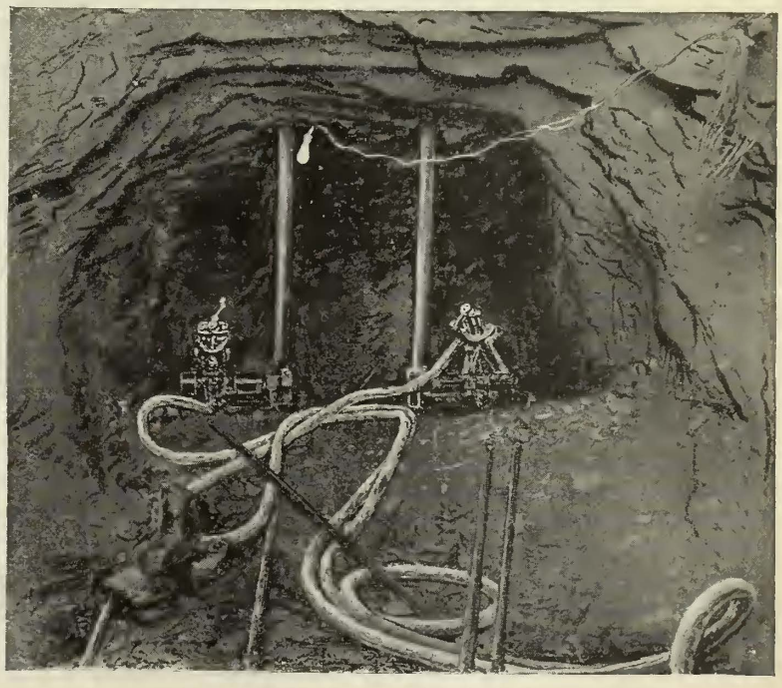


FIG. 6.—DRILLS AT WORK—BALTIMORE BELT RAILWAY.

World's Fair Transportation Building.

In the March issue of the STREET RAILWAY JOURNAL appeared an engraving showing the Transportation Building at the World's Fair grounds. Since that time work on the structure has proceeded with great rapidity, and the building is now approaching completion. The cut herewith presented is a reproduction of a recent photograph of the north entrance. The entrance, it will be observed, is decorated by a number of life-size figures, some allegorical, and others of eminent men who have contributed by their inventions to the development of transportation machinery and appliances. The figure at the right is that of a helmsman, and that at the left of a brakeman.

Gas Motors in Illinois.

J. M. Roach of the North Chicago Street Railroad Co. has been elected president, and O. W. Owsley, of the West Chicago Street Railroad Co., vice-president of the Connelly Motor Co. of Illinois, mentioned in our last issue, as recently organized to build gas motors under the Connelly patents. The company have secured a factory at 197 Clinton Street in Chicago, and five motors are already in course of construction. It is expected that these will be completed and ready for use on the lines of the North Chicago Street Railroad some time during September. They will be used on the Garfield Avenue loop. When these are built the company will construct fifteen motors for use on the Sedgwick Street and Larrabee Street lines. The company hope to complete these machines so that they may be operated during next winter. The general design of the motor is the same as that operated with success by Mr. Connelly on the North Side system, but minor changes will be made in the construction, which will add to their mechanical strength.

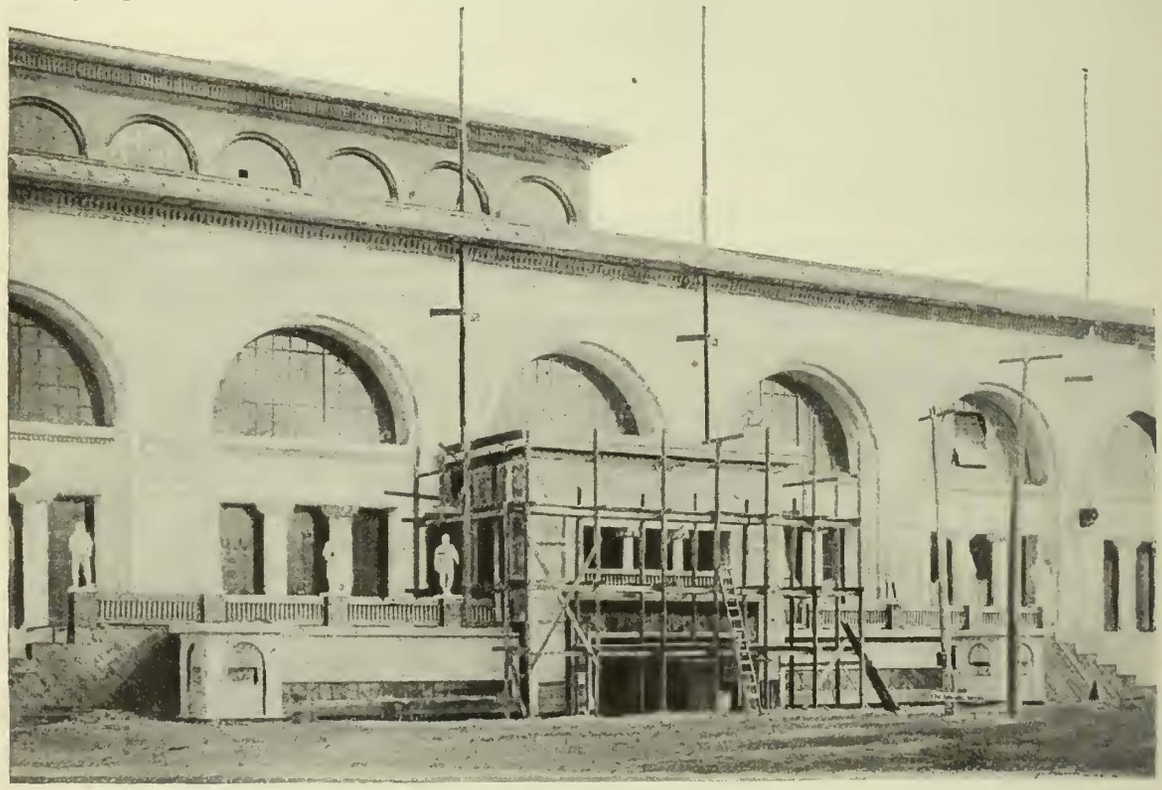
THE annual report of the General Omnibus Co., of Berlin for 1891, according to *Le Journal des Transports*, shows the number of passengers during the year to be 20, 872,701 in place of 19,193,192 in 1890. The number of passengers per vehicle per day was 414, in place of 409 during the preceding year and the receipts were $558, 553.68, an increase of $43,081.92 over 1890. In spite of the increase in cost of forage the dividend declared was 12 ⅓ per cent, the same as the preceding year.

An Air Brake for Street Railway Cars.

With the change from horse power to mechanical traction in street railway service, the greater weight and, in most cases, the greater speed of the cars have increased the demand for a quick action power brake. Trains composed of several cable cars or electric cars and trailers, weighing from six to ten tons or more, have to be stopped quickly in crowded streets so that the necessity of a power brake is almost, if not quite, as indispensable as in steam railway service. Air brakes have now practically supplanted all others in steam railway service, and in our April issue of last year we described the Genett air brake which was designed for street car service. In the accompanying illustrations is shown the same brake, improved, and as now placed on the market by the Genett Air Brake Co., of 11—23 So. Jefferson Street, Chicago, and 150 Broadway, New York.

The air compressor is small, compact and effective, and with the rest of the apparatus is so placed as not to interfere in any way whatever with the electric equipment. The air pressure in the cylinder is maintained steadily at any desired pressure without any attention from the driver. The action of the brake is instantaneous, both in application and in release, and it is capable of frequent application without fear of using up the stored air pressure. The brakes on a train of several cars can be operated by one motorman or driver, and can be applied to every wheel on the train, holding the wheels just short of the sliding point and thereby making the best possible stop without noise, jar or injury to the machinery. The brake is simple in construction, has few parts, and the cost of repairs is very small. Fig. 1, shows a car and the apparatus in place, with a section of the lower part of the car broken away to show the position of the machinery and cylinder. In Fig. 2, *1* is the air pump or compressor, *2* the eccentric which is attached to the axles of the car and furnishes motion to the piston of the air pump, *3* the jam cylinder which contains a piston attached to brake levers in such a manner that when the air pressure forces out the piston the brakes are applied, *4* the controlling valve with which the man in charge applies and releases the brake, *5* the reservoir where the compressed air is stored ready for use.

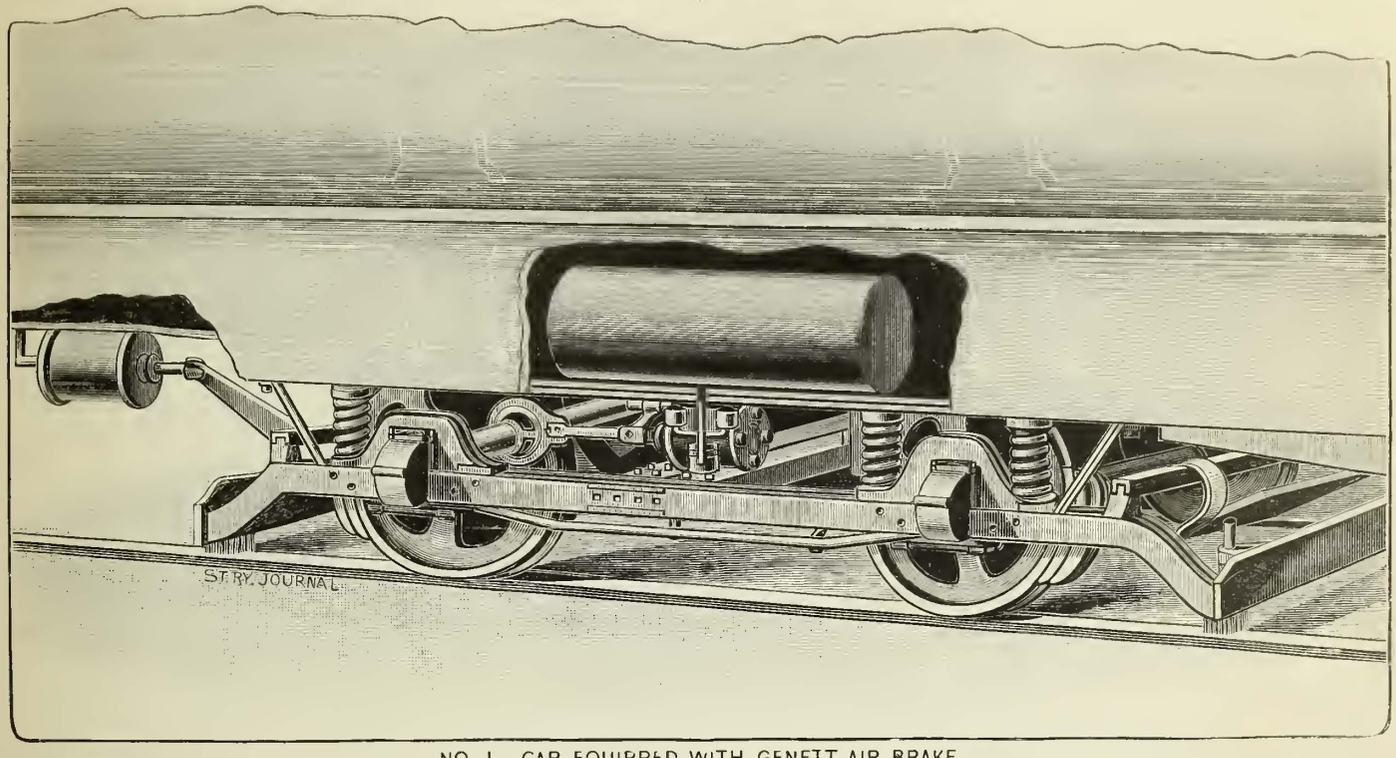
Fig. 3 shows the details of the air pump or compressor. This, as has been stated, is driven by an eccen-



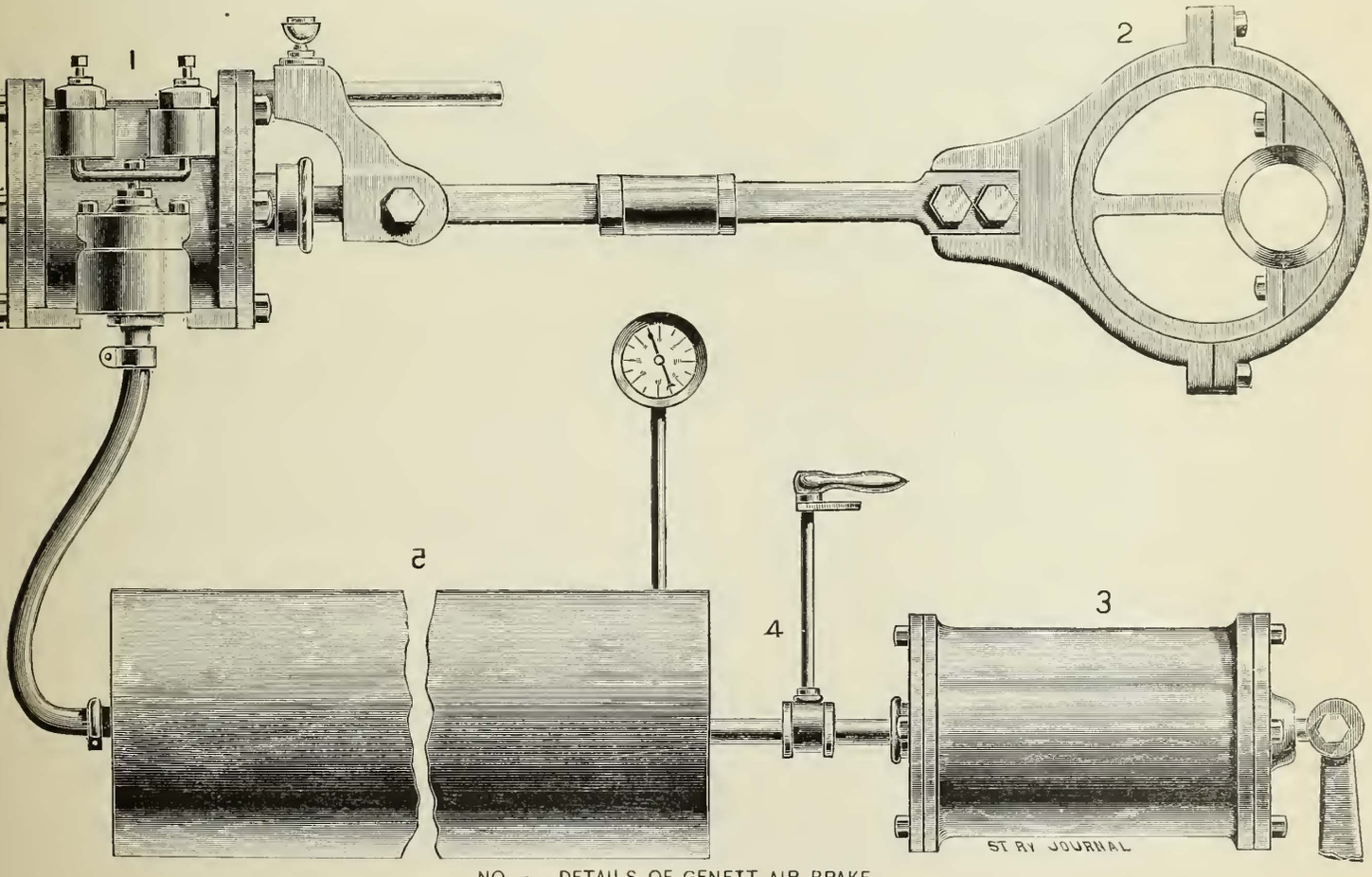
PRESENT APPEARANCE OF TRANSPORTATION BUILDING AT JACKSON PARK.

tric keyed to the car axle and has two suction and two discharge valves, such as are used in double acting pumps. It is of compact and effective design, and its special feature is the means by which the pump is prevented from working when sufficient pressure has been stored up. This is accomplished as follows: C and D represent the two suction valves, E and F the discharge valves which discharge the air into a single passage or port, O, leading through the governing cylinder, B, into the reservoir. This governing cylinder, B, contains a piston, *8*, the under side of which is held against and actuated by the air pressure in the reservoir. A standard spring encircles the piston rod, *9*, and can be regulated to any desired tension by regulating nut, *11*, which sets the pressure desired to be carried in reservoir.

The action of the air pump is as follows: As long as the air has not reached the set pressure desired to be carried, the pump compresses direct into the reservoir and will continue until such pressure is reached. When the pressure exceeds the tension of the spring it forces upward the governing piston, *8*, and with it yoke, *12*, which automatically lifts suction valves, C and D, from their seats. This opens the air cylinder and allows the air piston to move in free air, doing no work until the air brakes are



NO 1.—CAR EQUIPPED WITH GENETT AIR BRAKE.



NO. 2.—DETAILS OF GENETT AIR BRAKE.

applied. Any use of the brakes reduces the pressure, and causes the suction valves to return to their seats, when the compressor is ready to restore the pressure again. The action of the governor piston is so sensitive that the slightest reduction of pressure in the reservoir will start the pump to work even though it requires only one stroke to give full pressure, when it is cut out again. In starting, compressor fills the reservoir to a pressure of thirty pounds before the car has traveled 280 ft. In making a stop, only two to three pounds registered pressure is required, and this the compressor furnishes again before the car has traveled forty feet. The reservoir, moreover, holds in reserve ten times the required air to stop the car even without the additional supply, so that the air pressure is practically inexhaustible.

The eccentric can be easily attached to the axle of the car. It is made strong and durable, and being oval in shape between the strap and the cam, will not collect any dirt. The power of the air jam cylinder is easily calculated, and is equal to the square inch area of the piston multiplied by the air pressure carried in reservoir. Hence six inch diameter and thirty pounds air give 850 lbs. power, and eight inch diameter and forty pounds air give 2,000 lbs. power. The power may be increased by using larger diameters or higher pressures, and by arrangement of brake levers any additional power may be obtained, graded to the weight and speed of the car.

The controlling valve consists of a specially designed three-way valve, and is connected with the pipe to the reservoir, and also with the train pipe which supplies the air jam cylinder. There is also an opening to release the air from the train pipe and the jam cylinder when the valve is turned to release the brakes. A gauge in connection with the air reservoir can easily be attached to the dashboard, while the three-way valve can be placed directly under the platform where it is easily moved.

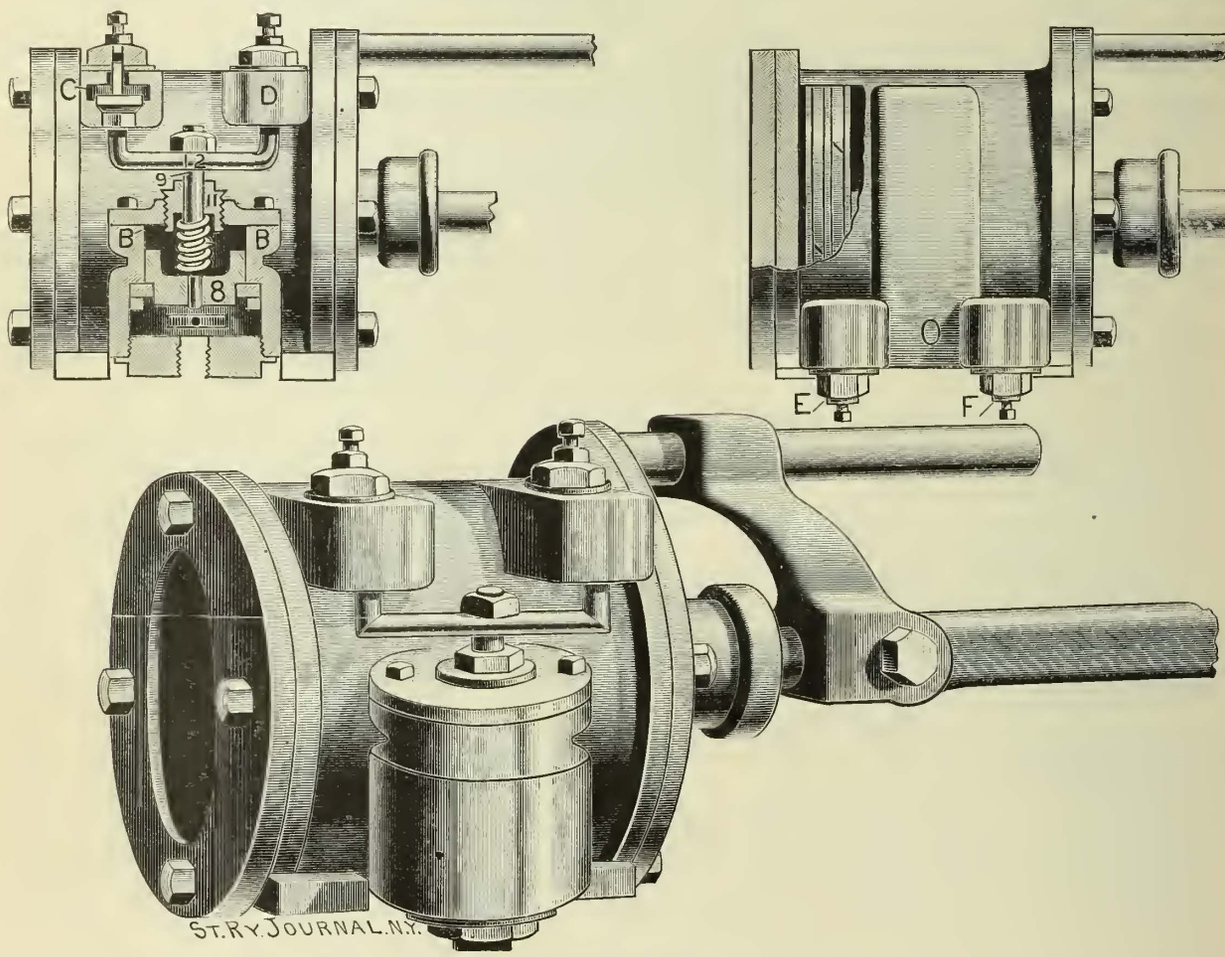


FIG. 3.—GENETT AIR BRAKE—DETAILS OF COMPRESSOR.

The petition of the Belt Line Railway Co. of Augusta, Ga., for an extension of time for the construction of the road until the 15th of last month was granted.

Short Grip Cars on the North Chicago Railway.

The North Chicago Street Railroad Co., of Chicago, have of late been experimenting with a grip car which is only twelve feet in length, and provided with seats for twelve persons, five on each side and two in front. The car was built for the experiment by the Brownell Car Co., of St. Louis, and the tests have been so satisfactory that Superintendent J. M. Roach has decided to purchase a considerable number for use on the North Side system. In a conversation with a representative of the Street Railway Journal, Mr. Roach said he favored the short grip car for the reason that by its use the jerking of a train seemed, for some reason, to be obviated almost entirely. It rounded curves easily, as the wheel base is only four feet. A train composed of the short car and trailer possessed all the advantages of a combination car, and one conductor was able to look after both without trouble. The grip car was sufficiently large to furnish accommodations for smokers, and would naturally be used by them almost exclusively so that ladies would not be annoyed by smoke. The experience he had had convinced him that the car possessed sufficient advantages to warrant its adoption on a large scale

On July 15, a disastrous fire occurred in the power station of the Penn Incline Railway, Pittsburgh, Pa., causing damage to the amount of $35,000, all insured. Considerable excitement was caused by the fact that one of the cars which was at the top of the incline caught fire, and had the cable parted the blazing car would have decended the incline and caused considerable damage; but, fortuuately this did not take place, owing to the efforts of the fire department.

Tourists will be especially interested in the announcement that an electric road to the Yosemite and Big Tree region of California has been projected by Prof. T. S. C. Lowe, of Pasadena, who has been appointed commissioner for the management of the Yosemite Park by Governor Markham.

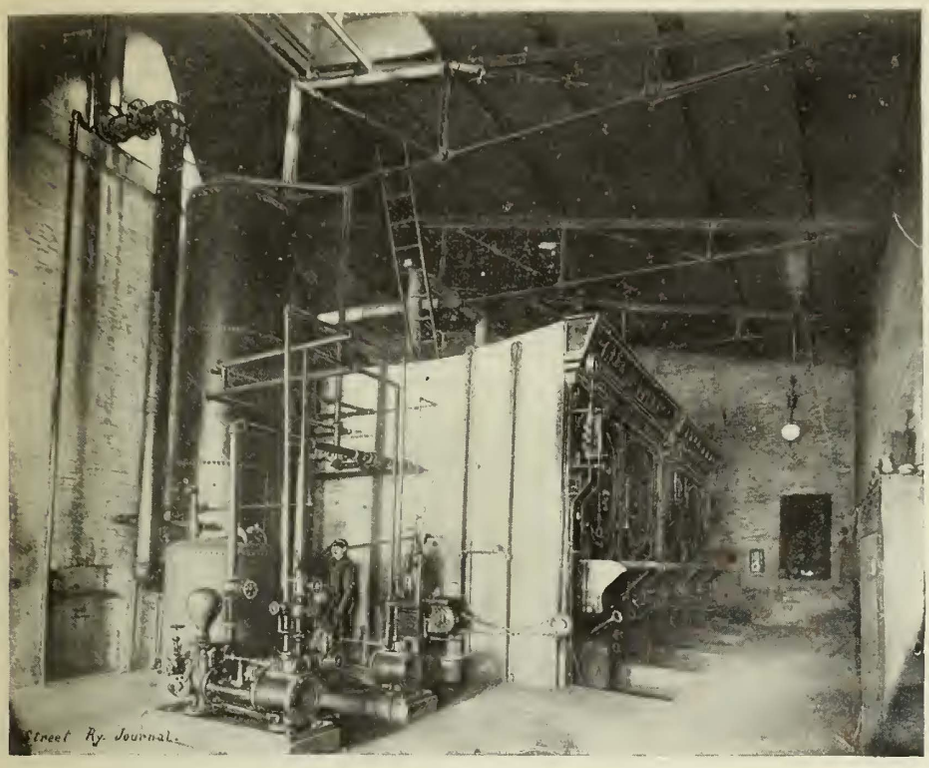
Street Railway Extensions in Chicago.

The street railway systems of the south and west divisions of Chicago are to be very considerably extended during the present year. Ordinances were passed by the City Council a few weeks ago, and work is to be begun immediately. It is not unlikely that electricity will be introduced as a motive power in both sections of the city.

The West Chicago Railroad Co. will build about forty miles of crosstown lines which will greatly improve their service. The contract for the track construction has been awarded to Wright & Meysenburg of Chicago. Johnson and Wharton rails will be used, weighing about eighty-five pounds to the yard.

It has not yet been determined how these roads shall be operated. The company hope to be able to find a motor that will be satisfactory in all respects, but nothing which has been examined has met all the requirements. The company, however, are making tests which they trust will lead the way to the adoption of a motor The track construction will be completed about November 1. If the question of a motor is not then determined, horses will be used, as the company will have plenty on their hands, as the Blue Island Avenue cable when it goes into operation will release about 900 horses on that line.

The Chicago City Railway Co. will build about twenty miles of new road. The Sixty-first, Sixty-third and Forty-seventh Street lines will be built first. Seven inch, ninety pound, Johnson rails will be used, and as they will be bonded, unquestionably electric motors will be operated. Nothing definite regarding a system can be stated at the present time.



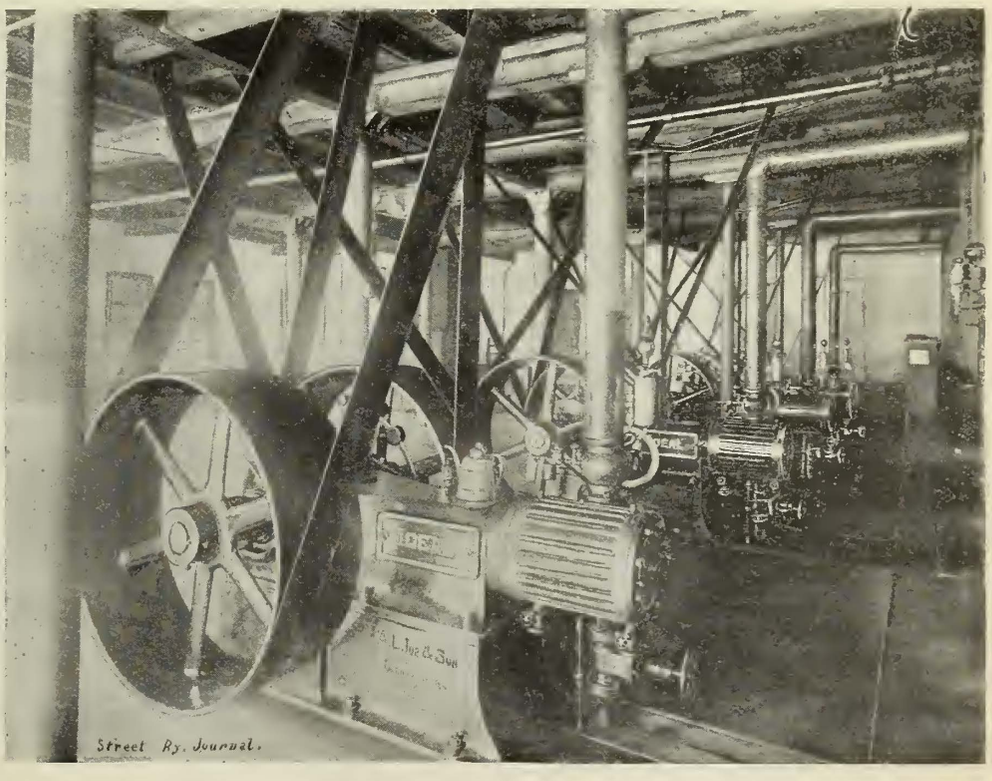
CHICAGO AVENUE ELECTRIC LIGHT STATION—SHOWING BOILERS.

A Chicago Electric Light Station.

Electric railway interests and electric lighting interests have so many points in common, and the construction of stations for the two purposes is in many respects so much alike, that many of our readers will doubtless be interested in the accompanying views of the municipal plant of the city of Chicago for street lighting, located on the corner of Chicago Avenue and Sedgwick Street. This plant has been in operation nearly two years and a half, and has been entirely free from shut-downs. The dynamos supply current to 250 arc lamps each night, covering District 4 in which there is about thirty-eight miles of underground electric lighting cable.

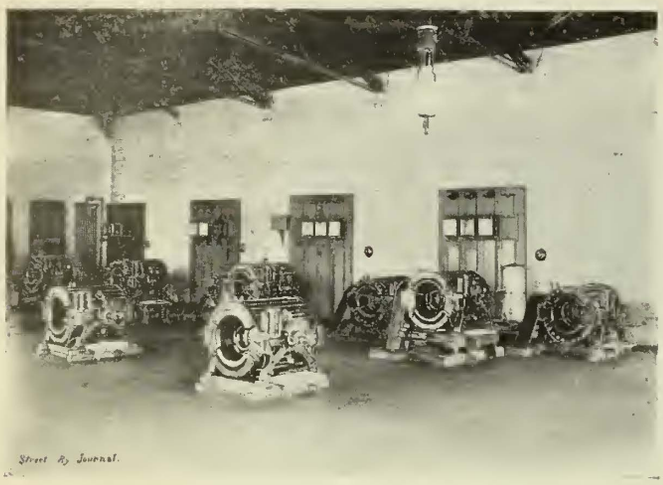
An excellent view of the eastern half of the boiler room of this station is given in Fig. 1. This room contains four steel boilers manufactured by the National Boiler Works of Chicago, each boiler being eighteen feet long, sixty-six inches diameter and having sixty-four four inch tubes. These boilers are set in brick as shown, and are provided with automatic stokers. At the left of the view is a Colles heater, made by E. G. T. Colles & Co., of Chicago. This heater is of 800 H. P. capacity and has recently been installed, with the result of appreciably increasing the efficiency of the plant. The heater is of large capacity and is capable of supplying a corresponding battery of boilers to that shown. A good idea of its unusual size can readily be obtained by comparing it with the man who is standing right near it. At the right of the heater are the pumps and surge tank.

The engine room is located in the front of the building and contains five engines of 125 H. P. capacity each, shown in Fig. 2. These engines are of the Ideal type and run at a speed of about 260 revolutions per minute. Each engine is belted directly upward to three dynamos, as



CHICAGO AVENUE ELECTRIC LIGHT STATION—ENGINE ROOM.

shown. The engines are run at a pressure of about ninety pounds. A view of the dynamo room is given in Fig. 3. This room is directly over the engine room and contains eleven dynamos of thirty-five lights capacity each, and one



CHICAGO AVENUE ELECTRIC LIGHT STATION—DYNAMO ROOM.

machine of fifty lights, all of the Thomson-Houston pattern. Eight circuits run from this station, and the switchboard connections under the floor are well insulated. B. B. Dotson, who was the engineer of the first municipal plant that the city of Chicago built in 1887, has immediate supervision of this station.

The New Anger Truck.

A new street railway car truck, the design of John E. Anger, of Troy, N. Y., has been recently brought out by the Gilbert Car Manufacturing Co., and is illustrated herewith. The truck is named after the inventor, and contains many novel features, as will be seen from an inspection of the accompanying engraving which shows it complete and ready for operation. Any tendency of the car body to oscillate is avoided through the half elliptical springs which are carried in the centre of the truck, and by the arrangement of the upper side bars which are jointed below the springs. The truck is the longest ever built, and supports the car for fifteen feet between centres of end springs, touching the body in twelve different places. This makes the truck very easy running and adds materially to its life.

The ease with which the motive machinery is accessible is another important feature. For repairing the motors or the truck, the lower side pipe truss rod is removable, allowing access underneath the truck from the side. The cap under the journal box is also removable so that the axle can be dropped out. This is especially important where gearless motors are used.

Although the truck has been in practical use for over a year, little has been said before by the manufacturers in regard to it, because they were anxious to first thoroughly test the truck in actual service. Use on street railways in Albany, N. Y., and Paterson, N. J., during the last twelve months, however, have proved the desirability of the various points embodied in its construction, and the manufacturers will now place it on the market with confidence that it will accomplish all that is claimed for it.

Handsome Cars for Milwaukee.

The style of cars, which the Pullman Car Co. will build for Milwaukee is illustrated in the accompanying engraving. The length of the car body is eighteen feet seven inches. The inside finish is quarter sawed oak; spring seats and back covered with Wilton carpet are used. The ceiling is of quarter sawed oak, and is handsomely decorated.

The floor is covered with Everett wood matting, and the windows are screened by roller curtains. Four sand boxes will be placed on each car, and at the platforms will be removable gates. All the trimmings of the car will be of bronze. The steps will be of steel of the Stanwood type, and for heating the stove of the Standard Railway Supply Co. will be employed.

The cars are mounted on truck, type 19 F, of the McGuire Manufacturing Co., and motive power is furnished by Edison double reduction motors.

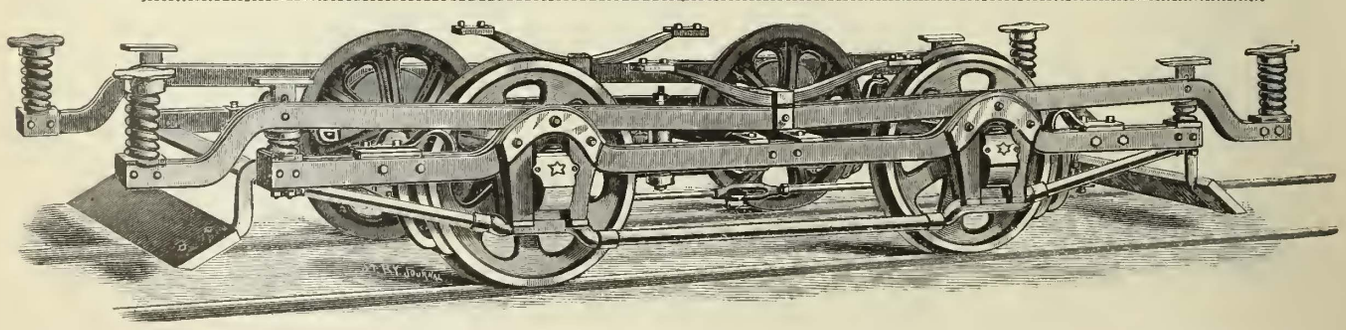
NEW PULLMAN CAR—MILWAUKEE.

The Pullman company have received the contract for supplying fifty of these cars. The order for the new open cars which the Milwaukee Street Railway Co. expect to purchase, will not be given out until some time this fall.

New York Street Railway Association.

The tenth annual meeting of the New York Street Railway Association will be held at the United States Hotel at Saratoga Springs, N. Y., on Tuesday, September 20, at 10 A. M. The secretary states that the papers to be presented are as follows:—"Recent Improvements in Cable Traction," by G. W. McNulty, engineer, Broadway & Seventh Avenue Railway Co., New York; and "Recent Improvements in Electric Traction," by L. H. McIntire, engineer, Harlem Bridge, Morrisania & Fordham Railway Co., New York. The meeting should be well attended.

15 Feet



THE ANGER STREET RAILWAY TRUCK.

Incline Railways in Switzerland.

Switzerland is peculiarly the home of the mountain railway, and many of its peaks, formerly inaccesible to the ordinary tourist, can now be easily and quickly reached by these incline railways. In spite of the enormous expense involved in construction, and the shortness of the season, these railways seem to be excellent investments judging from the number which have been built during the last few years and from the present list of projected roads. The latter include a railway to the summit of the well known Jungfrau, and another part way up the still more famous Mt. Blanc.

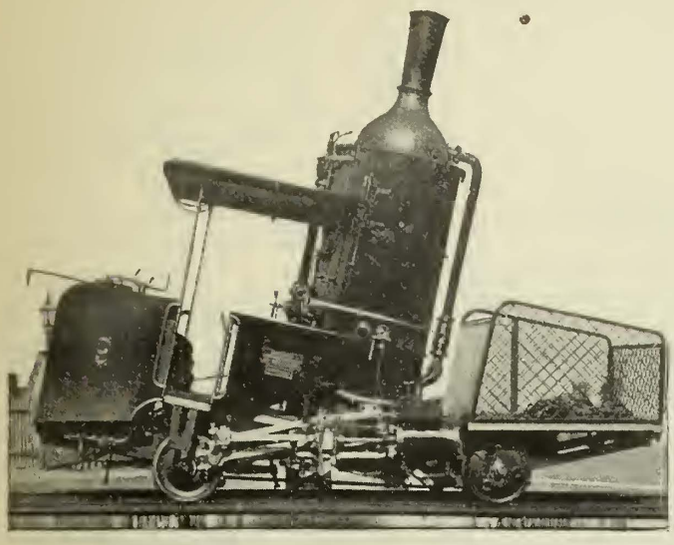


FIG 1.—LOCOMOTIVE—MT. RIGHI INCLINE RAILWAY.

The first of these roads was that built up the Righi

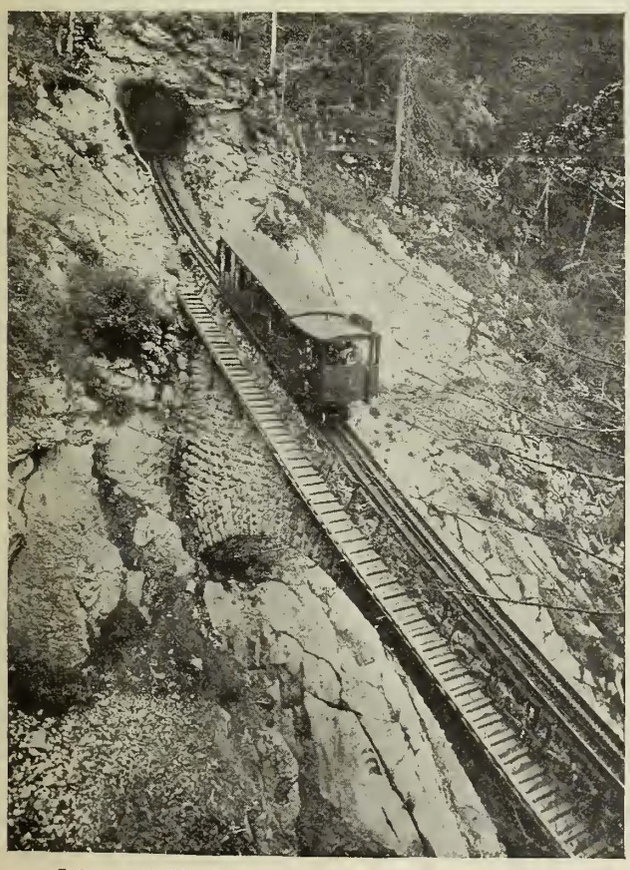


FIG. 2.—VIEW ON MT. PILATE INCLINE RAILWAY.

in 1874, and was patterned after the Mt. Washington (N. H.) railway which was built in 1868, though a few improvements were introduced.

The Righi railway starts from Vitznau on Lake Luzerne and extends a distance of three and a half miles to Righi-Kulm at an altitude of 5,905 ft.. with two or three branches to neighboring peaks. The type of engine used, shown in Fig. 1, weighs twelve and a half tons. A gauge of four feet eight and a half inches is used, and the rails weigh thirty-five pounds to the yard. The rack into which the driving pinion of the locomotive gears is located midway between the rails, and consists of two channel bars placed back to back and five inches apart. The bars are bolted together by triangular rivets of cast steel which serve as teeth. The ties are set into the solid rock or into masonry, and still further kept in place at intervals of 250 ft., by cross sleepers which are firmly anchored. The average grade on this line is 22 per cent and the maximum is 25 per cent. The average speed of a train is about three miles per hour.

The mountain railway to the summit of Mt. Pilate (so named because by tradition it was the mountain from which Pontius Pilate finally ended his life by throwing himself into Lake Luzerne), was surveyed in 1885, and was built in 1889. The grades on this line are much more severe than on Mt. Righi, being 36.6 per cent and the maximum 42 per cent. Under these conditions a simple rack railway did not present a guarantee of sufficient safety, and the builders had recourse to a new type of road invented by Colonel Locher. The rails are here placed on iron ties, the latter being firmly fastened to granite blocks on a substructure of solid masonry. In the centre of the track are placed two vertical racks back to back, into which gear the horizontal toothed wheels of the locomotive. The latter is not separate from the passenger car, but the two are combined so as to form one vehicle, the whole being carried on two axles and supoprted at three points, namely, at the leading and at the ends of the rear axle. As with the Righi railway, the motive power is in the rear of the passenger section. The car wheels are without flanges, so as to reduce friction, the train being kept on the track by the centre rack which forms a sufficient guide.

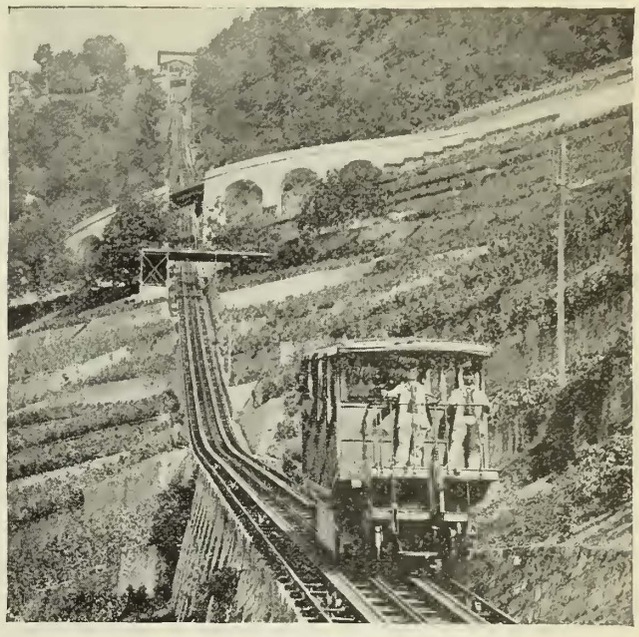


FIG. 3.—VIEW ON INCLINE RAILWAY AT GLION.

The horizontal pinions which gear into the rack are four in number, one on each side at both the forward and rear ends of the car, the latter being depended upon for the motive power. These pinions have also two flanges which run on the top and base of the channel holding the racks, the object being to steady the car. There are also specially arranged clutches which can be fitted under the rails in order to prevent the car from being blown over by the wind, if surprised by one of the furious tempests which are sometimes encountered at these high altitudes.

The boiler of the locomotive is placed transversely to the track, so as to keep the water on a level. The cars are in three compartments, each capable of holding eight passengers, and are protected by two hand brakes, one ordinary air brake and one automatic brake which fits into the gear teeth, and is operated by a wedge when the speed

exceeds three and a third miles per hour. The car, with passengers and motive power complete, weighs about 105 tons, and its average speed is 2.2 miles per hour. Fig. 2 shows a section of the road and gives a good idea of some of the difficulties encountered. The inclined plane railway at Glion, Switzerland, shown in Fig. 3, calls for no extended description, as it is a hydraulic cable railway similar to many in America. The line is single track at the top and bottom, with a turn out at the central part of the line. The rack in the centre of the track is for braking purposes.

Indianapolis Street Railway System.

The street railway company of Indianapolis, whose plucky defense of their rights against labor agitators last winter made them well known to railway men the country over, are at present operating their road very satisfactorily and giving an excellent service.

At the present time the company operate eighty-five miles of track, thirty-five of which are traversed by electric cars, the motors being of the Thomson-Houston and Westinghouse types. Fifty-five miles are operated with mule power, but it is the intention of the company to ultimately run all their cars by electricity. In pursuance of this policy, all the lines that are rebuilt are laid with heavy girder rails, and bonded for an electrical return. In an extension which the company are now making of four miles to the fair grounds, a forty pound T rail is being laid. Most of the rails at present in use were furnished by Wm. Wharton, Jr., & Co.

In the fall of 1890 the company introduced on the Irvington line two storage battery cars. They were operated four or five months, at the end of which time they were in such bad condition that they were withdrawn from service, and two mule cars were substituted. The cars were then overhauled by the company that had installed them, and the service was resumed for a second period of four or five months. The depreciation of the batteries was so great that it was then necessary to abandon them permanently. It should be said in this connection that the officers of the company still have faith in the storage system, and believe that the time is coming, and is, perhaps, not far distant, when the storage system may prove successful. The overhead wires in the streets are for the most part carried by centre poles. The car windows and platforms are properly guarded for the protection of the unwary passenger.

The power station was wisely planned to provide for considerable extension, and the wisdom of this provision is already appreciated, since the capacity of the plant was recently increased by several hundred horse power. The boilers are four in number: Two of the Babcock & Wilcox type of 300 H. P. each, and two Hazelton boilers of 500 H. P. each being used. Sufficient steam is generated in each battery to supply the engines, and each battery is run from three to four weeks while the other rests. In this way an abundance of time is secured to clean the boilers and to make such minor repairs as may be necessary.

Oil is burned under the boilers, and the company regard with great favor the use of this fuel. It is found much more economical than coal or natural gas which was formerly burned. The oil is brought in cars to tracks directly across the street from the power plant, whence it is piped to the reservoir of the station.

Until recently, power was supplied by a pair of Wheelock engines of an aggregate capacity of 500 H. P., and a single engine of the same make of 250 H. P. The demand for power has at times been so great that these engines have been called upon to develop 1,000 H. P. They have made a splendid record. The single engine which was installed two years ago has during that entire period lost only two hours in running time. Recently the management have added a second pair of Wheelock engines of a nominal capacity of 600 H. P.

FIG. 1.—TRANSFER CAR—INDIANAPOLIS STREET RAILWAY.

The entire equipment of generators was, until recently, of the Thomson-Houston type, and consisted of one multipolar, 250 H. P. and five eighty horse power machines. The Wheelock engines just installed will drive two Westinghouse multipolar generators of 250 H. P. each.

The transfer system of the company is rather unique, and the plan which is followed is one which, perhaps, would not be feasible in many cities. A general system of transfers is in use, and the public avail themselves of it to a remarkable extent. There are no cross lines in the city, and all cars, with the exception of those running on a single line, pass the transfer station on Washington Street near Illinois Street. A view of the station, which resembles a large vestibuled car, is presented in Fig. 1. Within the car, and near the doors at each end, is stationed a transfer man. Cars coming from either the east or the west stop at the platform of the transfer station, and those wishing to make a change enter the stationary car. The transfer men call the several cars as they stop, and transfer those waiting to the car that they wish to take. Persons who may wish to take cars at this point, but have not paid their fare on any car, hand their nickels to the transfer man on entering, and the latter registers it as an ordinary conductor. Passengers from the single line which does not pass the station, although it runs within a few steps of the point, are provided with tickets entitling them to admission to the station. The

tickets, which are good for only fifteen minutes after issue, are collected by the transfer men and registered by them as fares.

It would appear at first thought to a person who watches the operation of the system for the first time, as if it would be easy for those so disposed to practise a fraud on the company by slipping into the transfer station with a crowd leaving the car; but either the people of Indianapolis are extremely honest and above resorting to such a contemptible, petty bit of knavery or else they have a wholesome regard for the watchful eyes of the transfer men who guard the entrances and the exits. Certain it is that the company have no fault to find with the system on this score.

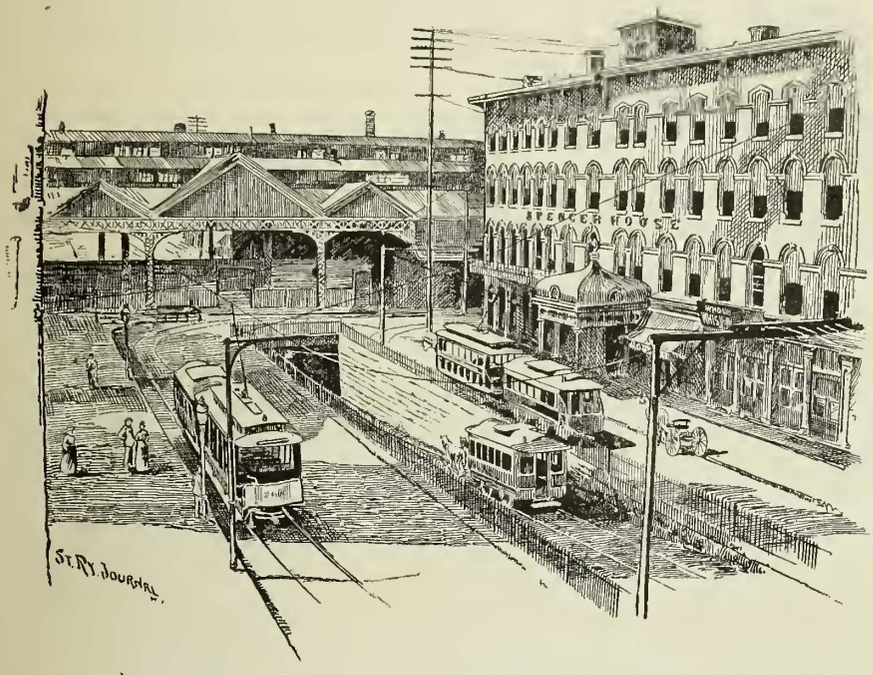


FIG. 2.—ENTRANCE TO TUNNEL ON SOUTH ILLINOIS STREET—INDIANAPOLIS STREET RAILWAY.

The company believe that this system is the most satisfactory one that could be adopted if transfers must be given. They are relieved of all the doubts that afflict a company when a general ticket transfer system is used on all the lines. The people of Indianapolis seem to regard it as an excellent institution. They have a convenient waiting room which is only a step from a car, a feature which is especially appreciated in rainy weather. The car which they wish to take is called when it reaches the station, so they do not have to watch for it. The strongest proof in support of the statement that the system is popular is to be found in the fact that the present transfer car is the last in a series. The first station was a ten foot box car which was drawn by a mule to the transfer point, and was removed at night. At all times the mule was attached to the car lest the city officials should object to an abandoned car. The plan worked well from the start; some residents, to be sure, objected to passing into the car, and protested that they would far rather pay two fares than be subjected to the annoyance of conforming to the regulations governing the transfer system. That idea was soon abandoned, and rich and poor patronized the station with increased regularity. A sixteen foot car was substituted for the original station, and this becoming too small, the present permanent structure was built in accordance with the plan of Tom L. Johnson. At the present time the great objection to the station consists in the fact that it is too small. Transferring from one car to another is a habit that grows on one, and it is hard to accommodate all the people that crowd into the stationary car at all hours of the day.

Fig. 2 shows a view of a car on South Illinois Street entering the tunnel, passing under the Union station train shed.

THE Blakely & Dickson Traction Street Railway Co.; capital $36,000, have been organized at Scranton, Pa.

The Street Railways of New York.

PART I.—*Metropolitan Traction Co.'s Lines.*

Although the Metropolitan Traction Co. does not directly operate any street railway in New York, it exercises a large influence in street railway affairs through the amount of stock in various surface street railway companies which it owns. The company has a capital stock of $20,000,000, with $12,000,000 paid up, and offices at 761 Seventh Avenue. The president of the company is Henry Thompson who is also president of the Broadway & Seventh Avenue Railway Co. The following is a list of the railway companies which the Metropolitan Traction Co. controls by ownership of stock, or by lease: Houston Street, West Street & Pavonia Ferry Railway Co., Twenty-third Street Railway Co., Metropolitan Crosstown Railway Co., Chambers Street & Grand Street Ferry Railway Co., Broadway & Seventh Avenue Railway Co., Broadway Surface Railway Co., South Ferry Railway Co., Sixth Avenue Railway Co., Ninth Avenue Railway Co.

For convenience in operation, these roads, with the exception of the Twenty-third Street Railway Co., have all been leased to one company as described below:

HOUSTON STREET, WEST STREET & PAVONIA FERRY RAILWAY CO.

This railway company is the successor of the Avenue C Railway Co., whose line was sold in 1874 under foreclosure proceedings. The company purchased the real estate, franchises, etc., formerly belonging to the Avenue C Railway Co., from Sheppard Knapp and others who were the purchasers under the mortgage sale, for $750,000, one-third of which was paid in stock and the other two-thirds in 7 per cent., twenty year bonds of the road. It has since been extended so that the main line has one terminus at the 42d Street depot and the other at the Chambers Street Ferry; branches also run to the Grand Street Ferry, East 10th Street Ferry and on Madison Street.

This line has assumed a very important position recently, on account of its having been selected by the managers of the Metropolitan Traction Co. as a lessee of the other roads controlled by them, viz., the Sixth Avenue, Broadway & Seventh Avenue, Ninth Avenue, Chambers Street lines and the Metropolitan Crosstown lines. The present capital stock of the company authorized by charter is $1,050,000 all issued. The funded debt consists of $500,000, 7 per cent., first mortgage bonds, due in 1894.

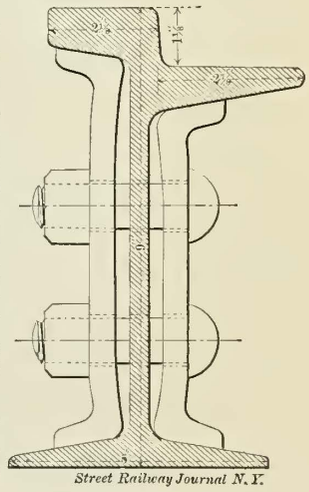


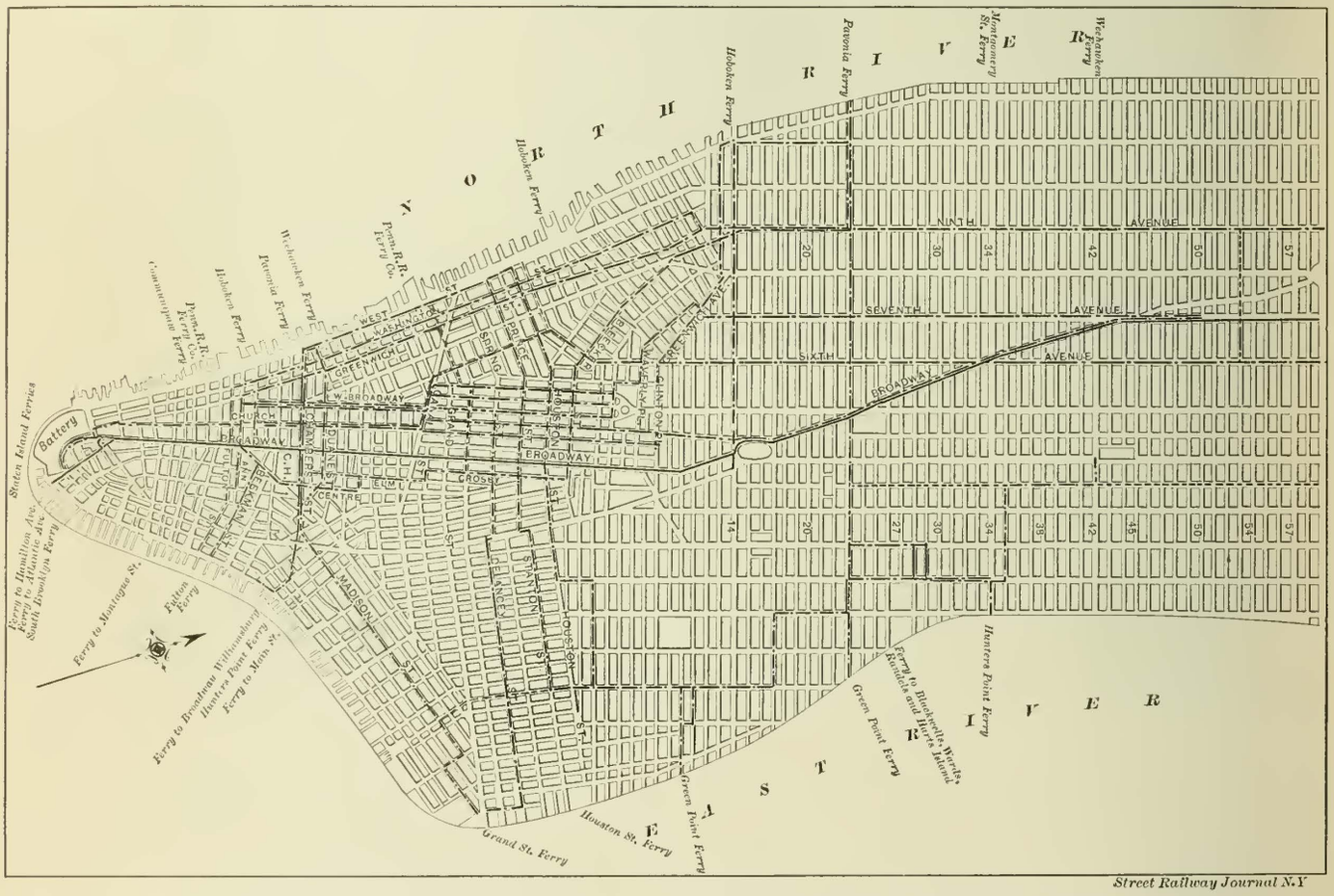
FIG. 1.—SECTION OF PHILADELPHIA GIRDER RAIL.

The length of line belonging to the company is six and a half miles double track. This is laid for the most part with sixty pound, centre bearing, tram rail. Renewals are, however, being made with the "Philadelphia girder rail," further installation of a centre bearing rail being prohibited by a recent act of the legislature. For new work the company on its various lines will use for the most part a heavy nine inch girder rail made by Wharton, similar to that adopted by the Philadelphia Traction Co., weighing ninety pounds per yard, and spiked directly to the ties. The average daily mileage of all lines controlled by the company is 38,000 on week

days and about 30,000 on Sundays. Of this number the Houston Street, West Street & Pavonia Ferry lines make 2,900 car miles per day.

The miles per horse per day average sixteen, and the employes work ten hours out of twelve. The number of passengers carried per day averages from 17,000 to 20,000. Stephenson cars are used. Since the new management has assumed control of the various roads in this extensive system, a number of important improvements have been adopted, and others more important are in contemplation. The transfer system will be extended to all the roads operated by the Houston Street, West Street & Pavonia Ferry Railway Co., just as soon as right has been granted to build the most important of the extensions contemplated, which will act as connecting links to the system. Another consequence of the consolidation has been a uniforming of all the drivers and conductors not being forgotten. The management of the company have already fitted two comfortable waiting and reading rooms for the benefit of the conductors and drivers of the road. One of these is at the depot of the Broadway & Seventh Avenue Railway Co., corner of 50th Street and Seventh Avenue, and is intended for the use of the employes of that division. The reading room is light and airy, lighted by electric lights, and supplied with a large number of the latest periodicals, daily papers, etc., with pen and ink and plenty of envelopes and writing paper. Adjoining this is a second room with boot blacking facilities, etc. Similar accommodations have been fitted up in the depot of the Sixth Avenue division at 43d Street and Sixth Avenue, and it is the intention of the company to have similar rooms at each of the depots of the other divisions.

The officers of the company are: President, John D.



MAP OF LOWER NEW YORK CITY, SHOWING METROPOLITAN TRACTION CO.'S SYSTEM.

on the different lines, a custom which was before followed only on the 23d Street line. A reference to the accompanying map will show the important extensions contemplated by the managers of this company, and privilege to construct which has already been requested. The extensions proposed are shown in cut by short dashes. Horse lines in the Metropolitan Tractions Co.'s system are shown by lines made up of dots and dashes, while the location of the cable line is indicated by a full line. The most important of the extensions are longitudinal lines on Ninth Avenue, Manhattan Avenue and Lexington Avenue with crosstown lines on 96th Street, 116th Street and 146th Street. A petition has also been made for permission to operate the lines by electricity on Sixth and Ninth Avenues, the trolley wires to be attached to the elevated structures; and it is hoped that the necessary consents will be secured before long. As evidence that the property owners in these streets are in favor of an electric system, it may be stated that at two public meetings before the board of aldermen at which any protesters were invited to appear, no objectors presented themselves.

While these projects for important improvements and extensions are being carried forward by the management, the comfort and welfare of the employes of the road are

Crimmins; vice-president, Henry Thompson; secretary, Thomas F. Ryan; treasurer, D. B. Hasbrouck, and general manager, Thomas H. McLean.

BROADWAY & SEVENTH AVENUE DIVISION.

The Broadway & Seventh Avenue Railroad Co. was chartered May 26, 1864. In 1885 it acquired, by an agreement with the Broadway Surface Railroad Co., the right to operate its cars over the tracks of that company upon a guarantee of the payment of principal and interest of $1,125,000 of first mortgage bonds, and the interest of the second mortgage bonds of the company to the amount of $1,000,000. The Broadway & Seventh Avenue line is divided into three divisions: Seventh Avenue & Park Place, University Place line, and the Broadway line proper. All three divisions are now operated by horses, requiring about 1,900 animals, but the Broadway line is now being reconstructed for cable traction, a ninety-one pound grooved girder rail being used. The tracks of the first two divisions are laid with a forty-seven to sixty pound, centre bearing, tram rail and there are about 227 box cars belonging to the road. The capital stock of the company authorized and issued is $2,150,000. The funded debt consists of $1,500,000 in 5 per cent., first mortgage bonds due in 1904, $500,000 in 5 per

cent., second mortgage bonds due in 1914, and $200,000 in bonds and mortgage at 5 per cent. In addition to this funded debt for the use of the tracks of the Broadway Surface Railroad Co. on Broadway between 15th Street and the Battery, the company assumes the payment of the principal and interest of the bonds mentioned above of the Broadway Surface Railway Co., and also for the use of the tracks of the South Ferry Railroad Co., the payment of principal and interest of $350,000 of the mortgage bonds of that company.

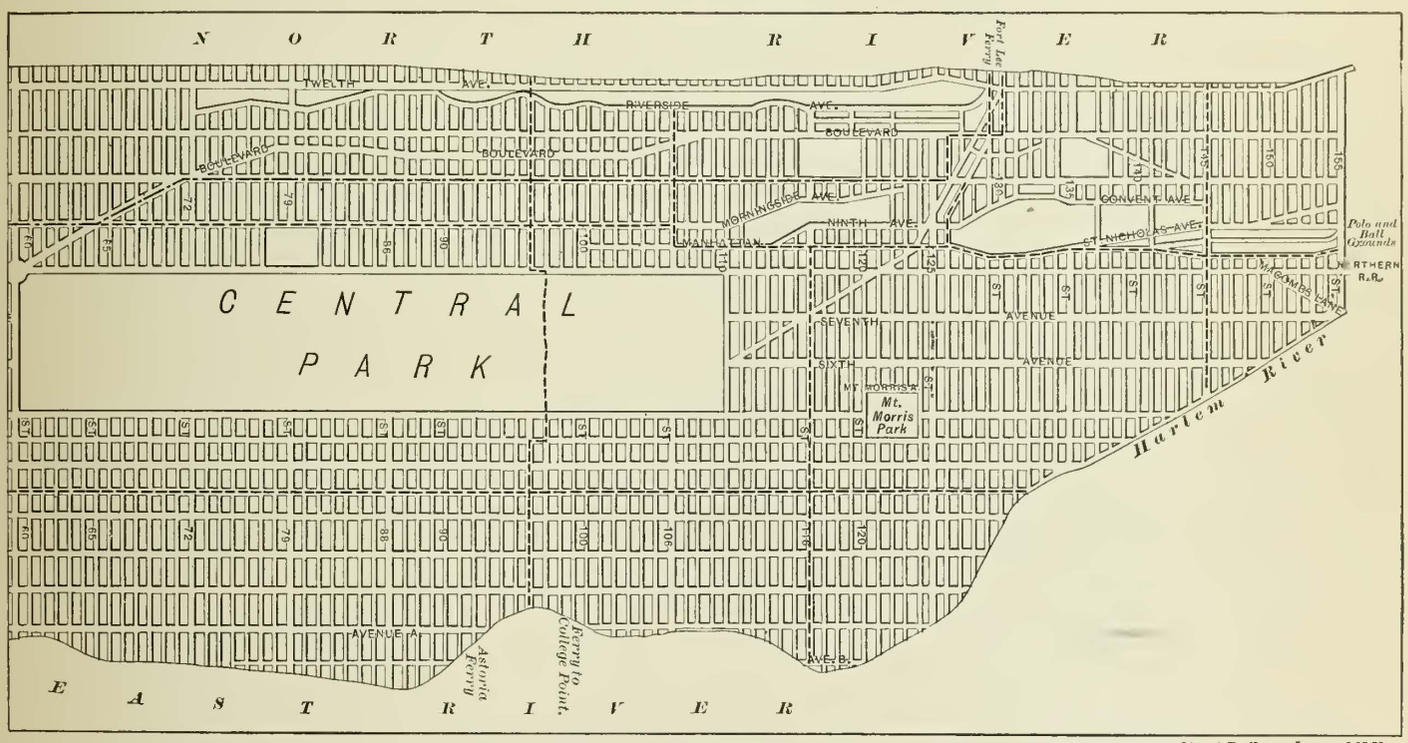
The terms of the lease with the Houston Street, West Street & Pavonia Ferry Railway include: The payment of the interest on the bonds of the company and those guaranteed by it, mentioned above, the rent to the city due under the Broadway Surface franchises, which amounted in the year ending June 30, 1891, to $85,497.96, and a 10 per cent. dividend on the stock of the Broadway & Seventh Avenue Railway Co.

with three centre lights. The interior of the car body is finished in the same style as the present Broadway cars, *i. e.* with body painted cadmium and lower concave ochre. The doors are especially large and ample and afford easy ingress and egress. The platforms are also large and are equipped with wire gates at the side. The bonnets are supported by pillars from the dash board. The car is equipped with the Stephenson superspring running gear having a nine foot wheel base, and is provided with a life guard which extends all around the sides, front and back.

The main depot of the division is at the corner of Seventh Avenue and 50th Street, and 1,900 horses are stabled here. The officers of the company are: President, Henry Thompson; secretary and treasurer, Thos. F. Ryan; superintendent Henry A. Newell.

SIXTH AVENUE DIVISION.

The Sixth Avenue Railroad Co. was the second street



Street Railway Journal N.Y

MAP OF UPPER NEW YORK CITY, SHOWING METROPOLITAN TRACTION CO.'S SYSTEM.

The average daily car mileage on this system on a week day is 12,850, divided as follows: Broadway line, 9,000; University Place line, 1,250; and Seventh Avenue, 2,600. The average number of passengers per day is divided about as follows: Broadway line, 90,000 to 100,000; University Place, 6,500 to 7,000; Seventh Avenue, 9,000.

The cars at present in use on the Broadway line were built by the John Stephenson Co., Ltd., and the Pullman Car Co., and were the first cars constructed without a letter board above the windows, the sash extending to the roof. These cars are very handsomely finished, the interior being fitted in natural wood, mahogany and maple being employed. Similar cars are also being used on the Seventh Avenue division.

The new cars adopted for the Broadway cable line are being built by the John Stephenson Co., and have a length of car body of twenty-two feet, with dimensions over all of thirty feet six inches. The width of the car body is seven feet and the aisles are thirty and three-fourths inches. As will be seen, this gives a large amount of room in the aisles and increases enormously the capacity of the cars. The free space between two cars when passing each other on a straight track is twenty-four and one-fourth inches.

The interior of these cars is finished in maple with paneled ceilings and trimmings of solid bronze. The seats and backs are covered with Wilton carpet, the windows are high and large and the car is lighted at night

railway company organized in New York City, the articles of association having been filed December 6, 1851. The company has a capital stock authorized and issued of $1,500,000, and a funded debt of $500,000, 4 per cent., first mortgage bonds. The length of the line owned by the company is five and one-eighth miles double track extending from 59th Street and Sixth Avenue to Broadway and Vesey Street, with a branch to the corner of Broadway and Canal Street. One mile and a quarter of this line at the lower end is operated in common with the Eighth Avenue Railroad Co.

The number of cars belonging to this line is 122, of which 102 are box and 20 open cars. Most of the cars were built by Stephenson, though some are from the works of the Lewis & Fowler Manufacturing Co. The cars make an average of 6,000 miles per day on week days and about 42,500 passengers are carried daily. The number of horses employed by the company is 925.

The offices and stables of the company are at 758 Sixth Avenue, and at the time of their construction were considered the finest then built for the purpose. Even at the present day they are worthy of remark, as the management has kept pace with the times by the addition of modern improvements. The officers of the company are: President, Frank Curtis; secretary and superintendent, E. H. Garrison.

The line was leased during the current year to the Houston Street, West Street & Pavonia Ferry Railway Co. for a period of 999 years.

NINTH AVENUE DIVISION.

The date of the Ninth Avenue charter is July 29, 1859. The line was built by an association and transferred to the Ninth Avenue Railroad Co. for $610,000 in stock. The total amount of stock authorized and issued by the company is $800,000. There is no funded debt.

The road extends from the corner of Broadway and Fulton Street through Ninth Avenue and the Boulevard to the corner of Tenth Avenue and 125th Street, and is eight miles long, all double track. The weight of rail is from forty-five to sixty pounds per yard. There are sixty cars, of which forty are box and twenty open. The former were built by the company themselves, and the latter are from the works of the Lewis & Fowler Manufacturing Co. The cars make an average of 5,100 miles on week days, and the number of passengers carried per day is about 23,000. The number of horses required to operate the line is 712, and the depot is at 814 Ninth Avenue.

The road was leased during the current year to the Houston Street, West Street & Pavonia Ferry Railway Co. for a period of ninety-nine years. The officers of the company are: President, Geo. Law; vice-president, Jacob Hayes; secretary and treasurer, James Affleck; superintendent, Lewis P. Foulk; being, with the exception of the superintendent, the same as with the Eighth Avenue Railway Co.

CHAMBERS STREET DIVISION.

This division is the only one of those belonging to the Houston Street, West Street & Pavonia Ferry Railway Co., on which short cars without conductors are used. The line is divided into two sections, with a common terminus at Chambers Street Ferry, and the other termini at Grand Street Ferry and James Slip.

Stephenson cars are used. The company was merged in 1891 into the Houston Street, West Street & Pavonia Ferry Co. by an exchange of stock, share for share, the amount issued by the larger company for the purposes of consolidation being $800,000. The Chambers Street line had no funded debt at the time. The daily car mileage is 1,700 and the average number of passengers carried per day is about 9,000.

METROPOLITAN CROSSTOWN DIVISION.

The date of the charter of the Metropolitan Crosstown Railway Co. is March 22, 1889, and the line extends from the foot of West 23d Street to the foot of Grand Street, East River. The cars make an average of 1,450 car miles daily, and from 7,000 to 9,000 passengers are carried each day. This line is now a part of the Houston Street, West Street & Pavonia Railway Co.

BROADWAY SURFACE RAILWAY.

Many efforts were made by different individuals to secure a street railway franchise on Broadway below 15th Street, but all failed until the one secured by the Broadway Surface Railway Co. This company was incorporated May 13, 1884, with Jacob Sharp as president, and it secured the consent of the local authorities in December of the same year for the construction of the road. There were charges that bribery had been used to secure this franchise, and Jacob Sharp, the promoter of the company, was tried on the charge and convicted, but obtained a stay, and died from pneumonia before the new trial came off.

The construction of the road was completed and cars were run thereon in June, 1885, by the Broadway & Seventh Avenue Railway Co. which had an agreement with the Broadway Surface company for the use of their tracks. On May 8, 1886, the road passed into the hands of John O'Brien who as receiver made an arrangement with the Broadway & Seventh Avenue Railway Co. by which this latter company continued the operation of the cars. In 1889 the road was sold at public auction and was purchased by the Widener-Elkins syndicate of Philadelphia, and it now forms a part of the Broadway & Seventh Avenue system.

TWENTY-THIRD STREET RAILWAY CO.

The Twenty-third Street Railroad Co. was chartered January 29, 1872, to operate under a franchise secured by S. A. Yeomans for $150,000. In 1873 the company was authorized to extend the route from 23d Street and Second Avenue to the foot of East 34th Street, and in 1876 the Bleecker Street & Fulton Ferry Railroad was leased to this company.

Its capital stock, at present authorized and issued, consists of $600,000, and its funded debt of $250,000, 7 per cent., first mortgage bonds due in 1893, and $150,000, 5 per cent., debenture bonds due in 1906. In addition to this funded debt, the company have guaranteed the principal and interest of $375,000 first mortgage bonds of the Broadway Surface Railway, for use of part of the tracks of that company. The 23d Street line is divided into four divisions, which have a common terminus at the foot of West 23d Street, and are named as follows: East 23d Street division, East 34th Street division, Union Square division and the Brooklyn Bridge & Fulton Ferry or Bleecker Street division. These lines are operated by horses, the present number owned by the company being 975. The stables are at the foot of West 23d Street. The length of track operated by the company is fourteen and three-quarters miles, laid with fifty pound, centre bearing and tram rail, except where renewals have been made, where, as stated above, the "Philadelphia girder rail" is being used. The cars belonging to this line are 101 in number, and are from the works of John Stephenson Co., Ltd., Lewis & Fowler Manufacturing Co., Jones' Sons Co., Pullman Car Co. and the J. G. Brill Co.

The average daily mileage on a week day on the 23d Street line is 4,100; of the Bleecker Street line 3,300; 14th Street and Union Square line 890, and average number of passengers on 23d Street 32,000, Bleecker Street 17,000 to 20,000 and 14th Street line 3,000 to 4,000. The officers of the company are: President, W. L. Elkins, Philadelphia; vice-president, P. A. B. Widener, Philadelphia; secretary and general manager, Thomas H. McLean; treasurer, C. E. Warren.

The Paterson Street Railway Co.

The street railway company at Paterson, N. J., like many in other cities, had much trouble, in the days when the benefits of electric traction were not so generally appreciated as at present, to secure the necessary rights to erect poles and conductors for an overhead line. The opposition, as usual, came from many sources, but the railway company finally triumphed, and their wisdom in the selection of electric power has been amply demonstrated. The electric system has been extended rapidly, so that it now covers nearly all the lines operated by the street railway company, and steps are being taken to equip with the necessary apparatus the only line now operated by horse power. It is only necessary to state that the number of passengers carried by the cars has increased 100 per cent. since the adoption of electricity, to attest the popularity of the latter system.

The electrical equipment now covers eighteen miles of track out of a total of twenty-five miles owned by the company. This track is laid with Johnson centre bearing girder rails, weighing fifty-eight and a half pounds to the yard, two miles of which are laid on chairs, the rest being spiked directly to the ties. The latter are laid two feet between centres and are of chestnut and white oak. The joints are supported by angle bars with a ten inch tie laid directly under the joints, a construction which up to the present has proved satisfactory. For a return, the rails are double bonded with galvanized iron bonds and cross connected every ninety feet. The contractors for the track construction were the Field Engineering Co. and the Thomas Murray Co.

The overhead line is supported by neat iron pipe span poles, supplied by the Pennsylvania Tube Works of Pittsburgh, and, in the outskirts of the city, by octagonal wooden poles. The feed and trolley wires were supplied by Benedict & Burnham, and the overhead material by A. &

J. M. Anderson and the Thomson-Houston Electric Co. On recent work the company solder the trolley wire to only every fifth insulator clip, supporting the wire at the other four insulators by a Rumrill "common sense" clip. By this means the work of taking up any slack in the trolley is much facilitated since only one-fifth the number of clips have to be unsoldered that would be were solder used at every hanger.

Sixteen foot cars are used throughout the line, and the rolling stock is very neat and tasteful. The cars are painted a deep wine color with gold lettering, and were supplied by the John Stephenson Co., and the Gilbert Car Manufacturing Co. Thirty-three inch wheels are used, and there is a short step between the body of the car and the platform. While this is considered a disadvantage by some, the management believe that the greater room secured under the car for the electrical apparatus more than compensates for any drawbacks. The registers are of the Railway Register and Lewis & Fowler make, and Smith headlights are used.

The motor equipment for the fifty-eight cars at present electrically equipped, consists of thirty-three motors of the Westinghouse type, twenty of the Edison type and five of the Thomson-Houston type. All of these are single reduction except three of the latter which are double reduction. Steel gears are used. The Gilbert truck is employed exclusively on all the cars.

The company rent their steam from the Edison Illuminating Co. of Paterson, and their generating apparatus is in the station of this company. Their present electrical equipment includes five compound wound Edison railway generators of 100 K. W. each, but these will be increased shortly by two more of the same type. These generators are belted directly to an equal number of Ball & Wood simple, non condensing engines, whose cylinders measure 16 × 16 ins. Cotton leather belting, manufactured by the Underwood Manufacturing Co., is employed to transmit the power. The boiler room contains three Babcock & Wilcox boilers of 300 H. P. each, which will soon be increased by the addition of two additional boilers of the same make of 400 H. P. each. A National feed water heater is located in the boiler room, and a Stratton separator is also employed.

Berlin Underground Electric Railway.

The need of additional transportation facilities in Berlin has caused the Allgemeine Elektricitäts Gesellschaft of that city to propose a plan, outlined below, for an underground electrical railway. The increase in passenger traffic is shown by the figures of a single tramway company who in 1881 carried 51,000,000 passengers, while nine years later they carried 121,000,000. According to statistics, over 50 per cent. of the inhabitants of the city have to leave their places of abode to reach their business. In the new plan the tramway and omnibus companies will still have the short distance passengers. The conditions to be held in view in carrying out the line are :

1. The street traffic is not to be interrupted by it.
2. That it shall not be influenced by changes of climate.
3. That it shall supply similar facilities to the tramways, only at a greater speed.
4. That the cost of construction maintenance should be proportional to the expected traffic receipts.

The practicability of the plan is proved by the great success of the City & Southwark Railway. The trains would be composed of an electric locomotive and three cars. accommodating 120 passengers, and running at three minute intervals, with a speed of twelve and a half miles per hour. The lines are not all to be constructed at once, but as occasion may require, and consist roughly of two concentric circles, each with double lines of rail and two cross lines at right angles to each other, crossing at the centre of the two concentric circles and connecting their circumference.

A narrow gauge of 39.37 ins. is to be used, and the sharpest curve in the "circles" is 164 ft. radius, but this only occurs once and where the speed is low ; the next smallest curve is 246 ft. radius for two short distances of 75 ft. and 79 ft. respectively. A curve, however, of less radius than 164 ft. occurs at the junction of the "circle" line with the "cross" line, but as the speed is necessarily very low it is of less importance.

The material through which the tunnel is to run is sand and gravel. The walls of the tunnel itself are composed of wrought iron plates, twenty-seven and a half inches broad, with flanges on the inside for bolting up ; the joints between the flanges being made with pine-wood strips, tow and cement. The thickness of the plates is .4 in. and of the flanges .59 in., the whole tunnel outside being covered with a layer of cement to prevent the plates from rusting. The tunnel is to be cut by a special machine designed for the purpose, which consists of a large shield with a large rotating cutting tool in advance of the shield, to which water is supplied at the top of the tunnel, and the refuse is drawn off by a large tube at the bottom of the tunnel. The whole operation is carried out under air pressure to prevent the inflow of water, and as the machine advances the sections are bolted up in their places. A shaft would be sunk and a machine set in each direction with a probable advance of sixteen and a half feet in twenty-four hours per machine.

The rails are to be supported at twenty-seven and a half inch distances by the flanges of the sections, and are to weigh forty and a half pounds per yard, the three insulators for carrying the electrical conductors are to be laid between the rails.

The trains, running at three minute intervals, will be about 1,000 yds. apart, and forty-eight trains, consisting of forty-eight locomotives and 144 carriages, will be running at once. Two power stations with two complete plants each will be erected, and under ordinary circumstances one engine and dynamo of each station will supply current to one of the cross lines and half the circle line, but the leads will be so arranged that, if necessary, the whole system can be worked from either of the stations at will. There will be a constant pressure of 500 volts, slow speed motors with varying resistances and gearing running in oil to diminish friction and noise.

The total length of the line is about thirty miles, with an estimated cost of £2,550,000 or £68,500 per mile. The charge for any distance per passenger will be 1.2d. The traffic is estimated at nearly five persons per carriage mile, or 57,000,000 passengers per annum, with 11,800,000 carriage miles or 117,000,000 passenger miles. This would bring in a total yearly receipt of £285,000 of which £144.000 would be required to defray running expenses.

New Power Stations of the West Chicago Street Railroad Co.

Construction on the two new cable power houses of the West Chicago Street Railroad Co. have been delayed quite seriously. The rains which have flooded Chicago interfered with the work, and on the site of the station at Blue Island Avenue and 12th Street an unlooked-for difficulty was encountered. An old slough was struck at two different points, and, to make a bottom, 87,000 cu. ft. of concrete was necessary. The contracts for equipping the two stations were let to the Pennsylvania Iron Works. In the Blue Island Avenue plant will be installed two Allis 40×72 in. engines of 1,700 H. P. each. Four sets of Walker's patent drums will be used, the shaft of which will be sixteen inches in diameter. The main line shaft will be eighteen inches in diameter.

In the station at the corner of Van Buren Street, two Allis 38 × 60 in. engines of 1,400 H. P. each will be installed.

The Lakeside Electric Railway at Toronto, Ont., was put in operation on July 15. The system used is the Rae, and all the machinery was built in Canada, and installed under the direct supervision of Mr. Rae, with the assistance of Mr. G. Wilson. The cars are double decked with fore and aft seats on the roof.

Meeting of the Tramways Institute of Great Britain and Ireland.

The Tramways Institute of Great Britain and Ireland met at Guild Hall, E. C., on June 27. Mr. W. Carruthers-Wain, who presided, was unanimously re-elected president for the forthcoming twelve months, on the motion of Mr. A. P. Smith, seconded by Mr. G. P. Bradford. Other formal business was then transacted, after which Mr. Elliott, the secretary, presented the annual report, in which it was stated that thirty-four companies were members of the Institute, and that there were also sixty-two delegates and 150 associates. This showed an increase of five companies since the last report, of six delegates and fifty-two associates. On the other hand, two companies had ceased to belong to the Institute (one owing to liquidation and the other to legislation), while twelve associates had ceased to be such owing to promotion, resignation and death. The Council urged most strongly upon the members of all classes the paramount interest to increase, by the addition of other companies and associates, the power and influence of the institution, as there could be no doubt that one result of the general election would be legislation which, unless carefully supervised and properly dealt with, must have injurious effects upon tramways and the shareholders.

Mr. Carruthers-Wain, in moving the adoption of the reports and accounts, congratulated the members on the satisfactory condition of the Institute, and drew attention to the recent development of electric tramways. After giving some figures concerning the slow growth of tramways in the United Kingdom, he concluded by impressing upon the members that pressure should be brought to bear upon parliamentary candidates at the forthcoming election, so that a committee should be appointed to inquire into the working of the Tramways Act of 1870.

The report of the committee on mutual assurance against accidents was then presented by Mr. A. P. Smith. The report recommended generally that a company should be formed to undertake the insurance of tramway plants. In the discussion on this matter a difference of opinion was expressed as to whether, among other points, if such a company were formed it could be made self supporting, and as to the liability of one company running steam cars and another horse cars. It was eventually proposed and carried that the meeting generally approved of the outlines of the plan, that the committee was authorized to take such further steps as might be desirable and the matter be reported upon at the next meeting.

Mr. F. Arnall, A. M. I. C. E., assistant surveyor of Birmingham, then read the following paper on

PERMANENT WAY CONSTRUCTION, ESPECIALLY AS REGARDS WEAR AND TEAR AND DEPRECIATION.

When tramways were first laid in Birmingham the question arose as to whether they should be laid and maintained by the Corporation or whether this work should be left to the company working the line. It was thought that as it was the duty of the corporation to maintain the roads it would not be altogether right to delegate that duty to a company who would use a part of the road for their private business, and whose primary object was not the care of the road, but the making of a profit in the using of a part of it. It was, therefore, decided that the tramways should be laid by the Corporation and maintained by them on terms to be agreed upon with the several companies concerned.

The first tramways were laid in Birmingham in 1872 and in 1875, the lines forming a continuous route, about four and a half miles long, from one side of the town to the other. It was nearly all double line and laid to a four foot eight and a half inch gauge. In construction the Larsen system was adopted—an iron rail laid on a continuous wooden sleeper, as shown in section in Fig. 1. It was found that although the rail was fastened to a continuous wooden sleeper, its bearing upon it was evidently very discontinuous; the wood warped and shrunk in a way that the iron rail could not follow, and however firmly it was fastened down it soon worked loose. As this system of construction in and about Birmingham is, however, now a thing of the past, it is hardly worth while now to go into detail as to the merits or defects it possessed. A part of it was taken up in 1887 for the construction of the Hockley cable tramway, and the remainder in 1889 for the construction of the Bournbrook electric line.

Steam traction was introduced into Birmingham in 1882, and has since received a very extensive development; its growth was rapid, but soon checked. Between 1882 and 1887 the three companies using steam on the Birmingham tramways acquired altogether about 120 locomotives, and I believe the various companies have always done their best to keep as many as they possibly could at work on the roads. This paper deals more particularly with the effect of this steam traffic upon the tramways rather than with the tramways themselves, and the Birmingham results are the more important because the traffic upon the lines is so exceptionally heavy. In some streets there are four lines of routes overlapping each other, and in other streets as many as five lines, each route having quite a full complement of cars running over it. The result is that we have as much wear and tear on these tramways in five years, or in four years, as the case may be, as we get on a single route in twenty years. This is, of course, apart from the effects of ordinary traffic, which I believe to be very small indeed.

Knowing, then, the actual amount of wear in five years where four routes run over the lines, we have a good guide as to the amount of wear to expect on a line over which the traffic from only one route passes will sustain in twenty years. Many things may conspire to increase the effect on the single route in the long period of twenty years, such as corrosion, the long continued effect of ordinary traffic, the natural growth of the district and consequently more frequent service, and so on; but I know of nothing that can possibly diminish the effect, except that the engines, etc., taken over the lines be reduced in weight or number, which can hardly be expected.

This point of view does not seem to me to have yet received at the hands of the Institute the attention which it deserves, especially bearing in mind its important bearing upon the question of depreciation or of prolonged maintenance, as apart from casual, every day repairs. Generally speaking, every case of repairs is a renewal of some part or another; it may be the replacing of a broken point, or only the renewal of the bedding under the adjacent paving stones, or of the grouting between them. Those engaged in the maintenance of steam tramways generally have a pretty good notion as to what every day repairs means, but the almost imperceptible wear and tear to the rails themselves, which is always going on but which generally takes a long time to make itself visible, when not overlooked altogether, is generally only provided for in an indefinite sort of a way by a depreciation fund. The traffic on some of the steam routes in Birmingham has already produced some results which may serve as data to assist in determining what this depreciation fund should be in similar circumstances, and, properly interpreted, may even be of service in circumstances which are not similar.

The first tramway laid for steam in Birmingham was the Birmingham and Aston route in 1882—a length of about one mile of double line inside the borough, laid by the Corporation, and a further length of about three miles or thereabouts in the district of the Aston Local Board, laid by the Aston Tramway Co. The gauge was three feet six inches, the rail used being that known as Barker's, a steel rail, forty-two pounds per yard, keyed to a cast iron sleeper, as shown in section in Fig. 2. The sleepers were cast in lengths of two feet eleven inches each, and laid with a gap of only one inch between them, so that they were practically continuous. They were moulded by machinery, and were as nearly true on the upper surfaces as castings not machined over can be, and though they formed a nearly continuous line, it soon became evident that they did not form a continuous bearing for the rail. In a very short time after the line was opened the rails began to work loose at the joints, which were always in centre of sleepers, and in spite of all tightening up and replacement of keys, this defect gradually spread along until the rail was loose from one end to the other; and the next result was, of course, the loosening and sinking of the paving stones alongside. A length of 200 to 300 yds. in Corporation Street was left unpaved, and here the keys could be readily got at for tightening up, etc., but it was found that the rail did not become loose because the keys were not tightly driven in, but because they were cut away by the harder rail. A trial of some steel keys was made, but it was found that they caused the edge of the hole in the rail itself to cut away, so they had to be abandoned.

It was found that the steam traffic was really subjecting the rail to a process of "cold rolling," which lengthened out the upper surface, while the lower parts of the rail remained unaltered. As a result, the rail tended to assume an arch or bow form, and when all the keys in a thirty length of rail had been knocked out, the loose rail rose in the centre six inches or nine inches. It, furthermore, was no longer straight on plan, but curved, the tread or bearing surface of the rail being on the outside of the curve. The effect was that when keyed down the rail was always in a state of strain, and the least looseness in the keys caused it to rise above its bed, and at the same time the horizontal curvature caused it to move sideways, so that when a car passed over it the lower parts of the rail did not fall directly in their proper places on top of the sleeper, and dust and grit from the road surface formed a most efficient grinding material which was constantly being renewed. Thus, the top of the sleeper wore away as fast, practically, as the top of the rail, and it, moreover, wore out of shape, and the notion that we should be able to replace the rails when worn out without having to disturb the sleepers, had to be definitely abandoned. This process went on until the flange of the wheel reached and ran on the bottom of the groove, and then destruction went on more rapidly still, until, toward the end of 1886, when the lines had been in use four years, some of the rails began to split along the groove and had to be taken out, thus terminating their career.

Four years seems a short life for a tram rail, but the conditions must be taken into consideration. The rail was in a macadam road, and the traffic over it, amounting to, perhaps, 30 000 steam cars in 1883, had rapidly increased until the fourth year, when it had to carry the traffic from five different routes, amounting to 120,000 cars in that year. The total in four years amounted to about 280,000 cars, roughly equivalent to somewhere about an average of five minute service during the period.

In lower parts of the tramway, where the road was paved all across, and where some of the traffic had been diverted down other streets, the wear and tear was not so great—nevertheless it was found necessary to take out and replace all the rails before the end of 1889, after the passage over them of about 380,000 steam cars in seven years. Outside the borough boundary the tramway company contrived to carry on for a few months longer, but took out their rails in the following year, after having been in service about seven and a half years and carrying the traffic of rather more than 400,000 cars.

Our experience thus shows that, apart from all questions of ordinary everyday repairs to paving, points, etc., the Barker rail will be worn out and done with, and must be replaced, after the passage over it of about 400,000 steam cars. If the new rails have to be put in in the night time and without disturbing the traffic, it may be taken that a mile of single line will cost about £2,000 in relaying it with girder rails, which is equivalent to about 1¼d. per car mile as a sinking fund to provide for the replacing of the rails alone.

The results I have indicated were, of course, not arrived at until after the Barker rails had been laid down for several years, but before even they were opened for traffic opportunity had been taken to examine the system and to gain lessons from its use elsewhere. The result was that when, in 1883, the Corporation were called upon to construct

tramways for what is now called the Birmingham Central Tramways Co., the conclusion had been arrived at that the system was not suitable for steam traction. Considering the extensive system of tramways that the Central company proceeded to construct, or have constructed, and the nature of the agreements already entered into between them and the Corporation, it is not too much to say that this decision of the Corporation has proved to be one of the utmost importance to the company. The system decided upon for the new tramways was the Gowan, or girder, rail, seven inches deep, to suit

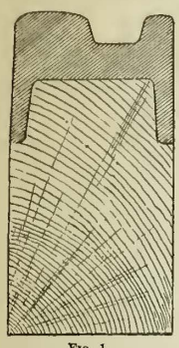


Fig. 1.

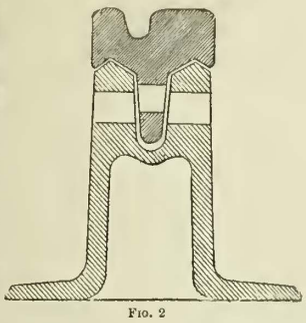


Fig. 2

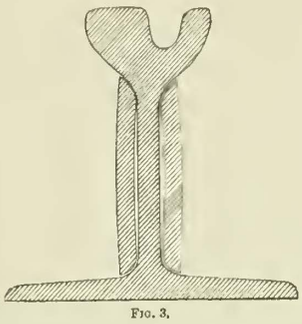


Fig. 3.

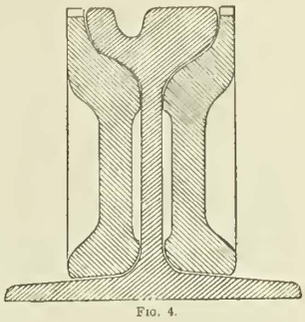


Fig. 4.

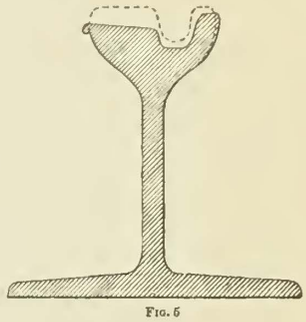


Fig. 5

six inch paving, seven inches wide on bottom, and weighing ninety-eight pounds per yard, the section being as shown in Fig. 3. The tenders of the Barrow Hæmatite Co. were accepted for the supply of rails and fishplates, and, in fact, all the rails of this section hitherto laid by the Corporation have been supplied by the Barrow company.

The joints were made of two sixteen inch fishplates, with four bolts, and were generally found to stand very well on a single route of tramway for the first two or three years, equivalent to the passage of, perhaps, 60,000 to 70,000 cars over them. After this they began to work loose, and the remedies resorted to—viz., tightening up the bolts and often replacing them, repacking the rail, etc.—are found to be only a temporary cure. For some time it was thought that the working loose was due to the nuts slacking back, or to the bolts stretching, and various varieties of locking nuts were tried, but with no beneficial results. The bolts may certainly have stretched a little, but the nuts certainly did not slack back or work loose, and it appears that the failure at the joints was due to several causes, which may produce different results under different circumstances.

It is not easy to imagine how a line of rails, properly fished together, and supported continuously on a solid bed of concrete, can work loose at the joints, but it is very certain that they do. The chief reason is to be found in what I believe to be the fact, that on a steam route the rail generally is not continuously and equally supported, and, furthermore, it never can be for long together. The rail bears more solidly in some places than it does in others, bridging over the hollow places, and there is, consequently, a minute deflection as the load passes over the places that are least firmly supported. When the joint happens to be over one of these slack places in the concrete the deflection will be greater. In the section of rail under discussion, deflection can readily take place, the head of the rail sinking between the tops of the fishplates, wedging them open. To be effective in resisting a tendency of this sort, each fishplate should act like an arch, the bolts passing through the crown, the abutments being at top and bottom of the plate. In the Birmingham section, however, though we have a fairly good abutment at the bottom, there is a very bad one at the top, and sliding can very readily take place there, and does. The narrow edge of the plate is not a good surface for withstanding an action of this sort; it is too narrow; this is very plainly seen when a loose plate is taken off, the top and bottom edges being often ground quite bright and smooth, and generally, a more or less deep ledge is worn in them by the extreme ends of the rails.

Many attempts have been made to deal with this weakness at the joints, with but imperfect success. In the last route constructed by the Corporation the length of fishplates has been increased from sixteen inches to twenty-four inches, and the number of bolts from four to six, but the traffic on this line is comparatively slight, and as yet the soundness of the joints upon it is no criterion of what we might expect on a steam route with heavy traffic. A large number of Marshall's soleplates have been used; at first the plates were sixteen inches long, with four clips on each side, but these not being in all respects satisfactory, the length was increased to twenty-two inches. These long plates were practically no better than the short ones, if so good. More close attention being paid to the movements of a loose joint under the traffic, it was seen that the defect was rather with the clips, so I suggested that the two centre clips should be brought close together, and coalesced into one, the two bolts being retained. Tl is form of clip turned out to be a great improvement on the old form, and I believe the plate is now as good as a soleplate can be expected to be. It should be remarked that in our work these plates have been under one disadvantage, inasmuch as with the exception of one route, and that of light traffic, they have been put under joints that were already faulty, and mending a bad joint is not such easy work as delaying the failure of a good one.

To find what the effect of increasing the bearing area at top and bottom of the fish plates would be, a number of C. I. plates, sixteen inches long, and of the section shown in Fig. 4, were prepared. They fit the rail closely top and bottom, and the top is brought up to the street surface, and finished with a corrugated surface, and it will be seen that in screwing up the bolts there can be no tendency to make them ride up on their abutting surfaces. A trial length of line was selected, and a number of these plates put in in the autumn of 1890 in a street of very heavy traffic, and their behaviour is being compared with joints of other forms made at the same time in the same street, and under precisely the same conditions. They are still standing very well. Where these plates are used without soleplates the joint seems about equally good as when fishplates and soleplates are used, and where it has been combined with a soleplate the joint is better than any that has yet been tried in Birmingham. As the plates have been in a year and eight months only, it seems too soon to speak very positively of their merits; nevertheless, it is worth remarking that in tha time they have had more than 250,000 steam cars over them, or the equivalent of a ten minutes' service for about twelve years.

To refer again to the "cold rolling" process which has been already mentioned, I am persuaded that this action is one reason why we have so much trouble with the joints; its whole tendency is to lift the rail off its bed, allow dirt, etc., to get underneath in irregular patches and thereby destroy the continuity of the bearing. The dipping at the joints, which is such a marked feature in a well worn steam tramway,

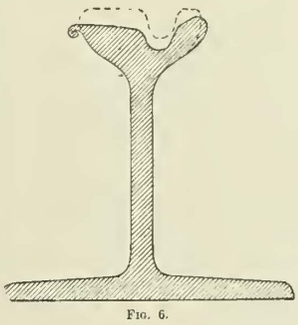


Fig. 6.

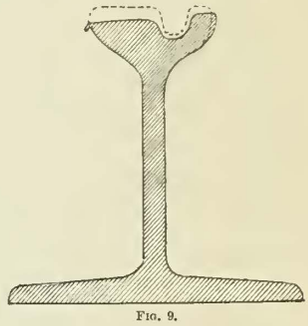


Fig. 9.

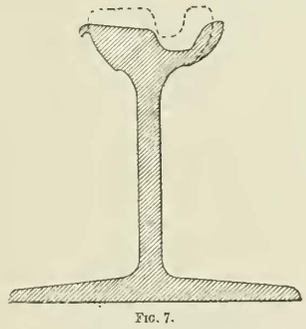


Fig. 7.

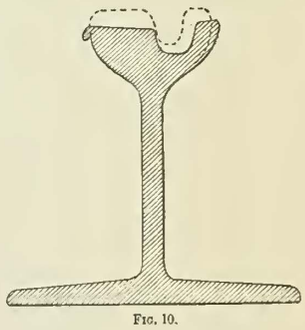


Fig. 10.

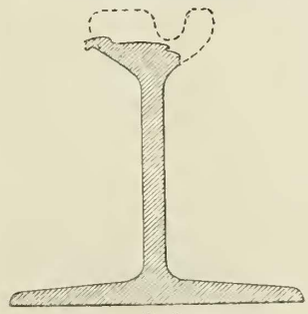


Fig. 8.

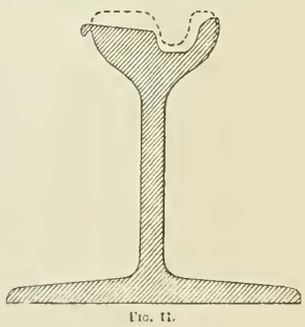


Fig. 11.

is not so much a lowering at the joints as a lifting of the intermediate parts of the rail, and it is found that whenever a rail gets this hog-backed appearance, the trouble with the paving, which at first was only experienced at the joints, is now found pretty general all along the rail. It is furthermore to be remarked that the curving up in the centre is very much more with the same amount of traffic on a six inch rail than it is on a seven inch rail, and so much is this so that I venture to advance the opinion that nothing less than a seven inch rail is fit for use on a steam tramway of a moderately heavy traffic.

I have here, Figs. 5 to 11, actual sections of some rails that have been taken out of the Birmingham tramways, showing the effects of wear upon them.

No. 5, Straight line; effect of 555,000 cars
No. 6, Flat curve " " 570,000 "
Ny. 7, Sharp curve " " 570,000 "
No. 8, Straight line " " 560,000 "

This example shows effect of expansion in wood paving, when allowed to become excessive.

Nos. 9, 10, 11, straight line; effect of 670,000 cars.

All these sections show more or less the effect of tilting over of the rail, which is always to be found on a steam tramway, has upon the wear and tear of the rails; the tread is not worn evenly down, but more rapidly towards the groove, leaving the flange standing up as a more dangerous obstacle to the ordinary traffic. From them some idea may be obtained of the great advantage which a rail with a central groove would have over one of the ordinary section.

These sections show that on a straight road a girder rail will be worn out and require replacing after the passage over it of less than three-quarters of a million of steam cars. Many things may cause the number to be less, but nothing, except reduction in weight, can cause the number to be greater. Taking the cost of relaying at £2,000 a mile, it works out that over and above the cost of every day repairs and maintenance of paving, etc., a damage to the extent of certainly over .5 of a penny per mile is accumulating on the rails, and may some day want paying off all at once. How this liability is to be provided for is for the company to determine, but it seems to form a very definite factor in any depreciation fund that may require to be set aside to provide for future requirements.

DISCUSSION.

Mr. Cox, in the discussion, said the difficulty was at the joints. He had tried Marshall's soleplates, and was now trying Whytehead's joint chair and fishplate. In the course of his experience he had found that single lines on tramways worked by steam wore as long as the double lines. Steam engines and cars passing all in one direction tended to break down the joints very much indeed; but on a single line that was counterbalanced by the traffic going in each direction. On the lines he was connected with, the fishplates wore in the same manner as Mr Arnall had explained. They were sixteen inches long and half an inch thick at first, but better results had been obtained with longer plates three-quarters of an inch in thickness.

Mr. Wroughton was of opinion that the Barker rail gave "more trouble than enough." In 1886 his company had laid a short length of line with transverse sleepers where the road surface was very hard, and when General Hutchinson made an inspection recently, he was surprised to learn that not a single joint had been touched or anything spent on the paving. Cross sleepers were, no doubt, the best system.

Mr. A. Dickenson, of Darlington, congratulated the author of the paper, and suggested that one of the methods by which the difficulty of joints might be overcome would be by reducing the number of the joints, and for that purpose electric welding, or some other process, could be used.

Wr. J. Waugh, of Bradford, believed in the use of the Barker rails, which he had found to stand exceedingly well.

Mr. Bradford was strongly of opinion that transverse sleepers were the best. There was less oscillation when the foundation was firmer, and it was the oscillation which caused the joints to break; he was thoroughly convinced that cross sleepers were the best, and they ought to be used.

In the course of his reply Mr. Arnall stated that he did not think that the Whytehead joint chair and fishplate would remedy the evil of the joints. People had made a diligent search for something to cure the evil of the joint, but up to the present they had not found it. The trouble did not so much arise from the inherent weakness of the joints, but from that process of "cold rolling" on the top of the rail. He agreed with what Mr. Cox had said regarding the cost or wear of the single and double lines. He had tried to discover the difference between the two, but could not do so. With reference to electric welding, he did not agree with Mr. Dickenson on that point, as such a process would increase the trouble through "cold rolling," to which he attached great importance. The cross sleepers would diminish noise, but, in reply to the question put by the president, he was unable to state what was the best system of laying tramways.

Mr. Sharp next read a paper on "The Further Development of the Connelly Motor in England and America."

A paper, of which the following is an abstract, was then presented by Mr. G. Annesley Grindle, C. E., on

ELECTRIC TRACTION: THE CITY & SOUTH LONDON ELECTRIC RAILWAY.

In the year 1884 an application was made by certain individuals to Parliament for power to construct an underground line from the city to the Elephant and Castle, and granted. The want of such an undertaking had been long felt, and various schemes had been suggested to afford communication between the City of London and the densely populated districts on the south side of the river, and relieve the congested traffic over London Bridge, which, in 1886, when the railway was commenced, was estimated at 7,000,000 vehicles and 56,000,000 foot passengers per annum. The course taken for the line was from a terminal station adjoining the Monument, under the Thames, a few yards above London Bridge, and beneath the Borough, Blackman Street and Newington Causeway to the Elephant and Castle, following, as nearly as possible, the line of roadway, and so avoiding the cost of land purchase and compensation. The work of construction was commenced in 1886, and so gratifying were the results of the operations on this first section, involving as it did the difficulties of tunneling under the Thames, that the directors applied to Parliament in 1887 for further powers authorizing them to extend the line to Stockwell—making in all a distance of some three and a quarter miles. The route for this extension was from the Elephant and Castle along the Kennington and Clapham Roads, with stations at Kennington, Kennington-Oval and Stockwell. The work of the extension proceeded concurrently with the completion of the original section, and for obvious reasons the opening of the first portion was delayed until the completion of the scheme in its entirety from the city to Stockwell. Since the opening of the line to Stockwell, further powers have been sought and obtained for an extension to Clapham Common. This extension, however, has not yet been carried out, but will doubtless shortly be commenced, and cannot but prove a valuable addition to the undertaking, Stockwell being at present, at any rate, a poor centre for a terminal station. The system of tunneling is somewhat novel, and introduced into this country by Mr. J. H. Greathead, M. I. C. E., to whom the designs of the line is due, and under whose able superintendence the construction works were so successfully carried out. Entirely separate tunnels are employed for the up and down lines, so avoiding all possibility of collision between trains approaching each other in opposite directions. The material used in the construction of the tunnels is cast iron, built up in consecutive rings, each ring being composed of several segments, with a key piece. The tunnels are driven by a shield, which in form may be described as like a tube of some ten or twelve feet long, with a bulkhead, the internal diameter of the tube being slightly larger than the internal diameter of the iron tunnel. A short length of soil is excavated in front of the shield, which is then driven ahead by means of hydraulic power, and the segmental ring is built up within the shield tube in the resultant gap caused by the forward movement between the bulkhead and the last built ring of the tunnel. The diameter of each tunnel is about ten feet. The stations are of brick and usual construction of arch and invert, and have a diameter of twenty-two feet. The tunnels run, as a rule, side by side, excepting under the Thames, where one line is directly above the other. The depth of the tunnels below the surface of the roadway varies from fifty to seventy feet, and is consequently below all sewers, gas pipes, water pipes and subways, and causing no disturbance to the surface of the roadway. At such a depth the question of ventilation would appear to be a serious one, but as a matter of fact the tunnels are self ventilating, and no special arrangement or machinery whatever is employed to effect what is generally acknowledged to be a very satisfactory state of air in the tunnel. This is due chiefly to the employment of separate tunnels for up and down traffic; the trains fit the tunnels almost like pistons, with the result that every train is continually changing the air, pushing, so as to speak, a column of air to the station ahead, whence it escapes by means of the lift shafts, and sucking air from the shaft of the station last passed. Of course, at such a depth steam locomotion would be out of the question, and originally it was proposed to work the line by means of cable haulage, and, in fact, contracts for such means of running were actually entered into. In the interval, however, that elapsed between the first conception of the undertaking and the time when its accomplishment was in the near future the application of electricity to traction purposes had been advancing by leaps and bounds, and with the success attained on the Newry and Bessbrook line (on which the loads dealt with, as mentioned before, were but little, if any, less than those it was proposed to run on to South London line). Messrs. Mather and Platt were induced to approach the directors of the line with a view to obtaining their consideration as to the advisability of employing electricity as their motive power in lieu of cable, and to submit a complete scheme for the purpose, together with proposals for the working. The matter was the subject of long and careful deliberation by the board of the company, and was warmly taken up by the chairman, Mr. Charles Grey Mott, to whose untiring energy and deep interest in the matter a great part of the success of the undertaking is due. The submitted scheme was eventually accepted in its entirety, and a contract entered into in the early part of 1889 for the equipment of the line in accordance with the same. It addition to the actual equipment of the line an offer was also made to work the line for a period of twelve months, or at the option of the company to guarantee the cost of haulage according to a sliding scale, dependent upon the train mileage run per annum, commencing at 3.5d. per train mile for the full possible mileage of 384,800 miles per half year. The trains under the guarantee to consist of: Locomotive, ten tons; three coaches of 4.25 tons each, and 100 passengers. During the summer of 1889 various experiments were carried out on a short length of line then completed, by a temporary plant at Great Dover Street station, and two experimental locomotives. The experience gained in these trials was at the same time both unique and valuable, affording an amount of information which had never before been attained, and which proved invaluable in working out many subsequent details. In the meantime the construction of the plant proceeded rapidly. In close proximity to the Stockwell terminus of the line, on a large plot of land which serves as a general depot, a spacious engine house, in which the entire current employed in working the line is generated, was erected.

The plant supplied consisted of three generating dynamos of the Edison-Hopkinson type, each having an output of 450 amperes at 500 volts. The machines are compound wound, with bar armatures, and are about the largest machines of the class that have ever been constructed, the total weight of each machine being over seventeen tons. The driving is effected by means of link leather belts twenty-eight inches wide, and to increase the grip, the belt is led under a jockey pulley. Each dynamo is independently driven by a vertical compound engine, designed and constructed for Messrs. Mather and Platt by Messrs. John Fowler & Co., of Leeds. The high and low pressure cylinders are seventeen inches and twenty-seven inches internal diameter respectively, and are both steam jacketed. The stroke is two feet three inches, normal running speed 100 revolutions per minute, giving a piston speed of 450 ft. per minute. The engines are fitted with automatic expansion gear on both high and low pressure cylinders, con-

trolled by a high speed governor driven by ropes directly from pulley on crankshaft. The steam pressure employed is 140 lbs. per square inch. The flywheels are very massive—fourteen feet in diameter, twenty-eight inches wide on face, and weigh fourteen tons. Each engine will indicate 375 H. P., and in practice two engines and dynamos are employed, and are sufficient to work the entire line, the third engine being kept in reserve. The engines are supplied with steam from six steel boilers of the Lancashire type, twenty-eight feet long, seven feet diameter, and are fed with fuel by means of Vicar's mechanical stoker. The water supply is effected by means of two Worthington pumps, and before entering boiler is forced through two feed water heaters, heated by the exhaust steam from engines.

Since the opening of the line, and in view of the extension to Clapham Common, a fourth engine and dynamo similar to the original three have been erected, also two additional boilers. The boiler house is below the general ground level, which greatly facilitates the stoking, the fuel being simply tipped straight into the hoppers, and so avoiding all cost for elevating, etc. Adjoining the engine house is a fitting shop where minor repairs can be carried out. From the dynamos the current generated is conveyed by means of lead covered cables to a massive, but simple, switchboard, and is there distributed to the feeding mains. These mains or cables, of which there are four, are of the well known Fowler-Waring manufacture, and consist of a $\frac{61}{14}$ B. W. G. copper core, insulated with patent insulating material and lead-sheathed. The cables are carried on brackets along the sides of the tunnel, and lead into the various signal boxes. In the signal boxes are fixed small slate distributing boards, fitted with plugs and fuses, and from these the current is conveyed to the working conductor by means of feeder cables. The working conductor is of steel, of channel section, specially rolled for the purpose, and of such composition as to ensure its having a low specific resistance. It is carried by glass insulators, which are cleated with creosoted blocks to the sleepers and laid between the two main rails at a distance of about one foot, from one rail—this position being rendered necessary on account of the low position of the central buffer coupling. The lengths of conductor are fished with two small fishplates and four bolts, as a mechanical coupling, while the electrical connection is ensured by means of a laminated copper strip secured by four copper rivets. The steel conductor is not continuous, but broken at every station, the intervening gap, a length of some two feet, being made up with a piece of well seasoned oak, by which means it is possible to isolate any one section of the line, without interfering with the remaining sections, or, in case of any accidental failure occurring on any section, it automatically disconnects itself from the system. At the points and crossings, which are in every respect similar to ordinary railway practice, the shoes or collectors have to be lifted over the crossing rail, the level of the conductor being one inch below that of the main rails. This is accomplished in a simple and effective method by means of inclined wooden planes, up which the shoes run. The insulation throughout the line is exceptionally high. The daily test of the entire system—which includes generators, switchboards, cables, feeders, working conductor, points and crossings, locomotives and lightning circuits with the full pressure of 500 volts—does not give a leakage current of one ampere, or considerably less than one H. P., and is often as low as a quarter of an ampere. The conditions of the line naturally are highly favorable in this matter, no difficulty with weather having to be contended with. The return circuit is made by means of the main rails, which are connected, in addition, to the ordinary fishplates with copper connecting strips fixed in the same manner as in the working conductor.

The electric locomotives, of which fourteen were supplied for working the line, were each designed to be capable of exerting a tractive force of 3,000 lbs., and running at a speed of twenty-five miles per hour. In general appearance the locomotives closely resemble steam tram motors. The weight of each locomotive is ten tons, and it is carried on two axles with a wheel base of six feet. In the construction of these motors a striking and novel departure from anything that had previously been attempted was made with regard to the armature. Instead of being, as in previous engines, connected with the driving axles by means of gearing, belts or chains, the armatures were actually built up on the axles themselves, thus entirely obviating all the necessary incumbent complications that had hitherto been in vogue. The magnets are supported partly by the axles and partly suspended from the car itself, an arrangement which allows of a certain amount of freedom of angular motion round the axle, yet always remaining concentric with the armature. A separate and independent motor is fitted on each axle. The motors are series wound, and the armature revolution per minute, of course, varies with the speed of the train ; at twenty miles per hour, the revolutions are approximately 250 per minute. The current is taken from the working conductor by means of three sliding shoes fixed by hinged supports to the frame. The shoes are of cast iron, and it is found in practice that they will run about 10,000 miles before requiring renewal. From the shoes the current is carried by an insulated cable to the main resistance switch which controls both motors. The resistances are placed in series with the motors, and gradually cut out as the switch is put over. A second switch controls the reversing movement, which is effected by changing the direction in which the current passes through the armature. The locomotives are fitted with hand and air brakes, the latter being of the well known Westinghouse type, and continuous throughout the train. To work the air brake, a supply of compressed air is carried in two steel reservoirs on the locomotive, and replenished at Stockwell on every round journey. Connection between the locomotive and carriages is effected by means of a central buffer coupling. The trains are made up of two coaches, each constructed to carry thirty-four passengers, open from end to end, with two longitudinal seats like those in an ordinary tram car. Entrance into the cars is gained by means of end doors, and between the carriages intermediate platforms are fixed, fitted with collapsible side gates. The carriages, which are twenty-nine feet over all, are carried on two four wheel trucks, and, exclusive of passengers, weigh over seven tons each. The lighting is effected by means of incandescent lamps, supplied with current from the working conductor.

The gauge of the line is standard, four feet eight and a half inches, and the rails, sixty pounds weight per yard, are of Ebbow Vale steel. The track is not ballasted, the cross sleepers merely resting on the sides of the iron tunnel. The road has many severe curves and gradients, the sharpest curve having a radius of one and a half chains, and the heaviest gradients one in fourteen with, and one in twenty-five against, the load.

A complete telegraphic and block signaling system is carried throughout the line.

Such is a brief description of the line and its equipment, the entire electrical portion of the latter being constructed by Messrs. Mather and Platt, of Manchester, from the designs, and under the superintendence, of Dr. Edward Hopkinson, a partner in the firm.

A few words on the working and results may, perhaps, be of interest. On November 4, 1890, the line was formally inaugurated by His Royal Highness, the Prince of Wales, who, accompanied by His Royal Highness, the late Duke of Clarence, made the journey from the City to Stockwell, and visited and inspected the plant and works. Shortly after this the line was passed by the inspectors of the Board of Trade, and eventually opened for public traffic on December, 18, 1890.

Upwards of eighteen months have therefore elapsed since the public opening, during which time the line has been in daily operation. For the first few months a train service of some twelve trains per hour each way was maintained, but with the growing traffic this has been increased, until at the present time, during the busy hours of the morning and evening, as many as sixteen and seventeen trains per hour are run. The public appreciation of the line is shown by the increasing numbers of passengers carried. For the half year ending June 30, 1891, the number of train miles run was 141,108, and passengers carried 2,412,343. For the second half year, ending December 31, 1891, the train mileage run was 188,666 miles, and passengers carried 2,749,055, exclusive of season ticket holders, the revenue from which on the average fare would represent 37,300 additional passengers, or a total of 2,786,355. The revenue receipts and expenditure have been—for the first half year, receipts £19,637, expenditure £15,520, or a balance to the good of £4,117 ; for the second half year, receipts £20,243, expenditure £15,516, balance to the good £4,727. These figures are significant when compared with the train mileage and passengers carried, 47,258 train miles more having been run, and 374,000 more passengers carried during the second half year, while the total expenditure has been £4 less, which reflects much credit on both the general manager and engineer, Messrs. T. C. Jenkin and Basil Mott, for the manner in which the working of the line has been conducted. It is to be regretted that this meeting was not a few weeks later, when the results of the present half year would have been available for comparison, but to date, since the opening of the line, the total mileage run is over 500,000 miles, and the number of passengers carried upwards of 7,000,000. The percentage of expenditure to receipts may appear high, but careful study and analysis of the figures show that this is not abnormally due to the traction expenses—the cost of locomotive and generating power, including salaries, office expenses, general superintendence, running expenses (including wages connected with the working of locomotive and generating engines, coal and coke, gas, water, oil, tallow and other stores), repairs and renewals, including wages and materials, only amounting to 40 per cent. of the total expenditure, or 30 per cent. of the gross receipts, which I venture to submit will compare favorably with any other mode of traction. From these figures it will be seen that the cost per train mile for the last half year was just under 8d., while under the sliding scale before mentioned the cost per train mile on the mileage run would have been 7.152d. But in the actual cost of 8d., drivers' wages and other items are included, which were excluded in the sliding scale and if deducted, bring the actual cost down to 5¼d. per train mile. This, I think, will be generally admitted as highly satisfactory, especially when the serious increase of the train load (no less than 40 per cent. above that originally stipulated for) caused by the increased weight of carriages is taken into consideration, the total train load for the 5¼d. per mile being forty-two tons. The working of the plant and line has been both regular and satisfactory.

On no single occasion during the whole period that the line has been in operation has there been any accident or stoppage of the generating dynamos, showing conclusively the security and certainty with which electrical plant can be worked. Slight delays have occurred from time to time with the locomotives, but these have in almost every instance been distinctly due and traceable to the unexpected load and strain put upon them, and in spite of which the record of work done by these locomotives will compare favorably with that accomplished by steam locomotives. The average mileage of the locomotives in regular use during the past year has been no less than 27,000 miles, while on a well equipped steam road the average is 20,000 to 23,000 miles per locomotive. The success of the line is further shown by the numerous similar projects which have followed. Last year a bill was passed through Parliament authorizing the construction of the Central London Railway, a line seven miles in length extending from the City to Bayswater, to be constructed in the same manner, and to be worked electrically on similar principles, but on a much larger scale. During the present session no less than six bills have been presented applying for powers to authorize the construction of similar undertakings. Of these six bills, four of which are applications for new lines, and two for extension of existing powers (including the extension of the City & South London line to the Angel,

Islington) three have passed through both Houses. The Great Northern & City line, running from Drayton Park to Finsbury Pavement, is of exceptional interest, being intended to relieve the Great Northern traffic, and over which it is proposed to run the ordinary rolling stock of the Great Northern Railway. The above bills in the first instance were referred to the Joint Committee of both Houses appointed to consider the whole question as to the best method of dealing with the electric and cable railway schemes, and to report their opinion as to whether underground railways worked by electricity or cable traction are calculated to afford sufficient accommodation for the present and probable future traffic. The Joint Committee, after having met on several occasions, and having had submitted to them a large amount of evidence, reported strongly in favour of the various schemes, and with regard to electric traction, as follows :

"The committee report that the evidence submitted to them was conclusively in favour of the sufficiency and special adaptability of electricity as a motive power to the proposed underground tubular railways."

It may therefore be assumed that before very long this system of transport will become fairly general in London, affording, as it does, a cheap, rapid and safe mode of conveyance.

DISCUSSION.

Mr. Scott Russell asked why a separate motor had been adopted. He thought otherwise a great deal would have been saved and greater adhesion obtained. He considered that all concerned in the City & South London line deserved the greatest credit for the success achieved.

Mr. A. J. Jarman said that when the armatures were wound on the axles, the latter were turned into part of the magnet with the wheels, thus forming the pole, and clinging to the rail ; hence, no sand was required to assist in starting. Another point was why the motors were wound in series. Supposing one of the main wires became cut or broken, that motor would stop. If, however, the motors were wound in parallel, there would always be one leg of the field magnet to work, but worked in series with series winding that motor would be cut out. Winding in parallel had many advantages over winding in series in working the machine on gradients. He was alluding to tramcar traction, and he considered it would be more advantageous to wind the motors in parallel than in series.

Mr. Reckenzaun stated that great credit was due to all concerned in constructing the City line, which was the pioneer line in that direction. With regard to operating expenses, he thought Mr. Grindle would have given details ; how much was paid for coal and wages, etc. Taking 5½d. per train mile, the working expenses seemed very low indeed. He agreed with Mr. Jarman that if two motors on a locomotive or tramcar were placed in series, there was a possibility of their not working in union ; if in parallel they worked together, and in case of accident one automatically cut itself out of circuit.

Mr. Holroyd Smith supported the remarks of Mr. Jarman and Mr. Reckenzaun on the matter of parallel working. From his own experience he had found a decided benefit by coupling up in parallel. It would be interesting to know the cost of producing one Board of Trade unit on the line. He would like to know whether any measurements had been taken to ascertain the relation between the electrical power put in the line and the mechanical efficiency obtained from it. Mr. Scott Russell had referred to the motors not being placed under the cars themselves. He (the speaker) said that if Mr. Russell had had the details of the line to thrash out he would have found that it was impossible to do so in that case. When the matter was fully taken into consideration, Messrs. Mather and Platt had decided upon the only safe way, considering the structure of the line, tunnel, cars, etc.

Dr. E. Hopkinson, in reference to the separate motor or otherwise, said that in the case of the City line there was the difficulty of putting the motor on the bogie due to the restricted space, but that was a mechanical difficulty which could have been overcome with sufficient application. The total weight of the locomotive was ten tons, and of the train fifty tons. Of the ten tons the motors weighed six tons, and the saving by not having a separate locomotive would be four tons out of the whole fifty tons. If, however, the motors were placed on the framework, the bogie would have to be strengthened and made heavier, and the total saving would be only about two tons. Under those circumstances it was not worth while to do so, and that was ample justification of the plan which had been adopted on the South London line. Mr. Grindle, who came to his firm in Manchester seven years ago, suggested that that railway was the place for electrical work. That gentleman urged them to turn their attention to it, and the result was the working out of the details. With regard to having the motor in series or in parallel, from an electrical point of view there was nothing to choose between the two. It was a great mistake to suppose that having the motors in series would reduce the risk of a breakdown.

Mr. Jarman stated that what he meant was that each pole of the field magnet should be wound so that they might be coupled in parallel and joined in series afterwards. That might be something new in motor work, but he had found it of great benefit in tramway work.

Other papers were also read by Mr. L. Epstein on "Electric Traction for Tramcars," and by Mr. A. J. Jarman on "Electric Tramcar Traction."

We are indebted to the London *Electrical Engineer* for a report of this meeting.

THE Chicago & Urban Transit Co. have increased their capital stock from $1,000,000 to $2,000,000, most of which has been subscribed. It is the intention of the company to begin to let contracts within five or six weeks.

Coming Development of Electric Railways.*

BY FRANK J. SPRAGUE.

(*Continued from the July issue.*)

No one will question the capacity of an electric motor to do the necessary work required, or to make a speed superior to that of the steam locomotive, provided sufficient energy be delivered to its terminals, but we must deal with existing or probable methods of supply. It is true that the speed at which a train is propelled by steam has only increased about 50 per cent. in sixty years, for in 1832 the "Matthew Baldwin" often made a speed of a mile a minute, but we must not confound speed with power, for while the maximum speed has not been so materially increased, the endurance, the perfection of the mechanism and the economy of performance have made great strides, and the increased speed, which is by no means the maximum possible of a locomotive *per se*, has been attained at much higher powers, and the schedule time has been shortened principally by cutting down grades, straightening curves, filling up ravines, abolishing trestle works, replacing wooden bridges by permanent ones of iron or stone, by the use of heavier and stiffer rails, better switches, improved methods of automatic signaling, the interlocking switch and signal system and the abolition of grade crossings ; in short, by improvements in details and management which permit of higher speeds on more extended sections of road, because of greater safety, lower traction co-efficients and a greater degree of confidence possessed by the engineer.

All these things are necessary for high speed electric railways, and any general improvements that will be of benefit to the latter must necessarily be of service to the former.

Now, any predictions which are made concerning the future of electric propulsion, either in ignorance or disregard of the possibilities of steam duty and the limitations necessarily existing in all systems of transportation, deserve and will receive little consideration.

Almost every one is familiar with the remarkable run recently made by a Schenectady locomotive hauling a special train on the New York Central Railroad, when the distance of 439½ miles from New York to Buffalo was made at an average speed of nearly sixty miles per hour, and which was the precursor of the Empire State express, which makes the regular run at an average speed of over fifty-two miles per hour. More recently we have accounts of an interesting record made by a well known writer on two runs between New York and Albany, on which a large number of indicator cards were taken. The weight of the train was about 270 tons. The steam pressure varied from 160 to 170 lbs. From an inspection of about a dozen cards, the indicated horse power varied from 551 H. P. at 44 miles to 1,120 H. P. at 78.9 miles. At 60 miles per hour the resistance is stated to have been 15 lbs. per ton, and at 70 miles, 17.10 lbs, per ton. About seven pounds of water were evaporated per ton of coal.

A remarkable statement concerning this performance was made by Mr. Sinclair, which, while almost incredible, will, if borne out by an analysis of facts, prove to be something of a surprise to those who make their prophesies of the electric economies by comparative statements. In the description of these tests it is stated that the whole trip shows an indicated horse power per hour for an average expenditure of only about three and one-eighth pounds of coal per hour. This is far better than many stationary engines.

On the New Jersey Central road one schedule time is eighty-six and one-fourth miles in eighty minutes, which is made where there are a number of necessary slackings. On May 13, the time was taken of the speed of a Baldwin compound locomotive for a considerable period of time on one of the regular runs. Ten continuous miles were made in 452½ seconds and five were made in 222 seconds. The fastest time taken was forty-four seconds and the slowest noted was forty-seven.

In making these very high speed runs there is not much attempt at maximum economy or coal consumption, the necessity being to generate steam as fast as required by the cylinder, but on taking an average of five trips I find that there was evaporated 7.19 lbs. of water per pound of coal used and 9.41 lbs. of water evaporated per pound of coal consumed. The total weight of train varied from 213 to 241 tons.

I recently inspected a number of engine sheets. On one, which gave the duty of twenty-five engines, the average total cost per engine mile was 10.85 cents, of which 2.66 was for fuel. The total cost varied from 6.8 to 19.24 cents, and the fuel (wood) from 1.96 to 4.77 cents. On another sheet giving the performance of twenty-two engines, the total cost per engine mile was 14.70 cents, of which the fuel cost 4.61 cents. The total cost varied from 8.82 to 27.98 cents, and the fuel cost from 2.04 to 7.48. In still another, that of the performance of eighteen engines, the total cost per engine mile was 14.73 cents, of which the fuel (coal) cost 6.62 cents. The total cost varied from 10.04 to 22.52 cents, and the fuel cost from 3.82 to 13.84 cents.

In discussing the electric system there is often a confusion of statements with reference to economy. Despite the undoubted fact that the electric motor can probably be run at variable high speeds with less variation of economy than can the steam locomotive, we must not forget that in the latter we are considering the economy of the unit as a whole, not merely of the steam cylinders but also of the boiler and the furnace. In electric propulsion a similar comparison of economies must take into account the variable duty of the central station and the losses on the line as well as those in the motor, and where single units are used the variation in economy of the whole system would be much greater than in the steam locomotive. There will be only a reasonable fixed efficiency of the central station and the line when the number of units is large enough to make the load on the central station nearly constant.

*Abstract of address delivered at the meeting of the American Institute of Electrical Engineers, Chicago, June 6, 1892.

Some time ago I made a very careful analysis of the work done on the elevated roads in New York City with a view of determining the coal consumption and the duty performed by the locomotives. At the time this investigation was made, now nearly seven years ago, there were in use on the Third Avenue division sixty-three trains at one time, running at very close intervals. The weight of the trains was from eighty to ninety tons, the speed was often as high as twenty to twenty-five miles an hour; stops were made every third of a mile; in short, the duty demanded of the engines was exceedingly severe. The maximum indicated horse power of the locomotives was found to average about 163 H. P., although on occasions these locomotives have been worked up to 185 H. P. Work was divided approximately as follows: Acceleration in starting, 59 per cent.; lifting, 24.3 per cent., and traction, 16.7 per cent. The average horse power exerted was 70.3 H. P., considerably less than one-half of the maximum.

The work on the line was so distributed that there was an almost constant total duty of about 4,500 H. P. The locomotives were on duty twenty hours, but used steam only six hours, and including all losses when standing still and the amount of steam used in braking, there was a horse power developed for about 6.2 lbs. of coal.

An analysis of the coal expenditure showed that, with an efficiency of 60 per cent. and without any of the energy of the train being returned to the line, the relative coal expenditures between steam and electricity would be about in a ratio of two to one, but if the energy of the train was returned to the line to the extent which I believe it possible, then the relative expenditure of fuel would be in the proportion of seventy-two. Since the coal charge on the four divisions was at that time about $550,000, it can easily be seen that, independent of any question of saving in the care of the structure and any reduction of depreciation of the motor equipment, the fuel saving would be sufficient to pay a good interest on the cost of electrical equipment, and a large interest on the cost of electric equipment minus this value of the present engines.

In discussing high speed possibilities and limitations, the testimony of Dr. Dudley, as given in a discussion of a paper before this Institute, February 24, 1891, is interesting.*

Such a shape can be given to the front of an electric locomotive as will make the air resistance not over one-half that presented by a plain surface of equal cross section and perpendicular to the line of motion, but even this fact does not alter the other, that the resistance per ton must be higher for small trains than for large ones.

Speed, capacity and coal economy are, however, not the only questions to be considered in railroad operation, and in discussing the general subject it will be found that the signaling and braking questions at high speeds are serious ones. Undoubtedly, an electric train with distributed motors, making the weight of the train available for traction, could, by using the motors as dynamos to return the energy of the train to the line from the highest to mean speeds and then on a local circuit, be more quickly and more effectually slowed down and stopped than where shoe brakes are used, and both methods, of course, would be available.

When riding at sixty or seventy miles an hour it is a very quick stop to bring a train at rest in less than 2,000 ft. This is often as far as any signal can be made out, especially when the weather is at all thick. Hence we may expect to find on electric railroads, if high speeds are to be attained, and quite possibly also on steam railroads, an extension of automatic signaling so that trains indicate on more than two sets of signals.

In discussing the use of electricity instead of steam, a well known steam engineer recently stated that, in his judgment, it must be conceded that electromotive force for the propulsion of cars will not be economical except for suburban traffic, and upon certain sections of important trunk lines, like the New York Central between New York and Albany, the Pennsylvania system between New York and Philadelphia, the other lines of like character where it is necessary to disband a large number of comparatively light trains every day, and at short intervals. The principal field for a power of this kind would be in suburban service long enough to make the ordinary street electric cars unpopular because of the time required, and in such cases as these mentioned above; also for moving freight trains in cities, that is, for the performance of transfer service. This is precisely in line with the arguments which I have advanced from time to time, and which I illustrated in a paper before the National Electric Light Association at its convention in Kansas City, where I outlined the possible service between New York and Philadelphia, and to which I will again refer.

I must repeat that it narrows itself down to the one question as to the number of trains operated between two terminal points. Make that number of trains sufficiently large and the electric motor is the best means of propulsion, whether for high or low speed, whether for large or for small cars. Decrease this number and we must rely on steam propulsion; or to put it in another way, the answer to the query, Will electricity take the place of steam for railroad purposes? is: Only in part, and then only when the number of units operated between the terminal points are so large that the fuel economy would pay a reasonable interest and depreciation of the necessary cost of the central station and the system of conductors.

Of course I do not in this general reply consider those special cases where advantages are to be gained for which there is a return for capital in another direction. Such a case is that of the Baltimore tunnel, where the investment and cost of operation will be greater than that for steam propulsion; in fact, there will practically be no economy in power, because the steam locomotives are not done away with, but simply unused for a period of a little over a mile. There is in this specific case, however, the incidental advantage of doing away with the necessity of a ventilating plant and yet getting rid of the annoyances incidental to tunnel service.

Every system has its limitation. The electric is not exempt from this law, and hence it will set forth what are well known limiting laws concerning the transmission of energy. They have been stated time and time again, but somehow or another people often lose sight of them in discussing the question of investments in large electric railways, so that I think it would be well, perhaps, to restate and emphasize them.

The weight of copper necessary to transmit a given amount of power with a fixed loss, will vary inversely as the square of the electromotive force used.

The distance to which it can be transmitted with a given weight of conductor will vary directly as the pressure.

The distance to which it can be transmitted over a conductor with a given cross section will vary directly as the pressure.

The weight of copper necessary where the supply station is in the centre of the system, is only one-quarter that required if the station is at one end.

The weight of copper will vary inversely as the square of the number of supplying stations properly placed.

The electromotive force required will vary inversely as the number of stations.

Lack of knowledge of these simple and unalterable laws has led to much misconception of electrical possibilities, and these have not been confined to the electrical engineers.

In many of the suggestions which have been made even by practical steam engineers, there has been an unnecessary confusion of the practicable and unpracticable, and the specific object which should have been borne in mind has been lost sight of.

Committees have drawn impossible specifications for trunk line service, and demanded of electric motors a capacity and performance superior to that of the best compound steam locomotives. I unhesitatingly pronounce any attempt to build some such machines for the present, certainly unnecessary and impracticable. The service thus suggested, if at all needed, will for many years be better performed by the steam locomotive than the electric.

Leaving out of present consideration trunk line work, there are three problems requiring solution in the application of electricity to propulsion on a large scale under conditions existing, for example, in Chicago or in any other place where there is a movement of a large number of trains on more or less complicated tracks, as will be found at almost all terminal stations. They are:

First. The development of an electric locomotive of ample power which shall be as readily controlled as the steam locomotive and shall be reliable in operation and shall show a high economy. Of course such a machine must have all the adjuncts which are necessary for train movement.

Second. A system of conductors and method of supporting the same, which can be relied upon for ample supply of current and absolute certainty of continuous contact at all speeds on curves, switches, cross-overs and the multitudinous combinations which exist on yard tracks.

Third. A system of automatic block signaling which, while effective for steam traffic, will not be thrown out of operation by the use of tracks as conductors of electricity for a general supply. This is a more serious question than is at first considered, for this use will materially interfere with, if not absolutely destroy, the utility of what is known as the rail circuit system.

This third problem is one which must necessarily follow the development of the other two, as the automatic signaling systems now existing have followed the development of steam practice.

It will probably be found necessary to erect a variety of kinds of conductors. From the most careful consideration which I have been able to give to the subject, I believe there is one way, and only one way, in which the current can be supplied in any complicated system, and that is from the overhead conductor, practically rigid in character, following very nearly the centre line of all tracks and switches with no movable overhead parts, and with return through the rail. The locomotive would then practically be moving between two electric planes, the lower being the guiding one. I know there has been a great deal about other possible systems of supply, We have heard much of the charged rail using low potential currents supplied at frequent intervals by motor generators driven from a central station.

Since we have discovered no conductors devoid of resistance, and the art of welding is not particularly applicable for railway service where moving contacts are a necessity, little credence need be given to any scheme of this character.

Intimately connected with the question of conductors, and one of the most serious ones which has to be met by the electrician, is that of potential. The personal danger limit of continuous or ordinary period alternate currents is pretty well determined, and it seems generally admitted by constructors that the danger limit for the continuous current machine, with its commutator, is about the same as the personal danger limit.

Hence we meet with two dilemmas. If using continuous current motors, we are limited to a difference of potential per machine of 1,000 to 1,200 volts, and we can, so far as safety of the machines is concerned, only probably go above this limit by putting the motors in series precisely as has been proposed for long distance stationary transmissions.

If this is not done, then we have the introduction between the transmitting dynamo and the receiving motor of a motor generator system, another pet theory which is often suggested but which I unhesitatingly pronounce as so uneconomical as to be impracticable.

If using an alternate current system, then converters must be used,

*For a full report of this discussion see the STREET RAILWAY JOURNAL for April, 1891.

either distributed along the line and supplying the working circuit or placed upon the locomotive to safeguard the motors.

While the use of a converter under these conditions is not as objectionable as the use of a motor generator, it cannot commend itself as a very practicable scheme, and certainly in view of the fact that no single phase alternate motor promises up to the present serious success.

For the present, and. I think, for a long time to come, we must confine ourselves to the consideration of railroad problems where continuous currents are used, and where the traffic is sufficiently large to justify the investment in central stations and conductors which would be required for the operation of such assistant.

There are two methods of propelling trains electrically, one by following steam practice, that is by building a motor and hooking it to the head of a train, the weight of the motor being such as is required for the necessary power and traction when grades and slippery tracks are encountered. From all that has been developed up to the present, to get the control that is necessary and to build the machines safely, the electric locomotive will weigh nearly as much per horse power as the steam locomotive. This weight can be better distributed, but I do not think if steam practice is followed on trunk line service, that there could be any very material reduction of weight of train.

The other plan is to have each car propelled by one or more motors This would be the ideal system so far as propulsion goes, provided the electric motor was unlike all other mechanical apparatus, in that it never failed, and if a number of machines could be as well taken care of, cost no more and show as little depreciation as fewer machines of larger capacity operated as a unit.

Should we arrive, as we hope, to possession of a single circuit, alternate current motor , then in view of the simplicity of its control, we may fairly hope for the distributed motor system. But here also the capacity and, likewise, the weight of the motor being determined by the total duty done, the weight of train limit would not be decreased, but rather increased.

Among the roads that are ripe for the electrical engineer, and on which in the near future I hope he will demonstrate he has a most legitimate claim, are the New York elevated and the Chicago elevated, the handling of the trains on the New York Central and Harlem roads below the Harlem river, the long talked of rapid transit road of New York, the Metropolitan underground road of London the proposed tunnel roads in London, Paris and Berlin, and, coming more immediately home, suburban service such as that of the Illinois Central Railroad, a most ideal track for the electrical engineer, and last, and, as it will prove, one of the most important, the operation of the terminal and warehouse systems for the interchange of freight on the lines entering a city situated as is Chicago.

There will probably be in operation in the United States within twelve months not less than five locomotives varying from 700 to 1,200 H. P. and from forty-five to eighty tons in weight. The character of the work done will vary. In that work in which I am most concerned from a personal standpoint, a 700 H. P. electric locomotive will be built for experimental work, and to attempt to solve as far as may be the various problems involved in railroad practice in Chicago. If my judgment is followed, there will be an experimental section of track in the form of a loop about thirteen miles long with eighteen miles of rail, and with every variety of single and double track construction, and simple and compound crossings and switches.

On this I hope to see erected such varieties of overhead construction as may be found best to meet the various kinds of service, and where the railroad problems on track jointly operated by steam and electricty can be developed in the most satisfactory manner. On this track there will be not only this locomotive, but also one of equal rated capacity supplied by one of the larger manufacturing companies. The duty demanded of these machines will be severe. They will be required to haul a train of not less than 450 tons, at thirty miles an hour, up a grade of twenty-six feet to a mile. They will probably be required to develop their full rate of capacity at all speeds between thirty and sixty miles per hour, and if there is sufficient track room they will be driven at a speed of at least seventy-five and perhaps 100 miles per hour for short distances. The potentials used will be nearly double that at present obtaining in street railway practice.

A still larger problem, so far as power goes, although not in the variety of conditions which will have to be met, will be that recently taken for the operation of the belt line tunnel now being constructed in Baltimore to avoid the necessity of boat transfer at Locust Point. The duty of the motor will be to propel the train with engines coupled on, but not in operation, through a tunnel about 6,000 ft. long.

The conditions require the motors, which will weigh about eighty tons and have a capacity of about 1,200, to propel a 1,200 ton freight train up a grade of forty-two feet to the mile at a speed of fifteen miles. Passenger trains of 450 tons' weight must be regularly started from rest twice in the tunnel on this grade, and in an emergency must start the freight train. The draw bar pull under regular duty, and when not starting, may be as high as 32,000 lbs.

Perhaps the traffic from New York to Philadelphia affords as good an example as any of what may be done on regular passenger service, provided the track is clear enough.

For this I, some three years ago, and again in the *Forum* of September, 1891, outlined an electric express service, with a method of supply through a rod carried above the car and a return circuit through the rails and earth.

Such is the work before us, a work well meriting your best efforts; yet it is well to temper your enthusiasm with prudence.

Limit your attempts to the solution of those problems which will prove of practical benefit.

Do not chase rainbows. They are beautiful and poetic, but they have small place in the world's economies.

Remember that neither sentiment nor ignorance are winning cards, but lessened costs of operation for equivalent duty and increased returns on invested capital.

All this is said in no spirit of discouragement. for I yield to no man in my confidence in the future of electric traction. No new field is so rich, none more pregnant with great possibilities, but the growth of the work will be more expeditious and healthy if we separate the visionary from the real, the impracticable from the practicable.

Compound vs. Simple Engines for Cable Roads.

In our July issue (P. 488) we quoted from *Power* a communication and editorial with above title, which has proved of considerable interest. We take pleasure in presenting the following on the same subject, from galley proofs kindly furnished by *Power*.

In continuation of the discussion instigated by our editorial remark concerning the use of simple non-condensing engines for the Broadway and Third Avenue cable roads in New York City, the following communications have been received. Two of these are from men in actual charge of cable plants, one of whom is putting into practice his evident belief in the adaptability of the compound non-condensing engine for cable service, while the other would look for favorable results from such an engine only under particularly favorable circumstances. The third letter is from a constructing engineer of wide experience in cable road work who requests that his name shall not appear, but who evidently believes in the possibilities of the compound engine in this direction.

Mr. A. N. Connett, chief engineer of the Baltimore City Passenger Railway, writes:

I am now installing three plants for our company, and in all I am using compound engines to run non-condensing. I consider that the constant load will be large enough to keep the low pressure cylinder ever from expanding below atmosphere. They have proved moderately successful on electric railway plants, and the service there is a more variable one than on cable plants. The Seventh Street road in Washington (cable) is showing an admirably economical result in the use of compound condensing engines. Of course it can be readily said that there is no danger of back pressure with such engines. But I think you state the case fairly when you say that the automatic proportioning of the loads between the cylinders will always give the low pressure cylinder sufficient initial pressure to make its introduction an object. The Brooklyn Bridge example is a poor one. Their variation of loads is largely in excess of most street railway plants. The Broadway and Third Avenue lines, I think, should have remarkably steady loads. The conditions of loading and alignment there cannot but make it so. The same will prove true in a somewhat less degree with the plants being installed by our company. The results obtained here will, no doubt, be very interesting, and I have the greatest confidence in being able to show five ponuds of water saved per hourly horse power by compounding over similar plants using simple engines.

On the other hand, we have from Mr. Fred. W. Wood, manager of Temple Street Cable Railway Co., Los Angeles, Cal., the following:

EDITORS POWER:—Apropos of the recent discussion regarding the adoption of simple non-condensing engines by the New York cable roads, permit me to say that the considerations which should govern in the design of the power plant for any given road depend so largely upon the local conditions that any general rule is impossible. That the use of compound engines is economical under certain conditions all engineers will admit. That compound engines do as a fact operate satisfactorily in some cable power houses is also not to be disputed. That the conditions of cable railway practice are unfavorable for the best operation of compound engines is equally true.

The percentage which the cost of power bears to the whole cost of operating seems to me to be a necessary factor in deciding upon the character of power plant to be used. This percentage is variable, and my judgment is that it may range from 25 to as low as 6. It is manifest that in dealing with an item that amounts to 20 or 25 per cent. of the whole cost of operation, much more money may be invested and complications introduced than would be warrantable if the item ranged lower than 10 per cent.

In those cities where the price of coal is $10 per ton, the cost of power is a large item, and complications in the engine room and expense for condensing apparatus and water may well be incurred, and the added risk of accidents and consequent delay from all these may be borne. But if fuel costs from $2 to $3 per ton, and if the traffic of the proposed road is of very large amount, the possible economy of cost of power may become an insignificant matter when compared with other considerations. Assume that the cost of power will be 6 per cent of the whole operating charge, and that under the rather unfavorable conditions 20 per cent. is the saving that compound engines would accomplish, the real saving would then be 1.2 per cent. of the whole operating charge. Now, if this saving of 1 and 2 per cent. is accomplished at some additional expense of plant and cost of repairs and liability to accident, it becomes a question as to whether it is wise to make the economy at the cost. It seems to me to be a question to be decided more from the standpoint of the manager than from that of the engineer.

While I fully appreciate the value of compound engines in the use of steam and in the distribution of working strains, my experience has also taught me that the economy which is purchased at the expense of added mechanism may prove to be dearly bought; and I should be very conservative in criticising the use of simple engines when coal is $3 per ton and the traffic of the road of great volume.

I know of one power house provided with well designed compound engines (and these engines with complicated attachments on the valve gear for increasing the range of the cut-off) in which the low pressure cylinder is and always has been idle, and from the valve gear of which all the attachments that so much was expected of have been removed, until the whole has been reduced to a simple and fairly economical Corliss engine. In other instances the original complicated engines have been removed, and replaced by smaller simple engines, to the great economy of the operation.

The keeping up of a steam plant in its daily operation to some approximation of the conditions usual while it is being experted and tested—the application of as high a degree of scientific knowledge and study in its daily operation as is put into its design and while in the hands of the mechanical engineer is, I think, of greater economic importance than the design of its engines.

With reference to the particular question: Would compound engines have been preferable in the New York power houses to simple ones? I think it is safe to assume that the designers have considered the whole matter, and that the small percentage of the total expense which the power item will probably be, and that the great importance of avoiding possible delay in the very large traffic to be handled, and the fact that the variations of load incident to cable railway work would place the compound engines under unfavorable conditions, have led them very wisely to adopt the simplest possible means of producing their power, and that their action is not in any sense to be regarded as evincing a lack of appreciation of our faith in the principle of compounding a steam engine *per se*.

If anything goes wrong in one power unit in an electric road, the design is usually such that this particular unit may be out for repair without delay to the system. This is impracticable in the cabel railway practice; hence the prime importance of avoiding possible accidents, especially under the conditions which obtain in very large cities.

Again, the percentage which the cost of power bears to the whole operating cost decreases as a cable road is worked to its maximum capacity; and the nearer this maximum capacity is approached the greater will be the proportion of the variable load and, consequently, the conditions for the good working of compound engines are still further departed from. These are, I take it, exactly the conditions that will probably arise in a cable road in New York City. And the engineer, who under other conditions would install triple expansion engines, might well use simple engines here.

We regret that we are not at liberty to announce the author of the following. His name stands for years of successful experience with cable railway work and heavy transmission machinery, and would give addional weight and interest to the opinions expressed:

What would apply to operating cable railways should in general apply to any other ordinary plant of machinery driven by steam power. In the first place, the conditions and location of power houses may materially interfere with the character and kind of engines to be used. In a general way, under ordinary circumstances, in our crowded cities, and especially where coal is dear, it is important that the most economical in the use of steam should be adopted, regardless of the cost of the plant, as the first cost is a small matter when compared to a plant that is costly to operate. There is not the least doubt but that the majority of cable railways to-day, in this country, are driven by high pressure engines, of the Corliss or automatic type. It is very questionable whether a well designed and proper size Corliss engine (for the work to be done), working at the most economical point of cut-off for the average duty, can be compared with the compound non-condensing engine, even when the wear and tear of the extra parts, and the loss by radiation in two cylinders are taken into account. The difference in cost between the single and compound engines would be very small.

I have never heard of a case where a change has been made from a high pressure automatic Corliss engine to that of a compound non-condensing. The compound engine of to-day will undoubtedly do the same work at less cost than a high pressure engine, as the compound engine simply carries the expansion of steam to its greatest limit. If proper data was taken before and after such a change, it certainly would be very interesting. Where it is possible to condense, in connection with the compound engine, there need not be the slightest question as to economy or hesitancy in using this class of engine in driving cable railways, as well as any other plant or class of machinery. The varying power required on a cable railway is unquestionably considerable, but no more so than in rolling mills, or in the triple expansion engines as used on our large transatlantic steamers. Take, for illustration, the engines of the "City of Paris," or the "City of New York," of 20,000 H. P. Consider that these vessels in a storm have their propellers whirling in the air at one moment, and the next plunged into the water. In this case we have triple expansion engines, with condensing included, so that if such engines answer under the conditions stated, there is no real reason why they should not answer in cable railways, or other work.

Possibly the finest examples of compound condensing engines in use to-day in the United States, on cable railway work, are to be found at the Seventh street power house of the Washington & Georgetown Cable Railway Co., Georgetown, D. C., the power house being adjacent to the Potomac River. The economy need not be questioned by any visitor, as a walk into the boiler house will satisfy him at once that about as little fuel is being used as is possible, for the work performed. The boiler house and appurtenances are about as perfect as practice and experience can make them. I have recently heard of a cable plant to be erected in San Francisco, in which vertical triple expansion condensing engines will be used, which I think is a step in the right direction. The engines will be placed directly on the centre driving shaft, and make 115 revolutions per minute, using a much smaller pinion than has been customary in cable railway construction, thus getting a higher piston speed, higher velocity on the main shaft, and reducing its diameter to the minimum. The high initial velocity will no doubt help to keep the cable steadier.

The subject is still susceptible of discussion, and we shall be pleased to hear from others regarding it.

Legal Intelligence.

Cable Railway Companies—Additional Servitude—Injunction Proceeding—Statutory Construction.

1. *Held*, In an action to enjoin a traction company from operating a railway track on a certain street is not multifarious, when the rights under which all the plaintiffs claim are the same, and the acts complained of affect them all alike.

2. Where Act 1887, authorizes traction companies to construct and operate, upon any street on which a passenger railway "now is or may hereafter be constructed," with the consent of such passenger company, appliances necessary for the traction of the cars of such passenger company; and, where the act further provides that traction companies may lease the property and franchises of passenger railway companies and operate such railway companies, *Held*, that a traction company, which has obtained a lease from a passenger company, may construct its appliances, not only upon streets already occupied by the passenger company, but also upon streets which the railway company has a right to occupy.

3, *Held*, that the use of a street by a cable railway company is not an additional servitude, entitling abutters to compensation, though vehicles cannot stand between the curbing and tracks without interfering with cars, and though the pipes under the surface of the street, by being lowered to make room for the cable conduit, may be slightly more difficult of access.

4. Where the use of a street by a railway company is not an additional servitude, entitling abutters to compensation, the latter cannot maintain a bill to enjoin the operation of the railway on the ground that the company has transcended its authorized powers, since it is amenable for an excessive exercise of power only to the state. *Rafferty et al.* v. *Central Traction Co. et al.* Pa. S. C., March 21, 1892.

Injury to Passenger—Defective Brake—Negligence of Driver.

In an action by a passenger against a street railway company for injuries caused by a collision, resulting from the fracture of the brake chain, and the consequent inability of the driver to stop the car on the grade, where there is no evidence that the driver was wanting in care or skill, it is error to submit the question to the jury.

2. Where the runaway car made great noise, the failure of the driver to shout to the employes of the car ahead to start their car will not be adjudged negligence, in the absence of evidence that shouting would have prevented the accident.

4. When the inspector testified that on the morning of the accident he looked the chain over, and tested its strength by winding it up several times, but did not examine each link, and a chain manufacturer of large experience testified that a flaw could not exist at the centre of the iron without being visible at the surface, the sufficiency of the inspection was a question for the jury. Judgment for plaintiff reversed. *Wynn* v. *Central Park N. & E. R. R. Co.* N. Y. C. of App. April 26, 1892.

Injury to Person on Track—Deafness—Contributory Negligence—In an action to recover damages for personal injuries resulting to plaintiff's wife, the court on appeal

Held, 1. That a person who is afflicted with deafness, and who wears a protruding apparel, obstructive of the sense of sight, and who ventures, without looking right or left, to cross a street railway track acts rashly, and is guilty of such contributory negligence as will prevent a recovery in damages in case of injury sustained by a collision with a coming mule and car.

2. *Held*, that the driver had a right to presume the

person sound of hearing, and that she would exercise her senses, so as to avoid an accident, by stopping in time to let the mule and car pass freely. Hence, a verdict in favor of the company, under such circumstances, will not be interfered with. *Schulte* v. *New Orleans etc. St. Ry. Co.*, La. S. C., Mar. 21,1892.

Injury to Passengers—Negligence—Declivity—High Speed—Damages—Verdict. On appeal,

Held, that the evidence justified a finding of negligence in respect to the condition or operation of a train of passenger cars (cable line) which, while carrying passengers, ran down a steep declivity, composing a part of the line, at very great and dangerous speed, and apparently beyond the control of those operating the train.

2. *Held*, that the evidence justified a finding that injuries received by the plaintiff, manifested immediately by temporary unconsciousness, by headache, nervousness, sleeplessness and some impairment of mental faculties, was also the cause of his paralysis, although that did not supervene until seven months after the injury.

3. If an injury is the direct cause of a diseased condition which results in paralysis, the latter may be ascribed to the jury as a proximate cause.

4. That the application for a new trial on alleged newly discovered evidence *held* properly denied, and verdict sustained as to amount.

Bishop v. *St. Paul City Ry. Co.*, Minn. S. C., January 14, 1892.

Use of Another's Track—Compensation—Expropriation—Procedure.

1. A street railway company which is authorized by the City of New Orleans to enter upon the tracks of another must, before doing so, make compensation to the company.

2. The material in place is the private property of the company occupying the street; and in the absence of any agreement, it must be expropriated to public uses like any other private property.

3. Where a city ordinance provides the mode of compensation, and the two corporations are within the limits of the same franchise, the ordinance will control the mode to be pursued in reference to fixing the compensation, as the corporations accept their franchises with reference to said ordinances. But the city ordinance cannot arbitrarily fix the amount of compensation.

4. There is no limitation in the ordinances of the City of New Orleans, which prevents the street railway companies from contracting with reference to the amount due from the use of tracks.

Canal etc. St. Ry. Co. v. *Orleans etc. St. Ry. Co.*, La., S. C., January 4, 1892.

Street Railways—Powers—Erection of Poles in Street—Ordinance—Test.

1. *Held*, that the provisions of the act empowering street railways, with the consent of municipal authorities, to use electric or chemical motors or grip cables as the propelling power of their cars instead of horses, do not legalize the erection of poles and the stretching of wires in a public street as a part of a system of electrical railroading.

2. *Held*, that an ordinance which purports to grant permission to erect such poles and stretch such wires is illegal.

3. *Held*, that an abutter, owning to the middle of a street, can use the writ of *certiorari* to test the validity of an ordinance which purports to confer the power to place such posts upon his land lying in the street.

State v. *Inhabitants of Trenton et al.*, N. J. S. C., January 8, 1892.

Use of Streets by Railroads—Ordinances—Resolutions.

Held, That a resolution of common council giving consent to a street railway to place posts and stretch wires on a street, and prescribing the size and location of the poles, and limiting the speed of the railroad when operated by electricity, is a street regulation, and such regulation of streets shall be by ordinance or by-laws, and not by resolution, as provided by charter of the City of Newark. Resolution is set aside.

State v. *Mayor etc., of City of Newark et al.*, N. J., S. C., January 8, 1892.

Street Railway Track—Projection of Rail Above Grade Crossing. A street railway company allowed one of its rails to project three inches above the surface of the street crossing or crosswalk, against which projection plaintiff stumbled, fell and was injured.

Held, that such condition of the track was negligence in the company, for which it was liable in damages. Judgment of the trial court affirmed.

Schild v. *Central Park N. & E. R. R. Co*, N. Y. S. C., December 14, 1892.

Note: A street railway builds its track in accordance with the chartered rights. Limitations usually govern the laying of tracks. Conditions must be complied with. A street railway company is bound to lay its rails properly and to keep them in proper condition. *Woster* v. *Ry. Co.*, 50 N. Y. 203. Where rails were left projecting four and a half inches above the surface without planking between them, and an accident was occasioned to one who crossed the track thus maintained, a verdict was upheld; see *Wasmer* v. *Ry. Co.*, 80 N. Y. 212. A traveler has the right to assume the safe condition of the crosswalk.

Horse Railroad—Injury to Child on Track—Negligence of Driver. Plaintiff (by guardian), a child of three years of age, slipped into the street unseen by a half grown sister who was in their house at work, and while there was badly hurt by defendant's horse car, which was being slowly pulled up hill by the regular horses and an extra tow horse. A witness testified that he saw a child on the down track crossing over to the other track while the car was yet ten feet away, and heard people shouting to the driver. He then turned his back, but, at renewed shouting, turned again, and saw the child knocked down by one of the horses. The driver and tow boy both testified that they were looking straight ahead but did not see the child, and knew nothing of the accident until the conductor blew his whistle to stop, which was after the car had passed the child.

1. *Held*, that a verdict for plaintiff would not be set aside as unsupported by evidence.

2. *Held*, under the circumstance of the incident as above set out, that an instruction that the highest degree of care is required of a driver who sees a person lying helpless on the track in front of his car was not sufficient ground for a reversal, as it could not have injured defendant. Judgment affirmed.

Giraldo (Guardian) v. *Coney Island & B. R. Co.*, N. Y. S. C., December 14, 1891.

Regulation of Street Cars--City Ordinances—Nuisance—Police Power. In an action by the complainant street railway company against the city authorities, on appeal it is

Held 1. That under the provisions of a city charter giving the council power to pass all ordinances necessary for the due administration of justice and the better government of a city, and to "cause the removal or abatement of any nuisance," the passage of an ordinance requiring a street car company to put "a driver and a conductor" on each car is a proper exercise of the city police power, and not an impairment of the company's rights, not being unreasonable or oppressive.

2. Also, that a provision in such ordinance, requiring the police to cause every car not provided with a "driver and conductor," to be returned to the stable, is not an enforcement without trial, but merely a means of preventing a nuisance by blockading travel. Judgment a reasonable time. A party wishing to alight must uot hesitate or loiter. On street railways the conductor only in favor of the city affirmed. *South Covington St. Ry. Co.* v. *Mayor etc.* Ky. C. of App., May 12, 1892.

The Lynn (Mass.) Belt Line.

If one wants to get the worth of his money, he has but to board one of the fine cars on the lines of the Lynn Belt Line Street Railway Co. at any point, and he will be carried entirely around the city, in fact, well out into the suburbs and returned to the same point, a distance of seven miles, for one fare. This ride on a pleasant evening is a very enjoyable one, and the citizens show their appreciation of the service by a very liberal patronage. The company operate twenty-five cars, six being long cars equipped with the Robinson radial trucks, and the others four wheel cars. The former are by far the most popular with the patrons. The capacity of this equipment is severely taxed on Sundays and holidays; in fact, there are times when they cannot begin to accommodate the traffic. The power house and car house are on Spring Street, some distance from the city. The buildings are plain wooden structures, but are conveniently arranged. The power equipment consists of two batteries of Root water tube boilers, and two Greene engines, one of 500 H. P. and the other of 150 H. P. These are coupled by means of belting and countershaft to five eighty horse power Thomson-Houston generators of the D 62 type. The Ireson belt is employed, and the shaft is provided with Barker clutches. Ordinarily only fourteen or fifteen cars are run, and the daily fuel consumption is four and a half tons of Cumberland soft coal, but when the traffic is heavy six or more tons are required.

It is the purpose of the company to put in condensers in the near future, and to take the water for this purpose from a neighboring pond. A current of about 525 volts is carried, and the circuit is connected with that of the Lynn & Boston lines which it crosses in numerous places.

The city of Lynn is growing rapidly, and since the great fire, two years ago, has made rapid strides. It is a city of comfortable homes, and these spread over a wide extent. Numerous shoe factories are found in every part of the city, and these, except in the heart of the city near the burned district, are mostly plain wooden structures of one or two stories. The future of its street railway interests would seem to be very bright, and the Belt Line, under the able management of T. W. Adams, superintendent, will doubtless receive its share of the patronage.

Montreal to Have Electric Power.

The street railway problem in Montreal was settled July 20, by the Board of Aldermen, who voted twenty-two to fourteen to allow the street railway company to install electric power. According to the proposition of the street railway company to the city, the latter will receive the following percentages on the gross annual receipts of the railway company: On all sums up to $1,000,000, 4 per cent.; from $1,000,000 to $1,500,000, 6 per cent.; from $1,500,000 to $2,000,000, 8 per cent.; from $2,000,000 to $2,500,000, 10 per cent.; from $2,500,000 to $3,000,000, 12 per cent.; all over $3,000,000, 15 per cent.

The railway company also offer to introduce immediately the sale of eight tickets for twenty-five cents, available on all working days between six and seven in the morning and five and seven in the evening, and to give transfers to every part of the city. Mr. H. A. Everett, managing director of the company, states that if the bill receives the necessary approval of the mayor the work on the electric equipment will be commenced immediately. The general feeling is one of satisfaction and relief that the question which has so long been agitated has finally been settled.

The Philadelphia Traction Co. have secured the services of the Field Engineering Co. as their engineers in charge of all electrical construction work in Philadelphia and vicinity. There will be about forty-five miles of track in West Philadelphia and about 150 miles in Philadelphia proper. There has been considerable delay and discussion in regard to the Philadelphia part of the work, but it is expected that construction will soon be actively begun. The material is all on hand.

Notes from Paris.

Paris is at last to have an underground railway. The Municipal Council arrived at this decision July 4, after hearing the evidence of the third commission on the project and listening to various reports relative to the cost of the line, necessary work and so on, and have settled upon the length of line, period of lease (seventy years), minimum wages to employes (fifteen cents per hour), fares (four cents), guarantee to be given ($100,000) and other points. The route and general plan of the railway is the same as given in our May issue, and electricity will be used as a motive power. Trains will be of one, two or three cars, having each a carrying capacity of fifty-two passengers. The speed is to be twelve miles per hour. The principal station will be at the Place de la Bastille, and the road will be connected by a branch to the Paris, Lyons & Mediterranean Railroad.

One condition of its construction is that the line shall not interfere with either the waterways, gas mains or sewers, nor are the streets to be opened above the tunnel, but the work is to be accomplished by small openings here and there at the sides, as is being done with the Sceaux-Limours railway now being built. Only at the location of the stations will there be any opening to the surface. On this head the permit to construct is very strict.

Another very important condition imposed by the Municipal Council is that there shall be a considerable participation of profits with those employees whose wages amount to less than $800 per year. This has been done it is said, to avoid the possible chance of the Council of State rejecting, as contrary to law, any terms fixing minimum salaries.

By the completion of this railway, Paris will be provided with a means of transit that will mean hardly less to it than did the elevated railway to New York, and it will probably hasten the adoption of some system of more rapid transit with the present surface roads. It has taken five years to bring this project to the point which it has now reached. It was first submitted to the administration in September, 1887, and passed through three commissions. In 1888 further consideration was postponed pending the completion of details with regard to the question of electric traction. This last point was finally settled in July, 1891, thanks to the progress of electric traction in the United States and to what the delegation to London gathered from the operation of electric motors there, and the necessary plans recommended for consideration in the report of a Mr. Sauton.

A Rhode Island Clambake.

The fourteenth annual Rhode Island clambake, tendered the electrical fraternity by the American Electrical Works of Providence, R. I., occurred at Haute Rieve, on July 23. Lunch was served at 11.30 A. M. at the Union Club's country house, and the bake was opened at two o'clock with appropriate ceremonies.

All who have ever participated in the generous hospitalities afforded by this well known wire company need not be told that the clams were of the best and that they disappeared rapidly. Mr. Eugene F. Phillips, the genial president of the company, was, as usual, the recipient of many encomiums, and when the party finally separated in good spirits it was with the best of feelings to their host and every wish for his future welfare as well as that of the company which he represents.

The Connelly tramway motor was recently put in operation in London on one of the lines of the London, Deptford & Greenwich Tramways Co., and at the test a large company of members of the Tramway Institute were present. The motor was of the same type as those used on the North system in Chicago. It was claimed that it was capable of drawing a heavily loaded car up a grade of one in twenty, and that its speed was sixteen miles per hour. The total expense for operating the car was stated to be $3.87 per day, this amount including labor, fuel oil, lubricating oil and wear and tear.

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THE STREET RAILWAY JOURNAL

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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.,
World Building, New York.

The New York Street Railway Association will hold its tenth annual meeting this fall at the United States Hotel, Saratoga Springs, N. Y., September 20, at 10 A. M. Two papers will be presented to the Association for consideration, entitled "Recent Improvements in Cable Traction" by Geo. W. McNulty, engineer, Broadway & Seventh Avenue Railway Co., New York, and "Recent Improvements in Electric Traction" by L. H. McIntire, engineer, Harlem Bridge, Morrisania & Fordham Railway Co., New York. With these gentlemen to report on the improvements made recently in the two most approved motive powers used in street railway service, an able review of the advances made by each is assured, and an interesting session may be expected. The place of meeting always possesses an attraction of itself, and it is to be hoped that every member of the Association who can attend will make a special effort to do so, and that this meeting will be marked by a larger attendance and a larger accession to its membership than any heretofore.

Valuable Lessons both as to mechanical details, inventive energy, financial ability and *esprit de corps* on the part of employes may be derived from reading the account of a visit to the extensive works of the Thomson-Houston Electric Co., at Lynn, Mass., the first installment of which will be found in another part of this paper. While we found many things to admire during our visit to the works, we were more profoundly impressed with the character of the employes as evinced by their skill and devotion to their work, but more particularly by their gentlemanly behavior on the streets when going and coming from work and in public after business hours, than by any other feature. It is an inspiring sight to stand at the close of the noon hour and watch the nearly 4,000 operatives and students as they approached the works from every possible direction and note the entire absence of disorder and boisterous conduct, showing that a proper system of discipline influences the individual not only while he is within the walls of a factory, but on the street and in his home. Where these things are found, excellent mechanical skill is not wanting and the products will necessarily bear the same stamp of excellence.

"Street Railways," our new handbook for street railway men, is now ready for delivery, and orders are being rapidly filled. A prospectus and price list will be found in our advertising columns. This work has been prepared solely in the interests of the street railway industry, and every person who has the development and improvement of this business at heart will secure this work and take an interest in its circulation. As is stated in the preface, the work will doubtless elevate the business and those engaged in it in public estimation, by showing the importance of the industry, the talent and varied accomplishments one must possess to become a successful manager in any department of the business. Many will be disappointed in the work, in that it gives much more than its title indicates. It is not alone designed for the leading officers of a street railway company, but should be in the hands of all the men at the head of the different departments as well. Even then its use should by no means be confined to men actually engaged in the street railway business; it will prove of great service to engineers and inventors, to all students in engineering and other technical schools, and to the student of economic subjects. We do not dwell upon the merits of the work in order to sell it, but because we believe that it will prove helpful to all who will use it. It must be remembered that this is the first and only work that covers the entire field of the street railway business and treats of all the leading methods of traction. This fact alone renders the work valuable.

Improvement in the General Construction for Electric Railways has been very noticeable within the last year and a half. The work on the first railways was very crude, it may be admitted, not much better or more substantial than would now be deemed necessary for a temporary installation; but at the present time the tendency is all in the direction of thoroughness, and the best possible construction that money can procure. Articles that have appeared in these columns from month to month give evidence of the fact that track laying is conducted by a great many companies in a style scarcely inferior to that required by the standard established by the best steam railroads. At the same time companies generally are seeing to it that overhead work is done in a manner that indicates a realizing sense of the fact that cheap construction is by no means economical. There was a reason and an excuse for the wretched construction of the early days of electric railroading. What was required was not definitely understood in the first place, and every piece of work was to a great extent experimental. Time soon demonstrated, however, that electric railways had come to stay, and experience, sometimes bitter, perhaps, indicated in a general way what was essential to successful and economical operation. With the best managers at the present time the belief is thoroughly established that construction cannot be too good. While these comments are to a certain extent trite, we are in-

clined to express in this way our confident belief in the value of good construction in view of the great amount of building to be done within the next few months.

The Meeting of the American Street Railway Association this fall at Cleveland, promises to be one of the most interesting in the history of the Association. Cleveland, besides its natural attractions which render it one of the pleasantest cities in the country, is especially interesting from a street railway standpoint. The transit facilities of the city are well developed, the three principal systems of street car traction, electricity, cable and horse, being all represented. In addition, the city is interesting because the early success of electric traction there did much to prove the desirability of the system as a motive power. The complete list of papers to be read at the meeting, announced in our last issue, shows that the advance made during the last year in street railway engineering and methods will be ably presented, and the papers will undoubtedly call forth the usual discussion, which in some respects is often more valuable than the papers themselves. Owing to a wise provision decided upon at the last convention, the papers to be presented will be set in type some time before the meeting, and copies will be distributed to any members desiring them, so that any who wish to present their own experiences on the subject under discussion, or bring up questions, may be able to prepare such subject matter in advance, with a knowledge of the way in which the subject will be treated by the speaker. This practice has been widely followed in many scientific bodies, but will be tried for the first time by the Association this year. We have often stated our belief that no street railway company in the country could afford not to be a member of the Association, and we trust that among those companies who have not joined, there will be many who will decide to send a representative this year. The annual fees are trifling, while the benefits to be derived from such a connection are large.

World's Fair Transportation has been a much discussed topic during the last few weeks in Chicago, and it has been repeatedly asked if the facilities were at all adequate to the enormous demands to be made upon them. In recent considerations of this question, it has generally been stated that facilities for handling, at a maximum, 150,000 persons per hour should be provided for. Four means of reaching the Exposition grounds at Jackson Park from the centre of the city will be available: The street railways, the elevated railroad, the steam surface roads and the steamboats. A cursory examination of the situation as thus outlined, is interesting. No one who is acquainted with the facilities of the South Side cable road to cope with great crowds will question the ability of the managers to do their share in solving the problem; but assuming that on two lines three-car trains are run every two minutes, the number of passengers that can be carried seems small in comparison with a total of 150,000 desiring transportation. Without going into detailed figures, we may state that the street railways, the elevated railway and the steamboats are relied upon to carry at the busiest periods during the day 50,000 passengers an hour. This leaves 100,000 persons dependent on the steam railroads, and it is estimated that 1,500 cars and 150 locomotives at least will be necessary to handle the traffic. Such an equipment the companies do not possess for their World's Fair service. This result having been reached in several independent estimates, even local papers have indulged in rather gloomy forebodings, and have unsparingly criticized the World's Fair management for failing to make proper provision. We are rather inclined to the belief that the prospect is not quite so dismal as it has been considered by many, and we hold this opinion primarily because we regard 150,000 passengers an hour as too high a figure to be assumed as the maximum demand upon the transportation facilities. The movements of crowds to and from Jackson Park will, we believe, be more gradual than those who have made the estimates are inclined to predict. Great crowds there will be at the best, but so many, who are able to control their own time, will go late or return early, that it will have the effect of appreciably diminishing the transportation at the busy hours. Then, too, a multitude will live near the grounds and will require no means of transit, if a fraction of the hotel projects materialize. In dealing with a question of this sort an opinion is naturally little more than a speculation, but we venture to assert that the estimate of the necessary facilities is decidedly too high, and that if proper terminal facilities are provided at the grounds the crowds can be carried as rapidly as under the circumstances a reasonable man has the right to expect. But at the same time we as confidently believe that the managers of the fair cannot afford to let the problem solve itself, as it is a matter of most vital importance.

The Homestead Strike, with all its dire consequences, is familiar to our readers, and we have no disposition to write a homily on the subject, for if we should, it might never be read by the strikers nor by the managers of the Carnegie works. From all appearances the law and justice seem to be on the side of the steel company, since the men admit that the wages offered are better than those usually paid for similar service, but what chiefly interests our readers is how to prevent a similar state of affairs in connection with the street railway industry. Those who attended the Pittsburgh convention and participated in the river excursion to Homestead, will recall with pleasure the visit to the steel mills, and will go over in memory all the interesting details of rail making. Little did we think at that time that the employes of the mills who seemed so industrious, and were, apparently, so devoted to their work, were cherishing bitter and hostile feelings towards their employers which would so soon culminate in an unlawful seizure of the great property, the frenzied attack upon the 300 watchmen sent by the steel company to take possession and guard the works, and an atrocious attempt upon the life of the manager. What has happened will happen, and although labor organizations will receive a general set back in the present struggle, the pent up fires in ignorant, selfish breasts will continue to break out spasmodically until the kingdom of perfect love is established in the earth. Nearly all labor troubles arise from ignorance and selfishness. The judgment of the masses is (right or wrong) that those who possess or manage great wealth never justly and rightly obtained so much more than their fellows, even though laws and social customs may endorse as honest the methods used for its accumulation. To correct this judgment and bring the fortunate classes into closer sympathy with their less fortunate fellows, is the work in hand. Street railway companies have an important mis-

sion in this respect, and there are none, no matter what their present state of fancied security may be, that sooner or later will not be called upon to face hostile action on the part of organized labor; hence, there is an individual responsibility in the matter, and it is not safe to delay until there can be some concerted action, or until our social system is reformed on some of the many plans proposed by popular writers on these subjects. Everyone in self defence should begin "to build over against his own door," and if our advice were asked, we should suggest that the first step in this direction would properly be to ascertain the present attitude of the employes in relation to the company, and the character of teachings they were receiving from their leaders and from the literature with which they were being supplied. Then an earnest effort should be made to counteract the false teachings by providing that a wholesome literature, either in the form of periodicals, specially prepared circulars, or a series of articles in local papers, should find its way to the homes of all the men, supplemented by an occasional popular lecture that would lead them to look on both sides of public questions, and tend to bring them into harmony with those who are working for the common good, or, in other words, create a public sentiment in favor of that particular enterprise. There is also great advantage to be gained in publishing periodically a full and accurate report of the business, showing clearly the net income and risks, and where the income is exceptionally large, dividing all above a liberal per cent. on the investment with the employes, thus recognizing them to a certain extent as business partners in the industry which their labors have helped to create. From a financial standpoint this course will be found to be more economical than it will to ignore the matter, and finally meet the issue which, as stated above, is bound to come.

The Value of Rapid Transit, to people generally, is daily becoming more thoroughly understood and appreciated, and throughout the country the number of obstacles put in the way of those endeavoring to satisfy the public demand for better transportation facilities is, happily, considerably less than a few years ago. The value of a good street railway system is so obvious that the education of the people in this respect has at times seemed almost marvelously and vexatiously slow. Taking a general survey of the field, it is a satisfaction to note that at the present time prejudice is much less pronounced, and that intelligent self interest causes the property owner to look with increasing favor upon the propositions of the street railway man. The public has not learned the lesson, or to express the idea a little more clearly, perhaps, has not changed its point of view, without suffering some decidedly unpleasant experiences which were the logical result of its erroneous views. It is with a rather grim sort of a satisfaction that we learn of an instance in point in a Western city. In this case a certain group of merchants learned a lesson regarding the significance of rapid transit that they will never forget. When the local street railway company proposed to lay tracks for an electric railway in front of these tradesmen's stores there arose a storm of bitter protest and opposition. If we are not mistaken, the merchants failing to secure injunctions took the law into their own hands and proceeded to stop the work by deluging the laborers with water from a two inch hose. The road was built of course—roads always are built under such circumstances—and cars were regularly run. The street railway company immediately began to heap coals of fire on the heads of the protesting merchants, not intentionally, perhaps, for the trade of the latter straightway increased quite materially, it is said. They refused to recognize the fact, and continued to protest against the disfigurement of the street and the dangers to their customers from rapidly moving cars. Recently, it happened that the company found it necessary to abandon, temporarily, on account of repairs, a part of one of their routes in which was included the track located in front of the premises of the protesting merchants. No longer were latters' eyes offended by the rapidly moving cars or their ears assailed by the clang of the gong. They ought to have been happy, but, no; they found that the patronage of their stores commenced to decrease in the most alarming fashion; trade seemed to follow the new line of the cars; even the traffic teams deserted the street for reasons that it would be hard to determine. The street soon began to lose its busy and prosperous appearance, and the merchants dismayed by the radical change in affairs, came to the conclusion, finally, that it was far better to modify their views, confess that they were wrong, to do anything, in fact, than to have things remain as they were. Regardless, then, of the humiliations attending an admission of error, and throwing ceremony to the winds, they humbly besought the railway company in their wisdom to restore the service at the earliest possible moment. Poetic justice, perhaps, would have then dictated the final abandonment of the road; but sentiment of that sort did not have any weight with the street railway company, as, to tell the exact truth, the street was a very essential part of the line. So the petition of the merchants was granted, and if the street railway managers felt a malicious satisfaction who shall blame them? We fancy that these tradesmen are now thoroughly alive to the advantages and importance of rapid transit. And, as we have said before, the public generally is gradually reaching the same conclusion. An electric pole is no longer such an objectionable sight as it was two years ago. The owner of the abutting property has begun to realize that the offensive pole is an integral factor in the electric road which has brought his office ten or fifteen minutes nearer his home and has caused his property in the suburbs to rise in value very materially. The pole is daily looked upon with more favor as its necessity is better realized, and all the electrical companies using overhead wires, electric light, telegraph, telephone, owe an immense debt of gratitude to it. Had it not been for the essential trolley line their overhead construction in many a city and town would have been laid low long ere this.

Reduced Passenger Rates to the Cleveland Convention.

The secretary of the American Street Railway Association informs us that he has concluded arrangements with the Trunk Line and Central Traffic Associations for securing the usual reduced rates for members to attend the Cleveland Convention in October. Mr. Richardson has recently been to Cleveland in consultation with Mr. H. J. Davis, the secretary of the local committee, and reports that the arrangements for the meeting are progressing satisfactorily. The hall that has been selected as the place of meeting is a very desirable one indeed, and the outlook is encouraging for a large and interesting meeting.

Correspondence.

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

The $350,000 Cable Road and the $46,000 Electric Road.

II

Taking up again Census Bulletin No. 55, entitled "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways*," I would like to ask what is meant by "Total Cost of Road and Equipment?"

Looking over the details of the cost of certain cable railways as that thing turns up in auditors' books, I find: Real Estate, Buildings, Street-work, Power Plant, Gas and Water Changes, Bridges and Viaducts, and similar charges, about the propriety of the including of which in such statements as those of the Bulletin there can be no question; and then come such items as: "Repaving Streets as Required by Charter," "Discount and Commission on Bonds," "Legal Expenses," "Cost of Extension of Franchise," "Old Horse Railroad Property," etc. In a list of which these are extremes, opinions will differ as to where the line should be drawn and the footing made to answer a call for "Cost of Road and Equipment," and the conclusion will depend on the purpose of the investigation.

For comparison of the ten cable with the nine electric roads, suppose we put on the right side, under "COST OF ROAD AND EQUIPMENT," every dollar spent in and about the construction and equipment of the new road, every outlay for materials and labor, every incidental expense of administration or otherwise; in short, "*everything that*," in the sweeping language of Brown's old Grammar, "*can be known or mentioned, as apple, truth*," &c.; and on the other side, under "FRANCHISES, ETC.," the old horse railroad, the extraordinary legal expenses, the expenses of transfer and reorganization, the discount and commission on bonds, the things of the nature of a price paid for the franchise (like repaving streets, giving the municipality a new drawbridge over the open sewer, installing a new town clock, etc.), and so on. This will be the left side, and in the comparison of roads I propose to leave it out. This seems fair because the item "*Franchises, etc.*," may be a large one in a large city, and sometimes it bears a closer relation to the place where, than to the system under which, the new road is to be operated. It is probably included in making up the cost of some of the horse railroads in a table given in my last letter; in the cases, say, of all of those costing from $185,000 to $516,000 per mile of line.

But we are immediately concerned about the disposition made of it in our two Census tables.

The *Financial Statement* of Electric No. 1, June 30, 1890, reads, on one side,

"CONTRA,

Franchises, etc.	$800,000.00
Construction	664,190.45
Equipment	408,163.83
Real Estate	84,000.00
Trustee Investments	5,020.00
Acounts receivable, etc., etc."	

The "Total Cost of Road and Equipment" for this road in the Bulletin is $1,156,354.28, an amount made up of the three items I have connected by a brace. The item "Franchises, etc., $800,000," is, very properly, left out. And I believe there is little, if any, of it on the whole electric side of the census tables.

But being out of the electric side it should, for the comparison, be out of the cable side.

It isn't by a long shot.

In the ten cable roads I find it, on information still far from perfect, however, *there* to the amount of about $10,000,000 (and probably more) or about $133,000 per mile of line, on an average. Without this item the $350,000 cable road of the Bulletin reduces to $217,000 (or less) per mile, including bridges and viaducts costing large sums.

I may be able to speak more precisely and more positively on this matter later, but it is enough for the present that nearly, or quite, the last dollar of this item has disappeared on the electric side, and some $10.000,000 of it stands charged on the cable side in this treatise on "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways.*"

Returning to "Operating Expenses." In my last letter I showed how an electric whose operating expenses, properly speaking, were 17.55 cents in six selected months of 1890, and 19.79 cents for the year 1891, turns up in the Bulletin with 13.53. Taking now No. 7, which operated for 8.34 cents per car mile for twelve months—in the Bulletin—we find the details as follows:

Fuel	$2,190.00
Wages of engineers and firemen	2,007.50
" " dynamo engineers and mechanics	912.50
Various supplies for power house	510.00
Repairs of cars	120.00
Repairs and renewals on motors (except gearing)	60.00
Repairs of gearing and trolleys	300 00
Wages of motormen and conductors	7,220.00
Wages of trackmen and others employed on line	730.00
Salaries of general officers and clerks	1,500.00
Total operating expenses for twelve months	$15,550 00

And in all of that twelve months this company did not apparently spend a dollar under these heads of the Census office form: "Repairs of Roadbed and Track," "Repairs of Buildings," "Repairs and Renewals on Engines," "Repairs and Renewals on Dynamos," "Repairs and Renawels on Other Machinery," "Miscellaneous Items under Current Expenses for Power," "Repairs and Renewels on Electric Street System," "Miscellaneous Items under the head of Maintenance of Rolling Stock," "Removal of Snow and Ice," "Damages to Persons and Property," "Miscellaneous Expenses under Transportation," "Miscellaneous Expenses of General Office," "Advertising and Printing," "Legal Expenses," "Insurance," and "Miscellaneous Items under the head of General Expenses."

The reports of some others have this appearance of being defective in a less degree.

No. 10, as said before, is operated by storage battery, and the figures exhibited for it are not used in making any of the averages of the Bulletin. Of the nine others three show figures for a fraction of a year (one of them though it had been in operation about sixteen months on January 1, 1891), and six, only, show results ostensibly based on twelve months' experience.

Now, among the 300 electric roads of 1890, was it not possible to collect reports of ten operated by the trolley, without filling out the list with a storage battery road, whose figures are not used? Was it not possible to get a whole year's experience on more than six? Was it necessary to use reports so obviously defective as some of those of the Bulletin? Would any man with an interest of his own at stake—wanting the *truth* for his own information—work on such material as this?

On the cable side, No. 2 is credited with 1,653,303 car miles; it made about that many *train miles*, say, 3,306,606 car miles. No. 10 is credited with 1,307,613 car miles; and made that many *train miles*, or 2,615,226 car miles.

The car miles given for Nos. 8 and 9 are correct in number, but the car was in each case an eight-wheeler and equal, for all business purposes, to two of the cars on the electric side. No. 3 made nearly all of its miles with eight wheel cars. No. 1 about 42 per cent. of its miles with eight wheel cars. No. 4 about 55 per cent. of its miles with eight wheel cars. No. 7 is credited with 1,244,750 car miles. About 90 per cent. of this mileage was made with eight wheel cars and the rest was train miles. Nos. 5 and 6 made miles about as reported, and all with four wheel cars.

Thus on two roads we find about 2,960,916 car miles entirely omitted; on three we find that all the "car miles" which were not made by eight wheel cars were really "*train miles*;" on three more, a large part of the work was done by eight-wheelers and on two out of ten

roads, the mileage is fairly reported for purposes of comparison.

Now, as I have said above, the eight wheel cable car, which by a singular fatality is so extensively pitted against the four wheel electric car in the Bulletin, is equal for all business purposes to two four wheel cars. I, therefore, rewrite "Table A 2" in part.

Turning once more to the nine electric roads, if we assume that 70 per cent. of their *reported* expenses is wages and that wages on the ten cable roads are 40 per cent. higher (both reasonable assumptions), the 13.21 cents per car mile becomes:

$$13.21+40\% \text{ of } (70\% \text{ of } 13.21)=16.91 \text{ cts.}$$

If we could add the undoubted omissions of their

A.—CABLE RAILWAYS.
2.—STATISTICS OF OPERATION. } (Revised by the Writer.)

No.	How the "Car-Miles" of the Bulletin were Made in Each Case.	Total Operating Expenses, as per Bulletin.	"Car-Miles" Made, as per Bulletin.	Equivalent Number of "Standard" Car-Miles Actually Made.	Cost per Car-Mile in Bulletin. (Cents).	*Corrected Cost* per Standard Car-Mile.
1	42% by 8 wheel, 58% by 4 wheel cars	$1,063,834.59	6,290,172	8,932,044	16.91	11.91
2	"Car-Miles" of the Bulletin should be *Train Miles.*	355,415.13	1,653,303	3,306,606	21.50	10.75
3	95% by 8 wheel, 5% 4 wheel cars	200,093.65	1,413,280	2,755,896	14.16	7.26
4	55% by 8 wheel, 45% 4 wheel cars	145,299.39	1,404,000	2,176,200	10.35	6.68
5	All by 4 wheel cars	441.151.59	4,698,120	4,698,120	9.39	9.39
6	All by 4 wheel cars	344,220.99	3.355,435	3,355,435	10.26	10.26
7	90% by 8 wheel cars; the rest should be *Train Miles.*	272,721.43	1,244,750	2,489,500	21.91	10.96
8	All by 8 wheel cars	225,069.39	1,595,650	3,191,300	14.11	7.06
9	All by 8 wheel cars	57,697.94	310,331	620,662	18.59	9.30
10	"Car-Miles" of the Bulletin should be *Train Miles.*	180,948.54	1,307,613	2,615,226	13.84	6.92
		$3,286,461.64	23,272,654	34,140,989	14.12	9.63

There are minor inaccuracies, of which I take no account, to reduce the complications. Thus, No. 7 included in its operating expenses some additions to its equipment, and other things more properly chargeable to cost of road, and No. 2 (which operates only 5.07 miles by cable instead of 5.75) worked into its report horse car figures which brought the cost per train mile (given as cost per car mile in Bulletin) up to 21.50 instead of 20.18, or 10.09 cents per car mile, and the cost per passenger up to 3.54 instead of 3.33 cents.

To explain some of the larger errors of the Bulletin, it should be said that some of the cable roads are in a state where street railway men call a *train mile* a *car mile*, and a grip car and a trailer hauled 100 miles are said to have made 100 car miles instead of 200, as in the East. (What they would do with the three and four car trains of Washington, St. Louis, Chicago, and the occasional morning and evening five car trains of another city, remains to be seen).

Thus we see that the 14.12 cents which has so long been "standard" reduces to 9.63 cents per "standard car" mile, for the ten cable roads of the Bulletin. The average is still high for the average cable road of this country. This is to *some* extent due to the circumstance that four out of the ten roads selected burned coal costing from $8.50 to $10.50 per ton and paid Pacific Coast wages and prices for everything. Cable railway men know that the cable road whose operating expenses (exclusive of interest on bonds only) are as high as 10.00 cents per car mile for four wheel cars is "paying high" for something. Recent figures are as low in some instances as 6.60 and 6.40, and the average, now, is probably well under eight cents per standard car mile.

I said in my last letter: "I have little doubt that, reduced to equivalent numbers of 'standard cars' and miles, we shall find the cable figures at least twenty-one cars and 1,000 car miles per mile of line, or a car each way every two and one-quarter minutes." A result of the revision of Table A 2 is that we get:

	Equiv. No. of Standard Cars per Mile of Line.	"Standard" Car-Miles per Mile of Line per Day.	Average Headway.
The $350,000 Cable Road (which cost less than $217,000)	24.00	1,242	1.85 min.
The $46,000 Electric Road.	2.93	177	13.00 "

reports and give them coal at the high average price paid by the ten cable roads, these nine suburban electric roads would show, where they stand, operating expenses exceeding those of the ten cable roads, by *at least ten cents per car mile.*

If we could move them into the cities served by these cable roads, their operating expenses would be swelled by repairs of pavements, by the wear and tear of track, due to city traffic, by a large increase in the accident account, by blockades on crowded streets and at steam railroad crossings, by increased taxes, by exactions of many sorts, and by twenty things incident to doing business in large cities.

And when we get the operating expenses of this particular nine electric roads, not for a few selected months, but for their second, third and fourth years, when the wear and tear have fairly begun, and the renewals for which no adequate allowance is made on their books, we shall the better understand why, with everything in its favor—on paper—the electric road realizes so little in dividends. Experience teaches that with the electric road the first year is the best, and "operating expenses" per car mile advance from year to year: while with the cable road progress is as plainly marked in the other direction.

I have speculated at some length on the relative showing we should have for this particular ten cable and nine electric roads, if we had them both hauling four wheel cars, paying the same wages, buying the same coal, and generally near enough together for a reasonable comparison. My main object has been to show that the figures of the Census tables are, as they stand, decidedly misleading, and to suggest why.

Some further inaccuracies of the Bulletin may be noticed.

Cables Nos. 3 and 7 are credited with grades of 70 per cent. and 80 per cent., and the text says of grades: "The steepest of all rises for a distance of 413 ft. at an angle of over thirty-five degrees with the horizontal." Now, I should suppose that anybody *digesting* these Census figures would pause here long enough to verify the data, and that having found them correct he would, in simple fairness, transfer these roads to the department "Inclined Planes and Passenger Elevators." But, anyhow, the facts are that No. 7 has a rise of eighty feet in 413, or a grade of about 20 per cent. (which is not uncommon on cable railways, being slightly exceeded for about 1,300 ft. at Portland, Ore., for instance), and No. 3 has probably no grade exceeding 7 per cent. On

the other hand, No. 8, which is credited with a maximum grade of 4 per cent., has about 1,500 ft. of 10 per cent. grade, up and down which, month after month, eight wheel cars run with the smoothness of machinery at a speed of 12.86 miles per hour.

I have alluded to the "carelessness with which returns are made on blanks sent out for such information as is embalmed in these tables." Most of the things I have pointed out are to be ascribed directly to this cause. The Census Office should be well aware of this uncertainty of things, and it should have contented itself with publishing the returns, marked plainly "FOR WHAT THEY ARE WORTH." But instead, it sits down with this mass of impossible figures, with millions of car miles left out on one side and millions of dollars on the other, with four wheel cars on one side, pitted against eight wheel cars or trains of two cars on eight out of ten lines on the other, with footings in which train miles are added to car miles, as if they were units of the same denomination—and grinds out some pages of ready made inferences *which are exactly characterized by the epithet preposterous.* Every arithmetical result is precise and as infallibly accurate as if worked out by a machine, sublimely unconscious whether the figures in the hopper stand for allspice or degrees Fahrenheit; and the strongest marks of a guiding intelligence in the business are found in such sentences as these: "It seems that the cable railways under consideration were built at a cost per mile of street occupied of over seven times as much as were the electric railways," and "a comparison between the economy of the cable and electric roads represented can not fairly be made without taking into consideration the fixed expenditure due to the greater first cost of the cable roads;" followed by little tables which look like this:

Electric	46 697.50	13.21	4.35	17.55	1.75	1.23
Cable	350,324.60	14.12	6.79	20.91	2.15	1.91

the small ends of *these* horns being the best ones to come out at.

The Bulletin itself could not long pass current among street railway men, cable or electric, but its machine-made inferences, made, to be sure, chiefly of rags, straw and coloring matter, but stamped with the government imprint, have been as good as an annuity in Treasury notes for the electric interest, and it will be long before the $350,000 cable and the $46,000 electric shall cease to circulate in the back counties, unless the beneficiaries alluded to shake public confidence by trying to make eight bills out of seven, after the manner of a writer in the *Engineering Magazine* of May 1892, who says:

"A comparison of the average cost of building and equipping cable, electric and horse railways per mile of track, taken from the recent Census reports is given below:

Cable roads	$350,000
Electric roads	30,000
Horse roads	41,000"

It is dangerous to tamper even with an eighty cent *silver* dollar; you may make it uncurrent in spite of traces of the stamp of the government left on its face.

My July letter said of Cable No. 1, which "cost" $684,000 per mile, in the Bulletin, "the last lesson of this case may be that it is a healthy sort of a system that can stand up under such a load."

Here is part of the lesson: In the first place, the $684,000 is not the "Cost of Road and Equipment," as that expression is commonly understood by gentlemen making electric exhibits under this title. In 1886, the "North Chi. St. R. R. Co." obtained possession of the lines and franchises of an older corporation, the "North Chi. City Railway Co.," under a lease for 999 years. The North Chi. St. R. R. Co. guarantees the interest on the outstanding bonds of the older company, and pays a fixed annual dividend of *30 per cent.* on its stock. The North Chi. St. R. R. Co. made a bargain with the City of Chicago by which the company got a tunnel under the Chicago River, at its own cost, and the city a new bridge, etc., and thereupon proceeded to cable about seventeen miles of (single) track, which now (since May 26, 1888) it operates, with also some sixty-six miles of horse railroad line.

The company pays the highest wages going, allows sick employes one-third wages when off duty, gives the public (since the first wrestle with the combined grade and curve at the north end of the La Salle Street tunnel) a service alongside of which that of the old horse cars was a shadow, and generally works along on broad gauge principles, with results about like this:

					Par Value	Market Price
$ 500,000	worth of	6	per cent.	bonds of the old Co.		112
1,500,000	"	4½	"	" " old Co.		95¾
2,350,000	"	5	"	" " new Co.		100⅜
500,000	"			stock " old Co.	$100	$500
5,000,000	"			" " new Co.	$100	$194

Net profit on the $5,000,000 of stock in 1890, 10.3 per cent.
" " " same in 1891, 12.25 "

Doubtless some electric man will (again) credit the horse car part of this large system with the earnings suggested by these figures, as the writer in *Engineering Magazine* for May, 1892, substantially does. In that case, perhaps, I can finish his education.

Now your electric road cannot stand up under that sort of thing and live, any more than we can balance successfully such a feather as 177 car miles per mile of line per day.

It may be well to admit here that the figures given in these letters may be tainted with error. They are as good as I have been able to get with much painstaking, and I think none of them are seriously misleading.

CABLE RAILWAYS.

(*To be Continued.*)

Montreal Notes.

The fever of electric traction has at last reached Montreal, and nothing else of interest is at present mentioned in street railway circles. The Montreal street railway is operating an excellent horse car system, although the passengers do help the employes in their work by being required to deposit their silver five cent pieces in a tin fare box held by the conductor. The cars run on sufficient headway to accommodate the traffic, and are far enough apart to necessitate a single track only, with turn-outs on each route. On Craig Street, however, where several lines converge, the track is doubled.

The cars are very neat indeed, and were made principally by Stephenson, Jones and N. & A. C. Clariviere, local builders. The Clariviere cars are close copies of the Stephenson and Jones cars, and attest the fact that the Canadians are better imitators of American street cars than their cousins across the Atlantic. The closed cars have sixteen foot bodies, and the open cars have seven and eight benches. The cars used in summer are stored away when snow appears, and other cars mounted on sleigh runners take their place. The number of cars operated in summer is much larger then in winter, and, in consequence, a number of men is discharged each year as winter approaches. Conductors and drivers receive as wages from $6 to $7 per week. The track construction is of the old horse car type, with the ordinary tram rail and stringer construction. No cast iron or built steel crossings are used, but the car wheel jumps over the rail crossing its path, or has a clear passage, according to the circumstances. The ordinary tongue switch is used. Instead of hitching the hill horse beside the car team, as in the United States, a novel device is substituted. Poles are used on all the cars, to the front hook of which a chariot with two horses is hitched, and the car is thus assisted up the grade. The chariot fits exactly in the rails.

But electricity is to do away with all the horse cars in Montreal, notwithstanding the arguments from the opposition in regard to the difficulties of operation in winter, and as a result the city will receive a boom in all quarters, which is sorely needed. Affairs are in the following shape at the present writing: The franchise of the Montreal Street Railway Co., the company at present operating the horse cars, has eighteen more years to run. But the company wish to substitute electricity for horses as soon as possible. In this privilege they have competitors, and not a monopoly, as in the case of the horse cars,

for three electric companies are in the field to obtain the right from the city authorities to operate the present horse lines electrically. They are the Westinghouse company, represented in montreal by A. H. Morin, the Thomson-Houston company, represented by S. R. Williams, and the Royal Electric Co., of Montreal, of which Wm. Hagar is general manager, and Wm. Thomson, brother of Prof. Elihu Thomson, electrician. The Montreal Street Railway Co. appear to favor the Edison system, and from present indications they will be granted the privileges. The mayor of Montreal is bitterly opposed to electricity, but his opposition is of no avail as everybody else is in favor of the innovation.

The Royal Electric Co., a few days ago, received from the Brownell Car Co., St. Louis, an "Accelerator" car. It is a beautiful specimen of the car builder's art, and is shown herewith. The illustration depicts the end of the triumphal march through the city. The people flocked after the car as it passed through the principal thoroughfares, and nothing but praise as to its grace and beauty was heard on all sides. The car is equipped with Brownell's new truck, and all the advantageous features of the "Accelerator" type of car. S. L.

St. Louis Notes.

The annual meeting of the National Brotherhood of Carworkers took place in this city on June 21, and was well attended.

The franchise of the Forest Park & Clayton Electric Railway has been passed by the City Council. The eastern terminus of the road is at Delmar and DeBaliviere Avenues. It extends westward on the former street to Adelaide Avenue, thence to Kingsbury Boulevard, and northwesterly to Clayton. The company wanted to use the Forest Park loop of the St. Louis & Suburban Railway, but the latter company would not think of it, notwithstanding the fact that at the terminus decided upon, the Lindell Railway offered transfer privileges.

The Meramec Street line of the Union Depot Railway is to be extended from the present terminus at Springtown Road to Carondelet. The route was mapped out by the citizens of Carondelet and submitted to Mr. Scullin, president of the railway company, who decided to accept it.

An electric belt line is to be built around Forest Park. The City Council has decided to sell the franchise to the highest bidder. Some lively bidding is expected, as the line will some day be useful for other than park purposes The proceeds of the sale are to be used for beautifying the park.

The owners of the Chattanooga (Tenn.) street railways were in St. Louis recently, endeavoring to sell their property. All inquiries at brokers' offices were met with no reply. It is known, however, that the St. Louis Trust Co. have taken up the offer of the representatives, and that the sale will shortly be accomplished. The visiting party consisted of Messrs. Charles A. Tyler, D. S. Watkins, J. C. Devine, all of Chattanooga.

The City Central Electric Railway Co., of which mention has previously been made, intends to connect the various points of interest in the city by rapid transit, on a direct route and for a single fare. It is to give to North and South St. Louis a thorough crosstown system of transportation, so that one section can communicate with the other in the briefest possible time and for a single fare. Transfer tickets will be issued to all parts of the line. Excursion cars will be run from the Fair Grounds to Tower Grove Park. This system will give to North and South St. Louis a direct connection with the new Union Station, and what has long been needed, convenient access to the beautiful cemeteries of the city. The road will be built and in operation six months after the franchise has been obtained, and a bond of forfeiture will be given for the construction of the road.

The projectors of the Chicago & St. Louis Electric Railway claim that the road has now assumed definite shape, that the bonds have been floated in New York, and the stock partially subscribed in New York and St. Louis. The capital stock is $6,500,000.

The Grand Avenue Railway Co. have applied to the City Council for a franchise. The route of this company's line runs along Grand Avenue from Carondelet on the south to the cemeteries on the north. There is no competition whatever, as the nearest parallel crosstown lines are some distance away. The proposed road will be about ten miles long, double track. For this distance a five cent fare will be charged at all times. It will use the tracks of four other companies whose cars run only two or three squares in the case of each line, and will thus prove a valuable feeder. The new company have met with no objection so far, and it is safe to say that the franchise will be obtained with little or no trouble. Messrs. Butler, Slattery, Conrades and others, all residents along the proposed line, are the prime movers in the scheme.

The Missouri Railroad Co. have filed suit against the Southern Railway to restrain the latter company from using their track on a portion of Market and Sixth Streets. There is a city ordinance allowing one company to use the tracks of another in so far as the traffic of the company does not injure that of the owners of the franchise. The Missouri company claim that their franchise is of a date previous to the above ordinance, and that there is no clause in their franchise which will allow the cars of another company to run on their tracks. The Southern company refuse to accept the damages assessed by the commissioners appointed by the mayor in the case of the Union, Union Depot and Broadway lines, because they are allowed to run only horse cars, while they have been operating electrically for some years past. The amount of the damages is $250,000.

The Lindell Co. are replacing all their galvanized iron guard wiring with copper, on account of the latter being non-corrosive. S. L.

Statistics of Horse Car and Omnibus Traffic in Paris.

The Annual Report of the Compagnie Général des Omnibus de Paris for the year 1891 shows the following interesting statistics.

Horse Car Traffic.— Total number of street cars in service during the year 1891 was 270, the same as during the preceding year. Each car covered on an average per day 59.8 miles. The total number of horses employed by the company for the operation of cars averaged 3,471 per day. The number of horses owned per car operated, was 13.55. The cars carried during their regular trips 72,988,111 passengers. Of these 41,578,473 rode inside the car and 31,409,638 on top. 13,150,388 passengers used transfer tickets. The average receipts per passenger were 3.552 cents. The average receipts per car mile were 46.6 cents.

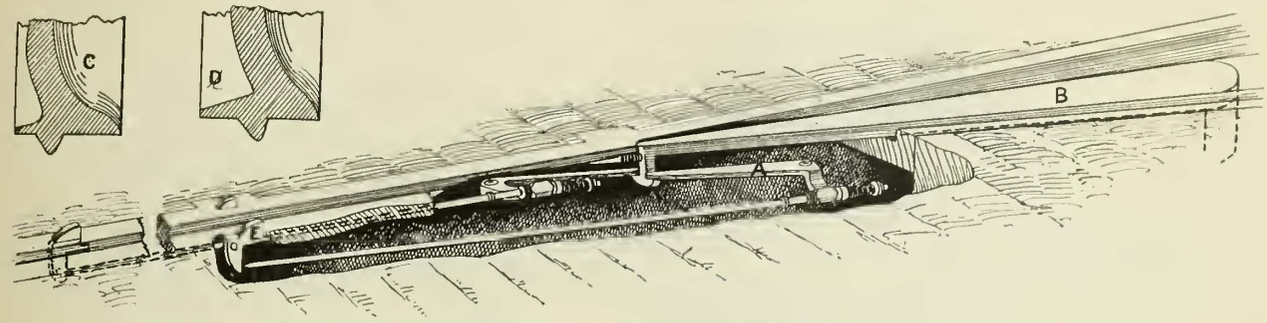
Omnibus Traffic.—The maximum number of omnibuses in service in 1891 was 650, an increase of 34 over the preceding year. Each omnibus covered on an average 56 miles per day. To operate these required on an average a stock of 9,122 horses, an increase of 126 over the preceding year. Each horse covered an average of 10 miles per day. The average number of horses allowed per omnibus was 15.33. The number of regular passengers carried during the year was 118,102,968; of these 68, 692,738 were carried in the interior of the bus and 29,401, 230 on top. The receipts per passenger averaged 3.772 cents. The receipts per omnibus mile were 13.76 cents.

The cost of forage per horse per day during the years 1890 and 1891, is shown in the following table :

	1890	1891
Oats	$0.1305	$0.1486
Bran	0.0008	0.0006
Corn	0.0962	0.0846
Beans	0.0386	0.0379
Hay	0.06	0.0485
Straw	0.0485	0.0452
Peat	0.0026	0.003
Total	0.3772	0.3684

Automatic Track Switch.

The accompanying illustration shows a street railway switch designed for use with cars propelled by animal or mechanical power, and operated entirely by the car wheels, independently of any other mechanism attached to the car, or of any attention on the part of the driver. As will be seen from the illustration, the proper switching of the car is insured independently of the direction of the preceding car, or of any change of the switch by accident or otherwise, some of the cars having wheels with specially designed treads or flanges to secure that result.



NEW AUTOMATIC CAR SWITCH.

The operating mechanism consists of switch keys or levers, E, pivoted within openings in the rail, and so placed as to project slightly above the rail, and in position to the right or left of the track groove to engage with the tread or flange of an ordinary, or specially designed wheel, C and D, by which they are depressed, and which in turn operate the switch tongue, B, through the medium of connecting rods and bell cranks, A. Spiral springs are also provided for the adjustment of the levers and to prevent shock, and one is placed at the end of the tongue, which assists in throwing the tongue into position after passing the centre line, and holding it there. The mechanism is housed in a chamber beneath the rail, or in a specially constructed rail, having a removable side by which access can be had for the adjustment or repair of the parts.

It will be seen that the device admits of any number of key combinations. For instance, the first key, which is operated alike by all cars, may be arranged to throw the switch in one direction, and provide for leading off such cars as are equipped with ordinary wheels, and two other keys located betwen the first key and the switch tongue in position to be operated respectively by treads or flanges of greater width than required to operate the first key, and designed to throw the tongue in the opposite direction; the keys and tongue being so located relative to each other and to the car wheels that the car may set the switch by the first key and reset it for itself by one of the last keys. The diameters of the outside treads are made somewhat smaller than the regular wheel tread so that it will ride above the guard rail on curves. The keys are so coupled together that the operation of the second key sets the first one in position for the first car. The device was originated by C. E. Garey, master mechanic of the Dry Dock, East Broadway & Battery Railroad Co. of New York.

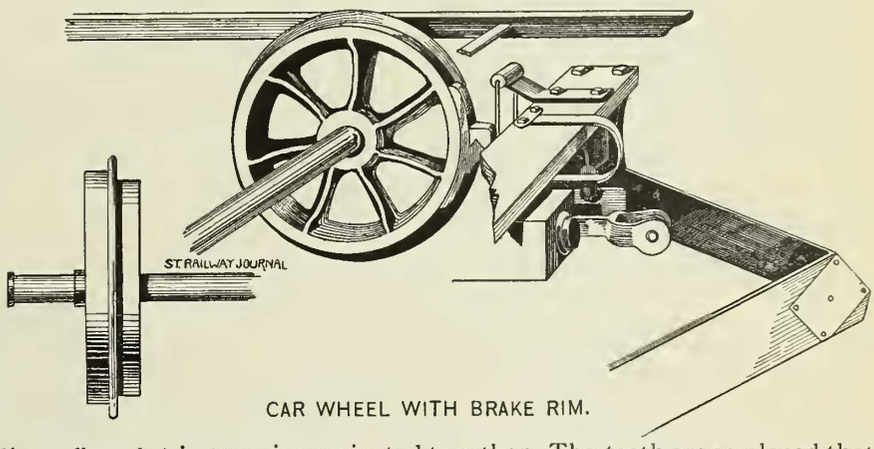
Car Wheel with Independent Brake Rim.

It is well known that the wear of the brake shoe upon the tread of a car wheel, materially shortens the life of the wheel. In order to prevent this wear and at the same time provide an always clean surface to which the brake shoes may be applied, the design illustrated herewith has been devised by Mr. W. E. Haycox. It consists of an independent brake rim cast on the inside face of the wheel, having a diameter somewhat less then that of the wheel proper, which provides for passing the guard rail on curves.

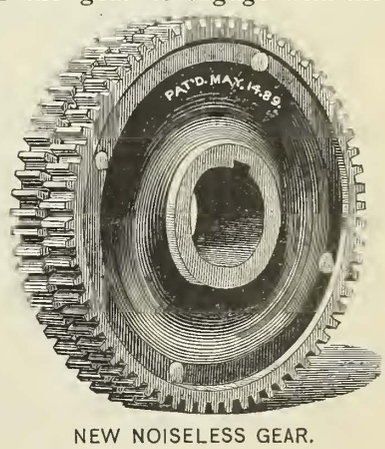
The independent rim adds but a few extra pounds to the weight of the wheel, and very little to its cost, but is claimed to add from 60 to 70 per cent. to the life of the wheel. A very efficient brake mechanism is employed with the design, and all the details of operationhave been carefully worked out. The Fulton Foundry Co., of Cleveland, O., are the manufacturers, and the tests made with the device have given good results.

A Noiseless Gear.

The gear shown below is manufactured for electric motors by the Climax Mfg. Co., of Buffalo, and is claimed to be noiseless as well as durable. The gear is of steel, and in two pieces, riveted together. The teeth are so placed that those of one part register with the spaces of the other. This arrangement enables the gear to engage with the pinion, which is of a similar type, closely and accurately, and, it is claimed, without any vibration or back lash. By the addition of a chamber in the web of the gear filled with non-resonant material, the wheels when at work are practically noiseless. A space is left between the two sets of teeth, so that there will be no injurious contact between the gear and pinion should a slight lateral displacement occur.



CAR WHEEL WITH BRAKE RIM.



NEW NOISELESS GEAR.

The street railway cars of the Binghamton Street Railway Co. carried on the Fourth of July 25,000 passengers, without the slightest accident or delay. The number of cars in service was fifteen, of which twelve were electric and three horse. This is a good record, and reflects much credit on the management of the company.

New Dynamo of Detroit Electrical Works.

A new design of twopole dynamo, in which the frame and bedplate consist of one solid casting, has been adopted by the Detroit Electrical Works for all sizes built by them, up to and including 30 K. W., and is shown in the accompanying engravings. Above the 30 K. W., the type will be similar to that illustrated, except that the machine will be multipolar. The journal boxes are provided with self centering and self oiling sleeves, which insure perfect alignment and lubrication. Each bearing is provided with a gauge glass which shows the height of oil in the oil chamber, and with a cock by means of which the oil can be drawn off whenever desired. The lubrication of the bearings is accomplished by the use of two rings which revolve in each and carry oil to the top of the shaft, from which it is distributed by means of grooves in the self centering sleeve. Directly over each of these rings, in the outer shell of the bearing, is a brass plug which can be lifted out when it is desired to ascertain whether the rings are working properly, or to put in new oil. The rocker arm, which supports the brush holders, is mounted directly on the self centering sleeve, insuring the centering of the brush holders on the commutator.

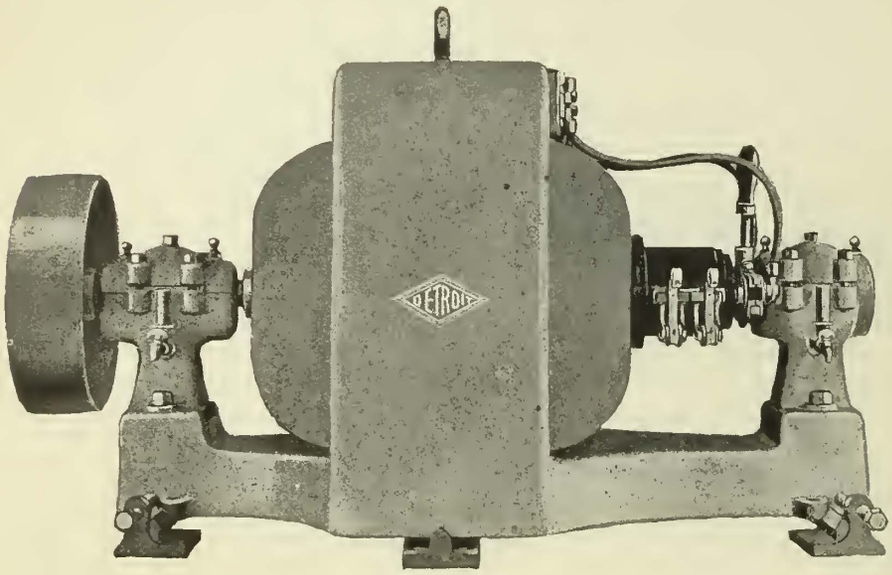


FIG. 1.—END VIEW OF DETROIT DYNAMO.

Carbon brushes are used on all sizes of machines both for motors and generators. The brush holders are of a new type and provide the requisite tension, and no more, to make good contact of brushes with commutator. This tension is obtained by the use of a spring coiled in the form of an involute, the outer end of which is continued straight from the side of the coil up to and a little above the outer ends of the carbon brushes. In this way the tension due to the coil when the straight end is in a perpendicular position is just sufficient to insure the proper contact. The coil of the spring is mounted upon an adjustable axis, so that as the commutator brushes wear the spring can be moved inward, maintaining the straight end in a perpendicular position, and insuring the same tension of the brush upon the commutator without changing the adjustment of the spring itself. The adjustment can be made at any time very easily by a single movement. As the carbon brushes feed radially they necessarily wear squarely across their entire thickness and never require trimming. Proofs of the desirability of this arrangement have been shown in practice by machines built by the Detroit Electrical Works. In one machine of an early type, but fitted with the Detroit improved brush holders and carbon commutator brushes, the original set of brushes, after sixteen months' continuous use, were still employed and not one-third worn out, while the commutator itself, although glazed by long use, showed no actual signs of wear when a straight-edge was applied.

The armatures of all machines, up to and including the 30 K. W. size are of the drum type, but have a special winding, covered by patents, which not only economizes space and firmly holds the wires at ends in position, but also has the important advantage of having no two wires of great difference of potential adjacent to each other, thus reducing largely the danger of burnouts. The armature is also well ventilated, and the insulation of the armature cores and wires is of the very best.

The commutators are of a new design, and are claimed to be the finest ever manufactured. Mica is the sole insulating material used in their construction. The field coils are wound on metal spools and are then slipped into place on the pole pieces, where they are almost entirely covered and protected by the iron frame of the machine. To replace any coil with a new one is, however, a matter of only a few minutes. The general design of the machine is such that the armature is protected on all sides by the frame of the machine and the metal flanges of the field spools, while its compactness necessarily requires smaller floor space and less head room than any other machine of equal capacity. All generators are compound wound to give any desired increase in voltage up to 15 per cent. at full load.

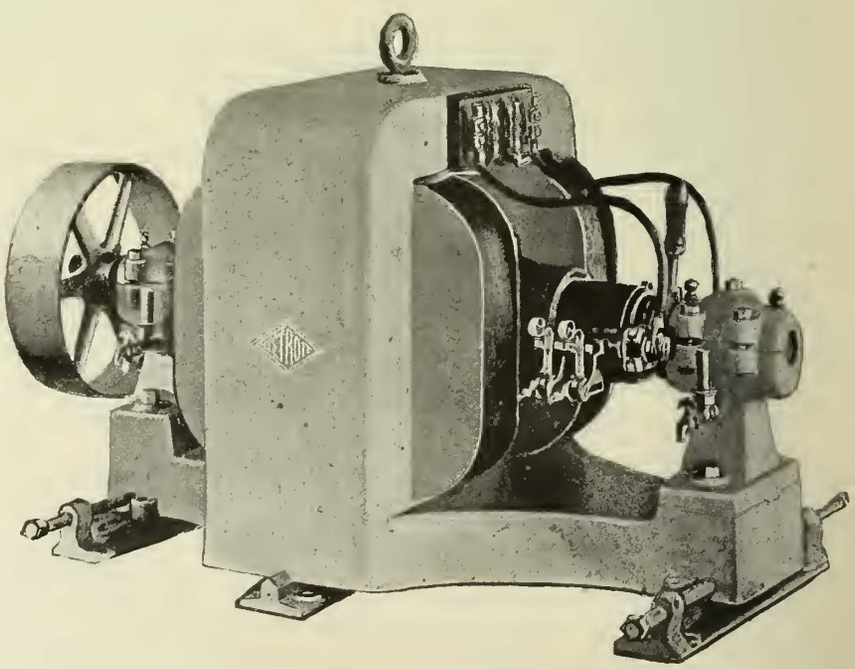


FIG. 2.—PERSPECTIVE VIEW OF DETROIT DYNAMO.

Each machine can be mounted on slides for taking up

slack in belt, or, if desired, it can be bolted to the foundations by lugs which are cast on the sides of the bedplate. The headboard of the generator is provided, in addition to the connections shown, with a double pole, quick breaking, headboard switch, so that when desired, and entirely independent of the switchboard appliances, the machine can be entirely disconnected from the mains. These dynamos have a fixed point of commutation, which renders

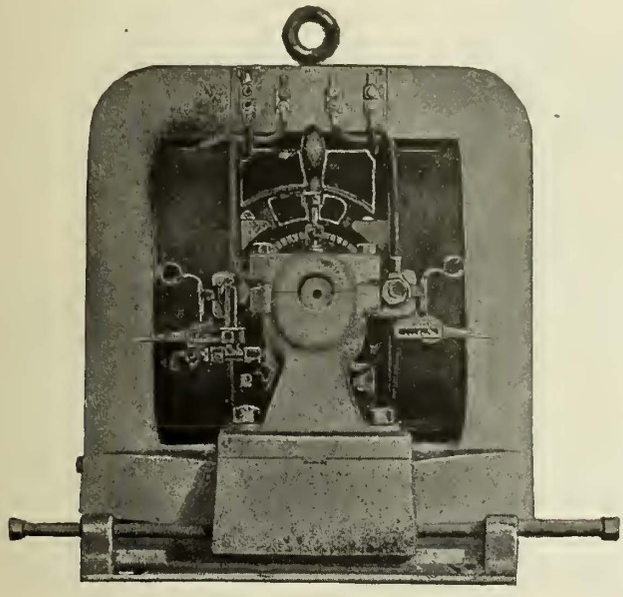


FIG. 3.—SIDE VIEW OF DETROIT DYNAMO.

possible the reversing of the machine and changing of load from no load to full load without noticeable sparking at the commutator. In designing this machine, the advantages of slow speed have been kept in view as well as efficiency.

The standard sizes of the machines now being made are as follows, ratings being made in kilowatts: ⅛, ¾, 1½, 3, 5, 7½, 9, 15, 20, 30, 40, 60 and 100. Larger machines of the multipolar type will soon be brought out.

Two New Devices.

A wire cutter is always a convenient tool for an electric railway man to have near at hand, and the one shown in Fig. 1, known as the Billings' wire cutter, and

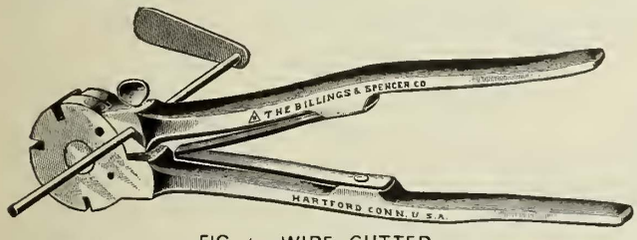


FIG. 1.—WIRE CUTTER

FIG. 2.—PIPE WRENCH.

manufactured by the Billings & Spencer Co., of Hartford, Conn., will be appreciated by any one who has frequent need of such a tool. It is drop forged from the best tool steel, and provided with four cutting edges on the rim and two which are enclosed. It also has an adjustable gauge so that wire can be cut accurately to any length. The workmanship is of the same high quality which characterizes all the appliances made by the Billings & Spencer Co. The total length of the tool is ten inches. Fig. 2 represents the Billings' pipe wrench. The jaws of this wrench are drop forged of the best tool steel, and the handles are of the best grade of machinery steel. This wrench offers many advantages over similar tools. It is simple in design, has few parts, and is characterized by the best workmanship and finish. A special feature of superiority is found in the fact that no matter how large or small the size of pipe for which it is adjusted, the angle of the jaws remains the same. The total length is fourteen inches, and is made to take pipe from one-quarter to one and a half inches.

Pole Top and Pull Over Bracket.

The pole top shown in Fig 1 has been recently brought out by the Railway Equipment Co., of Chicago, and is designed specially for large roads, although it is made adjustable and can carry from two to seven feeders. It is fitted with a wooden plug, which is inserted in the top of iron or steel poles, insulating them from the tops. It can also be used on wooden poles, and is fitted with ratchet or eye bolt whenever required. By using this top, electric roads can increase their feeder capacity as their traffic grows heavier or their system becomes more extensive, without a change in detail of their construction and the simple addition of the necessary light, yet strong, attachment.

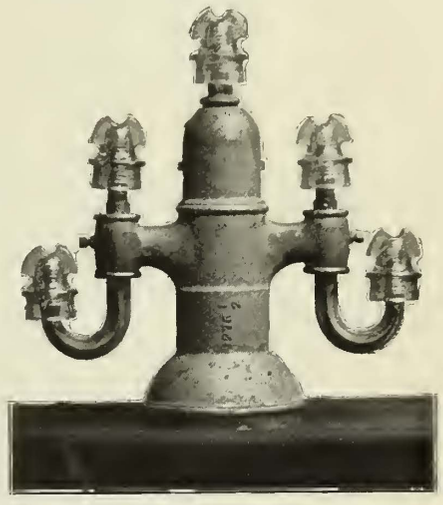


FIG. 1.—NEW POLE TOP.

Fig 2 shows the standard pull-over bracket made by the same company. An improvement has been made and

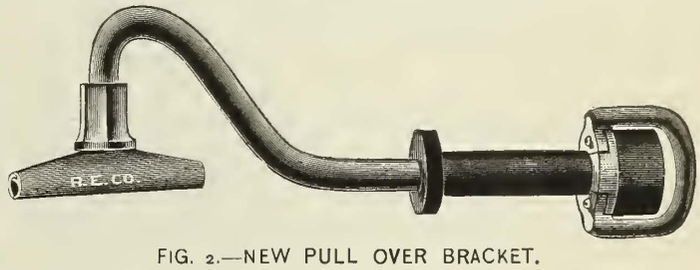


FIG. 2.—NEW PULL OVER BRACKET.

patented by which this pull-over bracket is made absolutely reliable for the purpose intended. The hook and wire attachment have unusual strength, the insulation is excellent and the bracket is fitted with the Chicago clamp, the merits of which are well understood.

THE Second Avenue Railway Co., of New York, have decided to install storage battery cars on their line, and have received the necessary permission therefor from the municipal authorities. About ten cars will be put in operation at first, and they will probably run from the depot of the company on 96th Street and Second Avenue to the Harlem River, a distance of about a mile and three-quarters. The Waddell-Entz battery will be used.

THE *Street Railway Journal* for July, is specially notable for its illustrated articles, each of which must prove of interest and value to those directly or indirectly engaged in the constantly growing street railway industry. The editorials are bright, crisp and strong, and there is an abundance of readable miscellany.—*Exchange.*

New Wheel Press.

To provide for those styles of electric street railway motors, which have the armature upon the axle of the truck, and which, by reason of the small distance from hub of wheel to the end of the armature, do not admit of the use of the ordinary styles of wheel presses when taking off the wheels, Watson & Stillman, of New York, have designed two styles of presses shown in the accompanying illustrations. Fig. 2. shows a belt power press, which, except in shape of moving abutment, is similar to their standard style. The moving beam rolls upon the lower tension bar, and also has one side roll upon the upper beam to avoid friction caused by the overhanging at the back. Two independent, adjustable, shaft carrying hooks are furnished, to avoid the kicking up of the shaft when placing it in the press, as in the other styles. The chuck and abutment beam block act as distance gauges when putting on wheels. The chuck, which is attached to ram by a centre pin and supported by a rolling carrier, is replaced by a small block when taking off the wheels. A safety valve is provided and the suction and pressure valves are easy of access by removing separate bonnets. The pump pistons are easily packed by a compressive packing and screw glands. Return weights, water tank and pressure gauges, with safety couplings, are furnished with all presses. The weight for the thirty-six inch wheel press is 6,000 lbs., and for the thirty inch press 3,500 lbs. The movement in both cases is fifteen inches, and the distance between bars forty inches and thirty-four inches respectively. Fig. 1 shows a hand press similar in general arrangement to the belt power press described above. The lever works perpendicularly and at right angles to line of press and convenient for operator to easily watch the work. The distances between bars are the same as with the belt power press, and the movement is twelve inches for both thirty-six inch and thirty inch wheels.

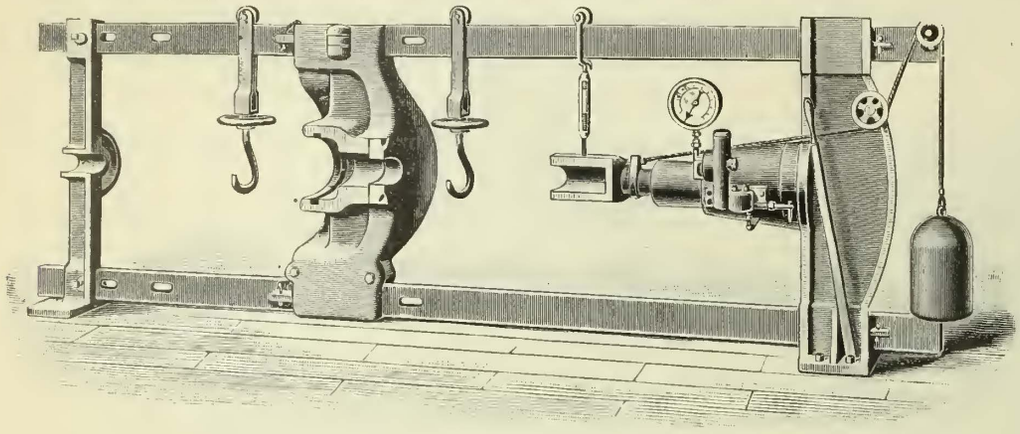


FIG. 1.—HAND WHEEL PRESS.

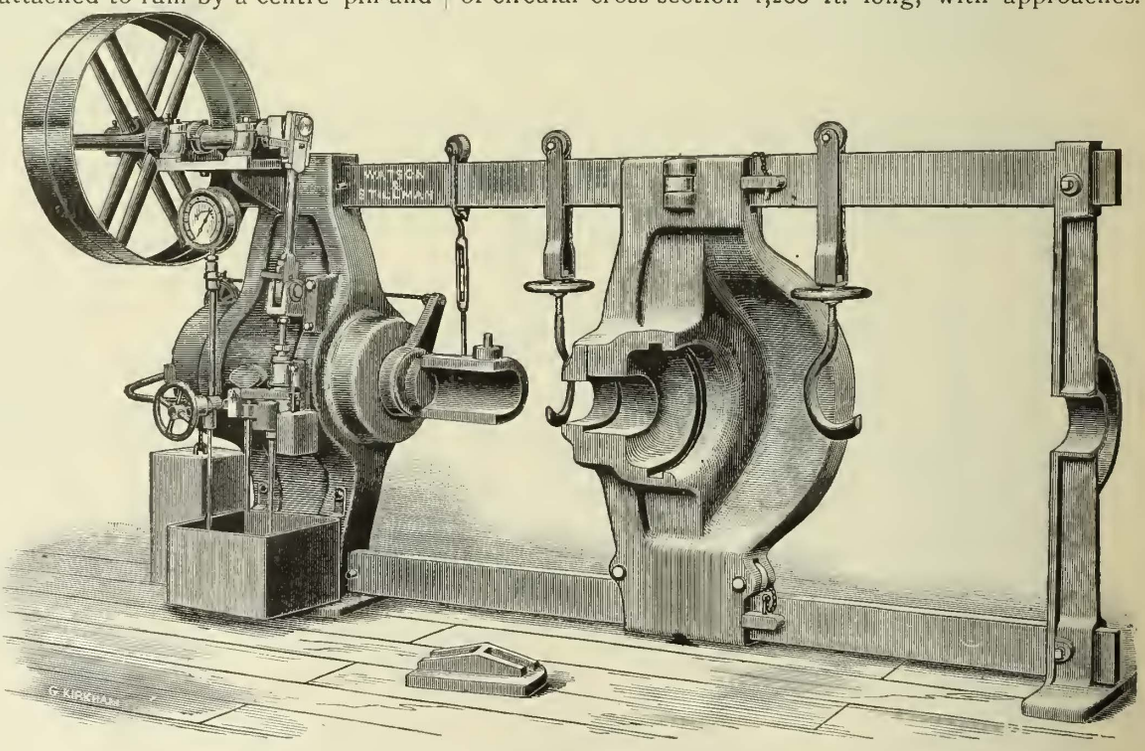


FIG. 2.—POWER WHEEL PRESS.

THE Interstate electric railway was put in operation July 19, at North Attleboro, Mass.

Tunnel Lining Badly Cracked.

The cast iron lining of the Hudson River tunnel is said to be cracked badly in several places, but that portion of the tunnel which is lined with a two foot ring of brick masonry is standing intact without cracks. That portion of the tunnel which was constructed before 1882, when the work was stopped for lack of funds was lined with brick, but when work was resumed in 1889, the Greathead system of tunneling was adopted, which employs an iron ring lining. These rings are nineteen feet six inches in diameter, and one and one-quarter inches thick, with ribs eight inches thick and two and three-quarters inches wide at intervals of twenty inches.

The cause of the failure of the rings is said to be due to the fact that the tunnel is built through a soft silt, so soft that it will flow like a viscous liquid, rendering the tunnel buoyant and producing a tendency to rise in proportion as its weight is less than the weight of the excavated material, but the material being solid enough to prevent the tunnel from rising, the vertical pressure exceeds the horizontal, tending to change the lining, from a circular to an elliptical form, the longer axis being horizontal, and the distorting force being strong enough to break the plates at the side just above the middle.

Work was suspended on the tunnel about a year ago, the funds having again become exhausted. The original plan of the work contemplated two tunnels side by side, of circular cross section 1,200 ft. long, with approaches. There still remains to be completed 1,600 ft. on the north tunnel, and nearly the whole of the south tunnel, or about 5,000 ft. in all, besides the approaches for both tunnels, that on the New Jersey end being 4,000 ft., and on the New York, 4,500 ft. The amount already expended on the work is about $2,550,000.

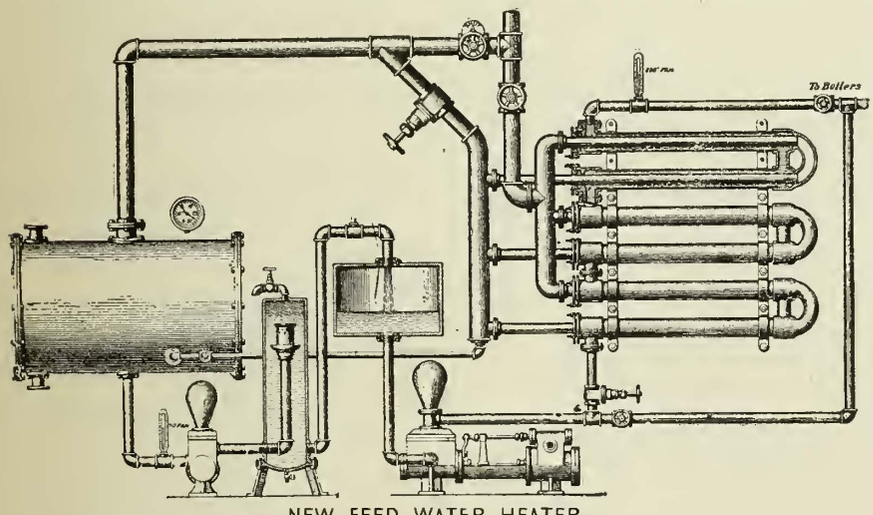
The method of construction thus far followed, both with the brick and iron ring lining, has been contrary to the advice of certain consulting engineers who, in the early history of the enterprise, suggested the buoyant tendency of the tunnel in such a formation, and recom-

mended a lining of wrought iron for the reason that neither brick nor cast iron has sufficient lateral strength, a feature which will be required when heavy trains enter the tunnel, adding to its weight and tending to sink it unequally in the soft material.

A New Feed Water Heater.

Mr. Elihu Nelson of 11 Wall Street has been engaged for some time in making a series of improvements in feed water heaters, condensers and oil separators. His latest invention is a combination of the three kinds of apparatus in one; and it would appear that he has succeeded in producing remarkable results. With an apparatus which is now on exhibition in the basement, No. 11 Wall Street, Mr. Nelson is able to carry the feed water into the boiler at a temperature almost as high as that of the steam which passes through the heater, while the waters of condensation after passing through the condenser are at such a temperature (not above 70 deg. F.) that they do not interfere with securing a high vacuum, and thus relieving the demand on the coal pile.

In the case of the apparatus which is now on exhibition, there is no load, and consequently, the amount of steam required is very small. The result is that while the absolute temperature attained is not exceedingly high, yet the relative approximation of the temperature of the feed water to that of the steam is remarkable. At a time when the steam was utilized for heating the building, we observed a much higher absolute temperature of the feed water. This was in an apparatus differing somewhat from that now shown at No. 11 Wall Street, but chiefly in the fact that it was especially adapted for stationary work, while the present apparatus is more especially suited to marine work, although requiring only slight modification to fit it for stationary service. So far as we know, the present invention of Mr. Nelson is the only feed water heater that can be successfully combined with the present ship condensers. It occupies very little space and can be set close beside the condensers already in use.



NEW FEED WATER HEATER.

This brings us to the point of saying that the significant features of the invention reside mainly in the feed water heater, which can be combined with a condenser and an oil separator of any preferred type. At the same time, Mr. Nelson has invented a condenser and an oil separator of his own which in an entirely new outfit he would probably prefer to use. But where a condenser is already set up, say, on board a steamboat or elsewhere, he can add the feed water heater and secure greatly improved results.

The cut illustrates the general arrangement of the apparatus, the vertical pipe broken off at the top representing the main exhaust pipe from the steam engine. A branch from this pipe passes to the condenser at the left, while another branch is connected through a header with the three centre pipes of a sectional feed water heater, the opposite ends of the centre pipe being joined to a return pipe connected with the branch that runs to the condenser, as already mentioned. The combined area of the three centre pipes is made somewhat greater than the area of the main exhaust pipe to allow for the greater friction, and the steam is admitted to the centre pipes by way of the header above mentioned in order to secure as fully as possible the equal distribution of the steam in the various pipes. By a suitable arrangement of valves, just the desired proportion of steam can be let into the centre pipes, the rest going through the branch exhaust pipe. The feed water is pumped into the outer pipe of the lowermost section and travels in a direction opposite to that taken by the steam from the engine exhaust pipe. In this way it is brought about that the steam is admitted to the feed water heater by multiple paths, and that it is practically fresh steam when it is met by the feed water, first comparatively cool, then of a higher temperature, and then still further heated. The result is that the feed water is raised to a temperature approximating very closely to that of the heating steam.

It is one of the advantages of passing the feed water and the steam in opposite directions that the water of condensation passes through comparatively cool, while the feed water is heated to the highest possible degree.

To sum up the whole description of the heater in a few words, it may be said that the different sections or groups of sections are connected up in such a way as to be in multiple arc between what may be called the main exhaust pipe from the engine and a branch exhaust pipe. The steam which is used for heating the feed water is thus applied to small portions of it successively while the steam is at a great heat, thereby securing the greatest possible efficiency. There is no clogging or backing in the apparatus. As a matter of fact, a vacuum is created, which greatly facilitates the action.

Beyond the condenser, the waters of condensation are pumped through an oil separator or purifier, and into a receiver shown at the centre of the cut. The water is cool enough so that the oil will rise to the top in the oil separator, where it can be drawn off through a suitable stopcock.

As to the coolness of the water after passing through the condenser, it may be stated that it reaches a degree which entirely admits of securing a high vacuum, as shown by an ordinary gauge. When there is no leakage, the vacuum runs from twenty-six to twenty-eight inches.

Street Railway News.

General.

Albany, Ore.—The Albany Street Railway Co. are experimenting with a "Prouty" noiseless steam motor, which is to take the place of the horses now in use on their lines. If it proves satisfactory, another will be ordered soon.

Americus, Ga.—The electric railway has again been suspended, the lessee having thrown up his contract.

Anderson, Ind.—The road of the Anderson Electric Street Railway Co., which is 2.8 miles in length, is now in operation. The company have two St. Louis Car Co.'s cars equipped with Edison motors.

Baltimore, Md.—The contract for machinery for the Blue Line of the City Passenger Railroad Co. has been awarded to the Robert Poole & Sons Co., and that for cabling it, to Edward Saxton. Contractor Saxton expects to begin work soon, and to have it done by the first of January. Work on the other lines is also progressing with all possible rapidity. E. D. Smith & Son have the contract for both roads.

Beverly, Mass.—The Naumkeag Street Railway have purchased the Beverly & Danvers Street Railway. The road was started to be operated by the storage battery system, but the system failed to work satisfactorily, and for the past six months the road has not been operated.

Belleville, Ill.—The city is trying to get rid of the present mule railway. It has revoked the franchise and ordered the tracks taken up; against which the company's representative has appealed. A franchise has already been granted the Edward Thomas Electric Co. to build a double track in Belleville.

Brooklyn, N. Y.—The Brooklyn City Railroad Co. have acquired the stock of the South Brooklyn Street Railroad Co. and absorbed it.

Braddock, Pa.—Wm. Yost, president of the Braddock & Turtle Creek Street Railway Co., has parted with his control of the stock of that road, and has resigned in favor of Jas. B. Callery, president of the Second Avenue Passenger Railway of Pittsburgh, who represents the purchasers. The other officers of the company are: Secretary, Jno. C. Reilly; treasurer, Jno. W. Taylor.

Brantford, Ont.—The street car drivers struck one day lately, but their places were so rapidly filled by new men that there was practically no interruption in traffic. The rails for the new electric service have been distributed along the route.

Canandaigua, N. Y.—The Canandaigua Street Railway line, with all appurtenances, was sold on mortgage foreclosures last month for the sum of $32,000. Charles C. Sackett, as representative for the majority of the stockholders, was the purchaser.

Chicago, Ill.—The North Chicago Street Railroad Co., are now using crude oil for fuel in all their power stations. The La Salle Street station was recently equipped with oil burning apparatus. The fuel gives great satisfaction, as it is economical and does not add to the smoke cloud for which Chicago is famous.

Receiver John A. Bell, of the Russell Carette Co., recently sold at auction, under an order of Court, all the property of the company for $10,500. The property consisted of 184 horses, the stables at 144 So. Green Street, the carettes and everything else connected with the line.

Street Superintendent Burke, has sent to the street railway companies a notice containing a list of streets on which the pavements are out of repair. The companies are held responsible and unless the repairs are made immediately, Mr. Burke asserts that his department will do the work and institude an action to recover the cost.

JUDGE ADAMS has dismissed the suit of Warren Springer against the West Chicago Street Railway Tunnel Co., Charles T. Yerkes and contractors Fitz-Simons and Connell, after a hard fight by plaintiff's attorneys to continue the case. Springer demanded $100,000 damages for injury to his leasehold interest in premises at 213 to 219 Canal Street and 208 to 216 Clinton Street. In 1891 the tunnel company took forcible possession of the place for the purpose of removing the building to excavate for a tunnel under the Chicago River. Before the work of destruction was completed Springer secured an injunction from Judge Tuley restraining any further damage to the premises. An appeal has been taken.

THE South Side Elevated Railway have leased the property to the east of their present stub terminal on Congress Street for $10,000 per year. This established a valuation of $100 a square foot, but the property is not supposed to be worth that figure. It was necessary for the company to pay the sum mentioned in order to secure room to accommodate the crowds at the terminus.

Easton, Pa.—An application has been made to have the name of the Easton, South Easton & West End Railway Co. changed to the Easton Transit Co.

Findlay, O.—Philadelphia capitalists have purchased the Blanchard Avenue car line.

Hamilton, Ont.—The new electric street railroad is now opened.

Haverhill, Mass.—A deed was recorded July 15, of the transfer of the Black Rocks & Salisbury Beach Railway to the Haverhill & Amesbury Street Railway Co., the consideration named being $1.

Lincoln, Neb.—It is thought that the Lincoln Electric Street Railway Co. now in the hands of a receiver, will be reorganized.

Los Angeles, Cal.—A deal is on foot for the consolidation of the cable and electric roads, which will harmonize the interests of the two and enable them to be operated more profitably.

New Haven, Conn.—The State Street and Whitney Avenue street railways have passed into the hands of a syndicate.

THE horse barn of the West Haven Horse Railroad Co. was destroyed by fire July 3. Loss, $25,000.

Norristown, Pa.—The Morristown Passenger Railway Co. have decided not to introduce electric cars, on account of the expense which the business would not justify.

Ottawa, Ont.—The first electrical car trucks ever made in Canada are now being constructed by Mr. P. Latour of this city. He is making them for the local electric car company.

Philadelphia, Pa.—The Philadelphia Traction Co. have leased the Ridge Avenue line.

Plattsmouth, Neb.—The Plattsmouth electric street railway was bought at sheriff's sale for $4,097. The sale may not be confirmed for the reason that it did not reach two-thirds of the appraisement.

Quincy, Mass.—The Quincy & Boston Street Railway did an enormous business on July 4, the total number of passengers carried being 14,427. There was not an accident or mishap of any kind. The number of cars used was nine, two of which were small cars. It is said that the number of passengers carried beats the record for one day's work of any street railway in the United States.

St. Louis, Mo.—The formal transfer of the Northern Central and the Union lines to the Cass Avenue Street Railway Co. took place June 31. An act of the Municipal Assembly of April 11, granted the transfer of the privileges and purchases of these two lines to the Cass Avenue company. They were not bought outright, but leased until 1925.

Sioux City, Ia.—Eight miles of electric railway and the 700 acre park adjoining the Big Sioux River on the west side of the city, have been sold to Chicago parties for $600,000. It is believed by some of the former owners of the property that the Chicago & Northwestern road is the real purchaser.

Tacoma, Wash.—The consolidation of the Thomson-Houston Steilacoom line and the Tacoma Railway & Motor Co. has been effected.

Toledo, O.—The Consolidated Street Railroad Co. have filed suit against the Toledo Electric Railroad Co. asking damages in the sum of $145,000. The petition is lengthy, but the object in brief is to secure compensation for the appropriation and use of the Consolidated tracks by defendant company. The suit covers the tracks which have been put in litigation by recent injunction and other suits, and is brought about by the insistence of the electric company in occupying and using the tracks constructed and owned by the Consolidated.

Toronto, Ont.—Probably the electric cars required for the Toronto service will be manufactured at Ottawa. The directors of the company have procured contract prices from Mr. Wylie, who has already turned out some fine open cars for the Ottawa company.

THE Dominion Wire Manufacturing Co., has shipped the first lot of their contract of twenty-seven miles of pure copper trolley wire for the Toronto Street Railway. This is the first lot of trolley wire in mile lengths over made in that country.

Wakefield, Mass.—The construction of the new electric road between Wakefield and Stoneham is well under way.

Extensions and Improvements.

Albany, N. Y.—The Albany Railway Co. will build about two miles of extension and will add twenty cars.

Altoona, Pa.—The City Passenger Railway Co. expect to increase their rolling stock soon.

Ann Arbor, Mich.—The Ann Arbor & Ypsilanti Street Railway Co. expect to build two miles of track for steam power.

Ashland, Ky.—The Ashland & Catlettsburg Street Railway Co. are changing from animal to electric power, and are extending their line.

Ashland, Wis.—The City Council has granted a franchise to the Ashland Lighting & Street Railway Co., a new corporation composed of members of old lighting and street car companies. The new company propose to change the present horse car service to an electric line, and extend it fully a mile at each end.

Ashtabula, O.—The Rapid Transit Co. will extend their line one mile and add two cars soon.

Atchison, Kan.—The Atchison Street Railway Co. will build one mile of road.

Atlanta, Ga.—The Consolidated Street Railway Co. are going to build a central depot.

Atlantic City, N. J.—The Atlantic City Railroad Co. expect to add four cars.

Baltimore, Md.—The Baltimore Traction Co. have just completed plans by which they will operate an electric railway from Pikesville and West Arlington to Curtis Bay and Fort McHenry. The entire route has been surveyed, and part of it is now running in good shape.

Battle Creek, Mich.—The Electric Railway Co. will increase their rolling stock by the addition of two cars.

Bay Ridge, Md.—The Bay Ridge & Arundel Railway Co. will add two dummy cars.

Belleville, Ont.—An application is about being made for power to construct and operate an electric street railway in this city.

Berea, O.—The Cleveland & Berea Street Railway Co. contemplate an extension.

Binghamton, N. Y.—The Binghamton Street Railroad Co. will construct at once a power station on State Street. The building will be of brick 129 × 65 ft.

Birmingham, Conn.—The Derby Street Railway Co. will increase their equipment by the addition of two cars.

Bloomington, Ill.—An extension will be built by the Bloomington Street Railway Co.

Boston, Mass.—Six miles of electric road will probably be built by the East Middlesex Street Railway Co.

Brantford, Ont.—The new street railway company have decided on the electric equipment of their present line.

Brooklyn, N. Y.—The Brooklyn City Railroad Co. will erect a building at Second Avenue and Fifty-ninth Street as a trolley storage and repair shop. The building will be 700 ft. long by 200 wide and three stories in height.

THE Brooklyn Heights Railway Co. will probably add five open cable cars to their line before long.

THE Van Brunt Street & Erie Basin Railway Co. will replace five old cars with new ones.

THE Broadway Railway Co. are in the market for a number of horses.

A CONTRACT has been drawn up between the Brooklyn Elevated Railroad Co. and the Union Construction Co. of New Jersey, for the building of two extensions of the system. One is from the present terminus on Fulton Avenue along Fulton Street to Crescent, and down Crescent to Cypress Hills Cemetery. The other is the one from the present terminus at Fifth Avenue and Thirty-sixth Street, through Fifth Avenue, Thirty-eighth Street and Third Avenue to Fort Hamilton.

Buffalo, N. Y.—The Buffalo Railway Co. have received from the State Board of Railroad Commissioners permission to change their power to electricity on Exchange Street from Main to Louisiana Streets, and on Michigan Streets between Exchange and Carlton Streets.

Cedar Rapids, Ia.—The electric railway company will add a new engine and a new generator to their plant.

Champaign, Ill.—The Rapid Transit Co, contemplate an extension.

Charlottesville, Va.—The street railway company are adding a number of cars to supply the place of those lost by a recent fire.

Chelmsford, Mass.—The Lowell & Suburban Street Railway Co. have asked for permission to lay double tracks on the Chelmsford road down Stony Brook Bridge.

Chicago, Ill.—The Calumet Electric Street Railway Co. will build a new power house and car barn at Burnside, near Ninety-fourth Street. They will also extend their line to Seventy-fifth Street.

THE Chicago & North Shore Railway Co. have asked for the right to extend their electric line south from Graceland Avenue to Dewey Court, the cable terminus.

THE World's Fair cable loop for the Chicago City Railway Co. at Jackson Park has been changed by the City Council, so that it will not interfere with the elevation of the Illinois Central tracks.

Cleveland, O.—An ordinance has been introduced in the Council to grant to the Cleveland City Cable Railway Co. the right to operate certain portions of their road with electricity.

Cottage City, Mass.—The Selectmen have granted the petition of the Cottage City Street Railway Co. to locate their tracks from the present terminus on Sea View Avenue along Waban Park to Lagoon Heights.

Cumberland, Md.—The residents of the city living on the west side of Wills Creek have presented a petition to the City Council to have the street railway company extend their road over the creek.

Deadwood, S. Dak.—The Deadwood Street Railway Co. are contemplating a change from horse to electric power.

Defiance, O.—The Defiance Light & Power Co. are preparing to make considerable extensions of their lines.

Denver, Colo.—The people of Valverde are agitating the extension of one of the city lines into their suburb. The plan is to build a line to connect with the South Eleventh Street line of the Denver City Cable Railway Co. and transfer for a five cent fare.

THE Aldermen have granted a franchise to the Tramway Co. to operate a car line on Fortieth Street and Josephine Avenue.

Detroit, Mich.—Application has been made by the Detroit Citizens' Street Railway Co. for permission to occupy several more portions of the streets in order to establish loop lines, etc.

Easton, Pa.—The Easton, South Easton & West End Horse Street Railway and the Easton, Pa., Phillipsburg, N. J., Horse Street Railway have been purchased by a syndicate of local capitalists headed by J. S. Rodenbaugh, president of the Lehigh Valley company, who will rebuild and extend the lines and operate them by electricity.

Elmira, N. Y.—The Elmira & Horseheads Railway Co. are considering the purchase of a number of cars.

Fond du Lac, Wis.—It is reported that Geo. W. Hathaway, of Cleveland, O., has in view the purchasing of the street railway line in this city and placing an electric system in its stead.

Fort Scott, Kan.—The Fort Scott Rapid Transit Co. have decided to extend their system and add two miles, with a loop at the southern terminus of the city. They will also build an extension of half a mile to the Fair Grounds.

Galesburg, Ill.—The College City Street Railway Co. have sold out to the Galesburg Electric Motor & Equipment Co., who will rebuild the entire system and equip with electricity.

Gallipolis, O.—The street railroad is to be extended to Point Pleasant.

Glens Falls, N. Y.—A short extension is contemplated by the Glens Falls, Sandy Hill & Fort Edward Railway Co.

Great Falls, Mont.—The street railway extension to Highland Park is to be built this season.

Greenville, S. C.—The Street Railway Co. of Greenville have been granted a thirty-seven year franchise to build an electric road. The franchise is void unless work is commenced on the line in six months, and unless four miles of it is completed and in operation in fifteen months. The company is exempted from taxation for ten years.

Harrisburg, Pa.—The Harrisburg electric line is to be extended to Rutherford Station.

Hartford, Conn.—Citizens of the outlying new districts have petitioned the horse railroad company to give them better car facilities. They are unanimously in favor of the electric system.

Haverhill, Mass.—The Haverhill & Groveland Street Railway Co. on July 11, voted to accept the terms of the charter granted by the Board of Aldermen some time ago for the use of electricity on the streets. It has been generally understood that the matter of using electricity had been given up.

Hoboken, N. J.—The North Hudson County Railway Co. have received another franchise for a surface road from the city. The Council has granted permission to lay tracks on Fourteenth Street, west of Willow Avenue, to the hill, conditional upon the company grading the street and paving between the tracks. The franchise is good for three years.

Hull, Ont.—Mayor Champagne has interviewed Mr. Soper, of Ottawa, regarding the possibility of extending the Electric Street Railway through Hull and to Gratineau Point.

Huntington, W. Va.—The Belt Line Street Railway Co. and the Huntington Electric Railway Co. have consolidated. The consolidated lines own seven miles of street railway, three being electric and four horse power. The entire line will be made electric at once.

Indianapolis, Ind.—The Citizens' Street Railway Co. expect to extend their line seven miles, and will add about ten cars.

Ironton, O.—The Ironton & Pittsburg Street Railway Co. will equip with electric power this year.

Jackson, Mich.—The Jackson Street Railway Co. will extend their line one half mile.

Kansas City, Mo.—The reorganization of the Interstate Consolidated Rapid Transit Road has been effected, under the name of the Kansas City Elevated Railroad. The work of reconstructing the line and equipping it with electricity will be pushed forward as rapidly as possible.

THE Stockyards & Northwestern and the E. L. Martin companies have applied to the City Council for new franchises, over the same route.

La Crosse, Wis.—The La Crosse Street Railway Co. have recently received permission to operate with electric power, but have not decided whether or not to make the change this year.

Laredo, Tex.—The City Council of Laredo have granted to the electric railway company the privilege of extending their track over several streets, and the company are preparing to place additional machinery in position.

Leavenworth, Kan.—C. F. Brotherton is interesting himself in the matter of converting Leavenworth's dummy line into an electric road.

L. M. ERB, manager of the Leavenworth Rapid Transit Railway, announces that his company will apply to the city for permission to change the motive power of the road to electricity.

Lincoln, Neb.—The Lincoln Street Railway Co. expect to add a number of cars soon.

London, Ont.—As a result of the offer of a new company to establish a system of electric railways in Ottawa, the president of the London Street Railway Co. has written that his company are prepared to convert their present system into an electrical one.

Madison, Wis.—The Turner Society have decided to raise $1,000 bonus to secure the extension of the electric street railway to Schuetzen Park.

Manchester, N. H.—The Board of Aldermen have granted the petition of the Consolidated Street Railway Co. for permission to use electricity as a motive power on all their lines. It is expected that the line to Quinsigamond village will be equipped first.

Mansfield, O.—The Citizens' Electric Railway will build a half mile of road, and possibly two and a half miles, depending upon whether the city does certain grading.

Marinette, Wis.—The Marinette Street Railway Co. have secured a franchise to extend their lines.

Medford, Mass.—The West End company of Boston, have asked of the Selectmen a franchise to extend their electric line through the town.

Michigan City, Ind.—The Citizens' Street Railway Co. propose to extend their lines.

Milwaukee, Wis.—As soon as the Villard syndicate can get control of the Hinsey road they will proceed to entirely rebuild it from end to end, making a new road of it. The Becker line will also be overhauled and extended.

Muskegon, Mich.—The Muskegon Railway Co. have undertaken the construction of a dummy line from Lake Michigan Park to the Hackley Park Assembly Grounds at Lake Harbor, and will have it completed by August 1.

Nashville, Tenn.—The Overland Railway Co. will build an extension to their line, and will add five double deck cars.

Natick, Mass.—The Natick Electric Street Railway Co. will build two and a half miles of line and install five cars during the coming season.

New Bedford, Mass.—The Union Street Railway is to be transformed into an electric railroad if the new management can secure the necessary permission.

New Britain, Conn.—Messrs. Dolan, proprietors of the New Britain Tramway, have petitioned for permission to introduce electricity as the motive power on their line. After the new system is in working order in the city the lines will be extended to Plainville.

New Brunswick, N. J.—The question of an electric street railway is being agitated to take the place of the present horse car railway. The consensus of opinion among the citizens is strongly in favor of the new enterprise, and the managers of the company are willing.

New Haven, Conn.—The New Haven & Centreville Street Railway Co. expect to add ten cars to their equipment.

New Whatcom, Wash.—The Fairhaven & New Whatcom Railway Co. intend to build four miles of track and add six electric cars soon.

New York, N. Y.—The Broadway & Seventh Avenue Railroad Co. have applied for permission to connect the track at Canal Street with the Metropolitan Crosstown Line at Spring Street through South Fifth Avenue.

THE North Third Avenue & Fleetwood Park Railroad Co., the Harlem Bridge, Morrisania & Fordham Railway Co., the Melrose & West Morrisania Railroad Co. have consolidated under the name of the Union Railroad Co., and the motive power will be the trolley system.

Northampton, Mass.—It is reported that a syndicate in New Haven have been trying to buy up the street railway line. Should they do so they will extend the tracks as far as the Meadow Driving Park, run a summer track to Laurel Park and possibly put in a new track to Easthampton. Electricity is to be used.

Oakland, Cal.—The Oakland, San Leandro & Haywards Electric Railway Co, have filed a petition with the Board of Supervisors asking for permission to lay double tracks from Haywards to Oakland.

Ottawa, Can.—The Ottawa Electric Street Railway Co, expect to extend their line two miles, and will probably add fifteen electric cars. The Westinghouse system will be used.

Ottumwa, Ia.—An ordinance granting a franchise to the Ottumwa Street Railway Co. for an extension to South Ottumwa, has been presented to the Council.

Pensacola, Fla.—The Pensacola Terminal Co. will build nine miles of steam road, and will add several cars.

Philadelphia, Pa.—The lines of the Traction company will be extended in Kensington, Frankford, Wissinoming, Tacony and Holmesburg.

Pittsburgh, Pa.—The Citizens' Traction Co. will build a number of extensions.

Pittsburgh, Pa.—The Second Avenue Traction Co. have asked for permission to extend their tracks from the present terminus at Hazelwood to the city line.

Three ordinances have been presented asking for the right of way for inclines from South Twenty-first Street to Mt. Oliver, and all on about the same survey lines. They were the Park incline plane company, the H. S. McKee incline company and the Mt. Oliver incline railway company.

Portland, Me.—The City & Suburban Railway Co. will build six miles of electric road and two and a half miles of steam road during 1892. They will add a number of cars about September 1.

Portsmouth, N. H.—The Portsmouth Street Railway Co. will extend their line this fall.

Pottsville, Penn.—Reading railroad capitalists have secured a controlling interest in the Schuylkill Electric Railroad Co. Extensions will be made by the electric railway company immediately to Fishback, and the People's line to Minersville is to be electrically equipped.

Poughkeepsie, N. Y.—There is a probability that the City Railroad will be equipped electrically, the electric light company having made advances looking toward an arrangement to furnish motive power.

Quincy, Mass.—The Quincy & Boston Street Railway Co. have presented a petition asking for a location of tracks for an extension of their tracks, also for authority to erect poles and string necessary wires for the proper operation of their cars.

Racine, Wis.—The Belle City Street Railway Co. have purchased four lots on Main Street and Lake Avenue on which they will erect offices and a power house for the new electric system. They have contracted for motors, rails, motor cars, trailers, ties and poles. They will have the new system completed by September 1.

Raleigh, N. C.—The street railway company have contracted for a mile of heavy rail, and are extending their lines considerably.

Reading, Pa.—The Neversink Mountain Railway Co. will probably increase their rolling stock.

Richmond, Va.—The Richmond & Manchester Railway Co. have received permission to extend their tracks on certain streets.

Rockford, Ill.—Charles Street is to have two street railways. The City railway will lay their track on the south side of the street, and the West End company will run on the north side.

St. Louis, Mo.—It is said that Drake & Orton, of Chicago, are working on a plan of joining Meramec Highlands, Kirkwood, Webster Grove, Old Orchard, Maplewood and Benton by an electric elevated road which would connect with the western terminus of a city electric line.

THE consolidated management of the Citizens', North Central, Cass Avenue & Fair Grounds and the Union railways, are commencing the reconstruction of thirty-four miles of their horse roads to electric, and are doing the work themselves.

St. Paul, Minn.—The St. Paul & White Bear Electric Railroad Co. have increased their capital stock to $350,000, and are contemplating the extension of the line to Stillwater.

Saginaw, Mich.—The Saginaw Union Street Railway Co. are improving their road and putting down five miles of double track with a forty-five pound T rail, and anticipate building a new power plant in which will be installed two 250 H. P. engines and the same horse power in generators.

Salem, Ore.—The Capital City Railway Co. will add four cars and build three miles of track during the present year.

Salt Lake City, Utah.—The West Side Rapid Transit Co. expect to build in 1892 twenty miles of track.

THE Salt Lake City Railway Co. expect to build four miles of road and add six cars during the present year.

San Francisco, Cal.—The Presidio & Ferries Railroad Co. will make some extensions soon.

THE Omnibus Cable Co. have asked a franchise to build additional tracks.

Santa Barbara, Cal.—The Santa Barbara Street Railroad Co. have applied for a franchise for a line on the Boulevard.

Santa Cruz, Cal.—A short extension is proposed by the Santa Cruz, Garfield Park & Capitola Street Railway Co.

Santa Rosa, Cal.--The Santa Rosa City Railway Co. will add a few cars during 1892.

Savannah, Ga.—The street railway company contemplate a short extension.

Seattle, Wash.—The West Street & North End Electric Railroad Co. will install four electric cars.

THE Grand Street Electric Railway Co. have recently finished their own power plant, and expect to be running with their own current by August 15. They will make an extension to their line.

Sheboygan, Wis.—The Sheboygan City Railway Co. will build one and three-quarters miles of road and add six cars during 1892.

Shreveport, La.—The Shreveport Railway & Land Improvement Co. will make an addition to their rolling stock.

Sioux City, Ia.—The Sioux City Street Railway Co. will build two miles of electric road and add five cars.

THE Sioux City Cable Railway Co. will add twelve cable cars and build one mile of cable road extension. The cars will be double deckers, and will be furnished by J. A. Trimble of New York.

Somerville, Mass.—There is talk about an electric line from West Somerville via Elm Street and Broadway, to connect with the electric system soon to be put in operation on the Winter Hill line.

Springfield, Mo.—The Metropolitan Electric Railway Co. will build one mile of road and add four cars.

A PETITION has been circulated on Scott Street and on Queen City addition, to have the Metropolitan Electric Street Railway equip the abandoned road on Campbell Street with electricity.

Topeka, Kan.—The electric road is to be extended south from Fourth to Holliday Streets, where it now stops, to the North End of Santa Fe depot.

Victoria, B. C.—The National Electric Tramway Co. expect to equip four miles of road soon.

Vincennes, Ind.—The Vincennes City Electric Railway Co. will add several cars and build one mile of track.

Waco, Tex.—The Waco Electric Railway will be extended six miles.

Wakefield, Mass.—The Wakefield & Stoneham Street Railway Co. have petitioned the Selectmen for an extension of the location of their tracks.

Washington, D. C.—The Anacostia & Potomac River Railway Co. will increase their equipment this year by the addition of eight cars.

Waterbury, Conn.—A numerously signed petition has been presented to the Common Council asking that permission be granted to the Waterbury Horse Railroad Co. to equip their line with electricity as a motive power.

Watertown, Mass.—The Newton Street Railway Co. have asked leave to locate, construct and operate a street railway on Main Street.

West Newbury, Mass.—The Haverhill & Groveland Street Railway Co. will equip their road through this town with electricity.

Wilmington, Del.—It is stated that the Wilmington City Passenger Railway Co. have in view the extension of the Riverview line as far as Shellpot this summer.

Woburn, Mass.—The North Woburn Street Railway Co. will probably equip with electric power this fall.

Worcester, Mass.—The Board of Aldermen recently granted the petition of the North End Street Railway Co. for relocation of the Consolidated Street Railway Co.'s tracks in Lincoln Street, and that of the latter company for the right to use electricity on all their lines.

Youngstown, O.—The Youngstown Street Railway Co. expect to increase the length of their line several miles.

New Roads.

Alton, Ill.—There has been incorporated the Alton & Suburban Electric Railway Co., ; capital stock, $50,000. incorporators, Manning Mayfield, Henry C. Swift, E. G. Webster.

Billerica, Mass.—A meeting of citizens was held in the Town Hall July 14, to see what action the citizens would take in securing electric street railway service between Billerica and Lowell. On the committee appointed to take charge of the matter were: H. A. King of Billerica Centre, and John E. Rowell and James Barrington of North Billerica.

Blasdell, N. Y.—It is contemplated to build an electric road to connect this place and Depew. Hiram P. Hopkins is interested.

Brooklyn, N. Y.—The Common Council have granted a franchise to the Union Railway Co. to build a street railway from Hamilton Ferry to Prospect Park. At the head of the company is R. H. Flynn, a South Brooklyn millionaire, and associated with him are John Delmer and others. The Union Street Railway Co. also wanted the franchise.

Cadiz, O.—An electric railway from Cadiz to Unionvale, to connect with the Wheeling & Lake Erie, is to be built.

Cambridge, Mass.—The Storage Battery Street Railway Co. is the title of a new corporation, capitalized at $50,000, to build a road in Cambridge from the corner of Mt. Auburn Street and Putnam Avenue to Mt. Auburn Cemeetry and to Fresh Pond. The directors are Edwin H. Abbot, A. L. Richards, H. O. Houghton, Jr., E. P. Usher, W. Jones, Woodward Emery and W. S. Hall.

Chicago, Ill.—The ordinance granting to the Chicago & Jefferson Urban Transit Co. the right to build and operate a street railway on certain streets, has been adopted by the City Council. According to the provisions of the franchise, the company are required to complete the construction of the lines authorized within a year and four months from the passage of the ordinance, unless delayed by an order or in junction of court. The company have the privilege of operating cars by animal power, cable or electric power, or by any noiseless motor or power approved by the mayor and commissioner of public works.

THE Chicago City Council has passed the ordinance authorizing the Grand Crossing & Windsor Park Railway Co. to operate a railway on Seventy-fifth Street, between the two points mentioned in the title of the company. The ordinance provides that the company may use animal, cable or electric power. If electric is used, the wires are to be eighteen and a half feet above the rails. The company are required to have the road in operation within eighteen months.

THE Chicago City Council has granted a franchise to the Chicago North Shore Street Railway Co. who will operate a street railway from the terminus of the cable road on the North Side to Evanston. An amendment to the franchise as proposed provides that within a year after a suitable conduit electric system is discovered it shall be adopted by the company.

Cincinnati, O.—At a recent meeting of the Board of Administration L. A. Russell, the attorney for the Cleveland Street Railroad Co., put in a formal application for the right of way to build the Price Hill Route. The application was signed by Sidney H. Short, L. A. Russell and Albert L. Johnson.

Clayton, Ill.—An electric road is to be built connecting this place with St. Louis.

Concord, N. H.—An important meeting of those interested in the construction of a railroad between Concord and Rochester, was lately held here. Among those interested are J. W. Jewell of Strafford, J. B. Tennant of Epsom and A. H. Chase, of Concord.

Deer Park, L. I.—The Deer Park & Babylon Railway Co. has been incorporated to construct and operate a street railroad of five miles in length from Deer Park to Babylon. Some of the directors are: Peter Alexander, New York City; Washington F. Norton, Fire Island, Joseph M. Sammis and Frederick S. Bunce, Babylon.

Denver, Colo.—A franchise has been granted to the Metropolitan Street Railway to construct and operate an electric railway beginning at the intersection of Fortiethand Williams Streets and running to the city limits, the line to be extended to Riverside cemetery.

THE Tramway Co. have been given a franchise to build a road as the connecting link between their present system and Banana Street, the terminus of their franchise in Elyria.

A FRANCHISE has been granted to the Metropolitan Railway Co. to run an electric line from Fortieth Avenue and Williams Street through Swansea to Riverside. The franchise was supported by petitions of residents and property owners.

Dillsburg, Pa.—A charter was granted July 7, for the Dillsburg, New York Springs & Gettysburg Street Railway Co.; capital $150,000. The president is Dr. William Hegle of Harrisburg.

Easton, Pa.—A charter has been granted to the Easton & Bethlehem Transit Co.; capital, $125,000. Three of the incorporators are Howard Mutchler, of Easton; George W. Cope, of Nazareth, and E. H. Laubach, of Stemton.

East St. Louis, Ill.—Messrs. Obermeyer and McCasland have petitioned for a franchise for a street car line on Broadway from the intersection of Collinsville Avenue to Walnut street.

Eldorado Springs, Mo.—At a mass meeting of the citizens of this place held lately it was resolved to take steps at once looking to the construction of a dummy line to Nevada. C. A. Edgar, W. P. Cruce, E. W. Bannester. O. R. Deland and J. B. Warren were appointed a committee on the matter.

Elgin, Ill.—The Elgin, Aurora & Fox River Electric Railway Co. has been organized and the following officers elected: William Grote, president; John M. Egan, vice-president; Henry A. Gardner, secretary; Henry H. Evans. treasurer; Arthur M, Beaupre, auditor; T. E. Ryan, general solicitor. Steps were taken to secure the right of way and begin the construction of the road immediately.

Elizabeth, N. J.—Articles of incorporation were filed lately for two street railways in Elizabeth. One road is to be known as the West End Railway Co., with a capital of $70,000. This line will traverse the western and northern sections of the city. The other is the Citizens' Street Railway Co., with a capital of $50,000. It will traverse the central and eastern sections of the city and connect with the West End Line. Applications for franchises for both roads have been made to the City Council.

IT is rumored, that a company has been organized for the purpose building an electric railway from Elizabeth to Plainfield, passing through Roselle, Cranford, Westfield, Fanwood and Netherwood.

Elmira, N. Y.—The East & West Side Railroad Co, expect to build between seven and eight miles of road at once, under the new organization.

Elwood, Ind.—Articles of incorporation were recently filed with the Secretary of State, of the Elwood Electric Railway Co.; capital stock $150,000. The directors are: A. W. Hatch, Willard C. Nichols, A. T. Hart, Edward McDevitt and J.C. Devore.

Erie, Pa.—There is talk of a stock company to build an electric railway to the Grove House Park on Four Mile Creek.

Etna, Pa.—The Connecting Street Railway Co. with a capital of $18,000, was chartered to build a three mile electric line in the borough. Daniel T. McCann, William D. Evans, and W. Wallace Bell are directors.

Faribault, Minn.—W. P. McKinley, of Champaign, Ill., has been in this city looking up the matter of establishing a street railway here.

Green Bay, Wis.—J. L. Case of Racine has made application to the City Council for a franchise to construct an electric street railway here.

Jefferson, Mo.—The Delmar Avenue & Clayton Railway Co, with a capital of $5,000, was lately incorporated by L. Dosenbach, G. K. Ramsay and others.

Kankakee, Ill.—Kankakee and Bourbonnais are to be connected by an electric street railway. The North Kankakee Electric Light & Railway Co. have closed a contract with the Detroit Electrical Works for a five mile line.

Lansing, Mich.—The Capital Street Railway Co., capitalized at $25,000, has been organized at Lansing to extend the present system to the agricultural college.

Le Mars, Ia,—A. C. Colledge is the grantee of a franchise to construct a street railway here.

Lincoln, Neb.—A movement has been inaugurated in Lincoln for the construction of an electric railway to connect the city with the several pleasure resorts near that place. The proposed line will reach Lincoln Park, Salton Lake and Cushman Park. It will be twelve miles in length, and the cars will be propelled by the storage battery system.

Lock Haven, Pa.—The Lock Haven Street Railway Co. with a capital of $30,000, has been incorporated by Henry T. Harvey, Lock Haven; James North, Mifflintown; P. B. Crider, Bellefonte, and others.

Marion, Ind.—The Queen City Electric Railway Co. has been incorporated. The company propose to build a line from Marion to Jonesboro. The capital stock of the company is $150,000. Some of the directors are K. W. Hatch, J. C. Devoy, and William C. Nichols.

Matteawan, N. Y.—Articles of incorporation of the Citizens' Street Railway Co., of Matteawan, have been filed. The capital stock is $20,000.

Mt. Vernon, N. Y,—A new surface railway company, known as the North Mt. Vernon Railway, has been organized, and will soon begin work in constructing the road. The directors are: County Judge Mills, Joseph S. Woods, Edward Hartley, Col. Edward Henneberger and R. M. Winfield.

Muskegon, Mich,—A dummy line is being rapidly constructed along the lake front beach between Lake Michigan Park (West Muskegon) and Lake Harbor. This will connect with the Muskegon Street Railway, affording convenient and quick access to the assembly grounds and Lake Harbor.

Norwalk, O.—Esbon Blackmar has received an amended franchise to construct and operate an electric railway.

Oakland, Cal.—G. W. McNear has asked for a fifty year franchise to build and operate an electric road.

Oskaloosa, Ia.—The Oskaloosa Electric Street Car Co. have decided to build seven miles of electric railway.

Philadelphia, Pa.—An ordinance has been granted to the Kessler Street Connecting Passenger Railway Co. to construct a single track railway on Kessler Street from Wallace Street, to Spring Garden Street, with necessary curves and switches.

Phœnix, Ariz.—On July 6 the City Council granted two franchises to build and operate electric railways in Phœnix. One was to men representing San Francisco capital and the other to L. Harrison, of Denver. They are compelled to begin work in six months.

Pittsburgh, Pa.—There has been chartered the Morningside & Highland Park Street Railway Co.; capital $55,000.

Rat Portage, Ont.—Arrangements are being made for the formation of a company to construct an electric street railway in this town.

Rochester, N. H.—In pursuance to the charter granted for an electric railway connecting Rochester, East Rochester and Gonic, and finally with Great Falls, the grantees have organized and chosen the following officers: President, Edwin Wallace; vice-president, Charles S. Whitehouse; treasurer, Henry W. Burgett; clerk, Stephen D. Wentworth.

St. Louis, Mo.—An ordinance has been passed authorizing the City Central Railway Co. to construct, operate and maintain a double track passenger railroad by electric power.

THE Manchester Road Electric Railway Co. have been organized. capital $20,000. The incorporators are: Thos. Howard, M. C. Orton and Jas. Daniels.

RESOLUTIONS of the Benton Taxpayers' Club have been introduced in Council urging favorable action on the proposition to establish a belt line electric railway around Forest Park.

AN ordinance has been introduced authorizing the North & South Rapid Transit Railway Co. to construct a railway from Eighteenth Street over routes to Florissant Avenue and thence north to Calvary Cemetery. The company are authorized to operate by storage batteries.

Sandusky, O.—It is said that a charter has been applied for by a new street railway company, whose intention it is to build a line from Sandusky to Milan.

Sanford, Me.—An electric road is to be built and put in operation here by next November. Probably it will be built on the charter of the Mousam River Railroad, incorporated March 12, 1889, by E. M. Goodall, Chas. H. Frost, Robert W. Lord and others.

Salisbury, Md.—A company to build a street railway here, who tried unsuccessfully a year ago to obtain a charter, are reviving the project. The incorporators of the company are: L. E. Williams, Jas. A. Perry, C. L. Waller, W. H. McConkey and I. Malone.

Sheboygan, Wis.—Articles have been filed incorporating the Sheboygan & Sheboygan Falls Transit Co. with a capital stock of

$50,000. The incorporators are: Gerhard Schneider, C. A. Dean and Jos. G. End. An electric line of some sort between the city and the Falls over the toll road, is the object of the company.

ANOTHER scheme talked of is that of building a road from Concord through Northwood to Rochester. The distance is thirty miles.

Somerset, Ky.—The Somerset Electric Street Railway Co. have decided to commence operations on the prospective line at once.

Stroudsburg, Pa.—Mr. J. H. VanderVeer, formerly of the People's Street Railway Co., of Scranton, Pa., is constructing a street railway here, to be operated, probably, by steam dummy, unless the consent is obtained for the trolley system. The road will probably be extended as far as Bushkill Falls, making in all about fifteen miles.

Tarentum, Pa.—A company was organized in Pittsburgh, July 8, for the purpose of building an electric street railway, with Tarentum and Natrona as the termini. The road will be five miles long and will pass through Creighton. The company is composed of Howard Wheeler, Edward Waters, Pittsburgh; J. C. Breckridge, James Lane, Tarentum, and J. C. Whitla, Beaver Falls.

Tiffin, O.—Articles of incorporation have been filed of the Electric Railway & Power Co.; capital stock $50,000.

Topeka, Kan.—Several Topeka and Potwin citizens are discussing the advisability of organizing a new street railway company for Topeka and suburbs.

Vernon, Ind.—A company has been organized, capitalized at $15,000, looking to connecting North Vernon with Vernon by a street railway, with mules as a motive power. The line will be two miles long. Jacob Foedle is president, Moses Alexander vice-president, Elmer Wagner secretary, and O. Bacon treasurer.

Warren, O.—The County Commissioners have granted the petition of Henry Garlick, of Youngstown, to be allowed to construct an electric railway on the Warren and Youngstown road, between the Mahoning County line and Girard village.

White Hall, Ill.—A street car line bedween White Hall and Roodhouse, a distance of four and a half miles, is talked of.

Elevation of Tracks in Chicago.

A few months ago Mayor Washburne, of Chicago, appointed three commissioners to consider the matter of elevating the railroad tracks in Chicago. The grade crossing problem had become so serious that it was felt that the day had come when radical action should be taken. The local street railway companies have been sufferers from the multiplicity of crossings at grade, as a number of collisions more or less serious have occurred at these points.

The commission recently submitted its report in which the subway plan, the viaduct plan, the plan of partially depressing streets and the elevated plan were considered. It discards the first three means of abolishing grade crossings, and expresses its approval of the last. After stating that the city has abundant power to compel the compliance of railroads with any plan for the protection of life and for the maintenance of rights. On thoroughfares the commission, in its reports, says:

This plan contemplates the entire separation of the traffic of the streets from the traffic of the railroads, thus securing the restoration of the streets and highways of the city to all the uses and purposes for which they were originally created. This, in the opinion of your commission, is the only plan which is sufficiently comprehensive to meet all the requirements of the present and the future of this city. Any plan to be satisfactory must provide not only that the existing restrictions be removed, but must also admit of the widest development and expansion of the traffic upon the streets and highways of the city and the railroads entering it.

In dealing with this problem, which is, beyond question, the most important one confronting this city in its business and other interests, partial solution, which will be merely a temporary makeshift, will be altogether unacceptable to the public and unwise in every respect. As Chicago is now one of the most important railroad centres of the world, and is clearly destined in the near future to lead all other cities on this continent in the struggle for commercial supremacy, we believe that this question should now be dealt with on the most comprehensive basis, and once for all.

Your commission is of opinion that at an early day the government of the city should take steps to cause the different railroad companies now occupying the streets and highways of the city with their tracks, to remove the same and restore the streets and highways to the uses for which they were originally intended. The present crowded condition of the streets, the difficulty in transacting business and the certainty of a large increase in the volume of travel, trade and business upon the streets in all parts of the city, make this plan an imperative necessity.

In making these recommendations, your commission is not unmindful of the expense and inconvenience which will be occasioned by their adoption, but is of opinion that these disadvantages will be more than counterbalanced by the increased facilities which the railroad companies will have and the diminished expense of maintenance and operation of their roads.

Personal.

Mr. C. D. Shain, formerly manager of the Eastern district of the Edison General Electric Co., has resigned his position.

Mr. S.S. Leonard of the Hill Clutch Works, Cleveland O., was in New York last month, and gave us the pleasure of a call.

Mr. William F. Carleton, of Carleton and Kissam, sailed for Europe July 23, on "La Champagne." He will remain abroad about ten months.

Mr. A. L. Scott, general manager of the St. Paul City Railway Co. of St. Paul, Minn., has resigned his position. The company will have their headquarters in Minneapolis in the future.

Mr. Thomas C. Nash, formerly of the John A. Roebling's Sons Co., and the inventor of the Nash splice for cable roads, has been appointed superintendent of cables for the West Chicago Street Railway Co.

Mr. J. H. Hanna, who for the past eight years has been with the J. G. Brill Co. of Philadelphia, has severed his connection with that company and is now traveling in the interest of the McGuire Manufacturing Co. of Chicago.

Mr. George Flett, of the firm of Messrs. Dick, Kerr & Co., engineers and contractors, London, Eng., is visiting the principal cities of this country in the interests of his firm, and incidentally is studying our systems of rapid transit.

Mr. Peter Moar who has for the last six years been connected with the Melbourne cable tramways as rope splicer, has recently taken a position with the North Chicago Co., having been sent out by Thomas & William Smith, ropemakers, Newcastle-on-Tyne, England, to superintend the splicing of Lang lay ropes which are being introduced. in this country.

Mr. J. Holt Gates has accepted the position of general sales agent of the American branch of the Siemens & Halske Co, of Berlin. Mr. Gates has for several years been connected with the Westinghouse Electric & Manufacturing Co., more recently as special agent for the territory from Chicago to the Pacific Coast. Mr. Gates has a wide acquaintance, abundant experience in selling electrical apparatus, and a capacity for hard work.

Mr. Edward E. Higgins, general manager of the Short Electric Railway Co., sailed for Europe on July 14 on a combined business and pleasure trip. Mr. Higgins will attend the Convention of European Tramway Managers in Buda-Pesth, September 9 to 12, and in the course of his travels will also visit Germany, Holland, Belgium, France and England, making a special study of methods of transportation and roadbed construction in the different European capitals.

Mr. G. S. Duncan, of Melbourne, Australia, whose coming to this country was announced in our June issue, arrived about the first of July, and is now visiting the principal Western cities with the view of making a careful study of electric traction. The entire cable system of Melbourne, Australia, has been constructed under Mr. Duncan's supervision, and he is thoroughly posted in cable railway matters. In case he finds electric traction better adapted for transit purposes, he will recommend its adoption in the cities of Australia on his return.

Mr. H. Durant Cheever, manager of the Okonite Company Ltd., well known manufacturers of Okonite insulated wires and cables, has gone to Europe on a well earned vacation, and generally in the business interests of the company. This is the third trip Mr. Cheever has made across the great pond. It will be remembered that, owing to an enormous European demand for Okonite wire, it was found necessary to erect large branch factories in London. Mr. Cheever will inspect the factories, and besides make a circuit of the Continental cities.

New Publications.

Latest Improved Heavy Duty Engines. Published by the Ball Engine Co., Erie, Pa.

This little circular shows the different types of engines for electric railway service manufactured by the Ball Engine Co., of Erie, Pa., together with a statement of the manufacturers concerning them. Views are also given of the interior of the power station of the Buffalo Electric Railway Co., and of that of the Rochester Railway Co., in both of which Ball engines are used. A list of the railway companies using the Ball engine is also given.

Railway Car Construction; by William Voss. Published by R. M. Van Arsdale, New York. Large quarto, 200 pages. Price $3.00.

The work illustrates and describes in detail the construction of all the different types of steam cars employed in American practice. The The matter is treated under twenty-six chapters and an appendix which gives all the standards adopted by the M. C. B, and M. M. associations, together with a code of rules governing the repair of freight cars. The illustrations are from scale drawings, and the accompanying matter not only describes minutely the material and methods of construction, but as well the office of every separate part. The description is interspersed with sufficient advice, and record of results and behavior of certain devices in actual practice, to relieve it of monotony, making the work intensely interesting even to the unmechanical reader. The work would seem to be a necessity to every foreman and mechanic employed in steam railway building and repair shops, as well as to inspectors employed in the rolling stock branch of the business. Street railway master mechanics will also find much valuable matter and helpful suggestions from the illustrations.

A Consolidation in New York City.

The North Third Avenue & Fleetwood Park Railroad Co., the Harlem Bridge, Morrisania & Fordham Railway Co., the Melrose & West Morrisania Railroad Co. have consolidated under the name of the Union Railroad Co., with $2,000,000 of capital stock, which is more than double the present capital stock of the three companies. The directors elected recently are as follows: Charles A. Stadler, William Cauldwell, John C. De La Vergne, Thomas W. Olcott, J. W. McNamara and Edward A. Maher of New York; Anthony M. Brady and Robert C. Pruyn of Albany; Albert Shaw of Troy.

The officers are: President, Edward A. Maher; vice-president, Charles A. Stadler; secretary and treasurer, Thomas W. Olcott.

About seventeen miles of the Union Railway are now in operation by horse power. It is expected that by next November the entire seventeen miles will be operated by the trolley system. Eight miles of new road will be constructed without delay, making twenty-five miles of road, all on the trolley system. The wires are being attached to the Suburban Elevated Railway's structure and the power station is being constructed.

Ammonia Motor Cars.

A company entitled The Railway Ammonia Motor Co. have been organized with headquarters at 280 Broadway, New York, to promote the manufacture and sale in the Eastern and Middle states, of the McMahon ammonia motors for street railway work. This device was illustrated and described in our January issue, and the car mentioned there has been in operation during the last six months on an experimental track on the grounds of the World's Columbian Exposition, Chicago. The officers of the Railway Ammonia Motor Co., are: Hon. W. A. Crombie of New York, president; Alex. H. Ross of Newark, N. J., vice-president; Brackett W. Burleigh of New York, treasurer; Henry Graham, secretary and T. C. Dunn, general manager. The company is organized with a capital stock of $1,250,000. Records made by the ammonia car at Chicago show the number of gallons of anhydrous ammonia used per mile average about four, and the cost for motive power was about one cent per car mile. The company will soon have a car in operation on one of the surface lines in New York City. The system is also applicable to elevated railways.

Some Uses for Graphite.

A correspondent in a contemporary says: If engineers, machinists and millwrights in general and pipe fitters in particular knew of the good qualities of graphite, I dare say there would be ten times the demand for it. Its lubricating qualities are questioned only by the impractical, and it is this quality alone that sounds its keynote, so to speak. During the past three years I have used about fifteen or twenty pounds of dry Ticonderoga flake graphite for pipe joints, cylinder heads, piston rod packing, etc. Bolts, smeared with graphite mixed as above, I have unscrewed after having been in the dampest places for upward of two years or more, proving the anti-rusting qualities of graphite. To cool hot bearings put it on as thick as it will mix with oil. Almost any oil or grease will answer but don't use poor graphite.

Equipment Notes.

The Eastern Electrical Cable Co., of Boston, Mass., have issued in handy form a little pamphlet "Wire Tables and Price List of Clark Wire and Cables."

The Jewell Belting Co., of Hartford, Conn., have on their books a large number of orders for belts from street railway companies, and their belts are giving the best of satisfaction in all installations.

The Van-Choate Electric Car & Light Co., of Boston, have moved into offices in the Exchange Building, and are arranging for an extensive plant where they will begin the manufacture of dynamos, lamps and motors. They will also put on the market an electric railway motor.

G. F. Whitney, of Boston, reports that the soap manufactured by him for cleaning cars is being used extensively in the street railway field, and that his orders among street railway companies are constantly increasing. He also manufactures soap for inside work, and an amber soap for cleaning varnished surfaces.

The United States Steam Railway Advertising Co., Carleton & Kissam proprietors, have leased the advertising privilege in the cars of the Duluth Street Railway Co., Duluth, Minn. This company are constantly extending their business connections with railroads, and are to-day, without doubt, the largest concern in the street railway advertising business.

The Reliable Manufacturing Co., of Boston, Mass., have their Reliable street car switch ready to place on the market, and are installing one on the Lynn & Boston and East Middlesex street railways. The manufacturers state that it has given very good results where tried, and that they anticipate a large sale. A description of the switch will be given in an early issue of this journal.

The Louis & Fowler Manufacturing Co., of Brooklyn, report business as in a satisfactory state with them, many orders for cars and other street railway appliances on hand testifying to the appreciation in which their appliances are held. They anticipate a large call for their snow plows for the coming season, and during the last week in July received orders for six of these appliances.

The Pittsburgh Steel Hollow Ware Co., of Pittsburgh, are meeting with great success in the sale of their rolled steel gongs, two types of which were illustrated in our last issue. These gongs are made from steel by a special process of rolling, and are guaranteed not to crack or lose tone. They are made in all sizes, and are attached for either overhead or foot use, and where they have been installed have given good satisfaction.

The Berlin Iron Bridge Co., of East Berlin, Conn., have received the contract for the new tin plate works which Hughes & Patterson are to erect at Philadelphia, Pa. The buildings will be of iron from the designs of the Berlin company. The main building will be 40×253 ft., with a wing 40×300 ft., both two stories high. The rolling mill will be 120×160 ft., with an annealing room 75×160 ft. The whole plant will require the use of 800 tons of iron in its construction.

A. Groetzinger & Sons, of Allegheny City, Pa., have a noiseless pinion of improved process raw hide, which is meeting with much success for electric street car service and mechanical purposes. The material is called dermaglutine, and the manufacturers claim that it has wearing qualities equal to steel, and at the same time is inexpensive to install. A. Groetzinger & Sons supply blanks or finished gears for all systems, and will be pleased to give full particulars of their gears upon application.

The Dickson Manufacturing Co., of Scranton, Pa., are very busy with the numerous orders for engines which they have on hand. This company have recently completed the engines which they will supply for the power house of the Broadway (New York) Cable Railway. The Dickson Manufacturing Co. are also building, among other engines, one of 1,250 H. P. and two of 600 H. P. each, triple expansion, for the Edison Illuminating Co., of New York, and report that the call for their engines for street railway and electrical purposes is large.

The Engineering Equipment Co., 143 Liberty Street, New York, have secured, by papers just executed, United States rights of manufacture and sale of the Goodell boiler and pipe covering. This is an important addition to the company's business which is now divided into three special departments, viz.: First, belting; second, boiler and pipe covering; third, overhead electric railway materials. In each of these specialties the company purpose to enlarge their facilities and strengthen their position in the trade from time to time.

The New York Car Wheel Works, Buffalo, N. Y., have removed their New York office from 115 Broadway to the corner of Bank and West Streets, where their well-known representative, Mr. J. R. Ellicott, has very comfortable quarters and is glad to welcome any street railway men. Adjoining this office they have secured three large rooms, two of which will be fitted up with all the machinery necessary for refitting wheels and axles, and for furnishing new work of the kind. Special arrangements are made for electrical fitting work. In their store room in New York a large supply of wheels and axles will be kept on hand to be furnished promptly for all standard cars, gears and motors, and the company guarantee all such work to be true to the closest specifications.

The Eddy Electric Manufacturing Co., of Windsor, Conn., are building a large addition to their present works, which is almost completed, and when finished will give a factory 330 ft. long and two stories high. The works are built in the most substantial manner, and the company are installing in place a large amount of machinery of the latest and most approved type, as well as a new 150 H. P. engine with boilers for motive power. This company are devoting much attention to the manufacture of generators for railway work and power transmission, and enjoy a large business in this line. They are also turning out many stationary motors for hoists, machine shops, general mining work, etc., and when their new factory is completed will undoubtedly have one of the most complete and perfect plants in the country for the manufacture of electric motors and generators.

The Lamokin Car Works, of Chester, Pa., are, as usual, very busy, and find the demand for the cars manufactured by them increasing. This company state that they have recently closed orders with the Belle City Street Railway Co., of Racine, Wis., for four 16 ft. palace furnished car bodies, August delivery, and with the Consolidated Street Railway & Light Co. of Oskaloosa, Ia., for eight 18 ft. palace finished cars complete, to be mounted on the Robinson motor truck, of Altoona, Pa. The Lamokin Car Works are also building for the Beaver & Elmwood Railway Co., of Pittsburgh, Pa., one 14 ft. open trail car. This car is constructed so that passengers are protected from danger incident to the open side car, as the seats are in the centre of the car, back to back, with an aisle on each side and sliding doors at each end. Passengers enter and leave the car at the ends of the car. At the sides of the car are iron rods with wire netting, making an open car, embodying all the elements of safety of a closed car.

The New York Insulated Wire Co., of New York, have recently closed a large contract by which the well known Grimshaw white core cables, tapes, etc., will be used in the installation of the entire incandescent lighting plant for the grounds and buildings of the World's Columbian Exposition, by the contractors, the Westinghouse Electric & Manufacturing Co. Since many of the buildings will probably also be tubed with the vulca ducts, the current for every incandescent light used in the grounds and the buildings, and many of the arc lights, motors, etc., will get their current from this well known wire. It would seem as if the Grimshaw white core wire could well be called the "world's choice," from the fact that it has been selected exclusively for what will probably be the equipment of 150,000 sixteen candle power lamps. In spite of the large demand for wire which this contract calls for, the whole over 15,000,000 ft., it is unnecessary to say that the

company always will carry a sufficient stock in their warehouse to fill all orders that they receive.

The New Process Raw Hide Co. of Syracuse, N. Y., have recently received a letter from F. O. Rusling, general manager of the West Bay City (Mich.) Street Railway Co., which gives some very interesting information in regard to the life of the new process raw hide pinions. Mr. Rusling states: "We purchased of you in September, 1891, a number of your raw hide pinions for the armature and intermediate shafts. These pinions have been running up to this date continuously since then, and we have within the past ten days discarded the first worn out armature pinion; of the intermediate pinions we have yet to take the first one off. Our cars run sixteen and seventeen hours per day, making an average of eight miles per hour. We send you this day *via* express an armature pinion taken off June, 29, 1892. This pinion has run 26,000 car miles on a Sprague No. 6 motor. Since adopting your raw hide pinions we have not lost one gear wheel from breaking teeth. We get more wear out of raw hide than we formerly got from steel, bronze or gun metal. The percentage of gains for raw hide over metal pinions on the wearing of gear wheels is very large. We shall soon give you another order, being satisfied we cannot get another make of pinion that will give us the service we have been able to get out of your goods."

The Ball Engine Co., of Erie, Pa., have, during the past six weeks, made the following sales through their New York agent, F. R. Chinnock: Prohibition Park Railway Co., Port Richmond, one 150 H. P. engine; Baltimore Traction Co., Baltimore, Md., two 130 H. P. heavy duty engines; Metropolitan Telephone & Telegraph Co., New York City, one 50 H. P. engine; Brokaw Bros., New York City, two 150 H. P. and one 80 H. P engine; Curtis & Dean, New York City, one 50 H. P. engine; Royal Light, Heat & Power Co., Front Royal, one complete steam plant, 100 H. P. engine and 125 H. P. boiler; Hot Springs Electric Co., Hot Springs, Va., one complete steam plant, 100 H. P. engine and two 80 H. P. boilers; Wm. Kynoch, Guantanamo, Cuba, two 80 H. P. engines; Buffalo Board of Trade, one 60 H. P. engine; Navy Yard, Brooklyn, N. Y., two 80 H. P. engines. Less than a year ago, owing to the great expansion in their business, they were forced to erect a large and complete machine shop, which was filled with the latest and most modern improved tools. No idea was entertained, they state, at the time that any further increase would be necessary for several years to come; but the demand for the latest improved Ball engines, built by this company, has been so great, especially for electric railway work, that already the makers of the engine have been again compelled to make a further extension of the same building. This extension, which is now under way, will be built on the gallery plan, the same as the rest of the building. It will contain, among other valuable features the most complete testing blocks and apparatus in the country, and will be capable of testing engines of very large capacity. Every engine that leaves the works of the Ball Engine Co. is thoroughly tested and guaranteed to give satisfaction under the most unfavorable circumstances. We also learn that the North Hudson County Railroad Co., Hoboken, N. J., in March purchased a 300 H. P. latest improved Ball engine from the Ball Engine Co., Erie, Pa., and they have been so well satisfied with the performance of the engine that they have ordered an additional engine of the same power from the same company. The Englewood Electric Light Co., Englewood, Ill., have ordered a 500 H. P. latest improved Ball cross compound engine, through the Chicago office of the Ball Engine Co., Erie, Pa.; and the Port Huron Electric Railway Co., Port Huron, Mich., have awarded order for one of their latest improved engines to the Ball Engine Co., Erie, Pa. The engine is a 400 H. P. cross compound of the latest type.

WESTERN NOTES.

The Chicago Raw Hide Co. are doing an excellent business, and are securing a number of contracts from electric railway companies.

The H. M. Loud & Sons Lumber Co., of Au Sable, Mich., have been awarded the contract for the diagonal poles for the Fort Wayne & Elmwood road, Detroit.

L. K. Hirsch, of 549 Rookery, Chicago, has on hand at the present time a large amount of second-hand rails suitable for use by street railroads. He also has for sale a large number of narrow gauge cars and locomotives.

The Cushion Car Wheel Co. of Indianapolis, recently furnished several sets of wheels to the Citizens' Street Railroad Co. of Indianapolis. They are giving satisfaction, and are found to contribute in no small degree to the smooth riding qualities of the cars equipped with them.

The Standard Railway Supply Co., of 1117 Monadnock Building, Chicago, Garson Myers, manager, are bringing out a new type of street car stove. It has meet the approval of car builders who especially appreciate the fact that when it is used it is unnecessary to cut the car seat.

The McGuire Manufacturing Co. have recently closed among other large contracts, orders with the following companies: the South Chicago City Railway Co.; the Kankakee (Ill.) Electric Co.; the Toledo (O.) Consolidated Street Railway Co. and the Pueblo (Colo.) City Railway Co.

The Valentine-Clark Co., of the Rookery, Chicago, make a specialty of wooden and steel poles and ties for street railway companies. This company have, heretofore, been known as the Ernest L. Clark Co., but the change in name has not involved any changes in the company. The company are receiving many orders for ties and poles.

The Ohio Machine Tool Works, of Cincinnati, O., have increared their line of manufacture, and are now making pulley lathes of improved design for the simultaneous boring and turning of pulleys, blank gears, etc. The machines will cut down both sides of a gear at one operation, while the diameter is being turned, and bore at the same time. The company state that they can deliver at once the twenty-six inch and thirty inch sizes, and can deliver the thirty-six inch and sixty inch on short notice.

The Electrical Supply Co., of Chicago, have recently made a new and advantageous arrangement with George W. LaRue, representing the Crocker-Wheeler Electric Co., whereby they become agents for the well-known products of the Crocker-Wheeler company. H. C. Hutchison, formerly of the Edison General Electric Co., will have charge of the motor department for the Electrical Supply Co., and will devote his entire time to this interest. The deserved popularity of the Crocker-Wheeler goods, and the well known reputation of the Electrical Supply Co. as "pushers" indicate that these arrangements cannot fail to prove profitable to both parties concerned.

Julius Lefmann, of 2200 North Second Street, St. Louis, has just issued a new catalogue. Mr. Lefmann makes a specialty of three joint iron and steel poles and railway appliances. Following is a list of street railways using the three joint poles: Benton-Bellefontaine Railway, Lindell Railway, Missouri Railroad, St. Louis Railroad, South St. Louis Railway, St, Louis & Suburban Railway, Union Depot Railway all of St. Louis; Brooklyn & Coney Island Railway, Eckington & Soldiers' Home Railway, Washington, D. C.; Fulton County Railway, Atlanta, Ga.; Jacksonville Railway, Jacksonville, Ill.; Minneapolis (Minn.) Street Railway; St. Paul (Minn.) City Railway; West End Railway, Boston, Mass.; Citizens Rapid Transit Co., Nashville, Tenn.

The Stirling Co., Pullman Building. Chicago, have had a splendid business since January 1. The aggregate capacity of the boilers since that time has been 24,000 H. P. The recent sales to electrical stations aggregate 4,468 H. P. as follows: South Chicago City Railway Co., three 300 H. P. boilers; Excelsior Electric Co., of Port Huron, Mich., one 250 H. P.; Pittsburgh & West End Railway, three 206 H. P.; Madison Electric Co., of Madison, Wis., one 200 H. P.; Defiance Light & Power Co., 100 H. P.; Hull Electric Light & Power Co., two 150 H. P.; Evansville Street Railway, Evansville, Ind., three 250 H. P.; St. Joseph & Benton Harbor Street Railway, two 200 H. P.; Ottumwa Electric Railway Co., Ottumwa, Ia., three 250 H. P.; Braddock & Turtle Creek Street Railway, one 200 H. P.

The Brownell Car Co., of St. Louis, Mo., are receiving letters from street railway companies in various sections of the country speaking in the highest terms of the "Accelerator" type of car manufactured by them. They have recently sent us three letters, from, respectively, Thomas H. McLean, general manager, Twenty-third Street Railway Co., N. Y., Geo. W. Baumhoff, general superintendent, Lindell Railway Co., St. Louis, and G. W. Hommell, manager of the Milwaukee (City division) Street Railway Co. In each of these letters the writer expresses himself as greatly pleased with the operation of the Accelerator as used upon his road, and the letters are exceedingly interesting as showing the decision reached by these gentlemen. Mr. Hommell's letter is given in full in the advertisement of the Brownell Car Co., in this issue.

The Springfield Emery Wheel Manufacturing Co. were put into insolvency by their creditors May 16, and James Staples of Bridgeport was appointed trustee. A new company have been formed, adding new capital and new machinery, and the incorporators have purchased from the trustee the plant, machinery, etc., of the old company, and will add a number of improved machines for the manufacture of emery wheels and emery wheel machinery. The new company have all the records of shipment of the old company and can, consequently, supply duplicate orders given to the old company at any time during the last eight years. They have also retained the principal foreman, superintendent and general manager, and are in better shape to fill all orders promptly than the old company ever were. The new company will be known as the Springfield Emery Wheel Co., taking the name of the old company with the exception of the word "Manufacturing," which is dropped.

Pullman's Palace Car Co., of Chicago and New York, have of late received orders for a large number of cars in their several departments. Among the contracts are the following: Fifty closed motor cars for the Milwaukee Street Railway Co.; four closed motor cars for the Galesburg Electric Motor & Power Co., Galesburg, Ill.; three closed motor cars for the Marshalltown Light, Power & Railway Co.'s road, Marshalltown, Ia.; 100 furniture cars, 200 gondola cars and 300 box cars for the Chesapeake, Ohio & Southwestern Railway Co.; 300 gondola cars for the Columbus & Hocking Coal & Iron Co.; 500 box cars for the Louisville, New Orleans & Texas Railway Co.; one private car for the Columbus, Hocking Valley & Toledo Railway Co.; one passenger coach for the Toledo & Ohio Central Railway Co.; three passenger coaches for the Kanawha & Michigan Railway Co.; twenty passenger coaches for the Chicago, Rock Island & Pacific Railway; one private car for Mr. A. A. McLeod, president, Philadelphia & Reading Railroad.

The Railway Equipment Co. of Chicago, are receiving a large number of contracts; in fact, they are fairly crowded with orders. The company are now well settled in their new quarters in the Pullman Building, and with every facility at their disposal, they are handling their increasing business with dispatch. Some idea of the large proportions which the business is assuming may be gained from the fact that the company have of late closed contracts for the line material for the Woodland & West Side road, Cleveland, the Interstate Elevated Road Kansas City, and for the electric railways in the following cities: Racine, Wis.; Kankakee, Ill.; Baltimore, Md.; St. Joseph, Mich.; Galesburg, Ill.; Lima. O.; Waco, Tex.; Michigan City, Ind.; Janesville, Wis. The company are also furnishing a large quantity of special material for the Atlantic Avenue road in Brooklyn. Owing to

the amount of trouble experienced this season on many electric roads from lightning, this company state that they are about ready to place on the market a lightning arrester of unusual merit for station, car and line use, and that full information concerning it will be cheerfully given on application.

The Charles Munson Belting Co., of Chicago, have secured an additional order for the new belting required by the Toledo Consolidated Street Railway Co. in the recent extension to their power station which was made necessary by the increase of traffic. This order consists of one 54 in. belt 126 ft. long, three 48 in. belts, and 154 ft. of 34 in. belt. This company also number among their recent contracts, one with the Brooklyn City Railway Co. for a 72 in. belt and two with the St. Paul Gas Co. for a 60 in. belt, and 72 in. belt 170 ft. long. They have also supplied belts recently to the Duquesne Traction Co., and the Pittsburgh, Allegheny & Manchester Street Railway Co. of Pittsburgh, comprising in all over 1,100 ft. of 48 in belts. Also one 72 in. belt at the station of the Missouri Street Railway Co., of St. Louis, as well as two 54 in. belts, five 16 in. belts and two 34 in. belts. At the station of the Union Depot Street Railway Co. of the same city they have two 54 in. belts, and to the Allentown & Bethlehem Street Railway have supplied two 40 in. belts, besides those needed for the generators. Their belts for street railway work, of which they are making a specialty, are meeting with great demand and are giving thoroughly good satisfaction.

The Sioux City Engine Works, of Sioux City, Ia., number among their recent sales the following: One 12×18 Gidding's automatic, boiler and complete plant for Chardon Electric Light Co., Chardon, Neb.; five 5½ and 9×14 Gidding's automatic compound engines to G. Y. Bonus; five 6½ and 11×16 Gidding's automatic compound engines to G. Y. Bonus; one 12×30 Corliss, boiler and complete steam plant to Diamond Iron Works, Minneapolis, Minn.; one 12×30 Corliss to Stratton & White, Fort Worth, Tex.; one 12×30 Corliss to Brookman & Barrett, Vermillin, S. Dak.; one 16×30 Corliss to the Joliet Enterprise Co., Joliet, Ill.; and one 20×48 Corliss to the Salem Electric Light & Power Co., Salem, Ore.; one 12×36 Corliss to Cavalier Roller Mill Co., Cavalier, N. Dak.; one 11×18 Gidding's automatic to Corvallis Roller Mill Co., Corvallis, Ore.; and one 12×30 Corliss to Chouch Bros., St. Edwards, Neb. The Sioux City Engine Works also report a decided increase in the demand for engines since June 20, and state that they have every prospect for a very large demand for their engines during the balance of the season, and in anticipation of this, have completed a number of standard selling sizes, ready for prompt delivery, and are now engaging additional force for a night gang, to take care of the rush of orders on hand. They also have in preparation a new list of users of the Sioux City engine, which will be soon ready for the trade and have also in preparation a descriptive catalogue of the Corliss engines, which they hope to issue a little later.

The Short Electric Railway Co., of Cleveland, report orders for additional apparatus from the Bloomington City Railway Co., Bloomington, Ill., ten 40 H. P. single reduction equipments and one 100 H. P. generator; South Covington & Cincinnati Street Railway Co., four 40 H. P. single reduction equipments; Schuylkill Electric Railway Co., Pottsville, Pa., four 50 H. P. single reduction equipments; West End Street Railway Co., Rockford, Ill., six 20 H. P. gearless equipments; Georgetown & Tenalleytown Railway Co., Washington, D. C., two 40 H. P. single reduction equipments; Wilkesbarre & Wyoming Valley Traction Co., Wilkesbarre, Pa., three 60 H. P. single reduction equipments, one 200 H. P. generator; and the Baddock Electric Railway Co., Braddock, Pa., one 40 H. P. single reduction equipments. They have also closed contracts recently with the Baltimore Traction Co., Baltimore, Md., and the Janesville Street Railway Co., Janesville, Wis. The Short Electric Railway Co. have, as usual, a large number of orders on hand. They report from their New York office through Mr. Edward J. Wessels, general Eastern agent, that they have just closed a contract with the Syracuse, Eastwood Heights & DeWitt Railroad Co., of Syracuse, N. Y., for one 135 H. P. generator, and four 30 H. P. single reduction motors. This is a preliminary order, and the economy will probably require a number of additional cars before long. The road will probably be in operation within the next sixty days, and will serve a territory between Syracuse and East Syracuse where there is at present no street railway line.

The Detroit Electrical Works have received a number of orders for their new generators, illustrated in this issue. Among recent purchasers they number the following: *Times* Building, Chattanooga, Tenn., two 30 K. W. generators, one 9 and one 15 K. W. motor; Bagley Estate, Detroit, one 40 K. W. generator and five 9 K W. motors. This contract also includes five freight elevators and controlling devices for motors, so that elevator is operated by one 9 K. W. motor, which is controlled, started and stopped by means of the starting rope of the elevator, the motor only running when the elevator is in use; Detroit Dry Dock Co., Detroit, two 250 light generators for lighting machine shop, boiler shop, dry dock, engine rooms and offices, etc., one 40 K.W. generator to furnish current for electric cranes; Detroit Dry Dock Co., for boats which they are building, one 125, one 150 and one 250 light plant, complete; Detroit Foundry Equipment Co, Detroit, one 9 and one 15 K. W. motor complete, with controlling devices, etc., for electric cranes. The Chicago office of this company has been given a number of contracts within the last few weeks. Mr. L. E. Myers, the special agent, received an order for fourteen 30 H. P. equipments for Racine, as well as for three 80,000 watt generators, the general station appliances, and the contract for 13 miles of overhead work. An order has also been secured from Kankakee for two 30 H. P. equipments, a 65,000 watt generator, and the contract for four and a half miles of overhead work. The Calumet Electric Railway Co. have ordered the third increase of motors for their road from the Detroit Electrical Works.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, JUNE 28, 1892, TO JULY 19, 1892, INCLUSIVE.

JUNE 28.

Automatic Tramway Switch, Waldo G. Fay, Columbus, O. 477,749
Brace Chair for Railroad Rails, William M. Brown, Johnstown, Pa. 477,641
Cable Railway Conduit, Milton H. Bronsdon, Providence, R. I. 477 884
Carrier Pulley for Cable Roads, Milton H. Bronsdon, Providence, R. I. 477 885
Car Brake, William F. Gibbs, Auburn, N. Y. 478,003
Car Truck, Henry C. Hodges and Clarence B. Hodges, Detroit, Mich. 477,657
Combined Rail and Cross Tie, Arthur J. Moxham, Johnstown, Pa. 477,679
Combination Safety Railway Track, Solon G. Howe, Detroit, Mich 478,059
Conduit for Electric Railways, Carl T. H. Schwieger, Berlin, Germany. 478,025
Device for Suspending Trolley Wires, Joseph Sachs, New York, N.Y. 477,781
Electric Railway, Joseph W. Bates, Minneapolis, Minn. 477,734
Expansion Rail for Railroads, Arthur J. Moxham, Johnstown, Pa 477,672
Expansion Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,675
Frog or Cross for Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,681
Heater for Vehicles, Edmond Molloy, Philadelphia, Pa. 477,811
Lightning Arrester, Frederic Haselwander, Frankfort, Germany. 477,656
Mechanism for Cable Traction, William A. Butler, New York, N. Y. 478,046
Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,673
Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,674
Rail for Railroads, Arthur J. Moxham, Johnstown, Pa. 477,683
Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,677
Rail Joint, Milton C. Niles, Oak Park, Ill. 477,694
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,676
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,681
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,682
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,685
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,687
Railroad Crossing, Arthur J. Moxham, Johnstown, Pa. 477,688
Railroad Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,689
Railroad Rail and Process of Making the Same, Arthur J. Moxham, Johnstown, Pa. 477,690
Railroad Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,678
Railroad Rail Joint, Arthur J. Moxham, Johnstown, Pa. 477,680
Railway Car, George M Hoadley and Sumner A. Bemis, Springfield, Mass. 477,935
Railway Rail Curve, James G. Jordan, Des Moines, Ia. 477,801
Street Locomotive, Ezra Dederick, Milwaukee, Wis. 477,889
Switch Piece for Railroad Tracks, Arthur J. Moxham, Johnstown, Pa. 477,686
Thrust Collar for Axles of Electrically Propelled Vehicles, Richard P. Osgood, Methuen, Mass. 477,695

JULY 5.

Ball Bearing, for Railroad Cars, John E. Norwood, Sykesville, Md. 478,351
Car Truck, George M. Brill, Philadelphia, Pa. 478,218
Car Wheel and Axle, Abner Johnston and William A. Johnston, Jersey City, N. J. 478,512
Dynamo Electric Machine or Motor, Elmer A. Sperry, Chicago, Ill. 478,142
Electric Locomotive, Elmer A. Sperry, Chicago, Ill. 478,139
Electric Locomotive, Sidney H. Short, Cleveland, O. 478,477
Electric Locomotive, Sidney H. Short, Cleveland, O. 478,242
Electric Railway Conduit, Milton Shoemaker, Sioux City, Ia. 478,175
Electric Railway, Frank Mansfield, New York, N. Y. 478,345
Fare Register, John W. Meaker, Chicago, Ill. 478,167
Insulator, Louis McCarthy, Boston, Mass. 478,518
Railway Chair, Silas Harris, San Francisco, Cal. 478,427
Railway Chair, Silas Harris, San Francisco, Cal. 478,428
Support for Street Railways or Tramways, James M. Price, Phila, Pa. 478,362
Trolley, John W. Davis, Lynn, Mass. 478,410
Trolley Wire Splice, Elmer A. Sperry, Chicago, Ill. 478,140

JULY 12.

Arc Extinguisher for Electric Switches, Sidney H. Short, Cleveland, O. 478,718
Automatic Trap for Cable Conduit, Ira Bishop and Arthur F. L. Bell. 478,910
Brace Chair for Railroad Rail, George Murray, Johnstown, Pa. 478,806
Cable Railway Grip, Charles Vozel, San Francisco, Cal. 478,773
Car Brake, Frederick A. Baier, St. Louis, Mo. 478,902
Conduit System for Electric Railways, William H. Ford, St. Louis, Mo. 478,956
Electric Locomotive, Joshua Gray, Medford, Mass. 478,591
Electric Rail Bond, Thomas J. McTighe, New York, N. Y. 478,629
Lifting Mechanism for Cable Grips, Ira Bishop and Arthur F. L. Bell. 478,911
Railroad Rail Joint, Warren H. Carr, Bath, Me. 478,920
Railway and Truck, James G. Johnson, Chicago, Ill. 478,332
Railway Rail, John T. Smith, San Francisco, Cal. 478,706
Street Railway Switch, Ira F. Harris, Nashua, N. H. 478,858
Street Railway Switching Device, Ira F. Harris, Nashua, N. H. 478,859

JULY 19.

Car Brake, Charles H. Allen, Stroudsburg, Pa. 479,256
Car Starter, George B. Warner and Llewellyn J. Allen, Woodbury, Conn. 479,127
Car Truck, John E. Anger, Green Island, N. Y. 479,237
Conduit Trolley for Street Cars, Arthur H. Heatman, Baltimore, Md. 479,327
Fare Register, Frederick C Boyd and Richard Martin, New Haven, Conn. 479,388
Railroad Rail Fastening, Henry A. Lyddon, Brainerd, Minn. 479,289
Railway Joint, Frederic W. Bond, Springfield, Mo. 478,993
Street Railway Switch, Roswell T. Smith, Nashua, N. H. 479,028
Signal for Electric Railways, Frank F. Loomis, Akron, O. 479,138

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

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	112	.....
Broadway R. R. Co	100	525,000	Q.—F.	2	.....	240	.....
Broookly City R. R. Co....	10	6,000,000	Q.—J.	2	.....	187	190
Coney Island & Brooklyn R. R. Co.....	100	500,000	.....	...	.....	145	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	108	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	115	120
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid	Ask'd
Albany R. R. Co., 1st Mort...	1865	40.000	J. & J.	5	1905	103	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	105	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	105	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	105	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	104½	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	109	110½
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	114	117
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	108½	109½

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1	.....	150	152
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	117	120
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	250	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	50	55
Eighth Avenue.....	100	1,600,000	Q.—J.	2	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	J. & J.	5	.....	115	118
Sixth Avenue.....	100	1,500,000	M. & S.	3	.....	196	200
Third Avenue.....	100	2,000,000	M. & N.	6	.....	205	210
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	.....	3	.....	130	135

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	104	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	6	July, 1924	105	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	95	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	116	120
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	115	117
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	101
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	6	1915	59	61
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	100	107
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	103	105
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	112	114
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. July 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,406,000	J. & J.	4	1887	87½	88
West End Com'n.....	50	9,085,000	J. & J.	5	1890–1892	74	74½

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, July 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	95	100
Union R. R Co., Prov.....	100	2,000,000	Q.—J.	2	1862–1863	200	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers. Holyoke, Mass. July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	$360,000	J. & J.	4	.....	245	250
Holyoke Street R. R.....	100	240,000	J. & J.	4	.....	212	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., July 18. 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.	3	.....	.....	55
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest 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	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
*Carrollton R. R. Co.....	100	800.000	Quart.	1½	1867	127	134¼
Crescent City R. Co.....	100	1,150 000	"	1¼	.866	97¾	98½
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	26	.....
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	139¾	143
Orleans R. R. Co.....	50	185,000	"	2	1868	58¾	65
St. Charles Street R. R. Co..	50	600,000	"	2	1866	93	94

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	* 1887	102¼	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93–'99	.....	.....
do do new	1886	40.000	M & N	6	1896	.....	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	122⅝	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92–'06	113½	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89–'01	.....	.....

* Bids on Carrollton R. R. are ex-privilege of new stock.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. July 18. 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	$300,000	J. & J.	4	.....	35	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	25	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	26	.....
New Haven & Centre He H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1889	100	.....
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. (Not yet Issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	223½	225

BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	89	90
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	26	27

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99	100
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	114½	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114½	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	400	.....
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	97	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	223	224
West Division City	100	1,250,000	Q.—J.	8¾	.....	635	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	183	184

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	98½	99¼
Chicago Passenger	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	.....	112
" " "	.....	1,850,000	M. & N.	4½	1927	96¾	97½
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100¾	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¼	101¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	97½	.....

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, July 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	..	.....	28⅞	29¾
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	62	62½
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	25¼	25¾
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.	...	.....	.....	59½
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25½	25¾
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	.....	45¾
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	.....	...	.....	.....	.....
Pittsburgh Incline Co.....	100	150,000	.....	...	.....	.....	.....
Duquesne Traction Co.....	50	3,000,000	.....	...	.....	28¼	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	1887	1,250,000	A. & O	5	1927	108	.....
Pitts. & Birmingham Traction Co	1889	1,500,000	M. & N.	5	1929	.....	101½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	.....	.....
Pleasant Valley Ry	1891	1,250,000	J. & J.	5	1919	100½	101
P., A. & M. R. R. Co	1891	1,500 000	J. & J.	5	1931	.....	104¾
Duquesne Traction Co.....	1890	1,500,000	J. & J.	5	1930	100⅛	100¾
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.....	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.....	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.....	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort	1883	125,000	.....	6	1903	102½	.....
Monongahela Incline Plane Co	1887	50,000	A. & O.	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.....	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.....	100	1,000,000	Monthly	5	.....	.....	115
Central R. R. Co.....	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	95	.....
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	45	65
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	33	39
Omnibus Cable Co.....	100	2,000 000	Monthly	4	.....	56	58½
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	22½	25½

Bonds.	Date of Issue	Am't Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.....	.....	650,000	M. & S.	6	1914	101	.....
Market Street R. R.....	.....	3,000,000	J. & J.	6	1913	120	.....
Omnibus R. R.....	.....	2,000,000	A. & O.	6	1918	114⅛	116¾
Powell Street R. R.....	.....	700,000	M. & S.	6	1912	112	.....
Park & Ocean R. R.....	.....	250,000	J. & J.	6	1914	111½	.....
Park & Cliff House R. R.....	.....	350,000	J. & J.	6	.....	95	.....
Cal. St. Cable R. R.....	.....	.....	.....	...	.....	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., July 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.....	50	$50,000	Q.—J.	3	1864	30	32
Cass Ave. & Fair Grounds.....	50	300,000	.....	...	1876	45	46
Citizens'	100	1,500,000	A. & O.	1½	1887	90	95
Jefferson Avenue.....	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	70	72
Missouri.....	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
Northern Central.....	100	200,000	.....	...	1884	100	105
People's.....	50	1,000,000	M. & S.	6	1889	45	50
St. Louis.....	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal.....	50	150,000	Jan.	.50	1872	15	25
Union.....	50	600,000	.....	...	1870	20	25
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban.....	100	2,500,000	.....	...	1891	48	50

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.....	1891	$500,000	F. & A.	6	1911	102	102½
* Cass Avenue.....	1886	200,000	.....	...	.....	.....	.....
Citizens' Cable.....	1887	1,500,000	J. & J.	6	1907	105½	106
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	100
Mound City.....	1890	525,000	A. & O.	6	1900–1910	105	106
Missouri Cable.....	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.....	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.....	1886	75,000	M. & N.	7	1902	104	105
People's Cable.....	1889	800,000	J. & J.	6	1889–1914	97	100
* Northern Central.....	1884	200,000	J. & J.	6	.....	.....	.....
St. Louis Cable.....	1890	1,500,000	M. & N.	5	1900–1910	97½	98
Union.....	1885	150,000	M. & N.	6	1895–1915	102	103
Union Depot.....	1890	1,600,000	A. & O.	6	1900–1910	105	106

* Called for Redemption.

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	270
Continental.....	50	1,000,000	J.—J.	6	1873	125	126
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	210	212
Germantown.....	50	1,500,000	Q.—J.	2½	1858	102	103
Green & Coates...	50	500,000	Q.—J.	3	1858	120	121
Hestonville...	50	2,050,000	.....	...	1859	32	34
Lombard & South.....	25	500,000	A.—O.	8	1861	55	60
People's Common.....	25	1,500,000	M.—S.	2½	1873	49	50
" Preferred.....	25	750,000	M.—S.	2½	.....	49	.....
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	65	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	84	85
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	220	230
Second & Third.....	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	200	203
Union.....	50	1,250,000	J.—J.	9½	1864	186	188
West Philadelphia.....	50	750,000	J.—J.	10	1857	200	202
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	129¾	130
Baltimore Traction.....	25	5,000,000	.....	1	1889	23¾	24
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	39	40
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	26	27

BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1,250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	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., July 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Outstanding.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO. Bankers and Brokers, 26 West Third Street, Cincinnati, July 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,000,000	Q.—J.	5	.....	109¾	109¾
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	108½	109
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	40
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	89	90
" " " Pref.	100	100,000	.....	6	.....	100	101

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" "	.....	50,000	J. & J.	7	July, 1893	103	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
	.....	50,000	J. & J.	5	July, '96	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104½	105¾
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	116	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	100
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	111¼
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	112	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO., Bankers, 9 South Street, Baltimore, Md., June 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	23½	24

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	105	110—
" " " cons. mort.	1892	500,000	.....	5	.....	102½	103
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " gen. mort.	.....	1,500,000	.....	5	.....	105	.....
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	110	110½
Balt. Trac. Co., No. Balt Div	1892	1,750,000	J. & D.	...	1942	106	106¼
" " "	1891	1,250,000	M. & S.	6	1901	105	.....
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	110¾	111

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & CO., Bankers, 1344 F Street, N.W., Washington, D. C., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	...	1863	310	350
Metropolitan R. R.	50	750,000	Q. J.	...	1864	90	100
Columbia R. R.	50	400,000	Q. M.	...	1870	.....	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	33	37
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	32	.....
Georgetown & Tenallytown	50	200,000	.....	...	.....	50	.....
Rock Creek R. R.	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	100	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	120	132½
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	99	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	103½	112
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	109	114
Anacosta R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & CO., 139 So. Fourth St. (Bullitt Building), Philadelphia, July 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	37	39
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	39	40
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	15	25
Newark (N. J.) Pass. Ry	100	6,000,000	.....	...	1890	29	30

BONDS.	Date of Issue	Amount Out standing.	Interest Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	91	94
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	93	97
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry	1890	6,000 000	J & J	5	1930	89½	91

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., July 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd	100		.....	....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	86½	87½
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Baltimore (Md.) Traction Co. showed as earnings in June, 1892, $65,100; in June, 1891, $57,717.

$ $ $

THE directors of the Albany (N. Y.) Railway Co. have decided to increase the capital of that company by $500,000 to $1,250,000.

$ $ $

THE Philadelphia (Pa.) Traction Co. showed total earnings in June, 1892, $364,877; in June, 1891, $332,096; increase, $32,781.

$ $ $

THE Newark (N. J.) Passenger Railway Co. report receipts for the month of June $104,440, compared with $92,495 for the same month in 1891.

$ $ $

THE Western Cable Railway Co. of St. Louis have filed a statement with the Secretary of State, increasing their capital stock from $20,000 to $200,000.

$ $ $

THE Janesville (Wis.) Street Railway Co. have filed articles with the Secretary of State of amendment to their franchise, increasing their capital from $30,000 to $50,000.

$ $ $

THE Union Railway Co. of Providence, R. I., have issued $3,000,000 in twenty year, 4 per cent., first mortgage gold bonds. The Industrial Trust Co., of Providence, is trustee.

$ $ $

THE West Philadelphia Passenger Railway Co. and the Union Passenger Railway Co. have declared the usual semi-annual dividend of $5 and $4.75 a share respectively, payable June 21.

$ $ $

THE Northern Central and the Case Avenue & Fair Grounds (St. Louis) Railway Co.'s bonds, called for July 14 and 26, will be cashed or exchanged at the office of James Campbell, St. Louis.

$ $ $

IT is stated that the Metropolitan Elevated Railroad Co., of Chicago, which proposed to build an elevated road on the West Side, have disposed of $9,000,000 of their 5 per cent. bonds.

$ $ $

THE control of the stock of the State Street Horse Railway Co., of New Haven, Conn., have been secured by a Boston company. The price paid per share for the controlling interest was $75.

$ $ $

THE gross earnings of the West End Street Railway Co., of Boston, for June, were stated to be about $600,000, or about $50,000 more than for the corresponding period last year, and $18,000 more than for August, 1891, the company's best month.

$ $ $

WHILE July is not considered as good a month for street railway travel as is June, the officials of the West End Street Railway Co., of Boston, it is said, anticipate that the gross receipts, during July, will aggregate about $580,000, against $554,431 last year.

$ $ $

THE stockholders of the Springfield (Mass.) Street Railway Co. have voted that the directors be given power to increase the capital

stock of the company from $700,000 to $1,000,000, and have petitioned the railroad commissioners for permission to carry out this plan.

$ $ $

AT a special meeting of the stockholders of the Brooklyn (N. Y.) City Railroad Co. July 26, a resolution was passed to increase the capital stock from $6,000,000 to $12,000,000. The object of the increase is to provide for the further equipment of the line with the overhead electric system.

$ $ $

AT a meeting of directors of the Toledo Electric Co. of Toledo, O., held June 30, 1892, it was unanimously resolved that a special meeting of the stockholders be held at the office of the company on August 9, 1892, to consider the advisability of increasing the capital stock to $500,000.

$ $ $

THE counsel for the receiver of the United Electric Traction Co. of Jersey City is reported as saying that the affairs of the insolvent company are being rapidly straightened out and are assuming a very satisfactory shape, and that there is every prospect that the works at Marion will be reopened this fall.

$ $ $

IT is announced that the control of the Love Electric Traction Co. has passed into the hands of an Eastern syndicate, The Love Electric Traction Co. was organized with a capital stock of $10,000,000. Of this amount $4,000,000 is retained in the treasury, and it is the outstanding $6,000,000 that has passed into the control of Eastern parties. Among the Chicagoans now interested in the Love Electric Co. are P. C. Hanford, J. G. Shortall and J. G. Wheeler.

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY CO., New Bedford, Mass.

POSITIONS WANTED.

WANTED.—Position as Manager or Superintendent of a Street Railway. Can give the best of references. Twenty years' experience. Twelve years as Superintendent in last position. Address, "W. G. H.," care of STREET RAILWAY JOURNAL, New York. 2t

WANTED.—Position as Engineer and Constructor for Power Plant with prominent Electrical Contractor or Street Railway Company desiring great economy. Over twenty-two years' practical experience. Highest references. Address, "A. J.," care STREET RAILWAY JOURNAL, New York. 1t

WANTED.—By a Practical Man, position with Street Railway Company as Superintendent or Manager. Have had experience with Electric, Steam Motor and Horse Lines. Satisfactory references as to ability and character in the construction, operation of Street Railways and Surburban Lines. Address, "STREET RAILWAY," 6,608 Evans Ave., Chicago, Ill.

THE earnings of the West Side Street Railway Co. of Chicago, Ill., for June are given as follows: In 1892, $412,693; in 1891, $369,116; increase, $43,577. It will be noticed that the gains average nearly $1,500 per day. During twenty-nine days of June the North Side of the same city showed, in 1892, $217,948; in 1891, 190,637; increase, $27,311.

$ $ $

AT a meeting of the majority of the stockholders of the Union Street Railway Co , of New Bedford, Mass., it was decided to sell their interest to James Irvine and others of New York, who will be the majority of the stockholders. The new board of officers is as follows, the old board having resigned: President, James Irvine; treasurer, Edward S. Brown; secretary, Wm. H. Allen; acting manager, Moritmer McCarthy. The directors are: James Irvine, Ex-governor Waller, J. A. Beauvais, Chas. H. Cifford, Abbott P. Smith, Chas. E. Cook, James E. Dwight.

$ $ $

THE San Francisco *Examiner*, in a recent issue, outlines a plan of consolidation which, it is stated, will soon be adopted by the electric and cable roads of Los Angeles. The property of the electric company and first mortgage bonds of the cable company, amounting in the aggregate to more than $3,000,000, are to be transferred to John McKee of Pallant & Co., bankers, and B. F. Dorn, of the law firm of Dorn & Dorn, and new bonds and stock will be issued. The president of the new company, it is said, will be Gen. M. H. Sherman of Los Angeles, and the secretary, Frank B. McDonald of San Francisco.

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THE Baltimore stock exchange has received application from the Traction company to list the 5 per cent. bonds of the North Baltimore division and the extension and improvement 6 per cent. bonds. The statement filed with the application contains some interesting figures, showing the prosperity of the company. Their total receipts for the year ending April 30, were $665,920. After deducting operating and general expenses, a surplus remained of $135,452, or over 20 per cent. of receipts. The net earnings of last June were nearly 40 per cent. of receipts. The Traction company's daily receipts are said to be some $3,000.

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WEST Chicago Street Railway stock sold on July 19 up to 186½ and North Chicago Street Railway stock advanced to 226, breaking all previous records. The advance is said to have been due to large purchases by Eastern capitalists. Commenting on this rise, a Chicago paper says: "One of the most frequent arguments that are heard advanced by the bulls on these street railway properties is that this increase will go almost wholly into net earnings. They say that it costs about so much to operate the road anyway, and if the receipts can be increased $1,000 a day the net earnings will be increased almost an equal amount. The statistics of street railway operations in Chicago by no means bear out that view. The South Side line ought to furnish a fair illustration of the cheapening of the cost of carrying passengers, for the lines have been practically completed for some time, and the traffic rapidly increasing. The South Side company carried, in 1890, 68,734,000 passengers. The expenses of operation were $2,297,651. This makes the average cost of carrying a passenger 3.34 cents. In 1891 the traffic increased to 77,463,000 and the expenses to $2,534,315. This made the average cost per passenger 3.27 cents. While the traffic increased nearly 9,000,000 passengers the cost per passenger decreased only 7-10 of a mill. In the case of the North Side company the average cost per passenger in 1890 was 2.79 cents, and in 1891 2.75 cents. The traffic in 1891 increased nearly 5,000,000 passengers, but the cost of carrying each passenger decreased only 4-10 of a mill. It cost the West Side company in 1890 2.93 cents and in 1891 2.88 cents. The traffic had increased over 10,000,000 passengers, but the cost per passenger decreased only half a mill. These statistics hardly coincide with the view that the present increase in traffic is to result in nearly a like increase in net earnings."

Great Railroad Traveling.

"I happened to take the 10:30 A. M. train the other day, from Chicago, on the Lake Shore and N. Y. Central, and thought the entire trip would be a bore," said Geo. W. Lederer to a DRAMATIC TIMES reporter. "But imagine my surprise, when I found upon entering the train, a *fac-simile* of their famous Chicago limited, and positively the same comfort, convenience and equipment which I have so often enjoyed on the latter. I arrived in New York City at 2:10 the next day, the train being on time to the minute, and had sufficient time left that day to transact a great deal of very important business. I shall return again to Chicago on the very same train, as it leaves here at 1.55 P. M., and gives me a good half day to settle up my unfinished business."—*New York Dramatic Times.*

The 10:30 A. M. train to which Mr. Lederer refers, is the popular "Chicago and Boston Special," the latest addition to the train service of the Lake Shore & Michigan Southern R'y. The equipment, which is of Wagner build, consists of two Vestibule Sleeping Cars, one Vestibule Buffet Smoking and Library Car, running through to Boston, arriving at 3:40 P. M. next day; one Vestibule Sleeper through to New York, arriving at 2:10 P. M.; a vestibule Dining Car, Chicago to Cleveland, and Utica to Boston, and day Coach, Chicago to Buffalo, and Buffalo to Boston.

The train leaves daily from Van Buren Street Station at the hour named above, and is the greatest favorite with business men and tourists, as by it not only are the cities on the B. & A. R. R. reached early in the afternoon, but the Atlantic Coast resorts are reached before dark.