


THE STREET RAILWAY JOURNAL



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ELEVENTH ANNUAL CONVENTION

OF

The American Street Railway Association.

Everything points to a most successful convention this year at the city of Cleveland on October 19, 20 and 21. The local committee has been very busy making arrangements for the reception and care of the delegates, and every person who attends can be certain of a visit which will be both pleasant and profitable. The meetings of the American Street Railway Association have been growing in importance and interest yearly, and that to be held this month merits the attendance of every street railway official in the country. Certainly each street railway company should be represented by at least one delegate, and should send as many others as can be spared from active service.

We take pleasure in presenting on this page a portrait of the president of the Association for the current year. Mr. John G. Holmes, president of the Citizens' Traction Co., of Pittsburgh, Pa., is a native of the city of which he is a resident, and was born in 1846. His father was Nathaniel Holmes who was prominent in the organization of the Citizens' Passenger Railway Co., of Pittsburgh, which built the first street railway west of the Allegheny Mountains, and with which Mr. Holmes, the subject of our sketch, has been identified since the running of the first horse car. After completing the usual preparatory studies, Mr. Holmes entered Dickinson College, Carlisle, Pa. His business career commenced in 1866, with his connection with the banking house of N. Holmes & Son, of which firm he is now the senior member. This firm was established in 1822 and is the oldest banking house in Pittsburgh.

Mr. Holmes was elected treasurer of the Citizens' Passenger Railway Co. in 1871, retaining that office until 1882, when he became president of the company. In 1887 all the lines of the Citizens' Passenger Railway Co. were leased by the Citizens' Traction Co., of which Mr. Holmes had also been elected president, and about twelve miles of road were changed from animal to cable power. During

the last two years the electric system has been introduced extensively on the other lines under Mr. Holmes' control.

Mr. Holmes has been connected with the American Street Railway Association since the first regular meeting and has missed very few of the conventions. In 1883-84 he was a member of the executive committee, and in 1890-91 of the local committee, and added much to the pleasure of last year's convention by his hospitable treatment of the delegates and their friends who were present.

THE CITY OF CLEVELAND.

Cleveland is an exceedingly interesting place for the street railway man to visit, and it is an extremely desirable meeting place for the Convention. Many local industries of peculiar interest to railway men are located here, and much of the equipment used in rapid transit service is manufactured in the city. Cleveland is wonderfully well supplied with street railway facilities, and many methods are worthy of study and imitation, especially in view of the fact that electricity has been employed for a long a time, and all departments have been thoroughly organized. There are few, if any, cities in which so varied an assortment of equipment of every department can be found in use. No extended reference to the systems is contemplated at this time, for the reason that a Souvenir Number of the STREET RAILWAY JOURNAL will soon be issued in honor of the Convention, in

which will appear detailed descriptions of all the street railways in the city.

SUBJECTS FOR DISCUSSION.

The subjects for discussion at the Convention include topics which are of timely and of universal interest to street railway men, and the ability of the gentlemen composing the committees is sufficient assurance of an able presentation of each subject.

The first paper to be read is on "A Model Electric Street Railway Roadbed and Underground Wiring," by Geo. W. Baumhoff, general manager of the Lindell Railway Co., St. Louis. Mr. Baumhoff's road was one of the first to make experiments with storage battery cars, and later, when the advantages of the trolley method had been shown, one of the earliest to adopt that system on a



JOHN G. HOLMES.

PRESIDENT OF AMERICAN STREET RAILWAY ASSOCIATION.

large scale. Mr. Baumhoff understands the needs of an electric railway, and his paper will, undoubtedly, contain many important facts as the outcome of his experience.

"A Perfect Overhead Electric Construction" is the title of the second paper which will be read by Charles H. Smith, superintendent of the Troy & Lansingburgh Street Railway Co. Mr. Smith has a good subject, and will give many important facts and suggestions which will be of value to electric railway managers.

A third paper is on the "Economy of Machine Shops for Electric Street Railways," and will be read by John H. Bickford, engineer of the Naumkeag Street Railway, Salem, Mass. Mr. Bickford holds, besides his office with the Naumkeag Street Railway, that of consulting engineer with several important electric railway companies, and is well fitted to present many valuable facts on the important subject upon which he will treat.

Following this will be a paper on "Power House Engines," which will be read by T. W. Wrenne, president of the United Electric Railway Co., Nashville, Tenn. The other members of the committee on this subject are: L. H. McIntire, engineer of the Union Railway Co., New York City, and F. S. Pearson, chief engineer of the West End Street Railway Co., Boston. All of these gentlemen know the needs of an electric railway power station, and we can confidently assert that Mr. Wrenne's paper will contain a great deal of new and valuable matter on this subject.

The fifth paper is upon the "Relative Cost of Operating Horse, Cable and Electric Roads," a subject of vital importance to street railway managers. The chairman of this committee is W. McC. Ramsey, electrical superintendent of the Federal Street & Pleasant Valley Railway Co., Pittsburgh. Mr. Ramsey is well acquainted with the economical management and care of electric railways, and his figures will undoubtedly be of great value to every railway company in the country, especially those who are now contemplating a change from animal to mechanical power. The other gentlemen on this committee are F. R. Greene, secretary of the Chicago City Railway Co., one of the largest cable railways in the country, and John L. Heims, superintendent of the Brooklyn City & Newtown Railway Co., whose experience as superintendent of a large horse railway eminently qualifies him to give valuable information on this branch of the subject.

"Standards for Electric Railways" is the subject of the paper which will follow, and which will be read by O. T. Crosby, president of the Utica Belt Line Railway Co., Utica, N. Y. Mr. Crosby's important paper and valuable suggestions on this subject before the Association last year will be well remembered, and assures an equally interesting presentation of further data this year. Associated with Mr. Crosby on this committee are: H. I. Bettis, assistant treasurer Atlanta Street Railway Co., Atlanta, Ga.; Edward E. Higgins, consulting engineer, Brooklyn Street Railroad Co., Cleveland, O.; Chas. W. Wason, general manager East Cleveland Railroad Co., Cleveland, O.; Julius E. Ruger, superintendent Citizens' Traction Co., Pittsburgh, Pa.

"The Form of Street Railway Electrical Statistics" is the title of the paper to be read by Thomas H. McLean, secretary and general manager of the Twenty-third Street Railway Co., of New York City, and general manager of the Houston Street, West Street & Pavonia Ferry Railway Co. of New York City. Mr. McLean's experience in street railway affairs has been a long one, and enables him to deal intelligently and practically with the subject. The other members of the committee are Henry M. Watson, president Buffalo Railway Co., Buffalo, N. Y.; H. I. Bettis, assistant treasurer Atlanta Consolidated Street Railway Co., Atlanta, Ga.; Charles E. Warren, accountant Broadway & Seventh Avenue Railroad Co., New York.

Notice is also given by the secretary that special papers will be read under the following titles: "Experiments on the Expansion of Continuous Rails," and "Is a Standard Rail Head Possible," subjects which are of much interest to street railway managers.

Upon the request of the executive committee, Mr. D. F. Longstreet has also consented to prepare and will read a paper relating the events which led up to the formation of the American Street Railway Association. Mr. Longstreet is a veteran in the street railway industries and his reminiscences will undoubtedly be of great interest, not only to the old timers, but also to the more recent members of the Association.

REDUCED RAILROAD RATES.

As usual, reduced railroad fares have been secured for the benefit of attendants at the Convention. These reduced rates, the secretary announces, include the lines controlled by the different traffic associations except for the Western and Pacific Coast States included in the territory of the Trans-Continental and the Western Passenger Association. The latter has, however, granted a fare and a third rate from Peoria via Chicago, Rock Island & Pacific, Chicago, Burlington & Quincy, Jacksonville Southeastern, and Atchison, Topeka & Santa Fe railways only. The charge for the trip to Cleveland and return will be a fare and a third. In order to secure this reduction, which is open to attendants and their families, whether delegates or not, it will be necessary to secure from the ticket agent at the station of departure to Cleveland a certificate stating that the passenger has paid full fare over certain lines to Cleveland, and that he has purchased his ticket not more than three days prior to the date of the meeting. Before purchasing a return ticket these certificates must be countersigned by Mr. John J. Stanley, general manager of the Broadway & Newburgh Street Railway Co., who will act as Clerk of the meeting for this exclusive purpose, when a return ticket can be procured at one-third fare.

LOCAL ENTERTAINMENT.

The Cleveland street railway companies, supplemented by the Street Electric Railway Co. will entertain attendants at the Convention in a most hospitable way.

Among the excursions already planned, is one to the works of the Short Electric Railway Co., which will undoubtedly be one of the most interesting of any. The special excursion to these works will occur on the afternoon of the first day, when visitors will be taken on street cars over the East Cleveland road directly to the factory. The exhibition here will be very fine and will consist of the different types of motors, and of new and improved generators, line appliances, etc., manufactured by the Short company.

HOTEL RATES.

The headquarters of the Association will be at the Hollenden Hotel, one of the largest and best equipped hostelrys in the country. The prices for board per day will be the same as the ordinary rates of the hotel, so that delegates need have no fear of exorbitant charges being made for this special occasion. In case delegates prefer to patronize other hotels or boarding houses, they will find a large number which will furnish ample accommodation at reasonable rates. Those desiring to secure rooms at any of the hotels should communicate with Mr. H. J. Davies, secretary of the local committee.

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will be represented as usual at the Convention, and will occupy spacious parlors in the Hollenden Hotel. Our friends who will do us the honor of calling will be sure of a cordial welcome, and we desire that all delegates and visitors should register at our headquarters.

THE EXHIBITS.

The exhibits of apparatus and appliances designed for street railways will be located for the most part in the Army and Navy Hall on Superior Street, almost directly opposite the headquarters at the Hollenden Hotel. Manufacturers have applied for space very generally, and several exhibits of more than ordinary interest have been planned. The plans of the local committee are sufficiently flexible to admit of the extension of the exhibit to rooms adjoining the main hall should the demand for space be unexpectedly large. It is a fortunate fact that the lot adjoining

ing the hall on the east is vacant, and the committee in all probability will locate there apparatus too large to be placed indoors. Unless all signs fail the exhibit will be the largest and most interesting ever seen at a convention of the Association.

ATTENDANCE OF LADIES.

The attendance of the wives and daughters of the gentlemen attending the Convention was gratifyingly large last year, and it is hoped that a still larger number of ladies will be present at Cleveland. Their participation in the excursions and banquet will be fully arranged for by the local committee.

THE ANNUAL BANQUET.

That enjoyable feature of the Convention, the banquet, will take place on Thursday evening, October 22, at the Hollenden Hotel. Each member-company of the Association is entitled to the free admission to the banquet of two of its officers.

The tickets admitting an additional officer or any gentleman in attendance at the meeting, can be obtained from the secretary for \$10 each; ladies tickets for \$5 each. The secretary has requested that members and others who expect to be present at the banquet will notify him promptly in order that definite arrangements as to the number who will attend may be promptly made.

SOME OF THE ADVANTAGES TO BE GAINED

by attending the Convention are set forth in our editorial columns, and we can only add that the best evidence of the value of the Association to individual roads is the testimony given by the delegates who have most frequently attended the meetings. We have yet to hear of a person who deprecates either the aims or the methods of the Association. There has been at times a little complaint that certain parties made themselves too prominent and assumed to shape the proceedings after their own peculiar ideas, but it is expected that at the coming meeting the business will be quickly and systematically dispatched, and that members will be considerate of the wishes of other members, and see to it that every one who desires shall have a chance to be heard. The new plan of providing copies of the papers in advance will go into effect at this meeting, so that all who wish to take part in the discussion will have ample time to prepare themselves. This arrangement, if properly observed, will doubtless make the proceedings of more value than those of any previous meeting.

The following are among the companies and firms which have expressed an intention of being represented at the Convention, and have secured space to exhibit their appliances:

- Baltimore Car Wheel Works, Baltimore, Md.
- Barnes Brake Co., Cleveland, O.
- Billings & Spencer Co., Hartford, Conn.
- Bodifield Belting Co., Cleveland, O.
- Brownell Car Co., St. Louis, Mo.
- Brooklyn Railway Supply Co., Stamford, Conn.
- Brill, J. G. Co., Philadelphia, Pa.
- Bruce, F. E., Agent Stirling Co., Cleveland, O.
- Cleveland Frog & Crossing Co., Cleveland, O.
- Combination Car Co., Cleveland, O.
- Davis & Cook, Watertown, N. Y.
- Detroit Electrical Works, Detroit, Mich.
- Dorner & Dutton, Cleveland, O.
- Duplex Street Railway Track Co., New York.
- Ford & Washburn Co., Cleveland, O.
- Fulton Foundry Co., Cleveland, O.
- General Electric Co., Boston, Mass., and New York.
- Graham, J. H. & Co., New York.
- Griffia Wheel & Foundry Co., Chicago, Ill.
- Hill Clutch Works, Cleveland, O.
- International Register Co., Chicago, Ill.
- Jewell Belting Co., Hartford, Conn.
- Johns, H. W. Manufacturing Co., New York.
- Johnson Co., Johnstown, Pa.
- Johnson Electric Co., Cleveland, O.
- Loomis, H. N., Hightstown, N. J.

- Lewis & Fowler Girder Rail Co., Brooklyn, N. Y.
- Lewis & Fowler Manufacturing Co., Brooklyn, N. Y.
- Mitchell-Brandt Copper Co., Erie, Pa.
- Meaker Manufacturing Co., Chicago, Ill.
- Morton Safety Heating Co., Baltimore, Md.
- New Departure Bell Co., Bristol, Conn.
- New York Car Wheel Works, Buffalo, N. Y.
- Nuttall, R. D., Co., Allegheny, Pa.
- Peckham Motor Truck & Wheel Co., Kingston, N. Y.
- Pittsburgh Steel Hollow Ware Co., Pittsburgh, Pa.
- Pennsylvania Steel Co., Philadelphia, Pa.
- Pomeroy & Fischer, New York.
- Railway Equipment Co., Chicago, Ill.
- Reliable Manufacturing Co., Boston, Mass.
- Robinson Machine Co., Altoona, Pa.
- Rochester Car Wheel Works, Rochester, N. Y.
- St. Louis Register Co., St. Louis, Mo.
- Schieren, Chas. A., & Co., New York.
- Scott, Charles, Spring Co., Philadelphia, Pa.
- Short Electric Railway Co., Cleveland, O.
- Sperry Electric Railway Co., Chicago, Ill.
- Taylor Truck Co., Troy, N. Y.
- The New Process Raw Hide Co., Syracuse, N. Y.
- Wall, P., Supply Manufacturing Co., Allegheny, Pa.
- Walworth Manufacturing Co., Boston, Mass.
- Washburn & Moen Manufacturing Co., Worcester, Mass.
- Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.
- Wharton Wm., Jr., & Co., Philadelphia, Pa.

A number of other companies and firms have signified their intention of exhibiting, but up to the time of going to press had not secured space.

Cable Service on the Brooklyn Bridge.

The cable service on the New York & Brooklyn Bridge cable railway up to September, 1, 1892, was as follows:

CABLE.	NUMBER OF DAYS.	PASSENGERS HAULED.	CAR MILES.	TON MILES.
No. 1 removed,	1,140	49,002,412	228,329	22,142,706
" 2 "	607	47,840,262	120,232	25,492,892
" 3 "	393	36,941,884	82,099	20,395,073
" 4 "	356	34,134,409	74,111	18,923,469
" 5 in use,	468	50,299,888	100,120	30,251,456
" 6 "	300	33,024,020	64,297	20,310,394

As will be seen, No. 5 has already performed nearly 19 per cent. more work than any other of the cables, and seems capable of lasting for at least 100 days more.

This great service is attributable, in the opinion of the engineers of the road, first, to its excellence as a cable; second, to the fact that it is not in contact with iron except in the drum grooves, all the sheaves, pulleys and grips being packed either with leather or with leather and india rubber; and third, probably greater in effect than either or perhaps both the above, the method of driving whereby the slip of the cable in the drum grooves is reduced to the least possible quantity.

Crosstown Electric Lines in Chicago.

As soon as the preliminary work is completed, electric motors will be put into operation on the crosstown lines of the Chicago City Railway Co. President Wheeler and Supt. M. K. Bowen, of that company, have recently visited Cleveland for the purpose of examining the electric roads there and express themselves pleased with the workings of electric railways in that city.

The first lines to be equipped are the roads on Sixty-first and Sixty-third Streets, and as these lines run to the World's Fair grounds no doubt they will be liberally patronized next year.

East Cambridge Power Station, West End Street Railway Co., Boston.

On January 15 last an electrical event took place which deserved, we confess, a very different sort of notice from that which has been bestowed upon it. We refer to the starting up of the above plant which has since been in successful operation. Many reasons have made it impossible for us to lay before our readers, until now, the details of this very interesting plant; but now, acknowledging that we have already deferred too long the duty of paying some tribute to the designers and builders of this plant, we bring to our readers without further delay the details of its construction.

This station is rivaled in capacity only by the central power station of the same company, which was illustrated

covered. Steam is supplied to the engines from two mains, all branches being connected by suitable valves. There is also a separator of special design located over the throttle valve of the high-pressure cylinder.

The Corliss vertical, circulating engines, placed behind the others, perform three distinct functions, namely, circulating the salt condensing water, operating the air pump for the condensers and acting as feed pumps for the boilers. Each engine is provided with a surface condenser located beneath the floor. There is also a duplicate system of exhaust piping to be used in case of emergency, and the engines can be run condensing or non-condensing as desired. There is also a free exhaust pipe, extending through and above the roof of the building for use when running non-condensing.

The steam equipment of the station has been con-

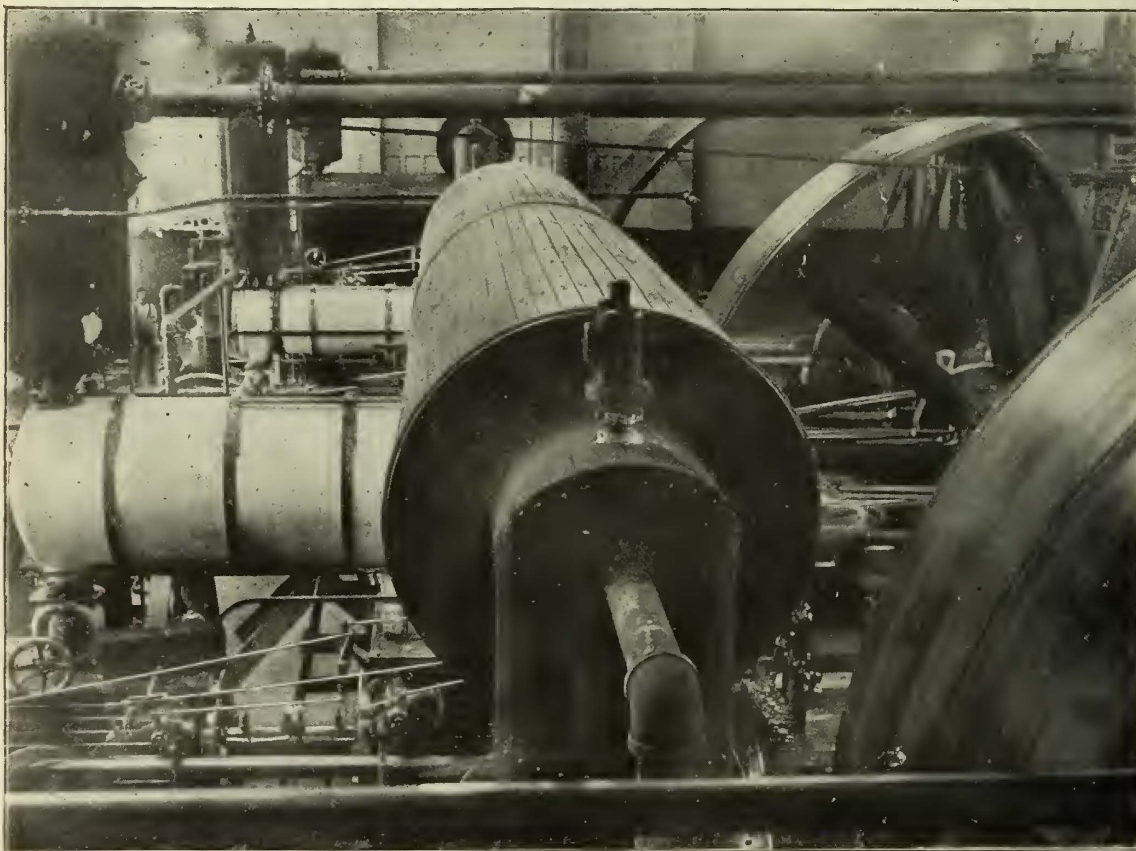


FIG. 1.—VIEW SHOWING GENERAL ARRANGEMENT OF STEAM SEPARATOR AND INTERMEDIATE RECEIVERS OVER ENGINES—CAMBRIDGE POWER STATION, WEST END STREET RAILWAY.

and described in our last issue, and in some respects the details of construction are the same. The power equipment (Fig. 1) consists of three cross compound, triple expansion engines and twenty M. P., No. 80, Thomson-Houston generators (Fig. 3), which will be replaced by ten M. P., 500 H. P., generators. The two flanking engines are rated at 1,000 H. P. each, but can be worked at 2,000 H. P., and the intermediate engine is rated at 500 H. P., with a maximum of 1,000 H. P. The high pressure and intermediate cylinders are tandem and rest on one foundation, those for the larger engines being twenty-three inches and thirty-six inches in diameter respectively, with a forty-eight inch stroke. The low pressure cylinders of each engine are on separate foundations, and are fifty-two inches in diameter by forty-eight inches stroke. The dimensions of the cylinders of the intermediate engine are 16 × 25 × 36, with forty-eight inch stroke. There are two intermediate receivers provided for each engine, which are placed above the cylinders as shown, with suitable steam pipe connections. These receivers are also lined with a coil of copper pipe about one and a half inches in diameter, which are charged with live steam to dry and superheat the exhaust steam before it enters the next cylinder; these receivers are also provided with insulating covering to prevent radiation. The cylinders are all steam jacketed and are also properly

constructed regardless of cost, making it absolutely reliable and capable of taking care of any possible emergency. The flywheels of the large machines are double crowned, and are of mammoth proportions, being each twenty-eight feet in diameter with a ten foot seven inch face, and weigh eighty tons. These wheels are built up of two rows of ten sections each with two sets of ten arms of elliptical section, which are bolted to the rim at the intersections, and also bolted to the hub which is cast independent of the arms. Each flywheel is coupled to the countershafting, which is located to the right in the basement of by two enormous double-ply leather belts, each fifty-four inches wide, and 150 ft. long, being carried under the generator floor by means of adjustable belt tighteners.

The system of countershafting is about the same as that adopted in the central power station, and its mechanical details are clearly shown in the accompanying illustration (Fig. 2). As will be seen, it is provided with the latest appliances for reducing the amount of useless friction and wear. Each section consists of a ten inch steel shaft with nine inch bearings. The main pulleys are each eight feet in diameter, with the same width of face as the flywheels, and carry the main driving belts. These pulleys are supported on a hollow steel sleeve with

independent bearings, which allows the shaft to pass freely through so that it can be driven, when the clutch is set, by each engine independently of the other. This method of mounting provides that the weight of the pulley and the strain of the heavy belt are borne independently of the shaft, as the strain on the shaft when running is taken outside and close to the bearings instead of between the bearings. A clutch ring is attached to the sleeve, and to the shaft adjoining is keyed an eighty-four inch friction

with the usual switch equipment with a lever so arranged that all the drop switches can be closed at once by one movement of the lever. Both the engine and generator floors are served with a traveling crane which provides for readily handling the heavy parts.

The boilers of the Cambridge station are the Babcock & Wilcox water tube type, and are arranged in five batteries. Each battery consists of two distinct boilers composed of three horizontal steam and

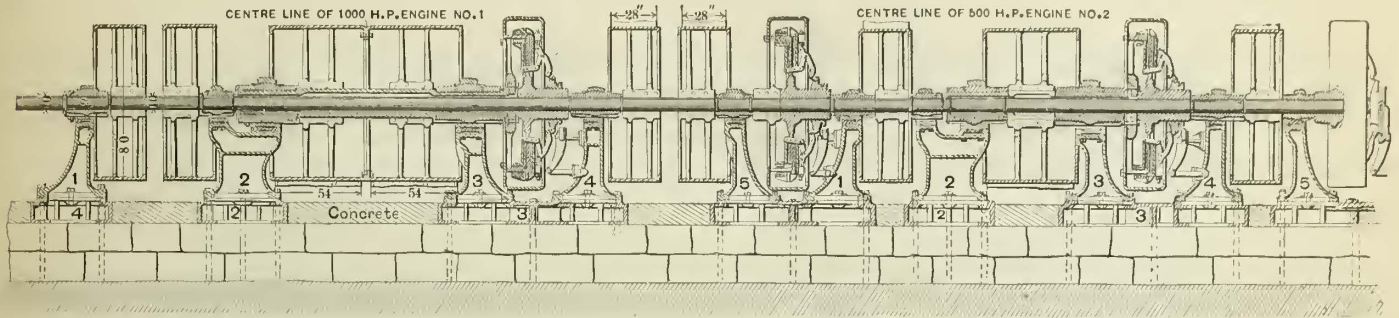


FIG. 2.—SECTION OF SHAFTING—CAMBRIDGE POWER STATION, WEST END STREET RAILWAY.

clutch, specially designed for this purpose, the whole being provided with a casing. The dynamo or driving pulleys are placed on each side of the main pulley, and are of the same diameter, with a thirty-two inch face, and drive the generators, which are located on the floor above by thirty inch double ply belts.

All the journal boxes of the countershafting are water jacketed to prevent their being overheated, and the circulation is maintained by means of a system of pipes which communicate with the feed water pipes. The journals are

water drums three feet in diameter running the full length of the setting (twenty-three and a half feet), beneath which are arranged in an inclined position the water tubes which form the principal part of the heating surface. The usual gauges, test cocks, etc., are provided. The arrangement of the interior of the boilers is such that the gases are compelled to travel from the furnace across the tubes three times on their way to the flues which lead to the stack so that nearly all the heat of the gases is utilized before being led into the flues. The coal

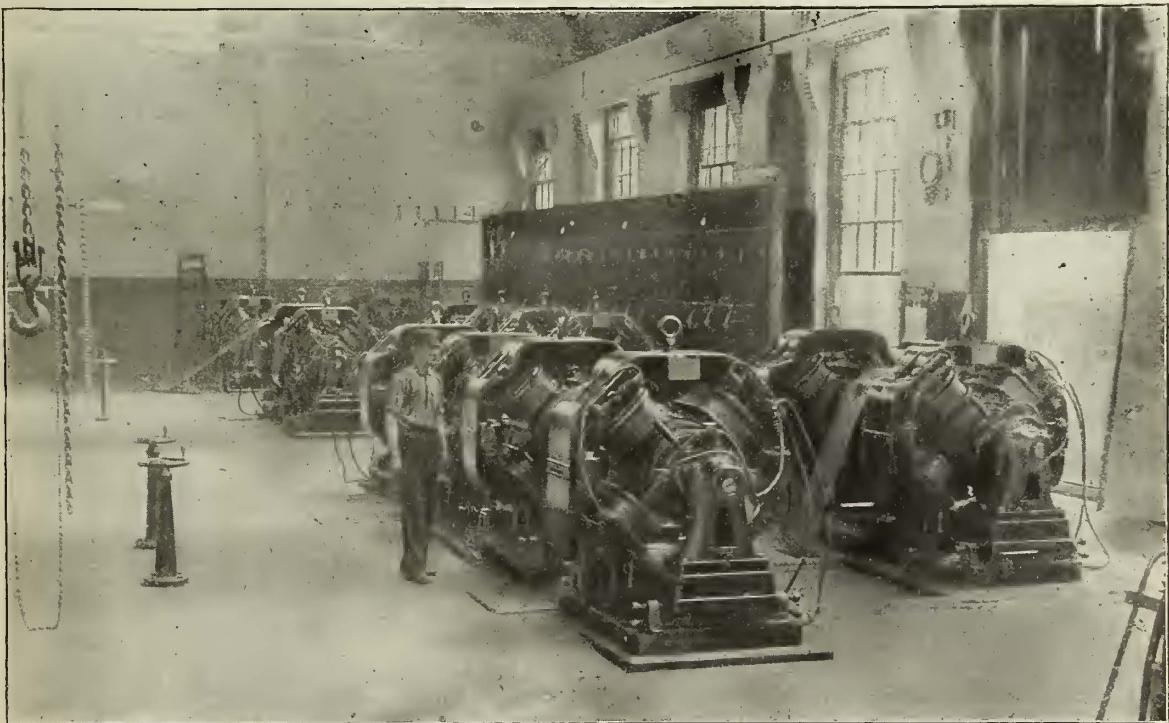


FIG. 3.—TEMPORARY GENERATORS—CAMBRIDGE POWER STATION, WEST END STREET RAILWAY.

also automatically lubricated by means of a second set of pipes which are parallel to the water pipes, and which connect with a supply reservoir, to which the oil is pumped after passing the filter and drip tank.

An interesting feature will be noted from the illustration in connection with the method of mounting the temporary generators; it is that two armatures are attached at the terminals of the same shaft and are driven from one belt pulley which is placed between the armatures; by this arrangement one belt drives two generators.

The switchboard is located at the back of the platform on which the generators are placed, and is provided

is handled automatically, and underneath the floor of the boiler room is located a track with iron cars which receive the ashes from a chute connected with the fire door of each furnace, when they are conveyed to the ash dump and removed by cartage.

The land on which the Cambridge plant is located is a part of the old New England Glass Works property, all of which has been purchased by the West End company, and will be utilized for storing track and other material. The building is a plain brick structure with a smoke stack 235 ft. in height with a seven foot flue. The roof is supported by a riveted lattice truss construction, and is of

a most substantial character, reflecting great credit upon the builders, the Boston Bridge Co. The engines, condensers, countershafting, pulleys and belt tighteners were all supplied by the E. P. Allis Co., Milwaukee, Wis., whose facilities for manufacturing large engines are probably not surpassed by any engine works in the United States, while the clutches were manufactured by the Hill Clutch Works, of Cleveland, and are among the largest and most powerful friction clutches ever built for electrical purposes.

The belting was all manufactured by Mr. Charles L. Ireson, of Boston. Each one is endless, made of the very best stock and is cemented only, neither pegs, rivets nor lacing being employed. The approximate breaking strain of each engine belt is 64,800 lbs., and each pair will transmit 2,000 H. P. at a speed of 6,000 ft. per minute. They are all made from the centres of extra oak tanned hides, and on the pulley sides are made of two twenty-seven inch widths, and on the outside of one middle twenty

diameter. A feed water heater and a No. 4 Cameron pump complete the equipment of the boiler room.

The engine room is 43 × 45 ft., and contains a compound, condensing, automatic cut-off engine, manufactured by the Phoenix Iron Works, of Meadville, Pa., who were also the contractors for the entire steam equipment. The cylinder dimensions of the engine are thirteen and twenty inches by twelve inches stroke, and with 100 lbs. initial steam pressure, cutting off at four-tenths stroke and running 240 revolutions per minute; it develops 150 H. P. There are two flywheels each seventy-two inches in diameter and fourteen inches face. The generating apparatus consists of a Thomson-Houston multipolar generator with a rated capacity of 125 H. P. This is connected to the engine by an endless, light, double belt made by the Bradford Belting Co., of Cincinnati, O., and fifty feet in length by thirteen inches in width.

The power station is located centrally, between the



FIG. 1.—POWER STATION AND CAR HOUSE—ROCHESTER, PA., ELECTRIC STREET RAILWAY.

inch width with a seventeen inch width on each side, requiring the centres of five hides for one width, and 165 hides for each belt. Mr. Ireson also supplied the belting for the central power station, as noted in our last issue, the order for the belting of the two stations being the largest single order for leather belting ever given to one firm.

The Rochester, Pa., Electric Railway.

BY HARTFORD P. BROWN.

The People's Electric Street Railway Co., of Rochester, Pa., was chartered August 18, 1891. John C. Whitla, Theodore P. Simpson, James P. Stone and Harry W. Reeves, of Beaver Falls; Dan H. Stone, of Beaver; Chas. H. Bentel, of Freedom; Henry M. Camp and Hartford P. Brown, of Rochester, were the incorporators and compose the board of directors. All preliminaries having been arranged, work was begun May 18, 1892; and on August 11, 1892, eighty-eight days after construction was begun, the first car was put in operation. The formal opening took place amid the most favorable auspices, on Saturday, August 13, 1892, in the public park at Rochester.

The power station (Fig. 1) is of brick, one story in height and substantially built. The dimensions are 45 × 70 ft. The boiler room is 27 × 45 ft. and is separated from the engine room by a brick wall. It contains one Manning tubular boiler, sixteen feet high and six feet in diameter with seventy flues, each four inches in

Pennsylvania Railroad and the Ohio River, while water for all purposes is pumped from the river, and coal is delivered both by water and rail close to the door of the boiler room. Coal costs delivered at the doors of the furnace ninety-five cents per ton, net.

The car equipment consists of four motor cars built by the Laclede Car Co., of St. Louis. The trucks are the J. G. Brill Co.'s, No. 13 pattern, equipped with elliptical springs. The electric motors are of the Thomson-Houston make, and consist of two fifteen-horse power, waterproof motors to each car. Their type J controller is used on all of the cars, and electric headlights are placed in the dash at both ends of the cars. H. P. Bruce was electrician in charge of this branch of the equipment, and the work speaks well for his skill and ability.

The track consists of forty-five pound girder and T rail made by the Pennsylvania Steel Co., of Steelton, Pa. The former is mounted on chairs and is used in the town, where street paving is expected. The T rail is used in the suburbs, and here the track is planked. This is accomplished by laying outside of each rail a plank six inches wide and of sufficient thickness to come to the surface of the rail and was done to enable teams to drive on and off the track easily and to use it in rural districts for a driveway.

The overhead construction is both bracket and span, the former in the rural districts, and the latter in the towns. A supplementary wire bonded to every rail runs the entire length of the track and aids in the return of current to the generating station,

The line parallels the Pennsylvania Railroad for a distance of about four miles and connects with the Beaver Valley Traction Co.'s line, which in turn parallels the railroad a further distance of six miles. The track of the People's Street Railway crosses the steam railroad three times at grade—twice over four tracks (Fig. 2) and once over two tracks. Safety switches have been adopted as the best security at these danger points, and a brief description of their working may not be inappropriate.

through any other automatic switches. The operation of the safety device requires about thirty seconds.

This road is also equipped with a block signal system which renders collisions out of the question, and reduces delays at sidings to a minimum. This consists of signal boxes, one of which is located at each siding and contains two groups of lamps, each group consisting of three lamps of sixteen candle power each. These lamps are wired in series of six, the three lamps in the upper half of one box being connected directly with



FIG. 2.—CROSSING STEAM RAILWAY AT ROCHESTER PA, SHOWING ARRANGEMENT OF SAFETY SWITCH.

The safety switches, two of which are placed at each railroad crossing, consist of a switch which is set to derail the street car approaching the crossing, and run it from the track in a line parallel with the steam railroad. By this means a car not under control can never run into danger from collision with the steam cars. The safety switch is controlled by a lever placed at the opposite side of the steam railroad tracks and connected with the switch point by interlocking material.

In order to make the crossing the car is stopped at the point of derail, while the conductor crosses over to the

the three lamps in the lower half of the next box about 4,000 ft. away, and are supplied by a current of about one ampere, taken from the trolley wire and carried by a No. 12 galvanized iron wire, in order to get the resistance necessary. Each box is equipped with two three, way switches for turning off the lights, or turning them on as the car enters the section. The cars going in one direction are blocked by lamps burning in the upper half of the boxes, and in the other direction by lamps burning in the lower half of the boxes.

The conductors and motormen are all neatly uniformed and are noted for their tidiness, and vie with each other in polite attentions to the traveling public.

The first half month of operation the road registered 28,000 passengers, and travel continues to increase rapidly. The completion of this road has connected the towns of Beaver Falls, New Brighton, Beaver, Bridgewater, Rochester, Freedom, St. Clair and Vicary, with an aggregate population of nearly 40,000 inhabitants, into one community.

The officers of the road are: H. P. Brown, president; J. P. Stone, secretary; C. H. Bentel, treasurer. C. A. Danals is superintendent, and Frank Mason electrician.

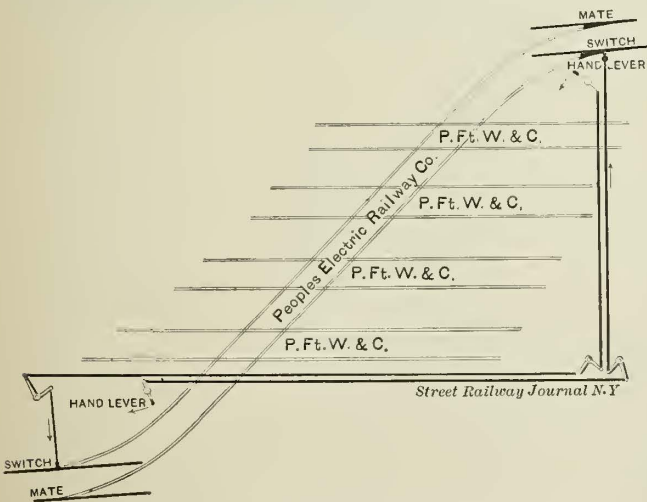


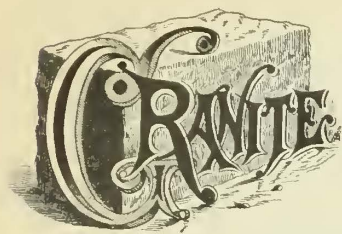
FIG. 3.—DIAGRAM OF SAFETY SWITCH MECHANISM— ROCHESTER, PA.

lever, and if the crossing is safe, raises it to a perpendicular, which throws the derail into continuous rail, and permits his car to pass the derail point. The motorman, with his eye on the switch point, sees the change as soon as effected, runs his car through the safety switch, rings his gong three times as a signal for the conductor to return to his car and cross over with it. Cars moving away from railroad crossings pass through the derail points as

A LANG lay wire rope manufactured by Thomas & William Smith, ropemakers, Newcastle-on-Tyne, England, which has been in service for nine and a half months on the line of the Providence Cable Tramway Co., was retired from service on July 1, it having been in service two months longer than any rope previously employed on this line. Its total mileage was 39,238. The rope is still in fair condition, and will probably be again put in service during a season of light traffic in the winter, it having been removed for fear it might not stand the extra Fourth of July traffic.

A NEW electric railroad, to be known as the New York, Mapleton & Van Pelt Manor Railway, is to be operated between Brooklyn (N. Y.) and Coney Island.

THE STORY OF A PAVING BLOCK.



when of a proper texture, is generally considered the most desirable formation for paving blocks, for the reason that the stones make a more excellent and enduring pavement than sandstone or trap rock.

All granite, however, does not possess good paving qualities, and a capital distinction should be made between a formation that is too soft, too brittle and unsound, and that which is tough, light colored and sound. It is the story of the latter that we are to tell, such a block as will sustain a crushing weight of about 18,200 lbs. to the cubic inch, and will have a life of fifteen or twenty years under heavy traffic in the streets of our large commercial cities.

When we reflect that the two cities, New York and Brooklyn, alone consume on an average from 15,000,000 to 20,000,000 of blocks per year to keep their streets in proper condition, we are impressed with the importance of this industry for the entire country, and our curiosity being excited, we are at once possessed with a desire to know the history of the little blocks that form such an important factor in road making. In order to gratify this desire we recently made a trip to Cape Ann on the coast of Massachusetts, one of the most interesting granite regions in this country, where we obtained the material for our story.

Granite is a crystalline granular rock consisting, in its typical varieties, of feldspar, mica and quartz, and is so named from the Latin *granum*, a grain, in allusion to its granular texture. A large number of other minerals occur in granite, and upon the presence of these supplementary minerals, the numerous varieties of granite are founded. The most common accessory constituent of granite is hornblende, a mineral which appears to replace to some extent the mica, and thus produces a hornblendic or syenitic granite, so named from Syene in upper Egypt where the extensive quarries of this type of rock were worked by the ancient Egyptians, and from which the obelisks were quarried. Many students, however, restrict the term syenite to a granite from which the quartz has disappeared while the mica has been superseded by hornblende. The hornblendic varieties are remarkably tough, rendering them the most suitable as a road material.

Granitite is a name applied to a variety of granite made up of orthoclase and quartz with more or less plagioclase and a small proportion of mica. This formation is also durable as a road material.

The granite of Cape Ann is designated in the government geological reports as a granitite, while some local petrographers claim that there are large areas of typical syenite, and that the name should be hornblendic biotite

granite. This question we will leave for the petrographers to settle, as well as that regarding the origin of granite, whether it is to be regarded as the original bed rock of the earth's crust, forming the floor of all subsequent deposits and the nucleus of mountain chains, or whether it is a metamorphic rather than a truly igneous rock and the child of almost any geological age. It is sufficient for our purpose that it is old enough to be tough.

Cape Ann though nominally a promontory is practically an island. It is about ten miles wide, and is formed by the projection to the northeast of a ridge of granitic rocks extending from near Dedham, Mass., until cut off by the sea, and extends about twelve miles from the general line of the shore. The internal area of Cape Ann is pretty deeply and evenly covered by



FIG. 1.—VIEW OF GRANITE QUARRY FROM THE BRINK.

glacial drift, but on the shore line, especially near the extremity of the promontory, the surface has been planed down by the erosive power of glacial ice and by the action of the sea in a post-glacial period, both when it was at its present level and when the shore was higher, so that large areas of granite are exposed and in favorable position for quarrying. The quarries that interested us most were in the vicinity of Rockport, Lanesville and Pigeon Cove, villages located at the extreme point of the cape, and which are reached by rail from Boston. Near the first the Rockport Granite Co., of which Mr. F. E. Foster, is superintendent and Mr. Chas. E. Rogers, treasurer and general manager, work extensive quarries and mine the rock, not only for paving but also for monument and building purposes. At the other places Mr. Charles Guidet owns a number of quarries which are worked under the supervision of Mr. L. A. Martin, and the entire output is employed for paving purposes, Mr. Guidet himself being a paving contractor in New York.

Figs. 1 and 2 show the general and economic equipment of typical quarries, from which it will be seen that a number of steam derricks are employed for lifting the blocks and placing them on tram cars or wagons for transportation. The derricks are operated by steam power, a portable hoisting engine being located at suitable positions for this purpose, from which the power is

transmitted by either manilla or wire ropes which are attached to the block to be moved by suitable clamps or hooks. The entire area of the quarry illustrated in Fig. 1 is about two acres, and in places the excavation has reached a depth of fifty feet. The rock in all the quar-

five pounds of blasting powder, and exploded by an electric spark. Frequently it requires three or four charges to accomplish the work, as the holes are not usually tamped, a better break, it is claimed, being obtained by repeated charges rather than by tamping, when it would require only

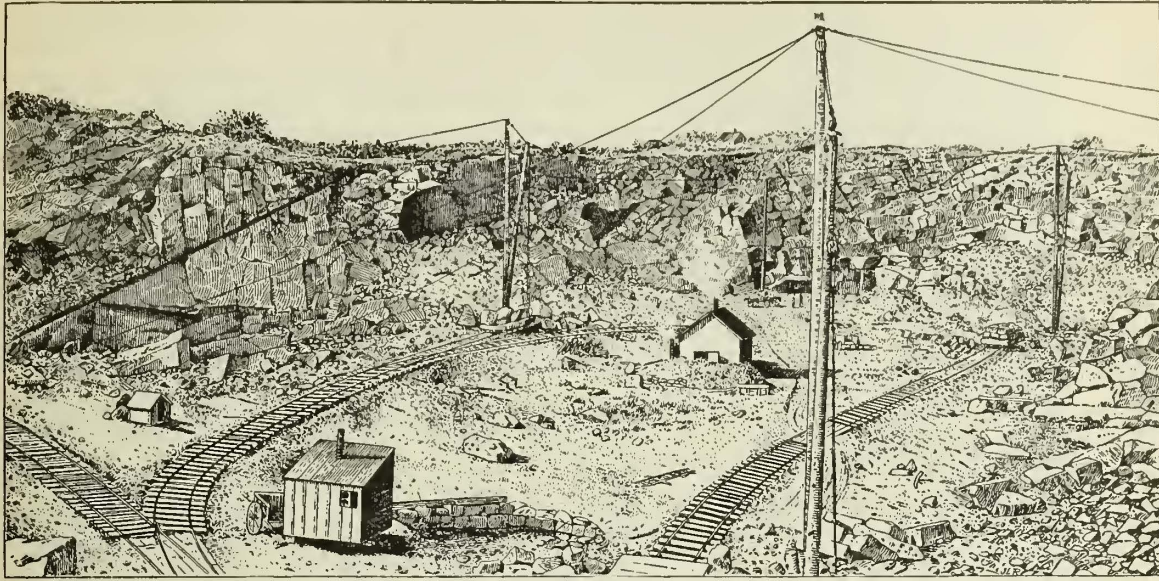


FIG. 2.—SOUTH PIT OF ROCKPORT GRANITE CO.'S QUARRY, SHOWING GENERAL STRUCTURE OF ROCK AND ECONOMIC EQUIPMENT OF THE PIT.

ries is cut into irregular shapes by joint planes, which in most cases run in horizontal lines, but sometimes in a perpendicular direction (Fig. 3). The attitude of the joint planes to each other regulates the quarrying of the rock in large or small masses as the case may be.

Besides being cut up into irregular masses by the joint planes, the quarried rocks of Cape Ann exhibit in an interesting manner the phenomenon of "rifting." By the term "rift" is indicated an incipient fracture in the rock which has not developed in the form of a joint plane, but along which the rock readily splits, although no relation seems to exist between these incipient fractures and the joint planes. It is owing to these features that the rocks of this region are so serviceable to the quarrymen. For convenience the quarrymen divide the rift lines into the "rift" and the "cut-off"; the most manifest of these is whatever direction they term rift, and the economical quarrying of the rock with reference to the rifts and joints measures the skill of the quarry foreman.

Having studied the character and some of the peculiar traits of the rock of this region, we are now ready to follow the details of quarry work, and for this purpose we will go down into the pit (Fig. 4) among the workmen. The first work consists in starting from their original bed as large masses as possible by blasting, and for this purpose steam drills are employed, with which a nest of three or four holes within a few inches of each other are drilled to the depth of from ten to eighteen feet, depending upon the depth of the seam. Each hole is then charged with twenty-

having done its work, the detached portions are now cut up by hand into blocks of a suitable size for handling. The foreman first lays off the dimensions and indicates the rifts with a chalk line when a number of men with hand drills proceed to cut a line of five-eighths of an inch holes (Fig. 4) to a depth of three inches and four to five inches apart. A row of holes being completed across the mass, a wedge is inserted in each one, or rather "plugs and feathers," as the quarrymen say, which

one charge. The charge is usually so placed that one end of the mass to be displaced is free, as the rock seems to be held in its bed under enormous pressure, and a satisfactory fracture cannot be had if the entire mass is bound. So great is this normal pressure that a block on being released seems to expand, as it cannot be replaced in its bed, being much too large for the hole from whence it came. The blast

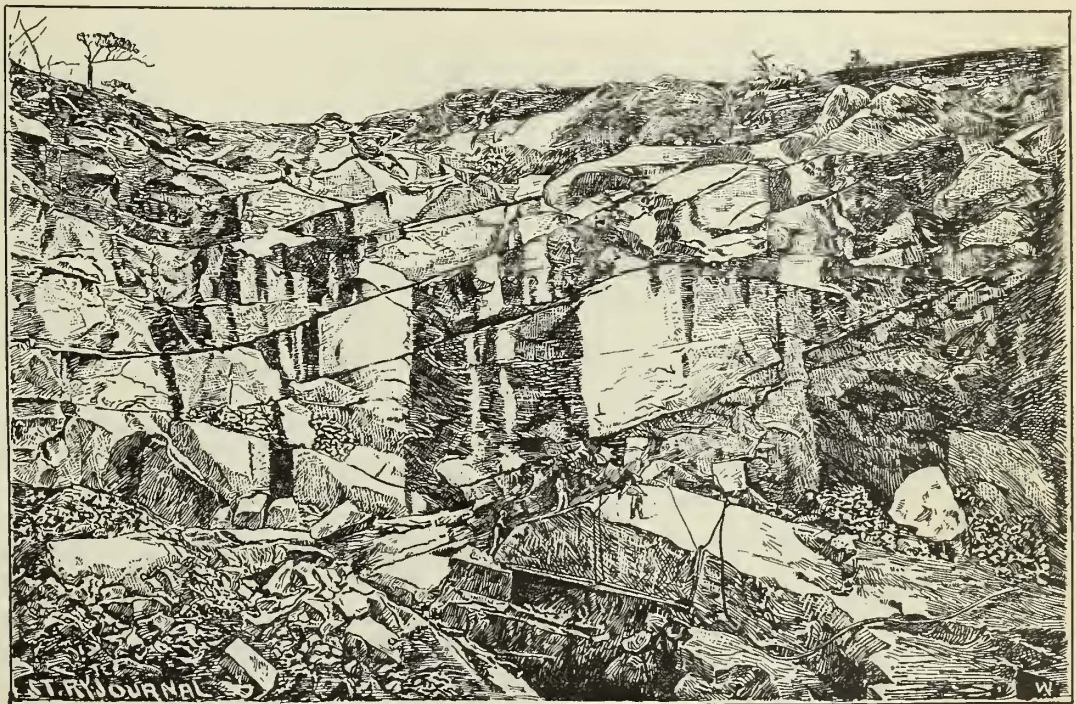


FIG. 3.—JOINT PLANES, SHOWING CHANGE IN CHARACTER IN DEEPEST PARTS.

consist of a tapering steel plug and two steel cheeks. These being in place, one of the men with a hammer of medium weight gives each wedge in succession a firm blow, and then a second, and usually by this time he has gone half way across the block; with the third blow the block has opened with a nearly straight fracture. Masses of almost any size are thus detached and in an incredibly short time. The dimensions to which the blocks are cut

in the quarry depend upon the size of the paving blocks which are to be made from them. Usually these are three feet wide and from three to six feet long and two and a half feet in depth. A day's work for one man in drilling wedge holes is usually from seventy-five to 150 holes in a day, but occasionally an expert will drill as many as 200.

This work being accomplished, the foreman places a mark upon each block to indicate the direction of the rift as a guide to future cutting, when the blocks are removed by the derricks (Fig. 5) and transported upon wagons to the cutting shed (Fig. 6), whither we will follow them presently. Frequently the quarrying continues to such depth that water veins are struck and it becomes necessary to provide powerful steam pumps and lines of hose and iron pipe for the purpose of lifting and discharging the water over the brink of the pit. Steam for the operation of the pump, drills and derricks is usually obtained from the boiler of the hoisting engine, but sometimes special boilers are provided. The area of a quarry is frequently limited on one side by what the quarry men term a "blue seam," but which is known as a dike; in most cases these are perpendicular veins from a few inches to a foot in width across the granite, and are generally composed of diabase or quartz porphyry. The dikes are in most part character-

in their nature secretions from the granitic mass formed during the cooling process.

As stated above, the quarry which we are visiting, near Pigeon Cove, covers an area of about two acres,

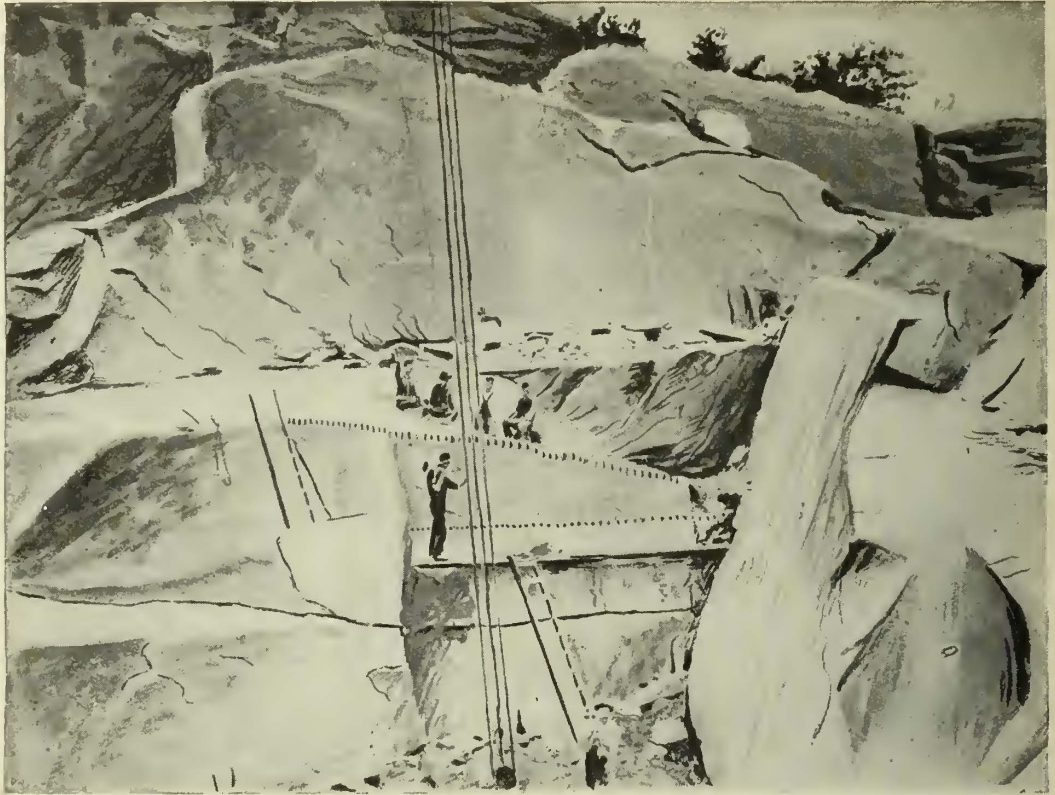


FIG. 4.—SPLITTING UP THE ROCK BY HAND AFTER THE BLAST HAS DONE ITS WORK.

but of irregular depth. At the time of our visit four layers of thick granite had been quarried, and a fifth, with an area of about one acre and estimated to be thirteen feet thick, had been uncovered, and was being cut out. The texture of the rock is said to improve with the depth, it being of a lighter color and firmer grain. The top and bottom surfaces of the different layers are discolored to the depth of two or three inches, which is termed the "sap portion." For cutting into paving blocks the sap is not removed, as it is just as durable as the other portions, but from stones designed for monuments or building purposes it is trimmed off. In this connection it is interesting to refer to the skill that must be exercised on the part of the foreman in placing a blast for breaking up the large masses, especially in the quarries where the rock is employed for monument and building purposes. The superintendent of the Rockport Granite Co.'s quarries called our attention to a mass that had been detached, which he said would be worth \$15,000 when prepared for market, but which could have been spoiled by an injudicious placing of the blast. In the same quarry we saw another block just quarried that was estimated to weigh 7,500 tons, being about sixty feet long, forty-five feet



FIG. 5.—HOISTING THE BLOCKS FROM THE QUARRY.

wide and thirty-five feet high. But to return to the paving work. Our block, which has been removed to the cutting sheds (Fig. 6), is now drilled and split with wedges into slabs by the cutter, in the same manner as before described. The slabs, which are about eighteen inches across and three or four feet

wide and thirty-five feet high. But to return to the paving work. Our block, which has been removed to the cutting sheds (Fig. 6), is now drilled and split with wedges into slabs by the cutter, in the same manner as before described. The slabs, which are about eighteen inches across and three or four feet

wide, are then laid on the ground, when the workman traces a shallow channel across the middle with a chisel or a sharp edged hammer, and then with a heavy sledge breaks the slab along the line of the tracing; this process continues until the slab is broken up into paving blocks

going as far south as New Orleans. For a return cargo these vessels usually bring coal which they discharge at Boston or at the coast towns of the vicinity.

Our block having completed its voyage and been discharged, on some New York wharf, for instance, is then after a little while transferred, with its fellows, in wagons, and stored along the curb of the street to be paved (Fig. 8), where it awaits the advent of the pavers. A suitable foundation having been prepared and covered with a layer of sand, the pavers place the blocks one by one in regular rows across the street, when they are thoroughly tamped and brought to a level and the joints are filled with a grouting material. Although our story is nearly completed, the real life work of the subject has only now begun, and although, at first

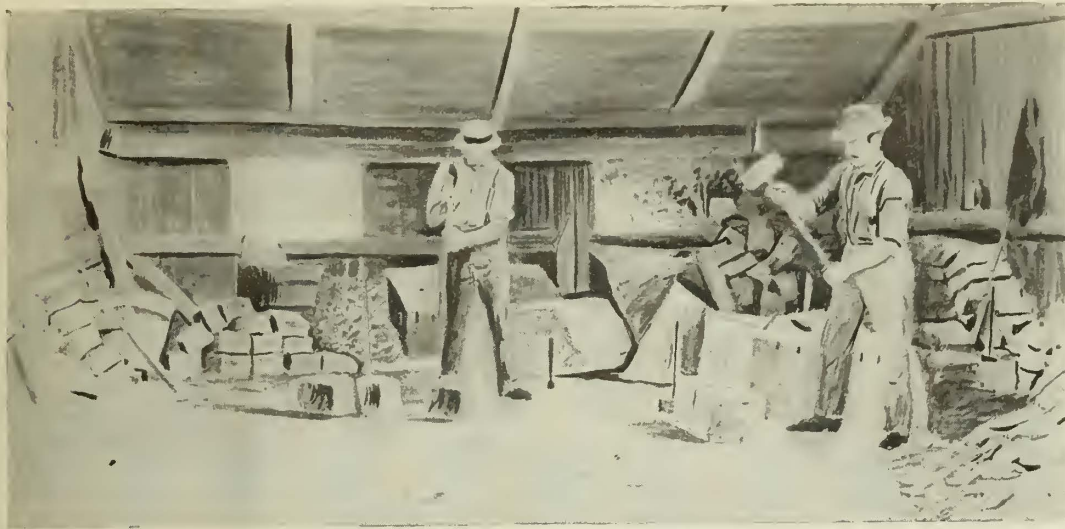


FIG. 6.—CUTTING SHED—SPLITTING AND TRIMMING TO STANDARD DIMENSIONS.

of proper dimensions, the New York standard being three and a half to four and a half inches in width, from eight to twelve inches in length and seven to nine inches in depth. The blocks are then placed upon a stand, shown at the back of the shed, and trimmed with a square faced hammer, one deft blow being sufficient, usually, to remove a large chip. The blocks are then thrown through the window to the back of the shed and are ready for shipment. A cutter usually gets out from 75 to 150 blocks per day, and the price received for cutting is about \$23.00 per thousand. The cutters become very expert at the work and can trim a block in a remarkably short time. Besides the regular quarry work in this locality, a number of cutters work independently of the contractors, and cut up the granite boulders and surface rocks which are found in all the regions and sell their products to the regular dealers. From the sheds the blocks are transported in wagons to the harbor and piled along the wharf or upon the sea wall to await shipment (Fig. 7).

sight, it seems to occupy a very ignoble position, being always under foot and subject to the ceaseless pounding of passing vehicles and animals, yet it contributes more largely to human comfort as a road material than the stones that enter into the construction of imposing buildings, or those which mark the resting places of the dead, or compose the monuments to heroes. Granite makes a comparatively smooth pavement, is easily kept clean, and although noisy and sometimes slippery in wet weather, it is, as before stated, very durable, provided the blocks are of proper texture and care has been exercised to pre-

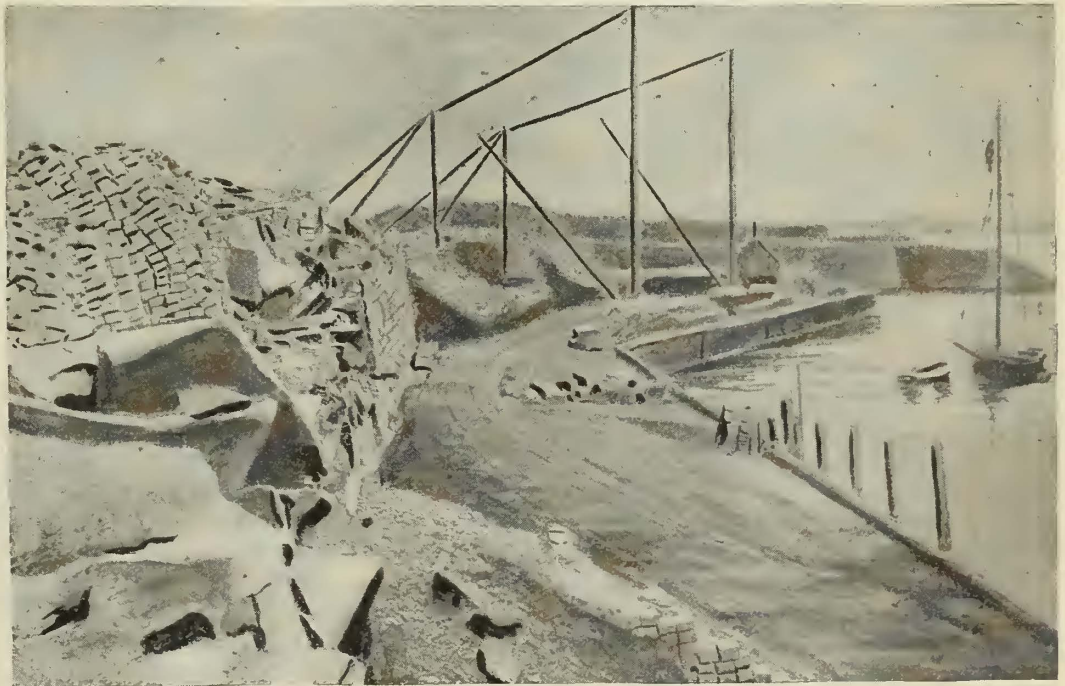


FIG. 7.—BREAKWATER AND HARBOR NEAR PIGEON COVE, WHENCE THE BLOCKS ARE SHIPPED.

As no natural harbor exists on this rock bound coast, it has been necessary to build breakwaters to provide a safe haven for the vessels. These harbors belong to private owners, and have been built at great expense. The sea wall consists of a riprap composed of refuse material from the quarries, and is necessarily very high, as the waves on the coast at times reach an enormous height. These harbors provide for vessels drawing about twelve feet of water at low tide, and these being laid alongside the wharf as shown, are loaded by means of chutes or by buckets operated by derricks. About 50,000 blocks constitute the ordinary load for a schooner, and they are shipped to all the principal cities on the Atlantic Coast,

vent the placing of blocks from different quarries in the same section. In case these precautions are not observed, unsatisfactory results will follow, for the blocks will wear unevenly and produce a rough surface.

It must not be inferred from the above, that granite for paving purposes is quarried only on Cape Ann, for this industry is extensively conducted in other localities throughout New England, but chiefly in Quincy, Mass.,

and on Rockland, Fox, Deer and Hurricane Islands off the coast of Maine. The quality of the blocks varies with the different localities, but it is claimed that there is no paving quarried superior to that found on Cape Ann.

Our story proper is concluded, but there is much of interest both physical and commercial that clusters

due to the relative lightness of the plants, and in a large measure through the pull which the deep currents are able to make on the extended fronds of the seaweed; thus in time the pebble is detached from its ancient fastenings and is brought into the mill of the surf when it is separated from the plant that brought it ashore, and is rolled about the beach until worn out or becomes impounded in some beach pocket.

Another portion of pebble material consists of blocks of granite which have been ruptured from the cliffs by the action of the waves and frost, but a good many of the small beach pockets, especially in the vicinity of Halibut Point, are almost entirely composed of rounded waste from the quarries, or from angular stones which have been discharged into the sea from excavations made in the headlands around the cape by parties exploring for suitable quarry stone.

Still another source of supply is found in the riprap of which the

breakwaters are composed. The pebbles formed from quarry stones are termed artificial pebbles and are readily distinguished by the eye from those formed in the natural way of material broken from the cliffs, or from deep sea deposits, as the former usually retain a blue gray hue of the ordinary quarry stones, while the latter are generally discolored by decay. The rate of wear which the surges produce on the angular masses from the quarries is very considerable, and it only requires the exposure of a single year to the full beating of the waves to produce a considerable rounding of the mass, while in ten years a large block will wear away to the familiar form of a beach pebble.

Other interesting features of this region are the evidences—consisting of the scouring action of the waves

about the region from whence our paving block was quarried and upon which we may dwell with profit. The first relates to dikes, of which there are more than 360 in the Cape Ann region, and of which we have before spoken. Their formation and the peculiar manner in which they cut the granite is strikingly illustrated in Fig. 9. The presence of these dykes has much to do with the contour of the rocky shore, for, being generally of a softer material than the granite, they yield to the erosive action of the sea which forms chasms or sea caves in the direction in which the lines of weakness extend. In sections where the dykes are not numerous, and the original inclination of the shore toward the sea is not abrupt, the effect of the marine action is not very apparent (Fig. 10), as the surges slip up over the slope and expend their energy in lifting the mass of water above the base.

The cost of Cape Ann is cut at frequent intervals with small fiord-like embayments, and these bays afford a place of deposit for the materials derived from marine action. Much of this beach accumulation is composed only of pebbles or boulders measuring from two inches to two feet in diameter, the mud produced by the wearing of the pebbles on the beach having been drawn away into the depths of the sea by the undertow. These pebbles are often thoroughly polished by marine action, and when of suitable size and shape—from six to ten inches—are frequently collected by the inhabitants who build them into garden walls, or place the more ornamental stones along their walks, or build them into ornamental towers which answer for gate posts. The material from which the pebbles are rolled consists in part of glacial detritus in the form of small boulders lying upon the sea floor, but which have been detached from their beds and transported within the area of wave action by the growth of seaweed upon their upper surfaces. This action of the sea weed is brought about partly by the impulse to float



FIG. 8.—FINAL STAGE—PLACING THE BLOCKS IN THEIR LITTLE BED.

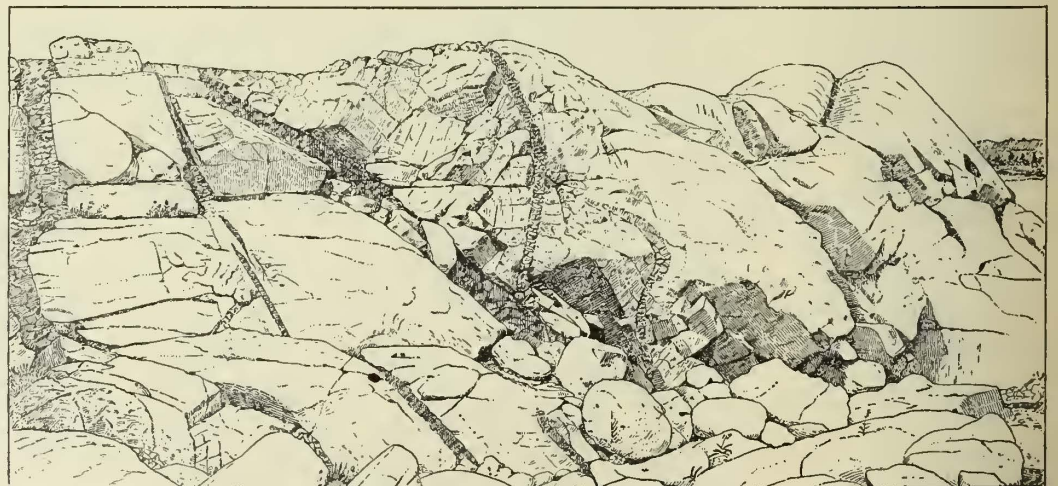


FIG. 9.—DIKES CUTTING GRANITE.

and the indentations which they have produced on the bed rocks—that the sea has stood in ages past at successive levels above its present tide mark to the height of 150 ft., and also that it has retreated to a still lower level; and there are now evidences—consisting of submerged forests—that the coast line is gradually sinking. While these are interesting features we cannot dwell upon them, and must refer the reader to the Ninth Annual Report of the U. S. Geological Survey for further physical features.

We now turn to a more practical feature and one

which is destined to work considerable change in the character of the extreme coast line and in the business of the locality. We refer to the extensive breakwater now being constructed by the government near Rockport, and which when completed will provide one of the largest harbors of refuge on the Atlantic Coast. The breakwater is located some distance from the shore and extends from Straitsmouth Island towards Andrews Point. The wall is being built of granite which is furnished by the Rockport Granite Co. and the Pigeon Hill Granite Co. The foundation will be of riprap, but from near the surface a solid sea wall will rise sufficiently high to protect the harbor from wave action, and into which coasting

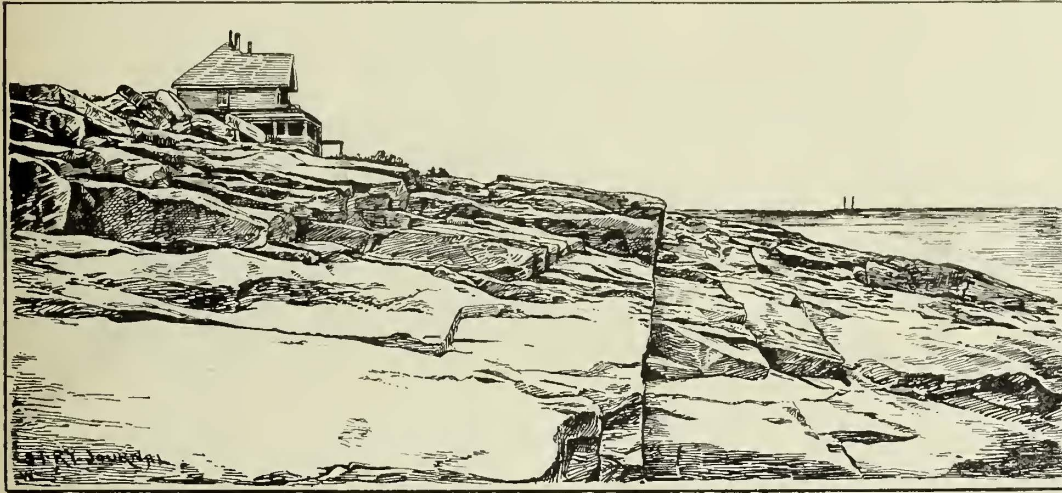


FIG. 10.—SEA SHORE NEAR PIGEON COVE, SHOWING THE EFFECT OF WAVE ACTION.

vessels can take refuge during storms. The material is transported from the quarries near by on tram cars. A deep cut having an arched bridge leads out from the quarry, so that it is not necessary to hoist the rock except to place it upon the cars which descend by gravity and deliver their loads directly upon dumping scows which are towed into position by tugs, and discharge their contents upon the line of work. This breakwater when completed will enclose 1,664 acres of good anchorage which, it is estimated, will accommodate 5500 vessels. The entrances will be located so that vessels can enter or leave with the wind from any point of the compass.

The importance of this work can be readily seen in the fact that from 78,000 to 100,000 vessels pass this point annually.

This illustrates another way in which granite is utilized and made to minister to human progress and human comfort, and, as in the case of coal, emphasizes the wise provision made by the Creator in ages past for the present comfort of man.



FIG. 11.—STEAM DRILL AND OTHER TOOLS EMPLOYED FOR CUTTING GRANITE.

COMPRESSED air delivered from a flexible hose with a small nozzle at a pressure of fifty pounds to the square inch is very effective in cleaning plush cushions. It is so used on the Union Pacific Co.'s road.

New Electric Railway at New Haven.

The city of New Haven was for a long time one of the few cities in this country having a population of over 20,000 which had not installed an electric railway, but two are now in operation in that city, viz., the Morris Cove Electric Railway and the New Haven & West Haven Electric Railway. The latter, which is the larger, has now fifteen cars equipped with electric motors, and the entire line, with the exception of a small branch, is now being operated by electric power.

This railway extends a distance of about four and a half miles from the centre of the city through West Haven to Savin Rock, a popular shore resort. There is also a branch of three quarters of a mile in length to City Point also operated by electric motors.

The line is double track, and is laid throughout, except at curves, with a sixty pound T rail, furnished by the Johnson Co., of Johnstown, Pa. The curves are laid with sixty pound, grooved, girder rails. On those streets where block pavement is in use chairs are employed to support the rail; elsewhere it is spiked directly to the ties. The latter are 6×6 ins. × 7 ft. in size and are spaced three feet between centres.

On part of the road within the city the track is also supported on a layer of concrete. For bonds galvanized iron is used, fastened through the lower flange of the rail by wedges and then riveted.

The power station is at about the centre of the line, and is located on West River very near New Haven Bay, so that fuel can be brought by boat to within a few hundred feet of the boilers, and plenty of water is available for condensing purposes. The boiler room is 28 ft. 9 ins. × 72 ft., and contains three Manning upright boilers manufactured by the Bigelow company of New Haven. The principal dimensions of these boilers are as follows: Diameter of shell, 56 ins.; diameter of firebox, 60 ins.; water leg outside, 72 ins.; number of tubes, 152; height of boiler, 18 ft.; the pressure in use, 150 lbs. This room also contains a Deane feed pump and condenser, a National feed water heater and Lowcock economizer. At present a forced draught is employed, produced by a G. C. Hawkins fan driven by a five horse power Westinghouse engine. The engines are at present running non condensing.

The generator room is 31 × 72 ft., and contains room for 1,000 H. P. of engines. The engines at present in position are three in number, and were furnished by Westinghouse, Church, Kerr & Co. They are compound, with cylinder dimensions 13 × 22 × 13, and each is directly connected to a Westinghouse multipolar, 180 H. P. generator. The switchboard is one of the open frame type, and is supplied with station appliances manufactured by the Westinghouse Electric & Manufacturing Co.

Part of the old rolling stock of the company now serves as trailers, and part has been fitted with electrical apparatus. The new cars are especially handsome, and are from the works of the Newburyport Car Manufacturing Co., of Newburyport, Mass. The motors were built by the Short Electric Railway Co., are of the single reduction pattern, horizontal split, and have shown excellent results in practice. The line has frequently to carry large crowds on holidays, and a car crowded and propelled by one motor has frequently drawn a crowded trail car.

The erection of the overhead line was done by the company themselves, and span wire construction is used throughout. The line is divided into three sections. The feed wires were supplied by the Simplex Electric Co., and the trolley wire by Wallace & Son, of New York. The

poles within the city limits are of iron, and outside of wood. The manufacturers of the iron poles were the Walworth Manufacturing Co.

On Labor Day the company, with fifteen motor cars and seven trail cars, carried 21,000 passengers.

The First Trolley Road in New York.

The first electric railway to be put in operation in New York City was on September 18, when ten cars belonging to the Union Railway Co. were put in service between 134th Street and Fordham. The event called out a large crowd of observers who made many favorable comments on the handsome cars and the change of motive power. Since that date a second division, that running out Boston Road to West Farms, has been put in operation, and on September 25 the cars crossed Harlem River, and started making regular trips from the southern terminus of the road at 128th Street and Third Avenue.

The line of this railway extends for a considerable distance under the structure of the Suburban Elevated Railway and the engineers wisely concluded to use this for the support of the trolley wires. The method adopted where the lower girders are within reach of the trolley pole, and the appearance of the system are shown in Fig. 1. An inverted wooden trough, which contains the trolley wire, is bolted to the cross braces of the structure, as shown, the trolley insulators being of a special type and secured by bolts to the trough. At points on the

out and ceiling of birdseye maple, natural finish and vine decorations. There are bevel glass windows at each end, and the car is lighted with four interior electric lamps, and carries an electric headlight. A Meaker fare regis-

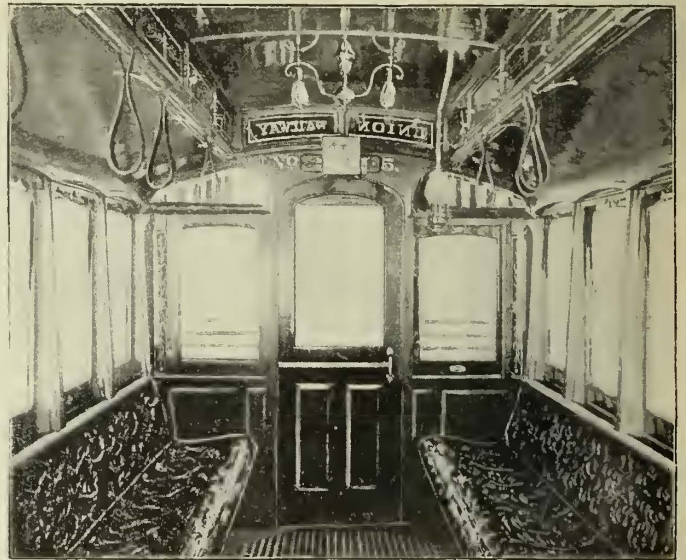


FIG. 3.—INTERIOR OF CAR—UNION RAILWAY CO.

ter, Lieb trolley stand and ratchet brake handle complete the equipment of the car body.

The trucks are of the Peckham radial gear type and carry two Thomson-Houston W. P. motors of twenty or thirty horse power each. Thomson-Houston lightning arresters and type D controller are also used.

The entire equipment was installed under the direction of L. H. McIntire, chief engineer of the company. Further details in regard to the road, and full particulars of the power station, were published in our last issue.

The Buda-Pesth Convention Postponed.

The Annual Convention of the International Street Railway Association, which was to have occurred at Buda-Pesth during September has been postponed on account of the cholera. The meeting will probably be held at Buda-Pesth, during the month of May, 1893.

The prospect is that the Engineering Congress, which is to be held in Chicago in 1893, under the auspices of the World's Congress Auxiliary, will be a gathering of very great scientific importance. Of the \$15,000 estimated to be necessary for its expenses, \$10,000 have been raised. Many of the most prominent engineers of the world have

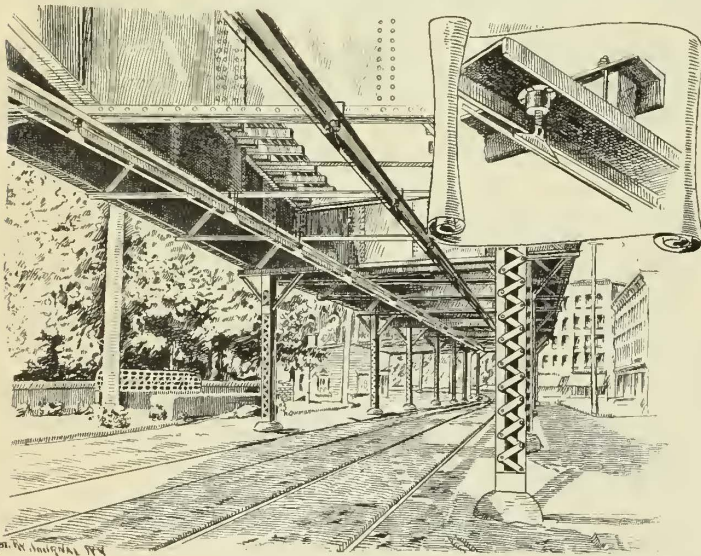


FIG. 1.—METHOD OF ATTACHING TROLLEY WIRE TO ELEVATED STRUCTURE—UNION RAILWAY CO.

line where the height of the elevated track above the street does not admit of this construction, ordinary span wires are employed, supported on the side posts of the elevated railway. Two great advantages of this method are that there are no added obstructions to the street, and that the danger of crosses and grounds from falling telephone, telegraph or other wires is entirely eliminated.

The cars of the Union Railway Co. are especially worthy of mention on account of their substantial and handsome appearance. The bodies are eighteen feet in length and were built by the St. Louis Car Co. There are six high windows on each side and the name of the company appears in gold on the main panel which is painted a Munich red with silver striping. The car number is in English vermilion shaded with yellow and orange, and is on the cove panel, while this panel and the rest of the exterior is a cream with chrome green decorations. The interior of the car is finished in cherry, with brass trimmings through-

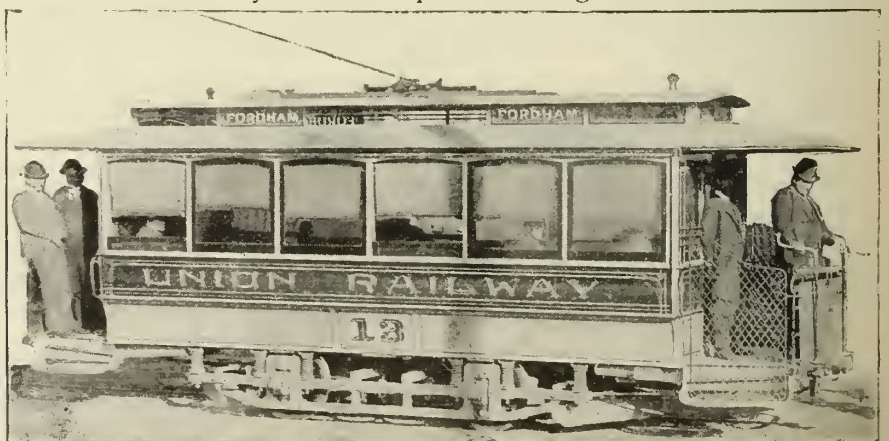


FIG. 2.—ELECTRIC CAR—UNION RAILWAY CO.

accepted memberships on the Advisory Council, among whom may be mentioned William H. Maw and James Dredge of the London *Engineering*; Don Fernandez Leal, president of the Mexican Society of Engineers & Architects; Sir C. S. Gowzski of Canada, and others.



DELEGATES AND OTHERS IN ATTENDANCE AT THE TENTH ANNUAL MEETING OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION.

Tenth Annual Convention of the Street Railway Association of the State of New York.

The Tenth Annual Meeting of the Street Railway Association of the State of New York was convened at the United States Hotel, Saratoga Springs, at twelve o'clock, September 20, 1892, Mr. John N. Beckley, of Rochester, president of the Association, in the chair.

The following delegates from railway companies were present: John W. McNamara, president Albany Railway, Albany, N. Y.; Daniel F. Lewis, president Brooklyn City Railroad Co., Brooklyn, N. Y.; W. J. Richardson, secretary Atlantic Avenue Railroad Co., Brooklyn, N. Y.; James A. Powers, superintendent Glens Falls Electric Railway, Glens Falls, N. Y.; John N. Beckley, president, and Charles J. Bissell, counsel Rochester Railway Co., Rochester, N. Y.; Charles Cleminshaw president, and Charles H. Smith superintendent Troy & Lansingburgh Railroad Co., Troy, N. Y.

The technical press was represented by James H. McGraw and C. B. Fairchild, *STREET RAILWAY JOURNAL*. M. J. Sullivan and E. S. Reynolds, *Street Railway Gazette*, Chicago; F. L. Kenfield, *Street Railway Review*, Chicago; N. D. Webster, *Electrical World*, New York; T. C. Martin, *Electrical Engineer*, New York, and T. R. Taltavall, *Street Railway News*, New York.

There were also present, H. C. Evans, Johnson Co., Johnstown, Pa.; J. A. Hanna, McGuire Manufacturing Co., Chicago, Ill.; W. F. D. Crane, H. W. Johns Manufacturing Co., New York; D. W. Pugh, John Stephenson Co., Limited, New York; Elmer P. Morris, W. J. Clark, A. Lewis and Prof. Feary, General Electric Co.; W. H. Delaney, Royaline Manufacturing Co., New York; W. S. Silver, Graduated Car Spring Co., F. D. Russell and E. Packer, Rochester Car Wheel Co., Rochester, N. Y.; C. S. Merrill, Engineering Equipment Co., New York; G. N.

McKibben, Reed & McKibben, New York; J. E. Wallace, Smith & Wallace, Boston; A. R. Cook, Q. & C. Co., Chicago; J. F. Ostrom, Pennsylvania Steel Co., New York; Frank R. Ford, Short Electric Railway Co., Cleveland, O.; Willard S. Brown, American Casualty & Insurance Co., New York; John Patterson, Taylor Truck Co., Troy, N. Y.; Frank A. Magee, The E. S. Greeley & Co., New York; J. H. Jones, of the J. M. Jones' Sons Co., West Troy, and Louis Pfingst, Boston.

The first business was the address of the president, which was as follows:

ADDRESS OF THE PRESIDENT.

The Street Railway Association of the State of New York:

GENTLEMEN:—The past year has been without special incident, so far as the street railroad interests of the state are concerned. I shall take your time but a few moments in giving a brief summary of the record of the year, and in calling your attention to a few practical matters.

Many members of the Association feared that the street railroad interests would be subjected to uncalled for attacks on the part of the legislature at its late session, and much apprehension was felt that unjust and hostile legislation might be successful in impairing the value and usefulness of street railroad properties throughout the state. The Executive Committee of this Association took early action looking to the protection of our common interests. The report of the work done by the committee in this regard, will, I am sure meet your approval. The success which has attended the efforts put forth is evident to every member of the Association. No bill striking street railroad interests, and no bill which injuriously affected street railroad interests, became a law. The obligation of protecting the properties which we are called upon to manage against adverse and iniquitous legislation is lost sight of. Certain of our brethren seem to rely upon the success of efforts which they trust will be put forth by others who, perhaps, have no larger interests to protect than have they.

The most important function of a state street railroad association is to furnish information to the members of the legislature as to the needs of street railroad companies, and to combat before legislative committees, and in personal intercourse with senators and assemblymen the erroneous propositions which are often advanced without adequate knowledge of the condition of things. A great majority of the

members of our legislature are honest men, who, when informed as to the facts will act intelligently without injury to any legitimate industry or business. There always has been and there always will be others in every legislative body, who take advantage of every opportunity which ingenuity can suggest, to strike corporations by the medium of unjust and hostile legislation. Thus far, the street railroad companies of the state have not been injured by unwise or dishonest legislation. But immunity cannot always be secured, except as the result of diligent and intelligent effort on the part of the street railroad companies themselves. A fair and intelligent presentation of the facts as they exist, made at the proper time, I believe, will always protect the interests with which we are identified; but such presentation ought to be made by the representative of this Association, and such representative ought to stand for every street railroad corporation in the state.

I trust the time will very soon come when every street railroad company in this commonwealth will not only have its name enrolled on the books of this Association, but will be as well an active, earnest and enthusiastic member. Our interests are common; our efforts should be united.

During the past year much progress has been made in the education of the people of the larger cities of the state upon the subject of the "trolley system" of propelling street cars. Even in the city of New York, where a year ago it seemed electric cars could never be operated because of the intense and unreasonable prejudice of the people, franchises are now being obtained, and there is every reason to believe that the old fashioned, slow moving and nuisance-causing horse car system of that great and prosperous city will soon give place on all the lines to the modern systems of propulsion by electricity or cable.

Our Brooklyn friends have carried on their campaign of education with skill and unceasing effort, and the complete success of such effort seems now to be assured. So, throughout the state, until as error, ignorance and hostile interests are cleared away, the people of every community are coming to realize that they live in the last decade, and not in the middle of the nineteenth century. The improvements which have been made in electric and cable railroad appliances, machinery and construction, may be said to have kept pace with the demand for the same. The electric motor of to-day represents a great advance over the electric motor of last year, and the cable roads under construction in the city of New York represent the cable system at its best.

We shall have the pleasure and the honor to-day of listening to papers from two gentlemen, each of whom is in the front rank of his profession, and from them we shall learn what science, skill and experience have done in perfecting the two systems of street car propulsion, which are doing so much to make life the more worth living in the cities of our state.

Street railroad men are learning that in the management of our properties it pays to be liberal. I do not mean that it is wise to be extravagant, or reckless, or improvident in the management of such properties, but that a broad and progressive policy, which furnishes to the people increased facilities for travel, adds to the net income to be derived from the operation of street railroads. The public, as most of us have come to know, are quick to appreciate improvements made, and as quick to respond with their nickels to the effort of a company to intelligently and efficiently serve them.

It seems to me wise, and in accordance with the best business principles, to keep a little in advance of the reasonable demands of the people with reference to improvements, additions and extensions. I do not mean that a company should heed the request or demand of a 100 families to extend a line where it will require 1,000 families to support that line when extended. But constructing an extension somewhat, perhaps, in advance of the time when such an extension will pay operating expenses, is, in my opinion, as a rule, the wise thing for a railroad company to do. The same principle obtains as to the number of cars to be run on each line, and as to other improvements and betterments of the system. We depend upon the people for our patronage, and every street railroad man knows that a good feeling on the part of the people towards the company which serves them adds to the receipts of the line, makes it easier to obtain needed concessions from city governments as well as from individuals, and prevents the granting of franchises on parallel lines to competing companies where perhaps, only one line can be made a commercial success.

While upon this subject of liberality of treatment on the part of railroad companies I desire to call your attention to the advisability, from a business standpoint, of adopting, whenever local conditions will warrant, a transfer system. It seems to railroad companies who now obtain two fares from passengers who desire to go from one part of the city to another by means of the cars on two lines, that the income of the company must necessarily be decreased if passengers are carried for a single fare of five cents.

After a careful study of this whole question, we decided at Rochester to introduce a transfer system under which a passenger can ride from any point in that city reached by the lines, of the Rochester Railway Co., to any other point reached by said lines for a single fare. We commenced giving transfers on this plan on October 5, last. We provided reasonable restrictions and necessary conditions. The experiment has proved an undoubted success, not only from the standpoint of the passenger, but from the point of view of the company as well. There is no question that the receipts of the company have been materially increased by the adoption and use of the transfer system. Perhaps the location of lines and other local conditions prevailing in other cities of the state may prevent the successful introduction of a transfer system. But I thought it might be of interest to members of the Association to know of the pronounced financial success of the undertaking, so far as Rochester Railway Co. is concerned.

Until March 1, the conductors and motormen of the Rochester Railway Co. were paid the same wages as were formerly paid to con-

ductors and drivers of horse cars. We very soon found after commencing operating electric cars that we required men of higher capacity to perform the duties of motorman and conductor than seemed to be necessary with the old system. It seemed to us that as the duties of the positions which the men held under the new system were more onerous and exacting, and as it required more judgment and skill to properly handle electric cars, that the men should be paid a somewhat higher compensation than they had before received. Therefore, the company, before the men themselves made any request for an increase of wages, advanced such wages. The action of the company, of course, gave great satisfaction to the men, and the result has been very beneficial, so far as the company itself is concerned. It has been found that while the item "wages of employes" has been materially increased the cost of operating the road per mile has in fact been diminished. This is accounted for by the fact that the men are more attentive to duty than before, and more careful in the handling of cars, by the greater freedom from accidents, and by the material lessening in the cost of maintenance.

I am satisfied that the management of many street railroad corporations, where electricity is the motive power, have not as yet given sufficient attention to the thorough instruction of their motormen as well as conductors, as to the function of each part of the motor, and as to the proper thing to be done by the motorman and conductor when trouble develops while the car is in service on the line.

Some weeks since I had occasion, while riding on an electric car in a city of another state, to ask the motorman some questions about the motors he was running. I found he did not know whether the motors were Thomson-Houston, Westinghouse, Edison or Short. He did not know whether they were double or single reduction. He did not even know whether he had under his car body one or two motors. I asked him what he did in case he had any trouble on the line? He said, "If the motor don't work I wait until another car comes along and pushes me in." I found that this motorman had been for nearly nine months in regular service as motorman in that city. This motorman knew enough to turn on and turn off the current, and to set and loosen the brake. This, of course, is an extreme case, but it illustrates a principle. My own judgment is, based upon some experience, that too much pains cannot be taken to thoroughly instruct the motorman as well as the conductor, so that each will know the cause of trouble when trouble develops in either of the motors in service.

The plan the company with which I am connected has adopted, is to select from among the motormen one of the men who is pronounced by the master mechanic, the electrician and the superintendent, the best posted as to the construction and use of a motor, and make such man, for the time being, instructor of motormen on cars in actual service. This instructor rides with motorman after motorman, observes the manner in which he handles his car under all conditions and gives detailed instructions as to exactly what to do whenever trouble of the usual sort develops. The instructor spends from half a day to three days with each man until he pronounces him in every way qualified to run a car on every portion of the line, and to do that which needs to be done when trouble develops.

I might call your attention to many other matters of practical interest if occasion seemed to call for further statement. It is, perhaps, presuming in me to say what I have said, addressing as I am many who have had more experience than I. My only object in calling your attention to the matters I have referred to, is to make some suggestions which may be of value to some who have had less experience than I have, brief and limited though that experience may be.

JOHN N. BECKLEY, President.

The secretary then read the report of the executive committee as follows:

REPORT OF EXECUTIVE COMMITTEE.

To the Street Railway Association of the State of New York:

GENTLEMEN:—Your Executive Committee respectfully submits the following report:

MEMBERSHIP.

At the last annual meeting of the Association, the by-laws were amended so as to provide, by nominal fees, for the admission to membership of all operating street surface railway companies in the state. Pursuant to this action, two invitations were sent during the year to all street railway companies not members, to join the Association. The first was sent immediately after the annual meeting in connection with the circulation of the address of the president and the report of the special committee on electric motive power for street surface railways; the second invitation was sent later in the year, accompanied with a printed copy of the annual report. As a result, five companies are members in the second class.

The Christopher & Tenth Street Railroad Co. having been leased by the Central Cross Town Railroad Co., the membership of the former has lapsed.

The trend of the times is towards consolidation. There was a time when we had over one-third more members than now. By lease and purchase by existing members, the number has gradually been reduced, until now, in the first class, there are but twenty companies.

It is believed by your committee that our annual social dinner is an essential element of the success and good fellowship which exists between the officers and members. We further believe that the Association should provide for this (as it has done at times, but not with regularity) and not depend therefor on individuals interested in its welfare.

The balance in the treasury has gradually reached the point when prudence and wise financing suggest that ample provision be made for the future. Considering the efficiency of the Association as an

organization, and the work accomplished by it every year—especially before the legislature of the state—the judgment of the executive committee is that the annual dues of members in the first class should be fixed at \$50; and we submit for your consideration an amendment to Article XV. of the by-laws, substituting the word “fifty” for the word “thirty-five.” The adoption of this provision would place the Association on a sure financial basis for years to come, considering its present running expenses, and at the same time provide for the cost of its social entertainments at our annual gatherings. The counsel employed by the Association is present, and will report as to the work done and results accomplished at the last session of the legislature.

SPECIAL REPORTS.

The money comes into the treasury of a street railway company in such very small sums and goes out in such correspondingly large amounts that it behooves us to see that the operating expenses are reduced to the lowest minimum. Inventive genius is very active, especially with electrical devices, and whatever tends to increase the accommodation of passengers, improve the service, and, at the same time, reduce the cost, must necessarily be welcomed by us; for they are the declared objects for which the Association was organized.

Two special reports were, therefore, provided on subjects of vital concern to the street railway business. The titles are: “Recent Improvements in Cable Traction,” and “Recent Improvements in Electric Traction;” both subjects to be treated by men than whom none are better able to prepare papers thereon.

Cable power has been with us for some time, but on a small scale comparatively with the systems which it was believed would be in operation before this meeting. The undertaking both on the Broadway and Third Avenue lines has been so extensive that it has been impossible to get the roads in operation. Much, therefore, that would have tended to make the report on the first subject of unusual interest has been denied the committee, so that the request has quite recently been made that the presentation of this report be deferred until the next annual meeting.

Electricity has been booming in this state since we last met. Brooklyn, fortunately for its citizens, will soon be blessed with the overhead system on a scale nowhere equaled in the world, the very best construction both for track and overhead work having been adopted throughout the city. When fully developed to successful operation in that city the system will bring about the condition of things throughout the country by the substitution of electricity for horses, set forth in the advertisement of a famous patent medicine, of which it is declared the “children cry for it.”

Already some of the leading dailies of New York City are beginning to change their hitherto insane abuse of the so called “deadly trolley” that has never yet killed even one human being; and they will soon be tumbling over one another in their enthusiastic advocacy of a system regarding which they have finally decided to learn something, and no longer to depend upon their imagination for their facts.

Whatever recent improvements with manifest merit have been made in the electric system, will be hailed with delight by those interested in this form of motive power.

COMMUNITY OF INTEREST.

For the first time in several years, there has been no “strike” on any surface street railway in the State. In the light of the year’s experience, the report of your committee at the last meeting is prophetic, for the time has indeed come, of which that committee said, “all matters of difference which may, and inevitably must, from time to time, arise between employer and employee, will be adjusted amicably by the parties interested.” The time has at last come when their community of interest is not only recognized, but appreciated, by both the employer and the employed in the street railway business.

THE OUTLOOK.

As we look out upon the future, our business prospects were never better. At peace with all the world, our people, for the most part, are contented and happy, because they are prosperous, and with the enlightenment of the press as to the new motive power to cheer us, the outlook is good for the nation, the state and the business with which we are, so intimately associated.

Respectfully submitted,
 DANIEL F. LEWIS,
 JOHN N. BECKLEY,
 CHAS. CLEMINSHAW,
 W. J. RICHARDSON.
 Executive Committee.

The treasurer’s report was read, and showed during the year :

Receipts.....	\$945.66
Expenses.....	918.17
Balance.....	\$27.49

The president then introduced Mr. Charles J. Bissell, the counsel of the Association, who briefly stated the work that had been accomplished at the state legislature at Albany, during the recent session. Mr. Bissell said that he had been retained by the Association to appear before the committees and the Governor, and by argument and reason to restrain the enactment of legislation injurious to the interests of the street railway com-

panies of the state, and other corporate bodies. Mr. Bissell stated that the result of his experience was, that he believed that the great majority of the members of the legislature were honest and straightforward, and needed only to have matters presented to them in a logical and open manner to properly appreciate the right side of any question and vote accordingly. He believed that there was but a very small minority, in either house, whose votes could be influenced by any other means.

Mr. J. W. McNamara, of Albany, followed by a statement to the same effect, which was seconded by Mr. Powers, of Glens Falls, as also Mr. W. J. Clark, of the General Electric Co., the latter statement referring to the legislature of Ohio.

Mr. D. F. Lewis, of Brooklyn, then called attention to the fact that much more effective work could be done in this direction if the smaller companies in the state could be brought into membership in the Association, the dues in such cases being merely nominal, and suggested that the supply men present could be instrumental in bringing the matter of joining the Association before the smaller companies in the state in the course of their business calls upon them.

Mr. J. F. Ostrom, of the Pennsylvania Steel Co., on behalf of the supply men present, said that he believed he could say that they would be willing to use their best endeavors in this direction. This was endorsed by Mr. W. J. Clark. The result was that during a brief recess of the Association a meeting of the supply men was held, of which Major Evans was chairman, and a committee appointed to report measures for the formation of a material men’s association as an auxiliary to the state Association to secure this end. The committee consisted of Messrs. J. F. Ostrom, W. J. Clark and J. H. McGraw.

Later in the day another meeting was held, and a permanent organization effected, as noted below.

Following the remarks of Mr. Bissell, the next business was the report of the committee on “Recent Improvements in Electric Traction.”

The report was read by Mr. McIntire, as follows :

REPORT OF COMMITTEE ON RECENT IMPROVEMENTS IN ELECTRIC TRACTION.

BY L. H. MCINTIRE.

The Street Railway Association of the State of New York:

GENTLEMEN:—We understand that anything which tends to an increase of reliability or economy of operation of an electric railway is an improvement; and it is with the intention of bringing before you in a brief manner the results of my experience and observation during the past year upon these points that this article has been written.

As you, of course, know, electric systems as first constructed were built on altogether too light a plan, and the increasing tendency year by year has been, and is, for heavier and more solid construction in every department, but particularly in the way of track and station equipments. It has been well said that no new departure is ever perfect at the beginning, and no one realizes this more than he who has watched the development of electric traction during the last few years.

The storage battery has made but little progress during the past year, and is not likely to cut much of a figure in electric traction until it is able to make a better showing, financially, than it has in the past.

It may seem strange that the management of roads, even at present operated by horses, cannot see that a change of some kind must come soon, owing to the great cry for rapid transit; and yet I know of roads at present being laid with flat centre bearing rails on stringers in streets being newly paved. I do not mention this as an “improvement,” but simply to show that what may be regarded as an improvement by some would be called a makeshift or temporary piece of work by others.

The general tendency of the times to consolidate all common interests under one management is showing its effect in electric traction, more now than ever, and scarcely a week passes that we do not hear of some syndicate obtaining control of some horse road, and the information usually ends with the statement that “it is intended to equip all the lines with electricity.” From many points of view this is an improvement and a marked one.

TRACK.

The improvement in track construction has been very great, and although many expensive errors have been made, we ought, on the whole, to feel satisfied with the progress.

The early forms of track construction were too light and soon went to pieces; but during the past year heavier rails have been rolled and better joint plates made, so that it is possible to keep the roadbed in perfect line and surface. This improvement has been a great help to the electric equipment and has reduced the cost of maintenance. As the cost of laying tracks is about the same, whether light or heavy, it is economy to put in only the best.

Now, on the question of what constitutes the best form of track, there is considerable variance of opinion. My experience and observation have convinced me that the deep girder rail, about nine inches high, spiked directly to the ties, is the best form for paved streets, and in dirt or macadam streets, a six inch girder rail laid in the same manner. In the country, and where the local authorities are willing, I would lay a T rail spiked directly to the ties.

The weakest place in all forms of track construction is at the joint. Every manufacturer of rails, and many of the railroad companies, have tried to overcome this trouble. There are probably as many patents upon rail joints as upon car couplers, and most of them about as impracticable. Up to the present time there has been nothing brought out which surpasses a properly designed "fishplate."

While speaking of track construction it might be well to call attention to the bonding of rails for the return circuit. Many forms have been used, and some of them are still in operation. I believe that No. 0 copper bond wire, long enough to connect with the web of the rail on each end of the fish plate is the best plan, and then grounding the whole system at frequent intervals, and abandon the supplementary wire which it has been the custom to use with the common form of bonding.

ELECTRIC EQUIPMENT.

Probably the greatest advance in any particular line has been in the matter of armatures for motors and dynamos. I consider that the introduction of the "iron clad" type will do more towards reducing the bill for repairs in that direction than any other one thing that has been introduced during the year. The electric companies have all, I believe, now adopted this form as their standard, and all roads that have tried them will, I think, agree with me that for simplicity, ease of repair and ability to stand the hard usage they receive, they stand at the head.

In the matter of controlling the motors, most of the companies still use the time honored rheostat; although I believe one company is endeavoring to introduce a new type of controller which they will, doubtless, be happy to explain at a later date.

Many roads, acting under a misapprehension of the requirements, started off with motors too small for the work, and endless trouble has been the result. Some new classification should be adopted by the electrical companies for designating the power of their motors, as the present office classification does not afford a proper understanding of its capacity, and the horse power term is but little better, depending on so many limiting conditions. A more satisfactory way would be to specify the number of pounds the motor can pull at different speeds, and the maximum current for which it is designed.

TRUCKS.

The first car trucks employed in electrical work were of the pedestal form; that is, the trucks were fastened to the car body and oscillated with the car. The motors, of course, had to be suspended from the car body, and the result was that the grinding of the gears was transmitted through the whole car; also, the oscillation of the car body caused the motors to correspondingly rise and fall. This was very undesirable, and it was soon found necessary to adopt the post form, in which the truck was complete in itself and the motors supported directly on the frame of the truck. The body was connected with the truck only by springs, thus being entirely free from the jolts and pounding of the truck.

In this form slight spiral springs were first used, the same as in the previous styles, but it was soon found that the high speed attained caused the body to oscillate to such a degree that it became very objectionable, and the different builders then modified their trucks by extending the side bars beyond the axle boxes, a sufficient distance to allow an auxiliary spring to be added at each end. For this auxiliary support, coil and elliptical springs have been used, both forms with marked success, and it is now possible to carry a car body, twenty-eight feet over all, practically without oscillation. This last modification has been a very great improvement, and has settled the long car question on most street railways. I mean by this that but very few double truck cars will be used, though, of course, there are places where two trucks can be used to advantage, and in such places they will still be employed. But where we are able to carry nearly as many people on four wheels as on eight, and to apply the power equally on each axle, so that there is no possibility of lack of traction, there can be no gain to the railroad company in using eight wheels.

CARS.

The car bodies first employed were of the same style and proportions as those used for horse roads, and were not properly designed for electrical purposes; first, the framing of the roof was too weak and would not support the trolley board properly; second, the framing of the floor was not adapted for the use to which the cars were put; for not only was the framing too weak, but it also was not well planned for putting in the trap doors which are required in order to inspect the machinery underneath the floor.

The car which it seems to me is best adapted for the present service is one eighteen feet six inches long inside, with platforms three feet six inches long. The rafters should be strengthened with steel plates, and the framing throughout should be heavier.

The coloring of the cars and the necessary signs are attracting considerable attention from the different railway companies, but up to the present time I do not think any concerted action has been taken. For my part, I believe that all of the cars on a system should be painted the same color, that is to say, each separate line should not have a distinct color, but signs should be used to designate the different routes, preferably by means of the well known reversible sign on the top of the car, both at the sides and front. At night the lines might be

distinguished by the color of the ventilator glass, which would in each case be the same as the ground color of the reversible sign.

OVERHEAD CONSTRUCTION.

There has been a general improvement in all parts of the overhead material. We are using stiffer poles, stronger span wires, better trolley wire insulators and handsomer curve fittings, so that the general appearance of the system is much pleasanter. The quality of insulation now in use is far superior to what we had two years ago, and as double insulation is now employed on the span wires, very little trouble from leakage is experienced.

The method of feeding the line is a very important matter, and should receive careful attention. The best arrangement is to divide the system into several sections, so that in case of trouble along any portion of the line, such as fire, etc., that section can be cut out and the balance of the system run as usual.

THE POWER STATION.

This may be rightly called the heart of any electric system. The trolley and feeder wires form the arteries, the rails and return wires the veins, and the cars the capillaries connecting them. The Biblical injunction to "Guard thy heart with all diligence, for out of it are the issues of life," would certainly seem applicable to the station. The chief element to be considered should be reliability, and, after that, economy. Just what means shall be used to attain this end seems so far to have been a disputed matter, as shown by the stations now in operation, which contain almost every conceivable device, good, bad and indifferent; all shapes, sizes and descriptions of engines, boilers and dynamos. Many designers of stations—if some of them can be said to have been designed at all—seem to have gone at their task utterly regardless of the future and oblivious to the experiences of the past. However, through it all I can say that a very marked improvement is observable lately. The designers of stations are learning wisdom from their past experiences, and the makers of apparatus are more alive to the requirements of the system, and better material and workmanship can be had where required.

The recent introduction of large multipolar dynamos has brought about a change in station arrangements not heretofore obtainable, and in all large stations now being built countershafting is dispensed with entirely, and the general tendency is towards reduction of parts, which in turn means simplicity. It is very probable that we have reached now a form of station that will be fairly permanent, and the main point in the future will be the size of the units. For medium size stations engines with releasing valve gear belted direct to the multipolar dynamo will be the best where the price of land is not excessive, and direct coupled engines and dynamos for larger stations. To my knowledge there have been no comparative tests made as to the economy of the various types of stations, although all reasoning would point to these latest types as being by far the most economical.

There has been heretofore too much taken for granted or assumed in electrical work, and the rapid growth of the business has called into it many who were totally unqualified for the positions which they obtained. I attribute much of the unsatisfactory work in the past to this course, but am happy to note that the great majority of these are passing into the background, and their places are being filled with men of good judgment and mechanical resources.

At the conclusion of the reading of the report, Mr. D. F. Lewis offered the following resolution:

Whereas: The Street Railway Association of the State of New York, assembled at Saratoga Springs for its Tenth Annual Meeting, has learned that the Union Railway Co., of New York, has put in operation this week the first electric trolley cars within the city of New York,

Resolved: That the Association congratulates the company and the public of the greatest city in the Union upon this adoption of the latest and most improved method of street railway traction;

Resolved: That this Association earnestly deprecates the opposition manifested against the trolley system in various quarters, as being founded upon neither reason nor fact, and as being contrary to the best interests of any community seeking rapid transit facilities and suburban homes for a growing population; and

Resolved: That the Association hereby tenders to Mr. L. H. McIntire, engineer of the Union Railway Co., its thanks for his able address on the work already accomplished in New York, and its wishes for the development in the metropolis of the system thus inaugurated.

The resolution was adopted.

The president then announced the report on electric traction to be open for discussion.

MR. MCNAMARA: Mr. McIntire failed to tell us if anybody has tried the deep girder rail, which he refers to, and found it any better than the system which he recommended to us a year ago. We are using the ordinary girder rail; and I still hope that we are right and he is wrong. As to the large generators, it is very comforting to know that you have got a machine that is capable of delivering a large amount of power, but if it breaks down

what then? Your large unit is taken out of service, and unless you have a correspondingly large unit to take its place, you are left without power. It is a question for us whether it is desirable to increase the size of the units, and if so, what should be the limit. Of course, I take it that the limit is only reached when you are enabled to duplicate the unit; because no one would attempt to operate a railroad, electric or otherwise, unless he was able to operate it continuously; so that if one of your large units fails you must have another to take its place.

MR. BECKLEY: In other words, the expression is relative. What would be a large unit for the Rochester Railway Co., would be a small unit for the Brooklyn City Railroad Co.

MR. MCNAMARA: Yes, that is it; we have found in Albany that we have worked very successfully with small generators. Our success has been so great that it was not until a week ago that we lost our first armature, running nine or ten machines. We discovered a defect in the armature which compelled us to take it out. Lightning has been in the station many times, but we have escaped its destructive influences, and it has been safely carried to the ground.

As to the painting of cars, we have them all one color; and the question is how to designate by colors the lines upon which they are to be operated, because every person who runs is not able to read. We have so far designated our lines by dash signs, painted the same color as the cars were when operated by horses.

MR. BECKLEY: What do you do at night?

MR. MCNAMARA: That is the point where the difficulty lies. The headlights usually preclude the possibility of giving sufficient notice in advance of what line the car runs on, so that when you exhaust the primary colors of red, blue, white, green and yellow, you have come to the end of it. Most people cannot distinguish between shades of color. I think this is a problem to be solved; but how to solve it, we are in doubt.

MR. MCINTIRE: The form of girder rail I refer to is laid on fifteen miles of road, in the northern part of New York. It weighs seventy pounds per yard and is laid on yellow pine stringers 5×5 . The rails are spiked directly to the stringers, which rest upon cross ties. I use a joint plate twenty-six inches long, bolted with six bolts; and the joint plates fit the taper under the head and at the bottom of the rail, so that as we pull the plate it wedges and tightens. At the joints, which is the weakest place, I put a tie directly under the rail joint, and one under where the timber joints; the balance of the ties are spaced thirty-six inches on centres. I also use an additional tie three feet long, under each end of the fishplate, so that the rail joint is supported by three ties. Every tie is tamped perfectly. That gives us a direct support joint. If it should come down, we have the suspended joint by means of the support from the ties at the end of the fishplate.

MR. LEWIS: Do you advocate an absolutely rigid joint?

MR. MCINTIRE: Yes, in paving. There is nothing else that you can put there that will stand; you can make it of iron or T rail, or use any of the devices that have been brought out, and it will go down if the joint is open and the wheels are allowed to pound. The rail men will immediately inquire, what will you do if expansion takes place? Now, if you lay a centre bearing or tram rail in this manner, you get into trouble, because it is exposed to the sun, and expansion will take place; but with a deep girder rail down in the earth, the heat is radiated, and you do not have that trouble.

MR. LEWIS: Do you put your rails close together?

MR. MCINTIRE: Yes, solid together.

MR. BECKLEY: Did you pass through last summer with this road?

MR. MCINTIRE: Yes, sir.

MR. CLEMINSHAW: Is that the road you built in New York?

MR. MCINTIRE: Yes, sir.

MR. CLEMINSHAW: Then you have not given it a test with an electric system, except during the last week?

MR. MCINTIRE: That is all.

MR. CLEMINSHAW: That settles the question.

MR. MCINTIRE: The trucking on Third Avenue is equal to any wear on the tracks which will be given it by electric motors.

MR. CLEMINSHAW: There is nothing known in traction that compares with the pound on the track which is given by an electric motor. What might be all right in the case of a horse road, with very heavy trucking, experience has told us is as nothing compared with the pounding of the motor on the rail.

MR. MCNAMARA: I have seen some of this seventy pound rail that was laid last year, on a road operated by horses, and it has got a pound at every joint that you can hear.

MR. MCINTIRE: It was not constructed properly. If you will lay your track and put your rails solid together, and bring the joint plates home with the bolts and properly tamp as it is drawn up, and see that it is supported properly, you will have a good track. As to dynamos, I have not seen any that begin to compare with the new type of iron clad armature, multipolar dynamo, and I cannot see why we should have any trouble with them. Of course, if something happens to the engine you must have a relay.

MR. POWERS: To my mind the first question that presented itself in this matter of electric roads and tracks, was the problem of the joints. The steam roads have solved this question to their satisfaction, perhaps not altogether, but practically so, so that you cannot count the joints as you ride over the best tracks. They have solved it on a totally different principle from that generally shown in the types of joint which I have been accustomed to see on street railway tracks. The general idea of the steam railroad man is to make his rail continuous, and then the question of supporting the joint becomes one of secondary consideration. If we could roll the rail continuous and have no joints, the track would be perfect; but the ordinary joint for street railroad tracks and electric railway tracks has been merely something for keeping the ends of the rails from spreading apart vertically. I had a liberal education on this question in about five minutes at Poughkeepsie. I looked at the joint which the New York Central road put on its tracks. They had an angle bar as heavy as could be taken in between the head and sole of the rail; it was about forty inches long, four bolts near the joint holding it firmly from having any up and down motion, with two bolts at the extreme ends. The bolts seemed to be larger than those generally used. I believe that is their standard system now, and there is no difficulty about holding your rail if you will put simply the ordinary amount of support under the track. We adopted this form on our road at Glens Falls, using a very light rail—forty pounds; and if anyone can count the joints on our road, I should be glad to have him do it.

MR. LEWIS: Do you notice any declension in the joints?

MR. POWERS: They are absolutely smooth, and the matter is well worth your consideration. It seemed to me that after all the experience the steam railroad people have gone through, and the enormous weight they get on a single pair of driving wheels, the fact that they have solved the problem to their satisfaction should be of value to us; while most of the so-called joints in the street railway business have been formerly tried on steam roads and are not satisfactory. It is no uncommon thing to find a new piece of electric track going to pieces in a short time. One reason is, the sparseness with which the ties are apt to be put in. We put them in less than two feet apart centres; less than sixteen inches at the joints. We stagger the rail joints.

The headlight question is very important. We run very fast, averaging ten miles an hour including stops, sometimes reaching eighteen miles an hour. I find in looking about among the electric railroads that the headlight is one of the easiest things to be neglected, mirrors soiled, burners old and the light dim, and you might almost as well not have any. They should cast a good re-

flection, so that any obstruction on the track, such as a drunken man or a carriage, may be seen and the car stopped before reaching the place.

MR. LEWIS: Where do you locate your headlights?

MR. POWERS: On the dash. We have adopted a thirty-two candle lamp. It adds to the appearance of the car to have this brilliant light, and it costs but a trifle more.

MR. CLEMINSHAW: Anyone who runs an electric road six months knows that there is nothing so important as this matter of joints. The Troy road has spent a good deal of money in that direction. Mr. Powers' statement may mislead somebody as to the joints on his road, and one sentence will explain the whole matter—he runs a single track road. That is all there is in it. We have a road where we run both ways, and it is one of the smoothest roads anywhere. The pounding is in both directions.

MR. POWERS: The steam roads do not run both ways.

MR. CLEMINSHAW: No, that is true; but they can screw up the nuts at the joints. We cannot do that in a street railroad, as they are underground. There is not an electric road in existence to-day that has run one year that has got a perfect joint. We built a road about fifteen months ago, sixty-three pound rail, new pavement, new ties thirty inches apart, and everything first class. It ran six months very well, but to-day it is going, going. There is no remedy. We have come the nearest to it with a suspended joint. The theory is taken from the steam railroad practice. We have so far had no trouble with these joints, but it may come.

MR. MCNAMARA: We have had some experience with headlights, and we have concluded that the place for the headlight is on the hood, for several reasons. The first is from an economic point of view. If you have it on the dash it is going to be broken. You are going to have cars on the line that will have a slight brush with some vehicle, and while your car may be uninjured, you will be minus your headlight.

MR. POWERS: Cannot you make the frame stronger?

MR. MCNAMARA: We are liable to have these accidents all the time; and the headlight is the first thing to go if you have it on the dash. We do not break any headlights on the hood, and our motor drivers all say they get better results; and we know that people who are to be warned are better warned with a light on the hood than with one on the dash. We have had an experience in accident cases, and have been able to demonstrate that our headlights are visible at a distance of 1,000 ft., plainly showing the car and surrounding objects. I doubt if a light on the dash would be as effective. Of course, unless the color light, showing the line on which the car runs, is very strong, if placed at the front of the car it is apt to be counteracted by the headlight. We have tried using a headlight with a rim of colored glass around it; in this case, red. We had a rim about an inch wide. It was distinguishable at forty feet away, but at 100 ft. away it was not distinguishable.

MR. POWERS: There is one condition which has occurred to me, and which strikes me as important in regard to the headlight on the hood; you avoid the possibility of the headlight being obscured by a wagon or other vehicle.

MR. BECKLEY: I want to say a word or two on the question of the color of cars. We have in Rochester eleven different lines of cars in operation, and it would be quite a serious matter for us to maintain the necessary equipment to have the cars of different colors, and each color devoted to a particular line. So far as the daytime is concerned, we have the problem solved to our satisfaction. We have the plan, adopted by the elevated railroad in New York, of employing two disks. These disks are put on the hood of the car, set in a socket, so that we can take one color of disks off and put in another. After we have exhausted the five chief colors, red, green, blue, yellow and white, we simply combine the colors. Of course, we have signs on the cars for the benefit of those people who can read, but the people who travel on the cars very soon learn to depend on the coloring rather than the lettering. Our signs and disks, by reason of the socket arrangement,

can be very easily exchanged, one line for another. We do not have the reversible sign. We get along all right in the daytime, but we must go a little further and get a light that can be seen 1,000 ft. away. We propose to use large bull's eyes at night, making similar combinations of color as on the disks in the daytime.

MR. CLEMINSHAW: We are having cars made now with bull's eyes, four times as large as usual.

The discussion was then closed.

Mr. George W. McNulty, engineer of the Broadway Railroad, New York, was to have prepared a report on "Recent Improvements in Cable Traction," but owing to the fact that it had not been possible to get the road in operation before the time of the meeting, as was expected, he requested that the report be deferred until the next meeting. The request was granted.

Messrs. Cleminshaw, Lewis and McNamara were appointed a committee on nominations, and they proposed the following names, and the gentlemen were thereupon elected:

President, C. Densmore Wyman, New York; vice-president, Daniel B. Hasbrouck, New York; second vice-president, James A. Powers, Glens Falls; secretary and treasurer, W. J. Richardson, Brooklyn.

Executive Committee: D. F. Lewis, Brooklyn; John N. Beckley, Rochester; John W. McNamara, Albany.

Mr. Lewis offered an amendment to the by-laws, increasing the annual dues of members in the first class to \$50, as recommended by the executive committee, which was adopted.

The meeting then adjourned to meet in Rochester, the third Tuesday in September, 1893.

In the afternoon nearly all in attendance at the meeting accepted an invitation from the Union Railway Co., of Saratoga, to participate in a ride on the electric road to Saratoga Lake. The ride, which was in the side vestibule, double deck Pullman cars, was a very enjoyable one, and a vote of thanks was tendered to the officers of the road for their courtesy.

After the trip over the line of the Union Railway Co., the material men met in Parlor 8, United States Hotel, at 5.00 P. M., and received committee's report, which was as follows:

The name of this organization shall be Association of Dealers in Street Railway Materials, of the State of New York.

The object of the Association shall be to make possible concerted action on any matters that may affect the business of its members, and to aid the New York State Street Railway Association in its efforts to prevent any legislation which it may consider hostile to the interests of the street railways of the state of New York, as well as to aid it in promoting beneficial legislation.

The officers of the Association shall be a president, two or more vice-presidents and a secretary and treasurer, to be elected annually.

The work of the Association shall be performed by the officers and committees as follows:

A. An executive committee of nine members, to be elected annually.

B. A legislative committee of five members, to be appointed by the president annually.

The dues of the Association shall be:

Initiation dues.....	\$ 5.00
Annual „	5.00

This Association shall hold an annual meeting on the date and at the place of the annual meeting of the New York State Street Railway Association, and other meetings at such time and place as may be called for by the president.

MEMBERSHIP.

Any individual, firm or corporation, dealing in street railway materials; any engineer, individual, firm or corporation engaged in street railway construction work, or any trade paper published in the interest of the street railway profession, may become a member by registering with the secretary and treasurer and paying the initiation fee and annual dues. Each member to carry one vote.

Your committee would suggest the following as officers and committee to serve for the ensuing year: President, Wm. J. Clark, New York; vice-presidents, D. W. Pugh, New York, Jno. W. Fowler, Brooklyn; J. H. Jones, Troy, W. E. Gilbert, Troy; secretary and treasurer, C. E. Stump, New York. Executive committee, W. J. Clark, New York; H. C. Evans, New York; Jno. A. Wood, New York; Wm. S. Silver, New York; C. E. Stump, New York; T. C. Martin, New York; S. W. Baldwin, New York; F. D. Russell, Rochester; D. C. Breckenridge, New York.

It would also suggest that the president be authorized to appoint a committee to perfect a constitution and by-laws as embodied in the above.

Respectfully submitted,

(Signed) JOHN F. OSTROM, Chairman.

After some discussion, the report of the committee was adopted and the officers declared elected. It was decided that only residents of New York State be eligible as officers or committee men and that the Constitution contain such a provision.

Also resolved that the president be appointed a committee of one to advise with the New York State Street Railway Association and advise it of the action of the meeting.

NOTIFICATION OF THE PRESIDENT.

The president-elect not being present, the notification of his election was duly sent him by the secretary of the Association, of which the subjoined is a copy, together with a copy of Mr. Wyman's reply :

OFFICE OF

THE STREET RAILWAY ASSOCIATION,

OF THE STATE OF NEW YORK,

COR. ATLANTIC AND THIRD AVENUES,

BROOKLYN, N. Y., September 22, 1892.

C. DENSMORE WYMAN, ESQ.,

Vice-President Central Park, N. & E. R. R. Co.

My Dear Sir:—It gives me pleasure to inform you that at the Tenth Annual Meeting of this Association, held at Saratoga Springs, Tuesday, the 20th inst., you were unanimously elected president of this Association for the ensuing year.

In this connection allow me to state that we missed you at the meeting which was altogether enjoyable and profitable.

Sincerely yours,

W. J. RICHARDSON, Secretary.

CENTRAL PARK, NORTH & EAST RIVER RAILROAD CO.,

TENTH AVENUE, 53D AND 54TH STREETS,

PRESIDENT'S OFFICE,

NEW YORK, September 24, 1892.

WILLIAM J. RICHARDSON, ESQ.,

Secretary N. Y. State R. R. Association :

MY DEAR SIR :—I beg to acknowledge the receipt of your favor of the 22d inst., conveying official notification of the action of the New York State Street Railway Association at its annual meeting on the 20th inst., in electing me as president for the ensuing year.

The election occurring during my unavoidable detention from the meeting was a grateful surprise to me, and I should be untrue to my feelings not to express my sincere pleasure at being accorded so honorable and important a position.

While I am sure the good wishes and friendship of the members influenced their favorable judgment as to my fitness for the post, yet coming to me as it does by so unanimous a vote I am constrained to accept, and to promise my best endeavors for the success of our Association.

The Empire State has not been as progressive as it should have been in the advance movement of late years made in many states, in the art of street railway transportation, yet inspired by the activity displayed by some of our members in the various cities within our confines, I believe the companies of the state will during the next year take the advanced place they should occupy in this important department of industry.

The State Association will, I trust, be of efficient aid in this matter, and as president I must beg the advice and hearty co-operation of each member, and for which I shall be exceedingly grateful.

Again expressing through you, my dear sir, my earnest thanks to the members of the Association for the honor they have conferred upon me by their choice, I am,

Very sincerely yours,

C. DENSMORE WYMAN.

Electricity and the Cable in Great Britain.

BY ALEX. MCCALLUM.

The slowness with which the street railways of Great Britain take to mechanical power as a substitute for the time-honored horse is apt to engender derisive contempt among American street railway men. But there are several adequate reasons for the present state of things, and the fault does not wholly lie with the directors and managers of British tramways. We must, first, remember the caution of the investing public and of all actively concerned in the management. When an American sees what he thinks is a good thing, he rushes for it at once, and sometimes he has to pay dearly for his precipitancy. When a Britisher sees what appears to be a good thing, he walks around it gingerly, surveys it from all points, demands that it shall be put to stringent and prolonged tests, and if, at length, it emerges triumphantly from these, he puts his money into it. Thus progress is slower in the old country than in America, but it is sure and very solid. By this process of waiting and watching and sometimes nibbling, the Englishman frequently benefits by the experience of his more go-ahead neigh-

bors, and at the same time he often keeps money in his pocket which he might otherwise lose. This is in the fullest sense the case with the tramway traction problem, for John Bull is evidently beginning to move in the way of adopting electric and cable haulage rather extensively.

Another reason why the horse is still almost universal on British street railways is the difficulty with local authorities. No doubt there is a similar bugbear in the United States, but probably no company there has to face such a combination of stumbling blocks as the Board of Trade, the Tramways Act of 1870, and the argus-eyed jealousies of local authorities. The Board of Trade does not look with a favorable eye on anything in the way of street construction which may be supposed to hinder traffic in any way, and it would never allow a car speed, unless in quite suburban districts, of more than eight miles an hour. The Tramways Act empowers town councils at the expiration of twenty years after the opening of any street railway to purchase, if they choose, the undertaking. In very many towns the time is just expiring or will do so in a year or two, and street railway companies will not even consider the advisability of adopting mechanical power, till they know whether they are to have a new lease of life or whether they are going to be bought out. No one could expect them to go in for new capital expenditure in the circumstances. Then the town councils or other local authorities have great suspicions as to the public safety with mechanical haulage, and in many towns the question of the amenity of the district is trotted out.

Americans have no idea of the power of that blessed word amenity in some British cities. Edinburgh, the proud and self-superior city which still calls itself the capital of Scotland, is notorious in this respect. The very mention of a trolley wire railway being installed there would raise a storm, both in the Council and among the citizens at large. The cable, which does not interfere so much with the appearance of the street, they have less objection to, but the difficulty is the paying for it. This public objection to the overhead conductor method is widely spread, but in many districts in England it can, we believe, be easily got over.

A fourth obstacle is consequent upon the caution we have remarked upon above. It is that even where a street railway company can settle everything to its own satisfaction with the local authority and the Board of Trade, the public is sometimes rather chary in subscribing the necessary capital to make the change. Only time and a gradual advance can cure this. The whole subject is being ventilated and discussed in Britain now as it has never been before, and the next few years will see some big changes.

Having said so much by way of preliminary explanation, a glance may be taken at what has already been done and what is now being done in the way of adopting mechanical power. We shall deal first with the electric lines, but shall leave out of account the electric railways in Antrim and in London, as these are not street lines at all, but railroads pure and simple. The earliest electric line in England is that of the watering place, Blackpool, in Lancashire. It uses the underground conduit system, and has been in operation with gratifying financial results since 1885. It is two miles long, single track, and cost over £32,000 (\$155,200). The track as for horses cost £11,000 (\$53,350) and it belongs to the Blackpool Corporation. The remaining cost, defrayed by the street railway company, was for conversion to electricity. The revenue is sufficient to pay 6½ per cent. as rent to the Corporation and 7½ per cent. dividend on the company's capital. Considering that Blackpool is not a large town, this is very good. But it will be noticed that the capital is not large. The local circumstances were highly favorable to conduit construction, and admitted of a cheap method quite suitable for the place, but quite unsuitable for a large city. This method has not been adopted elsewhere.

Another electric line, that of Barking Road, London, has just closed its existence as such, for the horse has again come into use. It is a section of the North Metropolitan Tramways Co.'s system, and is a little over a mile in length. Some three and a half years ago the General Electric Power & Traction Co., Ltd., London, undertook to work the line with storage batteries, in order to show what could be done in that way. As it offered to do the work for nine cents per car mile for traction charges, including drivers' wages, and as the corresponding charge on the extensive horse system of the North Metropolitan Co. was nearly twelve cents, the offer was accepted. But only five cars were required, and with such a small installation the Electric Traction Co. found it would require a larger allowance. Accordingly it asked and got a rise to eleven cents, and this year, probably finding that expenses were increasing as time went on, it asked for fifteen cents. This was more than the North Metropolitan Co. could stand and the request was refused. Some disputes followed; resulting in the North Metropolitan Co. putting on horse cars in the end of July. That company complained that it had never been furnished with what it actually cost the Traction company to carry on the service. Had matters turned out more favorably, the managers were prepared to extend the system to others of their lines. Indeed they would have done so a year or more ago, but the local authorities held a power to stop the electric cars whenever they chose on twenty-four hours' notice. This difficulty was never got over.

The accumulator used was the pasted leaden grid type manufactured by the Electric Power Storage Co. and widely and favorably known in other fields of electric work. We believe the manufacturers maintained the cells for four cents per car mile, but, perhaps, they found this not sufficient. Still they are prepared to guarantee their maintenance on large systems for two cents per car mile.

There is no doubt this matter of the cost of repairing and meeting depreciation on storage batteries is still the great point of difficulty in England in getting an independent motor car. It has, however, to be considered, as the Electric Power & Traction Co. pointed out to us in a recent communication, that the failure from a financial standpoint of

a small installation of five cars as compared with the cost of an establishment of thousands of horses and hundreds of cars, is no more an augury of the failure of the accumulator system on an extensive scale than the enormous cost of the first small installations of electric light a few years ago, compared with that of huge installations of gas light augured the failure of electric lighting.

A similar tale of failure of accumulator traction, for the time being at any rate, is just to hand from Birmingham, where the only other notable experiment with storage batteries is in progress. It is now two years since the system was installed on the Bristol Road section of the Birmingham Central Tramways Co. The road is three miles long, double track, and from seven to twelve heavy eight wheel cars have been in use. Like the London route, the gradients are very slight, and accumulators of a similar type to those on the Metropolitan line have been in service. In the first year's working the line showed a credit balance of \$14,647, the receipts being \$42,350 and the total expenses \$27,703. Per car mile run this was 30.3 cents and 19.8 cents respectively. In the year ending June last there was a sad change. The receipts rose to \$50,547, but the expenses mounted to \$58,690, showing a loss of \$8,143. Per car mile the receipts in cents were 26.5, and the expenses 30.78. Every item except car repairs shows an increase, but the greatest differences are for machinery and permanent way and buildings. The former shows a rise from .58 cent per car mile to 8.06 cents. Here is where accumulator maintenance is beginning to tell. The charges for permanent way and buildings have risen from .28 cent to 3.44 cents per car mile. This increase, Mr. Carruthers-Wain, the managing director, explains is due to the exorbitant changes now made by the corporation (to whom the track belongs) for its maintenance. The actual maintenance cost would be very much less. Had the company been able to maintain the traffic as was expected, instead of a deficit there would have been a profit of \$5,000 on the line. He also refers to an enormous strain put on the rolling stock and batteries, by the track being an inch or more wider in the gauge than the cars. The Birmingham company seems to have got out of the difficulty of maintenance of the batteries in the meantime, as it has just concluded a contract with the makers of a new style of storage battery, whereby after the company buys the cells the makers will maintain them, at a fixed charge of two cents per car mile run. So long as this is carried out there will be no further difficulty of the Tramways company as to maintenance. The new form of accumulator is the invention of Mr. L. Epstein, who has been working at storage batteries for years. He believes he has now succeeded in producing a cell which is much lighter, more durable and heavier in the discharge than any other. The plates are still of lead, but there is no pasting, the active surface being "formed" as spongy lead on the face of the plate itself. It is to be hoped that the new venture will be a success, the more especially as failure with storage batteries would probably mean a return to horse traction on the Bristol Road. It is an aristocratic residential locality where, we are afraid, the trolley wire would not be tolerated, and where, probably, the cable would not pay.

The only other place in Britain where accumulator cars are being run is Croydon, to the south of London. Here the cars are operated by an electric syndicate, and the local tramway company does not seem to know or care what the operating expenses are. The syndicate pays a fixed sum which the company considers sufficient for the privilege of running the cars.

The only electric tramway in Britain on the overhead conductor method is that at Leeds, some four miles or so in length. For the most part it is suburban, and was started in the summer of last year as an experiment. The line was leased from May, 1891, to October, 1892, to Mr. Graff Baker, of the Thomson-Houston Co., and he has since been showing the benighted Britisher how they do it in America. The equipment is that of the Thomson-Houston Co. with American appliances in almost every detail. Needless to say, the service has been very efficient, and the Leeds people seem highly pleased with it. Extensions of the system are probable should the conflicting interests of the local corporation and Tramways company not stand in the way. The first cost and the operating expenses have not been divulged, so far as I have yet learned.

This exhausts the list of existing electric street railways in Britain. The cable system of haulage is little better represented. The Highgate line in London was opened in 1884, but it is only three-quarters of a mile long. It has worked satisfactorily at a cost of about 50 per cent. of the receipts. Then come the Edinburgh lines with two and three-quarters miles of double track and very heavy gradients. The traffic here is light, and the speed allowed is only six miles an hour. The headway of cars is, generally, considerably over five minutes, and heavy loads of passengers are the exception. Yet under the management of Mr. W. N. Colam, C. E., the expenses run little above 60 per cent. of the receipts.

It is not necessary to say so much about these cable lines as the system has now got so far beyond the experimental stage that minute examination either of efficiency or finances is superfluous. But by way of a contrast we may pause a little over the Birmingham cable line. Here the company works three miles, double track, of cable road, or the same distance as it operates by electric accumulators. Running from the heart of the city in a northwest direction till it joins the South Staffordshire street railways, the road is a very hilly one, and there is a fair traffic. The service is a three minute one, and the cable speed on the town half is seven miles an hour, and on the suburban nine. The total receipts for the year ending June, came to \$153,187, and the total expenses to \$77,600. This means that the receipts per car mile run stood at 24.2 cents, and the expenses 12.36 cents. Comment is unnecessary. It may only be noted that the steam cars, horse cars, omnibuses, cable cars and electric cars of the company ran between them 2,657,145 car miles during the year, of which the cable cars ran only 621,210. Yet out of a total profit of

\$179,586 the cable cars contributed no less than \$75,582. Since the steel rope was inaugurated in 1888 it has been a continued success. The directors have such faith in the cable system for heavy traffic that in order to meet growing corporation charges for lease of lines, and to abolish the enormous expense of the steam cars, they propose to convert another section of their system to cable. It should have been noted that none of these Birmingham figures include allowances for depreciation, as a special fund is set apart to cover that.

This completes the record of street lines in Britain operated by electricity and cable. There are, of course, many steam lines, but these are meeting with growing disfavor, owing to their heavy cost and disagreeable character. Looking to the immediate future, both electricity and the cable are to have further tests under British practice. The trolley wire method has been adopted for nine miles of road in South Staffordshire, superseding steam. The track runs from town to town in that thickly populated district, and all the circumstances point to success. The Electric Construction Corporation of Wolverhampton is carrying out the work. Some sixteen cars will be used, and the cost over all—the permanent way being already in existence—is stated at over \$14,550 per mile of road length. The track is partly single and partly double. Side poles with brackets will be used, while the trolley pole will rise from the side of the car roof in bracket form to meet the wire. Mr. Thomas Parker has superintended the construction, and operation is expected to begin shortly.

The Brixton Road, London, cable line is also just about to be opened, and indeed it may be operating when this article is in the hands of readers. It has been a conversion from the horse system, and cars will run on a two minute headway. The road is three miles long, double track, and grip cars will haul the horse cars from three converging lines over it. Provision has been made for an extension, and everything indicates a great success. For the first time in Britain we shall have the cable really in its element, namely, dealing with an enormous traffic in the city district. Mr. W. N. Colam is the engineer.

As to the future, matters are more or less uncertain. Many towns are talking of electricity, but nothing definite has yet come of it. A short experimental trolley wire line was recently run in Bradford to demonstrate that the heavy inclines in that town could be successfully overcome, but a doubt arose as to whether the section subsequently to be installed could be operated profitably with the traffic there is upon it. Mr. Graff Baker has been negotiating with the Coventry Corporation with the view of stringing the trolley wire in that ancient city, but the conclusion has not yet been come to. There is a talk of an important line in the Midlands being converted to cable, and Bristol is thinking on the same means of operating a hilly route there. Glasgow is in a peculiar position. The street railway tracks there have all along belonged to the Corporation, and the local tramway company worked them on lease. The lease expires in 1894, and the corporation has resolved to operate the lines itself. Since coming to that resolution—a very unwise one from an American point of view—the corporation has been studying the question of mechanical motors. It, however, recently failed to come to terms with the tramway company for the purchase of its rolling stock, horses, stables, etc., and it can get no control whatever of the lines till the expiration of the lease. The Corporation has now determined to begin with horses, and to this end a horse establishment is to be equipped. Although much is said by the Corporation to the contrary, I consider this may mean the postponement of the introduction of mechanical power on an extensive scale for a considerable time. But I learn that as far as possible no time will be lost in beginning the experiments after the tramway company's lease expires two years hence. A year or two ago the members of the Corporation were very strongly in favor of the accumulator system, but as a result of closely watching the operation by that method in London and Birmingham they have now abandoned all idea of it. Not only do they find the cost of maintenance too heavy, but that the longer the batteries are in use the more frequently they require to be charged. This reaches a point where charging is required every hour or two, and obviously such a state of matters will not suit Glasgow.

The Corporation's committee is now, we learn in response to inquiry, getting estimates for the equipment of a few miles of the city's northern lines on the trolley wire method, with a view to getting an experiment started as soon after the lease expires as possible. There are some rather stiff gradients on these lines, and only this system or the cable could work them. Looking at local circumstances, the Corporation will probably have to adopt the cable on some of the crowded central routes. In Edinburgh the local corporation is about to buy the lines, which at present belong to the tramway company, but it will lease the working. Many of the routes are very hilly, and, with the example of the present local cable roads (which belong to a separate company), rope haulage is first favorite.

A word of reference may be made to the elevated electric railroad which has been under construction at Liverpool for some time. Though it is not a street railway and does not even follow the lines of streets to any considerable extent, it has this in common that motor cars are to be used. Eight wheel cars, each forty-five feet long, mounted on two bogie trucks, will run in trains of two cars. On the bogie at each end of the train will be fixed an electric motor of from seventy to 100 H. P. The rearward motor for the time being will alone be in action. The railroad, which has been frequently described in the trade journals of late, will be operating in the beginning of winter.

There is no doubt that recent events in London and Birmingham have struck a severe blow at the progress of accumulator traction in Britain. The strong objection to overhead structure in many quarters, however unreasonable it may be, makes the storage battery system very desirable, but the question is who will step forward and try to show that it can be operated economically on an extensive scale. Birmingham at present is the only chance, and the scale there is not very

extensive. The independence of the car, compared with other systems is another attraction. The trolley wire will, however, I am convinced, make progress, especially in manufacturing districts, and the only obstacle, ultimately, to the cable will be the first cost. Still, many busy cities will come, and indeed are coming, to see that for their dense traffic it will pay them in the long run to convert their busiest horse to cable lines. More of the expense than might at first be thought can be recouped out of sales of horses, buildings and lands no longer required. If the new electric road in South Staffordshire and the new cable road in London operate successfully from a financial point of view—and there should be little doubt of this—there will be a rush in a year or so for mechanical power. Public opinion being once roused, the present obstacles, which have been referred to above, will be speedily swept away. The dry bones are coming to life, and a "boom" both in electricity and cable is at hand.

Legal.

STREET RAILWAYS—IMPROVEMENT OF STREETS—ALTERATION OF TRACKS—CITY COUNCIL—RESOLUTION OF. This action was brought on a writ of *mandamus*, to compel respondent street railway company to make alterations in its tracks. The writ was granted and the company appealed.

Held. 1. That the permission given a street railway company by a city to occupy streets is subordinate to the city's statutory and corporate powers respecting the use, control and regulation of streets.

2. That under the statutes (How. sec. 3,554) authorizing city councils of cities in which are street railroads to establish, "by ordinance or otherwise," such rules and regulations in regard to the same as may be required for the grading, paving and repaving of streets, a city council may require the removal of the projecting ends of the ties of a street railroad when it deems that they will injure a contemplated concrete pavement by jarring the same and disturbing its stability; and such requirement may be made by resolution, and need not extend to railroads other than that occupying the street intended to be improved. Affirmed. *City of Detroit v. Ft. Wayne, etc., St. Ry. Co.*, Mich. S. C., March 18, 1892.

INJURY TO PASSENGER—BOARDING MOVING CAR—INSTRUCTION. In an action against a street railway company for personal injuries, plaintiff's theory was that she motioned the driver to stop the car; that he stopped it, and, that while she was getting on, the car suddenly started and threw her, causing the injury. Defendant's theory was that while the car was in motion at a place where, by the rules of the company, the driver had no right to stop, plaintiff rushed from the sidewalk toward the car; that the driver called out to her not to come near the car; that she paid no attention to the warning, but attempted to seize the forward part of the car; that a passenger standing on the front platform, stepped on the step of the car, and put his arm out to prevent plaintiff from seizing the car; that she ran against his arm and was thrown down, and did not touch the car at all. The court charged that, if plaintiff attempted to get upon the car while it was in motion, the car not having been stopped for her to get on it, and the motion of the car threw her down, she assumed the risk, and was not in the exercise of due care if she was injured thereby. The jury were also instructed that, if the car was stopped for her to get upon it, and she stepped on the step, and then, while she was in the act of stepping, the car was needlessly started, so as to throw her down, the company would be responsible.

Held. That the instructions were not given in abstract propositions of the law that a person was not in the exercise of due care who attempted to get on a horse car while it was in motion, but were given in connection with the two theories of the case, and were correct. Judgment for defendant affirmed. *Gallagher v. West End St. Ry. Co.*, Mass. S. J. C. March 29, 1892.

CONDEMNATION OF LAND FOR ELEVATED STREET RAILROAD—EVIDENCE—INCORPORATION. In an action upon petition to condemn land, on appeal the court

Held. 1. That under Act 1875 (Rev. Stat. 1891) which

authorizes the organization of companies for the purpose of constructing elevated ways or conveyors under the general incorporation law, does not prohibit the organization of companies for the construction of elevated railroads under the act in relation to the incorporation of railroad companies.

2. That a corporation organized for the purpose of building a "railroad," between certain points, in pursuance of Act, March 1, 1872 (2. Starr. & C. Ann. St. 1,907), which provides for the incorporation of associations "for the purpose of constructing and operating any railroad in this state," has a right to condemn land for the purpose of constructing an elevated railroad in a city.

3. That evidence as to the value of the land to be taken should be limited to the date of filing the original petition, and not to the dates of subsequent amendments.

4. Where in an action to condemn land for the use of an elevated railroad a stipulation has been entered into by the petitioner to the effect that the road should only be used for passenger traffic, that no soft coal should be used on its locomotives, and that its motive power should be fully equipped with the best modern devices, to render it noiseless and smokeless, it is proper to allow the jury to consider such stipulation in assessing the damages. Affirmed. *Dieberman v. Chicago & S. S. R. T. R. Co.*, Ills. S. C., March 24, 1892.

TIME OF RUNNING CARS—VALIDITY OF ORDINANCE—REGULATING SAME. 1. Where a horse railroad charter provides that its cars "shall run as often as the convenience of passengers may require," and the road "shall be subject to such reasonable rules and regulations in respect thereto as the common council may, from time to time by ordinance prescribe," an ordinance requiring the several street surface roads of this city to operate their roads "not less than one car every twenty minutes between the hours of 12 midnight and 6 o'clock A. M., each and every day, both ways for the transportation of passengers," will be presumed to be a reasonable and valid exercise of the legislative power of the city, until evidence rebutting such presumption is adduced by defendant road prosecuted for the penalty provided for the violation of such ordinance.

2. That in such a case the convenience of passengers, and not the cost of the defendant of running the cars, is the test of the reasonableness of the ordinance, which is a question of law for the court. But, the rejection of evidence offered by defendant for the purpose of showing that, with respect to one of its branch lines, such ordinance is unreasonable is ground for reversal. Reversed. New trial ordered. *Mayor, etc., New York v. The D. D., etc., R. R. Co.*, N. Y. C. A., April 17, 1892.

ENTERING MOVING CAR—CONTRIBUTORY NEGLIGENCE. In an action to recover for a death caused by the negligence of the defendant company it is

Held. that it is not, as a matter of law, negligence for a passenger to attempt to enter a street car while the same is moving, irrespective of the rate of speed or other qualifying circumstances. It is presumptively negligent to do so if the car is moving at its ordinary rate of speed, or with accelerated speed, and especially if the attempt is made between cars, or at the front instead of the rear of the car. It is ordinarily a question for the jury, depending upon the circumstances of each case.

RIGHT TO USE STREETS—PUBLIC HIGHWAYS. The proviso in the general railroad law of Pennsylvania, to the effect that it shall not authorize any corporation to enter upon and occupy any street in any incorporated city without the prior consent of such city, does not confer the right to enter upon public highways or city streets by virtue merely of such consent. *Penna. Ry. Co. v. Philadelphia Belt Line R. Co.*, Pa. Com. Pleas Court. March, 1892.

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A Cordial Invitation is hereby tendered to all in attendance at the Cleveland Convention to call and register at our headquarters, at the Hollenden Hotel. We value the honor of being enrolled among the number of those engaged in developing the street railway business, and welcome all the fraternity, while we view with delight and with pride the marvelous strides which this industry is making.

The Situation in England as it relates to the street railway industry is graphically and clearly portrayed in an article by our special correspondent printed in another column. Many, judging by the proverbial conservatism of the English, predict that the introduction of mechanical traction must necessarily be slow and of limited extent, but we are of opinion that electric power will so act upon the people that they will be galvanized into new life, so that the demand for rapid transit facilities on the part of the general public will break down the barriers, and that the business will make as rapid strides in the near future as it has already done in this country.

A Proper Steam Line Crossing was one of the incidental subjects discussed at the recent meeting of the Massachusetts Street Railway Association. The subject is one in which nearly all the street railway companies of the country are interested, and one in which they should assert their rights, for in nearly all cases the steam lines assume to dictate what kind of a crossing shall be employed, and usually refuse to allow the rails to be notched to provide for a smooth crossing for electric cars. It was clearly shown in the report that the street railways transport a larger number of passengers than do the steam lines, and from this view of the case, it would naturally seem that the rights of the street railways in this matter should be more justly treated. With the

advent of mechanical traction the jolting of the cars from any cause tends to injure the trucks and motors, and we can see no good reason why the electric lines should not be accorded as smooth a crossing as steam lines. We are glad to know that the matter is receiving attention, and that a memorial will be presented at the next meeting of the American Street Railway Association calling the attention of that body to the matter and suggesting plans of action.

Advance Copies of the reports of special committees at the coming Convention are to be furnished to all applicants, so that there will be an opportunity for all who so desire, to prepare themselves for taking part in the discussions which will follow. This is a new departure from the ordinary methods of the Association, and we believe will add largely to the value of the proceedings and facilitate the dispatch of business; but in order to derive the largest benefit from the new arrangement, it will be necessary for the chairmen of the various committees to send copies of their reports to the secretary in time to allow for printing and distribution, and that interested parties obtain them and use them as designed. We have, from the first, favored this method of conducting the Association's business, and trust that it may not fail through any neglect on the part of the committees. There will now be no excuse for those who style themselves diffident men for not taking part in the discussions, as they will have ample time for preparation, and since such men are usually possessed of a large share of good hard sense, they can doubtless impart a great deal of valuable information. As opportunity offers, we shall expect to hear, in the coming meeting, from a large number of such men, and we believe that the proceedings will be correspondingly more interesting. We believe that it is the duty of every one to contribute to others' good whenever he is able to do so, for in so doing he will multiply his own power for useful work.

"I am Entirely Indifferent to the anathemas which the daily press continue to hurl against the trolley system and those of us who were instrumental in its introduction," said a prominent street railway president recently, "and so is the public, now that our lines are in operation and an opportunity has been given to the people to ride in our cars. They begin to appreciate the improved facilities, and no amount of newspaper criticism seems to move them." This is a condition of affairs which we have anticipated, and we doubt if the history of journalism presents a parallel in which the daily press (usually on the side of right and in favor of public improvements) has made so many grave mistakes or suffered a more inglorious defeat. This senseless opposition has, however, served one good purpose, as it has given the managers of certain street railway lines an opportunity for the display of a degree of courage and perseverance in the face of bitter opposition that heretofore has been accorded only to soldiers or prominent reformers. This final victory should serve as an incentive to the managers of other railway lines in our large cities to do likewise, for there is a sure prestige of ultimate success and the promise of enjoying, as others now do, the proud consciousness of having taken a wise course in the matter. The attitude which the local papers in our large cities have taken in reference to the introduction of mechanical traction, emphasizes the fact that the technical press, in matters

pertaining to public improvements, is a much safer guide than the more popular publications.

A Defective Memory Epidemic seems to have broken out among street railway conductors in nearly every direction, as we read of several lines being compelled recently to discharge a number of afflicted men. This disease, or mental aberration, which manifests itself principally in neglecting to register fares, is a very contagious one, and unless promptly quarantined and the patient retired is apt to cripple the resources of a company. It is strikingly apparent that we need the labors of a Dr. Koch in this country to discover, if possible, the particular germ or bacteria which is the origin of this disease in order that a suitable remedy may be devised. One peculiar feature of this malady is that it is frequently accompanied by an abnormal development of an ability for trickery and a skillful manipulation of the register and reports to deceive the company and prevent the disease from being discovered. So prominent is this feature that the skill and ingenuity displayed by certain conductors in this direction surpass that of the executive officers in the management of the road, and could it be expended in the direction of useful and honest work would place many of these men in the front rank of successful street railway managers. While there is a field for improved street railway appliances in almost every department of the service, there is none so important or desirable as a class of trusty and reliable conductors with good memories, and who will not be partial to their friends. Such a class will be more readily developed when the general public takes an interest in such matters and observes whether the conductors on the cars on which they ride collect their fares and those of their neighbors, and promptly register the same.

"I Cannot Find Time to Read Street Railway Papers," said a street railway manager recently. Such an admission on the part of an executive officer of a street railway company argues one of two things: Either that he has failed to organize his forces so as to relieve himself of burdensome details, or that his directors are imposing upon him too heavy burdens which will eventually result in an inferior service. We admit that there are periods in the administration of the affairs of a company, such as the re-equipment of the lines for mechanical traction, or building extensions, when the details are all-absorbing; but when such is the chronic condition of the manager, we instinctively feel that he is likely to lose ground and be outstripped by some of his less prominent neighbors who read and take advantage of the practical suggestions that constantly appear in the journals devoted to this particular industry. He is not the most successful manager who does all the work himself, but rather he who holds his subordinates responsible for details while he gives himself ample time for research and improvement. The manager of the former type will soon wear himself out in the service of the company, while he flatters himself that he is making a great sacrifice for his employer; but the other will prolong his period of activity and enjoy the confidence and favor of his directors because of the constantly increasing dividends which he is able to earn. We know of men at the head of comparatively small systems who are always overburdened with details, while others who control a much larger mileage and an enormous traffic, are never overburdened and

manage their business with comparative ease. The sooner a manager learns to appreciate the situation and to govern himself accordingly, in so much less time will he reach the highest standard in his profession and gain an enviable reputation among his fellows.

The Introduction of the Trolley in the annexed district of New York City is an event fraught with tremendous possibilities; for it is reasonable to expect that the people of this city will readily appreciate and adopt this method of traction, as have the citizens of other places where the trolley cars have already been in operation; for not in one single instance, we are assured, would the people of these places submit to the removal of the cars. Hence, we predict that as soon as the New York people become acquainted with this method of transit, and their causeless fears regarding the danger element are allayed, they will demand its extension in such positive terms that neither the public press nor the municipal authorities will be able much longer to block its universal introduction. We congratulate the Union Railroad Co. on its splendid success and increased receipts so far, and the residents of the annexed district on having so admirable a system of rapid transit. In this connection the fact should not be overlooked that while the Union Railroad Co. were the prime movers in this enterprise, yet its execution has been largely in the hands of one man. Mr. L. H. McIntire, chief engineer of the company, has not only arranged all the mechanical details and superintended their execution, but upon him has devolved the duty of seeing the city officials frequently, and also the objecting property holders along the line, and of outgeneralling the mobs in the outlying districts which have repeatedly torn up his tracks and even threatened him with personal violence. Hence the credit of the work is largely due to his ingenuity, skill, industry and patience, and we have no doubt will eventually be thus recognized.

The Saratoga Convention of the New York State Street Railway Association, although not largely attended, was very fruitful in results. The fact was emphasized in the report made by the attorney that the efforts of the Association had resulted in checking state legislation that would have been hostile to street railway and other corporate interests. The statement was made that over 100 bills had been introduced at Albany at the last session, which, had they been allowed to pass, would have materially crippled the street railway interests of the state. Another fact was emphasized that it would be to the advantage of the smaller companies of the state to become members of the Association, for they could materially aid, by their influence with the local legislators, in shaping legislative action. We have, heretofore, referred to this matter, and we are quite sure that any company which will give attention to this subject and learn how great are the advantages to be derived, would not delay to enter the organization. In the paper and discussion following, it will be seen that there is a demand for a number of better appliances in some of the minor details of car building, particularly as regards the method of lettering and signs and night signals to indicate the routes over which the cars operate. There is a field for the exercise of inventive genius in this direction, and any person who will solve the problem satisfactorily will no doubt receive ample reward for any improvement in signals. The rail and joint question was also incidentally

discussed, but very little light, however, was thrown upon the subject. It is interesting to note from the discussions that on single track lines where the cars run in both directions the joints do not give as much trouble as they do on double track lines. From these facts it would be inferred that the life of a track would be greatly increased if the cars could be run alternately right and left handed, but owing to the confusion that would result, probably this practice can not be followed. The organization of a supply men's association was, in our opinion, a wise step, and we believe that it will result in mutual good to both the street railway and material men, and it is hoped that at the coming Cleveland convention a similar association will be formed.

The Approaching Convention is an event in which every street railway man should feel a deep interest, whether he is able to be present at Cleveland or not. If not present he will read the proceedings as reported in the technical papers, and will no doubt be benefited, but the advantages of being present are sometimes overlooked, and some of these advantages we wish to emphasize. These are, first, the social features, which give the men from widely separate localities an opportunity of becoming acquainted and of gaining that confidence that comes from being a part of a great organization to which one can look for support and sympathy in times of trouble or serious opposition. A second advantage would come from an inspection of the various appliances which will be placed on exhibition by the manufacturers and dealers in street railway supplies, as well as making the acquaintance of the same dealers, which perchance would be of advantage in future business transactions. The third advantage in the present case will be the opportunity of visiting and inspecting the street railway systems of the city, which embrace the various methods of mechanical traction, and on which a deal of experimenting has been done, the results of which are excellent systems which will serve as models for imitation. There will also be an opportunity of visiting the local electrical and other industries devoted to the production of street railway appliances of which the city is justly proud. We are aware that there are but few active street railway men who do not already appreciate all the advantages that we can name; but there are many who cannot be present because their directors have neglected to make provision for a vacation and also to provide the funds necessary. We should like to gain the ear of all such directors and suggest that it would be a graceful act on their part to offer a vacation to their faithful heads of departments, and provide liberally for meeting the incidental expenses of a trip to Cleveland, and to say that such an investment would, no doubt, prove a profitable one. A soldier, were he required to engage in battle alone, would make but a sorry attack or defense, but if he can feel the touch of elbow with comrades on the right or left, finds his own courage increased and his capacity for doing useful work more than doubled. The same is true of an association of allied industries; there is a confidence born of union, that adds greatly to one's productive power. In reviewing the history of the Association, and noting the names that have been prominently connected with it from its early history, we find that in most cases they are the same parties who now control or manage the most important street railway systems of our large cities, and who

are ever ready to witness to the advantages they have derived, by participating in the proceedings of the Association. In conclusion, we are confident that it will pay in more ways than one for every street railway company in the country, as well as those firms engaged in the manufacture of street railway appliances, to be represented at the Cleveland meeting.

Compensation for the Use of Streets.

When a town or city is young, the authorities are frequently puzzled to know what to tax, and at the same time cause the least inconvenience; that is, the least popular opposition. To this end methods are employed calculated to conceal the way in which the people pay such taxation, by taxing a corporation or something of that kind, which act requires the corporation to impose a higher rate of charges on the public in order that it can get its tax back again. By such means the town politicians escape the onus of the act, and put it on the shoulders of the corporation; although, as a matter of fact, the people only are the ones who pay the tax. But the subterfuge of the tax makers is shortsightedly successful in its purposes, and all the wrath due to the cost of the tax is transferred away from them upon somebody else.

In no department is this tendency of the politicians more marked than with street railway service; in such cases the street car corporations are special objects of attack, and commonly they are made to pay dearly for their privileges. From the standpoint of a city's best and most rapid development—and usually that is one of the chief objects of political management—this course of action defeats its own purpose; for the simple reason that it adds to the cost of residence in one of those ways which attract the home seeker's attention, next to rent itself. One of the first questions asked by the new or contemplating resident is: What is the cost of travel between the home and the place of business, and what kind of service is obtainable? This question answers itself, so far as a public policy is concerned; that town which affords the best street car service, and at the lowest cost, other things being equal, grows the fastest. In fact, it is well appreciated among steam railway officials that a low priced, frequent and comfortable service has built up a good many cities in this country, which to-day could have made no such showing if that service had been absent. The rule holds equally well in the case of street railways, for the methods of getting from one part of a town to another are as important to the resident as to get to the town at all. Either want failing of attainment, means a proportionate reduction in a town's development.

Probably there is no one feature more calculated to develop a town—therefore the nation—than a first class means of intercommunication between the people; this assumption is easily verifiable by noting the slow growth and general business idleness of the people in European cities where for ages such intercommunication has been almost absent, or so inconvenient that commercial and other intercourse has been attended with too much cost and delay to produce a general prosperity.

For these reasons it becomes self evident that if the politicians really have their town's best interest at heart, they must encourage by practical aid, rather than suppress, efforts which have for their end and aim the improvement of local transportation facilities. And consequentially, if the granted right of way really possesses a large value independent of that which the transportation company develops by its own enterprise, all such advantages should go in the direction of reducing fares rather than increased taxation, whatever its forms, which is a practical premium upon the non-development of the interested locality. The whole interests of the people are inwrought with the transportation problem; consequently any action of the people against the fair interests of transportation is practical suicide, so far as the desired results of intercommunication are concerned.

The Safety of the Trolley System.

The trolley system has been and is now being attacked in several cities with a virulence and bigotry which is uncommon and seems greatly out of place in this Nineteenth Century. These attacks, it is interesting to note, are being made in cities which have had no practical experience with the system. After the cars are in operation, and their advantages over horse cars become understood, the general abuse stops, showing that the benefits conferred more than outweigh any supposed drawbacks in the new power. But no amount of experience of other cities in this line seems to be of benefit in checking this spirit of opposition against the unknown electric car. The desirability of the electric system may be shown, and the fallacy of the arguments used to oppose it may be proved, but the same unreasoning prejudice exists and manifests itself on occasion.

This prejudice seems based upon two alleged grounds, viz., that the overhead structure required for the operation of the cars is objectionable from an æsthetic standpoint, and that maintenance of the system itself is attended with danger to passengers and occupants of the streets.

The first charge might, perhaps, have been made with some sort of propriety against the early electric railways. The pole lines on many of these roads were built to sustain a greater weight in the streets than is now necessary, and the entire method of construction was crude and of a less expensive type than now. But later improvements have greatly changed the appearance of the overhead portion of an electric line. Wooden poles have been replaced by those made of iron, manufactured especially for the purpose, unobtrusive and tasteful, while the number of wires absolutely required has been reduced to one trolley wire for each track, and two guard wires (not always necessary) with the proper span wires for holding these in position.

In regard to the alleged danger attending the employment of electric cars, we have repeatedly shown the groundlessness of charges of this nature, and it seems almost unnecessary to devote any further space in this paper to the subject. But since the opposition to the system is avowedly based largely on its supposed danger, and since in cities and among individuals ignorant of the practical workings of the electric system this idea has become widely accepted as truth, a further examination of the subject may not be without value.

The advantages gained by the use of electric cars is rarely taken into consideration in these attacks upon the system as a whole. By omitting this feature and assuming that the public gains nothing in the discontinuance of horse cars by cleaner streets, the removal from the centres of cities of extensive stables, quicker transit and better cars, let us see whether as viewed from a danger standpoint alone the electric cars are more objectionable than horse cars. The electric current, from its mystery, is supposed to conceal a death dealing power, dangerous alike to passengers and passers-by, and reports of accidents on several electric railways have been exaggerated, until a strongly founded belief has been created in the minds of many that such a danger exists. This is only another instance that a falsehood long persisted in becomes often accepted as truth. As a matter of fact we have yet to learn of a single instance of any passenger or other person other than an employe of the railway company, being permanently injured, still less killed by the current of an electric railway. All alleged accidents from this cause have been investigated and found to have been either fictitious or traceable to some other origin than the railway circuit.

The maximum voltage used on an electric railway has been settled by universal practice to be in the neighborhood of 500, never rising above this figure. In only one or two instances in the entire history of electric railroading have fatal results to employes followed a shock from this voltage, and in these, the circumstances under which the accident occurred were such as could not occur to any passenger, while there is no reason to believe that heart disease was not the cause of death. The danger to passen-

gers or passers-by, in any event from this source, is absolutely *nil*. A person can only receive a shock by touching the overhead wire and ground at the same time, and this cannot occur while the trolley is in its place eighteen or twenty feet above the track. In this position it is very firmly fastened, the poles and supports being especially designed to resist the greatest strain which can come upon them, while the guard wires carried above the trolley wire prevent any electric light, telephone or other wires falling on the trolley wire from above. But in case the trolley wire should at any time become broken and fall to the ground, the section of the line in which that point is situated is instantly cut out of connection with the generators by automatic safety catches, making the broken trolley wire perfectly safe to handle.

The second charge brought against electric cars, is that owing to their greater weight and higher speed they cannot be quickly stopped, and, consequently, they cause a large number of street accidents. An electric car can, of course, be run at the slow speed of a horse car, if desirable, and whether under these circumstances the opponents of the electric system consider them more dangerous than horse cars, we are unable to state; but even at the rate of speed at which electric cars usually run we consider them no more dangerous to occupants of the streets than cars drawn by animal power. The reason of this lies in the fact that the electric car, though heavier, can be stopped much more rapidly than a horse car, and within a shorter distance. With horse cars, only hand brakes are available. With electric cars, on the other hand, power brakes can be used by which the car, while running at a speed of ten miles an hour, can be stopped within a distance of about fifteen feet, depending upon the condition of the rails. In cases of emergency the current in the motors can be reversed by the motorman without changing his position, as has often been done, thereby stopping the car within a very much shorter distance.

Now, having considered the charges against the electric car, let us see who speaks in its favor. How has the introduction and use of the electric cars been regarded by the general public in the cities where electric power has been adopted? Do the people who live where these cars have been in use for a considerable time and who use them daily, regard them as dangerous and objectionable, and do they desire to return to horse cars? This question is easily answered. The verdict is unanimously in favor of the electric car. Every city in which electric cars have been introduced has pronounced with no uncertain voice in their favor. The improved method of transit has bettered the centre of the city, by the removal of a large number of horses from the streets, and by bringing the city into closer communication with the suburbs, thereby allowing those whose business requires their presence in the city during the day, to establish their homes at some distance. It has also helped the suburbs by raising the price of property and by bringing rapid transit in comfortable modern cars and in a way never accomplished and impossible with horse cars.

In answer to a circular letter recently sent by a metropolitan daily to the mayors of each city in this country in which electric cars are in operation, asking the popular opinion of them, many answers were received, all unequivocal and all favorable. In none of these cities would a proposition to return to animal power receive respectful consideration. In other words, the electric railway has come to stay, and its wider adoption cannot be prevented by the unimportant and weak objections brought against it. It has won the approval of the citizens of those cities where it has been installed, and while the future may bring improvement in details, it will not alter the favorable opinion in which electric cars are regarded by those who have actual acquaintance with them.

THE Ford-Washburn Storelectro Co., of Cleveland, O., are progressing satisfactorily in the development of their storage battery system, and will have a car in operation on one of the Cleveland lines during the Convention, when all will have an opportunity of witnessing the result of the experiments thus far conducted by this company.

The Power Stations of the Brooklyn City Railway.

The electrical equipment of the lines of the Brooklyn City Railway Co. which operates 180 miles of track in that city, is being pushed rapidly forward. The company have decided upon the construction of two main power stations. One of these will be located, as has already been mentioned, near the site of the present temporary power station on New York Bay at the foot of 52d Street, South Brooklyn. The other station, known as the Eastern

are below the boilers and on the floor line, obviating the necessity of the heavy supports which would be requisite if the flues were above the boilers. The steam pipe from each boiler is connected directly with the duplicate mains, shown in the figure, and supported from the roof. The connections are such that any boiler at any portion of either of the mains can be cut out without interfering with the operation of the plant. The ashes from the boiler pass through a chute into an ash car whence they are taken away. All the handling of both fuel and ashes is done by mechanical conveyors.

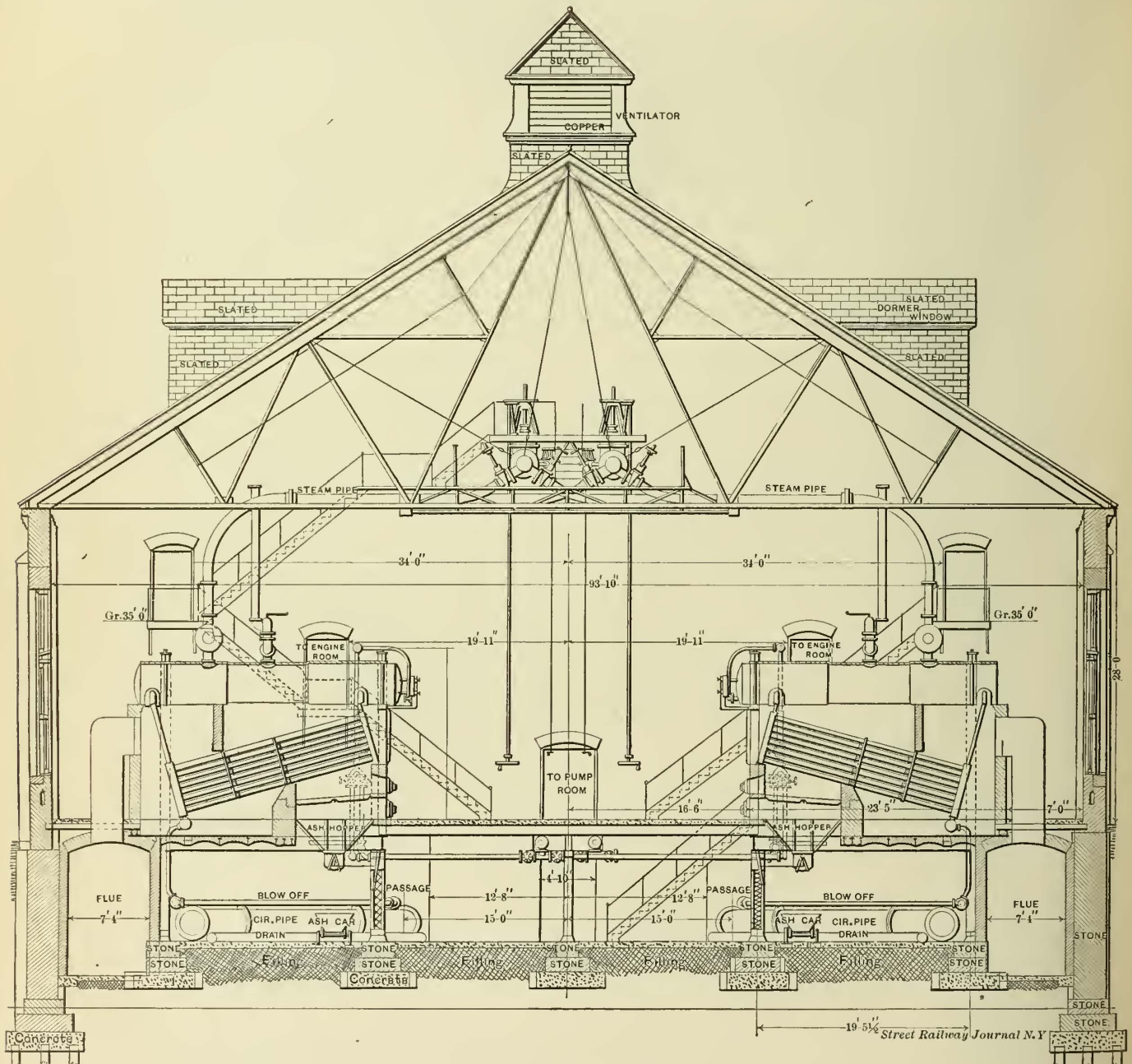


FIG. 1.—SECTIONAL VIEW OF BOILER ROOM—SOUTHERN POWER STATION, BROOKLYN CITY RAILWAY CO.

Station, will be located at the corner of Kent and Division Avenues, Williamsburgh. The ultimate capacity of the former will be about 12,000 H. P. The foundations for the machinery have all been placed in position, and by the time that this reaches our readers the roof girders will probably be in place, and the stack nearly, if not entirely, completed.

The power station is of brick with blue stone trimmings and measures 98×378 ft. outside dimensions. The boiler room is in the western part of the building and is 93 ft. 10 ins. × 138 ft. Fig. 1 shows a cross section of this portion of the building, and Fig. 2 the plan of the building. The boilers are twenty in number of 250 H. P. each, and were supplied by the Babcock & Wilcox Co., of New York. As will be seen, the flues, which are of large dimensions,

Fig. 3 presents a cross section and Fig. 4 the plan of the engine room, and these diagrams show very accurately the duplicate system of piping and also the arrangement of the engines and generators. As will be seen, the method of driving adopted is worthy of attention, and somewhat different from that employed in other large stations of this character. The generators are mounted on an elevated platform, and are connected in pairs, the armature shafts being in line. A pulley shown in greater detail in Fig. 5, is mounted between the two generators with friction clutches and belted directly from the engine. By means of these either or both generators can be run or not at the option of the engineer. The engines were manufactured by the E. P. Allis Co., who are the contractors for the entire machinery at the station. They

are cross compound, condensing, and their cylinder dimensions are twenty-six inches and forty-eight inches by forty-eight inches stroke. Four of these will be placed in position within the next month, and the four others, which will complete the station, will probably be installed during the next six months. These engines were designed

114 ft. long, three-ply, and will be furnished by Chas. A. Schieren & Co., the Monarch Belting Co., the Charles Munson Belting Co., and Fayerweather & Ladew. The switches, arresters, etc., will be located in a special "controlling room" shown in the plan.

The stack, which will be located between the engine

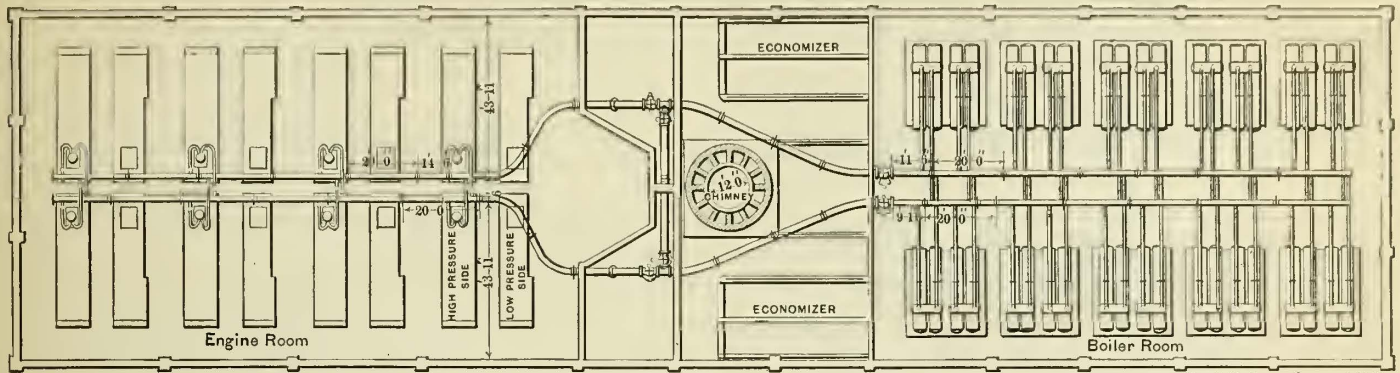


FIG. 2.—GENERAL PLAN OF STEAM PIPING—SOUTHERN POWER STATION, BROOKLYN CITY RAILWAY CO.

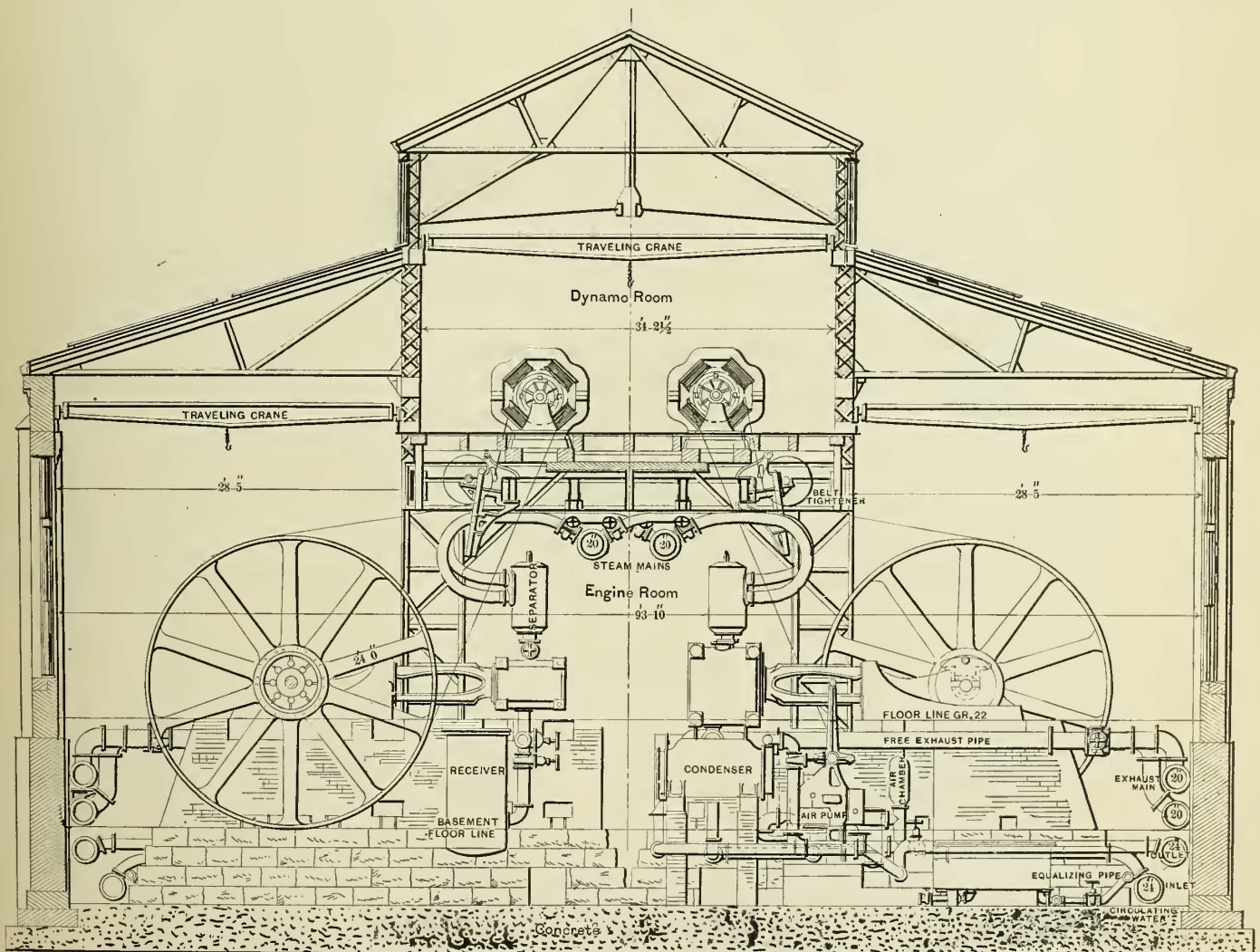


FIG. 3.—SECTIONAL VIEW OF ENGINE ROOM—SOUTHERN POWER STATION, BROOKLYN CITY RAILWAY CO.

to develop 900 H. P. each under the most economical conditions and to work up to 1,500 H. P. each. The iron work in the station was supplied by and erected by the Boston Bridge Co. The generators are of the Thomson-Houston M. P. type and of 500 K. W. capacity. The interior walls of the engine room, to a height of eight feet from the floor level, are wainscoted with enameled brick of red and cream color, allowing this portion of the room to be kept clean from grease and oil. The roof will consist of two inch hard pine, laid upon the purlines and rafters, and covered with slate. The engine room will be kept well lighted, and skylights have been arranged over each engine. The four belts already ordered are seventy-two inches wide,

and boiler rooms, will be 200 ft. in height and will have a flue twelve feet in diameter. The foundation of the stack consists of a layer of concrete four feet in thickness and sixty-two feet square, resting on piles. Above this is eleven feet of granite. The base of the stack is square for a height of twenty-five feet, then the corners are stepped in until an octagon is reached from which the stack is carried up in circular form. Fig. 6 shows the arrangement of the flues at the base of the stack. The gases from the engine are first carried through economizers which reduce the temperature of the gas to about 300 degs. The damper doors at the entrance to the stack are 16 x 11 ft. 8 ins. and it was quite a problem how these could best be oper-

ated. The plan adopted is the same as with the West End power station at Boston. The damper doors are hung by chains from bolts passing through the sustaining arc of the stack, and the doors are then worked by a rod from the outside. The floor of both engine and boiler rooms consists of concrete, four feet in thickness, and this rests entirely on sand, the stack and walls being the

Electric, Cable and Miscellaneous Notes from Providence, R. I.

The Pawtuxet electric line (Thomson-Houston equipment) which was put in operation on the 20th of January last by the Union Railway Co., of Providence, R. I., continues to operate in a highly satisfactory manner. Twenty-two of the

cars are mounted on the Robinson radial trucks, and the superintendent, A. T. Potter, told us that he felt he had made no mistake in adopting this type of truck, as in so far that it had required no repairs and was sustaining all the claims made for it. The car bodies, most of which were manufactured by the Newburyport Car Manufacturing Co., are giving every indication that they will have a long life, and are looking as well as when first put in service. A large portion of the track over which the electric cars operate is laid with the Providence girder rail, and though it has been in service seven years, the joints are standing up remarkably well, so that the wheels pound but little. This rail has had a very poor

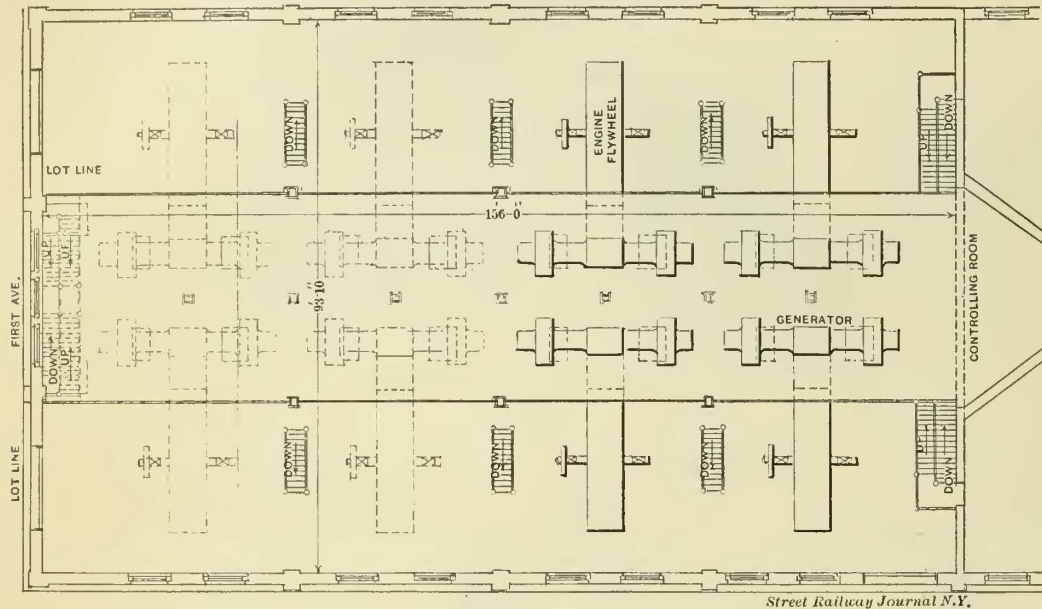


FIG. 4.—PLAN OF ENGINE AND GENERATOR ROOM—BROOKLYN CITY RAILWAY CO.

only portions of the building for which piles had to be driven.

The location of the station being on the bay, the best facilities are secured for the receipt of fuel and for securing water for condensing purposes. The managers of the company have built a pier 700 x 200 ft. in size, from which coal will be landed directly from barges and taken to the station by machinery.

THE EASTERN STATION

which will be located at the corner of Kent and Division Avenues, Williamsburgh, will have an ultimate station capacity of 24,000 amperes. The engines will be cross compound condensing engines; cylinder dimensions forty-two and sixty-two inches by sixty inch stroke, manufactur-

record in Boston and some other cities, but in Providence it is giving creditable service owing to the thorough manner in which the line was originally constructed. The superintendent is of the opinion that for horse car traffic there is no better track construction.

The company have adopted the new Thomson-Houston controlling device for the operation of their cars, and are satisfied that its use results in a large saving of power. In going through the car house we were much interested in the new and novel transfer table which was designed by M. Rounds, formerly with the Union Railway Co., and it is giving most excellent satisfaction. The table is long enough to receive a ten ton radial truck car, and operates so easily that one man can easily move it across the car house. The table runs upon six wheels

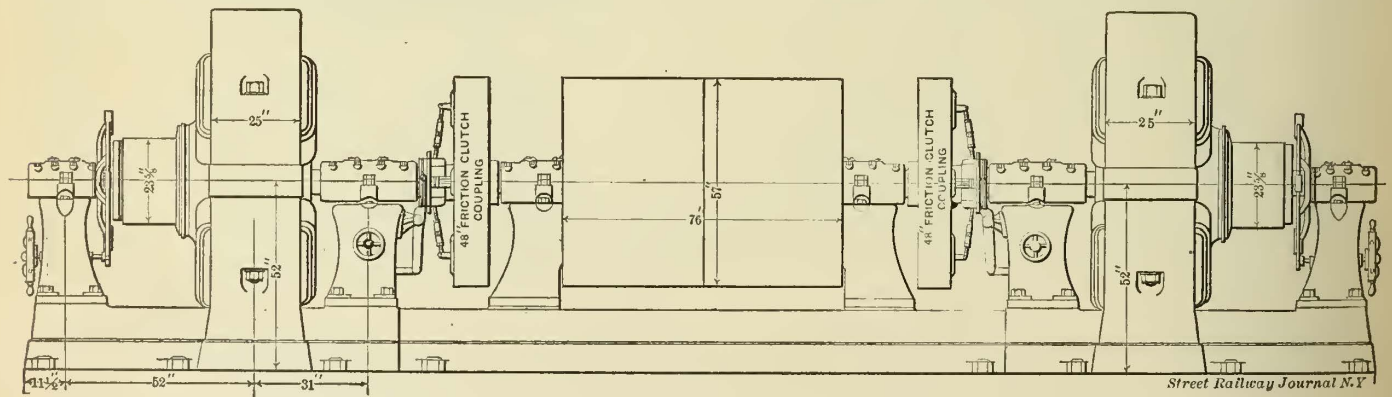


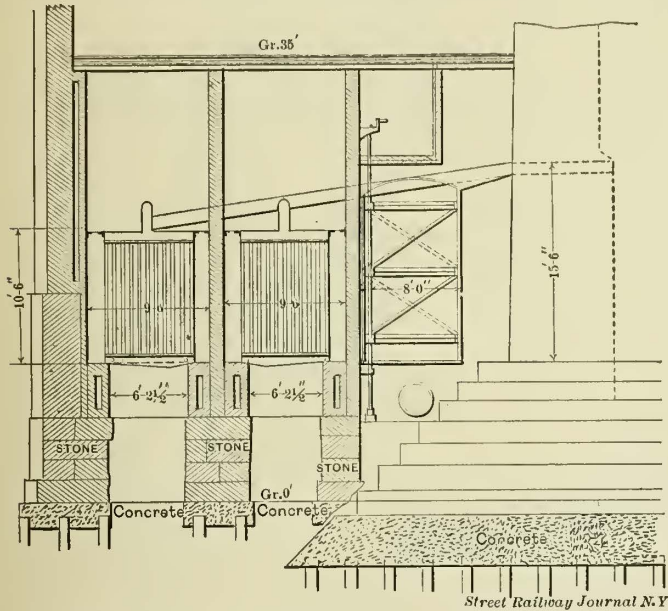
FIG. 5.—GENERATOR PULLEY AND CLUTCH COUPLING—BROOKLYN CITY RAILWAY CO.

ed by the E. P. Allis Co. Each pair of engines will be directly connected to one monster generator of 4,000 amperes capacity. These generators are being built by the General Electric Co., of New York, from designs furnished by F. S. Pearson, consulting engineer of the road, and W. H. Knight of the General Electric Co. These machines will have twelve poles and a commutator seven feet in diameter.

The boilers will be furnished by the Babcock & Wilcox Co., of New York, and will have a capacity of 250 H. P. each and 180 lbs. steam pressure. The boiler room will be in two stories; eighteen boilers will be located on the lower floor and the same number on the upper floor. The chimney will have a seventeen foot flue and will be 330 ft. in height.

which are about two feet in diameter, all having trip roller bearings. There are three tracks, and the middle wheels are flangeless, but are provided with a starting lever, having a rack and dog, so that one man can easily start the load and then can push it along with comparative ease. The company have ordered of the Union Street Railway Supply Co., of Mansfield, Mass., a number of electric snow plows, modeled after a machine which was in operation on their lines all last winter, and which was operated through all the storms of the past winter with great satisfaction to the management. The plow is operated by two S. R. G. 30 H. P. motors, and the motor shaft is geared to the axle by a pair of ordinary split car gears, thus obviating the use of a sprocket chain

which seldom gives satisfactory results. A system of simple levers operates the wings of the plow, and the steel track scraper is also readily raised or lowered as the conditions may require. The plow is a double ender, and works in either direction. The mechanism is covered with a plain cab, with windows for sufficient light. Mr. Potter informs us that he never operated a track cleaner with so good results as this home made plow gives. The company have recently removed the track brakes from their cable



Street Railway Journal N.Y

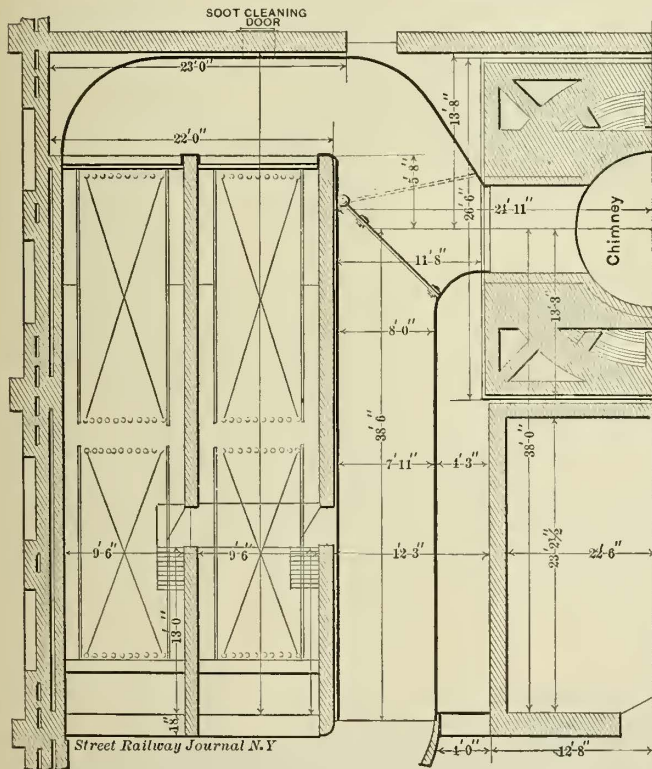


FIG. 6.—HALF PLAN AND ELEVATION OF ECONOMIZERS, FLUES AND CHIMNEY—BROOKLYN CITY RAILWAY CO.

grip cars and substituted the Kane brake, which has heretofore been used with satisfactory results on their horse car lines, and which we have before illustrated.

The success had with electric traction thus far in Providence has prompted the Union Railway Co. to make application to the Common Council for the privilege of operating the balance of their lines with electric power, but, unfortunately, the city authorities are inclined to impose upon the railway company very exacting requirements in regard to the extension, paving and grading of streets, besides a direct tax upon their income, which the company feel they cannot accept, so that the further development of electric traction in the city is likely to be delayed for some time.

The cable line operated by this company continues to give an excellent service, but some slight repairs have been necessary on the track owing to the rail, which is only thirty-five pound girder, being too light. The company have recently bought of the Roeblings a Lang lay rope which will soon be put in operation, and from which good results are expected. Owing to the increased traffic on the line, it has been found necessary to put a new and larger cylinder on the smaller of the two engines with which the lines are operated.

The Union Railway Co. have recently moved from their quarters on Market Square to the second floor of the Merchants' National Bank Building. The re-

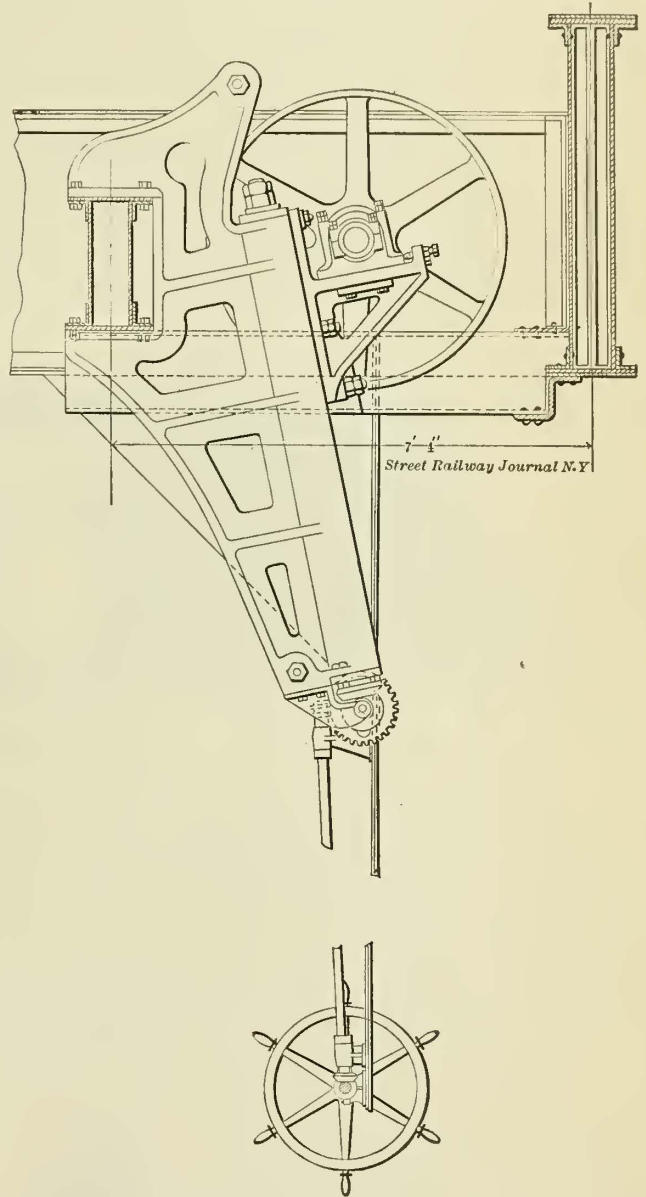


FIG. 7.—ENGINE BELT TIGHTENER AND OPERATING MECHANISM—BROOKLYN CITY RAILWAY CO.

ceiver's office, however, remains in the transfer building of the company on the bridge.

The charter of the Union Railway Co. requires that they sell school tickets for one fare to all children who are obliged to ride on two lines in order to reach the High school. These tickets are supplied to the principal of the school from whom the pupils purchase them and at the same time are required to sign a statement that they will not use the tickets unlawfully or dispose of them to other parties. It is found, however, that in many cases very little regard is paid to this agreement, for the tickets are frequently presented on other than school days, and in some cases are disposed of by the pupils to parties who present them on all occasions, and to the conductors who turn them in as full fare in making their reports. This is another striking commentary on the indifference of the public, not to say dishonesty, in reference to dealing with street railway companies.

Woodland Avenue & West Side Street Railroad Co., Cleveland.

The Woodland Avenue & West Side Street Railroad of Cleveland hoped to be able to operate their cars by electricity during the present month, but a combination of circumstances has conspired to cause delay. It will be several weeks at the least before electric cars will traverse the tracks. As the company have embodied in their plans a number of radical departures from conventional lines, it is believed that a description of their new equipment will be of interest.

In their track construction the company have for the most part used Johnson rails, the weights of which are ninety-eight pounds and eighty-two pounds. One mile is laid with the Wharton rails, nine inches in height, and weighing ninety pounds. In the case of the Johnson rails the heavier are spiked to the ties, and the others rest on chairs. Oak ties, 5 x 8 ins., are laid at distances of two and a half feet from centres. It has been decided to suspend the joints, and a tie is laid within eight inches on each side of the joints. Special attention has been paid to tamping, and this work has been thoroughly done. The pavement is the ordinary Medina sandstone.

Each rail is wired by a No. 00 galvanized iron wire,

wire and feeder contract was awarded to the McIntosh-Huntington Co., of Cleveland, who purchased their supply of the Western Electric Co., of Chicago.

The company decided to start with forty electric cars, and the order for the bodies and trucks was given to the J. G. Brill Co. The length of the bodies will be twenty-one feet, with platforms four feet six inches, making the cars thirty feet over all. They are to be finished in mahogany, with birch decorations for the ceiling. Doors at the side near the step are provided to facilitate getting on and off. Plate glass will be used in the windows, and cut glass in the ventilators. The latter will be of a new design, similar to those used in steam railway coaches. Wilton carpet will cover the seats. Illumination will be provided by ten incandescent lamps, one on each platform, and four each on two chandeliers within the car.

The power house, which is well under way, will embody a number of features which will render it of especial interest. The management determined upon departing from the ordinary practice only after extended study,

and they believe their plant will show a marked economy in working. The building is located on the west side about 200 ft. from the Cuyahoga River, from which water is brought for condensing purposes in an eighteen inch main. The building has a frontage of 160 ft. and a depth of 140 ft. It is one story in height, and is

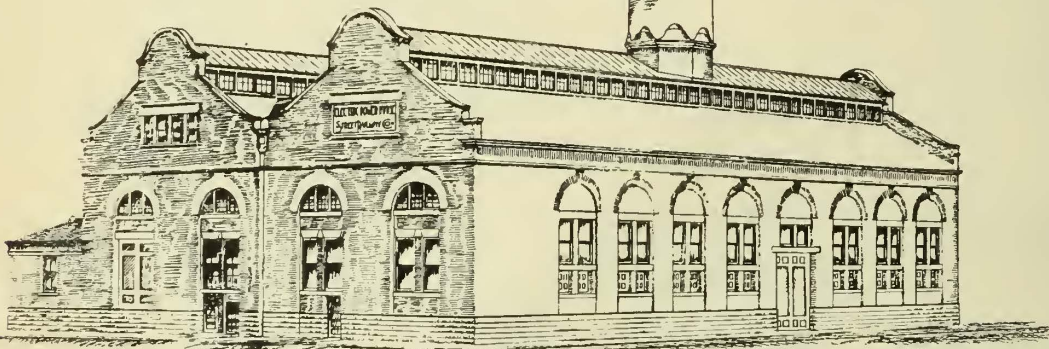


FIG. 1.—EXTERIOR OF POWER STATION—WOODLAND AVENUE & WEST SIDE RAILWAY.

built of brick with stone trimmings (Fig. 1). The structure is covered by two separate roofs, one over the boiler room, and the other over the engine and generator room. The smoke stack rises to a height of 175 ft. and rests on a foundation built on piles.

To provide an abundance of air, a space of five feet will be left under the flooring; the latter will be constructed of I beams with arches of tile and covered with cement. Steam will be generated in three boilers of the Scotch marine type of a capacity of 500 H. P. each. The engines will be three in number, of the marine type and

Side pole construction is adopted for the entire line, and metal poles will be used throughout the system. On forty foot streets the three sections of the latter are four, five and six inches, standard sizes respectively; on the sixty foot streets and on curves the sizes are five, six and seven inches, extra heavy. The poles are treated with a coat of paint inside and outside, and the section which is to be buried receives a second coat. Their length is twenty-eight feet, of which six feet is underground. The poles were furnished by the Electrical Construction & Supply Co. of Pittsburgh.

The pole top is that of the Railway Equipment Co., of Chicago, who furnished the entire overhead equipment, with the exception of the wire, including hangers, glass insulators, etc.

The trolley wire is of the best Lake Superior copper, and the gauge is No. 0. B. & S. Most of the feed wire has a cross section of 500,000 circular mils. The entire

triple expansion. They will run with two foot stroke and 140 revolutions, making the piston speed 560 ft.

Coupled to an extension of the engine shaft at each end will be a Westinghouse multipolar generator of 250 H. P., designed to run at 140 revolutions. The direct connection of triple expansion engine and generator has certainly not been attempted in this country heretofore, but the company are confident that the best results will be accomplished. The engine and boiler were constructed

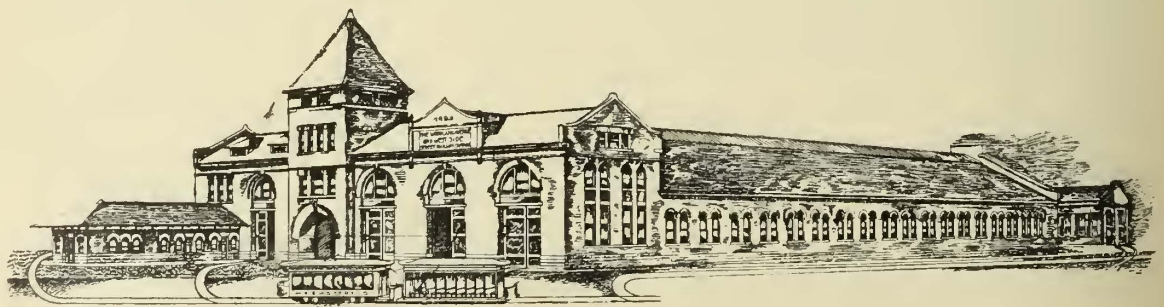


FIG. 2.—NEW CAR HOUSE—WOODLAND AVENUE & WEST SIDE RAILWAY.

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by the Globe Iron Works Co., of Cleveland. The engine was originally designed for marine service, but the company consider that it embodies a number of substantial points of excellence for street railway service.

The switchboard will be of novel construction. The foundation will consist of a series of pillars on which will rest an I beam. On the latter will be laid a course of tarred wood, from which will rise a solid brick wall forming the switchboard. The face and ends will be built of enamel brick set very close. The brickwork will be ten feet six inches in length, and will be completed by an ornamental framework of antique oak, making its total length thirty-six feet. The measuring instruments, which are to be of Westinghouse type, are to be bolted through the brickwork, and connections through it will be made by means of rubber tubing.

In charge of the electrical installation is F. W. Waterman, of the Westinghouse company, of Pittsburgh, who has been most successful in designing much of the work, and who is responsible for a great many details which will be thoroughly appreciated when the system is in operation.

The company have built an extensive new car house and shops at the corner of Lorain Avenue and Henley Street, about four miles from the down town terminus. The structure is brick withstone trimmings, and will be complete in its arrangement and equipment (Fig. 2).

The illustrations present a perspective view and a ground plan of the structure which is divided into two buildings, joined at the front by a tower rising to a height of seventy feet (Fig. 3). The total is 372 ft., and the frontage is 160 ft. on Lorain Street. Back of the tower the shops and car house are separated by a fifteen foot alley. The terminal loop is a track passing about the buildings and through an inspection room at the rear, equipped with pits and overhead platforms for inspection purposes. The cars stop at the waiting room for passengers, shown at the left in the perspective view. The arrangement of tracks is shown in the ground plan, a centre light designating each track. Cars may be readily switched at three points from the main track in front into the car house, and by a system of switches to any point in the building (Fig. 4).

They can in the same way be switched from the building at the rear. For 150 ft. at the rear of the car house the cars are run over pits, the tracks being supported on I beams. The shops will be fully equipped when finished with all of the most approved machinery for repair work.

The Improved Greene Engine.

In describing the method of practice as found in the Thomson-Houston Works at Lynn, Mass., in our last issue, we noted the fact that a 1,000 H. P. Greene tandem, compound engine was employed for generating the power in the testing department. The engraving on the next page represents this engine in position, with the flywheel

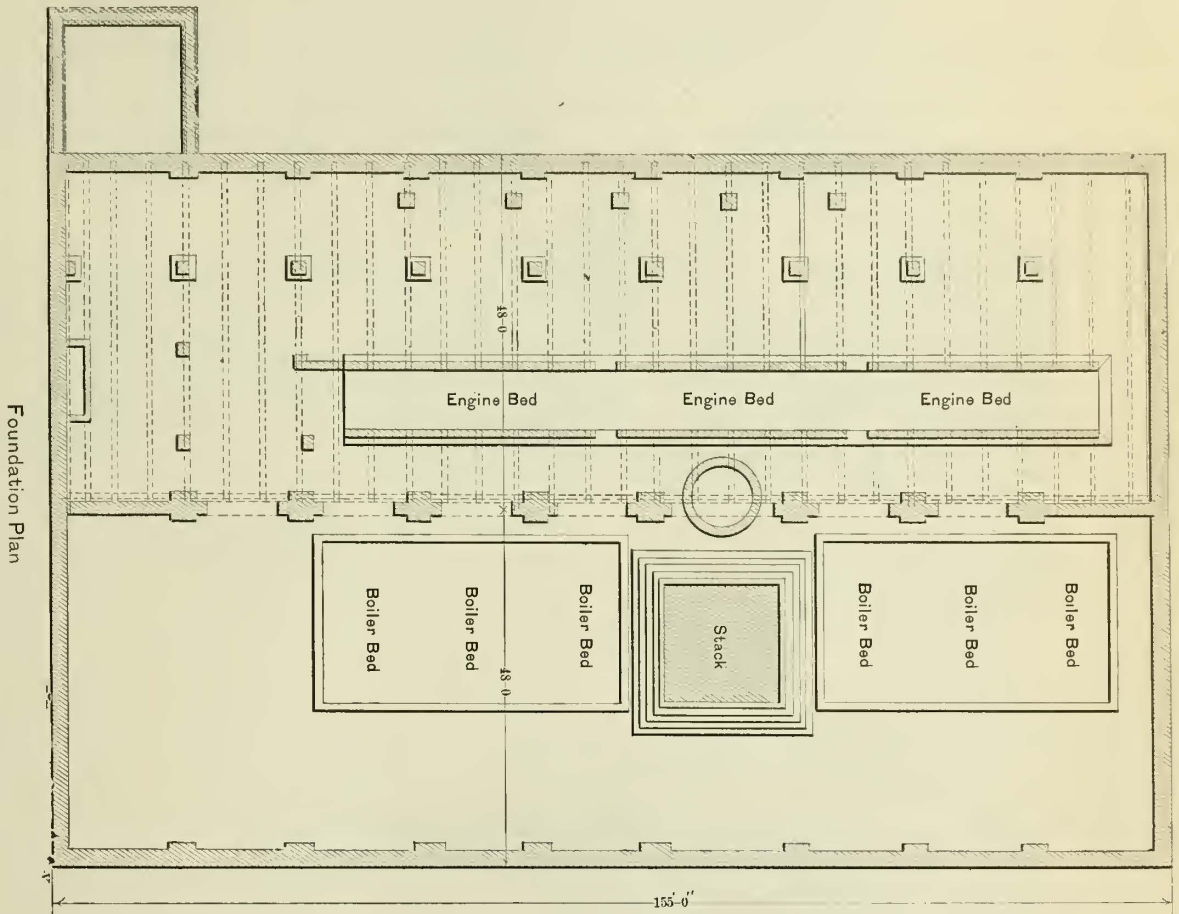


FIG. 3.—PLAN OF POWER STATION—WOODLAND AVENUE AND WEST SIDE RAILWAY.

coupled direct to one generator and by belt to another. As will be seen from the illustration, the valve gear of this engine differs materially from the ordinary compound engine. The steam valve motion is of the detachable type, the valves being closed by steam pressure on the ends of the large valve stems, insuring a quick and positive cut-

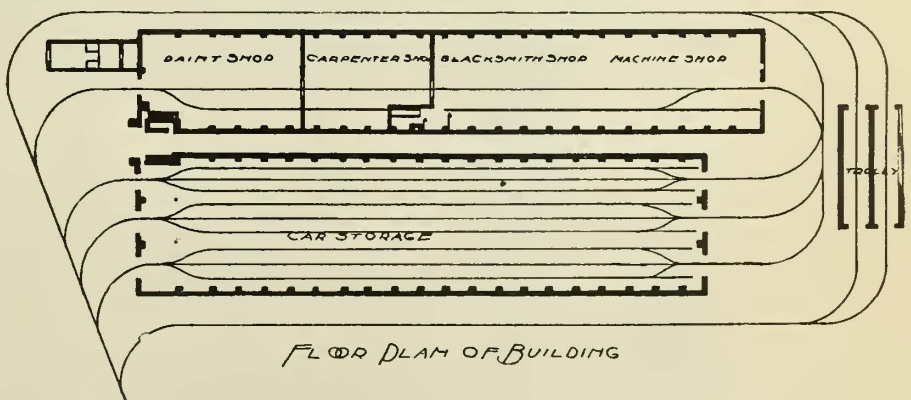


FIG. 4.—PLAN OF CAR HOUSE—WOODLAND AVENUE AND WEST SIDE RAILWAY.

off under all conditions of speed.

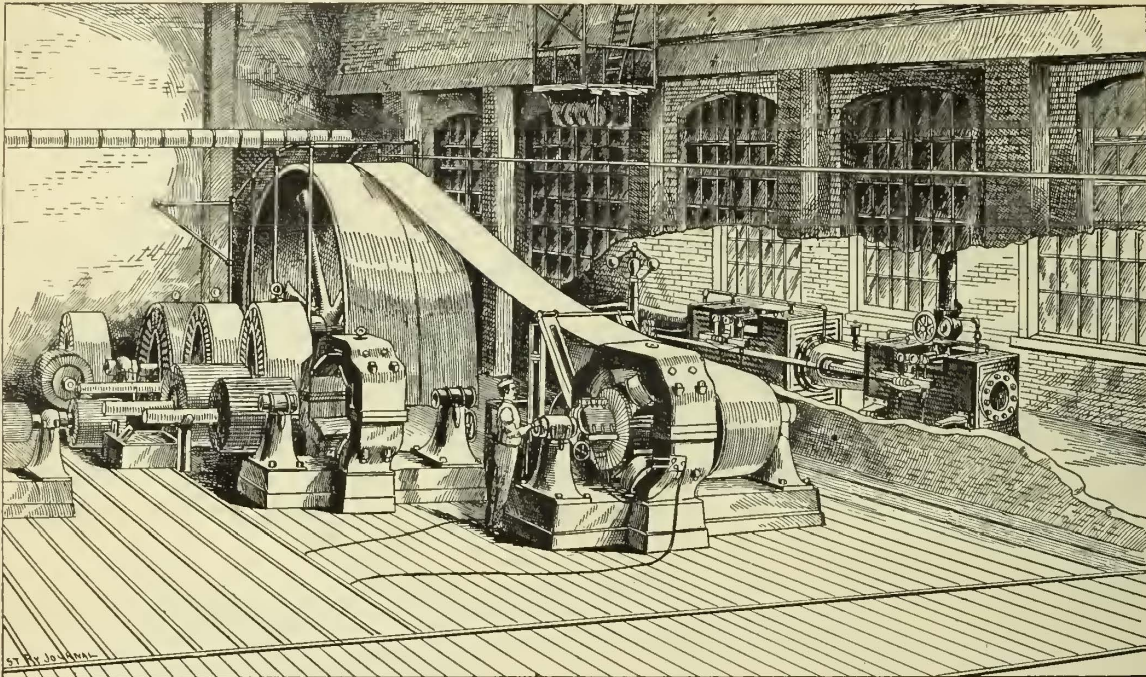
The exhaust valves are operated by an independent eccentric, thus allowing of adjustment without interfering with the steam valve mechanism. Both steam and exhaust valves are of the flat slide or grid pattern.

The governor is supplied with a device to automatically stop the engine should the governor belt run off or break, and also a special appliance by means of which the speed of the engine may be changed through a range of

twenty revolutions while it is in motion. This was rendered necessary by the peculiar duty the engine is called upon to perform in the testing of dynamos and generators. The cylinders are respectively seventeen and a

New Stephenson Car and Truck.

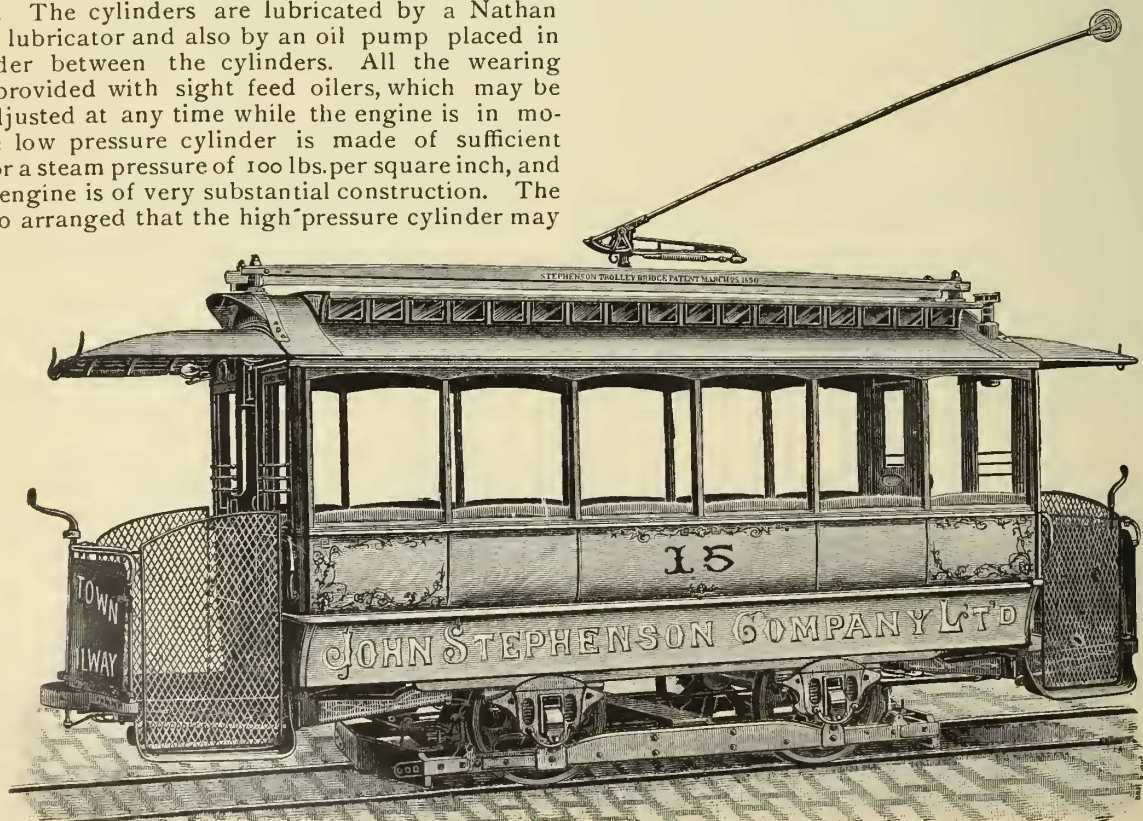
The accompanying engraving shows a car recently built by the John Stephenson Co., Ltd., for Johnstown,



1,000 H. P. TANDEM COMPOUND ENGINE—THOMSON-HOUSTON ELECTRIC WORKS, LYNN, MASS.

half and twenty-eight inches in diameter by forty-eight inches stroke, and is designed to run at 108 revolutions, with an initial steam pressure of 150 lbs. The flywheel is eighteen feet in diameter with a five foot face, being of sufficient width to receive two belts, and weighs about 67,000 lbs. The cylinders are lubricated by a Nathan compound lubricator and also by an oil pump placed in the spreader between the cylinders. All the wearing parts are provided with sight feed oilers, which may be filled or adjusted at any time while the engine is in motion. The low pressure cylinder is made of sufficient strength for a steam pressure of 100 lbs. per square inch, and the whole engine is of very substantial construction. The piping is so arranged that the high pressure cylinder may

N. Y., and mounted on the new Stephenson electric motor truck. The framework of this truck is of wood reinforced by iron, insuring durability and elasticity, and it is supplied with outside bearing brakes which are self equalizing and very powerful. The location of the brake



NEW STEPHENSON CAR AND TRUCK

be disconnected, steam admitted direct to the low pressure cylinder, and the engine run single.

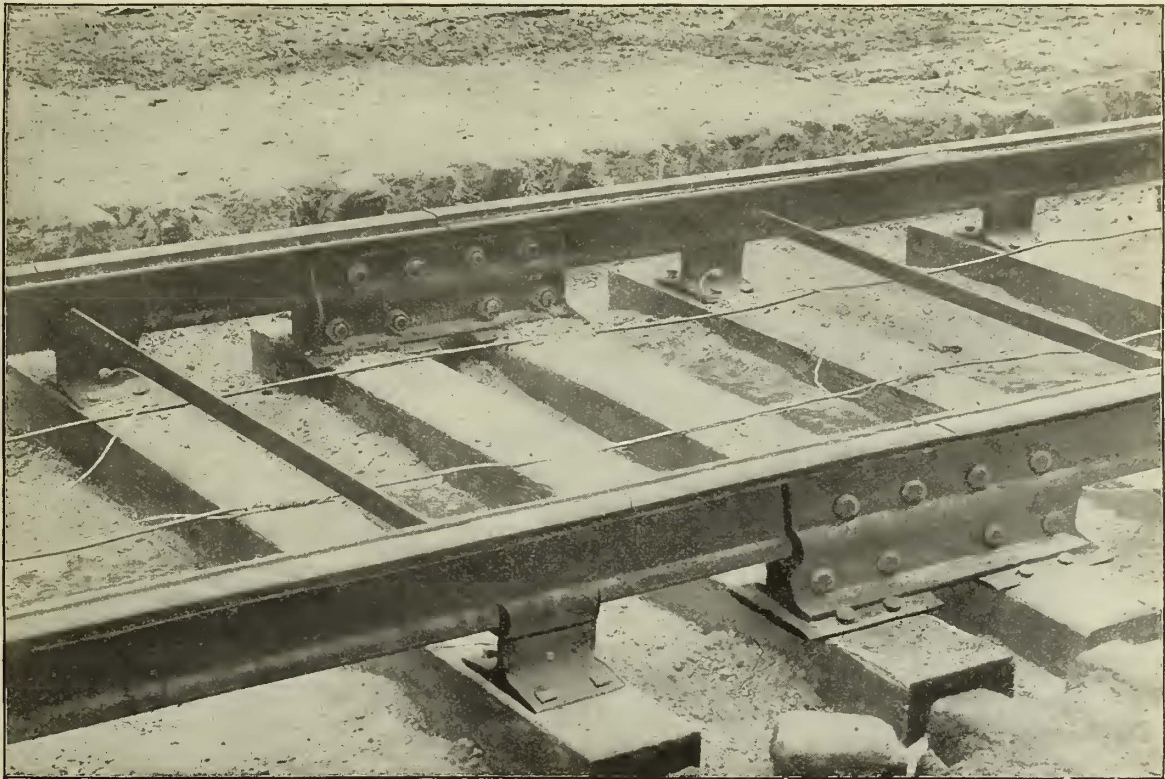
The engine has given excellent satisfaction, so much so that a second 500 H. P. Greene engine has also been installed in the works. The engine is manufactured by the Providence Steam Engine Co., of Providence, R. I.

gear outside of the wheels affords the maximum amount of room for the electric apparatus. Easy riding is secured by the regular Stephenson superspring gear.

The Stephenson standard trolley bridge is also an important feature of the car. This has been widely used and has everywhere given good satisfaction.

Recent Practice in Boston.

The West End Street Railway Co. have recently been relaying a portion of their tracks on Washington and Milk Streets, and on the former are using a seventy-two pound Johnson girder rail with chairs electrically welded, as shown in the accompanying illustration. The ties are laid on a six inch concrete foundation. A seventy-two pound Wharton girder is employed on Milk Street, and is laid on a 5 X 6 stringer. On some portions of the line, where a large number of electric cars pass a given section, they are putting in five No. 6 return wires thoroughly bonded to the rails. In some places, to improve the return circuit, the return wires are mounted on poles the same as the feed wires, and are connected with the rails about every 150 ft. by proper bonds which are led up the side of the pole. In order to meet this extra demand for feed wires, the company have recently pur-



RECENT TRACK CONSTRUCTION IN BOSTON, WITH ELECTRICALLY WELDED CHAIRS.

chased 320,000 lbs. of copper wire. The company have adopted a form of truck modeled somewhat after the Robinson radial type, but with all the parts much heavier than in former practice, and they are now building 200 of these trucks in their own shops. These trucks differ somewhat from the original model, in having a double set of springs and a cast iron bolster which is connected by arms to the middle truck. The intermediate wheels, which are twenty-two inches in diameter, have outside bearings, and the end wheels are thirty inches in diameter. The brake shoes are applied to both sides of the wheel, and are so hung that they require very little play. The centre portion of the truck is unobstructed, allowing ready access to the motor. Two twenty-five horse power motors are employed in winter, but in summer only one. The company have built 250 four wheel trucks of their own design for sixteen and twenty foot cars, and they are now building 200 more. These trucks have two sets of springs, one in the box to relieve the truck from shock and the other under the body. In all these trucks the Bemis box is used, and the axles are three and seven-eighths inches in diameter with a three inch journal bearing.

The mechanical department of the company has recently been reorganized, and Mr. F. S. Pearson, as chief engineer, has charge of car, truck and track repairs, the office of master mechanic having been abolished. L. S. Dumoulin is superintendent of the electrical department, and L. J. Hirt, superintendent of power stations.

Chicago South Side Elevated Railway.

It has been stated heretofore that one of the great obstacles to the complete success of the Chicago & South Side Rapid Transit Co. lay in their inability to secure a right of way into the downtown section of the city. At present the road terminates at Congress Street, which is the extreme southern limit of the business district. To meet the requirements of passengers, an extension of the elevated structure, at least half a mile northward, is necessary. To such a course property owners have expressed themselves as unalterably opposed, and the problem has seemed to be an insoluble one, but it has just been announced that a route has been selected which meets all the demands of the public. It is a loop, and the line from the present terminus is as follows: Congress Street to Wabash Avenue, to Lake Street, to Clark, to Jackson, to Plymouth Place and to the starting point.

New cars and locomotives are being built for the road, and a special type of car will probably be used for World's Fair service. The sides of these cars will consist of an ornamental wire grating, having eight or nine gates through which the passengers enter, and which are opened and closed by a lever worked from the platform. They are centre aisle cars with seats for seventy people, and are so much lighter than ordinary "L" cars that an engine can haul one-third more cars in a train than ordinarily.

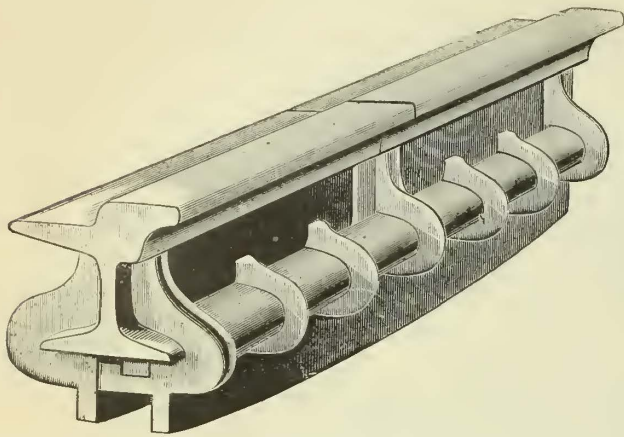
Electric Road for New Brunswick, N. J.

After some six months' negotiating, Edward J. Wessels, of 35 Wall Street, New York, has succeeded in purchasing a controlling interest in the New Brunswick City Railway Co. This is a horse road operating fourteen cars with forty horses. It is Mr. Wessels' intention to convert the road into an electrical road without delay, and it is expected that electric cars will be running before the end of December. The conditions are very favorable for good business.

The city itself has a population of some 21,000, and extensions will be made to Milltown and Highland Park, and surrounding towns. At a special meeting of the Board of Trade, held on September 23, resolutions were unanimously passed pledging the support of the entire Board in favor of the new road. It is expected that there will be considerable freight carried.

New Rail Joint Bridge or Suspended Joint.

A novel rail joint bridge or suspended joint, in which the use of bolts is entirely dispensed with, has been re-



FIGS. 1 AND 2.—NEW RAIL JOINT BRIDGE—SHOWING METHOD OF ATTACHMENT.

cently put on the market by the American Rail Joint Co., of Marion, Ind., and is illustrated in the accompanying engravings. The bridge or joint is of malleable iron, and, as will be seen from the engravings, is in two parts which can be easily fitted together without disturb-

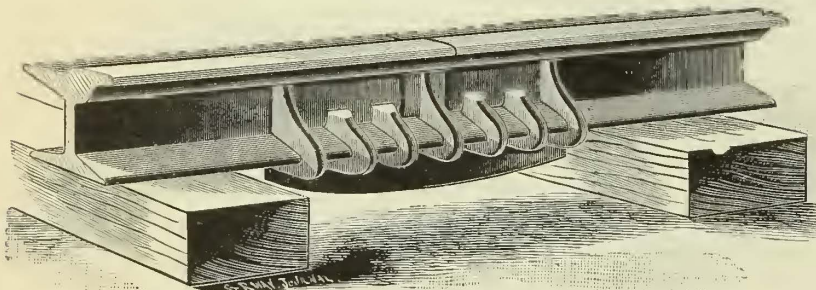


FIG. 3.—RAIL JOINT BRIDGE IN POSITION.

ing the position of the rails if they are already in place. It tightens on the wedge principle and fully accomplishes the purpose for which it is intended. The removal of the bridge or joint is an equally easy matter and requires only a few blows of a sledge.

We understand this joint has been tested in actual

The Montreal Street Railway.

It is surprising to see what energy and push can do when they are placed in operation together. Montreal is

a good example of both at the present moment. One month ago the franchise for the placing of an electric street railway in this city was given to the Montreal Street Railway Co. by the Council, and to-day there are nine miles of road in operation by that motive power. This can be placed to the credit of the new management, Messrs. James Ross, president; H. A. Everett, managing director, and Wm. McKenzie, president, Toronto Street Railway.

Although there were many difficulties to contend with, the managing director

and his assistants succeeded in getting the following belt line finished in time for the Exposition, a distance of five miles around, starting from the corner of Bleury and Craig Streets, along the latter to Amherst, to Rachael, to St. Lawrence, to Mount Royal Avenue to Park Avenue, which being the same as Bleury Street completes the quickest five miles of road ever built in Canada, considering the difficulties that were continually being thrown in the way.

The new cars are models of workmanship, and the admiration of all the citizens. They were purchased from the Newburyport Car Co., Mass., Amesbury Car Co., Mass., Crosen Car Co., Cobourg, Ont., and the St. Charles Omnibus & Car Co., Belleville, Ont. The motors in use at present are the Royal Electric, Edison, and Westinghouse.

ing the position of the rails if they are already in place. It tightens on the wedge principle and fully accomplishes the purpose for which it is intended. The removal of the bridge or joint is an equally easy matter and requires only a few blows of a sledge.

Improved Radial Geared, Cantilever, Extension Truck. No. 5 A.

The accompanying engravings illustrate the accumulated experience of several years devoted to truck building, and the truck is claimed, by the inventor, to em-

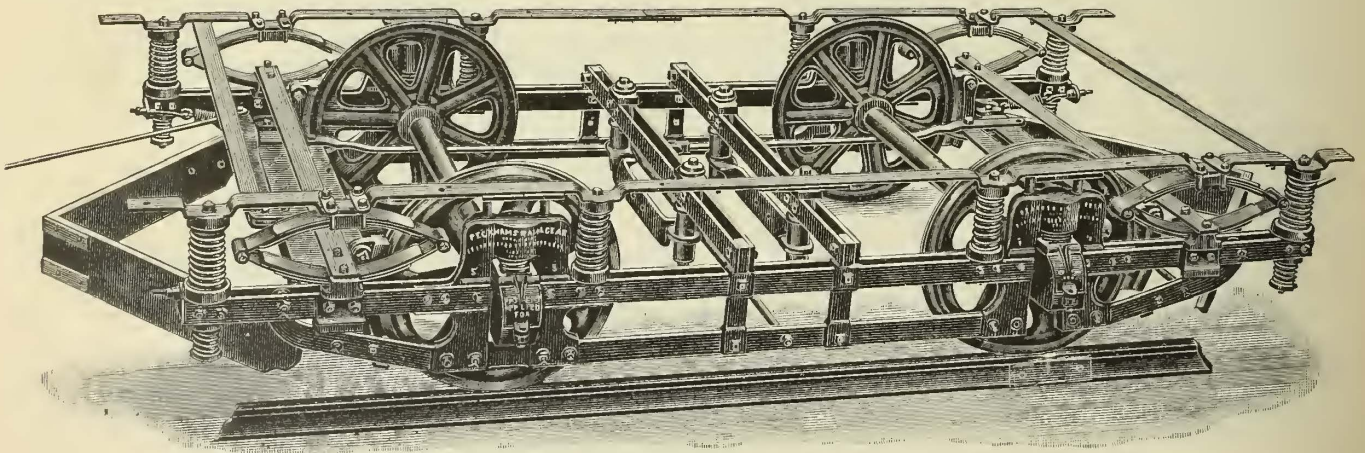


FIG. 1.—NO. 5A CANTILEVER EXTENSION TRUCK.

use for some months and is highly spoken of by street railway men.

The device is equally adaptable to old construction and new work, and to all types of rail. The total length is from twelve to eighteen inches according to the work.

THE Norwich (Conn.) street railway is in operation by electric power.

brace all the most desirable features that experience has shown to be the best adapted for all conditions of electric service.

It is the invention of Mr. Edgar Peckham, of the Peckham Motor Truck & Wheel Co., of Kingston, N. Y., and though modeled somewhat after the type of the non-oscillating truck heretofore manufactured by this company, has a number of features which differ decidedly from the former type of truck. The cantilever principle of

supporting the ends of the frame is still retained, but the shape of the side bars is changed, and in place of the bolts the parts are firmly connected by rivets which were upset while hot, preventing the loosening of parts and dropping of bolts. The principle of the radial motor hanger is retained, but elliptical springs have been substituted for the spiral springs employed over the main bolster, while a graduated double spring is employed at the ends to prevent teetering.

Brooklyn Tower Wagon.

A considerable portion of the line of the Atlantic Avenue Railroad Co., of Brooklyn, N. Y., extends under the elevated railway structure in that city, and necessitated the use of a special type of tower wagon, which could be adjusted in height to the distance of the trolley wire above the ground. The company have, in consequence of these conditions, built and have in use two

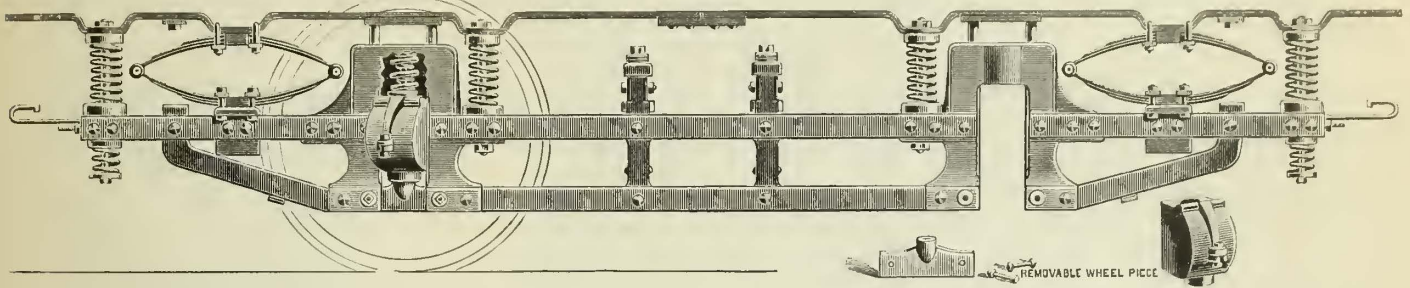


FIG. 2.—SIDE FRAME OF CANTILEVER EXTENSION TRUCK, NO. 5 A.

The radial box heretofore employed is retained with a few minor changes, and a double graduated spring is placed above the journal box to receive the shocks, which lessens the wear on the truck very materially. A great deal of attention has been given to the design of the journal box, and the radial principle employed relieves the draft very much on curves and permits of electrical cars of from twenty-six to thirty feet being easily operated. The truck illustrated herewith is specially adapted to the Thomson-Houston W. P. equipment, but can be modified to suit any type of motor. It will be noted that there is no obstruction over the motor, so that it can readily be reached for inspection without the removal of any part, and the method of hanging insures the proper adjustment of gears under all conditions.

wagons somewhat different from any heretofore employed, as will be seen by reference to the engraving on this page.

The lower part of the tower is rigid, and is about seven feet three inches in height by four feet three inches square at the base, and is made up of angle iron. The upper part is of wood and fits into the iron part like a telescope, so that it can be raised to any height or lowered at will by means of a crank and windlass, one of which is provided on each side. Access to the tower is afforded by a ladder at the end.

Each wagon carries in addition two extra ladders,

The inventor expresses himself as satisfied with this

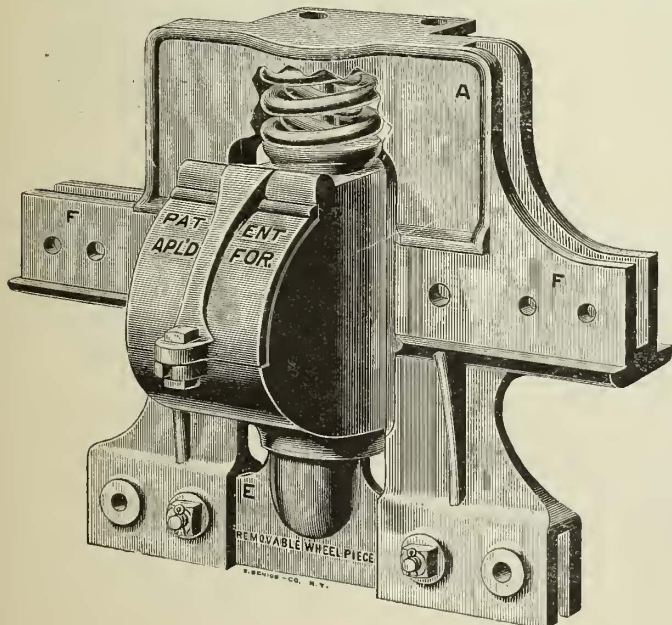
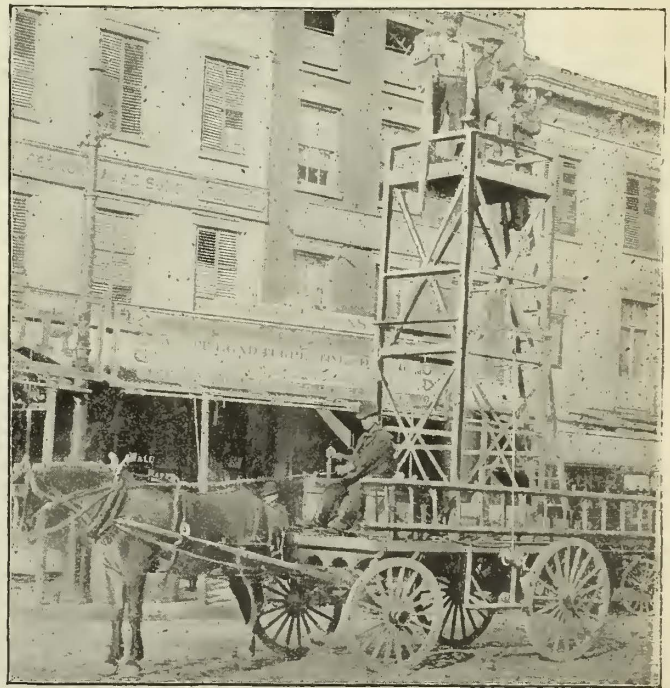


FIG. 3.—RADIAL GEAR, NO. 5 A TRUCK.

design and says that he has solved the problem to his entire satisfaction. The trucks have seen considerable service, ten of them having been in use on the Brooklyn City Railway lines for some time, and are also in use on the new cars being operated by the Union Railway Co. of New York.



ATLANTIC AVENUE RAILWAY TOWER WAGON.

two boxes of tools, wire, insulators, etc. The wheel gauge is a few inches wider than the track gauge to facilitate turning the wagon from the track to allow a car to pass. The wagon is nine feet long, and is drawn by one horse.

THE new station of the Duluth Electric Railway has been put in operation. The engines here were furnished by the E. P. Allis Co., of Milwaukee, and are of 1,000 H. P.

It is stated that Messrs. Jarvis and Conklin of Kansas City, have sold out their interest in the Salt Lake City Railway Co., to Messrs. K. C. Chambers and A. W. McCune.

THE Brockton & Holbrook Street Railway was put in operation September 19, the first car leaving the former town at 6:45 in the morning. There was a large celebration at Holbrook over the affair. The whole town was decorated, fireworks were displayed in abundance and there was much speech making. The affair terminated with a hop in the evening.

The Safety Steam Boiler.

In the accompanying engravings Fig. 1 shows a battery of Gill safety water tube steam boilers, manufactured by the Stearns Manufacturing Co., of Erie, Pa. The boilers

a bank of headers and a steam drum in detail. The column at the left hand shows headers of five and six holes, with the caps removed. The column at the right gives the appearance of the same headers, with the caps, bolts and dogs in place. The middle column shows headers of four

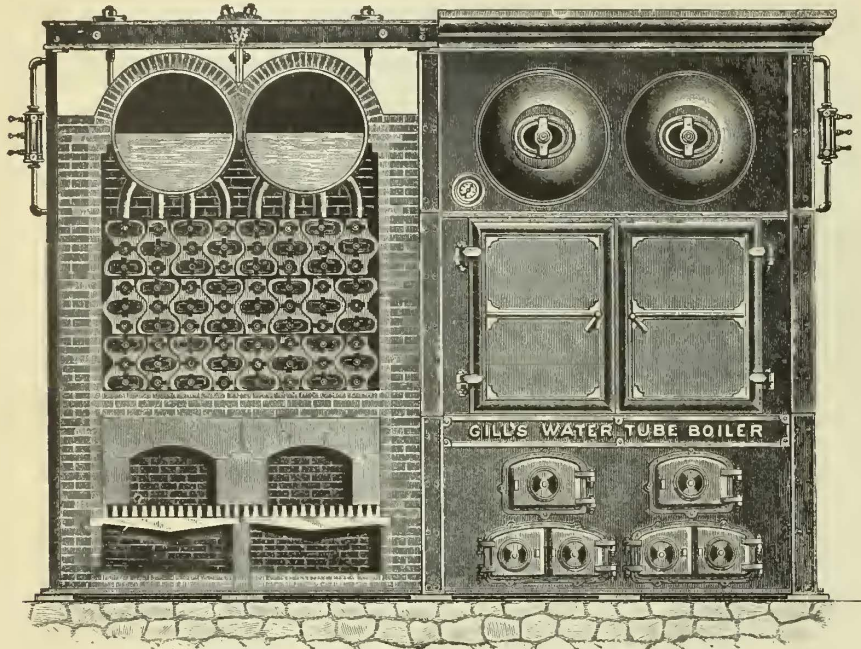


FIG. 1.—END VIEW—SAFETY WATER TUBE BOILER.

illustrated are of 200 H. P. each, and that on the left has the front removed. Fig. 2 is a longitudinal section of the same boiler, and gives a good idea of the arrangement of the different parts. The water tubes are four inches in diameter, and are inclined at an angle of about fifteen degrees from the horizontal, the tubes inclining upward from the rear toward the front of the boiler. Each nest of four or five tubes is expanded into a cast iron box or header at each end, and the tubes are placed about three inches apart and staggered. The connection between the headers and with the steam water drum consists of short tubes which are expanded into the top of the headers and into

and six holes, in section at the middle of the headers, and explains the manner of connecting the headers with each other and with the steam drum. A section through three headers and four tubes is shown at the base of the figure.

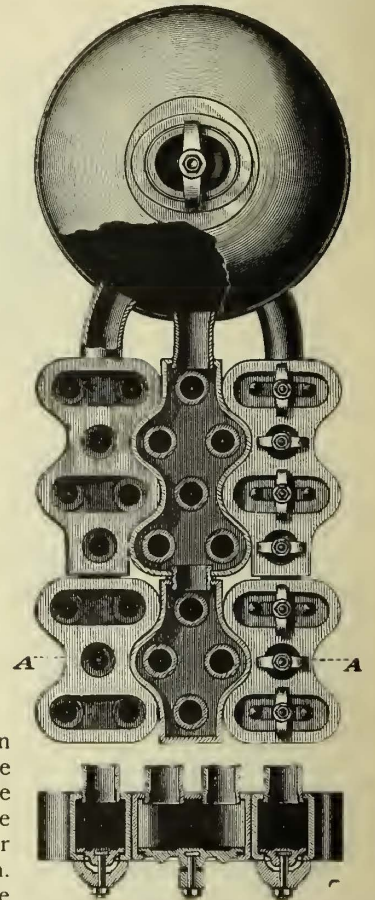


FIG. 3.—SECTION OF BANK OF HEADERS AND DRUM—SAFETY WATER TUBE BOILER.

Every part of the boiler is easily accessible, making the matter of repairs and cleaning simple. Access to all the points can be had by opening the large doors at the front or rear of the furnace. Narrow cleaning doors are also built in the side walls of the brick setting, through which a hose with a steam nozzle may be inserted for the purpose of blowing off any dust which may settle on the tubes. Two or three manholes are also built in the side walls, which allow the operator to enter the furnace above and below the tubes, if necessary. The boiler has been used extensively by electric light and street railway companies, and has given excellent satisfaction.

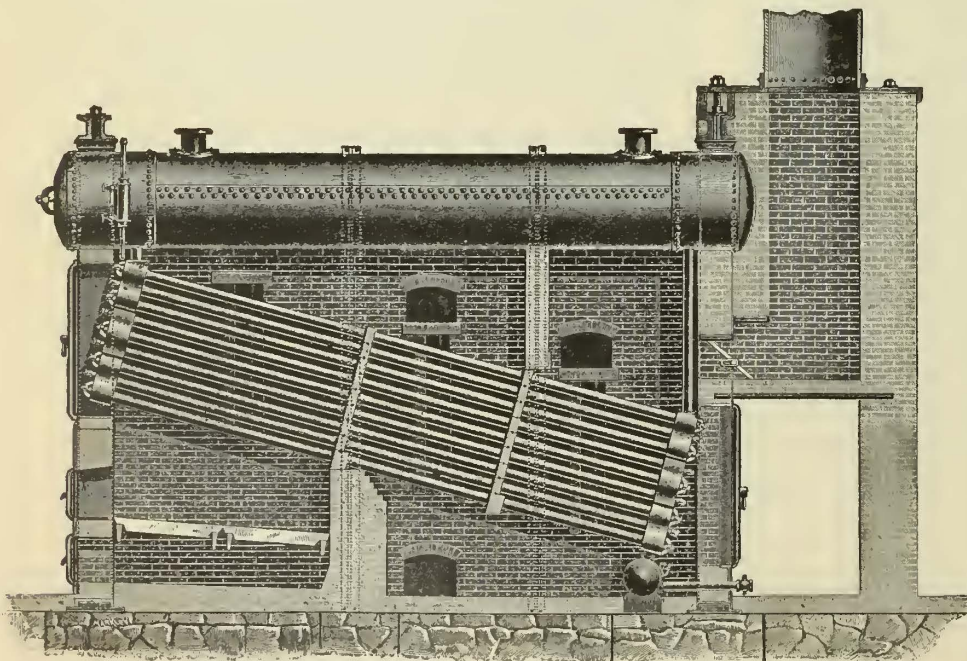


FIG. 2.—LONGITUDINAL SECTION—SAFETY WATER TUBE BOILER.

the drum, entering the latter radially, for which purpose they are curved to the proper form. The drums are of the best steel, vary in diameter from thirty to fifty inches, and have a thickness proportioned for the highest pressure desired, with ample factors for safety. Fig. 2 shows

Third Avenue company have lost a large number of horses during the past summer, owing to the excessive heat and the increased labor imposed upon the animals in hauling their heavy cars over the grooved rail of the cable construction.

THE Third Avenue Railway Co. of this city have recently purchased 400 horses from the Washington & Georgetown Railway Co., of Washington, D. C., and are still in the market for additional stock, as it is not expected that the cable line will be in operation before February or March of next year. The

A Live Steam Purifying Filter.

It is well known that some scale forming impurities are retained in the feed water of a boiler at a temperature of 212 degs. in the feed water heater, but are liberated when the water becomes heated to the temperature of the steam in the boiler, say to over 300 degs. To prevent all such impurities becoming incrusting on the interior of the boiler is the object of the live steam purifying filter shown in the accompanying engravings, and manufactured by E. G. T. Colles & Co., 22 S. Jefferson St., Chicago.

The feed water, as will be seen, after leaving the heater passes into the steam space of the boiler by the feed pipe and falls over a spray feeder. This feeder is a hollow fluted cone with its apex directly under the mouth of the feed pipe, so that the water is spread, and soon becomes heated to the temperature of the steam in the boiler. The water falls from the spray feeder into a receiver placed just under the water line and thence passes into the filter, taking with it the surface water in the boiler which is thus continually being skimmed automatically.

off, so that the pressure of the steam in the boiler will drive the water down through the filtering material, washing it thoroughly. In this way the filtering material will last for years without changing. The coke can also be

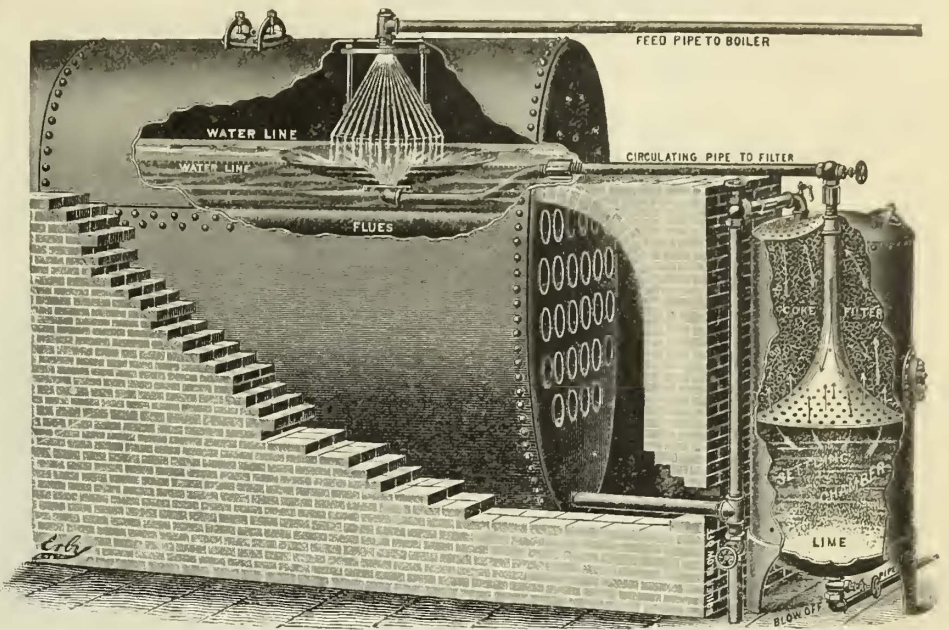


FIG. 1.—LIVE STEAM PURIFYING FILTER NO. 3.

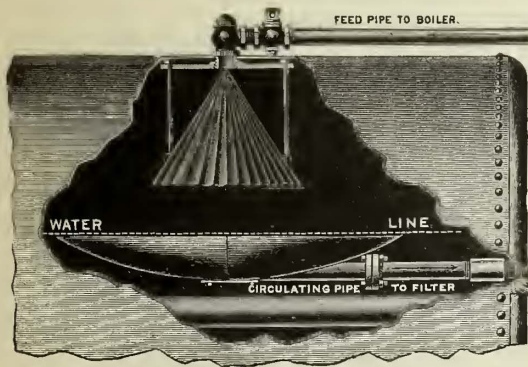


FIG. 2.—SPRAY FEEDER AND RECEIVER.

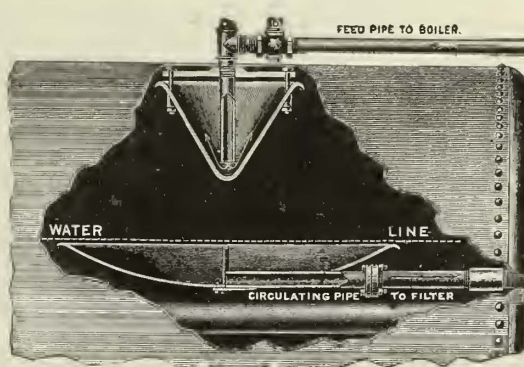


FIG. 3.—WATER SEAL SPRAY FEEDER AND RECEIVER.

removed and replaced within a short space of time. Fig. 2 shows the spray feeder and receiver in detail, and Fig. 3 shows another type in section.

If desired, the filter can be used without the spray feeder and receiver, and under these circumstances the method of connection is that shown in Fig. 4. The return pipe from the purifier is shown enter-

In its passage it gathers any impurity which may be separated and left behind in the boiler by evaporation. This water then passes through the filter inlet which is in the form of an inverted funnel, as shown, so that the downward circulation will not agitate the water in the settling chamber. The upper half of the filter is packed with common coke for filtering material, and as the area of the coke is 200 times that of the circulating pipe, the water passes up through the coke 200 times slower than through the circulating pipe, allowing ample time for its purification. The perforated plate above the filtering material serves to prevent the circulation from carrying the coke into the return pipe above it and thence to the boiler. The coke can be

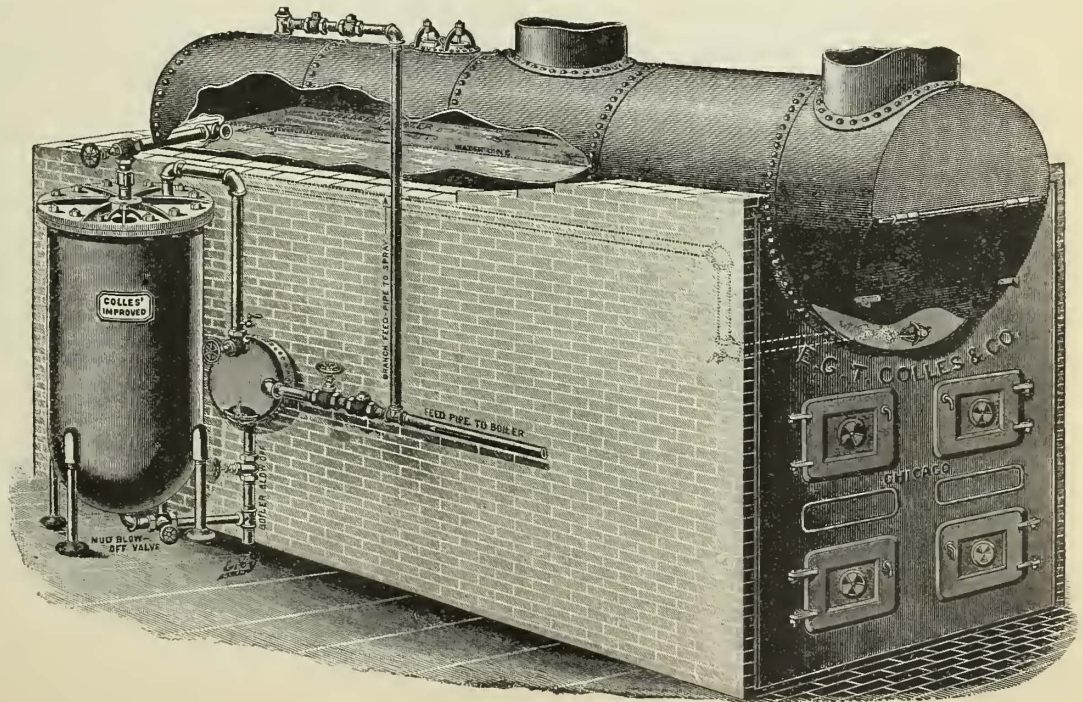


FIG. 4.—LIVE STEAM PURIFYING FILTER NO. 2.

cleaned by closing the valve on the pipe between the filter and the top of the boiler and by opening the filter blow-

ing the end of the mud drum, or it may enter the front head of the boiler as indicated by the dotted lines, or it may be connected to the boiler blow-off pipe as in Fig. 1.

New Vertical Triple Expansion Engine.

The engine shown in the accompanying illustrations, has been designed to meet the demand for a compact machine suitable for electric dynamo driving, and for other purposes where it is desirable to economize space, to secure economy in fuel, and to utilize the higher ranges of expansion, either as a condensing or non-condensing engine. As there are many places where it is not practicable to use a condenser on account of the scarcity of water, this engine has also been built to secure about the same economy with very high steam pressure without condensation.

A peculiarity of the design is that the engine is self contained and balanced. The reciprocating parts of the two sides have simultaneous

If it is desired that the engine shall be absolutely noiseless, it can be placed upon a foundation insulated on the bottom by cork from the foundation of the building, while on the sides packing or other material can be used that will not transmit noise or vibrations to the walls.

To meet the requirements of an engine using steam of 180 to 200 lbs. pressure, piston valves have been selected for the high and intermediate cylinders, and gridiron slide valves for the low pressure cylinders. By this means frictionless valves for the high and intermediate cylinders, where the pressure is high, are secured. In those cylinders the matter of clearance is comparatively unimportant.

In the low pressure cylinders, however, small clearances are very necessary for

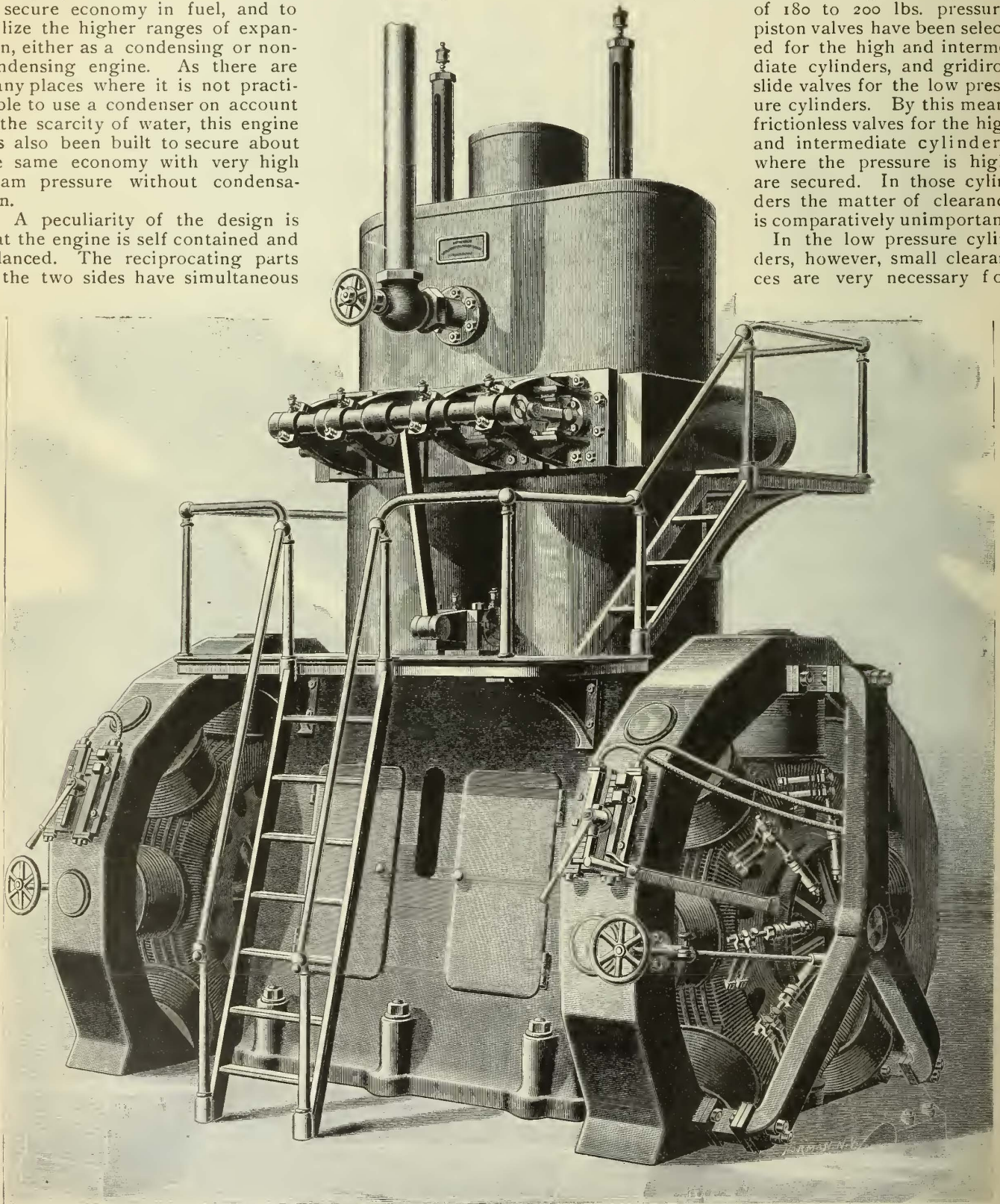


FIG. 1.—NEW VERTICAL TRIPLE EXPANSION ENGINE AND DIRECT CONNECTED GENERATORS.

opposite movements, the cranks being 180 degs. apart, and thus in a manner balancing each other. In consequence of this and the fact that each side is independently balanced by a counter weight on the crank, less foundation is required, and more quiet running produced than would otherwise be the case. This is very important in buildings where jarring from engines is very annoying.

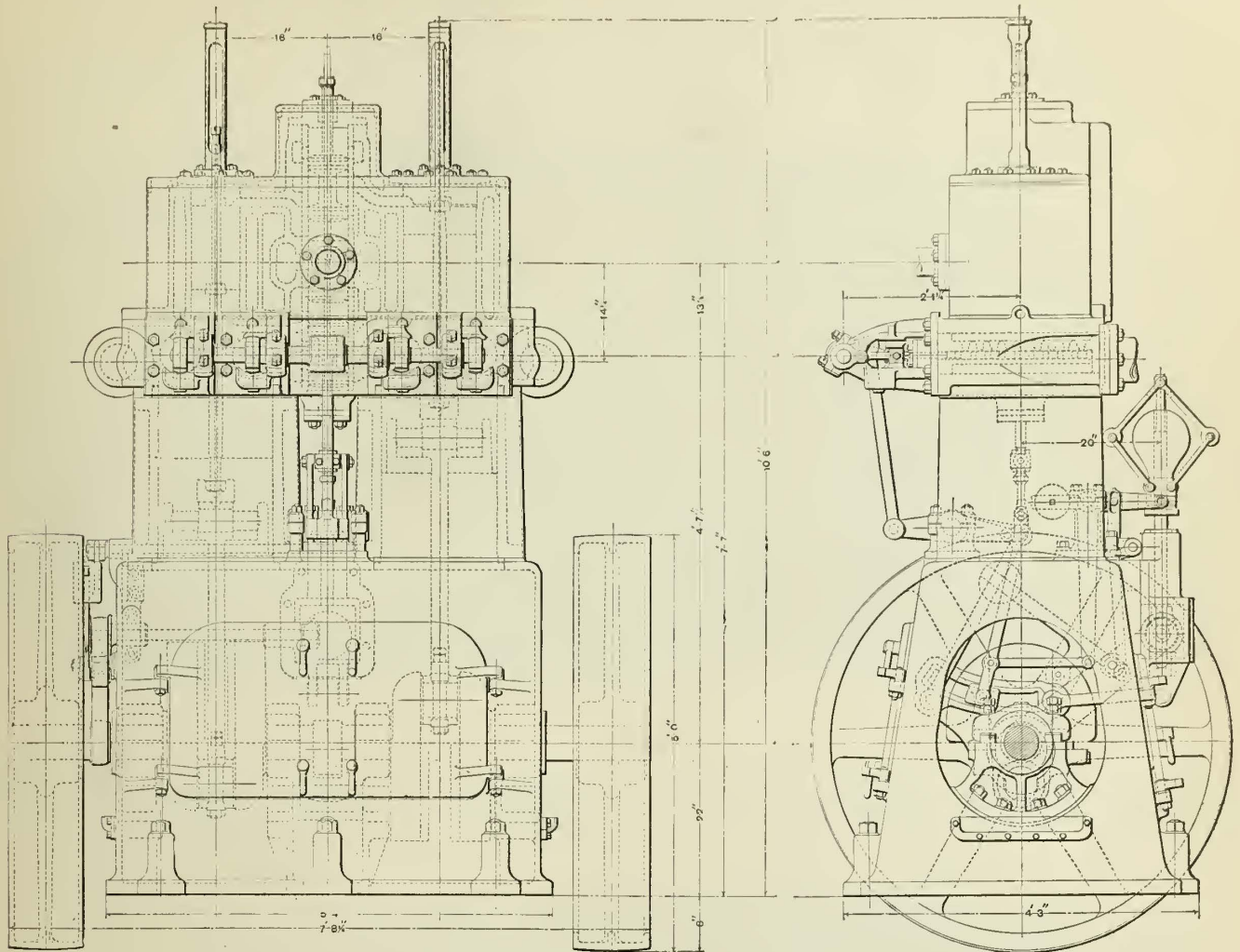
economy, and are brought about by the use of the gridiron valves in the cylinder heads.

The piston valve of the high pressure cylinder is actuated by a block sliding in the well known Fink link, so designed as to give it a perfectly equal lap and lead, and at the same time equal cut-offs at both ends of the cylinder. The position of this block, and, therefore, the cut-off, is con-

trolled by a sensitive high speed governor, the resistance to the movement of which is very slight. The exhaust of the high pressure cylinder, and the admission and exhaust of the intermediate cylinder, are controlled by a connection to a fixed point at one end of the link. These valves

New Self-Oiling, Dustproof Trolley.

The advantages of a trolley which is self-oiling and completely dustproof will be readily recognized by street railway managers, and one for which these claims



FIGS. 2 AND 3.—NEW VERTICAL COMPOUND ENGINE

have a fixed travel and point of cut-off. The movements of the low pressure valves, both inlet and exhaust, are produced by the connection of the Fink link, and are such that when these valves are unbalanced they are motionless. All pins and bushings in the valve gear are of hardened steel, thus reducing the wear and rendering replacement easy.

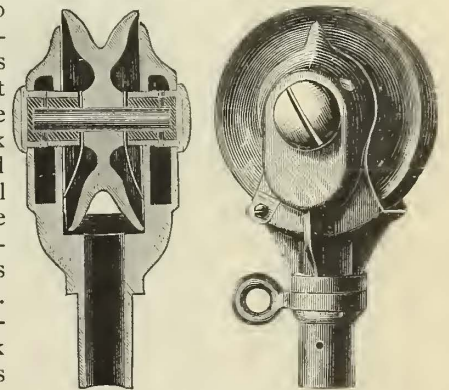
The governor is provided with a safety device, so arranged that in case the governor belt breaks, the arms of the governor will be elevated and the link block thrown to an extreme position, thus cutting off the supply of steam and bringing the engine to a stop.

The crank shaft is forged from a solid steel ingot, and the counter weight is bolted on. The pedestals are bored and turned on their bases to fit the bored seat in the bed plate or frame of the engine, to which they are secured by ream bolts. The seats for these pedestals are bored by a single setting of a boring bar and are consequently in perfect alignment.

Two sizes of this engine are shown in the accompanying illustrations, one (Fig. 1) being of 250 indicated H. P., and the others (Figs. 2 and 3) are 150 indicated H. P. The first runs at a speed of 225 revolutions per minute, and the second at 300. It is the intention of the builders to manufacture these engines in sizes up to 2,500 H. P.

The engine described is the invention of Geo. S. Strong, of 45 Broadway, New York, and is manufactured by the Providence Steam Engine Co., who build the well known Greene automatic cut-off engine. This company believe that they are filling a long felt need for an economical high speed and high class steam engine. The details of the engine have been worked out under the supervision of F. W. Dean, of 53 State Street, Boston, Mass.

are made has been recently patented by E. M. Doig, of Denver, Colo. The accompanying cuts readily explain the method of construction. The frame or fork is made with two hollow chambers through which the bearings pass. These bearings are of brass, and contain bushings of vulcanized fibre, which are fastened to the exterior brass shell so that it does not revolve. The wheel is held fast on the shaft by a steel pin; the chambers in the fork are packed with wool and filled with oil which lubricates the interior of the bearing through holes drilled in the fibre. The current is communicated to the fork by strip washers riveted to the fork. The wheel will run about two months without re-oiling, and the fork shaft and bushing will last six to eight months. This device has been in use about eleven months on the West End Street Railroad of Denver, Colo., where it has given good satisfaction.



FIGS. 1 AND 2.—SELF-OILING DUST PROOF TROLLEY.

THE Fiftieth Street, Astoria Ferry & Central Park Railway Co., of New York, have applied for right to operate several crosstown lines.

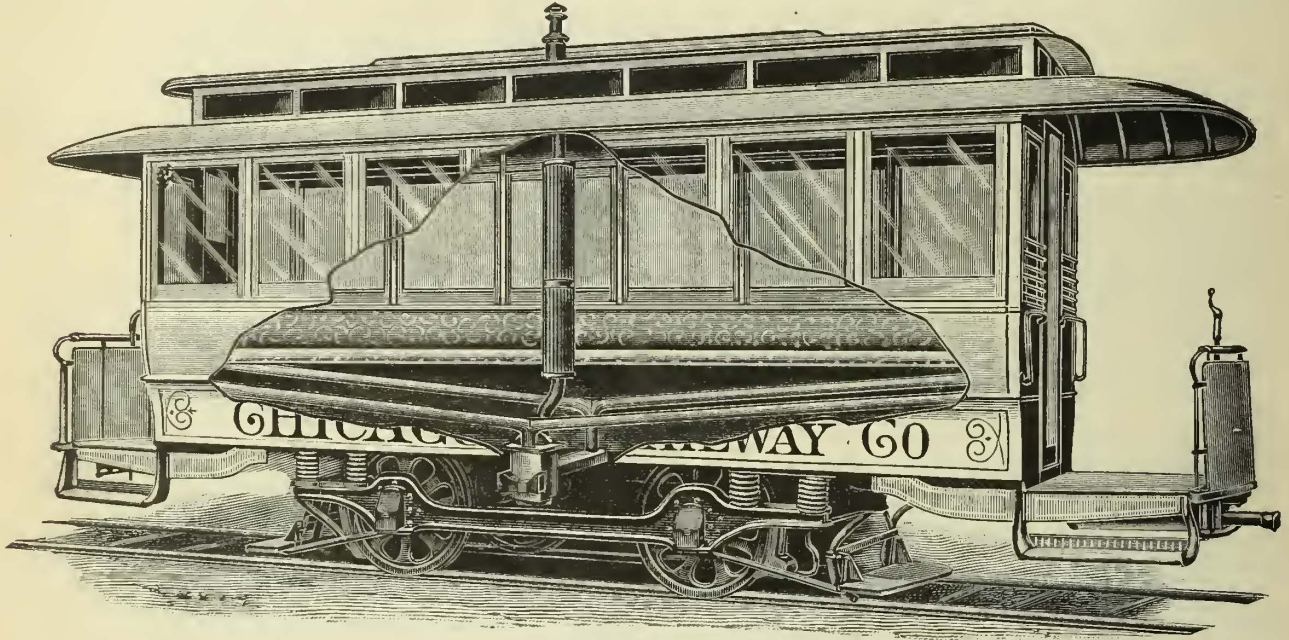
New Street Car Heater.

By using the heater shown in the illustration, it is claimed that both ends and both sides of a car may be comfortably warmed, while at the same time the temperature in the immediate vicinity of the stove is not raised to too high a point. The standard size is fifteen inches wide and deep, and extends thirteen inches below the floor, and four inches above it. Its location may be ar-

of the car, directly surrounding the firepot and combustion chamber. The heater, which is the invention of Lawrence Haas, is manufactured by the Haas Distributing Car Heater Co., of Grand Crossing, Ill.

Improved Ammonia Motor Car.

The ammonia motor system for street car propulsion, invented by P. J. McMahon, of Chicago, and described in



NEW STREET CAR HEATER.

ranged as preferred, as the system of pipes makes it possible to distribute the heat uniformly throughout the car. The smoke pipe, which with its casing occupies only six inches, may be located either outside or

our issue for January, 1892, has been recently modified and improved in a number of important particulars. The appearance of the latest car designed by Mr. McMahon, and now being built by the Railway Ammonia Motor Co.,



AMMONIA MOTOR CAR.

through the middle of the seats, passing through either the upper or lower deck as desired.

The heater is a self feeder, and requires only one damper in the pipe, which will control the fire satisfactorily. It is made of cast iron, and weighs 130 lbs. The grate is removable and can be replaced in a few moments without taking the heater apart, although this is a simple operation, as four bolts hold it together. The outer casing contains two separate air chambers, one for each side

of 280 Broadway, is shown in the accompanying illustration. The most important change, as will be seen, from the car illustrated nine months ago is in the location of the ammonia and absorption tanks. These are now placed under the car floor, and therefore occupy no space available for passengers. A re-arrangement of the driving machinery, necessitated by this change has also been made.

The principle upon which the operation of the car

depends is the evaporation of liquid anhydrous ammonia which gives at 60 degs. Fah. 100 lbs. pressure, at 80 degs. 150 lbs. pressure, and at 115 degs. 225 lbs. pressure. The ammonia cylinder, charged with liquid anhydrous am-

Works of the Falls Rivet & Machine Co.

The beautiful village of Cuyahoga Falls, O., has for its principal industry, the works of the Falls Rivet & Ma-



FIG. 1.—VIEW OF FALLS RIVET & MACHINE CO.'S WORKS.

monia, is surrounded by an exterior tank, which is charged with warm water, one charge being sufficient, under ordinary conditions, for a car run of thirty miles. The outer tank, which also partially surrounds the engine cylinders, contains water heated to about 80 degs. Fah. and is, of course, connected with the exhaust. The absorption of the ammonia gas by the water in the tank is so rapid as to relieve the engine of all, or practically all, back pressure, while the heat generated is sufficient to prevent any freezing from the expansion of the ammonia. On the return to the charging station the diluted ammonia is withdrawn from the outer tank, and a new charge of anhydrous ammonia and warm water is substituted in both tanks, an operation requiring about two minutes' time, when the car is ready for another trip.

The cost of preparing the anhydrous ammonia for use at the charging station, the manufacturers state, is less than one cent per mile of car run, and the entire cost of operation per car mile for the system only one-third that of the horse car system. The cost of installation, it is claimed, is less by half for the same number of cars and traffic than with the electric system, the entire equipment for a ten mile line, with fifty cars and plant, being considerably under \$200,000.

chine Co., which forms the subject of the accompanying illustrations.

The company was established in 1874, for the purpose of manufacturing rivets, and to-day is the largest concern of the kind in the country. The growth of the company can almost be followed in the view showing the buildings



FIG. 2.—VIEW OF PULLEY ROOM—FALLS RIVET & MACHINE CO.'S WORKS.

THE Esmond Street Rail Co., of 106 Broadway, New York City, will exhibit at the Cleveland Convention sections of their jointless rail for street and steam railways. They will also exhibit the Esmond four and six wheel swing bolster truck for electric and steam cars.

this company now occupies. One by one they were added, until now they stretch out in single file down the tracks of the C., A & C. railroad for a considerable distance. The foundations shown in the engraving are for the new storage warehouse which the company is erecting.

In 1884, the company commenced the manufacture of patent pulleys, and the excellent reputation their goods attained brought increased business, so that they have gradually enlarged their facilities for manufacturing,

New Snow Sweeper.

A new electric snow sweeper, built by the Brooklyn Railway Supply Co., of Stamford, Conn., and recently

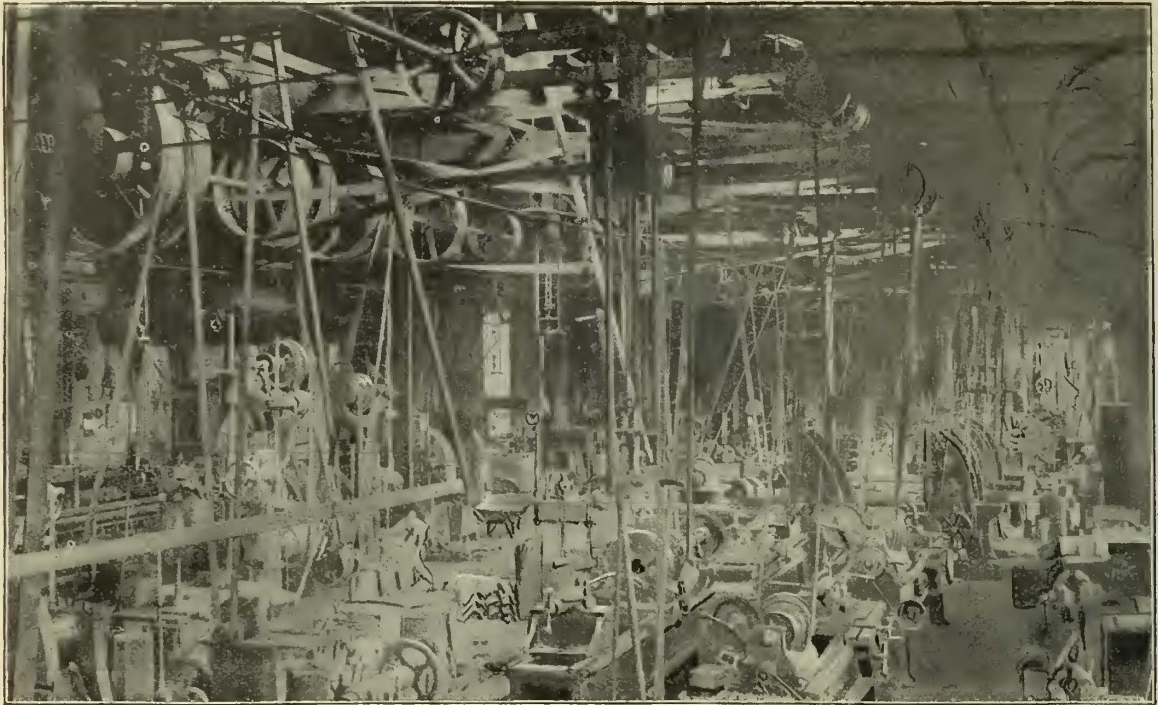


FIG. 3.—MACHINE SHOP—FALLS RIVET & MACHINE CO.'S WORKS.

until they have, to-day one of the most complete plants of the kind in the country.

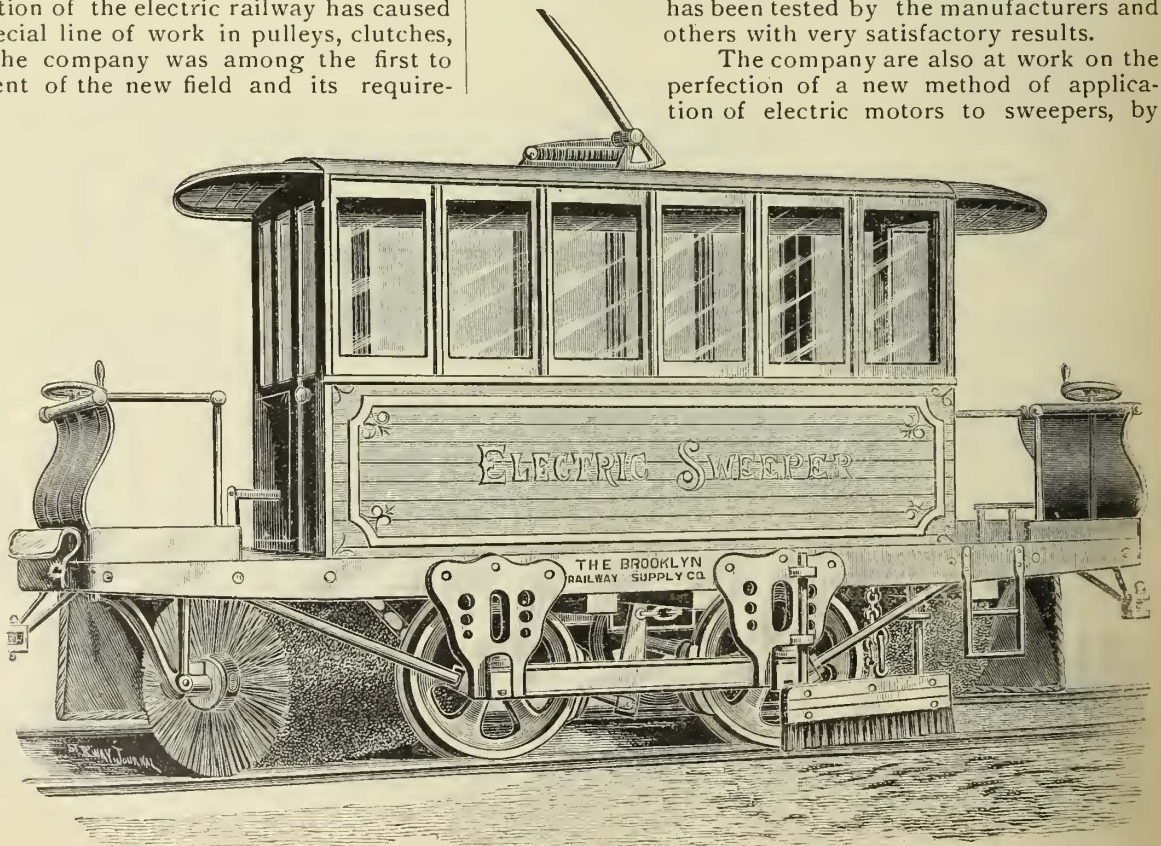
The wide adoption of the electric railway has caused a demand for a special line of work in pulleys, clutches, shafting, etc., and the company was among the first to appreciate the extent of the new field and its requirements. Their clutch pulleys and cut-off couplings are well and favorably known and are used in all parts of the country in many of the largest electric railway and electric lighting plants.

Fig. 2 shows the pulley department, and Fig. 2 portion of the general machine shop. Each of the shops is fitted up with the most improved labor and time saving machinery and the equipment of the foundry is no less interesting.

THE electric railway of the Companhia Ferro Carril do Jardim Botânico, of Brazil, has been put in operation. The motors are of the Thomson Houston type. McIntosh & Seymour compound engines are employed, and the boilers were supplied by the Babcock & Wilcox Co. The cars were built by the John Stephenson Co. The railway was installed by James Mitchell, of the Thomson-Houston International Electric Co.

placed by them on the market, is shown herewith. The mechanism is simple and compact, and the sweeper has been tested by the manufacturers and others with very satisfactory results.

The company are also at work on the perfection of a new method of application of electric motors to sweepers, by



NEW ELECTRIC SNOW SWEEPER.

which one motor can be entirely dispensed with and the connection be made in a most direct manner. This company have recently enlarged their works, and with their long experience in the manufacture of street railway appliances have every facility for turning out an excellent line of goods,

Combined Safety Ground Brake, Spring Fender, and Electrical Cut-Off.

A novel combination brake and fender for electric and cable cars, which has shown good results upon severe trials in the city of Boston, is illustrated in the accompanying engravings in longitudinal and transverse elevation. The device is attached to the car under the platform im-

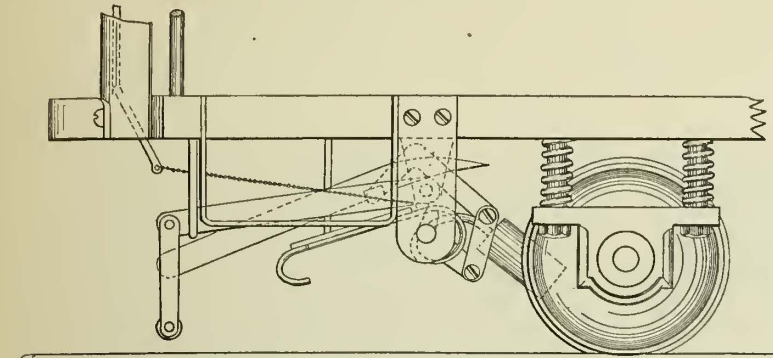


FIG. 1.—LONGITUDINAL ELEVATION—COMBINED BRAKE AND FENDER.

mediately in front of the wheels. The brake fender is supported on an iron cross bar, and consists of a number of parallel steel spring rods coiled around the cross bar at the upper ends in the form of a helical spring, and in appearance resembles somewhat the teeth of an ordinary hay rake. The lower ends of these springs are curved, and then are covered with a leather hood or apron. In case of accident the brake fender is dropped upon the roadway by means of a lever operated by the motorman. The springs clutch tightly to the paving, thereby producing sufficient resistance or friction to stop the car in the short space of twenty feet. Owing to its flexibility, the machine accomplishes this result without sudden jar. At the same time, being in contact with the pavement, it absolutely prevents any body or other obstacle passing under the wheels.

The fender, when not in use, is held away from the track by a pawl which is operated by a lever on the platform, under the control of a motorman, as already described. It may also be operated automatically, when an obstacle is encountered, by means of a light swinging tripper placed immediately under the dashboard, as shown in the illustration. By a cut-off device, not shown, the motor circuit is broken when the fender is dropped upon the paving. During the tests recently made in Bos-

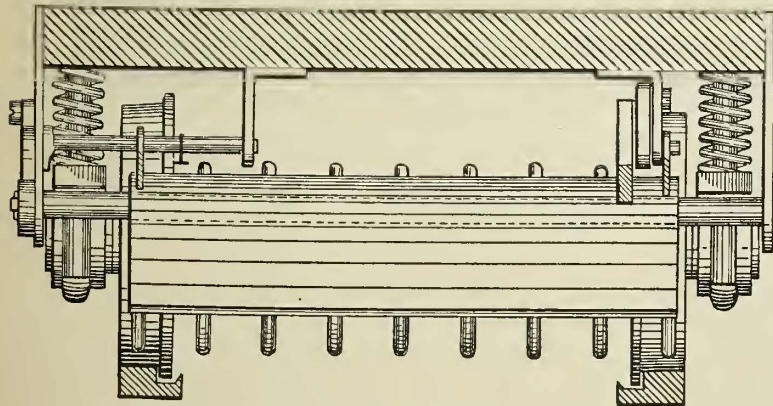


FIG. 2.—TRANSVERSE ELEVATION—COMBINED BRAKE AND FENDER.

ton, a loaded car running at a speed of about ten miles per hour was stopped by its agency, without the assistance of the ordinary brake, within the short space of twenty-one feet.

Upon steep grades this appliance may become of great value to street railways in cases where accidents are brought about by reason of defective or broken brakes. The general manager, Mr. Francis M. Eppley, of 140 Nassau Street, New York City, states that the company is meeting with great encouragement in the introduction of this device.

Automatic Cable Grip Release.

An automatic releasing device for cable grips, the invention of A. D. & F. W. Smith, of St. Louis, has recently been given a rigorous test upon the upper loop of the St. Louis Railway Co.'s cable road, with a view to its adoption. The result of the test was thoroughly satisfactory, and has fully realized the expectations of the inventors.

The claims made for the device are its simplicity and its perfect adaptation to the work to be done. It does not in any way interfere with the ordinary handling of the grip, it is equally adapted to the side or bottom jaw pattern or grip, and the inventors claim to be able to follow the construction of grips which are operated from the end platform of grip car.

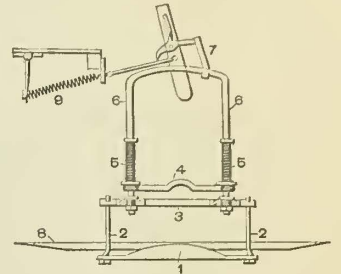
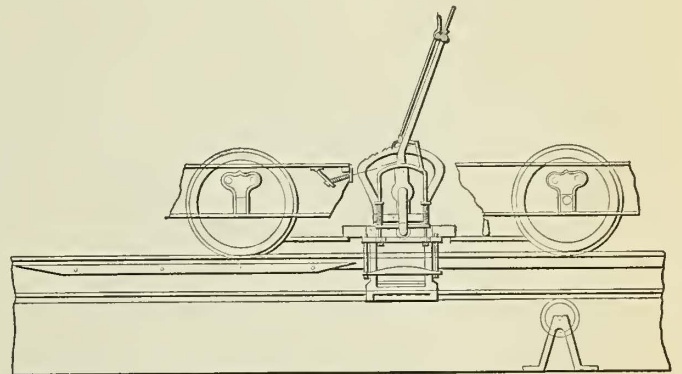


FIG. 1.

In Fig. 1, 1 is the frame or shoe passing on both sides of the grip below the slot rail and connected at the ends by the upward rods, 2, which pass up through the slot rail in front and rear of the grip and connect with the U shaped bar, 3. 4 is a bar passing on the inside of the



Street Railway Journal N.Y.

FIG. 2.—AUTOMATIC CABLE GRIP RELEASE.

eccentric leg, with loops on the end to encircle and guide the upright pieces of the frame, 6, and also forming with the grip the base for the springs, 5, which restore the frame to its normal position after passing the wedges. 6 is the vertical frame connecting with a short bar, 7, which lifts the dog out of the grip ratchet when the frame is depressed by the wedges in the subway. These wedges or bars, 8, are about sixteen feet long, and are placed one on each side of the conduit, and are attached to the slot rails or yokes.

The device has no permanent attachment to the grip, and can be removed from it in a few minutes by the loosening of a single nut.

Should the claims of the inventors be substantiated, this device will prove a boon to managers of cable roads, as it is intended to do away entirely with the possibility of cutting, kinking or stranding of ropes at crossings and wheels, by reason of the failure of the gripman to let go at the proper time.

The invention is controlled by the Automatic Cable Grip Release Co., of St. Louis.

THE Street railway lines in Washington, D. C., were taxed to their uttermost capacity during the meeting of the Grand Army posts last month and accomplished wonders. The new cable line of the Washington & Georgetown company, especially, carried a large number of passengers, who were on their way to Arlington, and it is estimated that on the the first day alone at least 50,000 veterans took this trip. The Soldier's Home railway was also largely patronized.

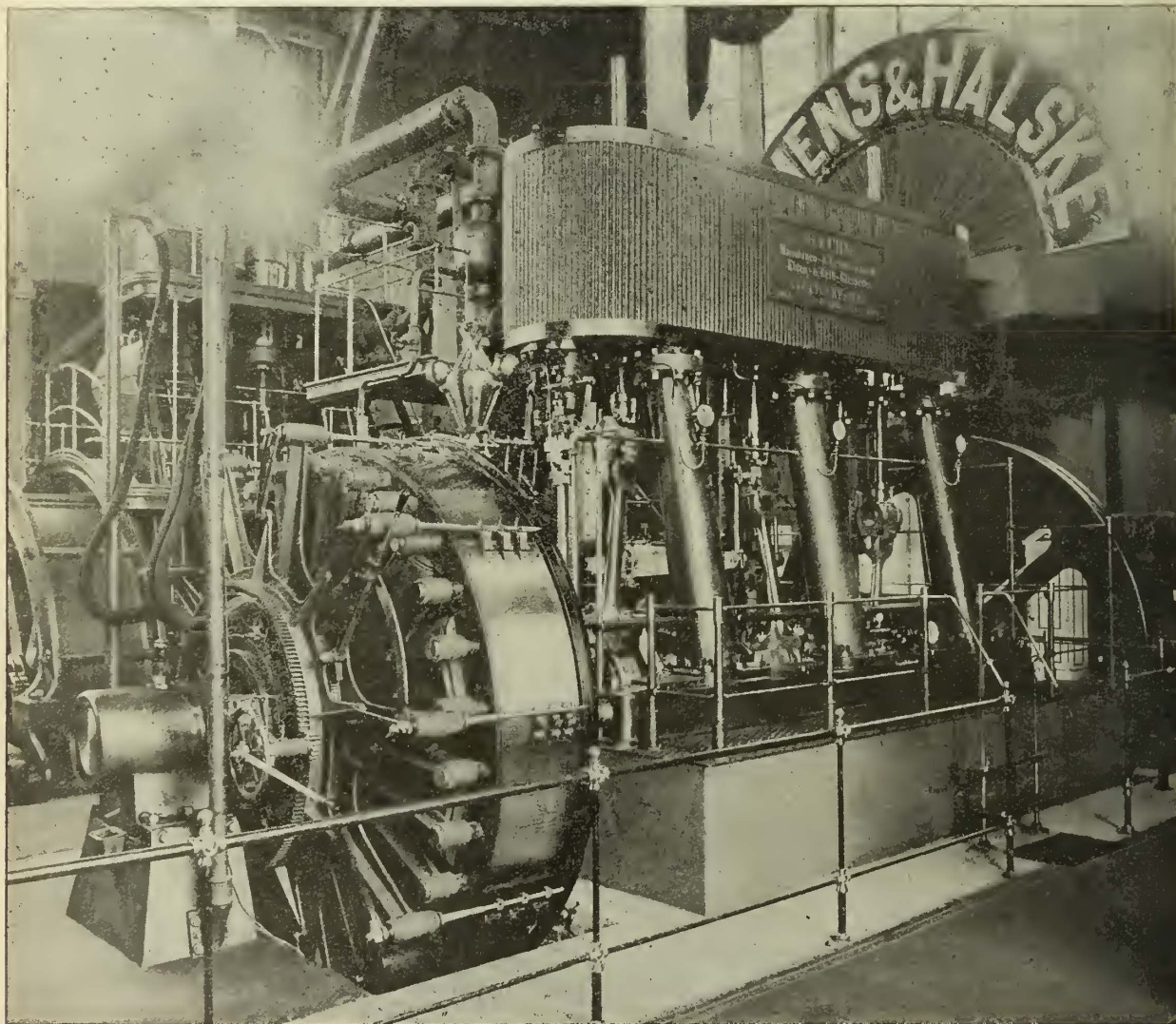
Siemens & Halske Railway Generator.

The work accomplished in electrical construction abroad by the Siemens & Halske Electric Co., of Germany, has been carefully watched on this side of the Atlantic, and now that this company have established a branch in America, a description of any of their apparatus will prove of even greater interest than before.

This company believing that large dynamos, coupled directly to the steam engine shaft, are bound to be the machines of the future, turned their attention to the

with copper segments. The machine shown has ten poles and an output of 746 k. w. The loss of volts in the armature being only 2 per cent. with maximum load, and only $1\frac{1}{2}$ per cent. of the power being required for exciting the field magnets, the electrical efficiency of the machine (746 k. w. size) is about $96\frac{1}{2}$ per cent. It is shunt wound and has surface velocity of fifty feet per second.

The works of the Siemens & Halske Electric Co. of America are located in Chicago. They receive all drawings from Berlin and will duplicate the construction that



SIEMENS & HALSKE 746 K. W. DIRECT CONNECTED RAILWAY GENERATOR.

designing and construction of such machines, and have gone from 500 H. P., to 1500 H. P. then to 2000 H. P. The wisdom of building large dynamos has been questioned by electrical engineers, and many arguments pro and con have resulted. Among others, Silvanus P. Thompson has expressed his preference for large generators, not through any admiration for mere bigness, as he says, but because he believes that the large machines may be made more efficient than the small in proportion to their cost, and in the same direction Kapp has showed that the output of generators in large sizes should vary very nearly as the square of their cost. The results found by the Siemens & Halske Co. tally very closely with these conclusions.

Their direct current railway and lighting generator, built in voltages of 100 to 700, is of the inside pole ring type, which class has from four to twelve poles. The poles are placed in the form of a star inside the rotating armature. The brushes, which are always of the same number as the field magnets, take off the current from the outside of the armature winding.

The armature itself consists of an iron ring wound

has resulted from the vast experience gained by Siemens & Halske during the half century of their existence.

Improved Steel Truck.

Realizing that trucks should combine great strength with least weight, the Robinson Machine Co. of Altoona, Pa., have put on the market their improved "Standard" truck, built entirely of steel, and as bolts and nuts are liable to work loose, they have used rivets in its construction wherever possible, and in all vital points. Another important factor cared for in this truck is its ability to pass curves easily. The yokes, in which the journal boxes ride, are made of steel, which lends to them great flexibility, so that the truck passes through curves smoothly and without any disagreeable jarring, and at the same time does away with all rigidity and possible breakage.

Under the yoke rests an equalizing bar, to which is hung the life guard. By removing a bolt in each end of this bar it can be detached together with the life guard, when wheels and axles can readily be removed without

the necessity of jacking up both ends of the car. The brake is adequate to all demands made upon it, can be operated from either end, and clutches the wheel simultaneously. The mechanism of the brake lies overhead, or close to the bottom of the car body, so that it is out of the way of the motors—a very good feature. Brake shoes can be changed by pulling out a split key at the top, where they set in the brake head, an operation which can be quickly performed. The extending side arms of the yokes give an unusually extended spring base, overcoming all oscillation, and as twelve uniform springs are used, an easy riding car is secured. Upon the top of these springs runs a bar of steel well braced, so that a sixteen foot car body is supported its entire length; this adds materially to the life of the car, as all strains are eliminated. Fewness of parts and simplicity of construction reduce the expense account for repairs to a minimum.

Another very desirable point, and one which will be readily appreciated by electricians and motormen, is the abundance of room on the sides of the trucks, allowing easy access to the motors. The journal boxes are dust and water proof, of simple design and built for wear.

The Robinson Machine Co. will have one of these "Standard" trucks on exhibition at the coming railway convention.

The Old and the New in St. Louis.

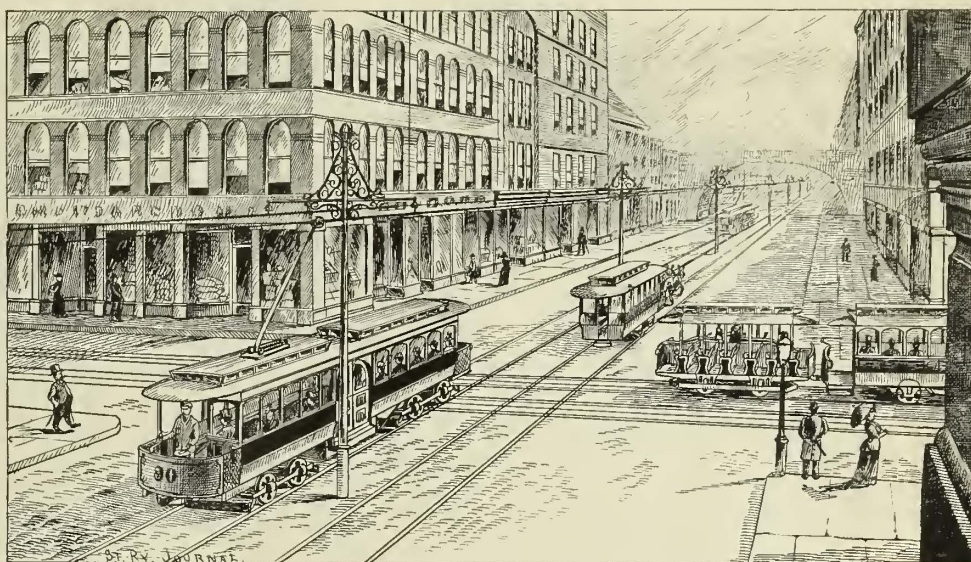
The accompanying illustration presents a view of Broadway and Washington Avenue, St. Louis, looking to the east. At this point, the most important street railway crossing in the city, two lines of electric cars run east and west; one cable road runs north and south, and three electric lines run north. A continual line of wagons and pedestrians crowds the streets to such an extent that a watchman is kept on duty to signal the cars. Some 425 cars cross here every hour, or about 7,600 a day. A good idea of the development of rapid transit may be found by comparing the relative sizes of the bobtail car with its two little mules and the large combination electric car. The illustration shows a Broadway cable train, which also presents a striking contrast to the bobtail. These bobtails, however, have been consigned to the woodpile, and were replaced by elegant electric cars, equipped with Thomson-Houston S. R. G. motors. The centre poles may be seen in the centre of Washington Avenue. Contrary to expectations, they have not proved an obstruction to the traffic, but have added to the beauty of the street.

THE Buffalo Railway Co. have recently awarded contracts to the J. G. Brill Co. for 100 four wheel trucks of their latest design; to the General Electric Co. an order for 100 motor equipments of the S. R. G. type, and six generators of 200 k. w. capacity; to the Standard Underground Cable Co. an order for four miles of underground cable, and to the National Conduit Co. the contract for a large amount of underground conduit. The contract for the new rail equipment was awarded to the Johnson Co. the rail to be of a semigroove girder pattern, nine inches in depth with a six inch base, and weighing ninety-three pounds per yard. The joint plates are to be thirty-two inches, to be clamped to the rail with twelve one inch bolts, the bolt holes being punched from a sixteenth to an eighth larger than the bolt. An additional equipment of engines is soon to be installed, but the contracts have not yet been let. No new car equipment will be ordered at present.

St. Louis Notes.

A bill has been introduced into the City Council authorizing the Forest Park & Bridge Railway Co. to construct and operate an electric railway from Third and Carr Streets on several streets including Washington Avenue to Grand Avenue, using the right of way of the Lindell Railway, Delmar Avenue, Pope Avenue and Florissant Avenue.

The Lindell Railway Co. have determined upon capturing a large share of the suburban railroad travel entering the city by way of the Missouri Pacific Railroad. At the intersection of Chouteau Avenue and the railroad tracks the street railway company are constructing a very fine suburban station of cut stone. The building measures about 75 x 25 ft., and is being put up by a prominent St. Louis architect. The necessity of this station will be appreciated from the fact that as soon as the new Union passenger station is completed suburban travelers will, on arriving there, be so far from their places of business that it will be necessary for them to take the street cars. The



THE OLD AND THE NEW IN ST. LOUIS.

point at which the station is being erected is about the most convenient at which the change from railroad to street cars can be made.

A bill has been presented to the City Council providing for an electric railway loop line commencing on Fourth and Olive Streets, and running east on the latter street to the river front, thence north to Locust Street, west to Fourth Street, and south to the point of beginning. The purpose of the road is chiefly to cater to the steamboat excursion traffic on the river during the summer months. The promoters intend to operate the line, if the bill is passed, in either of three ways, viz., to charge a five cent fare going to or from the river front, to establish a system of transfers with other companies, or, under special arrangements, to allow the cars of other companies to use the tracks of the proposed line. There are two very steep gradients on the route, but only one will have to be mounted on account of the line being of the loop type.

Several reports have been afloat that the St. Louis (Broadway) and Citizens' cable roads were thinking seriously of adopting storage battery cars for "owl" cars, instead of the slow going horse cars. Substantiation of these reports could not be obtained.

An arrangement has at last been arrived at between the managers of the Broadway cable road and of the St. Louis & Baden Railway, whereby passengers will be carried through on both lines for a five-cent fare, transfers being issued at the joint termini of the lines. Heretofore, the fare on the Broadway line has been five cents and on the Baden line ten cents. The Baden company has always been unwilling to enter into a transfer arrangement pre-

vious to the present time. An ordinance authorizing the change has been drafted, also allowing an extension of the company's franchise for thirty-five years. The Baden line is to be equipped electrically, and will derive its power from an electric plant to be established in power house No. 1 of the Broadway cable road, at Broadway and Salisbury Street.

From power house No. 2, at Broadway and Lami Street, electricity is to be supplied to the South Seventh Street branch of the Broadway road. This line has not commenced operations with any form of motive power as yet. Captain McCulloch, manager of the Broadway system, does not think it will pay until the City Council consents to give it a southw stern outlet, for instance, Tower Grove Park. He says that very likely the line will be connected at its northern terminus with the Cass Avenue system.

The latter has submitted plans to the City Council for changing the location of its tracks in certain localities and for erecting the necessary poles. The work of reconstructing this system, which includes the Northern Central, Cass Avenue and Union lines, is progressing satisfactorily, the downtown portion of the Union and Northern Central lines being finished. If, however, the contractors do not move more rapidly they will find themselves by the middle of next Summer with the lines unfinished. Work has not yet been commenced on the power house, which will be a large undertaking in itself. However, the contract for the electric equipment has been let, and the General Electric Co of New York is the lucky bidder. There are to be three large generators of 800 H. P. capacity each, and they are to be direct coupled, and will run at ninety revolutions per minute. The car equipment will consist of eighty-five cars, and each is to be equipped with two twenty-five horse power W. P. motors.

Work on the Clayton & Forest Park Electric Railway will be commenced in a few days. All construction is to be done by the Fruin-Bambrick Construction Co. The road will be completed and in running order about March or April of next year.

Mr. J. E. Sweeney, of the City Central Electric Railway Co., has recently offered to pay the entire cost of the Eighteenth Street bridge, if the city authorities will allow his road to use the bridge and give it the franchise asked. Mr. Sweeney has offered to make a deposit of \$10,000 as a guarantee of good faith on the part of the corporation he represents. The company have already made several concessions to the City Council, but the latter has not yet granted the franchise asked.

The Sportsman's Park, Cemeteries & Madison Railway Co. have applied to the City Council for a franchise. The bill includes the adoption of electricity and a fare of five cents.

The reports of the St. Louis street railways for the second quarter of 1892, showing the number of trips made and the passengers carried are herewith presented :

	TRIPS.	PASSENGERS.
Baden & St. Louis.....	5,155	43,720
Cass Avenue & Fair Grounds....	54,650	845,650
Fourth Street & Arsenal.....	2,528	5,760
Jefferson Avenue.....	45,794	503,790
Northern Central.....	41,084	550,674
Moured City.....	82,432	1,126,494
St. Louis & Suburban.....	29,806	1,766,119
Union Depot.....	142,956	2,310,629
Bellevue.....	36,306	801,090
Citizens'.....	101,346	2,487,289
Lindell.....	169,958	3,333,839
Missouri.....	278,430	3,842,071
People's.....	58,058	1,260,725
St. Louis.....	204,240	3,127,456
Southern.....	70,186	1,232,885
Union.....	50,870	415,202

Total trips.....1,373,799
Total passengers.....23,653,393

The car sheds of the St. Louis & Suburban Railway, which were destroyed by fire about three months ago, are being rapidly rebuilt, and will be completed about December 1. The company have just completed their car

repair shops, which are models in their way. They consist of two buildings, the wood and iron working shop, and the paint shop. Each has two tracks capable of holding twelve or fourteen sixteen foot cars at one time. In the wood and iron working shops are some fine lathes, made by the Lodge company of Cincinnati, also the latest types of wood working machinery. S. L.

Meeting of the Massachusetts Street Railway Association.

The usual monthly meeting and banquet of this Association was held at Young's Hotel, Boston, on September 21. The most important feature of the proceedings was the presentation of a paper on "Rail Sections and Special Construction," by Geo. W. Mansfield, which reads as follows :

GENTLEMEN :—I have long held the opinion that the great multiplicity of rail sections existing to-day is unnecessary. I have come to the conclusion that in so far as the street railway companies are concerned, six sections are sufficient, each one of which has in one form or another lived long enough to demonstrate its good features. I am aware that there are several patented forms and metallic systems on the market. As yet I have not been convinced as to their improvements. What I shall say in this brief paper, is not necessarily final. It will be a commingling of experience and present conclusions. I also am speaking only in cases of construction for investment.

In all street railway construction, others than the owners have to be taken into consideration. All municipalities have the inherent right to demand any section they please. The limitations, therefore, under which railway companies build their tracks, are, first, the requirements of the municipality ; second, their own pocketbook. It is perfectly true that the citizens at large expect and prefer the best section of rail, and it is equally true that it is wise for any street railway company to put in the best section of rail. The two, therefore, agreeing on this, the only point to decide is, can the railway company afford to meet the exactions of the municipality? The municipalities as a rule have but two points to consider : First, the section of rail best suited to the style of street in which it is to be laid ; second, that it be laid in a substantial manner.

Under the heading Style of Streets, we have to consider common dirt roads, macadamized streets, asphalt streets, and paved streets. The first three might be considered almost under one heading. We would then be reduced to two kinds of streets—paved and unpaved. Considering these various styles of streets, and eliminating for a moment the street railway company's financial condition, we should only need three sections of rails : No. 1, a section having a T rail head ; No. 2, a section having a flat flanged head ; No. 3, a section having a grooved flanged head.

Each section should be ten inches deep and have a base at least six inches wide. It is practically conceded that in so far as the head is concerned, Nos. 1 and 2 are greatly to be preferred, No. 3 section being open to the liability of filling with dirt and ice, causing the cars to jump the track, with consequent frequent derailments and serious inconvenience in cleaning the same in winter. Furthermore, there is an increased liability of narrow tired wheels getting into the groove and being twisted off.

If now, we take into consideration the financial condition of the street railways, we readily see that these sections are extremely expensive, and only the largest roads can afford them. It becomes necessary, therefore, to reduce the amount of iron in each section. I, therefore, have made each section six inches deep instead of ten inches. The only other departure is the narrower base, which is four inches. For the sake of brevity, I will designate these sections as 1-A, 2-A and 3-A.

It seems to me that with these sections it would be possible to satisfy all municipalities and all conditions of streets. Consider now for a moment each section.

Section No. 1. This section is too expensive for country roads and inadvisable in the main thoroughfares of cities of 300,000 population or more. In smaller cities and on suburban lines, it can be used with success and satisfaction. Its depth permits easy paving with the best of results.

Section No. 1-A. This section is essentially a sixty pound T rail. It should always be laid upon substantial ties having two foot centres. I consider it by long odds the very best section possible for all dirt, asphalt and macadamized streets. It can also be used in cobble or block paved streets, but in the latter case it would be better placed on stringers. In this latter case the foot of the rail should be notched so that the narrowest possible stringer can be used. In Springfield, Mass., most excellent results have been obtained with this rail. It is the only rail, I believe, used in the city. A course of specially designed brick, laid close to the rail, fills out the space between the edge of the stringer and the side of the rail and assists in keeping the paving in position ; the brick answers practically the same purpose as the flat flange of section No. 2. The only exception in paved streets where it would be advisable to substitute another section would be upon grades. This on account of the excessive wash from heavy rain falls.

Section No. 2. I have included under this section both the solid rail and the Johnson Co.'s electrically welded rail. They are practically the same. I am not prepared to discuss their relative merits. It seems to me that about the only argument for one or the other is the one of expense. The head of the

rail could be the same in either instance, and I am convinced that it is the best and only rail that ought to be used in the crowded streets of large cities, such as New York, Boston, Philadelphia, etc. It is placed directly upon ties and gives ample depth for the deepest of paving blocks. In the Johnson section the joints are held by a special joint called by that company the Standard Girder Joint. I consider it the best joint of its kind. In the solid section a six or eight bolt splice bar should be used. In either case there should be a specially heavy tie placed directly under the joint, and two others as close as good tamping will permit.

Section No. 2-A. This section would be similar in every particular to the solid form of section No. 2, only not as deep. This section can be used in macadamized or dirt roads if required by the municipalities. It hardly seems to me, however, advisable to use it unless compelled to. In paved streets, or in any street where depth is required, this section should be placed upon stringers, and the ties should be placed on three foot centres. A six bolt angle bar should be used so as to approximate the form of joint as closely as possible to the standard T rail joint.

Sections Nos. 3 and 3-A. These should be considered in all their various aspects precisely as Sections Nos. 2 and 2-A, the only difference in them being the grooved flange instead of the straight flange.

Let me now call your attention to a few points in regard to special work. There are to-day two or three companies here in the East making first class special work. I believe that all frogs should be at least ten feet in length. This would permit the cars to run off easily without any twist or wrench. One of the best trackmen of this section has called my attention to the fact that wherever there are branch-offs, whether single or double, the solid rail passing through the frog should always be the one upon which there is the heaviest traffic. Compromise joints have always been troublesome. The Johnson Co. now weld a section of the continuous track directly to the special piece. By this means all compromise joints are done away with and you are enabled to use your standard joint. This certainly is a most excellent feature and merits the heartiest approval. I believe its introduction has been made here on Washington Street. It is well worthy of your attention, and I advise you to look it over this afternoon. Messrs Soule & Dillingham are laying it and speak of it in the highest terms.

In general there are two methods of constructing switch pieces, one is the well-known Johnson method, and the other, the Wharton method, by which the rails or special pieces are held in position by cast steel moulded about them. There is not much difference between these. The latter are cheaper. In all special work, the running parts should be of steel. If possible, the special work should be of the same depth as the straight work. This, however, might be expensive. If it cannot be done, then I advise the use of timber.

In regard to the adoption of special work for country roads or for city roads, I believe the best pays. I see no reason why if it is used for city work it should not be used for all country work. In any event you are saving but very little, for the smallest roads require but a few pieces. Looking at the situation in this light, it seems to me unnecessary to have to use any more than one section for all curves. This section should weigh at least ninety pounds per yard. The Pennsylvania Steel Co. have introduced a removable guard for T rail, which I believe is an excellent thing.

There is one other feature which I have found in practice to be a most excellent one, and that is, to always use right hand connecting tracks. By such an adoption, your cars will not run against the points of the switch. It is a very simple matter for electric cars, if necessary, to back a short distance in getting from one track to the other.

In regard to the timber used in construction, I advocate in every instance the best and always as ample proportion as possible. Ties should always have at least a six inch face, be five inches in thickness and seven feet long. It is hard to determine what quality of wood is preferable. I have used almost every variety. I think that hackmatack can be used with great success with any of the above sections of rail, since it is bound to be placed at least six inches below the surface. Hackmatack, oak, cedar, chestnut and Georgia pine are all good. Their life seems to vary with the soil. If we were sure that timber in its natural condition would last, we would be happy, but unfortunately we cannot count on it. It seems, therefore, necessary to use every precaution to preserve it. There are two or three methods now in operation, viz, kyanizing, creosoting and vulcanizing processes. All have done well so far, although the latter has not had as long an experience as the two former. Springfield has had twenty years of experience with the former and declares the wood in as good condition as it was when put in the ground. I believe, however, that the parties exploiting this method have not expanded their business to any great extent. The latter method has recently been vigorously pushed. The process is simple and effective. It has had twelve years' experience, and so far has been successful. It is used extensively on steam railroads, particularly upon the elevated roads in New York. I have placed nearly 1,500,000 ft. of it in the ground myself this year, and anticipate good results. Reports from Professor Thurston, of Stevens' Institute indicate that the treatment in no way injures the wood. It is made harder and more elastic and increases its life indefinitely.

In regard to spikes, knees, tie rods etc., I certainly advise the very best.

In regard to bonding, I advocate the use of at least one No. 0 tinned copper wire for each joint. This is to be employed in every instance. In some cases it may not be necessary to run a supplementary wire, but it should always be the rule to heavily ground the rails as often as is convenient and in the most substantial and thorough manner. Don't be afraid of ground plates. I am convinced that much trouble and loss occurs in our ground circuits. Professor Thomson has always held the opinion that ultimately we would come to iron rods coupled with screw couplings for our return wire,

There is one other point of vital interest and importance to which I invite your attention. We all agree that grade crossings are a menace to life. In many cases, however, we are compelled to endure them. Our cars carry many more people than the steam cars.

These people must be protected. I advocate the adoption of a standard crossing, and then the petitioning of the Railroad Commissioners or the state to make it incumbent upon all steam railroads to permit its employment, under penalty of law. We ought to be permitted to use a crossing which places the tread of our rail on a level with steam rail and allows the notching of the steam rail sufficiently to allow our wheel flanges to pass through. All jump crossings are dangerous.

In all cases the basis of a substantial track is a good bed. Track should never be laid in a loose or uncertain soil. It will pay to remove the same and fill with good sand or gravel.

Exceptional care should always be taken in tamping. Under no circumstance slight this. I am inclined to believe that we ultimately will come to a bed of concrete or cement for a foundation upon which to place our ties. The Biblical story about the two houses has a special application to the foundation of street railway construction.

In concluding, I simply desire to urge a unity of action and a freer exchange of experience. Certainly, we know what is the best form of rail, and I firmly believe that if we honestly and conscientiously strive to get the best, all manufacturers will join with us in this application, and all municipalities will listen and heed our advice. I believe that it is befitting for this organization to start the wheel in motion which will bring about standard forms in this direction, and I urge that some resolution be prepared and adopted at this meeting, to be presented to the National Convention, held in Cleveland next month for that body's consideration.

St. Louis Electric Club.

A meeting was held September 17, at the Mercantile Club, St. Louis, to discuss the proposition in regard to forming a St. Louis Electrical Club. When the meeting had been called together James I. Ayer, of the Municipal Electric Lighting & Power Co., Capt. Robert McCullough, of the St. Louis Railway Co. W. L. B. G. Allen, Louis Nahm and many others expressed themselves in favor of the scheme. A committee on permanent organization was then named consisting of Messrs. Ayer, McCullough, Wagner, Allen and Bohle, and they were instructed to draw up a constitution and by-laws and report at the next meeting of the body, which was set for Friday, October 14. Among the gentlemen present were: C. R. Scudder, secretary St. Louis Electric Light & Power Co.; James I. Ayer, general manager Municipal Electric Lighting & Power Co.; H. P. Broughton, of the Municipal Electric Lighting & Power Co.; H. A. Wagner, superintendent Missouri Electric Light Co.; Robert McCullough, general manager St. Louis Railway Co.; J. A. J. Shultz, president Shultz Belting Co., H. L. Parker, A. W. Meston and F. W. Churchill of the Emerson Electric Co.; Louis Nahm, American Electric Manufacturing Co.; W. Matthews, St. Louis Electric Supply Co.; R. V. Scudder, Western Electric Manufacturing Co.; C. E. Sharpe, Southern Electric Supply Co.; E. J. Bagnall, engineer Lindell Railway Co.; H. C. Henley, inspector St. Louis Board of Fire Underwriters and W. L. B. G. Allen, St. Louis Engineering Co.

Street Railway News.

General.

Bridgeport, Conn.—Charles H. Hotchkiss of this city has received nearly the entire franchise of the old Bridgeport Horse Railroad Co. Mr. Hotchkiss will probably adopt electricity as a motive power. The Legislature will be petitioned for more privileges, and the road is soon to be put on a first class basis. The purchase was made from a Rochester (N. Y.) syndicate, who some time ago purchased the road.

Canton, O.—The management of the Canton Street Railway Co. have given their employes an advance in wages without their asking. The men are highly pleased and have published a card of thanks.

Chester, Pa.—The first consignment of cars, four in number, for the new electric road have arrived. They were built by J. G. Brill Co., of Philadelphia.

Davenport, Ia.—Manager Louderback, of the Davenport & Rock Island Railway Co. owning all the street railways in the city, has served notice on Mayor Bills, of the surrender of the West Second Street franchise. Cars will be stopped and the tracks taken up. This is the outcome of the action of the City Council in ordering the operation of the cars in a certain way. The company declare they are losing \$20,000 a year in running cars under the present ordinance.

Denver, Colo.—All danger of a tie-up of the city cable system, threatened last month, has been averted, the management having acceded to the demands of the men. The latter get an increase of wages to twenty-two and a half cents an hour, the former rate being twenty cents.

Logansport, Ind.—The Logansport Electric Street Railroad Co. have closed a contract for the purchase of the county fair grounds of thirty-seven acres. The line will be extended to the grounds. The company have offered to deed the city half of the grounds if it will improve and make a park out of it. The race track will be put in first

class repair by the company for the fall meeting of the trotting association.

Lowell, Mass.—The Lowell & Suburban Street Railway Co. have commenced work on the erection of a machine and repair shop adjoining the other buildings at the corner of Middlesex and Pawtucket Streets.

New Haven, Conn.—The West Haven Horse Railroad Co., having no further use for horses, as electricity has been adopted as a motive power, lately sold 100 animals at prices ranging from \$15 to \$81.

Northampton, Mass.—The Northampton Street Railway Co. have reduced their rates to five cents. The company have doubled their receipts in the past few years.

Philadelphia, Pa.—The Philadelphia Traction Co., and several companies which they control, have filed in the Common Pleas a bill in equity against the Quaker City Elevated Railroad Co., to prevent the erection of an elevated railroad by the defendant company. Counsel for the Traction company cites two acts of Assembly which he claims make it illegal for the Quaker City company to construct an elevated road on the route authorized by City Councils.

Roanoke, Va.—The street railway which was purchased last February by the Roanoke Electric Light & Power Co., has been put in operation on the overhead system. The engines are of the Armington & Sims type, and Edison generators are used. The officers of the company are: President, J. T. Engleby; vice-president, S. W. Jamison; secretary, G. C. McCahan; general manager, W. Frank Carr.

Vancouver, B. C.—The directors of the Vancouver Electric Railroad & Lighting Co. have closed contracts for two new boilers, one engine, two generators and two cars.

Extensions and Improvements.

Ann Arbor, Mich.—The Ann Arbor & Ypsilanti Street Railroad Co. will extend their motor line to South Ypsilanti. The car barns will be removed to the same place. Work has begun.

Boise City, Idaho.—The Boise Rapid Transit Co. are proposing to increase their power station next spring and supply power for manufacturing purposes.

Buffalo, N. Y.—Consents have been granted to the Crosstown Street Railway Co. to construct a street railroad on Michigan and other streets; to change the motive power upon their Exchange and Michigan Street lines from horse to electricity; to construct a railroad on Grant Street between Hampshire Street and the Military Road; to construct a railroad on William Street from the present terminus to the city line, and to construct a railroad on Huron, Pearl and other streets.

Cambridge, Mass.—The West End Street Railway Co., of Boston, have petitioned for leave to construct and use tracks on Peabody, Cambridge Kirkland and other Streets.

Chicago, Ill.—An electric line on Forty-seventh Street, from Western Avenue to Cottage Grove Avenue, in place of the horse car line now in operation there, is proposed. A petition from the property owners has been presented to the Chicago City Railway Co., asking for the change.

Cincinnati, O.—At a meeting of citizens lately H. M. Littell, General Manager James M. Doherty and several directors of the Mt. Auburn electric railway were present, and stated it as their desire at an early date to extend the line of their road from Carthage, through Hartwell and Wyoming to Lockland, a distance of four miles.

The Cincinnati Street Railway Co. have asked permission to extend the tracks of the Cincinnati & Spring Grove Street Railway from Baltimore and Western Avenue along Baltimore Pike.

Columbus, O.—The Columbus Street Railway Co. lately received six new open cars from the J. G. Brill Co., of Philadelphia. The company have given an order to the Brownell Car Co., of St. Louis, for twenty cars similar to the new twenty-foot car now in use on the High Street line and known as the Accelerator.

Denver, Colo.—The Denver Tramway Co., it is said, are trying to obtain control of the franchise of that part of the Circle railway that extends through South Denver and Sheridan and Loretto Heights. In this case very extensive improvements will be made.

Detroit, Mich.—It is reported that the Wyandotte branch of the Suburban Street Railroad Co. will shortly abandon the Healy motor and equip the line with electricity.

Gainesville, Tex.—The present street railway will probably be converted into an electric system.

Gloucester, Mass.—The street railway company will build an extension to Lanesville.

Hartford, Conn.—President Goodrich, of the Hartford & Wethersfield Horse Railroad Co., has asked leave to construct an experimental underground electric wire system from the Vernon Street stables to Broad and along Park.

Harrisburg, Pa.—The Citizens' Street Railway Co. have decided to make several extensions.

The East Harrisburg Passenger Railway Co. are at work on an extension to Hoffmans' woods. They have given notice, also, of their intention to extend their line from the city limits to Grantville and Progress on the Jonestown road to the intersection of the first public road beyond the village of Progress.

Laredo, Tex.—The Laredo Electric Street Railway Co. have petitioned the City Council for a franchise to extend the line and make of it a belt railway.

Leavenworth, Kan.—W. F. Putnam has become the owner of the Third Street railway, and also of the Rapid Transit Street Railway, from the Messrs. Erb, and will change both systems to electricity.

Lynn, Mass.—It is said that the North Shore Traction Co. have plans to build a road between Lynn and Salem on the east side of the Boston & Maine Railroad. This road will run from Lafayette Street, Salem, through Loring Avenue and Swampscott to East Lynn.

A HEARING will be given to the Lynn & Boston and the Naumkeag Street Railway companies October 3, on a petition to allow the Naumkeag to extend their trolley system and to allow the Lynn the right to erect a trolley system into the town to connect with the Naumkeag.

Malden, Mass.—The petition of the West End railroad for right to erect the trolley system on their tracks in Malden has been granted by the Board of Aldermen on condition that the West End reduce the fare from eight cents, which has been the fare for years, to five cents, and the road has agreed to do so.

Manchester, N. H.—The Manchester Street Railway Co. have petitioned for right to extend their line from the corner of Elm and Valley Streets to the end of Wilson Street.

Memphis, Tenn.—The Citizens' Street Railway Co. have petitioned for right to build a double track on Adams Street and to make other improvements and extensions.

Meriden, Conn.—A deal has been completed, whereby the Meriden Street Railway was sold to John W. Coe, assistant treasurer of the Meriden Provision Co., who has secured \$67,000 of the \$80,000 of stock. It is believed the purchase was made in the interest of an out of town syndicate and that electricity will be tried again. Mr. Coe is reported to have said that an electric road will connect Wallingford and Yalesville with Meriden.

Nashville, Tenn.—A bill authorizing the Overland Dummy Railway to use electricity has been passed by the Council.

New Britain, Conn.—By a vote of the Common Council, Dolan Bros. have been granted permission to use the trolley system. They will extend the line to Plainville.

New York, N. Y.—The Metropolitan Traction Co. lately applied to the Board of Aldermen for permission to extend the tracks of the Metropolitan Crosstown Railway and other lines controlled by them.

Oakland, Cal.—A petition is being circulated among the residents of Fruitvale to the San Leandro & Haywards Electric Road Co., asking them to extend their line to East Twenty-seventh Street along Twenty-third Avenue.

COUNCIL has granted to the East Oakland Street Railway Co. a franchise to run electric cars through certain streets of the city.

An ordinance has been passed granting to the Consolidated Piedmont Cable Co. a franchise to construct several extensions.

Omaha, Neb.—The Omaha Street Railway Co. have been granted a permit to extend their tracks half a mile.

Plainfield, N. J.—An ordinance has been passed authorizing the Plainfield Street Railway Co. to extend the location of their tracks.

Potwin, Kan.—The Potwin Council have been asked for an ordinance allowing the Topeka Railway Co. a franchise through the streets of Potwin.

Sacramento, Cal.—Application has been made by J. H. Henry, president of the Central Electric Railway Co. for a franchise on G Street.

San Francisco, Cal.—Behrend Joost on behalf of the San Francisco & San Mateo Electric Railway has applied for a new franchise to cover the old route now operated, and for supplemental feeders.

Savannah, Ga.—President Collins of the electric railway has placed the order for a sixty horse power motor capable of drawing cars containing 300 passengers at the rate of thirty miles per hour. It will be used on the Thunderbolt branch of the system.

Youngstown, O.—An ordinance has been asked granting the Youngstown Street Railway Co. the right to extend their Fruit Street lines. The ordinance calls for the line to be in operation by December 1, 1892.

New Roads.

Akron, O.—Council has passed an ordinance, extending to 1917, granting permission to the Cuyahoga Falls & Akron Railway & Power Co. to construct and operate an electric street railroad in and along certain streets therein named.

Alameda, Cal.—The Alameda, Oakland & Piedmont Electric Railroad Co. will build a street railway from Alameda to Oakland and Piedmont. The capital stock is \$500,000. The directors and stockholders are Col. F. H. Meyers, Brooklyn township; Eli S. Denison, Oakland; W. H. Rank, Alameda; S. H. Bass, Oakland.

A PETITION was recently circulated and extensively signed favoring the granting of electric franchises to W. M. Rank, by property owners on San Jose Avenue, St. Charles Street, Martin Street, Kings Avenue and High Street.

APPLICATION has also been made to the Council by David Hirschfeld for franchise rights on the streets wanted by W. M. Rank, save on San Jose Avenue. Mr. Hirschfeld offers to pay ten dollars license for each car and at the end of five years to give the city 2½ per cent. of the gross receipts of the road.

Ashland, Pa.—A corporation has been formed here to be known as the Schuylkill Traction Co., capital \$600,000, which will connect all the towns in the Mahanoy Valley by an electric railway.

Atlantic City, N. J.—An electric company, of which J. Rush Ritter, of the Solicitors' Loan Association, of Philadelphia, and George Cook are the leaders, have applied to the Borough Council for a franchise to build a road on Brigantine Avenue.

Belleville, Ill.—The Southern Construction Co., of Galveston, Tex., propose to build an electric railway on the turnpike between this city and East St. Louis, providing they can raise a subsidy of \$25,000.

Boyerstown, Pa.—There is a project on foot to build an electric road from Boyerstown to Ringing Hill and thence to Pottstown. Dr. J. F. D. Geiger, J. & H. K. Boyer, of Boyerstown, are among those interested.

Brainerd, Minn.—The electric street railway franchise recently granted to H. Spalding and others, of this city, has been acquired by C. N. Parker, of St. Paul, who proposes to immediately construct and put in operation the four miles of track required by the terms of the franchise. The road will be in operation by November 1.

Cambridge, Mass.—The Storage Battery Street Railway Co. have petitioned for a location. Among those appearing in behalf of the petition were Archibald Howe, W. S. Hall, A. E. Jones and Hon. H. O. Houghton. The proposed road was objected to by H. M. Whitney, Gen. E. W. Hincks and George G. Wright. The matter was referred to the committee on roads and bridges.

Carthage, Mo.—The Southwest Missouri Electric Street Railway Co. have filed articles of incorporation.

Chelsea, Mass.—The proposed new electric railroad in Chelsea will be a belt line. The amount of capital will be \$75,000. A. D. Bosson, C. H. Black, C. A. Campbell, Joseph R. Carr and others are said to be interested.

Chicago, Ill.—The Chicago Union Elevated Railway Co. has been organized; capital stock, \$5,000,000; incorporators, Samuel A. Craig, Thomas Bayle and others.

The Chicago, Harvey & Glenwood Rapid Transit Co., with a capital stock of \$300,000, have been incorporated by Clayton L. Hayley, W. R. Jones and Calvin C. Hall.

THERE have been filed articles of incorporation of the Chicago & Southwestern Electric Railway Co. The capital stock is \$250,000, and the incorporators are George W. Warr, Fred. S. Collier, O. L. Baskin, M. D. Byers, Henry R. Baldwin, all of Chicago.

Clearfield, Pa.—A charter has been issued to the Clearfield & Curwensville Passenger Railway Co. to run between the above towns, seven miles; capital \$100,000. Three of the directors are: John J. Patterson, Mifflintown; Isaac B. Norris, Curwensville; W. E. Wallace, Clearfield.

Detroit, Mich.—F. H. Cozzens has asked the Council to act on the petition for a franchise filed by the Detroit, Springwells & Dearborn Railroad Co. last winter and referred to the committee on streets and ordinances. The franchise desired is for a rapid transit railroad from Livernois Avenue and over a number of streets to Warren Avenue and the city limits.

Dixon, Ill.—A. C. Bardwell has petitioned the City Council for a franchise for the construction and operation of a street railway.

Elmira, N. Y.—The West Side Street Railroad Co. have been granted a franchise to and through Horseheads, and will construct an electric road.

Eureka, Cal.—A road is proposed to run from Elk River to Arcata, through this city, with three or more branch lines on the cross-town streets. Among those interested are: Stephen Hill, W. S. Clark, J. C. Bull, Jr., and O. H. Spring.

Everett, Wash.—The Union Railway & Electric Co., of Everett, was lately organized with Col. J. B. Hawley, president; M. Swartout, vice-president; George S. Brown, secretary; W. G. Swallow, treasurer. The capital stock is \$200,000, and work will begin immediately to construct electric railway lines, and probably a belt line around the peninsula and to Snohomish.

Fostoria, O.—A certificate of incorporation has been issued to the Tiffin & Fostoria Electric Railway Co. The capital stock of the concern is \$175,000 and among the incorporators are: Hon. Charles Foster, of this place, and J. A. Beatty and E. W. Brown, the promoter. The road will be constructed as soon as the preliminary arrangements can be made. It will be thirteen and five-eighths miles in length.

Haywards, Cal.—In September, 1891, a franchise was granted to F. Chappellet, H. M. Miller, N. C. Ames and Herman de Laguna to operate an electric road from Haywards to the county line of Santa Clara County. Recently they sent a communication to the supervisors, desiring them to commence work on the road, and asking them to designate the exact location where the tracks shall be laid.

Hazleton Pa.—The Hazleton & South Side Electric Railway Co., capital \$75,000, has been chartered to build a line twelve and a half miles long. The president is Alvin Markle.

A CHARTER was also issued to the Hazleton & North Side Railroad Co., length, capital and officers the same as the other company. It will run from Hazleton to Dritton.

Home City, O.—At a meeting of the citizens of Home City, Delhi, Fern Bank and Addyston, of which W. G. Miner was chairman it was resolved to build a street railway. Committees were appointed to secure the franchises and the right of way from the property owners along the proposed route.

Homestead, Pa.—A charter has been granted to the Homestead & Highland Street Railway Co., capital \$30,000. This company will build a two-mile line to Munhall and Mifflin township. The directors are: James S. Kuhn of McKeesport, Jacob Trautman, Louis Rott, Dr. George Gladden, John F. Cox and Richard Tricking, all of Homestead.

Huntington, Ind.—A company called the Huntington Street Railway Co., has been organized among a number of local capitalists who intend to put in an electric plant at once, if the franchise can be obtained. The capital is \$100,000, and the officers are: President, Dr. G. H. McLin, vice-president; Robt. J. Day, Sr.; secretary, Willis Kenower; assistant secretary, W. N. Richter; treasurer, Olney Grafton.

Jersey City, N. J.—John V. Bacot, of East Orange, Charles B. Ludlow, New Brunswick, Arthur L. Fairchild, New York, Stuart Lyman, Englewood and E. Mora Davison, New York, have associated themselves into what is to be known as the Pennsylvania City Development Co., of Jersey City, whose object is to form, operate or aid the formation of railways, street railways, elevated railways or other transportation companies, and to build, construct and equip the same. The total amount of capital stock is \$2,000,000, divided into 20,000 shares. Articles of incorporation have been filed.

Long Island City, N. Y.—The Long Island City Board of Aldermen have granted the Crescent Street Railroad Co. a franchise to operate cars through the streets of this city. Flushing is the terminus of the proposed route.

Manistee, Mich.—A franchise has been granted by the Council, and the contract has been awarded for the construction of the long hoped for electric street railway. The first two miles of the road are to be completed before January 1, 1893.

Marshalltown, Ia.—The Marshalltown Light, Power & Railway Co. have just been incorporated; capital \$250,000.

McKeesport, Pa.—A charter has been issued to The Versailles Traction Co., capital, \$18,000. The proposed road will be three miles long and operated by electricity. The line will extend from McKeesport to the village of Boston. S. M. Bowman, of McKeesport, Frank Thomson, of Pittsburgh, and W. H. Sykes, of Versailles township, are three of the directors.

Montgomery, Ala.—The West End & Riverside Street Railway Co. have recently been organized with a capital stock of \$100,000. Dr. S. D. Seelye and Mr. Satchwell are among the incorporators. The company will build the West End line and have secured other franchises.

New Albany, Ind.—The end of the year may see electric cars running from the elevated station at First and Water Streets over the tracks and terminals of the Kentucky & Indiana Bridge Co., the New Albany Street Railway Co., and the Highland Electric Railway Co. to the top of the New Albany knobs, nearly eight miles distant.

New Orleans, La.—On September 11 Comptroller Kennedy sold at public auction to Judah Hart for \$500 the franchises for a proposed street railway. It is provided in the ordinance that at the expiration of the franchise of the Levee and Barracks line this proposed line shall be extended to the lower limits of the city. The grant is for twenty-five years, at the expiration of which the railway and appurtenances shall revert to the city.

Norwalk, Conn.—The Norwalk Tramway Co. propose to begin immediately the work of building an electric road from the foot of Spring Hill and thence, over various routes, to the South Norwalk depot.

Pasadena, Cal.—Prof. T. S. C. Lowe will build an incline plane road near this place. Cable power will be used. An electric road may also be built.

Philadelphia, Pa.—A charter was issued September 2 to the Philadelphia & Ardmore Passenger Railway Co.; capital stock, \$40,000. Frederick P. Hays is president.

A NEW electric street railway company entitled the Ridge Avenue Cemetery Railway Co., with a capital of \$6,000, has been incorporated, Geo. S. Widener, of 1202 North Broad Street, is president.

FREDERICK W. RUSH, of 1643 South Fifteenth Street, is president of the Ferry Passenger Railway Co. that will build a new electric street railway. The capital is \$5,000.

Phillipsburg, Pa.—A charter has been issued to the Phillipsburg & Houtzdale Passenger Railway Co., the line to run between Phillipsburg and Houtzdale, ten miles; capital stock, \$100,000; John J. Patterson, Mifflintown; Isaac B. Norris, Curwensville, and W. E. Wallace, Clearfield, are three of the directors.

Pittsburgh, Pa.—The Aspinwall Street Railway Co. with a capital of \$12,000 has received a charter. The proposed road will be operated by electric power, and will be about two miles long. It will begin at a point where the line of the Citizens' railway now ends and the Freeport road, thence along this road to Ross Grove. Of the directors are: William R. Holmes and George C. Wilson, of Pittsburgh and James J. O'Donnell, Allegheny City.

THE Bellefield Street Railway Co., capital \$12,000, have been chartered to build a line two miles long, beginning on Centre Avenue to Herron Avenue. The directors are: George W. Elkins, William T. Elkins, Joseph Stuart, John G. Traggarth and George C. Wilson, Pittsburgh. The road will be operated in harmony with the Pittsburgh Traction system and will be an electric line.

Pittston, Pa.—The Pittston, Jenkins & Avoca Street Railway Co. has just been incorporated to build and operate an electric railway. Thos. English is president, and the capital stock is \$75,000.

Pottsville, Pa.—The Pottsville, Cressona, Schuylkill Haven & Orwigsburg Electric Railway Co., with a capital of \$75,000, have been granted a charter. The officers of the company are: John T. Shoener, of Orwigsburg, president, and George F. Dengler, of Schuylkill Haven; L. K. Hannum and C. W. Wildermuth, of Pottsville, and J. I. Hollenbeck, of Audenried. The new road will probably be completed by next spring.

Raritan, N. J.—A project is on foot to construct an electric railway between Raritan, Somerville, Finderne, Bound Brook and New Brunswick, N. J. Among those said to be interested in the scheme are Sylvanus Ayers, jr., J. I. Livingston, E. Chamberlain and L. M. Coddington.

San Francisco, Cal.—The Southern Heights & Visitation Railway Co. has been incorporated for the purpose of building a double track railroad through the southern section of the city. Associated in the enterprise are: Charles F. Crocker, H. E. Huntington, F. S. Douth, N. T. Smith and J. L. Willcutt. The capital stock is to be \$1,000,000.

Santa Barbara, Cal.—H. L. Williams has petitioned the supervisors for a franchise to construct a railway from the city of Santa Barbara to Summerland and through the Montecito Valley.

Santa Cruz, Cal.—The Santa Cruz Electric Railway has been incorporated. Capital stock, \$500,000. Directors: James P. Smith, J. H. Logan, F. W. Ely, W. H. Talbot, Morris Newton, H. H. Clark and J. G. Tanner.

Scranton, Pa.—A charter has been granted to the Lackawanna & Old Forge Street Railway Co. The line which the company propose to construct will extend from Duryea to Hyde Park.

Sharon, O.—An electric railway is proposed here by J. C. Whitla, Dr. Theo. P. Simpson, Simon Harrold and J. P. Stone of Beaver Falls, Henry M. Camp, of Rochester and Howard Wheeler, of Beaver Falls.

Sioux City, Ia.—The Morning Side Street Railway Co. want a franchise for a line of street railway. The company is a new one, the incorporators being Wm. L. Joy, A. H. Rederich and five others. The company propose to build an electric line to connect with the elevated line at or near Leech Street, or with the Peavey system. The construction of the line is to be commenced by June 1, 1893.

Spokane, Wash.—Operations, which, owing to misunderstandings have been for some time suspended will again be resumed on the Spokane & Cœur d'Alene Electric Railroad.

St. Paul, Minn.—The Fifth Ward Railway Transfer Co., capital \$50,000, have filed articles of incorporation. The incorporators are L. H. Glassbrook, M. H. Holy, H. H. Galusha and others.

Stoneham, Mass.—The Boston, Malden & Stoneham Co., through F. K. Sweetser, E. P. Shaw and W. B. Ferguson have petitioned for a route from Stoneham Centre to the Boston & Maine Depot in Malden.

THE Stoneham & Boston Railway Co., through W. B. Stevens, George W. Mansfield and George H. Campbell have also petitioned for the same route.

Tacoma, Wash.—The long talked of electric road between this city and Seattle is now in a fair way to be built. Frank C. Ross says he will build the line from Sumner to Tacoma if Fred Sander and other Seattle parties build from Seattle to Sumner.

Takoma Park, D. C.—Work has been commenced on the electric road to be known as the Petworth, Brightwood & Takoma Railroad. It is hoped to complete the road by December 1.

Vicksburg, Miss.—R. C. McFarland and J. B. Mattingly, of Vicksburg, and E. F. Fuller, of New York, have lately received a franchise for an electric line four to five miles long.

Wilkesbarre, Pa.—An electric railway is to be built and operated by the Lackawanna & Old Forge Street Railway Co., of which John Graham, of Wilkesbarre, is president.

York, Pa.—More than a year ago a charter was granted to a York corporation known as the Black Mountains Railway Co., to build an electric railway from the southern terminus of the present street railway to the top of Shunk's Hill, and from thence down the hillside to Highland Park by a gravity road, two miles. Operations have at last been commenced.

Personal.

Mr. Charles Guidet, paving contractor of this city and the owner of large granite quarries on Cape Ann, Mass., died at his home in this city, September 23.

Mr. E. L. Babcock, president of the Falls Rivet & Machine Co., of Cuyahoga Falls, O., was in New York last month and called at the office of the STREET RAILWAY JOURNAL.

Mr. Charles T. Yerkes, president of the North Chicago Street Railway Co., who went abroad last spring, returned from his trip via the City of Paris, September 21.

Mr. J. A. Hanna, of the McGuire Manufacturing Co., called at this office while in New York last month. He reported an increased call for McGuire trucks among street railway companies.

Mr. J. H. Bickford has resigned his position of electrical engineer of the Naumkeag Street Railway, and has opened a temporary office as electrical engineer at 60 Washington Street, Salem, Mass. He will later, probably, remove to Boston.

Mr. David S. Carll, who has had charge of the cable construction for the Washington & Georgetown Railroad Co., has accepted a posi-

tion as permanent engineer with the company, and will have charge of all the mechanical appliances employed in the operation of the lines.

Mr. F. L. Hart, who has been for a number of years mechanical engineer in charge of the 128th Street cable power station of the Third Avenue Railroad Co., has recently resigned that position to accept a situation with the Broadway & Seventh Avenue Railroad Co., and will have charge of the cable stations of the latter line.

Mr. Dennis Sullivan, superintendent of the Coney Island, Brooklyn, Electric Railroad, was shot on Monday, September 19, by Frank Gately, an ex-employee whom Mr. Sullivan had discharged the Saturday previous. One bullet shattered the joint at the left shoulder blade and the other severed the apex of the left lung. Although Mr. Sullivan is in a critical condition, the physicians have a hope of his ultimate recovery.

Mr. Edward E. Higgins, general manager of the Short Electric Railway Co., who is now traveling in Europe, informs us in a recent letter that he will soon sever his connection with the Short company, and will engage in independent professional work in New York City as consulting expert on all matters pertaining to the engineering and economic features of street railways. In his work among prominent street railway operators during the past few years he has acquired a fund of special information which thoroughly fits him to enter into close advisory relations with investors in street railway properties.

New Publications.

Electric Lighting Specifications for the Use of Architects; by E. A. Merrill. Published by W. J. Johnston Co., Ltd., New York.

The practice of installing even the smallest electric lighting plant under minute specifications is now so general that the value of a book of this kind will be readily appreciated. Specifications adaptable to each case differ with the conditions, but a general outline from which changes can be made is, of course, often convenient. The specifications include those applicable for the different systems of incandescent and arc lighting, and with the specifications are included the rules adopted by the National Electric Light Association at Montreal in 1891, and amended at Buffalo in 1892, the rules of the National Board of Fire Underwriters and those of the New England Insurance Exchange. The volume contains 176 pages.

Perfected Graphite for Lubricating Purposes; published by the Joseph Dixon Crucible Co., of Jersey City, N. J.

In this small pamphlet are given the advantages determined from experiment of pure graphite as a lubricant and a brief summary of some tests made with Dixon's perfected graphite as a lubricant, by Prof. R. H. Thurston. These tests showed that, as compared with the best quality of winter sperm oil, the graphite, when mixed in enough water to distribute it over the bearings and under the same number of pounds pressure and with a shaft traveling at the same rate of speed, was three times a better lubricant than the sperm oil. The best quality of lubricating grease without being mixed with graphite showed the same results as the oil, but when 15 per cent. by weight, of graphite had been added the bearings ran nearly six times longer. Where the graphite was used it was also shown there was no cutting, and the bearings were in perfect condition.

Economic Legislation of all States and the Law of Incorporated Companies Operating Under Municipal Franchises. Vol. I.; by Allen R. Foote. Charles E. Everett, editing attorney. Published by Robert Clarke & Co. Cincinnati.

The prospectus and the set of advance sheets comprising the first 258 pages of this work sent us, indicate the publication soon of a most valuable book to all persons interested in companies operating under municipal franchises. Mr. Foote states that no time or expense has been spared in its compilation and this is evident from the completeness of the book and the care employed in the systematic arrangement of subject matter. In his work the author was assisted by one or more attorneys from each state, with one for the territories, who have each contributed a section on the history and status of municipal franchises in his state or territory. The work will be in two volumes and will be ready for delivery about October 1. Price, bound in leatherette, \$10.00 per copy, in law sheep \$12.00 per copy.

The Catalogue of George Cradock & Co., Wakefield, Eng. Third Edition.

This handsome catalogue shows the extensive field covered by George Cradock & Co., and the variety of uses to which their well known ropes are applied. It is divided into five sections, being respectively, the mining, shipping, engineering, cable tramway and agricultural divisions of their business. The pages contain a large number of illustrations, among which are some of special interest, showing the appearance of the rope manufactured by this firm after a considerable period of use in cable railway service. These include views of sections of rope employed in Melbourne, London, Edinburgh and elsewhere, and show that the wear was very evenly distributed over the surface of the cable. The catalogue also contains, in addition to views of cable appliances, a number of important tables of the breaking strains of different ropes, directions for splicing ropes, etc. This company manufacture the Lang lay rope, and recommend it for cable railways. Among the street railway companies which have employed Cradock's cables we notice a number of American roads.

Systems of Car Lighting; by A. M. Wellington, W. B. D. Penniman and Charles Whiting Baker. Illustrated. Engineering News Publishing Co., New York.

This treatise on the comparative merits of the various systems of car lighting is a revised reprint of a series of articles on this subject which have been recently published in the *Engineering News* of New

York and is a result of original investigations and tests made by the authors, of whom Messrs. Wellington and Baker are editor and associate editor of the *Engineering News*, and Mr. Penniman is chemist of the Baltimore & Ohio Railroad. The book is devoted to steam railway car lighting, but the tests are in many particulars valuable to street railway managers as well. The principal systems of lighting discussed are the dry carburettor or gasoline vapor system; the Pintsch compressed oil gas system; oil burning lamps and electric lighting. The first, which we think has not been employed on any street cars, did not evidently meet the approbation of the authors in every particular as a car illuminant. In the chapter on the Pintsch system a more favorable opinion was reached. This system has met with wide adoption on railways abroad, and is being installed on cable railways in this country. Oil burning lamps, the authors estimate, are employed on at least 27,000 out of over 30,000 cars now running on passenger trains in this country, and this chapter is of special interest to street railway managers. The authors consider the relative values of 150 deg. and 300 deg. test oils, pronouncing themselves greatly in favor of the use of the latter—which, indeed, is insisted on in most states—and for central draught burners. For electric lighting of trains they recommend the combination dynamo and storage battery system employed on the Pennsylvania limited trains between New York and Chicago, and on a few other roads. The photometric tests on the value of the different lights, showed a slight gain in the use of gas over oil lamps, through the better distribution of light, while the comparative cost of operation for the same amount of light is in favor of oil. Throughout, the authors state, they have endeavored to avoid giving expression to any conclusions of their own, so far as clearness and completeness would permit, preferring to allow the reader to form his own independent conclusions; but on the other hand they have not hesitated to record all facts made against any system, as well as for it. In order not to do injustice to any system, the authors announced their willingness to publish any statements from any persons interested in any system criticizing any statements made in the book. This request has been complied with in several instances.

Equipment Notes.

The Sperry Electric Co. have opened an office at 29 Broadway, New York, and are introducing an electric motor and trolley system which has been in use for over a year at Youngstown, O. It is said to have given good satisfaction.

The Shawmut Fuse Wire Co. is the title of a company recently organized in Boston with headquarters at 85 Water Street. The company manufacture a fuse wire made of a special alloy which has a number of advantages for the purposes for which it is intended.

Charles D. Shain, for a number of years Eastern District manager of the Edison General Electric Co., has resigned from that position, and has established himself as an electrical engineer and manufacturers' agent at room 303 Electrical Exchange Building, New York. Mr. Shain has been appointed selling agent for the Weston Electrical Instrument Co. of Newark, N. J.

The Pittsburgh Terra Cotta Lumber Co., of Pittsburgh, Pa. manufacturers of porous terra cotta, report extensive sales of their product recently. The material is being largely used for building purposes, and the company, among other applications, have made a special form of tile for ceilings and roof. In connection with iron girders or beams, this makes a fireproof structure.

Messrs. Smith & Wallace, of 8 Oliver Street, Boston, have placed on the market an improved electric snow plow. They state that a plow similar in many respects to the plow now sold by them was used with marked success all last winter on the line of the Allentown & Bethlehem Rapid Transit Co., where the weather was particularly severe. The plow has been improved in many respects since then, and is now quoted by the manufacturers at a low price.

The Page Belting Co., of Concord, N. H., write us that their trade is steadily growing for their staple grades of belts and in their specialties, including the Acme link, Eureka dynamo and dynamo double belts, and that the demand for their belts is so great that they find it hard work to keep up with orders. They are at present working on some new buildings which they expect to get into by January 1, and which will more than double their capacity. The company state that they are also having a large trade for their raw hide lacing.

The Lamokin Car Works, of Chester, Pa., manufacturers of street cars, tell us that among their customers for cars delivered in September are the following well known street railway companies: Paterson Central Electric Railway, Paterson, N. J.; Chester & Media Railway, Chester, Pa.; Dennison Electric Railway, Dennison, Ohio; Philadelphia Traction Co., Philadelphia; Schuylkill Electric Traction Co., Pottsville, Pa.; Derby Street Railway, Derby, Conn.; Belle City Railway Co., Racine, Wis.; Citizens' Passenger Railway Co., Harrisburgh, Pa.

Milliken Bros., of New York and Chicago, manufacturers of Milliken patent poles for electric street railway and electric light work, inform us that they are very busy in their pole department and have orders on hand for poles for nearly all the large cities in the country which are now installing or extending electric railway systems. This firm are also designers and builders of iron and steel roofs, making a specialty of iron work for electric power and light stations, and are very busy on this line of work, having many large roof and building contracts on hand.

The Interior Conduit & Insulation Co., New York, have issued in pamphlet form a recent article in one of the electrical papers

descriptive of a perfectly wired private residence. The system of interior conduits employed and the manner in which they are applied in this instance, the manufacturers state, represents the highest state of the art yet attained. The development of their business, they say, during the past year has been extraordinary, and over 1,000,000 ft. of their tubing per month is now being installed throughout the country. Their underground system for electric railways is also giving good satisfaction wherever used.

J. P. Sjoberg & Co. is the title of a firm recently established in New York City at 155 and 157 Eleventh Avenue between Twenty-first and Twenty-second Streets, as manufacturers of street car wood work, and for repairing, rebuilding and constructing street cars of every style. Mr. Sjoberg has had long experience in this line of work, having been connected with J. A. Trimble for a number of years. The factory of the firm is equipped with the best and latest improved machinery, and located in the centre of New York's lumber yards and lumber drying companies, giving them the best opportunity to examine, select and kiln-dry their lumber.

A. Groetzinger & Sons, of Allegheny, Pa., manufacture an improved process raw hide pinion which is giving good satisfaction in electric street railway service. The great advantage of these pinions lies, of course, in their noiselessness, but the manufacturers state that in the point of wear they are equal to the best steel pinions, while the expense of installation is inconsiderable. The material of which these pinions are made is termed dermaglutine, and the manufacturers supply finished gears for all systems, or blanks from which the gears can be cut, if preferred. These pinions are also largely used for other fast running machinery where the qualities possessed by them are a desideratum.

The Burnham & Duggan Electric Appliance Co., of Boston, Mass., have met with an extensive demand for their brackets and guard wire supports. Among the prominent companies which have adopted these supports are the Worcester, Leicester & Spencer Railway, of Worcester, Mass., the Worcester & Millbury, of Worcester, Mass., the Newton & Boston, of Newton, Mass., the Naunkeag Street Railway, of Salem, Mass., Norwich Street Railway, of Norwich, Conn., and the Quincy & Boston Street Railway, of Quincy, Mass. This guard wire support effectually protects the trolley wire from accidental contact with telephone and other wires, and so greatly lessens the liability to accident.

The Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y., are having a large call for the various appliances which they manufacture. Their stove department has been especially busy during the last month on account of the approaching winter. The excellent results obtained last winter with the snow plow manufactured by this company have had their natural consequence in many orders for similar appliances from street railway companies who wish to keep their lines free from snow this winter. The register department also shows its usual activity, and to a visitor the factory of the company presents a very busy appearance. In the girder rail department there is the usual rush, and this rail seems to be more popular than ever.

The Chapman Valve Manufacturing Co., of Indian Orchard, Mass., report that the demand for all classes of goods which they manufacture has been unusually large during the past year, this being especially true of their new valve with bronze sides for high pressure steam service, which was described in a recent issue of the STREET RAILWAY JOURNAL. The call for their goods has been much larger than they anticipated, and among the customers to which they have furnished high pressure steam valves recently, they number some of the largest steam plants in the United States. The Chapman valve has given such excellent results in practice that the company write us it will take some time to fill all the orders which they have on hand.

The Neffel & Marsh Co., of 126 Liberty Street, New York, have just completed a reconstruction of electric line of the Camden Horse Railroad as well as the extension of the same to Merchantville. This piece of work was of a difficult and novel nature. The road was previously operated with a two wire overhead system, and at a potential of 220 volts. The present road is a single wire, 500 volt line with Westinghouse motors. The change in line work and motors was made without any accident and without stopping the operation of the line. The only time when work was possible without current on the wires, was from midnight until 5 A. M. Mr. J. Stanford Brown had immediate charge of this work. The same company are now installing the electric light plant for the Green Island Electric Light Co., of Green Island, New York, with a capacity of 150 and 2,500 incandescent lamps.

The Ellis Car Co., of Amesbury, Mass., are meeting with a large call for their street railway cars of all sizes and styles, and have a large number of orders on hand from prominent companies in different parts of the country. On their floors are seven ten bench, open cars for the Naumkeag Street Railway Co., of Salem, Mass.; three ten bench open cars for the Haverhill & Amesbury Street Railway Co.; ten box cars for the Hopedale Electric Co. and one box car for the Bradbury-Stone Storage Battery Co. These latter cars are for storage batteries, and the two for the Hopedale Electric Co. are finished with mahogany both inside and out, and are very handsome in appearance. They are also changing twenty-five sixteen foot box cars into twenty foot cars for the West End Street Railway Co., Boston, Mass., and have also a number of orders for electric snow plows which have been described in the STREET RAILWAY JOURNAL.

The Meneely Bearing Co., of West Troy, N. Y., manufacturers of rolling journal bearings for railway cars and general machinery, have sent us the results of some tests of their bearings, made by Delaware & Hudson Canal Co., Sept. 14-17, 1892, with Belt Line trains of four

cars, each train weighing 102 tons. The coal test showed that with brass bearings the consumption in running eighteen round trips (270 miles) was 14,800 lbs. With tubular bearings the consumption in running the same distance was 11,100 lbs., showing an excess of consumption with brass bearings of $33\frac{1}{3}$ per cent., or 3,700 lbs. of coal. In the dynamometer test the results showed that with brass bearings the power required to start a train was 3,276 lbs., while with tubular bearings the power required was only 252 lbs., the ratio of required power being 13 to 1. In the gravity test the results were: With brass bearings, distance run from foot of grade, 100 ft.; tubular bearings, distance from foot of grade, 534 ft.

The Richard Vose Car Spring Co., of New York, report, among recent large contracts closed by them, the following: with the J. G. Brill Co., 180 sets of their graduated rubber and iron cone springs, with steel cushions for cars built during the spring and summer months for the Chicago City Railway Co.; with the Bemis Car Box Co., and American Car Co., 200 sets of the same style of spring; for the West Chicago Street Railway Co., and with the Brownell Car Co., of St. Louis, Mo., 50 sets for cars of the Baltimore Traction Co., Baltimore, Md. Their graduated rubber and iron cone spring has been adopted as the standard on these roads. They will also furnish graduated springs for the Broadway cable cars, New York, and also for the 114 new cars lately contracted for by the Baltimore City Passenger Railway Co. These springs give great satisfaction on roads which use them, and the manufacturers state that the prospect for the balance of the year is very encouraging for a large amount of business.

John A. Roebling's Sons Co., of Trenton, N. J., have received the usual number of orders for cables during the past year for various cable railways in the United States, and in addition repeated orders for cables from abroad. Among the new roads in this country to which they have supplied duplicate cables, are the Broadway, New York, cable railway, the Baltimore City Passenger Railway, Baltimore, Md., and the Third Avenue Railway of New York. The order received by them from the Third Avenue Railway Co. was the largest single order ever awarded to any cable company, the cables being not only larger in diameter, but greater in length than any previously made by them. The Roebling company state that in Chicago where their cables have been put into competition with cables of other makers, the Roebling cables have lasted three times as long as some of the others. The company are also very busy in their insulated wire department, and are meeting with a large sale for their trolley wire, feeder wire and magnet wire.

The Ball Engine Co., of Erie, Pa., write us that the demand for their well known automatic cut-off engines is constantly increasing. The business of this company during the past year has been very large. They state that at the beginning of the year they expected, with the new works just erected by them, they could easily take care of their orders, but during the first nine months of 1892, the volume of their business increased 40 per cent. over that of the same period in the previous year, and they very shortly found that they could not keep up with their orders, and were, therefore, again compelled to build an addition to their works. They have been running at their factory night and day since the first of the year, except during the hot months of July and August, and still have several months' work ahead. The prospects for the future, they consider, are very bright as the Ball engine is constantly gaining in popularity and they say that they have every reason to believe that they will have all they can do during the present fall and winter.

The Billings & Spencer Co., of Hartford, Conn., manufacturers of machinists' tools and drop forgings, write us, in reviewing last year, that their business has been very satisfactory, and in amount far exceeded that of 1891. Their trade, they say, in Billings patent commutator bars, drop forged, of both pure Lake copper or Tobin bronze, has been constantly increasing, and they are now doing a large business in this line, not only with the electrical companies manufacturing dynamos and motors but also with the street railway companies direct who require these goods for repairs. The sales in their machinists' tool department have also been very satisfactory and constantly on the increase. In the electrical line their linemen's hand vise, combination pliers and drop forged wrenches are meeting a large demand. They state that they consider the outlook for the coming year to be very promising, and in evidence of this, mention that they are at present erecting a new factory, office and shipping department. The total length of these buildings will be 208×40 ft., two stories and basement.

Carleton & Kissam, proprietors of the United States Steam & Street Railway Advertising Co., of Boston and New York, report a very prosperous business during the past year. Their exhibit at the Pittsburgh Convention, as will be remembered, attracted general attention by reason of its novelty—as an exhibit—and occasioned favorable comment from various railway officials. Since that time Carleton & Kissam have added considerably to their extensive list of cities and now have under lease over 6,000 "full time" cars. They conduct their business in such a manner that complaints from passengers are unknown, railway officials are pleased, and it is safe to assert that this firm have the correct idea of running the business that has been somewhat unpopular in certain quarters. Their rentals to street railway companies aggregate nearly \$150,000 annually, and they have over \$80,000 invested in advertising racks. Their perfectly systematized method of conducting business has gained them the confidence and trade of the world's great advertisers. Mr. Carleton resides in Brookline, and Mr. Kissam in New York.

The Wainwright Manufacturing Co., of Massachusetts, 8 Oliver Street, Boston, inform us that their sales during the six months ending July 1 were in excess of the entire sales for the year of 1891, and that the orders in prospect are better at the present time than they have ever been. They have been especially successful with their feed water

heaters for compound engines, of which they make a specialty, and have sold a large number of them to street railroad companies. The Lynn & Boston Street Railway Co., at their Lynn and Chelsea stations, have nine of these heaters, and the Union Railway Co., of New York, have four. The following is a list of their recent sales to street railways and electric companies: Newark Electric Light & Power Co., of Newark, N. J., 500 H. P.; Portland Electric Railway Co., Portland, Ore., 900 H. P.; Ottumwa Railway Co., Ottumwa, Ia., 500 H. P.; Ypsilanti Electric Co., Ypsilanti, Mich., 200 H. P.; Mahanov, Shenandoah, Girardville & Ashland Street Railway Co., Rappahannock, Pa., 500 H. P.; Hull Electric Light & Power Co., Hull, Mass., 500 H. P.; Bay County Electric Co., Bay City, Mich., 700 H. P.; Aurora Street Railway Co., Aurora, Ill., 500 H. P.

Elihu Nelson, of New York, manufactures a compact feed water heater for marine and other uses which is meeting with considerable success, and which is claimed to be the only heater that can be used with the present type of ship condenser. The following description of the heater is from a letter written by William A. Pettit, engineer, formerly of the steamer "Crescent City." The heater is connected to a marine compound engine, and the steam, after traversing the heater, is passed through a condenser where it is condensed, and beyond the condenser an air pump carries the water of condensation through an oil separator into a receiving tank, apparently free from oil. A boiler pump takes the water from the receiving tank along with an extra supply to compensate for the loss, and carries it to the heater. I have also found that you have attached a vacuum gauge to the condenser, and another to the exhaust pipe near the engine. I have made the following observations of the reading of these gauges, and to the thermometer attached to the feed water pipe leading from the heater: Vacuum at condenser, twenty-nine inches; vacuum at exhaust pipe, twenty-seven inches; temperature of feed water beyond the heater, 212 degs.

The Jewell Belting Co., of Hartford, Conn., inform us that they have received a large number of orders for belts recently, and that their belts are giving good satisfaction in the various electric light and street railway plants where they have been installed. During the last year they have closed a large number of contracts, and every indication points to a continued and increasing call for their well known belts. Among other companies which they have supplied recently are the following: Jamestown Electric Street Railway Co., Jamestown, N. Y., two thirty-six inch double; United Electric Co., Springfield, Mass., one forty-four inch double; Chillicothe Electric Street Railway Co., Chillicothe, O., complete outfit; Piqua Electric Street Railway Co., Piqua, O., complete outfit; Elkhart Electric Street Railway Co., Elkhart, Ind., complete outfit; Albany Railway Co., Albany, N. Y., one forty-eight inch double; Carrol Electric Light Co. (street railroad), Matteawan, N. Y., complete outfit; United Electric Street Railway Co., Nashville, Tenn., complete outfit; Consolidated Electric Street Railway Co., Atlanta, Ga., two forty-eight inch double; Hamilton Electric Light & Tramway Co., Hamilton, O., complete outfit; Chicago, Milwaukee & St. Paul Railroad Co., Milwaukee, Wis., one fifty-six inch double.

Westinghouse, Church, Kerr & Co., of Boston and New York, report that their business during the past year has been the best of their ten years' record, since the demand for their engines, stokers and other specialties has steadily increased, and at present shows no indication of falling off. The large work, they state, is chiefly running into compound engines and the development of the type in which they are interested, of which, perhaps, the most prominent feature is the ability to work economically over wide ranges of load. Naturally, in the electrical street railway field there is a large call for this class of machines, and this industry has largely contributed to the increase of trade which they have had during the year. To them the most interesting feature of the year's work has been the development of the direct coupled system of driving street railway generators, and the experience thus far gained, they consider, indicates that this system has not only come to stay, but must almost of necessity become the standard practice regardless of size. They have considerably increased their facilities recently, chiefly through the erection of a large erecting and testing shop, and have established a special "testing branch," which is simply an extension of the plan which they have always followed in the placing of every engine under test before shipment.

The Robinson Machine Co., of Altoona, Pa., manufacturers of the well known Robinson all-steel trucks, report business as being excellent, and that during the summer they found it necessary to work far into the night to keep up with their orders. Owing to their rapidly increasing business, they have decided to enlarge their plant, desiring to be always prompt in making deliveries. Among the recent contracts may be noted the following: Citizens' Street Railway Co., Steelton, Pa.; York Street Railway, York, Pa., both above orders to be equipped with Lamokin Car Co.'s car bodies; Duquesne Traction Co., Pittsburgh, Pa.; Niles & Mineral Ridge Railway, Youngstown, O.; Consolidated Street Railway Co., Oskaloosa, Ia. (under Lamokin Car Co.'s car bodies); Brightwood Railway Co., Washington, D. C.; Philadelphia Traction Co., Philadelphia, Pa. (complete with Lamokin Car Co.'s car bodies). They have also secured orders from Watertown, N. Y., and Dennison, O., the latter with car bodies from the Lamokin Car Co. As regards their all-steel double trucks for long cars, they have just been awarded a contract for twenty sets from San Francisco, Cal. It is their intention to have on exhibition at the coming street railway convention one of their all-steel standard trucks, and trust that all interested will carefully examine it.

The Robinson Electric Truck & Supply Co., of Boston, have removed their offices from 180 Summer Street to 620 Atlantic Avenue, where, they state, they will be glad to welcome their friends. Their new offices are in the Hathaway Building, which adjoins the New England Building, in which their former offices were situated, and to

which it is connected by bridges, so that the new offices are practically on the same floor with the old ones. This company write us that the West End Street Railway Co., of Boston, are adding to their equipment 100 additional Robinson radial cars. The trucks for these cars are being built at the shops of the West End Co. The Winter Hill line is already equipped with twenty-five new radials, and other lines will be equipped as rapidly as the cars can be built. The car bodies for these radial trucks are of the usual length—twenty-five feet, exclusive of platforms. When these are all out they will make more than 150 Robinson radial cars with twenty-five foot bodies on the West End road. Among other orders for Robinson radial trucks filled within a few months by the Robinson company are twelve for the Metropolitan Railway Co., San Francisco, Cal.; twenty-one for the Union Railroad Co., Providence, R. I.; forty for the Brooklyn City Railroad Co., Brooklyn, N. Y., and six for the Rock Creek Railway Co., Washington, D. C. In addition to these, many others have been delivered in various parts of this and several foreign countries, including British Columbia, Brazil and several European countries.

The Street Railway Advertising Co., of New York, during the last two years, have enjoyed a phenomenal growth and extension of their business, under the personal management of Mr. Samuel P. Ferree, the treasurer and owner. For the previous five years the business had been confined to the main street railways of Philadelphia, but immediately upon Mr. Ferree's assuming the entire supervision, the business was extended to New York City and Brooklyn, where they now control 2,000 cars on the best and most valuable lines, and are in a similar position there, to that held for so many years in Philadelphia. They have recently extended their system to the adjacent cities of Harrisburg, Lancaster, Reading, Altoona, Chester, Atlantic City and similar points. Their policy has always been to encourage home or local advertisers to use their cars, and the results confirm the wisdom of such a course. To-day, there is no medium known by which local advertisers can so prominently and effectually reach the public. In order to secure the curved veneer advertising rack in sufficient quantities to meet their own demands, as new lines were added to their system, the Street Railway Advertising Co. were compelled to establish a manufacturing plant of their own. This places them in an independent position, and they are now able to equip an entire line of 100 cars at once. It would be well for street railway officials to confer with this company before leasing the advertising privileges on their cars, for the ability and responsibility of this company are fully attested by the lines they control.

John Stephenson Co., Ltd., of New York, are at work upon a number of new cars which they are equipping with their new standard truck, described on another page of this issue in connection with a car of the Johnstown Electric Railway, N. Y. The Stephenson factory contains at present many handsome cars in process of construction. Among these are some of an order of thirty-two passenger cars for the cable line of the Washington & Georgetown Railway Co., Washington, D. C., which immediately attract attention. The body color is Paris green with gold lettering, the interior is fitted up in quartered oak and the seats are upholstered with old gold plush. The car body is sixteen feet in length, and has a monitor roof. This order was the direct outcome of the excellent satisfaction given on the line of the same railway by the grip cars recently built by the Stephenson company for the same road. The Stephenson shops also contain the second of the order of 100 cars which this company are building for the Broadway Cable Railway. These cars, as described in a recent issue, possess a number of novel features and are being equipped with the new Stephenson standard truck. Adjoining the Broadway car in the Stephenson shops is another handsome car which the company are building for the Newark & South Orange Electric Railway. This car has extra large platforms, and the body is eighteen feet in length, and is painted blue, with gold lettering and silver trimmings. Among other cities for which this company are building cars are: East Liverpool, O.; Houston, Tex.; Elmira, N. Y.; Canton, O.; Cleveland, O.; and Puebla, Mexico.

W. R. Fleming & Co., Mail and Express Building, New York, report the following sales of the Ide and Ideal engines manufactured by the Harrisburg Foundry & Machine Works, Harrisburg, Pa: Central Park Apartments, New York City, two 175 H. P. Ideal engines; Raritan & Perth Amboy Electric Light Co., Perth Amboy, N. J., one 150 H. P. engine; Racket & Tennis Club, New York City, one thirty-five horse power and one seventy horse power Ideal engines. San Francisco Laundry Association, San Francisco, Cal., one 100 H. P., tandem, compound, Ideal engine; Edison Spanish Colonial Co., New York City, two twenty-five horse power, Ideal engines for steamships "Mexico" and "Panama"; Rubber Reclaiming Co., New York City, one fifteen horse power Ideal engine; Canfield Rubber Co., Bridgeport, Conn., one thirty horse power Ideal engine; Hotel Beresford, New York City, two forty-five horse power Ideal engines. This firm has just completed a plant for Hotel St. Lorenz, in New York City, that consists of two sixty horse power, Ideal engines, and is also installing in the Century Club of the same city one fifty and one sixty horse power Ideal engines. The firm has also recently taken several contracts for complete steam plants, and is now erecting the following: Hotchkiss School Association, Lakeville, Conn., one complete plant of seventy horse power, Ideal engine and ninety horse power, horizontal, tubular boiler; Mount Vernon Construction Co., Alexandria, Va., complete boiler plant of 300 H. P.; Municipal Electric Light Station, South Norwalk, Conn., complete plant of 100 H. P. Ideal engine and 125 H. P., horizontal, tubular boiler.

J. G. White & Co., electrical engineers and contractors, 29 Broadway, New York, have sent us a list of the contracts closed by them during the current year, as indicative of the confidence street railway companies in the quality of their work. This list includes the following

roads: Wilmington Street Railway, Wilmington, N. C., 3 miles overhead construction; Yonkers Street Railway, Yonkers, N. Y., 4½ miles overhead construction; Steinway Street Railway, Astoria, L. I., 5 miles overhead construction; Pawtucket Street Railway, Pawtucket, R. I., 2½ miles overhead construction; New Orleans & Carrollton Railroad, New Orleans, La., 16 miles iron pole overhead construction, same amount track construction; Baltimore Traction Co., Baltimore, Md. (recently completed), 7½ miles overhead construction; Carey Street extension, 4 miles overhead construction; Central Railway Co., Baltimore, Md., 11 miles overhead construction; City & Suburban Railway Co., Baltimore, Md., 7 miles overhead construction; Lake Roland Elevated Railway Co., Baltimore, Md., 20 miles overhead construction; 12 miles track laying; Newport Illuminating Co., Newport, R. I., erecting 20 miles incandescent and railway feeder, erecting 15 miles arc and pressure wires; Binghamton Street Railway, Binghamton, N. Y., 12 miles new overhead construction, and refitting 8 miles old overhead construction; Tonawanda Street Railway, Tonawanda, N. Y., 4 miles overhead construction; Highlandtown, Towson and Point Breeze branches of City & Suburban Railway, Baltimore, Md., 2½ miles double track, iron pole, cross suspension, 12 miles double track octagonal wood pole, bracket and cross suspension, about 13 miles track construction; Interstate Consolidated Rapid Transit Co., Kansas City, Mo., 13 miles overhead construction.

Barbour, Stockwell & Co., Cambridgeport, Mass., report an increased demand for tee rail work over last year, and their specialties in this line have found a ready sale, not only in New England, but in many points in the South and West. Their patent steel frog is also meeting with general approval. This frog is made from any section of girder, tee or tram rail cast into a bed plate of gun metal, thereby making the waist of the frog (which is usually bolted together) a solid piece of metal and giving it strength and durability where these qualities are most desired. There are no bolts to work loose, and no angle irons to drop off and cause the frog to separate, as is the case with most of the modern construction. The Barbour, Stockwell & Co., sleet wheel which has been placed upon the market during the last year will undoubtedly meet with a large sale this fall and winter. This wheel thoroughly cleans the trolley wire of all sleet and ice, having a frictionless metalline bushing. It is made to fit any trolley pole, and a change can be made from the regular wheel to the sleet wheel by any motorman or conductor in a minute. In the line of steam railroad crossings, several styles have been put on the market, and taking into account their time of use they have given excellent satisfaction to the railway companies using them. The Dowd gravity track cleaner—another one of the many improved devices that this progressive firm are putting forward—furnishes a perfect contact for all electric cars. It consists of a set of steel wire brushes attached to both ends of the car, and works automatically as the car moves along, requires no expert mechanic to adjust it, and leaves the rails thoroughly cleaned. The above firm have lately enlarged their plant, and are prepared, with their increased facilities, to fill any sized order with promptness and dispatch.

The Berlin Iron Bridge Co., of East Berlin, Conn., are putting up two iron buildings for the Randolph & Clowes Co. at Waterbury, Conn. One is a casting shop 42 × 82 ft., and the other a pickle room 25 × 100 ft. The Berlin company are also building a new gas house for the Philadelphia & Reading Railroad at Philadelphia, Pa., a new retort house for the Geo. H. Morrill Co., of Boston, Mass., and a new boiler house for the Pope Manufacturing Co. at Hartford, Conn. All of these buildings are to be of iron, after the well known plans of the company. This company have also received a contract from the Elmira Electric Illuminating Co. for the iron roofs for the new plant at Elmira, N. Y., which the latter company are building. The dynamo room of this station will be 66 × 177 ft., and will be covered with the Berlin company's patent anti-condensation, corrugated iron roofing, the floor space being controlled by a ten ton traveling crane. They are also building for the United States Projectile Co., of Brooklyn, N. Y., an addition of iron, 240 ft. long, to their present building. The company write us also that their business during the present year has been very large. In no single year heretofore have they done a greater business than \$1,000,000, while this year their sales up to September 15 were over \$1,000,000, with three months and a half to their credit. They state that they have done more bridge work in 1892 than usual, and that their iron building work has also increased very largely. They have now contracts for iron buildings at New Orleans, La.; Anaconda, Mont.; Detroit, Mich.; Berwick, Chester and Philadelphia, Pa.; Wilmington, Del.; Elmira and Syracuse, N. Y.; Providence, R. I.; Hartford, Waterbury and Meriden, Conn.; Aspen and Denver, Colo.; Lynn, and Millbury, Mass., and Bath, Me., all on their well known designs of iron fireproof construction.

The National Pipe Bending Co., of New Haven, Conn., have been making heaters for fifteen years, and their sales of over 500,000 H. P. indicate that the heater is a success wherever used. They report the following sales among others: Two 150 H. P. to the Consolidated Electric Railway Co., Macon, Ga.; two 300 H. P. to the Binghamton Street Railway Co., Binghamton, N. Y.; one 100 H. P. to the Kingston City Electric Railway Co., Rondout, N. Y.; one 400 H. P. to the Edison Electric Illuminating Co., Altoona, Pa.; one 200 H. P. to the Camden Horse Railway Co., Camden, N. J.; one 500 H. P. to the Jersey City & Bergen Railway Co., Jersey City, N. J.; two 400 H. P. to the Hudson Electric Light Co., Hoboken, N. J.; one 100 H. P. to the Punxsutawney Electric Street Railway Co., Punxsutawney, Pa.; one 500 H. P. to the Malden Electric Co., Boston, Mass.; one 700 H. P. to the Portland Electric Light Co., Portland, Me.; one 800 H. P. to the Coney Island & Brooklyn Street Railway Co., Brooklyn, N. Y.; one 650 H. P. to the Seashore Electric Railway Co., Asbury Park, N. J.; two 300 H. P. to the Naumkeag Street Railway Co., Salem, Mass.; one

125 H. P. to the Ocala Light & Power Co., Ocala, Fla.; one 500 H. P. to the New Haven & West Haven Street Railway Co., West Haven, Conn.; one 200 H. P. to the Catskill Cable Road, Catskill, N. Y.; one 200 H. P. to the Biddeford & Saco Street Railway Co., Saco, Me.; one 100 H. P. to the Little Falls Electric Light & Power Co., Little Falls, N. Y.; one 150 H. P. to the Leominster Electric Light Co., Leominster, Mass.; one 1,000 H. P. to the Allegheny County Light Co., Pittsburgh, Pa.; one 200 H. P. to the East Side Railway Co., Brockton, Mass.; one 400 H. P. to the Yonkers Street Railway Co., Yonkers, N. Y.; one 200 H. P. to the Haverhill Electric Light Co., Haverhill, Mass.; one 350 H. P. to the Hopedale Machine Co., Hopedale, Mass.

The Morton Safety Heating Co., of Baltimore, Md., write us that their system of heating is growing rapidly in favor on account of its simplicity, efficiency, economy and absolute safety. This company have several large contracts now on hand as well as many smaller ones, and find their heaters are growing constantly in popularity. One evidence of this is shown by the recent action of the Railroad Commission of the State of Maine, which at the meeting in August approved the system and authorized its use in the state. This was done on the application of the Grand Trunk Railway of Canada, who propose to run trains heated with the Morton heaters through the state. The Morton heater, of course, is especially adapted to street railway lines, and they number many street railway companies among their customers. The company have recently issued a pamphlet entitled "Stored Heat in Earthenware Tubes" descriptive of their system of heating, which contains a number of testimonials worthy of attention. Among the street railway companies who use Morton heaters and have written to the company testifying their entire satisfaction in its operation, are the Consolidated Light & Power Co., of Dover, N. H.; the Federal Street & Pleasant Valley Passenger Railway Co., of Pittsburgh; the Pittsburgh, Allegheny & Manchester Traction Co., of Pittsburgh, and the Roanoke Street Railway Co., of Roanoke, Va. Other street railway companies which are using Morton safety heaters, are the Attleboro, North Attleboro & Wrentham Street Railway Co., of North Attleboro, Mass.; the West End Street Railway Co., of Boston; the Baltimore City Passenger Railway Co., of Baltimore, and the Baltimore Traction Co., of Baltimore. The railway companies which heat their cars by this system include some as far north as the Grand Trunk Railway Co., of Canada, and others as far south as Virginia, showing that the heater is equally well adapted for severe cold weather and moderate cold.

The Pennsylvania Iron Works, of Philadelphia, are at present building quite an extension to their already large plant. This building, according to the *Iron Age*, "will be 230 x 65 ft. in width and will have a clear height of forty feet. It will be used exclusively for the heavier kind of work done by the company, and will, in consequence, be equipped with machinery intended for handling work of the most massive description. The list of some of the most important machines which will find permanent resting places in this building is as follows: A twenty-five ton electric crane built by the Morgan Engineering Co., of Alliance, O., which will have a traveling speed of 300 ft. per minute. In one corner of the shop will be a pit lathe, in which two wheels, forty feet in diameter and ten feet face can be turned at the same time. There will also be a 122 in. x 50 ft. Bement, Miles & Co. planer, a sixty-three inch lathe and two horizontal boring mills, all by the same company, a fourteen foot boring mill by the Betts Machine Co., and several Brown & Sharpe standard milling machines. It is expected to devote this extension almost exclusively to the manufacture of cable driving appliances and the larger parts of refrigerating machines. We may state in addition that this company has been in actual operation only some five years, therefore, its extensive plant is equipped with machinery of the best design. The following dimensions of the main rooms will give a good idea of the extent of the whole establishment: The office is 100 x 40 ft. on the ground; the foundry, 200 x 225 ft.; the present erecting shop, 180 x 70 ft., and two machine shops, 225 x 90 ft. and 225 x 80 ft. An aim in laying out the first plans was to provide for the easy handling of heavy pieces of work, and we therefore find that the largest castings can be taken from the foundry and deposited in any department without any hand labor whatever. In addition to the above there is an ice machinery department measuring 190 x 80 ft., in which work peculiarly pertaining to the manufacture of these machines is carried on."

The Germania Electric Co., of Boston, manufacturers of the improved Schaefer incandescent lamp, the De Khotinsky incandescent lamp, and the Germania dynamo, write us that they have completed the construction of the addition to their factory at Marlboro, Mass., and now have the plant in such shape that they can promptly fill their orders. This has given them a definite increase in output, so that during the last month their sales have more than doubled, although during the same period last year they showed a decrease. Their dynamo, they state, is now fairly on the market, and has received a considerable amount of favorable attention. Two large machines are being put into the Rotch mills at New Bedford, Mass., and one of 600 light capacity was started up during the last month at the mill of the Mascomo Flannel Co., at Lebanon, N. H. Besides these they have sold a considerable number of other plants, and find that the dynamo is very favorably regarded by purchasers, not only on account of its slow speed, but also the fine workmanship and moderate price. In their lamp business they have about concluded devices at the factory necessary for the construction of the De Khotinsky lamp, and are now manufacturing a three-watt lamp of this type for fifty volt circuits. They are also ready to put on the market a curled filament for street railway lamps which does away with the anchoring wire at present in use, and hence avoids any tendency of the filament to saw off under the constant vibration of the car. Their storage battery is now so far along that they announce themselves willing to take orders for equipments for either street railway or lighting plants. The battery used is that of Captain De Khotinsky, which has

given such great satisfaction on the Prussian government railroads. The active material is placed in longitudinal grooves in a lead grid, which method of construction allows considerable expansion to the material without either buckling or forcing the active material out of the grid, thereby reducing the chances of short circuiting, either through deformation of the plate or the lodgment of falling particles. The demand for their shade holders, they also state, has increased to double what it was last year, and finally, they look forward to a very prosperous season of business next year, equal to several times that which they have formerly carried on.

The Reliable Mfg. Co., 53 State Street, Boston, manufacturers of the Reliable sand box, Collett ratchet brake handle, Reliable track switch, trolley wheels and other street railway supplies, only completed their factory in Everett last January, but since that time they have added several new machines of various kinds, and now employ ten times the number of mechanics. Their business has steadily increased with the growth of electric street railways. Their Reliable sand box is meeting with a large sale, it being able to distribute coarse or fine sand in large or small quantities, and at just the moment and place required, thereby preventing accidents and so often saving many times over the cost of their application. Their Collett ratchet brake handle is also being largely adopted. Some of these handles have been in use over three years, and are good for as many more years. They are guaranteed for one year by the manufacturers, and are claimed by them to be the best and cheapest ratchet handle that can be put on electric cars. Their Reliable track switch, described in our last issue, is just being put on the market, and seems to meet with general favor. It is automatic, and the mechanical arrangements are very simple. The Reliable Manufacturing Co. also now manufacture an excellent line of trolley wheels. Last month Reliable sand boxes were shipped to Lowell & Suburban Street Railway Co., Lowell, Mass.; Lynn & Boston Street Railway Co., Lynn, Mass.; Ottawa Electric Street Railway Co., Ottawa, Ont.; Merrimack Valley Street Railway Co., Lawrence, Mass.; East Middlesex Street Railway Co., Melrose, Mass.; Rockland, Thomaston & Camden Street Railway Co., Rockland, Me.; Rochester Street Railway Co., Rochester, N. Y.; Kankakee Electric Railway Co., Kankakee, Ill.; Alliance Street Railway Co., Alliance, O.; also to Lamokin Car Works, Chester, Pa.; for Citizens' Passenger Railway Co., Harrisburg, Pa.; Paterson Central Electric Railway, Paterson, N. J.; Philadelphia Traction Co., Philadelphia, Pa.; and to the Newburyport Car Mfg. Co., Newburyport, Mass.; for Natick Street Railway Co., Natick, Mass.; Worcester & Millbury Street Railway Co., Worcester, Mass. The following are a few of the railway companies to which the Collett ratchet brake handles have been shipped during the month: New Haven & West Haven Horse Railway Co., West Haven, Conn.; Lowell & Suburban Street Railway Co., Lowell, Mass.; Natick & Cochituate Street Railway Co., Natick, Mass.; Fitchburg Street Railway Co., Fitchburg, Mass.; Globe Street Railway Co., Fall River, Mass.; Lynn & Boston Street Railway Co., Lynn, Mass.; Allentown & Bethlehem Rapid Transit Co., Allentown, Pa.; Merrimack Valley Street Railway Co., Lawrence, Mass.; Briggs Carriage Co. and Ellis Car Co., Amesbury, Mass.; Newburyport Car Manufacturing Co., Newburyport, Mass.; Thomson-Houston Electric Co., Lynn, Mass.

The R. D. Nuttall Co., of Allegheny, Pa., manufacturers of electric railway supplies for all systems, are doing a large business, and their appliances are meeting with deserved popularity in all sections of the country. This company have recently been making some important additions to their factory, and have increased their machinery to enable them to keep pace with the constantly increasing demand for the articles manufactured by them. They have now divided up their works into different departments under the charge of competent men. The machine shop department has been placed under the charge of Mr. E. F. Caterall who has had a long experience in this line of work. The fitting department is under the charge of Mr. M. Benninger, who is a thorough mechanic and graduate of one of the best technical schools in Germany. The armature winding department is under the direction of Mr. H. Gilleland, who has had long experience in general armature work, and is well posted on the subject. Mr. A. Swoger is in charge of the tool room of the Nuttall Co., and exercises as well a general supervision over all the small tools of the factory. This system of division chiefs, the Nuttall Co. find, works excellently in practice, since it holds every one strictly responsible for the production of work in his respective department. The company are also paying special attention to the matter of inspection, each article manufactured by them being thoroughly inspected before it leaves their works. In this way they insure to the user of their goods a perfectly well made and finished article. It is undoubtedly owing to this care on their part that the gears and other appliances manufactured by them have reached the degree of excellence found by users. The company have also enlarged their selling department by the establishment of offices in Chicago and St. Louis. Their Chicago office is presided over by two gentlemen thoroughly acquainted with the line of business in which they are engaged, and widely known in the trade. They are Mr. P. H. Carey, formerly with J. G. White & Co., of New York, and Mr. E. H. Harrison, formerly with H. Ward Leonard & Co., of New York. These gentlemen have already secured a large number of orders for Nuttall appliances, and they report the prospects for business excellent. They are making preparations to carry a large stock of supplies in Chicago so as to be able to ship promptly on demand from that point any appliances which may be ordered. The St. Louis agents of the R. D. Nuttall Co. are Messrs. T. C. White & Co. This firm was organized about the first of last April and are genuine hustlers. They have already received a large number of orders in St. Louis and vicinity, and have found their business to increase so rapidly during the six months in which they have been at work, that they have been obliged to move from 904 Pine Street, where they were at first located, to more commodious quarters at 805 Locust Street.

WESTERN NOTES.

The Railway Equipment Co., of Chicago, have secured the right to manufacture and sell on a royalty the Ahearn electrical car heater and other electrical appliances belonging to Messrs. Ahearn & Soper, Ottawa, Can.

The National Electric Manufacturing Co., of Eau Claire, Wis., are now represented in Chicago by Paul W. Bossart, special agent. The office is now located at 608 Pullman Building, having been removed from 931 "The Rookery."

Arthur S. Partridge, Bank of Commerce Building, St. Louis, Mo., has recently secured several excellent agencies for St. Louis and the West, and has sold of late a great deal of material to electric railways. His business in electric railway supplies, he states, is constantly on the increase.

The Charles Munson Belting Co., of Chicago, manufacturers of Eagle and Dynamo belting, tell us that they have recently closed, among other orders, one with the Brush Electric Co., of Baltimore, for another monster belt. This belt will be three ply, fifty-four inches wide and 130 ft. long.

The Kuhlman Co., of Cleveland, O., write us that they have just received a large order from one of the Cleveland street railway companies for "Cleveland Combination" cars. They state that these combination cars are meeting with great success, and that they are giving good satisfaction to railway managers and the general public. In consequence the Kuhlman Co. are improving their facilities for manufacturing them, and making arrangements for a large output during the coming season.

The Valentine-Clark Co., of 540 Rookery, Chicago, successors to the Ernest L. Clark Co., report that they are meeting with a large sale for their street railway poles and ties. Their business, the past season, has been satisfactory in all respects, and for the season of 1892 they are anticipating a much larger demand than ever, and they are now hard at work equipping themselves to supply the demand. They expect to carry larger stocks than ever before, and will also establish more yards at various initial points enabling them to handle orders from any section of the country with more promptness and dispatch.

Taylor, Goodhue & Ames, of Chicago, have organized a company that will be known by their combined names. They will manufacture and deal in electrical material, with offices at 827 Monadnock Building. The three gentlemen composing the company have all been with the Electrical Supply Co., of Chicago. William Taylor, the president of the new corporation, was assistant manager in that company. The three organizers of the new business are energetic men and thoroughly acquainted with all branches of electrical trade. They will sell to both electric light and railway companies, and will soon introduce a number of interesting and novel specialties.

The St. Louis Car Co. have just completed for the St. Louis & Suburban Railway Co. thirty palatial cars, which are claimed to be the finest and most comfortable street cars ever seen in the West. They are thirty-four feet over all, with bodies twenty-eight feet long, handsomely finished in cherry, with elegantly decorated veneered ceilings, suspended from which are five two-light bronze electroliers of C. G. Woods' latest pattern. The seats on both sides of the centre aisle are rattan with reversible backs. The cars are each equipped with two twenty-five horse power, Thomson Houston type T, single reduction motors, with latest controlling device. The cars are light, roomy, comfortable and convenient.

The Q. & C. Co., of Chicago, manufacturers of railway specialties, write us that the Bryant metal sawing machine and other specialties manufactured by them are meeting with a large demand, the rail saw being especially popular. Although this machine has been on the market for only a year, and in the hands of the Q. & C. Co., for but a few months, it has had a large sale. The Q. & C. Co. have improved it in many details, and state that whenever used it has given the best of satisfaction. Among other recent customers are J. B. & J. M. Cornell, New York; Barbour, Stockwell & Co., Boston; Smith & Lovett, Boston; Dearborn Foundry Co., Chicago; Paige Iron Works, Milwaukee; Sampson Steam Forge Co., Chicago; Stacey Manufacturing Co., Cincinnati; West End Street Railway, Boston; Manhattan Railway Co., New York, and the Troy & Lansingburgh Railway, Troy, N. Y.

Pullman's Palace Car Co., of Chicago, have a large number of orders on their books, and their new cars throughout the country are maintaining their usual record for handsome appearance and excellent workmanship. Among their recent orders in the street railway department are the following: One double deck motor car, for the Tampa Suburban Railway Co., Tampa, Fla.; forty-five closed horse cars, for the Capitol, North O Street & South Washington Railway Co., Washington, D. C.; two combination open and closed motor cars, for the Joliet Street Railway Co., Joliet, Ill.; Three closed motor cars, for Messrs. Jones & Hovey, for service at Marshalltown, Ia.; six closed motor cars for the Galesburg Electric Motor & Power Co., Galesburg, Ill.; one double deck centre vestibule motor car, for the Louisville Terminal Railway Co., Louisville, Ky. In their freight and passenger car department they also state that they are, as usual, very busy.

The Lodge & Shipley Machine Tool Co., of Cincinnati, O., are in receipt of many orders for the different types of lathes and other machines manufactured by them. This company purchased, a short time ago, the entire plant, business and good will of the Ohio Machine Tool Works, and so secured the entire interest claimed in all pulley lathes formerly belonging to the Lodge & Davis Machine Tool Co., and which that company had transferred to the Ohio Machine Tool Works. The Lodge & Shipley Machine Tool Co. are manufacturing

a heavy lathe especially adapted to the rapid production of motor gears. This lathe will turn, face and bore an iron gear twenty-three inches in diameter, four and one-half inches face, three and three quarters inches bore in less than half an hour. Only a very small additional amount of time is required in turning out a steel gear, and the machine can continue at the work all day. This motor gear lathe has been adopted by several of the largest of the electric supply companies in the United States and is giving generally the very best of satisfaction.

The Stirling Co., of Chicago, report a constantly increasing demand for their water tube safety boilers, and that they have a large number of orders on hand at present from street railway companies. The boiler manufactured by this company has shown itself especially adapted for street railway power stations, and the company have equipped the following companies since January 1, 1892: Minneapolis (Minn.) Street Railway, a 2,000 H. P. boiler; Yonkers (N. Y.) Street Railway, a 2,400 H. P. boiler; Waco (Tex.) Electric Railway, & Light Co., a 150 H. P. boiler; Toledo (O.) Consolidated Street Railway, a 600 H. P. boiler; Piqua (O.) Street Railway, a 100 H. P. boiler; Ottumwa (Ia.) Electric Railway, a 750 H. P. boiler; St. Joseph & Benton Harbor (Mich.) Street Railway, a 400 H. P. boiler; Evansville (Ind.) Street Railway, a 750 H. P. boiler; Pittsburgh (Pa.) & West End Electric Railway, a 618 H. P. boiler; Braddock (Pa.) & Turtle Creek Electric Railway, a 206 H. P. boiler; Mobile (Ala.) Electric Light & Power Co., a 350 H. P. boiler; Springfield (O.) Street Railway, a 500 H. P. boiler, making a total of 6,464 H. P. during the preceding nine months. The Stirling Co. report that they can show a similar list of electric light plant boilers installed during the same period, and aggregating as large a total.

The Laclede Car Co., of St. Louis, are, as usual, rushed with orders. Of the equipment for the Third Avenue cable road, of New York, 108 cars have been delivered, seventy-eight are being shipped and are on their way, and twenty-two are not yet finished. Twenty combination cars are being built for the Philadelphia Traction Co. for use on the lines of the Pittsburgh and Duquesne Traction companies, of Pittsburgh, Pa., ten combination cars for the Pittsburgh & West End Co., of Pittsburgh, also cars for the Suburban Rapid Transit Co., of Pittsburgh; ten forty-seven foot vestibule cars, Baumhoff's patent, for the Lindell Railway Co., of St. Louis; cars for the Topeka Electric Railway Co., of Topeka, Kan.; the Lincoln Electric Street Railway Co., of Lincoln, Neb.; Superior Rapid Transit Co., of West Superior, Wis.; Electric Railway & Power Co., of Tiffin, O.; Springfield Electric Street Railway Co., of Springfield, O.; Bloomington City Railway Co., of Bloomington, Ill.; Brightwood Railway Co., of Washington, D. C.; Ashland & Catlettsburg Railway Co., of Ashland, Kv.; Urbana & Champaign Street Railway Co., of Champaign, Ill.; Shreveport Railway Co., of Shreveport, La., and Easton, Pa. The company is to replace the present frame buildings with those of brick, and will then be in better shape to manage their large and increasing business. The boiler capacity of the works has been increased from 200 H. P. to 400 H. P.

The Fulton Foundry Co., Cleveland, O., are at present extending and enlarging their works so that they can be better able to fill larger orders than ever before. Their works are running to their full capacity, and this company are at present turning out a large number of switches, railroad crossings and special work. In the truck department, however, they report special activity. A large number of companies have adopted the Fulton Foundry truck as a standard, and orders are being received from all sections. The following roads are among others which use the truck: East Cleveland Railroad, Cleveland, O.; Bloomington City Railway, Bloomington, Ill.; Janesville Street Railway, Janesville, Wis.; Toronto Street Railway, Toronto, Ont.; Montreal Street Railway, Montreal, Can.; Consolidated Street Railway, Toledo, O.; Brooklyn City Railway, Brooklyn, N. Y.; Springfield Street Railway, Springfield, O.; Milwaukee Street Railway, Milwaukee, Wis.; Edison General Electric Co., Schenectady, N. Y. Many of these companies have ordered additional equipments showing that they are well satisfied with the operation of the truck. Every truck recently furnished by the Fulton Foundry Co. has been equipped with their double tread wheel which they find very popular. They are turning out a large number of these wheels, and are endeavoring to get ahead with their orders, so that they can always have a large stock on hand.

The Detroit Electrical Works write us that during the past year their factory at all times has been worked to its fullest capacity in their endeavor to keep up with orders for railway motor equipments and generators that have been received. Among the most prominent of the contracts which the company have taken during this period are the following: Dubuque and Sioux City, Ia.; Racine, Wis.; South Chicago, Cairo, Jacksonville and Kankakee, Ill.; Omaha, Neb.; Kokomo, Ind.; Detroit, Mich.; Chattanooga, Tenn., and Salina, Kan. Of these orders a number have been for increase of equipment, notably Jacksonville, Ill., where the Jacksonville Railway Co., after purchasing three Detroit standard equipments and three of another type, and running both for a number of months, placed their order for an increase with the Detroit Electrical Works; also, the Calumet Electric Street Railway Co., South Chicago, whose first order was given the Detroit Electrical Works, July 31, 1890, since which time the same manufacturers have received five orders from this company for increase of equipment, the last being placed after the company had tested other motors. The Detroit, Chattanooga, Dubuque, Racine and Salina contracts were only placed with the Detroit Electrical Works after the most thorough and personal investigation of all other systems by the officers of the railway companies. Owing to the great amount of work which has been contracted for by this company, it has been found necessary to largely increase the manufacturing facilities, and consequently the factory has been enlarged and new machinery intro-

duced, so that now their capacity is fully treble what it was a year ago. This company are now manufacturing multipolar generators up to 250 K. W. capacity, and before the year is past will be prepared to furnish up to 500 K. W. capacity. Their generators have every improvement suggested by the latest practice, and in consequence of their being of new pattern, have many advantages over machines previously designed. As a convenience to the trade, and that all business may be transacted with greater dispatch, the general offices of the company have been removed from the works in Detroit, corner of Woodward Avenue and the railroad, to the Campau Building, corner of Larned and Griswold Streets, where now the company have an elegant suite of offices fitted up with every known convenience for prompt dispatch of business, and where, they write us, they will always be pleased to entertain their friends and customers. As, notwithstanding the fact that the capacity of the works has been greatly increased, the work in hand is still so great that it requires the working of a night force as well as the regular day force, it will be seen that the outlook for this company is very bright, and they have little doubt but that the business of the coming year will be more than treble that of any year in the history of the company.

Press Comments On Our New Hand Book "Street Railways."

"In the work the author has treated the subject in the broadest sense, giving first a very comprehensive view of the actual methods employed, and then entering into many details of the construction and management of roads, which are here probably brought together for the first time.

"It has evidently been Mr. Fairchild's aim throughout to place the subject matter before the reader in such a manner that even those little versed in technical matters will be able to gather a correct understanding of the various systems and to form an opinion of their relative merits viewed from both a mechanical and a commercial standpoint. The illustrations throughout are admirable, and together with the lucid text, make this the best compendium on the subject extant. Mr. Fairchild and his publishers are to be congratulated."—*Electrical Engineer*.

"To those who have not looked into the matter before, this handsome quarto will come as a surprising revelation of the enormous development in America of what we on this side of the water call tramways, but what they in the United States appropriately enough designate street railways. The great monthly journals published in America and devoted to street railway interests are, indeed, sufficient evidence of this development, but to the general public here they are quite unknown. No such journals could exist here, and no such book as the present could be attempted, for the street railway industry as understood across the Atlantic, is with us only in embryo. In 'Street Railways' Mr. Fairchild has produced an eminently practical and useful work.

"There seems to be scarcely a detail which a tramway manager should know that is omitted from the work, while for all interested in the subject the book is a valuable one. Hundreds of illustrations and diagrams elucidate the text. We believe there is no other work of a similarly comprehensive nature yet published. It represents vast knowledge and industry on the part of the author, and everything is brought down to date.

"Mr. Fairchild is recognized as an eminent authority in the American street railway world, and his book merits careful study by all who are connected with the new tramway department of the Town Council. To some of them it may be an eye opener; to all it will be profitable."—*The Glasgow (Scotland) Herald*.

"Mr. Fairchild has accomplished a great work and has produced what must be considered the first full and complete treatise upon street railways. For years he has been a close and careful student of every phase of the many systems of transit, and he has recorded the results of his study and investigation in a very painstaking manner. His treatment of the subject is broader than the scope of any other work upon this topic, including not only electric, cable and animal traction, and steam, air and gas motors, but also inclined planes, rack rail inclines and elevated railroads. These various methods of traction are treated in great detail, and Track Construction and Car Building form two very valuable chapters in the book. Three chapters treat of discipline and rules, the organization and financing of companies and the keeping of street railway accounts, all of them subjects of great importance, but not generally given the attention they deserve. The book is profusely illustrated with a great number of original plans, sketches and drawings, so that every description can be easily and thoroughly comprehended. Few people have any idea of the prodigious amount of work involved in the preparation of such a volume, but those who do will appreciate the accuracy and completeness of what Mr. Fairchild has done. To any man who has any connection with a street railway this book must be invaluable."—*Manufacturers' Record*.

"This book deserves to become a manual on street railways, for it is the best and most comprehensive work that we have seen on the subject, about which there is not much reliable literature. While the book contains a great deal of technical detail, it has been so skillfully written that an ordinary reader, interested in the wonderful development of the street railway system of transportation follows on, chapter after chapter, with keen interest.

"We think it would be a good plan to make a hand book of the chapter on electric traction for the benefit of men engaged in operating electric cars."—*Locomotive Engineering*.

"This volume is a book of great usefulness to those dealing with the practical side of the subject, and of some value even to lawyers,

"It is also undoubtedly a very useful book for engineers."—*Railway and Corporation Law Journal*.

"There have been treatises on street railroads, or tramways, but none recently, and this class of roads has received so rapid a development, both in extent and methods of operation, within a few years past that a new treatise had become a necessity. Mr. Fairchild has undertaken to fill this vacancy, and has done it with a very considerable degree of success.

"The great development of electric traction is very well treated, and much space is given to electric appliances, but the cable road and other systems are not neglected. The chapter on Rules and Operating are of a practical kind, and the author has given accounts of the best methods of management and those which have been approved of in practice. Upon the whole, Mr. Fairchild has made a very good book, and one which will meet a decided want.

"It can be recommended to all who are interested in street railroads and their methods."—*The Railroad and Engineering Journal*.

"There has been a need in the street railway field, for some time, of a practical reference book, a book that an untrained or unskilled man could look to for practical points and information. Until the publication of this book there has been nothing to fill this need in supplying it. Mr. Fairchild has brought his years of experience and his ability and his enthusiasm to a focus, and the result is a book that is quite invaluable. It evidently represents a large amount of work, as the book is quarto size and there are nearly 500 pages. A glance at the table of contents shows how comprehensively the subject is covered."—*Electrical Industries*.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, AUGUST 30, 1892, TO
SEPTEMBER 20, 1892, INCLUSIVE.

AUGUST 30.

Car Truck Gear, Edgar Peckham, New York, N. Y.	481,704
Electric Motor and Regulating Device therefor, Frank J. Sprague, New York	481,739
Electric Railway, Rudolph M. Hunter, Philadelphia, Pa.	481,906
Extensible Step for Cars, William H. Voss, East Stroudsburg, Pa.	481,658
Motor for Street Cars, James G. Lightford, Indianapolis, Ind.	481,755
Rail Chair, Charles E. Mark, Cleveland, O.	481,575
Railway Joint, Henry T. Hey, Philadelphia, Pa.	481,758
Railway Rail Joint, Charles E. Mark, Cleveland, O.	481,576
Street Car, John A. Melling, Cleveland, O.	481,800
Trolley Carriage for Conduits, Stephen L. Platt, Elgin, Ill.	481,817

SEPTEMBER 6.

Automatic Gipsy for Cable Railways, Andrew J. Smith, St. Louis, Mo.	482,279
Automatic Trolley Disconnecter, George A. Kimball, Seattle, Wash.	481,956
Car Journal Box, Charles T. Schoen, Allegheny, Pa.	482,200
Crossing for Underground Cable Railways, William H. Page, Philadelphia, Pa.	481,966
Conduit System for Electric Railways, Reuben Lawrence, St. Joseph, Mo.	481,559
Means for Drawing Cables into Conduits, Thomas F. O'Connor, New York, N. Y., and Joseph W. Marsh, Pittsburgh, Pa.	482,270
Trolley for Electric Railways, Clarence A. Adams and Thomas J. Thorp, Lincoln, Neb.	482,031
Trolley for Electric Railways, James M. C. Tyner and Samuel S. Irving, Minneapolis, Minn.	482,325

SEPTEMBER 13.

Bell, Edward D. Rockwell, Bristol, Conn.	482,696
Electric Locomotive, William H. Soley and William W. Perkins, Philadelphia, Pa.	482,594
Inclined Conductor for Electric Railways, Geo. A. Dupuis, Detroit, Mich.	482,343
Street Railway Switch, Tom. L. Johnson, Cleveland, O.	482,426
Underground Trolley, Joseph Fischer, Cleveland, O.	482,509

SEPTEMBER 20.

Brace Chair for Railroads, George Murray, Johnstown, Pa.	482,807
Car Wheel, George Hull, Binghamton, N. Y.	483,064
Chair for Railroad Rails, Arthur J. Moxham, Johnstown, Pa.	482,801
Channel Rail and Chair, Arthur J. Moxham, Johnstown, Pa.	482,803
Closed Conduit for Electric Railways, Levi P. Bunce, Minneapolis, Minn.	482,933
Combined Railroad Rail and Chair and Method of Making the Same, Arthur J. Moxham, Johnstown, Pa.	482,805
Conduit for Electric Railways, Francis O. Blackwell, Boston, Mass.	482,719
Electric Locomotive, Conrad M. Conradson, Madison, Wis.	482,863
Electric Railway Conduit, Ralph M. Hunter, Philadelphia, Pa.	482,964
Fare Register and Recorder, Charles Crook, Brooklyn, N. Y.	483,102
Guard Rail, Simon H. Stupakoff, Pittsburgh, Pa.	482,766
Insulator, Charles T. Lee, Boston, Mass.	482,872
Metal Railroad Tie, Robert E. Daniels, Youngstown, O.	482,997
Metallic Railway Tie, Charles B. Macneal, Philadelphia, Pa.	482,967
Rail Joint, Thomas J. Kennedy, Renfrew, Pa.	482,796
Railroad Rail Chair, Arthur J. Moxham, Johnstown, Pa.	482,802
Railroad Rail Chair and Process of Making the Same, Arthur J. Moxham, Johnstown, Pa.	482,804
Railway Chair, Simon H. Stupakoff, Pittsburgh, Pa.	482,765
Sign for Cars, Charles S. Reed, Boston, Mass.	482,923
Street Railway Switch Appliance, James P. Hoedger, Spokane, Wash.	482,903
Trolley Stand for Electric Railways, John C. Hough, Pittsburgh, Pa.	483,061

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, Sept. 19. Stock quotations are per cent. values.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Sept. 19.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Sept. 19. Stock quotations are per cent. values.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

Table with columns: Bonds, Date of Issue, Amount, Interest Paid, % last div., Principal Due, Bid, Ask'd.

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

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd.

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Sept. 19.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd.

HOLYOKE STOCKS.—Corrected by J. G. MACINTOSH & Co., Bankers, Holyoke, Mass. Sept. 19.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd.

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

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Sept. 19. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

* 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. Sept. 19. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Sept. 19. Stock quotations are per cent. values.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Montreal St. Ry. (p'd up sh.) and Montreal St. Ry. bonds.

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

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Louisville St. Ry. Co. and various bonds.

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WERNEN, 82 Washington Street, Chicago, Ill., Aug. 19.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Chicago City, Chicago Passenger, and various bonds.

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 421 Wood Street, Pittsburgh, Pa., Sept. 19. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Central Traction R. R. Co., Citizens' Traction R. R. Co., and various bonds.

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Sept. 19.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes City R. R. Co., California St. Cable Co., and various bonds.

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Sept. 19. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Benton-Bellefontaine, Cass Ave. & Fair Grounds, and various bonds.

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, Sept. 19. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Citizens' Traction R. R. Co., Continental, and various bonds.

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Sept. 19.

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.							
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, 25 West Third Street, Cincinnati, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati ex. 1½ per cent.	50	\$6,000,000	Q.—J.	5	.....	107½	107½
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	108	108½
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	125	135
Mt. Auburn Cable	100	300,000	.....	.....	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	.....	.....	92	95
" " " Pref.	100	100,000	.....	6	.....	100½	101½
BONDS.							
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	.....	.....
" " "	.....	50,000	J. & J.	7	July, 1893	102½	.....
" " "	.....	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	99½	100½
" " "	.....	50,000	J. & J.	5	July, '96	102	103½
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	.....	2-0,000	M. & S.	5	Mar. 1906	104½	105½
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	116	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	108	108½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	95
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	111½
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., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	.....	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	26½	27
BONDS.							
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	105	110
" " " cons. mort.	1892	500,000	.....	5	.....	103	105
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	115	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.	5	1942	106½	106¾
" " " "	1891	1,250,000	M. & S.	6	1901	105	106
City Pass. R. R. Co.	1891	2,000,000	.....	5	1911	111	112

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Washington & Georgetown R.R.	50	500,000	Q. F.	.....	1863	310	.....
Metropolitan R. R.	50	750,000	Q. J.	.....	1864	96	103
Columbia R. R.	50	400,000	Q. M.	.....	1870	58	65
Capitol & North O St. R. R.	50	500,000	Q. J.	.....	1875	33	40
Eckington & Soldiers' Home	50	352,000	.....	.....	.....	40	.....
Georgetown & Tenallytown	50	200,000	.....	.....	.....	50	.....
Rock Creek R. R.	100	401,700	.....	.....	.....	100	.....
Glen Echo R. R.	50	100,000	.....	.....	.....	.....	.....
BONDS.							
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	101	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	130	.....
Eckington & Soldiers' Home	.....	150,000	J. & D.	6	1896-1911	101	.....
Capitol & North O St. R. R.	1921	240,000	J. & J.	5	1921	100	.....
Metropolitan R. R. convert.	1901	200,000	J. & J.	6	1901	110	.....
Anacostia 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. (Bulletin Building), Philadelphia, Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issuc.	Bid	Ask'd
STOCKS.							
Rochester (N. Y.) Ry.	100	5,000,000	.....	.....	1890	55	59
Buffalo (N. Y.) Ry.	100	6,000,000	.....	.....	1891	52	54
Pateron (N. J.) Ry.	100	1,250,000	.....	.....	1891	.....	25
Newark (N. J.) Pass. Ry.	100	6,000,000	.....	.....	1890	29½	30
Columbus (O.) St. Ry.	100	3,000,000	.....	.....	1892	45	50
BONDS.							
Rochester (N. Y.) Ry.	1890	3,000,000	A & O	5	1930	94	96
Buffalo (N. Y.) Ry.	1891	5,000,000	F & A	5	1931	97½	.....
Pateron (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	90	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	94	97½

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Sept. 19. 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	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	.....	.....	22½	25
" " " pref'd	100	.....	.....	.....	.....	95	105
East Cleveland R. R.	100	2,000,000	Quart.	2	.....	172	175
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	135	140

Financial.

THE stockholders of the Metropolitan Traction Co., of New York, voted last month to increase the capital stock to \$30,000,000.

THE Gloucester (Mass.) Street Railway Co. have declared a dividend of \$3 per share to stockholders of September 24, payable on and after date.

THE Columbus (O.) Street Railway system for the month of August shows receipts \$45,949.83 as compared with \$33,895.63, during the same month in 1891.

THE gross earnings reported for the Rochester (N. Y.) Street Railway Co. during August are, \$69,676, as compared with \$58,337 in the same month last year.

THE earnings of the Buffalo (N. Y.) Street Railway Co. for the month of August are reported as \$125,364, as compared with \$86,793 for the same month last year.

IT is announced that the Newton (Mass.) Street Railway Co. will pay a dividend of 2 per cent., September 30, to stock of September 25, making 7 per cent. thus far this year.

THE New York State Railroad Commission has granted the application of the Brooklyn City Railroad for permission to increase their capital stock from \$6,000,000 to \$12,000,000.

THE Helena (Mont.) Rapid Transit Co. by resolution of the board of directors have given an option to R. S. Vivian, of Kansas City, to sell \$375,000 in bonds of the company for ninety cents on the dollar.

THE State Board of Railroad Commissioners have approved of the increase from \$120,000 to \$350,000 of the capital stock of the Cayadutta Electric Railway Co., which runs from Fonda to Gloversville, N. Y.

THE stockholders of the Lake Street (Chicago) Elevated Railway Co. recently held a meeting to ratify the reorganization of the company. Over 80 per cent. of the stock was represented. It is intended to issue \$10,000,000 bonds to complete the work.

THE negotiations which have so long been pending for the sale of the Troy (N. Y.) & Lansingburgh Railroad to a syndicate were consummated last month. The purchasers are Clark, Dodge & Co., of New York, and the price paid was \$112.50 for each \$50 share.

THE gross earnings during August for the Baltimore (Md.) Traction Co. are given as \$65,047, an increase of \$8,002 over those of the corresponding period last year. The maximum receipts in any one day in the month was on August 30, when \$2,635 was taken in.

THE report of the Lake Charles (La.) Street Railway Co., for the year ending July 31, 1892, shows cost of road \$9,478; earnings from December 17, 1891, \$3,913.11; cost of operation, \$3,013.59; net earnings, \$899.52, of which \$478.61 has been used toward construction.

The Newark Passenger Railway system of the New Jersey Traction Co. shows gross receipts for August \$102,491.47, as compared with \$91,653.67 last year. The gross returns since January 1 have been \$793,024.80, as compared with \$665,900.15 in the same eight months of 1891, an increase of \$127,124.65.

The gross earnings of the North Chicago (Ill.) Traction Co. for August were \$246,132, a gain of \$25,888 over the corresponding month last year. The aggregate receipts for the other months since January 1 (omitting one day, the receipts of which are not at hand) are \$1,392,103 as against \$1,227,486 for the corresponding period of last year.

BALTIMORE (Md.) Traction stock has been advancing steadily in price since the starting of the cable last month, the price quoted September 18 being 26½. The gross earnings for the first ten days in September were \$26,578, with maximum receipts during one day of \$3,215. During the same period in 1891 the gross earnings were \$19,337, and maximum receipts \$2,162.

The Citizens' Street Railroad Co., Indianapolis, Ind., have recorded a mortgage to the Illinois Trust & Savings Bank of Chicago and Stoughten J. Fletcher, trustees, for \$800,000, divided into 800 bonds of \$1,000 each, drawing 6 per cent. interest. Of this amount \$500,000 is to be used in refunding the existing indebtedness of the company and \$300,000 to be expended in prosecuting general improvements.

The Pittsburgh (Pa.) Traction Co. show receipts for the month of August of \$63,952. During the same month last year the receipts were \$26,232. It should be stated, however, that the mileage of the line is different, and that three cent fares were in force in August, 1891, so that a fair comparison of the business done is not shown by the above figures. The day of largest traffic in 1892 was the 27th of the month, in 1891 the 30th.

The Atlantic Avenue Railroad Co. show in their annual report for the year ending June 30, gross earnings from operation \$777,658; less operating expenses, \$700,640; net earnings from operation, \$77,018; income from other sources, \$111,440; gross income, \$188,459; deductions for taxes and interest, \$133,983; net income, \$54,475; dividend, 6 per cent. on capital, \$68,794; deficit for the year, \$14,319; total surplus at end of year, \$147,700. The amount expended by the company during the year for betterments was \$826,691, of which amount \$806,041 was spent on the road and \$20,650 in additional equipment.

The management of the West & South Towns Street Railway Co., of Chicago, have awarded contracts for track construction, and have authorized the sale of half the bond issue of the company. The total issue consists of \$500,000 of first mortgage, 6 per cent., gold bonds, payable in 1912, or redeemable after 1902 at 105 and interest. The charter of the company allows five kinds of motive power as follows: "The cars to be used on said railway may be operated by animal or cable power, electric, compressed air or gas motors, provided if overhead wires are used, the main electrical feeders shall be placed underground, and connections to the trolley wire shall be made through hollow iron pipes." The company also have the right to operate cars over tracks not owned by it "upon such terms and conditions, by lease or contract, as may be agreed upon between the companies owning such respective tracks, or toherwise not in conflict with any of the conditions of this ordinance or the general ordinances of the city."

The street railway companies in which Philadelphia capital is largely invested, says the *Daily* (Phila.) *Stockholder*, continue to report handsome increases in their earnings. The statements of some of them are remarkable in one feature, namely, that large gross earnings are reported with heavy decreases in the operating expenses. This is true particularly with the Columbus Street Railway Co., whose August operations show a gain of \$12,686 in the gross receipts, and a decrease of \$9,797 in the operating charges. The figures of the month, together with those of August, 1892, are appended:

	1892.	1891.	
Gross earnings.....	\$46,584.20	\$33,897.88	Inc. \$12,686.32
Operating expenses....	22,220.69	32,017.87	Dec. 9,797.18
Net earnings.....	\$24,363.51	\$1,880.01	Inc. \$22,483.50

The Newark system, another system in which Philadelphians are largely interested, shows net earnings for July of \$5,518.54. The operations for the month, as compared with the same month last year, show as follows:

	1892.	1891.	
Gross earnings.....	\$107,430.21	\$98,207.35	Inc. \$9,222.86
Operating expenses....	67,847.71	64,142.39	Inc. 3,705.32
Net earnings.....	\$39,582.50	\$36,063.96	Inc. \$5,518.54

The net earnings of the Rochester company for July are given at \$34,786, an increase of \$14,120. The figures of the month's operations follow:

	1892.	1891.	
Gross earnings.....	\$67,201	\$58,146	Inc. \$9,055
Operating expenses.....	32,415	37,480	Dec. 5,065
Net earnings.....	\$34,785	\$20,666	Inc. \$14,120

The Buffalo company show a net gain of \$14,753 for July. The other figures follow:

	1892.	1891.	
Gross earnings.....	\$116,410	\$93,035	Inc. \$23,374
Operating expenses.....	63,239	54,617	Inc. 8,621
Net earnings.....	\$53,171	\$38,417	Inc. \$14,753

The Works of the American Engine Co.

The factory of the American Engine Co. is located at Bound Brook, N. J., thirty-one miles from New York City, on the line of the New Jersey Central Railroad, and the following interesting statements given in the *Bound Brook Chronicle* will give an idea of the extent of the work now being carried on there.

The raw materials used in the manufacture of high speed engines, including pig and scrap iron, coal, coke, moulding sand, etc., are run into the yards by means of switches from the railroad and unloaded directly into bins arranged alongside of the foundry which is equipped

PFEIFFER & PRONICK,

SCHERMERHORN BUILDING,

6 Wall Street,

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Total Issues of Street Railway Bonds.

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N. W. HARRIS & CO.,

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From Manufacturers or Capitalists for arrangements to either manufacture the most durable, efficient and economical Electric Railway Car Truck, or to "place" the patents on royalty, stock company or sale.

The Ellery Radial Car Truck is the very best Electric Car Truck for Electric Railways.

Small model on successful exhibition.

Applications for patents allowed.

Inventor will advance no preliminary expenses to "promoter" or "company."

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NATIONAL RAILROAD DETECTIVE AGENCY,

Office, 673 Broad St., Newark, N. J.
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Trustworthy and experienced male and female operators sent to any part of the country for a reasonable charge. Satisfactory results guaranteed. For terms and references, address to headquarters.

PATENTS

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Send model or sketch for free advice as to patentability. Full information in my fifty page book, FREE. Address

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with a twenty ton traveling crane and other facilities for handling heavy weights. From the foundry to the machine shop is but a step, and this latter department is especially complete in all particulars. A ten ton traveling crane, five horizontal and three vertical boring mills, capable of doing work of large dimensions, half a dozen Brown & Sharpe universal grinders and milling machines, sixty or more lathes, upright and radial drills, numerous jigs and special tools all from standard makers make up the equipment of this department.

Engines can be seen here in various stages of construction, and from eight to 150 H. P. Being of high speed, they are chiefly designed for running electric dynamos, steam yachts, etc., although they can, of course, be used wherever power is needed. Adjoining is the blacksmith shop with annealing ovens, cutting and punching machines, etc. On the south, and connected with the shops already mentioned are three other buildings; one is a carpenter shop, another is used for storage of patterns, while the third is a general storage room for all sorts of stock, such as steel, bar iron, nuts, bolts, hardware, belting, pulleys, hangers, etc. The electric light and power plant consists of three dynamos, one for running the cranes in the foundry and machine shop, and two others for lighting the shops and adjacent village.

Protection against fire is carefully provided for by a complete sprinkler system which exists throughout the entire plant, including store houses, pattern room and offices, and which is supplemented, as an additional precaution, by hydrants and a large fire pump located where they are

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.

HELP WANTED.

WANTED.—An additional betting salesman this fall. Young, energetic, capable man to represent standard goods in New York or New Jersey. ENGINEERING EQUIPMENT Co., 143 Liberty St., New York.

WANTED.—A practical business man who is thoroughly familiar with the manufacture of Street Cars, and competent to assume the active business management of a large Car Manufacturing Company already established. Must be able to invest \$25,000 or more in the business. To the right party this opportunity is a most favorable one, as the prospects for the development of a large business are excellent. Full particulars and information will be furnished. Address "CAR COMPANY," care STREET RAILWAY JOURNAL, New York. It.

POSITIONS WANTED.

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 Suburban Lines. Address, "STREET RAILWAY," 6,608 Evans Ave., Chicago, Ill.

WANTED.—A position as chief engineer by a thoroughly competent man who understands doing all repairs, and also understands repairing and managing railway generators and motors, having had charge of the assembling and testing those machines in the Thomson-Houston works; also understands wiring and repairing cars. Can take entire charge of mechanical department of power house and station. Can furnish the best of city reference in Brooklyn and New York. Have first-class papers from both cities. Address ECONOMICAL, STREET RAILWAY JOURNAL.

WANTED TO PURCHASE.

WANTED TO Purchase Entire Issue of Good Street Railway Bonds. Correspondence solicited. Address, V. I. HASKELL, 39 Dey St., N. Y. City

FOR SALE—CARS.

84 Cross Seat Open Cars, gauge 4 ft. 8½ ins., 30 of which seat 50, 34 seat 40, and 20 seat 32 passengers each. Cars are in good condition—some are nearly new. We are selling on account of change of motive power. Apply to the office of the 3d Ave. R. R. Co., 65th St., and 3d Ave., New York City. It.

FOR SALE—FRANCHISE.

A HALF, OR WHOLE INTEREST, IN A NEW ELECTRIC RAILWAY,
With a Valuable Franchise having TWENTY ODD YEARS TO RUN, in a Town of about 20,000 People, which is growing rapidly. THE SYSTEM IS WELL LAID OUT, and EQUIPMENT IS FIRST-CLASS. The Owner will SELL PART, or ENTIRE INTEREST, on EASY TERMS, his object being, to be released from the care of management. No other Electrical Franchise exists, and there is room for considerable extension of business. Answers will not be considered unless accompanied with satisfactory business references, when fullest investigation can be had. About \$25,000 will be required.

Address, "ELECTRIC RAILWAY,"
Care Street Railway Journal, New York.

FOR SALE.

125 tons second-hand 38 lb steel tram rails, in excellent condition.
100 tons second-hand 23 lb steel T rails, but little used.
100 tons 38 lb steel girder rail, excellent condition.

D. E. GARRISON & CO., - 219 N. 4th St., St. Louis, Mo.

FOR SALE CHEAP.

FORTY (40) OPEN AND FORTY (40) BOX (12 FOOT BOBTAIL) CARS, with fare box in each. All in good order. Gauge 4 ft. 10 in.
For full particulars write to

JAMES CAMPBELL, 307 Pine St., St. Louis, Mo.

FOR SALE.

A STREET RAILWAY AT PRESENT OPERATED BY HORSES. TRACK-AGE 3¼ MILES, OF WHICH 2 MILES ARE LAID WITH 50½ LB. GIRDER RAIL BONDED FOR ELECTRIC SERVICE.

Address

A. BAUMAN, Lancaster, Ohio.

FOR SALE.

CARS The Houston, West St. & Pavonia Ferry R. R. Co.,
COR. 7TH AVE. & 50TH ST., NEW YORK,

Have for Sale 14 and 16-foot Second-Hand Box Cars, in Good Running Order.—Gauge, 4 feet, 8½ inches. APPLY AT THE OFFICE,
761 SEVENTH AVE., N. Y. CITY.

FOR SALE.

RE-LAYING RAILS FOR SALE CHEAP for Immediate Delivery.—

- 800 Tons 35-lb. Iron Tee with Fastenings.
- 1200 " 28-lb. " " " "
- 400 " 48-lb. " " " "
- 150 " 52-lb. Johnson Steel Girder Rails.

Always in the Market for L. K. HIRSCH,
OLD RAILWAY MATERIAL AND SCRAP. 549 ROOKERY BUILDING, CHICAGO.

FOR SALE.

Electric Cars,

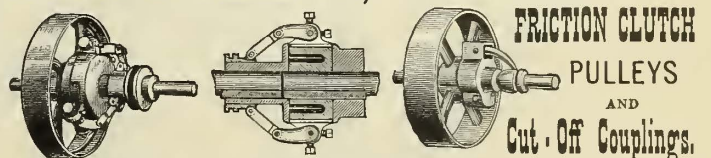
BOTH OPEN AND CLOSED.

QUICK DELIVERY AND AT LOWEST PRICES AND ON LONG TIME. THEY ARE REAL BARGAINS.

For Particulars write to

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J. H. & D. LAKE CO., HORNELLVILLE, N. Y.
MANUFACTURERS OF



The Simplest, Strongest and Best CLUTCH PULLEY made. Adapted to light or heavy work, stopping and starting machines easily and quickly without jar. Write for Illustrated Circular.

MICA FOR ALL ELECTRIC INSULATING PURPOSES
EAST INDIA MICA
IS THE BEST ON THE MARKET,
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SEND FOR SAMPLES AND QUOTATIONS,
A. O. SCHOONMAKER,
158 WILLIAM STREET, NEW YORK.

easily accessible. Tramways are arranged around the shops, running from one department to the other, with turntables, cars, etc., the cars having roller bearings, and being capable of carrying enormous loads with ease, and needing only one operative to handle them.

In regard to railroad facilities the company are exceedingly fortunate, as they have ranged about them the Port Reading Railroad on one side, the Lehigh Valley, Philadelphia & Reading, and the Jersey Central on the other, with intercommunicating switches, so that transfers can be made with convenience and dispatch.

The president of the company is Hon. Ray V. Pierce, and the general manager Mr. Elmer S. Smith.

Dedication of the World's Fair Buildings.

The dedication of the buildings of the World's Columbian Exposition at Chicago, will occur October 20, 21 and 22, and the following programme of the dedicatory exercises connected therewith has been decided upon:

On the evening of Wednesday October 19, a grand reception will be tendered the President of the United States, his cabinet and other distinguished guests at the Auditorium. After the close of the ceremonies on this and each of the three succeeding evenings, there will be magnificent pyrotechnic displays.

Thursday, October Twentieth, the first day, will witness an imposing procession indicative of peace, contentment and prosperity, participated in by civic organizations, which will be reviewed by the President of the United States, his cabinet, members of Congress and other honored guests. In the evening, at Jackson Park, amid many electric lights and other displays, a water pageant, "The Procession of the Centuries", will move through the canals of the Exposition grounds, illustrating some of the great facts of history connected with the discovery of America.

Friday, October Twenty-first. On this day the President of the United States and other distinguished official guests will proceed to the Manufacture and Liberal Arts Building, in which the dedicatory exercises will be held.

At one o'clock in the afternoon in this building the dedicatory programme will be carried out under the direction of the Director-General. It will consist of the reading of an appropriate ode, report of the Director-General to the World's Columbian Commission, presentation of the buildings for dedication to the President of the United States and their dedication by him, and orations by Wm. C. P. Breckinridge, of Kentucky, and Chauncey M. Depew of New York. At the close of this programme a special electric and pyrotechnic display will be given.

Saturday, October Twenty-second. On this day, a series of military manoeuvres and parades will constitute the main portion of the day's programme. In the evening attractive and appropriate celebrations will be provided, followed by a magnificent display of fireworks.

Insullac.

A new compound, with the above name, has recently been put on the market as a substitute for shellac, which, heretofore, has been the only practical agent for effective work in coil and armature winding and in the multitudinous applications where insulation resistance and waterproofing is required.

The manufacturers, the Massachusetts Chemical Co., of Boston, claim for the new compound, which is an alcohol varnish, an insulation resistance nearly four times greater than that of the best grain alcoholic shellacs. The Massachusetts Electrical Engineering Co is the authority by which this superiority is established.

"Insullac" varnish is of a beautiful transparent amber color, but to suit the public taste the manufacturers will produce it in any desired color. Its appearance when applied, method of application and rapid drying qualities are identical with those of shellac.

A careful analysis of the new compound, by Professor Babcock, shows no traces of any acids injurious to any materials to which it may be applied, or any constituents in any way injurious to the health of workmen.

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.

RAILWAY FEEDER-WIRES

Experience has demonstrated the necessity for the
BEST INSULATION on Feeder Wires.

THE BEST IS NOT TOO GOOD.

SIMPLEX

IS THE BEST.

SEND FOR ESTIMATES TO

SIMPLEX ELECTRICAL CO.

620 Atlantic Ave., Boston, Mass.

GEORGE CUTTER, - Western Selling Agent, - THE ROOKERY, CHICAGO.



EXECUTIVE COMMITTEE AMERICAN STREET RAILWAY ASSOCIATION, '91-'92.

- | | | | | |
|---------------------------|-----------------------|----------------------|----------------------|--------------------|
| 1. JOHN G. HOLMES. | 3. J. B. SPEED. | 5. ALBION E. LANG, | 7. T. C. PENNINGTON. | 9. H. M. WATSON. |
| 2. WILLIAM J. RICHARDSON. | 4. LEWIS PERRINE, JR. | 6. THOMAS H. MCLEAN. | 8. MURRY A. VERNER. | 10. W. WORTH BEAN. |



SOUVENIR

OF



The Street Railway Journal.

ORIGIN AND BENEFITS

OF THE

AMERICAN STREET RAILWAY ASSOCIATION.

*

THE American Street Railway Association, whose tenth anniversary and eleventh meeting we greet and celebrate, was born December 13, 1882, at Boston, where liberty itself had its birth, and was of good stock, inheriting a spirit of fraternity and continental unity. The times were those of great political, scientific, educational and mechanical activity, and questions of material progress occupied the minds of our people when, fortunately, a few railway men, being mindful of their duties and responsibilities in regard to their particular calling, undertook to bring the street railway business into line with the march of progress which characterized so many other industries.

What can we do to unite a distracted class? What to unify discordant elements? What to calm the tempest of personal and sectional passions and jealousies? What to cultivate a spirit of fraternity among the members of the same calling? How to promote technical knowledge, and provide for an interchange of experience in all matters relating to the construction, equipment and management of street railways, to the end that the best service may be obtained at the least possible cost?

Important questions for statesmen even; how well they were answered by these men who made no pretence to statesmanship the subsequent history of the Association strikingly shows, for they seemed to realize that the permanent success of the Association depended very much upon the auspices attending its establishment and the character of the organic laws which it should adopt.

The gentlemen most active in the formation of this Association and to whom the entire fraternity owes a debt of gratitude were: D. F. Longstreet, Providence, R. I.; H. H. Littell, Louisville, Ky.; Henry M. Watson, Buffalo, N. Y.; *Walter A. Jones, Brooklyn, N. Y.; Thomas Lowry, Minneapolis, Minn.; J. E. Rugg, Boston, Mass.; Moody Merrill, Boston, Mass.; Charles Cleminshaw, Troy, N. Y.; William J. Richardson, Brooklyn, N. Y.; Julius S. Walsh, St. Louis, Mo.; T. H. Robillard, Montreal, Canada; Abner C. Goodell, Salem, Mass.; Tom L. Johnson, Indianapolis, Ind.; *Calvin A. Richards, Boston, Mass.; Wm. H. Haz-

*Deceased.

zard, Brooklyn, N. Y.; George B. Kerper, Cincinnati, O.; Charles Hathaway, Cleveland, O.; C. C. Woodworth, Rochester, N. Y.; Frank de H. Robison, Cleveland, O.

The call for the first meeting of what was then styled an Association was from the pen of H. H. Littell, and was dated from Louisville, Ky., November 8, 1882, and the preliminary meeting was held at Young's Hotel, Boston, December 12, 1882, when Mr. Littell called the meeting to order, and the Hon. Moody Merrill was unanimously elected chairman. After an address by the chairman and the appointment of a committee to draft a constitution and by-laws, of which Mr. Charles Cleminshaw was chairman, an adjournment was taken until eleven o'clock, December 13, when the report of the committee was read by the secretary, Mr. William J. Richardson, and a permanent organization under the name and title of the American Street Railway Association was perfected.

The details of this meeting, and of all subsequent meetings, in fact, a complete history of the Association was given in the October, 1889, issue of the STREET RAILWAY JOURNAL, and in our Souvenir edition of last year, so that it is not necessary to repeat it in this connection, but we give below extracts from the proceedings of the different conventions, which will indicate the character of the work and show by what stages the street railway systems have reached their present efficiency; but first we will briefly review the work and note the benefits and duties that come to the membership as an incentive to still higher efforts, and as a means of calling the attention of such street railway companies as have not yet become members of the organization to its objects and aims.

BENEFITS.

The eminent success which has attended the organization and operation of the Association is the source of mutual congratulation among all the friends of urban transit both at home and abroad. To its direct agency and the influence of its proceedings, diffused through the medium of the STREET RAILWAY JOURNAL, more, no doubt, than to any other cause, are due the marvelous improve-

ment of street railways in all their relations, the rapid intellectual and social elevation of managing directors as a class, and the universal awakening of public interest in all that concerns the installation, operation and maintenance of this important industry, even calling for a still better and higher order of service. Although this Association has accomplished great good, it is destined to exert a still broader and more beneficial influence, a statement to which any wise observer, who will briefly scan its history and note the successive steps of its advancement, will assent.

Only ten years since its first meeting, at which not a single street railway line operated by mechanical traction was represented! Cable lines, however, had been in operation for some time in San Francisco and were being introduced in Chicago, but electricity, as a motive power, was not mentioned. Then there were only 3,000 miles of street railway track, all told, in this country; now there are over 5,000 miles operated electrically.

The Association may be regarded as a great interro-

who took part in the early meetings are still earnestly seeking light, but along higher lines. The same characteristic will, doubtless, mark the subsequent history of the Association, for what we call our improved street railway systems are but the aggregate of the trial attempts of the past in practice to solve the rapid transit problem, which in its historic growth has taken on such forms and appliances as conditions seemed to demand, and has yielded to such formative influences as the growth and changes in city life have required, and which it must continue to do as society and social conditions improve. Hence, then, there must continue to be an earnest groping after light and knowledge, and where this spirit is light will surely



HOLLENDEN HOTEL—HEADQUARTERS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

gation point, for its proceedings have always been marked by an eager desire on the part of its members for definite information in regard to the practice of others in particular cases, and to the advantages and cost of mechanical traction. In the earlier meetings the questions related principally to the feed and care of horses, stables, track construction, track cleaning, registers, and how to make conductors honest. It is not claimed that all these questions have been definitely answered and a standard of practice established; but many of them have been answered, while others have become obsolete, and in the records all the best that has been thought and said to the world regarding this industry has been preserved for the guidance of those who will come after.

The later meetings continue to be marked by the same spirit of inquiry, and we find often the same men

come, not of itself, but as the reward of toil, of effort, of wisdom, so that in time all the puzzling questions which confront the average manager will be satisfactorily solved.

We believe that the benefits which the Association is able to confer upon its members should be shared by the street railways of the whole country, and that the time has now come when all companies should be gathered into this great educational brotherhood; when the practical street railway men in the North, the South, the East and the West should unite in a general effort to promote the welfare of this industry in the whole country, by concentrating the wisdom and power of experienced minds, and by distribution among all the accumulated experience of all those who are devoting their energies, and contributing their means and genius to advance the dignity, respectability and efficiency of this particular calling.

EXTRACTS FROM THE PROCEEDINGS OF THE DIFFERENT CONVENTIONS.



First Annual Meeting, Boston, 1882.

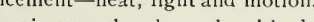
"You have come here from all parts of the country for the purpose of forming a National Street Railway Association. Some one may ask what interest in common, affecting the street railways of the country, corporations local in their character can have, that would seem to call for an organization for their protection. I would say that, probably, our Association is not to be formed so much to protect as to promote them. The street railways of this country have grown so rapidly during the past ten years, and are still growing with such rapidity, that an association of this character seems highly desirable. There are now organized and doing business in this country and Canada, 415 street railways. These companies employ an army of about 35,000 men. They run 18,000 cars, which, with the horses attached, would make a solid line of cars reaching from Boston to Albany."



"If there is any benefit to be derived from this Association, the young companies, just starting in growing places, will profit by it more than the large companies. They will receive the benefit that may arise from a knowledge of the various inventions that will be exhibited and discussed at our meetings, and from the experience of the older railroad men whom they may meet, representing the roads of the entire country."

Second Annual Meeting, Chicago, 1883.

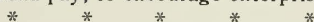
"And we face that last and greatest discovery of the century, the application of which bears more directly upon our immediate interests than any other, namely, electricity as a motive power. So long as purely brute strength and endurance enter so largely as a factor in our enterprise, there must ever be perplexing and annoying obstacles that the ingenuity of man will be taxed to overcome. Any invention looking toward the abolition of these, thus simplifying our methods of locomotion, will be eagerly welcomed and thoroughly discussed in our deliberative councils. I see in the recent subjugation of the subtle and hitherto illusive force of electricity to the needs of man, boundless possibilities for the world's three greatest requisites for advancement—heat, light and motion."



"The crude experiments already made with electricity as a motive power in propelling cars, in lieu of steam or horse power, clearly foreshadow the inevitable application of the new motor to our immediate interests."



"Nothing tends to develop any particular locality so much as a well conducted street railroad. Along the course of its road will at all times be heard the sound of the hammer, indicating the erection of new domiciles, their builders being drawn hither by the superior inducements offered for speedy and cheap transit. The street railroad car may well be called 'the poor man's carriage.' Under judicious and economical management, the rate of fare should be such that the burden will be light on the public, at the same time making the operation of a street railroad pay, to encourage enterprise in that direction."



"The rate of wages should be in all cases such an amount as to afford a fair support to the employed, and sufficient to induce men to be desirous of retaining their positions permanently. A high standard of educational qualifications is not required in the street railroad service, but the better the company is equipped with men above the ordinary laborer, conductors especially, the more it will prove to the advantage of that company's interests. The conductor and driver deal directly as our agents with the public; and as they exhibit good judgment and discretion in their intercourse with people, so will be our commendation by the public, and consequent remuneration by increased business, resulting from the highest efficiency in the service. It is, therefore, for the best interests of a company to get the best class of labor that may be obtained for this work especially. The inducement held out by some roads, of an increase of pay for long continued service, is a very judicious plan to insure faithful performance of duty. This plan wherever tried is highly spoken of by such roads as have adopted it."



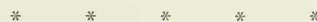
"Too much care cannot be used in preparing the hoof for the shoe. The frog should never be cut; the shell requires more or less cutting. The shoe should always be fitted to the foot, and not the foot to the shoe as is often done."

"In shoeing the horse, the workman should bear in mind that he is protecting the foot from the unnatural wear, and that it is only done for that purpose; therefore, all prejudices as to opinions of how it should be done should be laid aside. The horse commences life with sound feet, but too many of them are ruined by unskillful shoeing, and thus brought to comparative uselessness at a time of life when they should be in the prime of their power."

Third Annual Meeting, New York, 1884.

"The graduated system of compensation works well with us here, and makes 'strikes' an impossibility. No honest and intelligent laborer will 'strike' for higher wages when he knows that by serving through a regular course he will attain what he cannot possibly get anywhere else."

"Furthermore, this system furnishes us a reliable and trustworthy set of workmen, because the longer they stay the more efficient they become in the discharge of their several duties. Such a wage system secures to us steady and punctual men who perform their work more cheerfully because they know that their value is acknowledged by the company which remunerates them for their services with the highest possible wages."



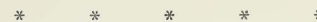
"Mr. President, I think my friend is right; but, from my experience, I think it is necessary to keep up the moral sense of the community that ride in our cars. That is the thing to which we ought to give more prominence. We carry gentlemen in our cars—gentlemen of as apparent respectability as you who sit before me—and who, while they would shrink from the commission of the crime of forgery, burglary or anything of that kind which would send them to state prison, yet do not shrink from robbing you or me, and educating our conductors to be the most infernal scoundrels outside the state prison."

Fourth Annual Meeting, St. Louis, 1885.

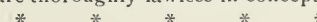
"In conclusion, your committee consider the application of electricity to the propulsion of street cars as entirely feasible. The seven electric railways in Europe, besides the tests in this country, prove this to be true. It is now narrowed down simply to a question of dollars and cents, or comparative economy with horses, cable power, etc. In the crowded streets of the American cities no system of overhead wire would be permitted by the municipal authorities. The rails could not be used to carry the currents for obvious reasons, therefore a conduit system offers the only practical solution. The system of running cars by accumulators can be applied with least trouble and less first cost, but at a great sacrifice of electricity. The result of two years' working of the electric railway at Zankerode, Prussia, showed that only 30 per cent. of the power of the steam engine was applicable to the propulsion of cars, but even this compares favorably with the cable system."

Fifth Annual Meeting, Cincinnati, 1886.

"We commend, therefore, mutual street railway insurance as worthy of earnest consideration as a means of reducing a costly department of our business, and at the same time of avoiding intensely annoying delays and difficulties in the adjustment of losses, when losses occur."



"Owing to the ingenuity of the government to unjustly tax and increase the burden of corporations, it behooves us to oppose by every honorable means within our power further aggressions, which, though according to law, are thoroughly lawless in conception."



"This was brought about by an organization called the Knights of Labor, a secret society which required absolute obedience to the mandates of the few who controlled it. The injustice of the orders that our employes were required to obey was in many cases admitted by them, but so powerful was the organization at that time that no slavery could have been more abject, and, it would seem, more humiliating, than that to which the employes of the street railroads had become the willing subjects. The tyranny of the order was manifestly so un-American that the absolute power which it had shown at the outset soon waned. Exceedingly unwise, and even foolish action followed their first efforts, and, as the result, what little respect the order had enlisted in the minds of the people was materially lessened by reason of its reckless disregard of public convenience in the wholly unwarranted stoppage of the great business of city transportation."

Sixth Annual Meeting, Philadelphia, 1887.

“To move a large number of cars, as for instance, upon the Third Avenue or Broadway lines in New York City, the electrical conductor, whether overhead or underground, must be of great size, if the current is of low tension; while, on the other hand, if a small or moderate sized conductor be used, the current must then be of dangerously high tension, and, of course, it would then be very difficult to avoid great loss of electricity from leakage.”

* * * * *

“Without referring to the excessive first cost required for the expensive cable traction system, and comparing the first cost of the entire plant and equipment needed for a storage battery electric railway, on which three cars will perform the service of four horse cars, with the first cost of the entire plant and equipment of a railway using horse power, it will be found that the advantage will, in most cases, be in favor of storage electricity.”

* * * * *

“No electric or steam car, or any self propelled vehicle, will climb grades of more than 6 per cent. in slippery weather, with absolute certainty. If we go beyond 6 per cent., we must have some artificial adhesion; we must introduce some rack on the road, or cables, which have a positive motion. Any one who attempts to guarantee a self propelled vehicle, whether propelled by steam or any other means, on grades of more than 7 per cent. will most certainly lose his reputation.”

Seventh Annual Meeting, Washington, 1888.

“Looking from such a standpoint, we are impressed at once with the national importance of the vast interests here represented, and this feeling grows deeper and broader as we consider the financial relations of our calling with the millions involved; the varied, useful and indispensable relations it sustains to the well being of every person, in every city and every town of any importance in the whole land; the mighty factor it has become in making or unmaking values in properties of all kinds; and especially does this feeling become almost overwhelming when we consider to what grand proportions this industry has grown during the lifetime of the youngest of our members.”

* * * * *

“I think from my experience in the business, that there are just as smart men in the employ of the company on the cars as there are in the office; and, indeed, some of the most successful managers of railroad properties, street and steam, are those who have come from the bottom round of the ladder and climbed by diligence to the top. I think, in fact, that the men know more about the profits of our business, the expenses and the income, than we think for, and if all the profits of a company are not taken by the management, but by a small investment made in this way (reading rooms for conductors and drivers), or in some other proper manner an interest is shown in the employes, I believe that very decided returns will come from such an investment.”

Eighth Annual Meeting, Minneapolis, 1889.

“I wish to say in this connection, that I have been exclusively engaged in the street railway business for sixteen years, and I am fully convinced that confidence begets confidence; good treatment secures good treatment in return, and anything that the street railway manager can do to advance the interests of his employees will, in my judgment, yield good results. There is more importance in the exchange of a “good morning” between the employer and the employe than most men generally suppose. I have got such a set of men that to-day, in view of my last five years’ experience, I would rather take the money that is lost by drivers in making mistakes in change and in falling out of their pockets, than all that is knocked down on the road. I treat my men on all and every occasion as if they were my equals, and I believe I get better results from it.”

* * * * *

“A young lady and a young gentleman, a tender young lady and a still more tender young gentleman got upon the car, and they were nestled in one corner like two turtle doves. No one in the car noticed them. They were exchanging the most endearing glances, and their hands were closely locked. They had been sitting in that way for some moments, when the young man suddenly started as if he had sat on a tack. He said: “My darling, I must let go your hand.” She answered, “Why, pet, must you let go my hand?” He said, “I must; the fact is, there is a bug crawling down my back, and I cannot keep my thoughts on you and the bug at the same time.”

* * * * *

“There is one place, however, as all of you know who have had any business in court, and especially when opposed to a woman, where

she stands pre-eminently above you. What chance to win a lawsuit has a man when he is opposed to a woman? Did you ever see such a case tried? Why, it does not make any difference what she says or what she does; the lawyer who cross examines her is put down at once as a brute, and it is a dangerous thing even to ask her age. A man does not stand any more chance to win a lawsuit in that kind of a case than he does of going to Congress without lying or spending money.”

Ninth Annual Meeting, Buffalo, 1890.

“To-day, the world over, and in this country more than any other, labor and capital, the former willingly and the latter under the lash, are on a dead run for the same goal. And this goal, this consummation, ignore it as we may, call it what we will, disguise it as we please, is no other, in fact, than absolute state management; and state management is neither more nor less than state socialism of the German type.”

* * * * *

“Conceding to you a great satisfaction in the consciousness of doing work that benefits others, we of the technical press are also glad to state that we take great delight in our work, furnishing, as we do, a medium by which inventors and dealers can present their wares directly to the users, and by which all are regularly informed of the latest and best practice in all parts of the world. We can but feel some satisfaction in our work, and the more from the frequent evidences given both by the street railway companies and the advertisers of their appreciation of our work.”

Tenth Annual Meeting, Pittsburgh, 1891.

“‘Horse sense’ counts for but little in this age of rapid transit. We old dogs have been obliged to learn new tricks, and without the usual privilege of serving an apprenticeship. Our stables are being converted into power houses; the electrician has taken the place of the veterinary surgeon; our drivers are being educated as motormen, and most of us have horse cars for sale. It is well for us that at such a time, when a thousand unsettled questions perplex us, we can come together in this organization with the memories of nine other gatherings warm in our hearts, to exchange experiences, compare notes and give to each other helpful information.”

* * * * *

“Financially, the cable road shows a low operating cost, less depreciation and a high earning capacity, in other words, most favorable as an investment. Practically, it ranks foremost in trustworthiness and complete independence of climatic conditions, moving its loads steadily through heat, cold, snow, frost or flood, so that, indeed, no disturbance short of an earthquake has any effect on its power to maintain a service on which the public has learned to depend.”

* * * * *

“I feel that the time has now come when some of the physical dimensions of electric cars may, with benefit to all, be standardized. As to how far such standardization should go, committees of this Association can best determine. The guiding principle, it seems to me, should be this: That standardization of parts should be so directed as not to interfere with the progress of invention. Bearing this in mind, may we not at this stage of development have a standard axle diameter for cars of a given weight? Also standard key weights for gears? And while there is some uncertainty in my mind on this point, may we not have a standard gearing? It, of course, involves uniformity in the reduction ratio between speed of the armature and speed of the car. There is, however, now no very great difference in this respect, and the possibility of uniformity is at least worth considering.”

* * * * *

“The occupation of the poor car horse has almost entirely gone. He has been forced to seek other spheres of usefulness and toil. Perhaps he has become an agriculturist or, it may be, the motive power of the laborious cart; but whatever his employment, I have no doubt, were we able to comprehend his musings, we would often find him, in his restful hours, sadly contemplating the marvelous change a few brief years have wrought. If he dreams, methinks he will sometimes in his restless sleep hear the tinkling bell which once made music to his ear, and thus live over again, in imagery, the busy, toilsome days when weary and footsore he tramped our hard, uneven streets and faithfully dragged his heavy load. If there is anywhere in the mysterious beyond a happy pasture ground for the noblest of God’s dumb animals, I verily believe that the patient, suffering and faithful service of the abused car horse will secure him an abundant entrance thereinto. In the meantime we bid an affectionate farewell to his services, and gladly welcome the power which the genius of man has harnessed for our use.”

THE CLEVELAND CONVENTION.

ELEVENTH ANNUAL MEETING OF THE AMERICAN STREET RAILWAY ASSOCIATION.

THE coming Convention at Cleveland is an event in which every street railway man should take a deep interest, whether he is to be present at the meeting or not. If not able to be present, he can read the report of the meeting, which will appear in the November issue of the

which give the men from widely separate localities an opportunity of becoming acquainted, and of gaining that confidence that comes of being a part of a great and powerful organization, to which one can look for support and sympathy in times of trouble and serious opposition,



INTERIOR OF THE ARCADE BUILDING.

STREET RAILWAY JOURNAL, but will miss the inspiration and good cheer that an attendance at the meeting always gives.

The advantages of a membership in the Association, and of being present at its annual gatherings, are in too many cases overlooked, and for this reason we will emphasize some of them with the hope of reaching those companies which have thus far remained indifferent to the benefaction and claims of the Association. Among the former there is nothing richer, nothing of deeper import and more lasting value than the social features

and of enriching those social bonds which will do much to encourage, cheer and benefit in every way the toilsome lives to which most street railway men are bound, making them productive of more good work than they could otherwise accomplish.

The meetings of the Association offer an opportunity for recreation, fun and amusement, as the latter are characteristics of the proceedings, especially those at the banquet. It allows one to drop care, to drop toil or thoughts of it, and engage in the serious discussion of the practical part of the street railway business, and at the banquet to

exchange thoughts of mirth, regard and friendship. A bow that is seldom unstrung refuses at last to unbend, and loses its elasticity; the same is true of man. He needs these intervals of rest and change, and is wise when he provides for these needs.

In an Association like this there is a confidence born of union that adds greatly to the productive power of the individual. A soldier required to engage in battle alone would make but a sorry attack or defence, but if he can feel the touch of elbows with comrades on the right and left, he will find his own courage increased and his power for doing useful service multiplied many fold.

A second advantage in the present case will come from the inspection of the various appliances which will be placed on exhibition by the manufacturers and dealers in street railway supplies, and of making the acquaintance of their representatives, which, perchance, will be of advantage in future business transactions. These exhibits are in the nature of an exposition of industries allied to the street railway business, and are collected at no little expense on the part of the manufacturers, and merit careful inspection on the part of all who wish to avail themselves of the latest and best appliances that the market affords.

A third benefit will come from the opportunity of visiting and studying the operations of the street railway systems of the city, which embrace not only animal but the leading methods of mechanical traction, with which a deal of experimenting has been done, resulting in excellent cable and electric lines which will serve as models for imitation.

A fourth inducement to visit Cleveland at this time will be the opportunity of visiting in company with others the extensive local industries which are devoted to the production of street railway appliances, and of which the city is justly proud. Prominent among these are the works devoted to the manufacture of electrical supplies which are quite fully illustrated in another column, the managers of which will provide generously for all who will do them the honor of accepting their hospitality. Then there are other works also illustrated in this issue,

whose names are familiar to all our readers, whose products are in use in every part of the country, and whose extensive facilities for work inspire confidence that orders will be promptly filled and the goods of the best quality.

Lastly comes the practical work of the Association, to give and to receive, and to take home the newest and best thought derived from actual practice either with the old, familiar or newest things, and the new born intelligence which may be gained from the examination and discussion of fresh ideas, new inventions and new theories that belong to this business, so that there may be a determination and better understanding of how to elevate and improve the standard of the business until it shall hold a high position in public estimation and favor.

We are aware that there are but few active street railway men who do not already appreciate the advantages that we can name, and do not claim to know the business so thoroughly that they need not concern themselves to learn more about it; but there are many who will not be present at the Cleveland meeting, not from indifference, but because of the indifference of their directors, who have neglected to make provision for their vacation and for the necessary funds. Could we gain the ear of such we would like to suggest that it would be a graceful act on their part to offer a vacation to their faithful heads of departments and to provide liberally for the in-



PERRY-PAYNE BUILDING.

cidental expenses of a trip to Cleveland.

In reviewing the history of the Association, and noting the names that have been prominently connected with it from its early history, we find that in most cases they are the same persons who now control or manage the most important street railway systems of our large cities, and who are ever ready to witness to the advantages they have derived, by participating in the proceedings of the Association. In conclusion, we are confident that it will pay in more ways than one for every street railway company in the country, as well as those firms engaged in the manufacture of street railway appliances to be represented at the Cleveland meeting.

PROGRAMME AND PRELIMINARY ARRANGEMENTS

FOR THE

ELEVENTH ANNUAL CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION AT
CLEVELAND, O., OCTOBER, 19, 20, 21, 1892.

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THE officers of the Association and the local committee, having done their part in perfecting the arrangements for the coming Convention, it now remains for the clans to gather in even larger numbers than last year, and make this the most profitable, enjoyable and memorable meeting in the history of the Association. The business meetings will be held in Association Hall (illustrated on 2d page), which is located near the headquarters of the Association, and is amply large and convenient for the accommodation of all who will attend. The first business meeting will be called to order at ten o'clock Wednesday morning by the president, Mr. John G. Holmes, of Pittsburgh.

Following the adjournment of the first meeting, the delegates and others in attendance will accept an invitation from the Short Electric Railway Co. to visit the Brush and Short works which are located in the suburbs of Cleveland. The trip to the works will be made in handsomely decorated electric cars, over the lines of the East Cleveland Railway Co., when an opportunity will be given to meet the representatives of the Short company, and make a tour through the extensive works and inspect the details and successive steps in the manufacture of generators, motors and other electric appliances for which this company is gaining an enviable reputation. A substantial lunch will follow, and the visitors may be assured of a royal good time, in keeping with the proverbial hospitality of this company.

A second business meeting will be held on Wednesday evening at 8 P. M., and on the morning and afternoon of Thursday, and the morning of Friday. Besides the regular business meeting of the Association, special com-

mittees will report on the following: "A Model Electric Street Railway Roadbed and Underground Wiring," Geo. W. Baumhoff, chairman; "A Perfect Overhead Electric Construction," Chas. H. Smith, Chairman; "Economy of Machine Shops for Electric Street Railways," John H. Bickford, chairman; "Power House Engines,"

T. W. Wrenne, chairman; "Relative Cost of Operating Horse, Cable and Electric Roads," W. McRamsay, chairman; "Standards for Electric Railways," O. T. Crosby, chairman; "Form of Street Railway Electrical Statistics," Thos. H. McLean, chairman.

Special papers are also to be presented under the following titles: "Experiments on the Expansion of Continuous Rails," and "Is a Standard Rail Head Possible?" A paper is also to be read by Mr. D. F. Longstreet, one of the founders of the organization, which will narrate the events which led up to the formation of



SOCIETY FOR SAVINGS BUILDING.

the American Street Railway Association.

THE ANNUAL DINNER

will take place on Thursday evening, the 20th inst., at the Hollenden Hotel, which, as usual, will be made an enjoyable feature of the Convention. Two delegates from each street railway company that is a member of the Association will be entitled to free admission to the banquet.

For all others, whether an additional delegate or representative of business firms, a charge of \$10 each will be made, except the ladies, for whom a charge of \$5 each for admission to the banquet will be made. In order to secure seats at the banquet, however, it will be necessary for the members and others who expect to be present to notify the secretary of the Associa-

tion in advance, so that definite arrangements may be made for the accommodation of all who wish to attend.

HOTEL ACCOMMODATIONS.

The headquarters of the Association will be at the Hollenden Hotel, one of the finest appointed hostelries in the country. At this and the other hotels of the city only the regular rates for room and board will be charged, so that visitors need have no fear of exorbitant charges being made for this special occasion. The rates at the Hollenden on the American plan will be \$3 to \$5 per day according to room; European plan, rooms \$1 to \$2.50 per day.

The other hotels that will provide accommodation to the delegates are the Weddell House, with rates of \$3, \$3.50, \$4 and \$5 per day; the Stillman Hotel, \$3.50 and \$4; Forest City House, \$2.50, \$3 and \$3.50; Kennard House, \$2, \$2.50, \$3 and \$3.50; American House, \$2 and \$2.50; Hawley House, \$2; Wilmot House, \$2.

Persons desiring to secure hotel accommodations should communicate with Mr. Henry J. Davies, secretary of the local committee, and rooms will be assigned in the order in which the applications are received, and as far as possible in accordance with the expressed wishes of the applicant.

REDUCED RAILROAD RATES.

Most of the railroads of the United States have granted the courtesy of the special rate of a fare and a third for the round trip to all, including friends and members and the families of all in attendance whether delegates, supply men or others, the exception being the lines in the Western and Pacific Coast States controlled by the Trans-

Continental Association, and the Western Passenger Association. The latter association has, however, granted the same concession from Peoria via the Chicago, Rock Island & Pacific; Chicago, Burlington & Quincy; Jacksonville South-eastern, and Atchison, Topeka & Santa Fe railways only.

It will be necessary, however, for all to strictly comply with the rules of the railways governing reduced rates. These rules require that the party purchase a first class limited or unlimited ticket to Cleveland, not more than three days prior to the date of the meeting, for which full fare will be paid, and at the same time secure a certificate from the agent at the initiatory station, stat-

ing that such full fare has been paid. The purchaser should be particular to inquire of the agent if all or only a part of his journey is covered by the certificate, as it may be necessary to purchase separate local tickets and procure separate certificates. In order to secure the reduced rates for the return journey, the party must present his certificate from the ticket agent to Mr. John J. Stanley, the clerk of the Convention, for this exclusive purpose, within one day after date of adjournment, who

will certify that the holder has been in attendance at the Convention, and which, being viséed by the agent of the Central Traffic Association, will, on presentation at the local ticket offices in Cleveland, secure for the holder return fare at one-third the usual rates. No stop-over privileges, however, will be granted on the return tickets, and the holder must return by the route for which fare was paid in going.

EXPOSITION OF APPLIANCES.

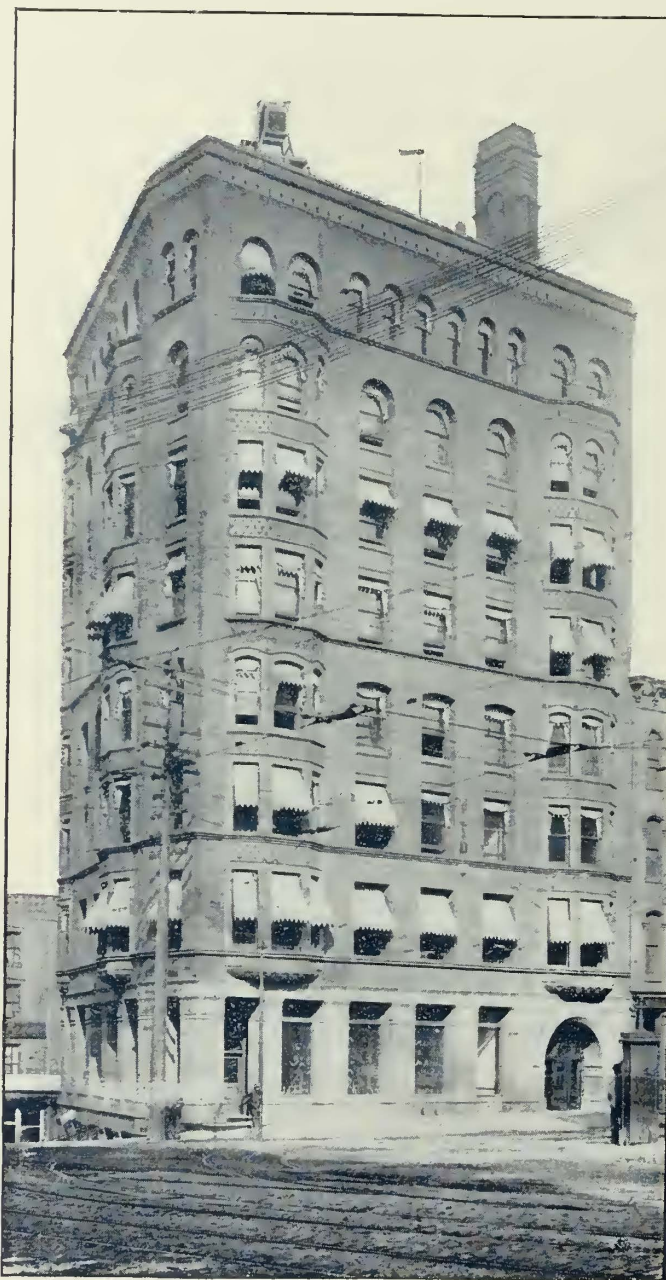
Army and Navy Hall on Superior Street, almost directly opposite the headquarters at the Hollenden Hotel, has been secured as the place for the exhibition of such appliances and supplies as will be presented for the inspection of the delegates and visitors. The location is convenient both to the headquarters and to Association Hall, and provides an abundance of room for all except the large exhibits, for which room will be provided in a vacant lot adjoining the exhibition hall. A nominal charge for space in the hall will be made, and all who will apply in time can be sure of being accommodated.

The indications are that the exhibit of appliances and supplies will be the largest and most interesting ever presented for the attention of

the Association, and, as is stated in another column, has been made at no little expense on the part of the exhibitors, and deserves the careful attention of all the delegates, which we have no doubt it will receive, and prove to be one of the most valuable features of the coming meeting.

LOCAL ENTERTAINMENT.

The street railway companies of Cleveland, in cooperation with the Short Electric Railway Co. and other manufacturing companies of the city, have several little surprises in store for the delegates in attendance at the Convention, and will provide in a hospitable manner for the entertainment during the intermissions, and following the business meetings.



WESTERN RESERVE BUILDING.

LADIES INVITED TO ATTEND.

The general interest of the Convention having heretofore been largely increased by the attendance of ladies, the same practice will meet with popular favor this year, and the delegates are urged to bring their wives and daughters with them to the Cleveland meeting, ample

SPECIAL EDITION.

We take pleasure in presenting this Souvenir edition of the STREET RAILWAY JOURNAL, which will be distributed free to all applicants, as a token of our interest in the well being of the Association, and in honor of this Eleventh Annual Convention.



SCENE IN WADE PARK.

provision having been made by the local committee for their entertainment and participation in the excursions and banquet.

REPRESENTATIVES OF THE STREET RAILWAY JOURNAL

will, as usual, be present at the Convention, and a cordial invitation is extended to all in attendance to call and reg-

JOIN THE ASSOCIATION.

For reasons fully set forth in another column, we commend the claims and benefits of the Association to every street railway company doing business in the territory which it embraces, and urge upon all the duty and privilege of becoming members in order that they may reap the benefits and share in the good work in which the



CENTRAL VIADUCT.

ister at our headquarters, parlor No. 142, first floor, of the Hollenden Hotel.

We value the honor of being enrolled among the number of those engaged in developing the street railway interests of our country, and welcome all those thus engaged, and wish to assure our friends that it will be our aim in the future, as in the past, to do our part in improving, popularizing and extending the rapid transit facilities of our cities and towns.

organization is engaged. The present membership of the Association embraces 198 companies doing business in the United States and Canada. This is only a small number compared with the many corporations engaged in this industry in the country, and it must be inferred that the companies holding aloof from the organization do so because of ignorance as to its purpose, or because of indifference to the benefits which they have already received, or would receive were they enrolled in its membership.

THE LOCAL COMMITTEE AND SOME PROMINENT CITIZENS.

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DR. A. EVERETT.

The street railway veteran of Cleveland is Dr. A. Everett, president of the East Cleveland Railroad Co. The statement is true as referring to his age—for he was born in Liberty Township, Trumbull County, O., in 1821—and to his years of usefulness as a street railway manager.

Since 1860 he has been at the head of the affairs of the company with which he is now identified, and a sketch of his life means practically the description of the development of the system he has managed so admirably. In that year Dr. Everett was one of a company of gentlemen who purchased the East Cleveland road, the owners of which were glad to dispose of their interest, as the enterprise was not successful financially. He was selected as president by the stockholders, and the rapid growth in the value of the property gives evidence of the wisdom of their choice. The doctor devotes himself as actively to his duties to-day as at the time when the enterprise was an exceedingly small affair. The equipment originally comprised two miles of track and four eight-foot horse cars with windows 7 × 9 ins. From the very start Dr. Everett followed the policy of extension and improvement, the development finally involving the transformation of all the lines into an electric system which to-day is equal in point of completeness to that of any city in the country. The length of the several lines comprising the system is to-day fifty miles, and 100 motor cars carry 10,000,000 passengers yearly, deriving their power from a station of 2,500 H. P. capacity.

H. J. DAVIES.

Those who have desired information regarding the present convention of the American Street Railway Association have, doubtless, by this time become thoroughly acquainted with Mr. H. J. Davies, secretary and treasurer of the Brooklyn and South Side street railroad companies. He has devoted no little time to convention business, and a more patient committeeman never answered the innumerable letters and inquiries of anxious exhibitors. Mr. Davies was born July 26, 1859, near Toronto, Can., but the family moved, four years later, to Cleveland. He was educated in the common schools of Cleveland, and subsequently began the study of shorthand. He became an expert stenographer, and did a large amount of business in the courts of Ohio and Western Pennsylvania. He was associated for many years with Mr. J. G. Pomerene, one of the best reporters in the West. In 1889 Mr. Davies gave up his stenographic work to take the position of private secretary to Hon. Tom L. Johnson. In the following January he was elected secretary of the Brooklyn and South Side street railroad companies.

A. L. JOHNSON.

Albert L. Johnson, president of the South Side Street Railroad Co. and vice-president of the Brooklyn Street Railroad Co., was born in Helena, Ark., December 25, 1860 and is a brother of Hon. Tom L. Johnson. In 1871 he went with his parents to Louisville, Ky., and during his school days worked for the Central Passenger Railway Co., collecting fares on the Walnut and Fourth Street line on holidays and other days of heavy travel, when fare boxes could not conveniently be used. When fifteen years of age he was appointed road officer on the Walnut Street line, and retained this position until his parents removed to Indianapolis. In Indianapolis he worked as a conductor on Illinois Street, and was afterwards foreman of the barns of the Citizens' Street Railroad Co. of that city. In this capacity he bought all the horses and mules for the line, and was known in St. Louis as the "kid buyer," being but sixteen years old. Later he was bookkeeper and secretary of the company. From Indianapolis he went to Cleveland, arriving there three years in advance of his brother. He put in operation the Brooklyn line, which was then a fare box road with four cars and thirty mules. He occupied at that time the positions of manager, superintendent, purchasing agent, bookkeeper, timekeeper and road officer. He has been one of the managing officers of the Brooklyn company ever since.

After the adoption of electricity by the Brooklyn and South Side companies, Mr. Johnson ran a motor three hours every morning and three hours every evening, during heavy travel, for six weeks, in order to familiarize himself with the operation of motors and with the troubles

and difficulties liable to be encountered in the running of the roads by the new power.

Mr. Johnson has probably superintended the laying of as much street railway track as any other man in the country. While he was in Indianapolis he had entire charge of construction during one season. He has superintended the laying and relaying of the forty miles of track of the Brooklyn and South Side companies in Cleveland during the past twelve years. He laid the Park Avenue cable line in Brooklyn, N. Y., the Canal Dover & New Philadelphia line and the East Liverpool & Wellsville line. He is the inventor of two street car brakes, a motor truck and an electric railway motor.

He is a Democrat in politics, and was elected a member of the first Board of Aldermen of Cleveland by a plurality of twenty-seven votes in a district which had previously given Republican pluralities of more than 500. He served one term, and has since refused to hold any political office although several nominations have been tendered him.

In addition to his Cleveland interests, Mr. Johnson is a large stockholder in the East Liverpool & Wellsville Street Railroad Co. and the Tuscarawas Electric Co., which operates a street railroad between the cities of Canal Dover and New Philadelphia, O. He is the president of the former company, and secretary and treasurer of the latter. He was the main projector of both lines. The East Liverpool & Wellsville road, eight miles in length, was probably constructed in shorter time, considering the physical difficulties, than any other road in the world. Mr. Johnson obtained his franchise for the line on September 16, 1891, and on December 16, ninety days later, operated electric cars over its entire length. In that time he surveyed and laid the road, built a brick car house and brick power station and put the line in operation. He removed 78,000 cu. yds. of stone and dirt from a mountain between the two towns, and built three long wooden trestles, which have since been converted into wagon bridges by the local authorities. The road is laid with Johnson rail, that in the paved streets of the cities being eighty-two pound girder, and in the country roads fifty-six pound T. The power station and cars are equipped with Short apparatus.

Mr. Johnson has applications for franchises pending in Cincinnati and two other large cities. He is the principal stockholder in the Johnson Electric Co., of Cleveland, a concern recently organized for the purpose of manufacturing motors, gears, pinions and other material used by electric street railways. The company now employs constantly more than 200 men.

FRANK DE H. ROBISON.

One of the most active and energetic street railway men, of Cleveland, is Frank De H. Robison, president of the Cleveland City Cable Co. For seventeen of his thirty-six years, Mr. Robison has been connected with the street railways of Cleveland. He was secretary and treasurer of the Superior Street Railway Co., before it became part of the present cable system, and the change from horses to electricity was made. He is a thorough believer in rapid transit, and under his direction the lines of the Cleveland City Cable Co. have become a model cable system. He is greatly interested in out-of-door sports, and is president of the Cleveland Athletic Club, with a membership of over 2,000 members, of the Cleveland Base Ball Club, and the Cleveland Kennel Club.

J. B. HANNA.

One of the best known street railway men in Cleveland is J. B. Hanna, the indefatigable secretary of the Woodland Avenue & West Side Street Railroad Co. Mr. Hanna is so thoroughly identified with his company that the two names are almost interchangeable in the estimation of residents of the city. He had a somewhat varied experience before he settled down to the duties of his present position. He was born on a farm near New Lisbon, O., August 26, 1854. His parents moved to that town, which is the country seat, when he was quite young, and subsequently made Cleveland their home. When he was fourteen years of age the family removed to Morrison, Ill., and at this place, when sixteen years of age, Mr. Hanna began his business life as a drug clerk. When twenty years old, he went to Clinton, Ia. where he was employed as clerk in a dry goods store, remaining in that position four years, when he returned to Cleveland, entering the employ of Rhodes & Co., dealers in coal, ore, etc. He was stationed



THE LOCAL COMMITTEE.

1. H. J. DAVIES.

2. F. DE H. ROBISON.

3. A. L. JOHNSON.

4. J. B. HANNA.

5. DR. A. EVERETT.

by the firm at Ashtabula Harbor for five years. On the organization of the West Side Street Railroad Co., he was appointed to the secretaryship, and he held the same position when the consolidation with the Woodland Avenue company was effected, forming the present corporation. Mr. Hanna has been treasurer of the Ohio State Tramway Association since 1885, and secretary and treasurer of the organization since 1889. He is a member of the local executive committee having in charge the arrangement for the convention of the American Street Railway Association.

CHARLES F. BRUSH.

The story of what Charles F. Brush has accomplished has been so frequently related as the first chapter in modern arc lighting that it is familiar to every one connected with electrical industries. His re-



CHARLES F. BRUSH.

markable inventions, which seem matters of course to-day, were fundamental in character and overcame the obstacles which blocked all progress in arc lighting. He performed his great work in an exceedingly brief period, and it is a remarkable fact that the Brush apparatus, which is in use the world over is to-day substantially the same in design and method of construction and identical in principle as that first designed by him to illustrate his inventions.

Mr. Brush was born in Euclid Township, Cuyahoga County, near Cleveland, March 7, 1847. His early life was passed upon a farm, after which he attended the public schools of Cleveland. In the high school he made a fine record as a student, and even at that time he gave marked evidence of his aptitude for mechanical pursuits. In 1866 he entered the University of Michigan, and was graduated three years later with the degree of Mining Engineer. Returning to Cleveland, he opened an office as an analytical chemist, and while he was thus engaged for three years, he was noted for the skill and accuracy which characterized all his work. Subsequently he was interested in the iron business for four years.

In 1875 his attention was attracted by the experiments in electric lighting in progress in Paris and London, and the question arose whether a dynamo superior in construction to any in use would not prove a profitable invention. The matter was talked over with George W. Stockly, of the Telegraph Supply Co. of Cleveland, and an agreement was entered into by which facilities for manufacturing were to be given to Mr. Brush if he invented the right machine. Within two months of the time of the interview Mr. Brush set up his first dynamo, which was so complete and so successful that no radical change has

been made in the machine to this day. Of the invention Professor Dolbear says in one of his lectures: "Mr. Brush, of Cleveland, attacked the problem and solved it in a simple enough way, to be sure, so that it is a matter of surprise that those who had before worked with the dynamo had not stumbled upon the method of distributing the light. It consisted chiefly in the consideration of what was apparent enough, that if one arc required fifty volts, two arcs would need 100 volts, and ten arcs 500 volts, and so on. * * * As simple as the multiplication table, yet it waited for the man who had the genius to see the simple thing to do it."

While the dynamo, which he had constructed, performed its work satisfactorily, no lamp was available to use in connection with it, as the antiquated clockwork type was the best to be had. It was necessary to supply the demand in the same way that the dynamo was found—by invention. Mr. Brush believed that he could make a satisfactory commercial lamp as well as a practical machine, and he proceeded to his second task. This was accomplished within a few weeks. The lamp proved to be an invention almost equal to the machine itself, and as at present constructed it is substantially the same in form and principle as the one first produced. Within a year both machine and lamp were in working order and ready to be put upon the market. At this time Mr. Brush was less than twenty-eight years of age, but he had laid the foundations for his marvelous success. Of his other inventions—and they constitute no small number—it is unnecessary to speak here. His fame will always rest upon his two great fundamental inventions.

Mr. Brush possesses a vast fund of available scientific knowledge, but above all he is intensely practical. He is a fine mechanic and competent to perform work intrusted to the most careful employes.

The incident that revealed to the writer the fact that Mr. Brush has a "good eye" was in seeing him pause as he was passing through the shop and remark—"That lathe is not true," referring to one of the several watchmakers' lathes that were just unboxed. When the centres were brought together they were "out" about one thirty-second of an inch, a great deal for such a tool, but very little to "offend" the eye of a passer-by.

CHARLES HATHAWAY.

Charles Hathaway, of Cleveland, one of the directors of the Cleveland City Cable Co., is a street railway pioneer. The list of street railways that he has constructed is a formidable one. At times



CHARLES HATHAWAY.

he has employed 3,000 men in work of this kind at points widely separated. Born at Grafton, Mass., in 1824, his boyhood was passed on a farm. After attending school for three years, in Worcester, he was apprenticed in a machine shop, and learned his trade thoroughly. In 1844, he took his first railroad contract, and he engaged in this work till 1857, when he built his first street railway in Philadelphia. From

that date until a year or two ago he was engaged in constructing railways in cities throughout the United States and Canada. In 1860, he was associated with George Francis Train in building street railways in England. Mr. Hathaway has made his home in Cleveland since 1873. He has been prominently connected with local street railways since that time. He built the Broadway & Newburgh, the Payne Avenue, and the Superior Street railroads. He bought the St. Clair road, in 1884, and operated it until the consolidation with the Cleveland City Cable Co. For fifteen years he was president of the Superior Street Railroad Co., and held the same office in the St. Clair Street Railroad Co., for many years. At the present time Mr. Hathaway claims he has retired from business, but he is still to be found regularly at his office.

M. A. HANNA.

W. A. Hanna, one of the most prominent citizens of Cleveland, is president of the Woodland Avenue & West Side Street Railroad Co.



M. A. HANNA,
PRESIDENT WOODLAND AVE. & WEST SIDE STREET RAILROAD CO.

He was born in Lisbon, O., in 1837, but Cleveland has been his home since 1852. He is the senior member of the firm of M. A. Hanna & Co., which is extensively interested in coal, iron, mining and shipping. Mr. Hanna is president of the Chapin Mining Co. and a director in the Union National Bank, Chapin Bolt & Nut Co., West Side Banking Co. and the Globe Iron Works Co. He has taken an active part in Ohio state politics, and has been an influential factor in several of the most interesting campaigns. He purchased the Woodland Avenue Street Railroad Co., and became its president in 1882, and has held the same office since the consolidation with the West Side Street Railroad Co. three years later. During his administration the service has been greatly improved, and the electrical equipment of the road is now in progress.

WILLIAM G. ROSE, MAYOR OF CLEVELAND.

William G. Rose is now serving his third term as Mayor of Cleveland. He was first elected in 1877, and served two successive terms.

He was nominated for the Lieutenant-Governorship in 1883, on the Republican ticket with Foraker, but was defeated. Last spring he was for the third time selected as the executive head of the municipality.

HON. TOM L. JOHNSON.

There is no name more familiar in the street railway world than that of Hon. Tom L. Johnson, president of the Brooklyn Street Railroad Co. His inventions in this particular field comprise many of the most essential and fundamental features in street railway equipment. While his connection with street railways is familiar, his personal history, which is full of interest, is not so well known. He comes of Virginia-Kentucky stock and among his ancestors were many men of influence and distinction. One of these, Richard M. Johnson, represented Kentucky in Congress, commanded a regiment in the war of 1812, and fought the Indians in the Battle of Thames, in which he was badly wounded. He was credited with killing the Indian chief Tecumseh. He was chosen Vice-President of the United States on the



TOM L. JOHNSON,
PRESIDENT OF THE BROOKLYN STREET RAILROAD CO.

ticket with Van Buren, in 1836. At the same Battle of the Thames, Col. James Johnson, the great grandfather of Tom L., led against the British, whom he routed in a gallant charge. His brother Judge Ben Johnson, removed from Kentucky to Arkansas in 1830, which state his son, Robert W. Johnson, represented in the United States Senate.

Col. James Johnson's son, Gen. William Johnson, who also saw service in the War of 1812, was long a leading man in Kentucky. His son, Albert W. Johnson, married Miss Helen Loftin, daughter of Colonel Loftin, a prominent and wealthy Tennessee planter, and to them in Scott County, Kentucky, was born on July 18, 1854, Tom Loftin Johnson, who began life under very different conditions from those that his family had enjoyed for several generations. At the close of the war, instead of attending school, he had to go to work, and he ran errands as an office boy of the Central Passenger Railroad Co., of Louisville, in which A. V. du Pont was the principal stockholder. At the age of sixteen Mr. Johnson was made secretary, and was put in charge of the office. He possessed not only executive ability, but he developed a talent for inventions, and the sale of two of his patents for a considerable sum gave him his financial start. Colonel Johnson, his father, had

also gone into the street railroad business, having become superintendent of the Central Passenger Railroad. He and his son bought an interest in the Louisville road. From Louisville they went to Indianapolis, buying up the street railroad system of that city, which, after it had been made very profitable, they sold in 1887. In the meantime Tom L. Johnson had gone to Cleveland, settled there and bought a controlling interest in the Brooklyn line of street railroad, which he had greatly extended and transformed into an electric line. Before adopting electricity as a motive power, Mr. Johnson visited various electrical works and a number of cities in which electric cars were in operation, and so acquired a thorough, practical knowledge of the new force as applied to street cars.

Besides his interest in the Brooklyn and South Side street railroad companies of Cleveland, Mr. Johnson is a large stockholder in the Southern Railway Co. of St. Louis and the Johnstown Passenger Railway Co. of Johnstown, Pa., of both of which companies he is the president. Under his direct supervision and management both were changed from horse lines to electric roads. Under his direction, also, the Tuscarawas Electric Co. built a line of electric street railway connecting New Philadelphia and Canal Dover, O. The system is now under the management of his brother-in-law, Mr. Robert A. Johnson.

While connected with the Louisville company, Mr. Johnson invented and patented a fare box which was adopted and used by the central passenger and many other companies. Later, and before the introduction of electricity into street railway work, he designed a

cable system and built a short experimental road in Cleveland, and a longer road in Brooklyn, N. Y., which was successfully operated, but was abandoned as soon as electricity, in his opinion, was shown to be a more desirable power. He also invented and patented an automatic lever brake, which is now in use on almost every cable road in the United States. Among his other inventions are a tower wagon used for stringing overhead wires, and the Johnson life guard, which is in use on all the roads in which he is interested, and which has lately been adopted by the West End Railway Co. of Boston.

He is a director and a large stockholder in the Johnson Co. of Johnstown, Pa., which is engaged in the manufacture of all kinds of rails for street railroad use. He is the inventor of the Johnson girder rail, which is the standard rail used by electric roads in the United States.

Mr. Johnson never took an active interest in politics until the fall of 1888 when the Democrats of Cleveland, without his knowledge, placed him in nomination for Congress. The district was strongly Republican, and he was defeated by a plurality of 500 votes. In 1890 he was renominated and elected. His political friends confidently predict his re-election this fall. Mr. Johnson was a delegate to the last Democratic national convention, and was the author of that part of the platform which declares the Republican protective tariff to be a fraud. He is one of the leaders of the radical wing of the Democratic party, and he is an earnest believer in and a strong advocate of the single tax doctrine of Henry George.



RESIDENCE OF CHARLES F. BRUSH, EUCLID AVENUE.

CLEVELAND.

THE FOREST CITY—ITS STREET RAILWAYS AND OTHER INDUSTRIES.

CLEVELAND is an interesting and a prosperous city, and there is much within the corporate limits to challenge attention and to inspire admiration. But Cleveland is an intensely modern municipality; whatever wealth can add Cleveland possesses, but of entertaining history it can boast but little. True, local historians start their narratives at a time when, some centuries ago, a forgotten Indian tribe occupied the site of the flourishing Forest City, but it is only necessary to go back to 1796 to find the founder of the city, Gen. Moses Cleaveland, entering the mouth of the Cuyahoga River to make the beginning of a settlement. He never realized the importance of his work, and he never revisited the locality which bore his name. Honored, as the founder has been by the erection of a monument to his memory in the Public Square, still his name has suffered at the hands of a utilitarian and irreverent editor, who in 1830, finding it too long to suit the width of his page, eliminated a letter, and thus formed the name by which the city is known the world over to-day. Going back to 1814, when Cleveland became a village, we find that the first ticket was unanimously elected by twelve votes, and consulting the records at as recent a date as 1854, when Cleveland and Ohio City, now Brooklyn, were consolidated, we learn that the joint population did not exceed 25,000.

But enough has been written to indicate that the city is a thing of recent creation. To-day Cleveland has a population of 300,000 souls, and its newspapers predict the addition of another 100,000 before the century closes. It boasts, with reason of its manifold attractions, its parks, its Euclid Avenue and its industries, which have given it a world-wide reputation.

Figures are dull at the best, and no extended description of the sources of Cleveland's wealth is contemplated. Brief references only will be made to some few of the interests for which the city is chiefly distinguished. In general, it may be stated that these pre-eminent industries group themselves into the following classes: Ship

building, iron, transportation, oil and general manufacturing.

SHIPBUILDING.

In 1813 twenty-eight yoke of oxen hauled down to the Cuyahoga the first boat constructed in Cleveland. It had been built in a yard which is now the site of an opera house on Euclid Avenue, half a mile or more from the river. This was the beginning of an industry which has grown steadily, until to-day the superintendent of the census states that, notwithstanding Cleveland's distance from the seaboard, it builds more vessels than any city in the Union, and is second only to the Clyde. The citizens believe in these craft, as at the present time a greater tonnage of vessels is owned in Cleveland than in any other customs district in the United States, with the exception of New York. Less than fifty years ago the first steamer was built, but the trade on the lake developed to such proportions that the best craft that skill could construct were urgently demanded. With its enormous steel and iron industries Cleveland offered every facility for building vessels in accordance with the most approved modern ideas, and steel steamships, second in size and equipment only to the ocean greyhounds, have been launched from the local yards.

TRANSPORTATION.

The rapid growth of the city is accounted for principally

by the fact that it possesses such exceptional transportation facilities. The regular lines of passenger and freight boats from all over the chain of lakes touch at the port either in transit or as a terminal station. Ten railroads centre in the city, with an aggregate of 5,885 miles. The freight shipped and received from lake traffic exceeded in 1890, 4,000,000 tons, which was carried by a fleet whose home port is Cleveland, numbering 250 vessels, with a gross tonnage of 200,000 tons. During the same time the railroads centering in the city handled slightly less than 40,000,000 tons of freight.

IRON AND COAL.

The leading business in Cleveland, which gives em-



WM. G. ROSE, MAYOR OF CLEVELAND.

ployment to the greatest number of persons, and in which the largest aggregations of capital are invested, is the iron industry in its various branches. In the city a very large proportion of the steel rails used on steam railroads

tons, or one-third of the entire product, and Cleveland has in all probability more capital invested in Lake Superior mines than any city in the country. The methods of handling and distributing the ore at the docks

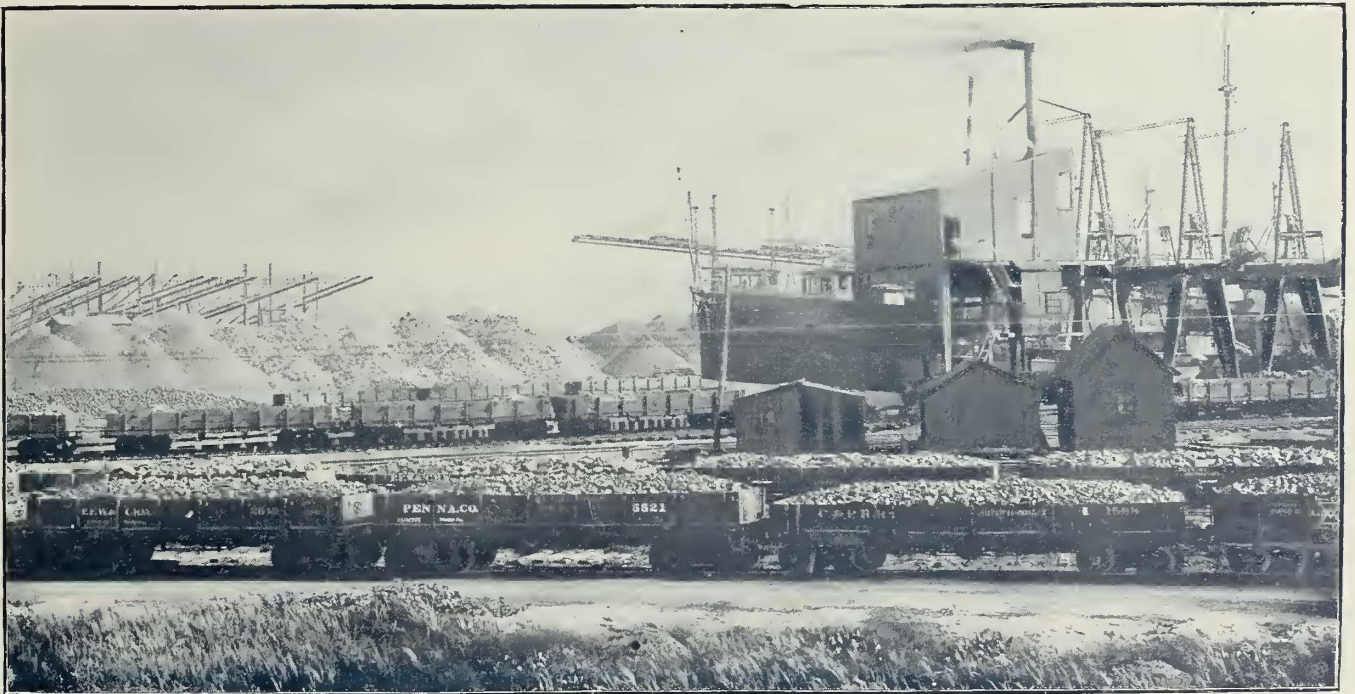


CLEVELAND DRY DOCKS.

throughout the country is manufactured, and several of the largest bridge works in the country are located here. In fact, almost any article made of iron, from the crudest pig to the finest steel, from a wire nail to a steel ship, can

form one of the most interesting sights to be seen in the city.

Somewhat closely connected with the iron industry is the coal interest. Almost all the coal shipped to the



ORE DOCKS—HOISTING AND CONVEYING MACHINES AT THE LEFT.

be found in process of manufacture in the city. All this has been accomplished since the first foundry was started in 1826.

Just forty years ago the first shipment of iron ore was made from the mining districts of Michigan. The trade has increased until the receipts aggregate 900,000

northwest above Duluth is controlled by companies located in Cleveland, whose shipments in 1890 reached over 3,000,000 tons.

OIL.

The refining of oil is an industry that is particularly associated with Cleveland, and the principal company en-

gaged in the business which handles more oil than any other two concerns in the world, and which has made all its largest stockholders millionaires, was organized in the city. From all the great oil fields in Ohio the crude oil is piped into the city. The refineries occupy many acres within the city limits, and their owners are the possessors of thousands of acres of oil lands. The industry ranks next to that of iron.

ELECTRICITY.

To the electrical fraternity, and to the great majority of street railway men, Cleveland is of special interest as the city in which is located one of the largest electrical manufacturing plants in the country in which is constructed apparatus used the world over. It is regarded as the birthplace of the commercial arc lamp, and many other inventions of the highest importance in the electrical world have been here developed.

MANUFACTURING.

Some idea of the magnitude of the manufacturing

city in search of information. The cable lines in their equipment represent the apparatus and appliances endorsed by the best practice of the day. The fund of information available in the electric motor fields is practically unlimited. The visitor can study the construction and development of one type at the place of manufacture. The oldest and latest forms, representing almost every manufacturing concern, even some of the most recent in the field, can be observed in operation in regular service. Most of the trucks can be inspected, and the list of companies who supplied the rolling stock is a long one. The power houses represent the period when old buildings were remodeled to serve a new purpose, and they include two stations constructed in accordance with the latest ideas. They illustrate as well the different ideas regarding the best arrangement of plant. There are to be seen high speed engines belted directly to generators, slow speed engines connected to countershaft, Corliss engines belted to generators and the direct connection of electric machine to engine shaft. The companies, too, have been op-



VIEW IN THE OIL DISTRICT.

interests of Cleveland may be gained from the following table, compiled from the latest authentic figures for 1890:

Value of manufactured products.....	\$98,926,241
Capital invested.....	53,974,346
Hands employed.....	53,349
Wages paid.....	\$30,423,635
Number of manufacturing establishments....	2 065

These figures, while they make a splendid showing, are incorrect as referring to Cleveland to-day. The data are taken from a recent address by Robert P. Porter, superintendent of the census, and are based on returns for 1890. No one who is acquainted with Cleveland requires any assurance that the development of its material prosperity has proceeded with marvelous rapidity during the last two years.

STREET RAILWAYS.

The street railways of Cleveland collectively form a rapid transit scheme that is scarcely surpassed in any city in the country. Within a few months at the farthest every line will be operated either by cable or electricity. The system is complete from every point of view, and particularly so from that of the railway man, who visits the

erating electric cars for a sufficient length of time to thoroughly systematize their work in all its departments, and have adopted many ingenious labor-saving devices in the equipment of their plants.

The railway system is comprehensive, embracing, as it does, 180 miles of track, and is laid out with an eye to the needs and convenience of the public. From the heart of the city almost any point within the municipal limits can be quickly reached; in fact the ramification of tracks is so complete that in sections of the city lines parallel each other for considerable distances, almost within a stone's throw. The companies operate their cars at a high rate of speed, but the number of accidents caused by the motors is insignificant.

It is a fact worthy of note that the finest thoroughfares in the city are traversed by electric cars; in fact one can in no way gain a better view of the city's beauties than from a car window, though, be it said, the show is a fleeting one, for the speed is too great to permit of any careful survey. The routes include the famous Euclid Avenue, Prospect Street and Jennings Avenue, and pass all the principal parks.

All the lines converge at the centre of the city, and

occupy four tracks in the principal thoroughfare. And just here is found a most interesting fact, viz., that the residents of the city are thoroughly educated up to the idea of rapid transit, and appreciate the fact

are located contact switches are located in the overhead trolley system, by means of which, when the bridge is swung, the current is cut off for a distance of 1,000 ft. on each side. The purpose of this arrangement is obvious. The possibility of a car running into the open draw is rendered exceedingly remote with even a most careless motorman in charge. If he failed to stop at the signal his car would not have sufficient momentum to carry him to the point of danger.

The two principal viaducts are the Central and the Superior Street. The former, which was built during 1887-88 by the King Iron Bridge & Manufacturing Co., of Cleveland, connects the West Side with the city proper. Its total length is about 4,000 ft., and its height above the level of the Cuyahoga River is 101 ft. The roadway is forty feet in width with eight-foot walks on each side.

The Superior Street viaduct is 3,211 ft. in length and connects the east and west sides of the city. That on the west side of the Cuyahoga consists of eleven stone arches, eight of which have eighty-three feet span and two ninety-seven and a half feet span. The length of way thus supported is 1,382 ft. Of the eastern portion 930 ft. is iron work, including the draw which is 332 ft. in length. The elevation of this section of the viaduct is seventy feet above the Cuyahoga. The roadway is forty-two feet wide, and the walks on each side eleven feet in width.



THE GARFIELD MONUMENT.

that it is the duty of the pedestrian to look out for himself, and not to shut his eyes and blindly cross crowded streets regardless of cars constantly passing to and fro. They seem to appreciate, in a most unusual and intelligent fashion, that perfect safety lies in keeping one's eyes open, so that Superior Street with its four tracks crowded with cars, which in some places would be regarded as extremely dangerous, has no terrors for them, and confusion and narrow escapes are rarely to be witnessed there.

The street railways of Cleveland are owned by nominally six, practically five, companies. In the following pages a somewhat detailed description of each system is presented, while in the appended table are summarized facts regarding each road:

NAME OF COMPANY.	STOCK.	BONDS.	MILES OF TRACK.
East Cleveland R. R. Co.....	\$2,000,000	\$1,000,000	50
Woodland Ave. & W. Side St. R. R. Co.	2,000,000	None Iss'd.	32
Cleveland City Cable Co.....	4,000,000	1,884,000	32.25
Brooklyn Street R. R. Co.....	600,000	600,000	30
South Side Street R. R. Co.....	300,000	300,000	10
Broadway & Newburgh St. R. R. Co.	1,000,000	None Iss'd.	26

VIADUCTS.

The viaducts, which are such essential parts of the thoroughfare system of Cleveland, are owned by the city. For the use of these structures as part of their routes, the street car companies pay the municipality a fixed rental, and in addition, furnish the rail and keep the pavement in repair. At the points where the drawbridges

THE MONUMENTS OF CLEVELAND.

Pre-eminent among the monuments of Cleveland is the magnificent Garfield Memorial, located on the loftiest elevation in Lake View Cemetery, five miles east of the Public Square. The monument, which was built by public subscription at a cost of about \$150,000, consists of a



STATUE OF GENERAL GARFIELD—INTERIOR OF MONUMENT.

circular stone tower 150 ft. in diameter and 165 ft. in height, in front of which is a square vestibule with a balcony roof. The tower is crowned with a conical stone roof adorned with bands of sunken tile. The principal exterior decoration is a frieze on bas relief, divided into

four panels, each representing an epoch in Garfield's life, as follows: The teacher, the soldier, the orator, the president and his death.

Inside the porch is a vestibule in which is a statue of Garfield, of heroic size. He is represented as rising in the House of Representatives to address the speaker. The memorial was dedicated May 30, 1892.

The Perry monument, in the Public Square, was unveiled in 1860, in commemoration of Com. Oliver Hazard Perry's famous victory on Lake Erie in the war of 1812.

The bronze monument, in the Public Square, of Gen. Moses Cleaveland, the founder of the city, was unveiled in 1888 by the Early Settlers' Association.



RAPID TRANSIT FACILITIES OF CLEVELAND.

EAST CLEVELAND RAILROAD CO.

Capital stock	\$2,000,000	
Bonds	1,000,000	
		\$3,000,000

Miles of track :
 Electric

President, A. Everett,
 Vice-President, C. W. Wason,
 Secretary and Treasurer, H. A. Everett,
 Asst. Secretary and Treasurer, L. E. Beilstein,
 Superintendent, E. Duty.

DIRECTORS.

A. Everett, M. A. Bradley,
 H. A. Everett, W. W. Boyington,
 G. E. Herrick, J. S. Hartzell,
 C. W. Wason.

No single company in Cleveland can lay claim to the honor of being the first company in the local street railway field. The honor is shared by two companies alike, the East Cleveland Railroad Co. and the Woodland Avenue & West Side Railroad Co. The project of building lines on Prospect Street and on Kinsman Street was conceived by the same gentlemen; but it was deemed best to divide the responsibility for the operation of the two roads between two companies. In pursuance of this policy the East Cleveland company conducted the Prospect Street enterprise, while the Kinsman Street Railway Co. operated the line designated by their name. The railways were both started on September 10, 1860, a day memorable in the annals of Cleveland as the date of the unveiling of the Perry monument in the Public Square. Each company owned four cars eight feet in length; two of them were designed for regular service, and the others were reserved for special occasions.

The East Cleveland company's cars ran every twenty minutes to Sterling Avenue, and one every hour to Willson Avenue.

The enterprise was not financially successful, and a controlling interest was sold to several gentlemen who elected Dr. A. Everett to the presidency, and he has been the executive head of the East Cleveland company since that time. Mr. Charles Wason was elected to the vice-presidency, and held the office till the time of his death, two years ago.

The company have pursued a policy of gradual extension, and at the present time they operate seven lines, as follows: Euclid Avenue and Prospect Street; Cedar Ave-

nue; Wade Park Avenue; Central Avenue; Mayfield; East Cleveland; Euclid Avenue and Collinwood.

For years the directors have had an abiding faith in electricity as a motive power for street cars. As early as 1884 they made a preliminary experiment to determine whether the electric system was practicable for their use. A section of conduit about three-quarters of a mile in length was built on Central Avenue, and the Bentley-Knight underground system was installed. One car was operated on this section, but the leakage proved so great that the idea of constructing a conduit system was abandoned, and the plan of equipping the road electrically was shelved for the time being. The failure of the experiment with the conduit was by no means surprising, especially in the light of present experience. The conduit was built of wood, and the general construction would be regarded to-day as exceedingly flimsy. But in those days the necessity for great strength in every detail of equipment was not realized as it is at the present time.

In 1888, the company, having made a thorough investigation of the overhead system, as far as was then practicable, and deeming it well adapted to the requirements of their service, applied to the City Council, and was granted a franchise. In December of that year the first electric line in Cleveland was operated on Euclid Avenue, and the electric system, which has contributed so materially to the prosperity of the city, was thus introduced. The original equipment consisted of sixteen Sprague motor cars.

The fifty miles of track of the company are now laid entirely with girder rail of the Johnson and Wharton types. The weights range from fifty-two to ninety pounds to the yard. The distance between centres of ties in the more recent construction is two feet. The rails are connected by copper rail bonds which are soldered to a continuous ground wire.

With the exception of one line where brackets are used, side poles are employed throughout the system; and these are metal with the exception of those placed on the suburban extensions. The original trolley wire was a No. 4 silicon bronze; that used in recent construction is a No. 0 hard drawn copper.

The company have a varied equipment in rolling stock. Most of the car bodies are of their own manufacture; thirty have been completed in the last fourteen months. Among the makers represented in the rolling stock are: John Stephenson Co., Lewis & Fowler Manufacturing Co., J. M. Jones' Sons, Newburyport Car Manufacturing Co. and J. G. Brill Co. The cars are equipped

with electric motors of the following types: Eighty No. 6 Edison double reduction; ten No. 14 Edison single reduction; one Thomson-Houston single reduction. The single reduction motors are of twenty horse power each, and the double reduction fifteen horse power each.

The company at present are making the wooden truck of the Fulton Foundry Co., of Cleveland, their standard; but the trucks of several other makes are also on the lines. Among the number are those of the J. G. Brill Co.; Sheffield Velocipede Car Co.; Bemis Car Box Co.; John Stephenson Co.; Robinson Electric Truck & Supply Co.

The power station which is located on Cedar Avenue, and of brick, presents an attractive appearance. The dimensions of the first building designed for the power plant were 80 x 100 ft., to which was added later an extension, 80 x 140 ft. with flat roof finished off having battlements rising to about thirty feet from the sidewalk, making the present building an L with a front of 160 ft. and sides of 100 and 140 ft. This building will probably be again extended soon, so as to occupy an area 240 x 140 ft. All future buildings will be of brick with roof of 2 x 4 in. joists laid edgeways and supported on iron trusses. The first

Co., of Cleveland. Each of these is 72 ins. x 18 ft., of 130 h. p. capacity, and is designed to supply steam at 100 lbs. pressure. All are provided with the Murphy smokeless furnace and automatic stoker, manufactured in Detroit, which give satisfaction. The Ford boiler cleaner is being

tried, and seems to give good results. The pumps are of the Deane duplex and Hughes' patterns, two of the former and four of the latter being employed. Five Berryman heaters, 12 ft. x 40 ins., and Reliance water columns, complete the boiler house equipment.

Water for the boilers is now taken from the city mains, but the railway company have just completed an artesian well, 377 ft. deep, having a bore eight inches in diameter. This well will give a supply of 100,000 gals. every twenty-four hours, with natural rise of water to within seventy-five feet of the surface. The contractors for this well were the Buffalo Well Drilling Co.

The railway company are using for recording the steam pressure at all times, a Bristol recording steam gauge, made in Waterbury, Conn. This makes records upon prepared disks,

which show the pressure record for each twenty-four hours, and which are kept on file.

Power is furnished by both high and low speed en-



C. W. WASON,
VICE-PRESIDENT EAST CLEVELAND RAILROAD CO.



HENRY A. EVERETT,
SECRETARY AND TREASURER EAST CLEVELAND RAILROAD CO.

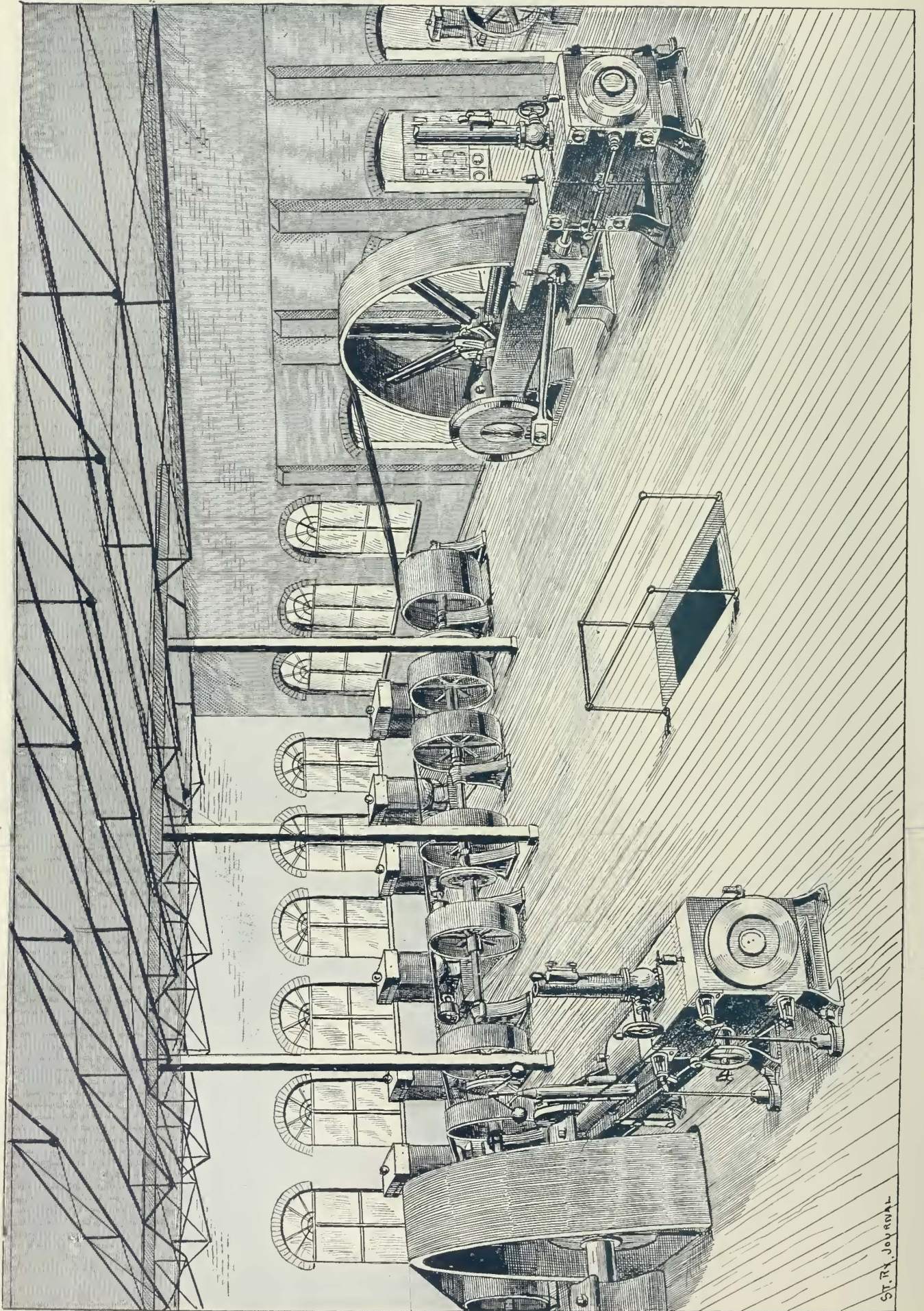
stack was 136 ft high with a six-foot flue, and the new stack just completed is 175 ft. high and has an eight-foot six-inch flue.

The boiler equipment consists of seven Cooper boilers, and an equal number built by the Variety Iron Works



E. DUTY,
SUPERINTENDENT EAST CLEVELAND RAILROAD CO.

gines. The former, which were first installed, occupy the old part of the building. The original installation was one 125 h. p. Armington & Sims engine, with two generators of sixty horse power each. This was soon increased 200 per cent., which took care of all the motors for about

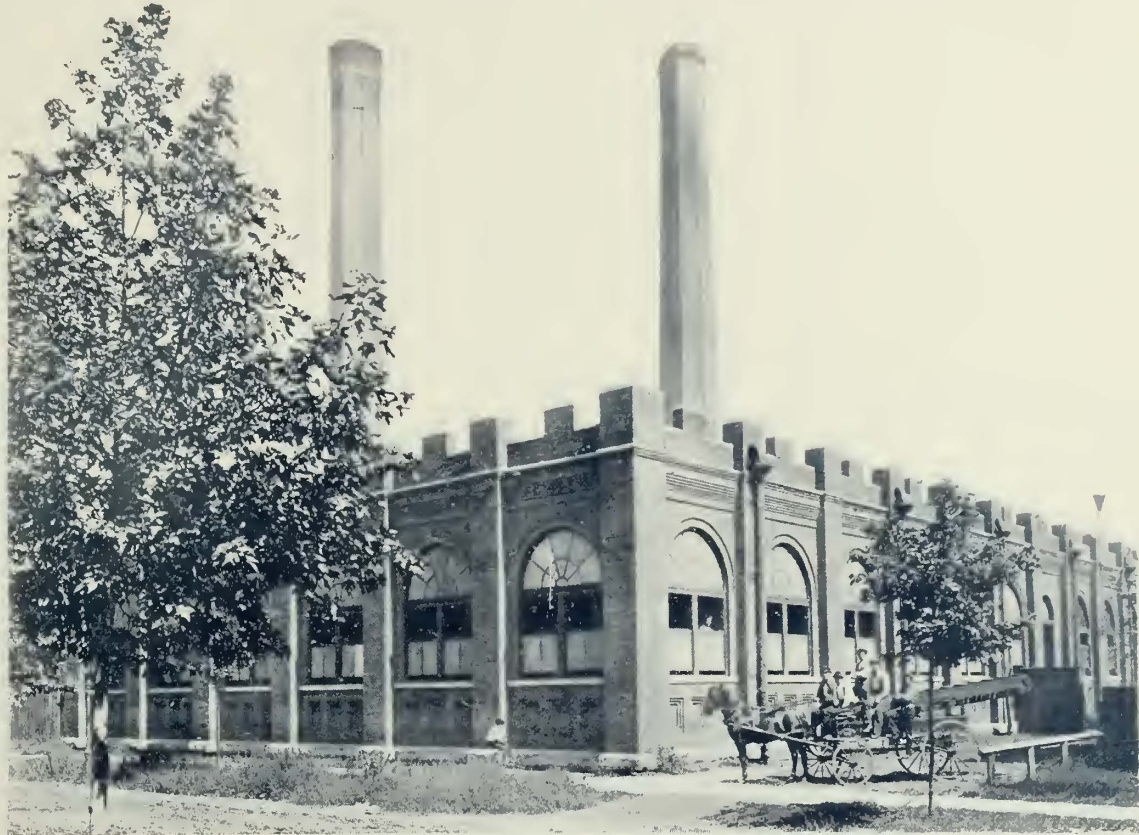


POWER PLANT OF THE EAST CLEVELAND RAILROAD CO.—SLOW SPEED ENGINES.

ST. RY. JOURNAL

seven months, after which time the plant was again increased 200 per cent., giving an aggregate generator

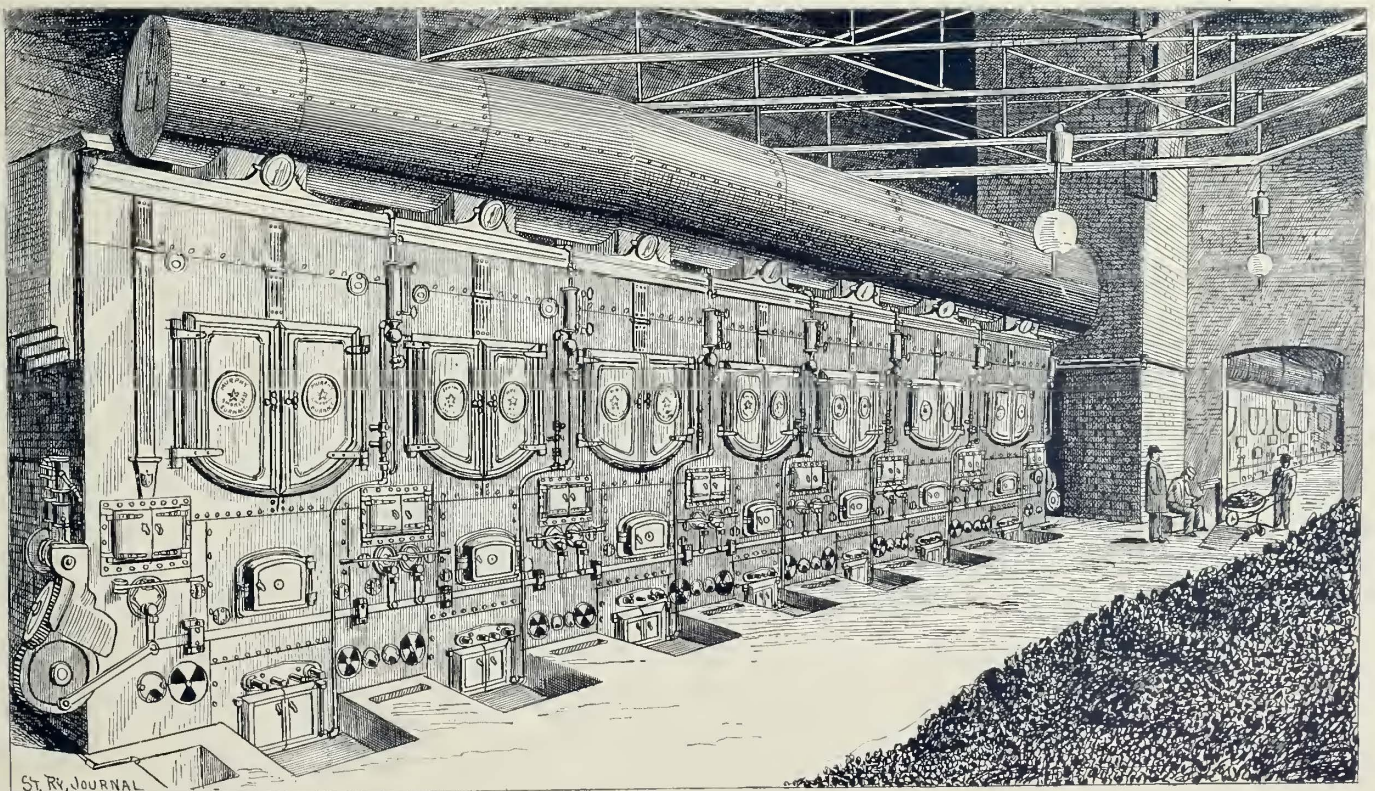
been very favorable, and the management is enabled to judge of the efficiency of the two kinds of plants.



POWER STATION—EAST CLEVELAND RAILROAD CO.

capacity of 1,000 H. P. About one year later an increase of over 100 per cent. was made, and at present the generator capacity is more than 2,000 H. P. The last increase

The present steam engine equipment consists of three 250 H. P., $18\frac{1}{2} \times 18$ in. Armington & Sims engines, running at 200 revolutions, and three 125 H. P., $14\frac{1}{2} \times 15$ in.



BOILER ROOM—EAST CLEVELAND RAILROAD CO.

was made contrary to the general opinion at that time, in regard to the practicability of running low speed engines in connection with high speed engines, but the result has

engines of the same type running at 260 revolutions. The slow speed engines are two in number, manufactured by C. & G. Cooper & Co., of Mt. Vernon, O., of 500 H. P.

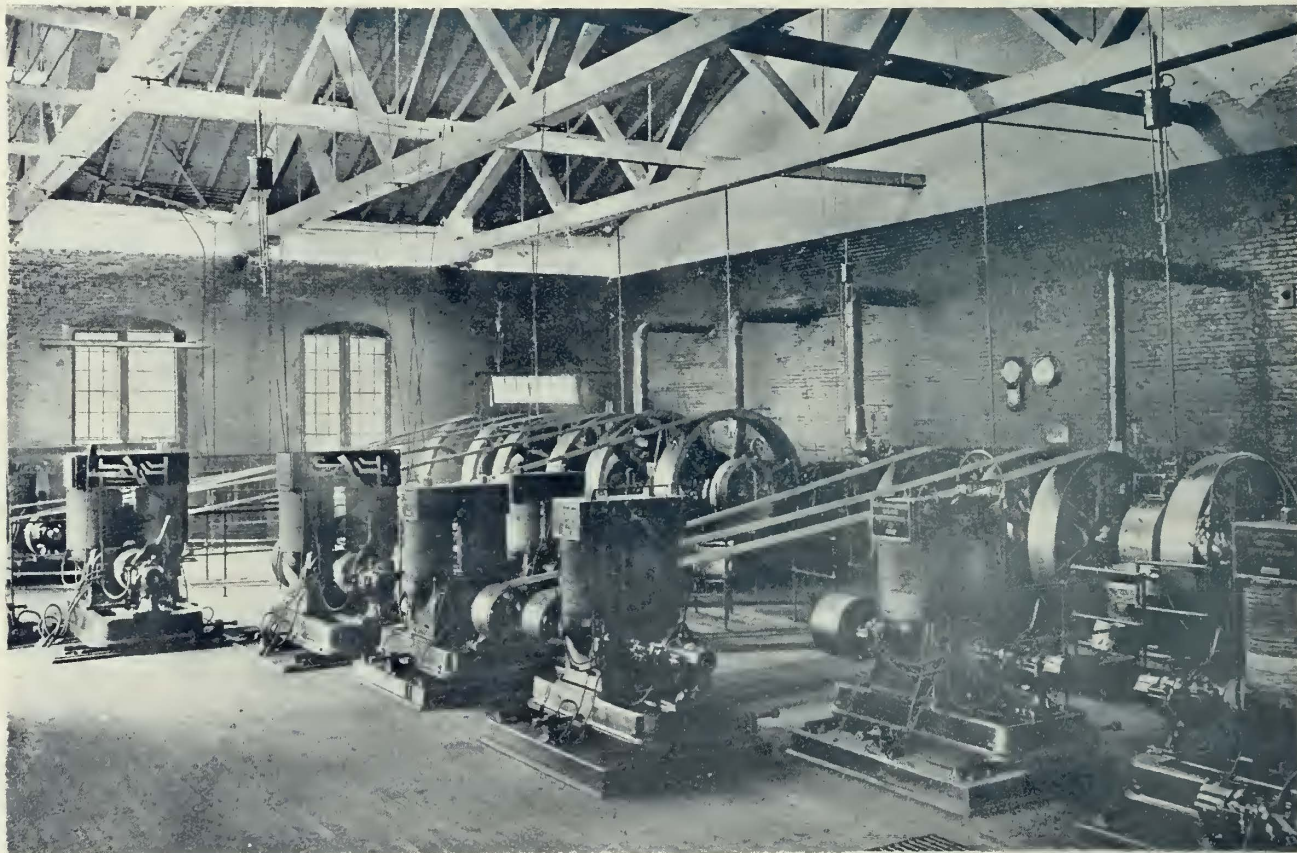
each, cylinders 28×48 ins., and with a speed of seventy-two revolutions per minute. The flywheels of these engines are twenty feet in diameter, with a fifty-two inch face and weigh twenty-five tons each. The engines are fitted with a bell crank on the governor, with a movable weight by which the speed can be increased or decreased at will while the engine is running. The effect of the weight is to balance in part the influence of gravity on the governor balls, and the connections are so arranged that should the governor belt break, the steam supply will be cut off, and any tendency on the part of the engine to race will thus be prevented.

All oiling of the engines is done automatically

The receiving pulley of the engine next to the old part of the building is on a quill or hollow sleeve, so that if the plant is extended in the future and another slow speed engine is added, it can be shut down without interfering with the running of the line shaft.

The engine nearest the observer in the view of the station interior is belted direct with a cut-off coupling between the receiving pulley and the shaft, by means of which the engine can be stopped while the shaft can be run from the other engine. The receiving pulleys are 74×50 ins. The shaft is supported by eleven Hill self-oiling bearings and stands.

As each generator is driven from a clutch pulley it



POWER PLANT OF THE EAST CLEVELAND RAILROAD CO.—HIGH SPEED ENGINES.

through a series of pipes connecting with a reservoir and having branches with outlets over each oil cup. The waste oil is first put through two filters, then runs by gravity into a tank, whence it is pumped to the reservoir over the boilers, which has a capacity of about eight barrels. From this reservoir the oil runs through a settling T, which has a valve at the bottom, through which all impurities may be drawn out, and thence to every engine in the station. Small branch pipes lead to all bearings. Each pipe is fitted with a small valve by which the flow can be regulated.

The belting, which is two-ply, was supplied by the Bodfield Belting Co., and gives good satisfaction.

The high speed engines are, of course, belted directly to the generators. The low speed engines are belted to a line shaft furnished by the Hill Clutch Works, of Cleveland, O., and consisting of four lengths, aggregating about seventy-nine feet seven inches in diameter. On this there are six 88×29 in. split friction clutch pulleys, so arranged that either of the two engines, which are at the ends of the shaft, can run the entire line, and there being a friction clutch cut-off coupling in the centre, each engine can run one-half separately.

can be stopped or started without interfering with the other machines, and as the engines are entirely independent of one another, the plant is strictly interchangeable, lessening the possibilities of a shut-down to a minimum.

The generators, which are sixteen in number, are all of the Edison compound wound type, and vary in size from forty to 150 k. w. capacity each. The first six generators installed were of the shunt type, but it was found that the voltage varied so greatly when these were relied upon to supply the current that a change was made to compound winding. The present machines hold the voltage within a maximum range in variation of ten volts, and give excellent satisfaction. Two more generators of the 150 k. w. size will soon be added to the station equipment.

A special device has been adopted to keep the armatures cool while running. The power station is provided with a basement six feet in the clear under the engine and dynamo rooms, and having grated windows. Laid into the generator foundations are tile pipes, four inches in diameter, the upper opening being directly under the armature while the lower end opens into the basement. The air in the latter being always cooler than in the en-

gine room, a stream of cold, dry air is insured through the tile pipes. It has been found by tests that the air in the basement is about twenty degrees below that of the engine room.



TROLLEY AND MOTOR INSPECTION ROOM—EAST CLEVELAND RAILROAD CO.

The power house, motor shops and grounds are lighted by Graves arc lamps, operated from the street railway circuit. These lamps have proved very satisfactory to the company, especially on the ground of economy of power. The company consider themselves the pioneers in lighting in this manner from a 500 volt railway circuit, having had lamps in operation about three years.

The switchboard is in the old part of the building, and is so arranged that it can be extended indefinitely as the plant grows.

Each line section, which, it might be mentioned, includes not more than three miles of double track, is provided with a fusible copper plug switch on the switchboard so that each section may be operated separately or with the

others, the feed wires of all the sections being connected together at their outer ends by fuses. The fusible switches employed are of a special construction, designed by Mr. R. M. Fuller, assistant electrician of the company, and manufactured by the East Cleveland company. The peculiarity of this switch lies in the method of supporting it; it is held between a stationary post and an

eccentric, at the outer end of which is a lever with a ball or weight. This arrangement compensates for any slack in the fuse wire, at all times insures a sure contact, and makes it easy to replace melted fuses. The company have always used fusible plugs, and regard them as much superior to circuit breakers. They have never had a machine damaged from overload due to short circuit on the line.

The power house is provided with the Wason lighting arresters, two of which are connected to each feed wire on entering the building. These arresters are arranged to be switched on separately, permitting the placing of new fuses at any time. The company have never had a case of damage from lightning in the power house.

The voltmeter is connected to a switch, from which the voltage of any machine can be taken, and each section of line is provided with an ammeter. All the feed wires being connected together at their outer ends, the station attendants are enabled to switch out all but two wires after one o'clock at night, when only the night cars are operated. These two feed wires are provided with a drop, which rings a large bell in case a fuse blows on any section.

The greatest loss on the longest line, which is about six miles from the power house, is never over 10 per cent., and it is the intention of the company as the number of cars increases, to put up additional feed wires, always keeping the loss within 10 per cent.

The company are furnishing two stationary motors between 200 and 300 H. P. They hope to increase this load until it approximates ideal conditions according to their point of view. A curve of the load on the station shows that a heavy demand is made for current in the morning; the curve then falls till about noon, when it



MOTOR REPAIR SHOP—EAST CLEVELAND RAILROAD CO.

rises as people take cars to go home for dinner; the curve then drops until people start homeward at night.

It is found that there is practically a coincidence between the hours of greatest demand from the cars and those of minimum load from the stationary motors, and *vice versa*. If the latter demand can be increased materially the tendency would be to keep the plant working at

maximum load at all times, and thus at the point of highest efficiency.

The car shops of the company, located at Lake View, five and a half miles from the centre of the city, are exceedingly complete in arrangement. The building is brick, with a frontage of 360 ft. and a depth of 80 ft. The southern section of the building is used as an inspection department. The track running through this portion of the building forms a part of the terminal loop. The car entering the rooms runs over a pit in which an employe is stationed, who thoroughly examines the motors, and at the same time a second employe on the raised platform is enabled to inspect the trolley. When the inspection is complete, the workman in the pit moves a signal which allows the motorman to start. Stationed at different points on the loop are repair men, who watch the car as it passes them. If they detect anything requiring attention, or notice any rattling about the machinery, they jump aboard, and, being provided with tools which they carry in a belt, they proceed to remedy the fault at once.

Should a motor car require repairs of any serious character, it is switched into the repair department which is located just south of the inspection room. The room is provided with pits and with apparatus sufficiently heavy to handle the motors quickly and with ease. The car is run in over a pit, at the bottom of which a carriage, with a hydraulic jack of a capacity of ten tons, runs on a track. When the motor is lifted off by the jack it can be shifted to any desired point by means of cranes with chain hoists. Gears are removed by screw pressure, by a machine exerting a power of sixty tons, designed by J. E. Lyons, foreman of the shops. Now, as to the results accomplished in the repair shops, as a consequence of the admirable system and labor saving machinery employed, Mr. Lyons states that a motor can be taken out of a car, and the armature and intermediate bearings rebushed in an hour and a half. A motor can be taken from a car within fifteen minutes, and an armature can be substituted in eight minutes.

The machine shop is very completely equipped. Among the special tools used are four lathes, two drills and one shaper, all made by Prentice Bros. of Worcester, Mass.; a 250 ton wheel press made by the Baker Engine & Machine Co., of Geneva, O., and a bolt cutter, manufactured by the Jarlock Manufacturing Co., of Erie, Pa. Three forges are run in the blacksmith shop. The tin shop occupies a corner in the same room. The company manufacture their own headlights, and do all the general repairs on tin work. All the machinery in the plant is operated by a thirty-five horse power Sprague motor which takes current from the railway circuit.

The company make the greater number of cars used on the lines, and therefore the carpenter shop is a very complete department. During the last year twenty-five cars have been built. The south room of the building is used as a paint shop. It is the intention of the company to paint and varnish their cars at least once every year.

In the winding room five men and two boys are employed on armatures and fields.

The building is heated by steam from a boiler made by Parker & Meikle of Cleveland. It is located in the basement which extends entirely under the building and which is used for storage.

WOODLAND AVENUE & WEST SIDE STREET RAILROAD CO.

Capital stock.....	\$2,000,000.
No bonds.	
Miles of track	
Horse.....	32

President, M. A. HANNA,
 Vice-President, C. F. EMERY,
 Secretary, J. B. HANNA,
 Assistant Secretary, K. HANNA,
 Treasurer, H. P. EELLS,
 Superintendent, GEORGE G. MULHERN,
 Assistants, A. E. DUTY and EDWIN HANNA.
 Electrical Engineer, THOMAS SHEEHAN.



GEORGE G. MULHERN,
 SUPERINTENDENT WOODLAND AVENUE & WEST SIDE STREET
 RAILROAD CO.

Any one who glances at the preceding table of data regarding the Woodland Avenue & West Side Street Railroad Co., is likely to draw an incorrect inference. The railway, it is true, is to-day operated by horses, but it is on the point of becoming an electric system. Had it not been for the series of unfortunate delays which seem almost inevitable accompaniments of street railway enterprises, the several lines would have been electrically operated before this time. It had been hoped by the management that operation would be begun at least before the convention of the American Street Railway Association met at Cleveland; but while this proved impossible, it is believed that a careful inspection of the plant, even in its present incomplete state, will prove to be of great interest. This is true, especially in view of the fact that the company have come rather late into the field, and their plans have been formed only after a mature examination of street railway systems throughout the country.

The Woodland Avenue & West Side Street Railroad Co. are the successors of two railway companies, each of which contributed a half of the name by which the present company are styled. The West Side Street Railroad

Co. were organized in 1866 by D. P. Rhodes. The original franchise granted the corporation gave them the right to operate over Main Street bridge and up Light-house Street, but no advantage was taken of this privilege for the reason that the grade was so heavy on the latter street that successful operation by the route was out of the question. A second ordinance granted the company the privilege of running over Pearl Street, Detroit Street, Champlain Street, Seneca Street to Superior, and of this franchise the company availed themselves. They subsequently changed their route so that cars ran through Water Street instead of Champlain Street.

In 1882 Mr. M. A. Hanna bought a controlling interest in the company and at once instituted a radical change in the business policy. He put on better cars, better horses, and built new and commodious car barns. The service was greatly improved and at once began to meet the demands of the patrons of the line.

In 1885 the company were consolidated with the Woodland Avenue Street Railroad Co. This latter corporation, under the name of the Kinsman Street Railroad

four are located on the West Side, and the fifth comprises a series of buildings at Woodland and Willson Avenues.

It has been previously stated that the company will, in a comparatively short time, operate all their lines by electricity, and for this reason, only a cursory sketch of the present equipment has been given; for, practically, it belongs to the past. The new equipment is worthy of even a far more extended description than can be given here, but, supplemented as the text is by illustration, it is believed that an excellent idea of the interesting plant and system can be gained.

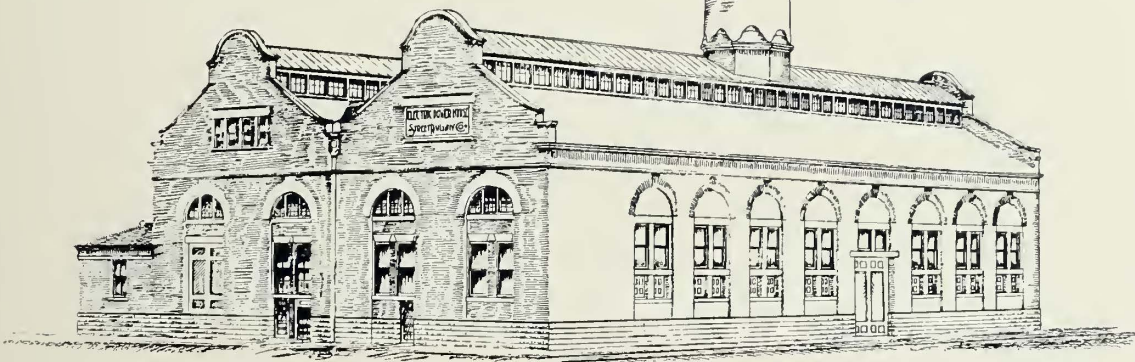
In their new track construction the company have for the most part used Johnson rails, the weights of which are ninety-eight pounds and eighty-two pounds. One mile is laid with Wharton rails nine inches in height and weighing ninety pounds. Of the Johnson rails the heavier are spiked to the ties, and the others rest on chairs. Oak ties 5 x 8

ins. are laid at distances of two and a half feet from centres. It has been decided to break joints, and a tie is laid within eight inches on each side of these points. Special attention has been paid to tamping, and this work has been thoroughly done. The pave-

ent is the ordinary Medina stone.

Each rail is wired by a No. 00 galvanized iron wire, and the joints are bonded on both the inside and outside of the rail. To provide a good ground in even the driest weather, the wire is run into the soil about twelve feet at points about 1,000 ft. apart, and connection is made with sewer pipe, or a coil of wire is left in the earth, if no metallic connection is found.

Side pole construction was adopted for the entire line, and metal poles will be used throughout the system. On forty-foot streets the three sections of the poles are four inches, five inches and six inches standard sizes, respectively; on the sixty-foot streets and on curves the sizes are five inches, six inches and seven inches extra heavy. The poles are treated with a coat of paint inside and outside, and the section which is to be buried receives a second



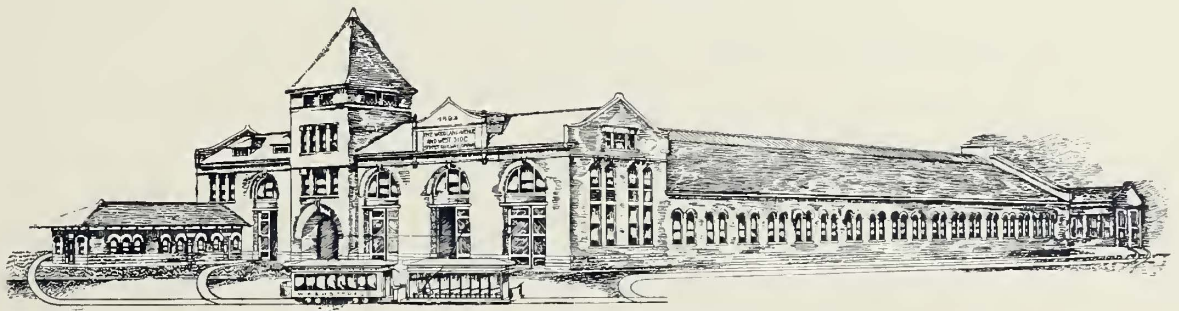
EXTERIOR OF POWER STATION—WOODLAND AVENUE & WEST SIDE RAILWAY.

Co., secured a charter in 1859. Their franchise gave them the right to run down Woodland Avenue—then Kinsman Street—to the Public Park and return.

The officers of the consolidated company were the same as those who are now in charge: M. A. Hanna, president; J. B. Hanna, secretary, and George G. Mulhern, superintendent.

The company at present operate four horse car lines, the aggregate mileage of which is thirty-two miles. The lines are: Woodland Avenue, Pearl and Lorain Streets; Kinsman and Fulton Streets; West Madison and Franklin Avenues; Detroit Street and West Cleveland. One hundred and eighteen cars, made by the Brownell Car Co., J. M. Jones' Sons, J. G. Brill Co., Lewis & Fowler Manufacturing Co. and the operating company, are used in the service. After the installation of the electrical system, these cars will be used as trailers; only new cars will be used in connection with the motors.

The company have been using five car barns, of which



NEW CAR HOUSE—WOODLAND AVENUE & WEST SIDE RAILWAY.

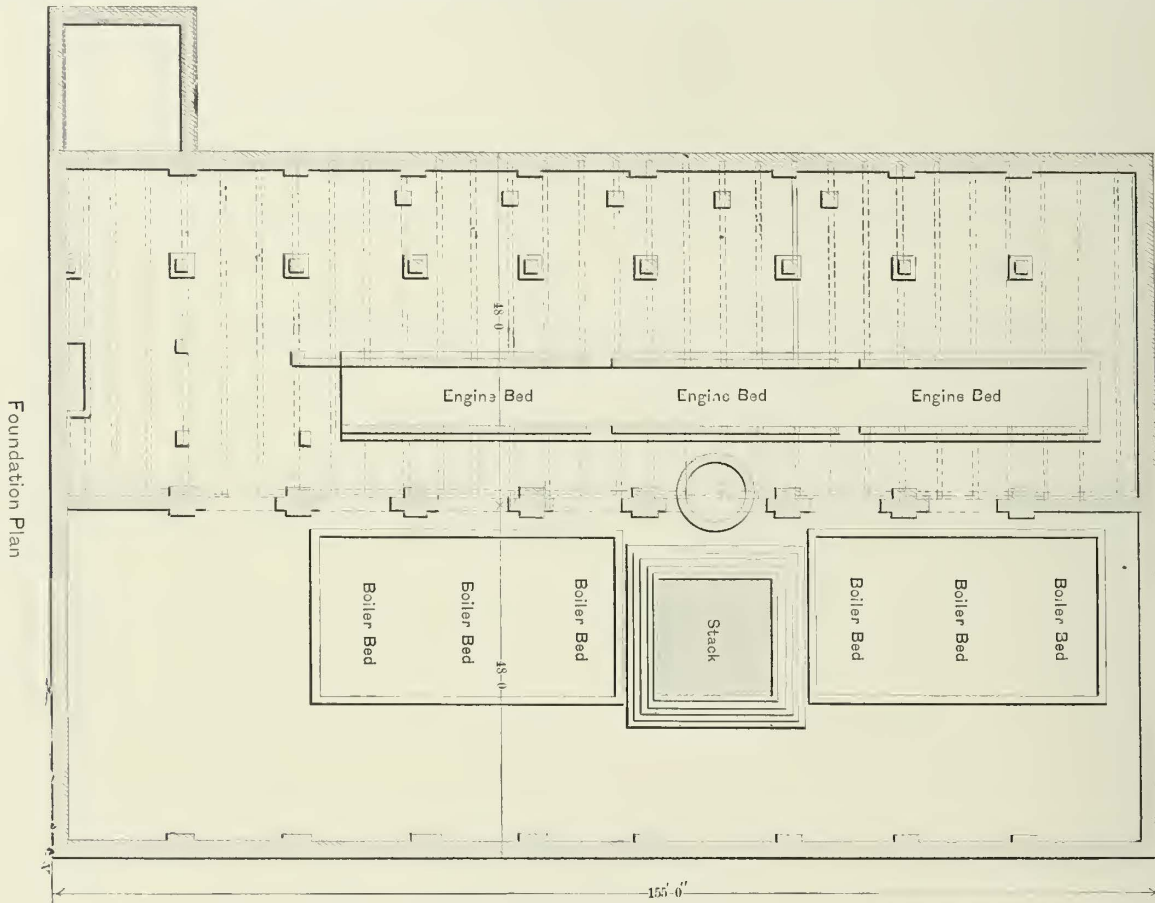
coat. Their length is twenty-eight feet, of which six feet is underground. The poles were furnished by the Electrical Construction & Supply Co., of Pittsburgh. The pole top is that of the Railway Equipment Co., of Chicago, who furnished the entire overhead equipment with the exception of the wire, including hangers, glass insulators, etc.

The trolley wire is of the best Lake Superior copper, and the gauge is No. 6 B. & S. Most of the feed wire has a cross section of 500,000 circular mils. The entire wire and feeder contract was awarded to the McIntosh-Huntington Co., of Cleveland, who purchased their supply of the Western Electric Co., of Chicago. The company decided to start with forty electric cars, and the order for

economy in working. The building is located on the West Side, about 300 ft. from the Cuyahoga River, from which water is brought for condensing purposes in an eighteen inch main. The structure can readily be seen from the Superior Street viaduct.

The building has a frontage of 160 ft. and a depth of 140 ft. It is one story in height, and is built of brick with stone trimmings. As the illustration shows, the structure is covered by two separate roofs, one over the boiler room and the other over the engine and generator room. The smoke stack rises to a height of 175 ft., and rests on a foundation built on piles.

To provide an abundance of air, a space of five feet will be left under the flooring; the latter will be



PLAN OF POWER STATION—WOODLAND AVENUE & WEST SIDE RAILWAY.

the bodies and trucks was given to the J. G. Brill Co. The length of the bodies will be twenty-one feet, with platforms four feet six inches, making the cars thirty feet over all. They are to be finished in mahogany with birch decorations for the ceilings. Doors at the side near the step are provided to facilitate getting in and off. Plate glass will be used in the windows and cut glass in the ventilators. The latter will be of a new design similar to those used in steam railroad coaches. Wilton carpet will cover the seats. Illumination will be provided by ten incandescent lamps, one on each platform, and four each on two chandeliers within the car.

The motors will be of the Westinghouse single reduction type. Two motors of twenty-five horse power each will operate each car.

The power house embodies a number of features which render it of especial interest. In its equipment it will be unique, and its operation will be carefully watched by railway men. The management determined upon departing from the ordinary practice only after extended study, and they believe their plant will show a marked

constructed of I beams with arches of tile, and covered with cement. Steam will be generated in three boilers of the Scotch marine type, of a capacity of 500 H. P. each. The engines will be three in number, of the marine type, and triple expansion. They will run with two foot stroke and 140 revolutions, making the piston speed 560 ft.

Coupled to an extension of the engine shaft at each end will be a Westinghouse multipolar generator of 250 H. P., designed to run at 140 revolutions. The direct connection of triple expansion engine and generator has certainly not been attempted in this country heretofore, but the company are confident that the best results will be accomplished. The engines and boiler were constructed by the Globe Iron Works Co., of Cleveland. The engines were originally designed for marine service, but the company consider that they embody a number of substantial points of excellence for street railway service.

The switchboard will be a novel construction. The foundation will consist of a series of pillars on which will rest an I beam. On the latter will be laid a course of tar-

red wood from which will rise a solid brick wall forming the switchboard. The face and ends will be built of enamel brick set very close. The brickwork will be ten feet six inches in length, and will be completed by ornamental framework of antique oak, making its total length thirty-six feet. The measuring instruments, which are to be of Westinghouse type, are to be bolted through the brickwork, and connections through it will be made by means of rubber tubing.

In charge of the electrical installation is Mr. F. W. Waterman of the Westinghouse company of Pittsburgh, who has been most successful in designing much of the work, and who is responsible for a great many details which will be thoroughly appreciated when the system is in operation.

The company have built extensive new car house and shops at the corner of Lorain Avenue and Henley Street, about four miles from the downtown terminus. The structure is brick with stone trimmings, and will be complete in its arrangement and equipment. The illustrations present a perspective view of the structure which is divided into two buildings joined at the front by a tower rising to a height of seventy feet. The total depth is 372 ft. and the frontage is 160 ft. on Lorain Street. Back of the tower the shops and car house are separated by a fifteen-foot alley. The terminal loop is a track passing about the buildings and through an inspection room at the rear equipped with pits and overhead platforms for inspection purposes. The cars stop at the waiting room for passengers, shown at the left in the perspective view. The arrangement of tracks is such that cars may be readily switched at three points from the main track in front into the car house, and by a system of switches to any point in the building. They can in the same way be switched from the building at the rear. For 150 ft. at the rear of the car house, the cars are run over pits, the tracks being supported on I beams. The shops will be equipped with the most approved machinery for repair work.

CLEVELAND CITY CABLE CO.

Capital stock.....	\$4,000,000	
Bonds.....	1,884,000	
		\$5,884,000
Miles of Track :		
Cable.....	19.25	
Horse.....	13.	
		32.25
Number of passengers carried during the year ended June 31, 1892.....		7,900,000

- President, FRANK DEH. ROBISON,
 Vice-President & Treasurer, JOHN J. SHIPHERD,
 Second Vice-President, GEORGE H. HOLT,
 Secretary, W. PARSONS,
 Assistant Secretary, G. A. SCHRIEFER,
 Superintendent, M. S. ROBISON.
- DIRECTORS :
- | | |
|---------------------|-----------------|
| FRANK DEH. ROBISON, | M. S. ROBISON, |
| JOHN J. SHIPHERD, | GEORGE H. HOLT, |
| CHARLES HATHAWAY, | G. E. TAINTOR, |
| G. D. L'HUILIER. | |

Over three years ago the Cleveland City Cable Co., acquired possession of the Superior Street railway and the

St. Clair Street railway, both of which were operated by horses. The new company determined to introduce on a portion of their system improved transit facilities, and the work of introducing the cable on Superior Street and Payne Avenue was at once begun. These two lines, of which the aggregate length is nineteen and a quarter miles, were first operated by cable in December, 1890. The St. Clair Street line is still traversed by horse cars, but steps have been taken to equip it with electricity.

The track construction and the underground work generally for the cable system is of the most substantial character. The conduit, which is eighteen inches in depth, is made of English Portland cement and was laid up about folding cores. The cast iron yokes, weighing 365



JOHN J. SHIPHERD,
 VICE-PRESIDENT CLEVELAND CITY CABLE CO.

lbs each, are placed every five feet and rest upon a foundation of concrete. The chilled carrying pulleys are sixteen inches in diameter and are spaced thirty-five feet, apart. The curve pulleys, which have removable rings with chilled grooves, are forty-two inches in diameter.

The track is laid with Wharton girder rail weighing seventy-eight pounds to the yard, the joints resting directly upon the yokes. The slot rails are of the Z type and are placed an inch higher than the track rails, so that a watershed is formed. The tracks and the space between tracks are paved with granite blocks.

The power house of the company is located on Superior Street near Madison Avenue, and the building is one of the most ornamental structures used for the purpose in the country. It is artistically built of pressed brick, with high clock tower and office front, with a smoke stack at the rear reaching a height of 150 ft. The plant was designed by the late Col. Wm. H. Paine, assisted by Robert Gillham.

Steam for the station is generated in three Babcock & Wilcox boilers of 362 H. P. each, the fuel being crude oil which is piped directly from Lima, O., to an iron reservoir in the station. The oil is delivered to the furnace in the form of a spray under a pressure of from five to eight pounds, and is combined at the burner with a jet

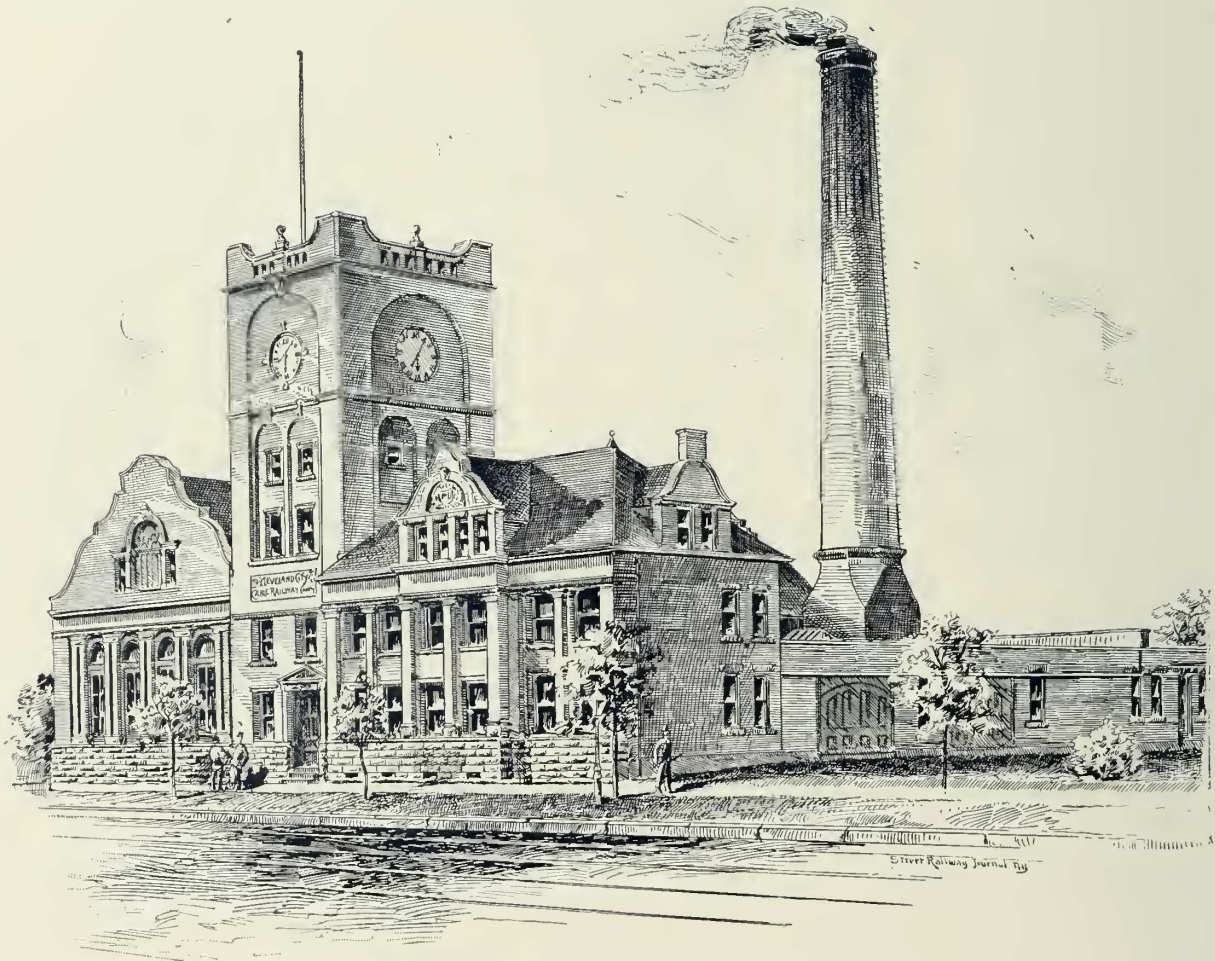
of live steam from the boilers. The oil flows by gravity from the reservoir to a small circulating pump, by means of which a portion is forced to the burners, the rest flowing back to the storage tank.

Two engines built by Wm. Wright of Newburgh, N. Y., each of 1,250 H. P. with cylinders 38×60 ins., furnish the power for driving the ropes. The flywheels are twenty-four feet in diameter and weigh sixty-five tons each. Each engine is able to carry the entire load, so that one is always held in reserve.

The main shaft is sixteen inches in diameter, and is ninety feet in length. The method of transmitting the power from this shaft to the winding drum is somewhat novel. The object of the designers of the plant was to

lowed between the faces. The disks are then connected by a key set into the face of each disk which is held in place by two large bolts passing through the coupling keys. In case it is required to put an additional wrap on the drums, the key is removed, and the rope passed through between the faces of the disk, when the keys are readily replaced. The whole operation may be performed in a brief period of time. The shaft is also provided with powerful friction clutches for the purpose of cutting out any set of winding drums.

The winding drums are provided with Walker differential rings, and all the winding machinery for the plant was supplied by the Walker Manufacturing Co., of Cleveland.



POWER STATION OF THE CLEVELAND CITY CABLE RAILWAY.

dispense with the auxiliary shaft ordinarily used, and diminish the number of gears without sacrificing at the same time the overhanging feature for the drums. The desired end is attained by leading the main shaft between the different sets of winding drums to which, by means of pinion and gear, it transmits its power, the engines being attached at either end. The pinions on the main shaft are about five feet in diameter and twelve-inch face, engaging on either side with gears thirteen feet in diameter with the same width of face, mounted on the winding drum shafts. Each set of drums varies in diameter, depending upon the different speeds of cable required.

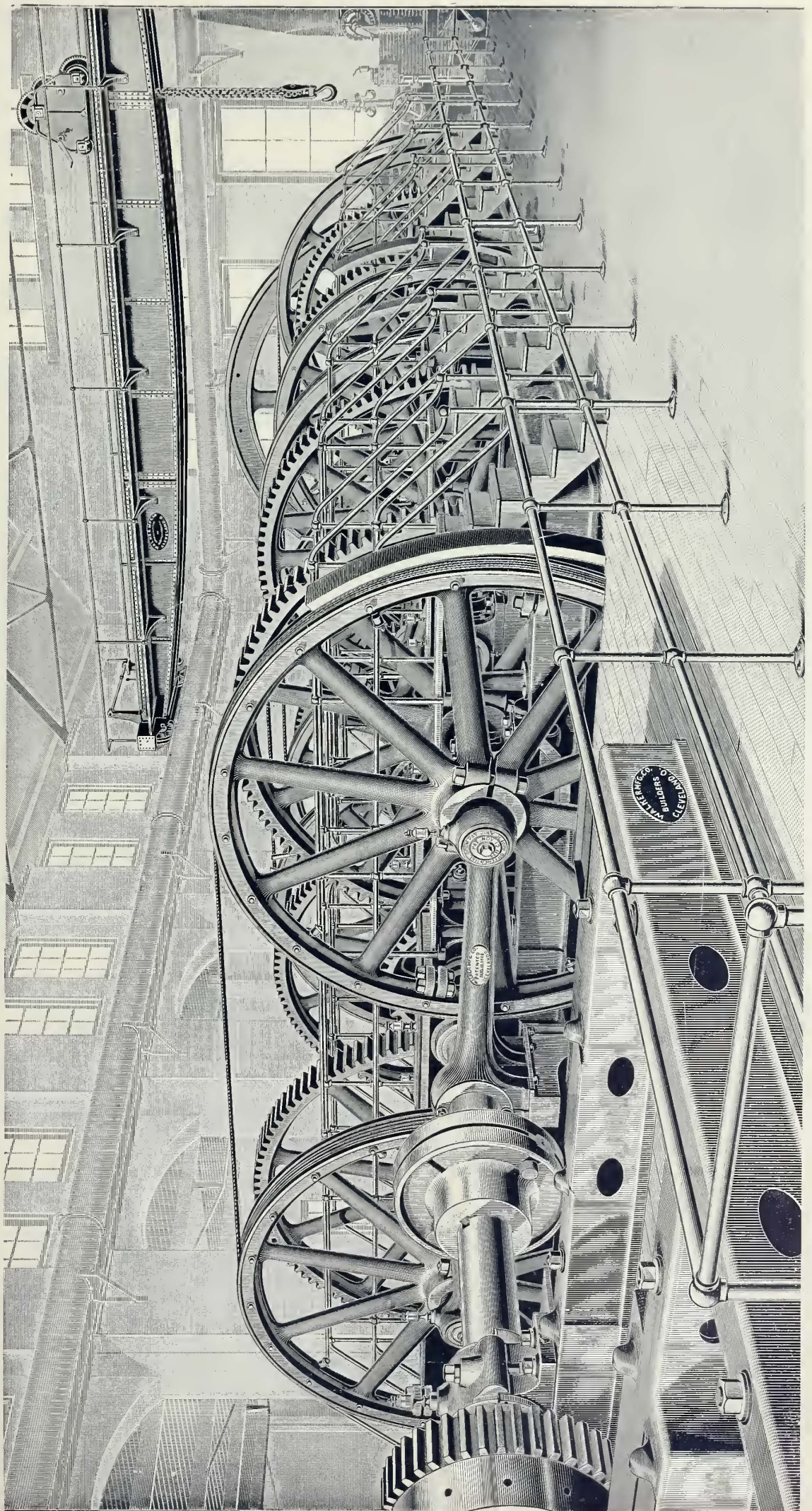
The plant is designed for driving six independent cables, but only four are yet in position, as shown. To provide for placing additional wraps upon the drums without cutting the cable, the main shaft is divided into sections measuring thirty feet each, which are connected together by means of coupling and steel keys. Each section terminates in a large disk, two-inch spaces being al-

The tension carriages, four in number, are located in a well lighted room 80×100 ft., directly back of the engine room. Each carriage consists of a twelve-foot sheave mounted on a frame twenty feet long and three feet wide, which is carried on four twenty-four inch truck wheels. The track extends the entire length of the room. Each carriage is provided with a sheave drum by which it is drawn back by the pull from circular weights weighing several thousand pounds each. The latter, which are changed according to the load, are slotted so that they may be easily and quickly removed. The weights on the several lines range from 4,000 to 7,000 lbs. Provision has been made in the room so that the number of tension carriages may be increased to six.

An overhead traveling crane, capable of lifting the heaviest piece of machinery in the plant, is an interesting and desirable adjunct to the station.

One of the interesting features of the system is the auxiliary machinery located underground in Superior

Street, near the post office. An auxiliary rope, running at a speed considerably less than that of the main cable, is required for the downtown route of the line, which turns from Superior Street into Water Street. At the end of the latter street is a grade of sufficient length so that cars are switched from one track to the other by gravity. The design of the auxiliary machinery, which is similar to that of the drums of the driving plant, occupies a space below the surface about thirty by ninety feet, the street being supported by means of steel I beams with brick arches laid in cement mortar. The main Superior Street cable, at a speed of twelve miles per hour, enters the vault, thence with half wraps embraces the two twelve-foot overhanging driving drums, shown in the left of the figure, thence to an end sheave in the same vault, and by the south track tube returns to the station. The shafts of the auxiliary drums are provided with pinions four feet in diameter with ten-inch face, which engage with gear wheels ten feet in diameter having the same width of face, which are mounted on the shafts of the auxiliary driving drums which are also



INTERIOR OF POWER STATION—CLEVELAND CITY CABLE RAILWAY.

twelve feet in diameter (shown on the right), all the shafts being ten inches in diameter. The initial drum

tem, are operated from the power station, running for a distance of 2,500 ft. through two twenty-inch blind conduits made of vitrified pipe.



STREET SCENE DURING THE CONSTRUCTION OF THE CABLE LINES.

shafts are also provided with friction clutches. By this arrangement the speed of the auxiliary cable is normally six miles per hour. From the auxiliary drums the cable passes to the tension carriage, with twelve-foot horizontal sheaves mounted on an incline of twenty degrees in the same pit, but not shown in the figure. The auxiliary machinery is mounted upon cast iron girder frames resting upon brick foundations, the side section of the frames being 12×14 ins. and provided with adjustable pedestal boxes. All the drums are overhanging with struts.

The lengths of the four cables are as follows: Western Superior Street, 24,300 ft.; Eastern Superior Street, 23,900 ft.; auxiliary, 7,850 ft.; Western Payne Avenue, 24,050 ft.; Eastern Payne Avenue, 26,300 ft. The ropes are of the John A. Roebling's Sons Co's. make.

The Superior Street road is a straight line extending to Doan Street. The Payne Avenue line follows Superior Street for a considerable distance and then branches off to the south. The two sections of cable necessary for the Payne Avenue branch of the sys-

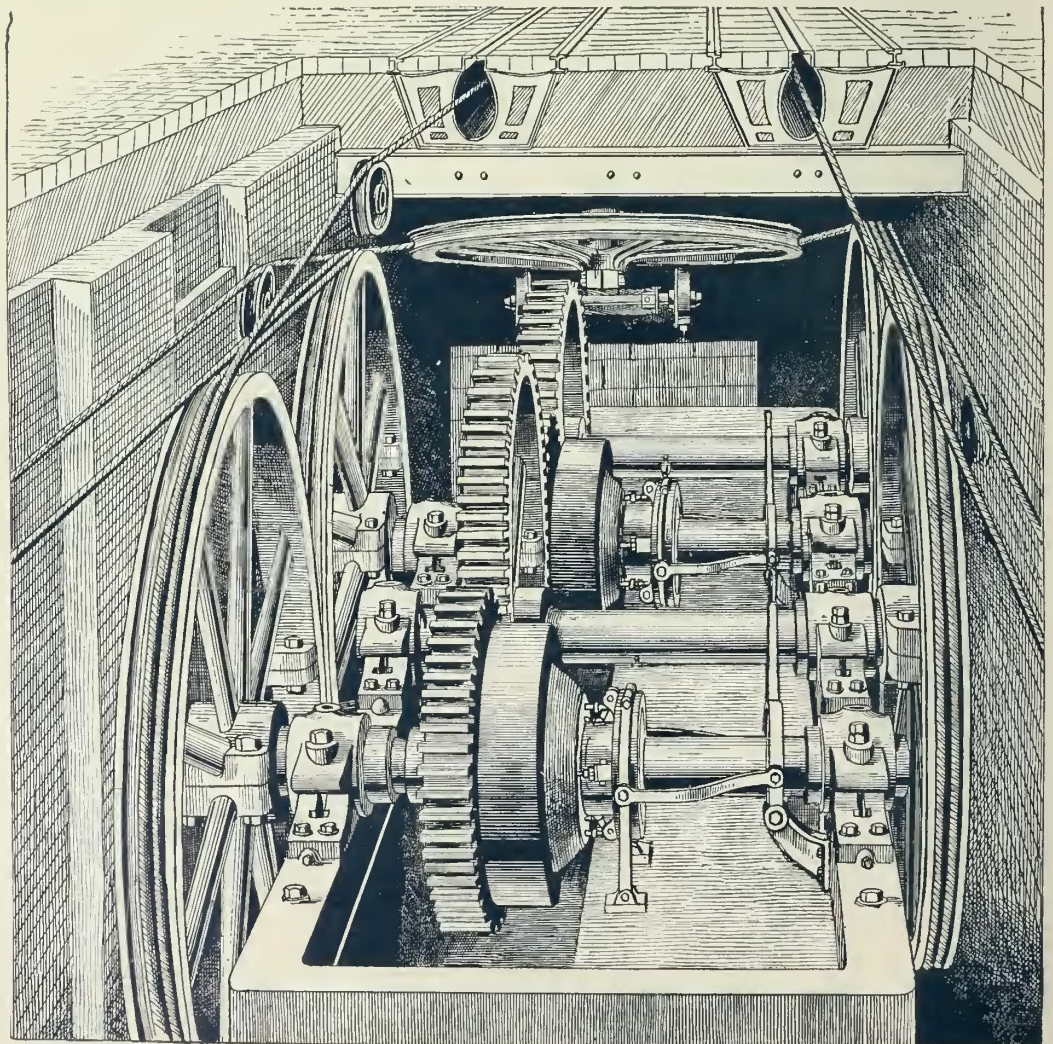
tem, are operated from the power station, running for a distance of 2,500 ft. through two twenty-inch blind conduits made of vitrified pipe.

The main cables on Superior Street and Payne Avenue run at a speed of twelve miles per hour. The cable east of the power house runs at a speed of fourteen miles per hour.

The company own forty-seven grip cars of the Stephenson make; they are provided with a special pattern of grip designed by the late Col. William H. Payne, and with Johnson automatic brakes. The passenger cars, which are 131 in number, were manufactured by the J. G. Brill Co., and J. M. Jones' Sons. Stephenson, Dorner & Dutton, and Brill trucks support the cars.

The principal car house of the company is located at the eastern terminus of the Superior Street line. The building is a brick structure one story in height with a frontage of about 200 ft., and a slightly greater depth. Six tracks are laid within the car house, and four transfer tables, made by Alfred G. Hathaway, of Cleveland, are provided

for shifting cars from one track to another. The cable company employ the transfer table in all their car houses,



PIT MACHINERY FOR DRIVING AUXILIARY CABLE—CLEVELAND CITY CABLE RAILWAY.

and thirty are used in Cleveland. When cars enter the building, when coming from the city, they are run over a

cement lined pit where they are thoroughly washed and inspected. Thence the cars are shifted to the outgoing track.

BROOKLYN STREET RAILROAD CO.

Capital stock.....\$600,000
 Bonds..... 600,000
 \$1,200,000

Miles of Track :
 Electric.....30

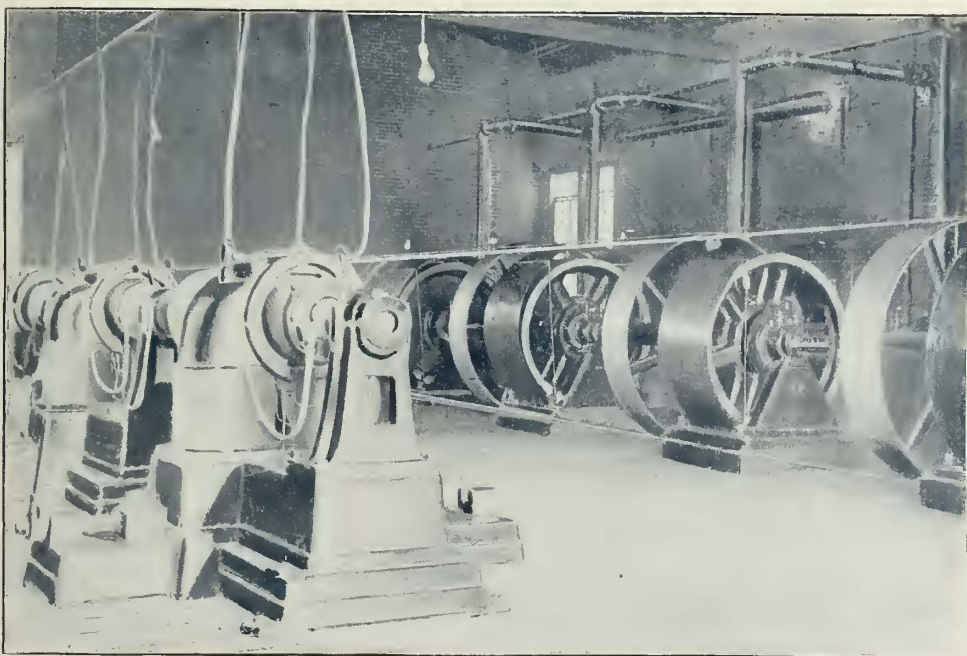
President, TOM L. JOHNSON,
 Vice-President, A. L. JOHNSON,
 Secretary & Treasurer, H. J. DAVIES,
 Superintendent, SAMUEL HARRIS.

DIRECTORS :

TOM L. JOHNSON, JOHN F. WHITELAW,
 A. L. JOHNSON, W. B. HALE,
 H. J. DAVIES, L. A. RUSSELL,
 A. I. DU PONT.

consider the Brooklyn company alone as operating all the lines.

The Brooklyn Street Railroad Co., was incorporated in 1869. The company built and operated a single track horse car line from Spring Street, in the village of Brooklyn, northerly along what was then Columbus Street, now Pearl Street, to Lorain Street, in the city of Cleveland, a distance of about two miles. The incorporators were : Adam W. Poe, John S. Fish, A. Clark, B. F. Tyler and Seymour Trowbridge. In 1879, Mr. Tom L. Johnson acquired a controlling interest in the stock of the company, and steps were at once taken to extend the road from Lorain Street to the Superior Street viaduct and thence to the Public Square. The tracks in Pearl Street, between the viaduct and Lorain Street, were owned by the West Side Street Railroad Co., who refused to permit the Brooklyn company to use them. Prolonged negotiations and litigations resulted, the Brooklyn company finally securing the right to run their cars to the Public Square, paying the West Side company a rental for the use of their tracks. In the meantime, Mr. Johnson transferred his passengers at the corner of Pearl and Lorain Streets to omnibuses, and so carried them to the centre of the city. The road was subsequently extended through Scovill Avenue into the eastern part of the city, and from Scovill Avenue south on Willson Avenue and other streets to Forest City Park. The distance between the present termini of the main line of the road is about ten miles.



SCOVILL AVENUE POWER STATION—BROOKLYN STREET RAILROAD CO.

SOUTH SIDE STREET RAILROAD CO.

Capital stock.....\$300,000
 Bonds..... 300,000
 \$600,000

Miles of Track :
 Electric.....10

President, A. L. JOHNSON,
 Vice-President, TOM L. JOHNSON,
 Secretary & Treasurer, H. J. DAVIES,
 Superintendent, SAMUEL HARRIS.

DIRECTORS :

A. L. JOHNSON, H. J. DAVIES,
 TOM L. JOHNSON, W. B. HALE,
 JOHN F. WHITELAW.

It will be noticed by reference to the preceding lists of officers that the Brooklyn Street Railroad and the South Side Street Railroad companies are under the same management. The two roads are practically operated as one system, and it is customary in Cleveland to

consider the Brooklyn company alone as operating all the lines.

The South Side Street Railroad Co. was incorporated in 1872, and for years operated a road on a small scale. Bobtail cars, each drawn by a single horse, formed the rolling stock, and a six-cent fare was charged. In 1885 Mr. Johnson and his associates secured possession of the property. At present the road extends from the village of Brooklyn by way of Pearl Street, Clark Avenue, Jennings Avenue, the Central Viaduct, Ontario and Superior Streets to the centre of the city, running through one of the most desirable portions of the city. The South Side company also operate a line on Scranton Avenue and Seneca Street, two and a half miles in length.

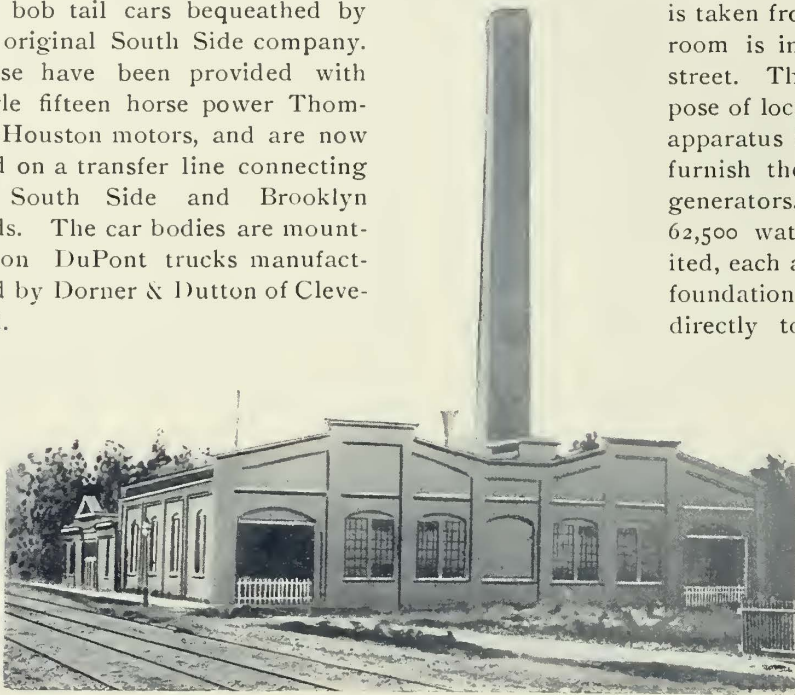
The company meet with a number of heavy grades on their lines. On the main line four grades as high as 6 per cent. are encountered. On the Scranton Avenue line there are two 8 per cent. grades extending for a distance of 1,000 ft. each. Cars running on this route are operated without trailers, and as a measure of precaution, each car is provided with a track brake of the company's own design.

In the summer and fall of 1889 the motive power for operating the cars was changed to electricity, and both systems are now electrically equipped. The track is laid with Johnson girder rail, a part weighing fifty-two pounds to the yard, and the remainder seventy-eight pounds

The lighter, which was laid for horse car service, is to be replaced by rail of a heavier weight.

The overhead system is built with side pole construction throughout. The original overhead work was done by the Thomson-Houston Electric Co., but since that time the company have done all work of this kind, and now manufacture all the appliances and devices for the overhead equipment.

The two companies own and operate seventy motor cars and ninety-two trailers. These are all of the Stephenson make with the exception of a few bob tail cars bequeathed by the original South Side company. These have been provided with single fifteen horse power Thomson-Houston motors, and are now used on a transfer line connecting the South Side and Brooklyn roads. The car bodies are mounted on DuPont trucks manufactured by Dorner & Dutton of Cleveland.



SCOVILL AVENUE STATION—BROOKLYN STREET RAILROAD CO.

Most of the motor cars are equipped with two Thomson-Houston double reduction, fifteen horse power motors. In addition, five cars are equipped with Wightman motors, one is operated by Westinghouse motors, and one by a Short gearless motor.

The companies own three power houses, one located on Pearl Street near their office, one on Canal Street near the Central Viaduct, and one at the corner of Scovill Avenue and Florence Street. Originally each of these stations supplied its own district, but at present the lines are connected together, all three plants feeding into the general network. The Scovill Street station is the most pretentious structure in appearance, as it was built specially as a power station. It was completed with the apparatus ready for use in May, 1890. The structure has a frontage of eighty-eight feet, with a depth of forty-eight feet. The smoke stack is 165 ft. in height. The steam for the station is generated in three boilers eighteen feet in length, and of 150 H. P. capacity each, made by the Variety Iron Works Co. of Cleveland. They are equipped with the Roney mechanical stoker. Slack is used as fuel. Water is taken from the city mains.

The room in which the engines and generators are located is seventy-five feet in width and forty-eight feet in depth. It is well lighted, and the plant is conveniently arranged. The 16 x 24 in. engines are five in number, and were manufactured by the Straight Line Engine Co., of Syracuse, N. Y. The engines are connected by belts, made by the Bodifield Belting Co., of Cleveland, to five

Thomson-Houston generators of 62,500 watts capacity each. The switchboard, which is of the company's make, is supplied with Thomson-Houston instruments.

The largest power station of the Brooklyn company is that situated on Pearl Street adjoining the general offices. The boiler room contains five boilers of 150 H. P. each, made by the Variety Engine Works Co., of Cleveland. Butman furnaces are used with Jarvis settings. Until recently the company secured water from their artesian well, but finding that it caused a great amount of scale in the boilers, it has been discarded, and the supply is taken from the city mains. The engine and generator room is immediately in front and looks out upon the street. The machinery has been arranged with the purpose of locating as large an amount of power generating apparatus in the space as possible. Five Ball engines, furnish the power for driving the Thomson-Houston generators. The latter are ten in number, each of 62,500 watts capacity. As the space is extremely limited, each alternate machine has been placed on a raised foundation four feet in height. They are connected directly to the engines by Bodifield belts, each engine driving two machines by two fly-wheels.

The third station is located on Canal Street, and the equipment is similar to that employed in the Pearl Street plant. Six boilers of 150 H. P., of the Variety Iron Works Co., generate the steam. Power is supplied by seven Ball engines of 125 H. P., each of which is connected to one of seven Thomson-Houston generators by a Bodifield belt.

The companies own four car houses; one located in Brooklyn, one on Pearl Street, one at the Ciark Avenue terminus and one on Willson Avenue.

BROADWAY & NEWBURGH STREET RAILROAD CO.

Capital stock.....	\$1,000,000
No Bonds	
Miles of track	
Electric.....	26

President, HORACE E. ANDREWS,
 Vice-President and Superintendent, JOHN J. STANLEY,
 Secretary and Treasurer, DR. EDWIN FOWLER.

DIRECTORS:

HORACE E. ANDREWS, DR. EDWIN FOWLER,
 JOHN J. STANLEY, SAMUEL ANDREWS,
 CHARLES J. SEABROOK.

The company have been operating a street railway since 1873, although the incorporation was effected some time before. The beginning of the enterprise was modest enough, for at first only four cars were run. The route which was then followed was a portion of the present Broadway line, the terminus being at Union Street. The road was subsequently extended to Newburgh, the present terminus of the road, and in 1885 the use of horses was discontinued and the Sprague electric system was installed. Twenty-five motor cars were put into service, the bodies being furnished by the J. G. Brill Co. The

Belt line, which was equipped from the first as an electric system, was put into operation in April, 1891.

The company have recently discarded the last of their light rails, and can boast of a splendid track construction throughout their entire system. All the rails are of the



JOHN J. STANLEY,

VICE-PRESIDENT BROADWAY & NEWBURGH STREET RAILROAD CO.

Johnson Co's manufacture. Twenty miles are laid with rails weighing eighty-two pounds to the yard, and the remainder is laid with the latest type of ninety-eight pound rail. The latter is spiked directly to the ties, the former resting on Johnson chairs. Oak ties measuring 5×8 ins.

opinion. His experience generally is that each method has its advantages and disadvantages which so nearly counterbalance each other that it is hard to express a preference. In laying the last rail during the hot weather, no allowance whatever was made for expansion, the ends being butted up snugly to each other.

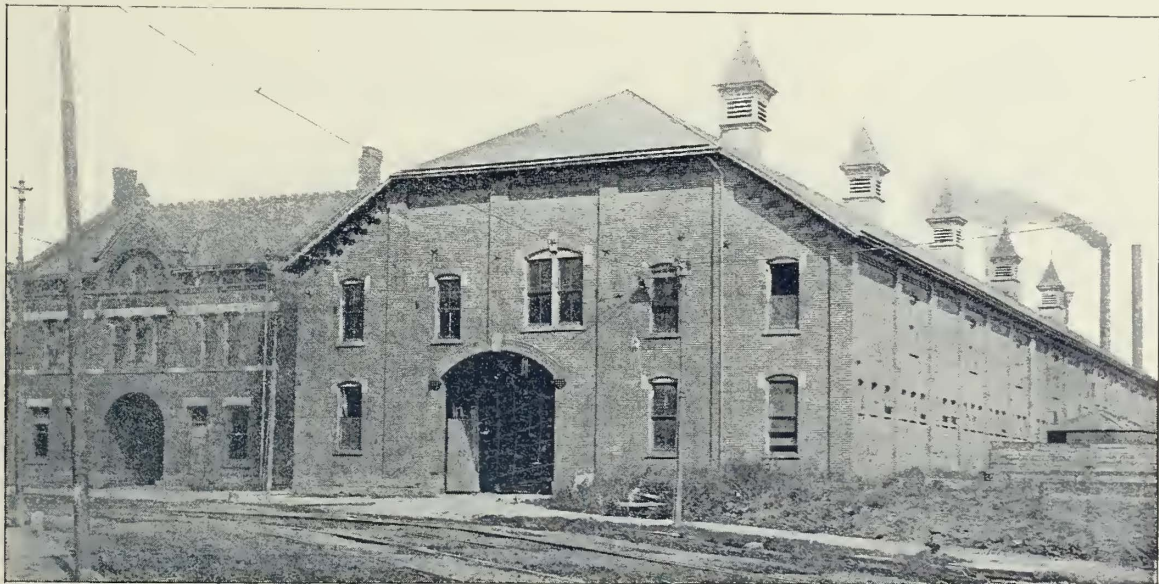
Side metal pole construction is followed throughout the system. The trolley wire is of silicon bronze, which, with all the overhead construction, was put up by the Cleveland Construction Co.

The rolling stock of the company consists of the following motor cars: Twenty five Edison (Sprague), twelve Short, of which eleven are double reduction and one single reduction, and one Westinghouse single reduction. The bodies for the motor cars were built by the J. G. Brill Co. All the cars are mounted on single Brill trucks, although twelve of the car bodies are twenty-one feet in length. The cars now used as trailers were constructed by the same company and by J. M. Jones' Sons.

The power station is located on Broadway, corner of Aetna Street, about four miles from the Public Square. The site is particularly advantageous inasmuch as it is very nearly in the centre of the system, and is in proximity to the heaviest grades which the motors are obliged to surmount. The building in which the power plant is located is a brick structure $325 \text{ ft.} \times 62 \text{ ft.}$

The boiler room occupies the rear section of the building, directly back of which are railroad tracks. Coal is brought to this point in cars, and is shoveled into the rear windows of the boiler room. The boilers are five in number, each of 200 H. P., and were constructed by the Variety Iron Works Co. of Cleveland.

In the adjoining section is located the engine and generator room. This part of the plant is of peculiar interest inasmuch as the four Reynolds-Corliss engines, made by the E. P. Allis Co. of Milwaukee, Wis., are belted



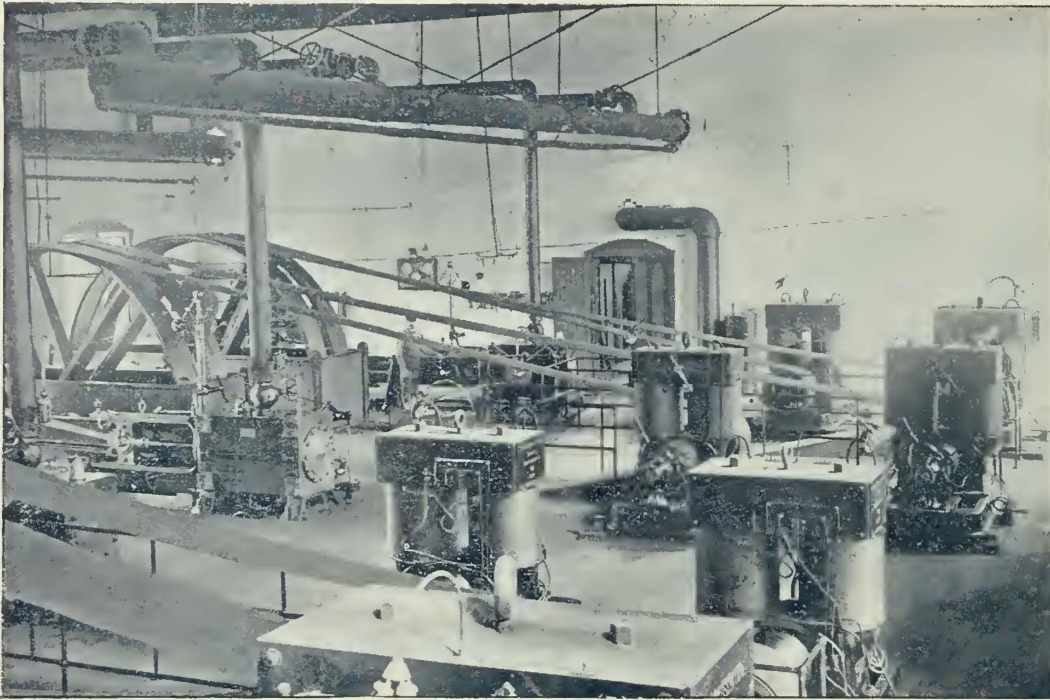
GENERAL OFFICES AND POWER STATION—BROADWAY & NEWBURGH STREET RAILROAD CO.

are used except at the joints, on each side of which, at a distance of about eight inches, a tie measuring 5×12 ins. $\times 7$ ft. is laid. In the most recent construction the company have followed the practice of breaking joints. Prior to this the joints have been made even. As to the relative advantages of breaking joints and laying them even, the superintendent, Mr. Stanley, is not prepared to express an

opinion. This method of connection is found to give excellent results, and the plant is unquestionably one of the most economical in the city. The largest of the engines is of 600 H. P., and the flywheel, which makes seventy revolutions per minute, has a diameter of twenty-four feet. The face of the flywheel is made with a double crown, and it is connected to two No. 80

Edison generators of a capacity of 150 k. w. each. The pulleys of the latter are thirty-six inches, and their speed about 550 revolutions.

slate switchboard, constructed by the W. B. Cleveland Co., of Geneva, O. It is provided with the latest forms of circuit breakers and lightning arresters of the Cleveland type. The arrangement is such that when a circuit breaker acts, the attention of the engineer is immediately called to the fact by the ringing of a gong.



INTERIOR OF POWER STATION—BROADWAY & NEWBURGH STREET RAILROAD CO.

The other three Allis Reynolds-Corliss engines are of 250 H. P. each, and each has double sixteen-foot flywheels, making eighty-eight revolutions per minute. They are belted to six Edison 80 k.w. generators with pulleys twenty-

structure was carefully planned to meet the requirements of the service, and it has proved highly convenient in arrangement and appointment. The structure is brick, and it serves a variety of purposes. All cars pass through it



CAR HOUSE—BROADWAY & NEWBURGH STREET RAILROAD CO.

six inches in diameter, and have a speed of about 700 revolutions.

The belts, which are twenty-four inches in width on the larger engine and eighteen inches wide on the smaller engines, were made by the Charles Munson Belting Co. of Chicago, and the Chicago Belt Co.

Current is distributed by a handsome, marbled

on a track forming part of the terminus loop, and this track and an adjoining one to which cars can be switched if light repairs are necessary, are provided with pits extending the entire length of the building. The cars are inspected and ordinarily are washed each trip.

Outside the building, at the rear, the loop track spreads into a number of tracks leading to the repair

shops which adjoin the car house proper. Extending the entire length of the repair department is a cement lined pit, at the bottom of which a hydraulic jack, mounted



MOTOR REPAIR SHOP—BROADWAY & NEWBURGH STREET RAILROAD CO.

on a truck, travels on a track. By means of the jack, motors can be readily lifted from under the car bodies. For lifting the car bodies, a frame with screw jacks at each corner is provided. This appliance, which was designed by Mr. John J. Stanley, has been found to be extremely servicable. Cranes and chain hoists are available for moving the motors.

The machine room is adjoining; here are located a drill and lathe made by Strong & Turney, of Cleveland, and a fifteen horse power Sprague motor, which furnishes all the power required, taking the current from the railway circuit. In this section of the building is located the armature winders' rooms.

No oil is kept inside the building, but for storage purposes a small oil house has been erected in the rear of the main structure.

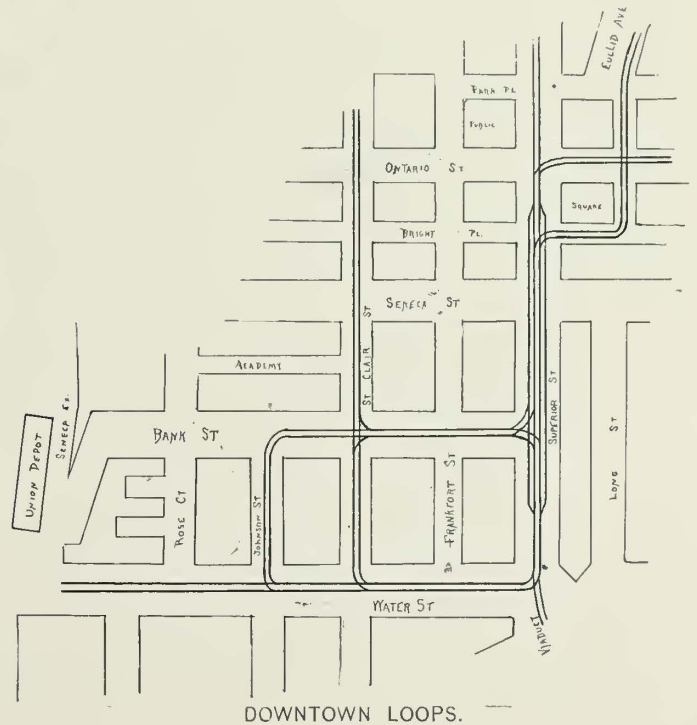
Superior Street and the Loops.

When Gen. Moses Cleaveland, the founder of the city ordered the original surveys, he fortunately provided Cleveland with a magnificent main thoroughfare. Stretching 120 ft. from curb to curb, Superior Street affords sufficient accommodation for vehicles of all classes. Its extreme width gave to all the railway companies an opportunity to reach the very centre of the city, although four tracks are necessary for this purpose. With this occupation of the street by cars there is still an abun-

dance of room for other vehicles. During the busy hours of the day as many as 700 cars pass hourly a given point on Superior Street, counting those passing in each direction, so that extensive terminal facilities are required.

Of the four tracks on Superior Street, the two outer are traversed by the cars of the Brooklyn and South Side companies and the Woodland Avenue & West Side Railroad Co. The Cleveland City Cable Co., the East Cleveland Co. and the Broadway & Newburgh use the two inner tracks. All cars follow a loop with the exception of those attached to the cable, which turn from Superior Street into Water Street and make a gravity switch at the end of the latter.

There is only a single trolley wire over the tracks traversed by the electric cars, and a joint arrangement is, of course, essential. The principle is followed that each company shall use their own power as far as possible, but on the common wires the supply is provided as follows: The Brooklyn Street Railroad Co. furnish power over the two outer tracks on Superior Street, the East Cleveland company send the current from their power station to the Bank Street loop and around the southwest driveway on the Public Square. The Brooklyn company keep alive the wire through the centre of the square, and thence through Ontario Street to the Central Market House, where their own and the cars of the Broadway & Newburgh Company diverge. The East Cleveland company and the Brooklyn company own in common the poles and



DOWNTOWN LOOPS.

wires on the Bank Street loop and on Superior Street west of the Public Square.

While this is the general arrangement, the circuits are so provided by switches that the distribution scheme can be materially varied, and, in case of necessity, power from one power station can supply the entire system of loops.

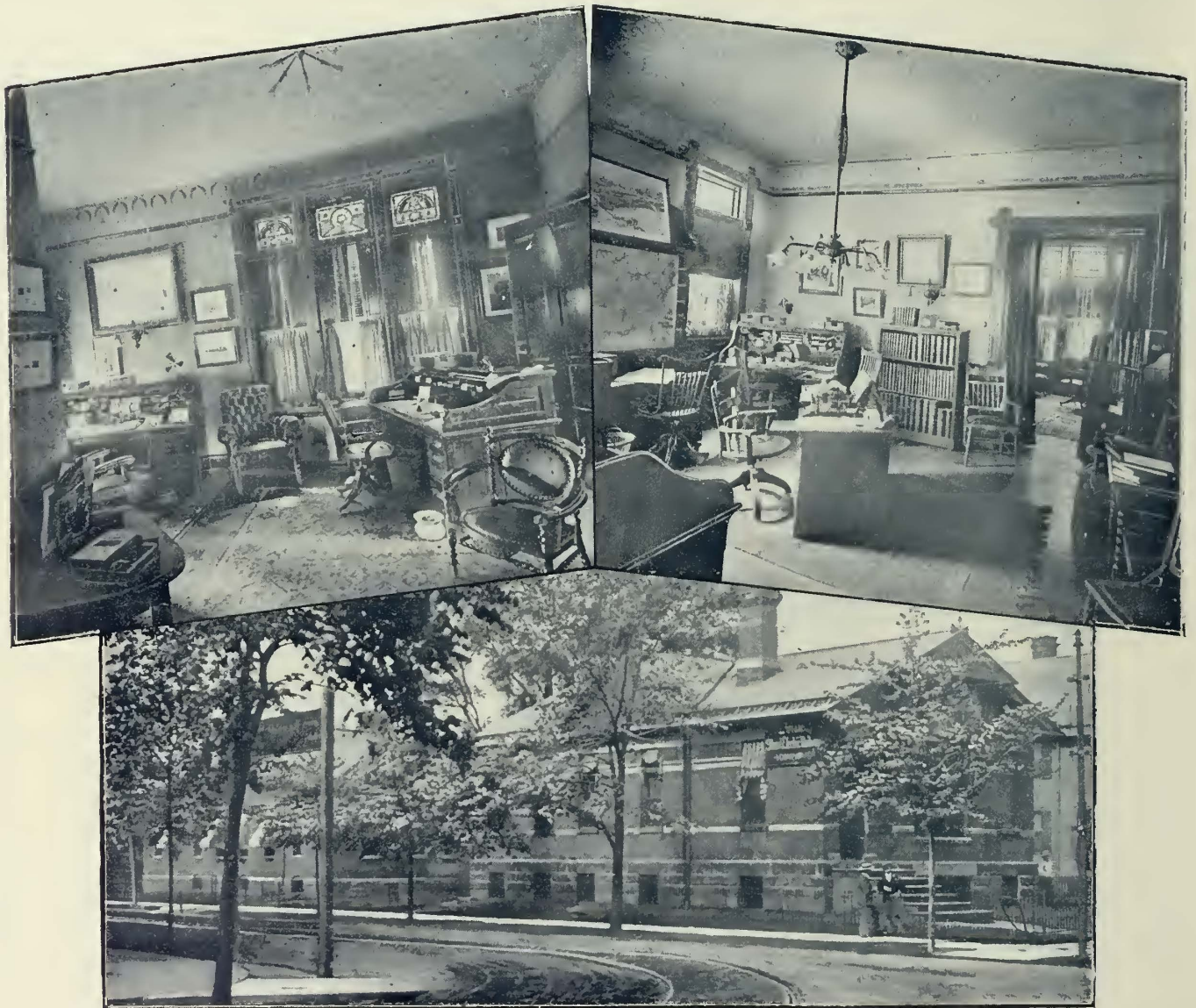
Each company keep a report of the number their cars using current in this system, and settlement is effected monthly on the car mile basis.

THE SHORT ELECTRIC RAILWAY COMPANY.

SKETCHES OF ITS HISTORY, ITS MACHINERY AND THE MEN WHO MANAGE IT.

The Short Electric Railway Co. conducts one of the leading enterprises of the convention city, an industry known the world over wherever the street railway exists. Despite the present magnitude of the business, its history covers but a brief period. While it may be stated in the conventional and time honored way that the company has sprung from an extremely modest beginning, it may also

struction. Its facilities for manufacture are to-day unsurpassed, but the spirit of improvement is still dominant, and even within the last few weeks new types of machinery have been constructed embodying changes designed to contribute to the efficiency of apparatus already regarded as wonderfully efficient. To the genius and indefatigable energy of Prof. Sidney H. Short are due the



OFFICES OF THE SHORT ELECTRIC RAILWAY CO.—INTERIOR AND EXTERIOR.

be added that the date of this origin is a recent one. In brief, it may be said that the entire record is included in the present rapid transit era. The sudden rise of the company into prominence is a counterpart of the rapid development of the electric railway system, the extension of which has occasioned so many rhetorical flourishes.

Since the Short company has been actively engaged in its particular work, it has repeatedly designed apparatus of more than ordinary interest, mechanically and electrically, and the introduction of several of its machines marks the dates of radical advancement in railway motor con-

struction. Its facilities for manufacture are to-day unsurpassed, but the spirit of improvement is still dominant, and even within the last few weeks new types of machinery have been constructed embodying changes designed to contribute to the efficiency of apparatus already regarded as wonderfully efficient. To the genius and indefatigable energy of Prof. Sidney H. Short are due the

growth of the enterprise and the development of the system which bears his name; but at the same time the fact should not be forgotten that a most important contributing factor in the company's prosperity has been the active association with the Brush Electric Co. with its splendid manufacturing plant and almost unlimited facilities.

The history of the Short Electric Railway Co. began legally in July, 1889, when it was incorporated with a capital stock of \$5,000,000; the preliminary steps, including the development of the railway system, are traced in the

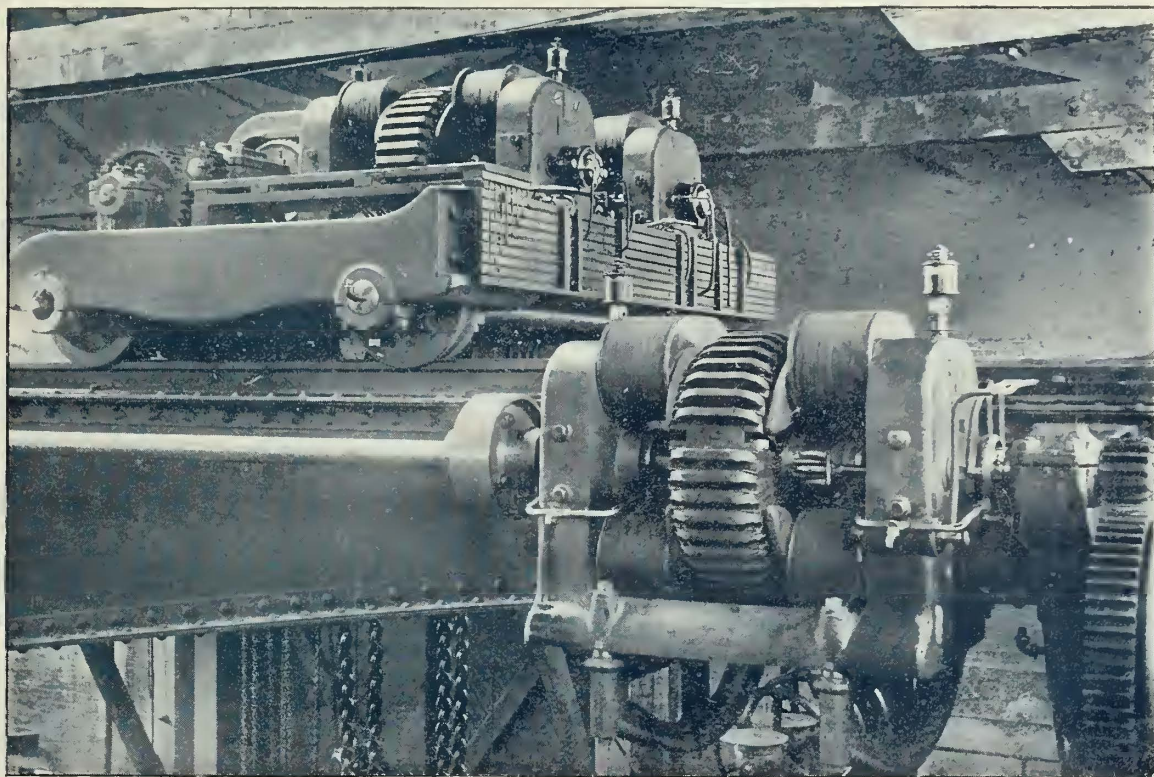


SIDNEY HOWE SHORT.

sketch of Professor Short's life, presented elsewhere in this issue. The Brush Electric Co. subscribed to a large share of the stock, and contracted to manufacture the apparatus of the new company. The time of the organization was opportune. The few electrical roads that were then considered in successful operation had attracted a much larger degree of attention than any excellence in method of construction or in electrical machinery warranted. At the same time the stockholders of horse car companies anxiously desired a change from animal power to some better form of car propulsion, and the public keenly shared in this spirit of anxiety. The almost eager willingness of street railway companies to install apparatus which they knew to be in an experimental stage only, and their

officers and one special agent." No manufacturer of railway motors will forget the sale of the 200 motors at Rochester, which created a positive sensation, for at that time, an order for such an equipment was unprecedented. The fact was commented upon in almost every technical journal in the world, as an event of marked significance. The construction of motors for the Flower City and other localities, brought a tremendous pressure to bear upon the factory, and the facilities were found to be inadequate to the demand. Double shifts of men were arranged, and the railway department was kept in operation seven days in the week.

The motor turned out at that time was of the double reduction type, and though this is a machine practically



MOTORS ON THE TRAVELING CRANE.

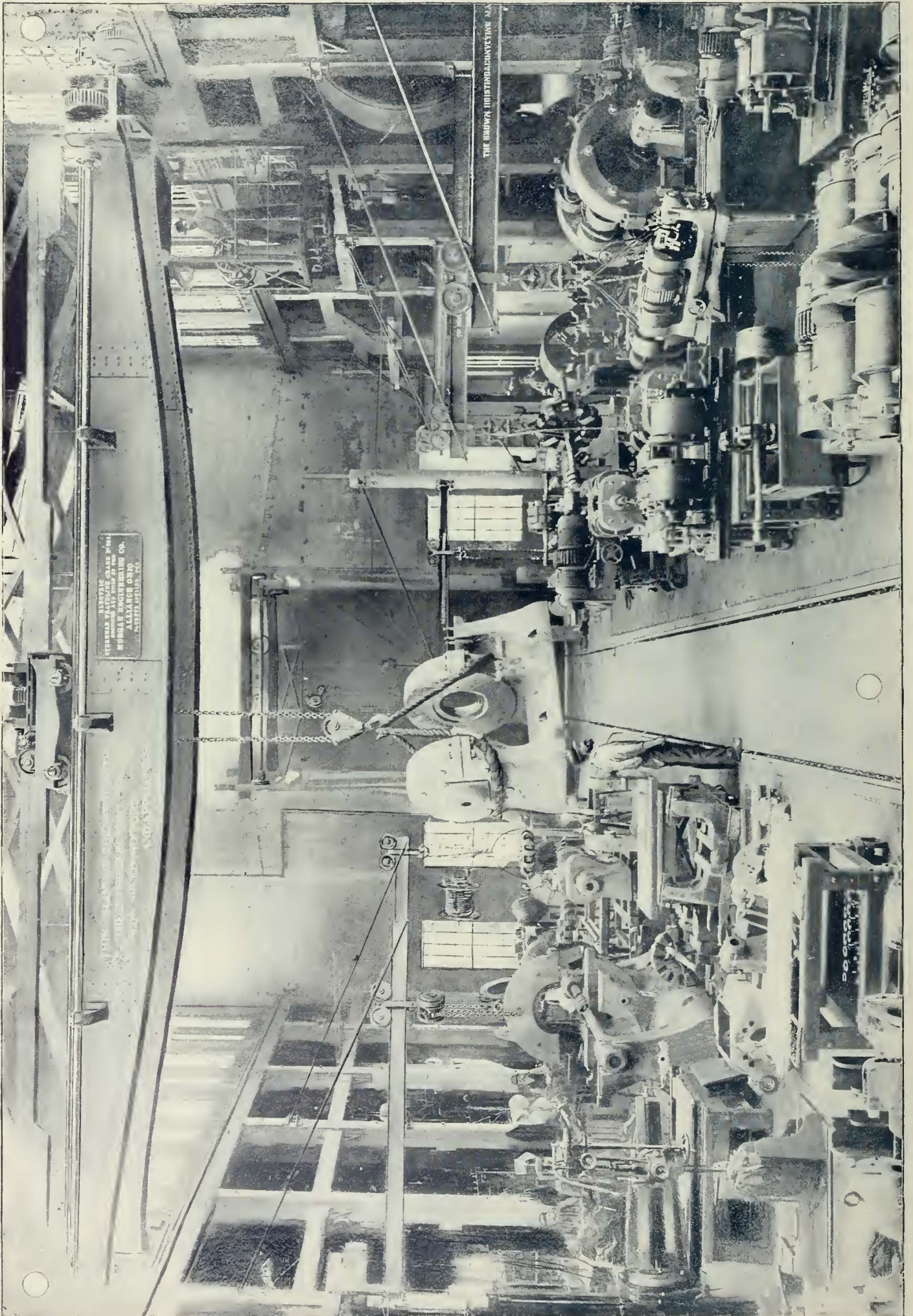
adoption of every device promising to be an improvement in electrical equipment, stand in strong contrast to the reluctance, skepticism and absolute ignorance that blocked the introduction of the steam railway locomotive.

The rapid introduction of street railway apparatus, and the experience which its care and operation developed, led to greater discernment and caution in the purchase of electrical machinery. The Brush company, with Professor Short as general electrician, and manufacturing under his supervision, fixed the standard for superior workmanship and fine electrical and mechanical designing. The business of the company was at the same time well managed under the direction of Professor Short, president, J. Potter, vice-president, and Wells W. Leggett, secretary and treasurer.

The first road built by the new company was at Muskegon, Mich., in 1889, and its successful completion was followed by the installation of the system in Pittsburgh, Cleveland, Indianapolis, Jamestown, N. Y., Johnstown, Pa., Louisville, Ky., Pottsville, Pa., and Rochester, N. Y.

Here was a business of three-quarters of a million and the results were accomplished, as some one said, "with the ridiculously small working force of the general

of yesterday, it seems almost ancient in the light of present developments. But antique or not, the machine has performed its work efficiently and economically, up to the present the cost of operation being less than one cent per car-mile. Meanwhile work on the single reduction motor was quietly progressing, and the first of these machines was put into operation on the Brooklyn line in Cleveland, in midsummer, 1891. This was followed almost immediately by the first gearless machine, an original type, which was so unexpected that its introduction fairly created consternation among manufacturing companies. The motor was exhibited at the last convention of the American Street Railway Association, at Pittsburgh, where it was examined with the greatest interest by electrical engineers and street railway men. It was at first regarded with some suspicion by the electrical fraternity, but its record in operation has demonstrated that the inventor's belief in it was well founded. Its hill-climbing qualities and its ease in running were features that especially attracted attention. The first gearless motors are now in operation on the Brooklyn system in Cleveland, and the second shipment was sent to the Lindell line, in St. Louis, where the machines are in daily service.

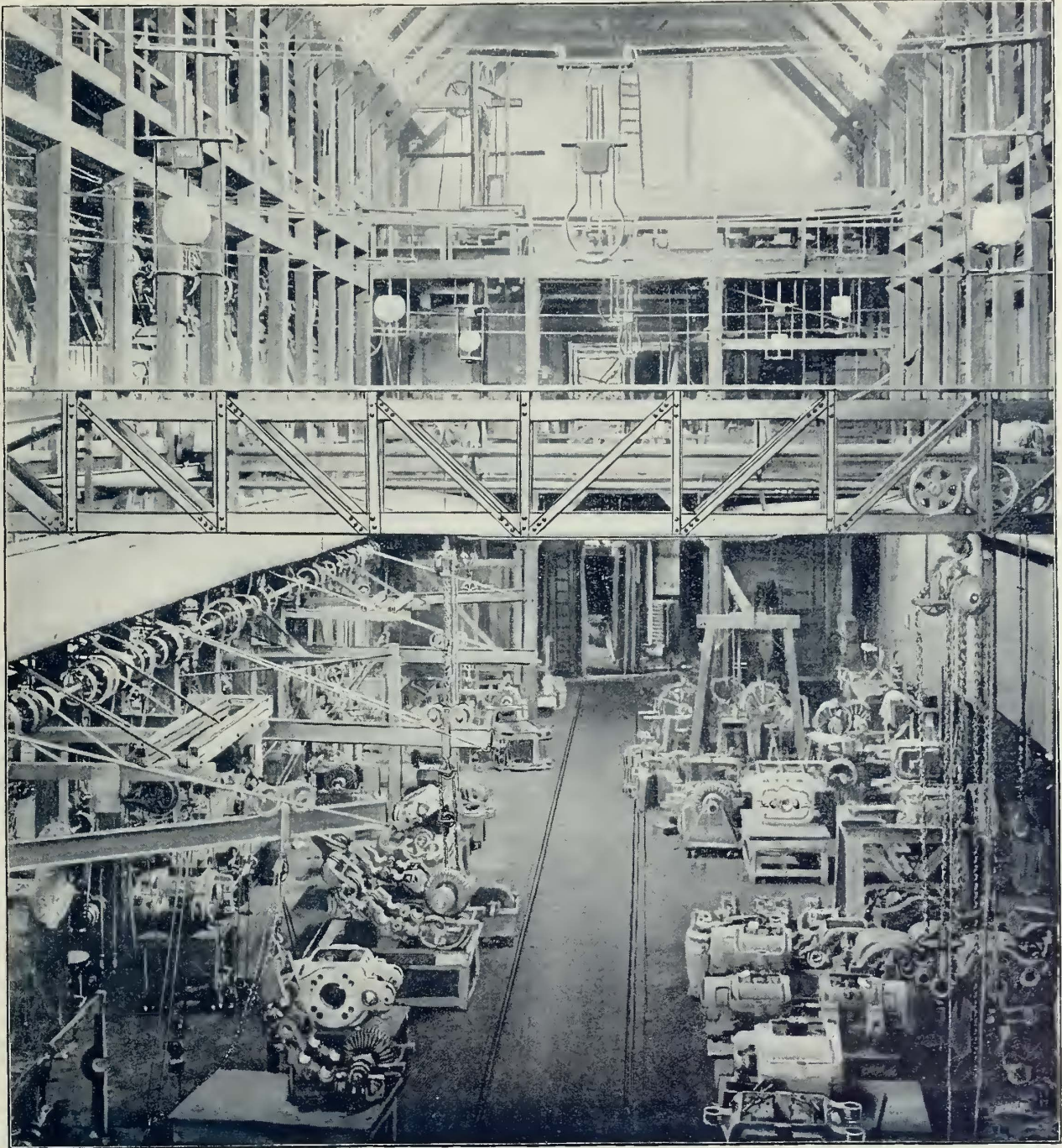


MACHINE SHOP, SHOWING TRAVELING CRANE CARRYING FIFTY INCH GENERATOR FRAME.

The first form of gearless motor, in spite of the success which attended its operation, was not in all respects satisfactory to Professor Short, and he set to work to modify the form with the purpose of decreasing the speed and increasing the efficiency. The result is a strikingly interesting six-pole machine which will be exhibited at the coming convention. Its percentage of efficiency is the highest thus

his opinion the Short company could not make a successful generator, although the perfection of its motor was unquestioned. That belief has now been so materially modified by striking proofs that his opinion as now expressed is a fairly overwhelming endorsement of the generator.

With the extension in the business of the company, there has been a corresponding increase in the working



ASSEMBLING ROOM.

far obtained in any commercial street car motor. The gearless is pre-eminently the characteristic machine of the Short company, and under a separate caption a description of the new motor is presented in this article. The reference here is simply incidental as relating to the history of the company.

At the same time that the motors were being subjected to the perfecting process, the most careful attention was paid to the development of the generator. The latest types in point of construction and in efficiency in operation leave little to be desired. A prominent street railway manager some time ago remarked with emphasis that in

forces, and in the company as organized to-day there is represented as high financial, legal and selling ability as can be found in any corporation in the country, including Edward E. Higgins, general manager; William Hazleton, 3d., assistant general manager, and William B. Bolton, general counsel. In March last a change was made in the list of officers. Mr. J. Potter became president and assumed the active management, while Professor Short, previously president and general electrician, assumed the latter office exclusively for the Brush and Short companies.

There is a constant increase in the number of roads

using the Short apparatus. In 1891 the number of companies aggregated twenty-five, and at the present time the total has been increased to fifty-four.

WHERE THE SHORT APPARATUS IS MANUFACTURED.

It would be a difficult task to attempt an adequate description of the plant in which the Short railway apparatus is constructed. The vastness of the works, the variety of operations, the multiplicity of special machinery, the scores of ingenious appliances, simple in operation but difficult of explanation, the nicety in the adaptation of means to ends, combine to make any detailed description profitable, or in fact practicable. It is proposed to note merely a machine here or an operation there that arrested the attention of the writer in a necessarily brief visit to the works, for any examination of the plant that is limited to days is more than superficial.

Generally, it may be stated that when the manufacture of the Short apparatus was undertaken in the shops, the tools previously adequate for the work were found to be entirely too small. It was necessary to modify the entire machine shop and to introduce changes which have within a year and a half radically altered the appearance of the works. A marvelous improvement has been made by the introduction of tools of recent design, by the rearrangement of old machines, and by the adoption of splendid facilities for handling work.

Whoever is fortunate enough to pass the watchful guardian of the gate naturally first visits the machine shop, of which a view is presented herewith. Besides the bewildering array of machines located so closely that they almost touch each other, one is first attracted by the traveling crane which silently carries its ponderous weights from one point to another. It is related, as illustrating the noiselessness of the monster machine and the ease with which it is controlled, that an artist who visited the shop to make a sketch stood in the centre aisle wholly oblivious of his surroundings. The crane he had noticed was behind him at the end of its course. Happening to glance up he saw the chains with their burden of half a score

tons directly in front of him. Startled for an instant, he realized that the operator had caused the load to make a detour about him; but as the story runs, his keen appreciation of what might have happened had not the machine made the proper turn destroyed his ability to make his sketch.

In the illustration the crane is holding aloft a casting weighing about ten tons for a fifty-inch generator designed for direct connection, which in all probability will supply current at the World's Fair next year.

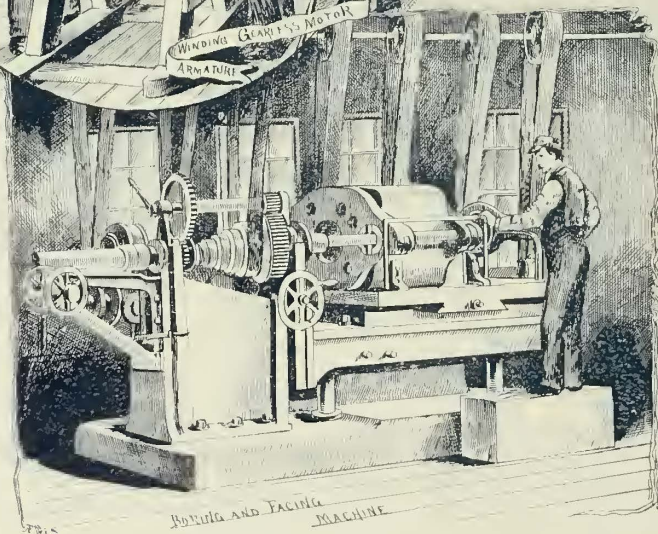
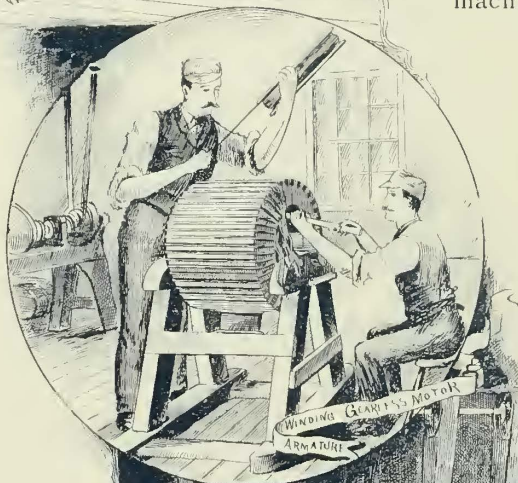
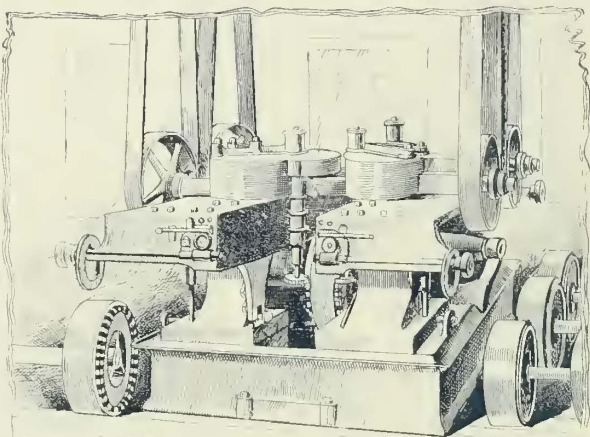
The crane was built by the Morgan Engineering Co. of Alliance, O., and has a capacity of ten tons. It is equipped with three Brush slow speed motors, one of ten horse power and two of five horse power each, specially designed for the work, the complication of gearing being dispensed with.

If a complete description were contemplated of the Short motor armature, a beginning might be made with the hub, but it is assumed that the characteristics of the machine are familiar to the great majority of attendants at a street railway convention. The preliminary work, however, on this fundamental part of the machine involves an interesting operation which is illustrated in No. 1 of the accompanying sketches. The view shows the method of boring or trueing armature hubs. The casting is placed against the face plate which is vertical and at right angles to the bed of the machine. It is fastened and centered by loop bolts, its position being such that the opening for the armature shaft is turned absolutely true.

The next step is to place the hub on the mandrel of a lathe on which the periphery is turned true; then to wind

on the Norway sheet iron core with tissue paper, separating the successive layers, the last eight or ten layers of iron being of extra width; and then the core is ready for the four-spindle milling machine shown in the next sketch, No. 2.

This ingenious machine was designed especially for cutting the slots in the armature core, and it performs its work with amazing rapidity and fidelity, while at the same time it occupies but little more floor space than a single spindle miller. In a plant that, to one unacquainted with the works, seems crowded almost to the point of confusion, compactness is a great desideratum in



FIGS. 2, 3 AND 4.

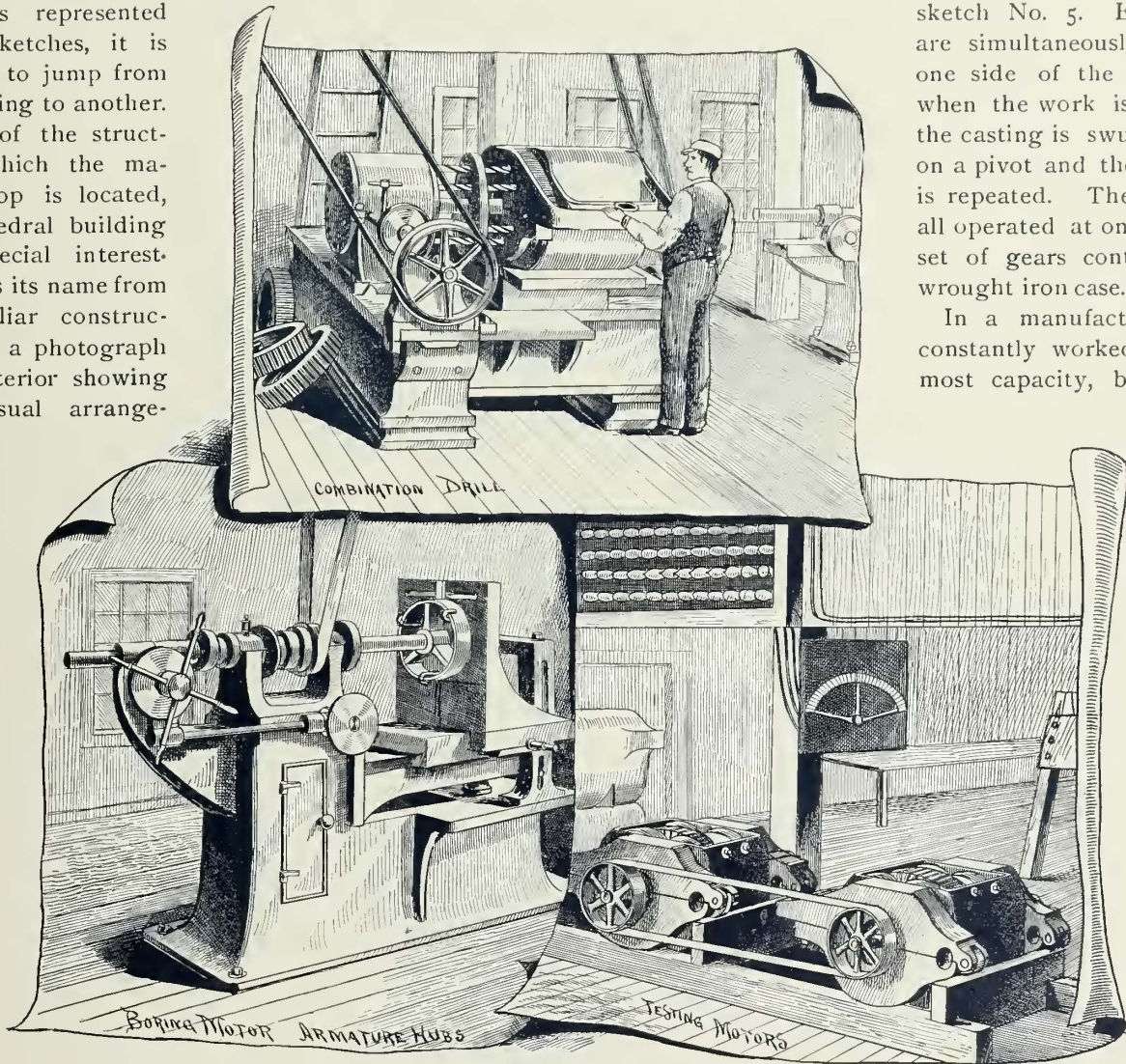
any device. An inspection of the machine shows that it has four horizontal shafts, each of which is belted independently to a countershaft, and each is connected to a vertical shaft by beveled gears. Attached to each of the latter are cutters all in the same horizontal plane. The core is mounted on a shaft passing through the centre of the machine and is rigidly held. Special adjustments make it possible to mill cores of different sizes, and to insure absolute accuracy in the slots both in width and in their relation one to another.

To follow any sort of order in referring to the several operations represented in the sketches, it is necessary to jump from one building to another. Outside of the structure in which the machine shop is located, the Cathedral building is of special interest. It derives its name from its peculiar construction, and a photograph of the interior showing the unusual arrange-

The next sketch (No. 4) graphically tells its own story of the mode in which S. R. G. motor frames are bored and faced by a horizontal boring machine. The holes in the casting are trued for the axle and armature shaft bearings.

The holes in the motor frame through which pass the bolts for holding the field magnets, must, of necessity, be accurately drilled. To perform this operation with rapidity and exactness, *i. e.*, so that the direction of the sixteen holes may be in alignment, Mr. Hassan of the Short company has designed the gang drill shown in operation in sketch No. 5. Eight holes are simultaneously drilled in one side of the frame, and when the work is completed the casting is swung around on a pivot and the operation is repeated. The drills are all operated at one time by a set of gears contained in a wrought iron case.

In a manufactory that is constantly worked to its utmost capacity, but is still



SKETCHES 1, 5 AND 6.

ment is reproduced herewith. Here are located the assembling and shipping departments. Considerable machine work is performed on the ground floor; while in the galleries the winding of armatures and field magnets is carried on. It is equipped with an overhead traveling crane to facilitate handling heavy machinery.

In the balcony can be watched an operation that at the present time is of special interest. Sketch No. 3 illustrates the winding of the armature for the new gearless motor, of which a description appears elsewhere. The armature is mounted on a temporary shaft resting on a stout wooden horse, so that it may be easily turned as the work progresses. It will be noticed at a glance that it is considerably wider than that of the original gearless, and it may be added that it is designed to present its periphery instead of the sides to the pole pieces. It has ninety-two bobbins, from each of which lead two flexibles, making 184 commutator connections.

unable to meet the demands upon it, rapid methods of completing the varied necessary incidental operations are desirable, and even essential. One of these short-cut expedients is illustrated in the manner of testing motors (sketch No. 6.) Two machines are inspected at the same time by running one as a motor and connecting it to a second machine which is operated as a generator. The sketch shows the means that are employed. Both motors are mounted on a substantial framework, and attached to each armature shaft is a temporary pulley with a belt connecting the two. A switch is at hand for turning on the current which may be varied at will, while the machines can be inspected under the changing conditions. The load is carried by a bank of incandescent lamps which are found to constitute the best form of resistance.

Many railway companies at the present time require large power units, and their construction by the Short company involves a series of operations that are full of

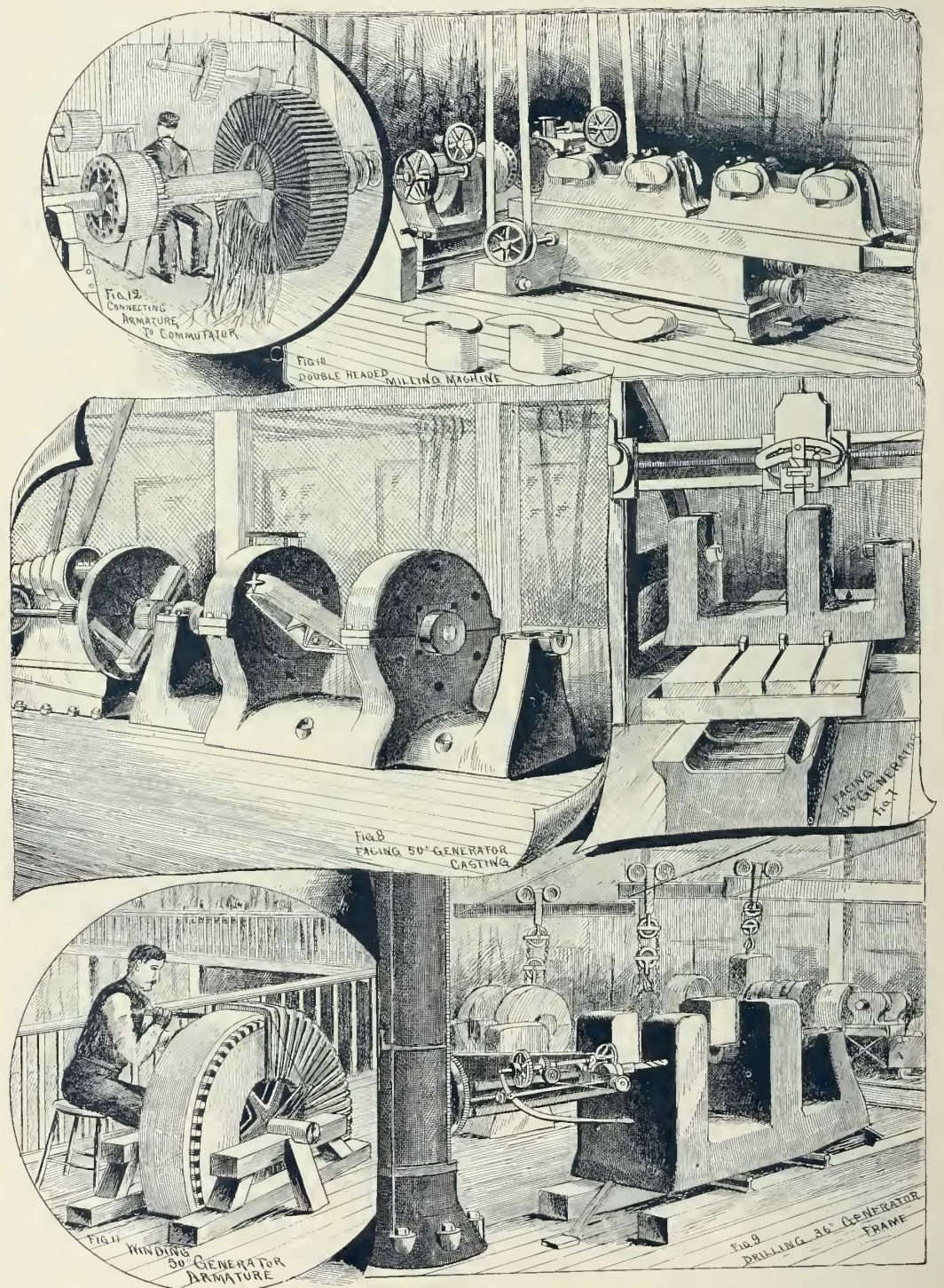
interest as illustrating the marvelous precision and accuracy of the special machinery, and the ease with which heavy work is performed. The inspection of the work here referred to, takes the visitor back to the machine shop. Until within a year and a half the largest planer in the works had a width of sixty inches. In sketch No. 7 is represented a planer just double that width, facing the inside of a thirty-six inch generator frame, so that it may present an absolutely true surface for the mounting of the field coils.

A special lathe (sketch No. 8) is available for facing the inside of the casting for the fifty-inch generator. The operation, as conducted, is interesting and somewhat unusual. The head stock is of the ordinary pattern, but it is so mounted that its inclined base may travel on a corresponding inclined foundation. It can be raised or lowered by the adjusting screws at each end of the base, so that it may be accommodated to the different sizes of generators. A shaft passing through the generator or frame is mounted on the generator bearings, and is connected by a dog to the lathe. A tool holder is mounted on the shaft, and the feed is automatically governed by a novel device. Attached to the outer end of the feed screw is a head with four projecting arms. At each revolution of the shaft one of the arms strikes against a pin on the frame, giving it a quarter turn.

There is no more interesting operation to be seen than that performed by the universal drilling machine (shown in sketch No. 9) boring a thirty-six inch generator frame for field magnet bolts. The nice methods of adjustment, the marvelous accuracy in alignment of the holes on each side of the frame—for the error must not exceed, at the very outside, one thirty-second of an inch—and the rapidity with which the work proceeds, combine to attract the visitor. The heavier castings rest in front of the machine on T rails, which are leveled, and are shifted by jack screws, the smaller generator frames are placed, when drilled, in a pit at the base of the machine.

The double headed milling machine (sketch No. 10)

is of novel design, and was built expressly for facing pole pieces. In this view four thirty-six inch magnet cores are shown clamped to the bed plate, but the machine is so designed that sixteen motor magnet cores may be substituted for the four larger castings. Two cutter heads face both ends of the cores at the same time. The feed is



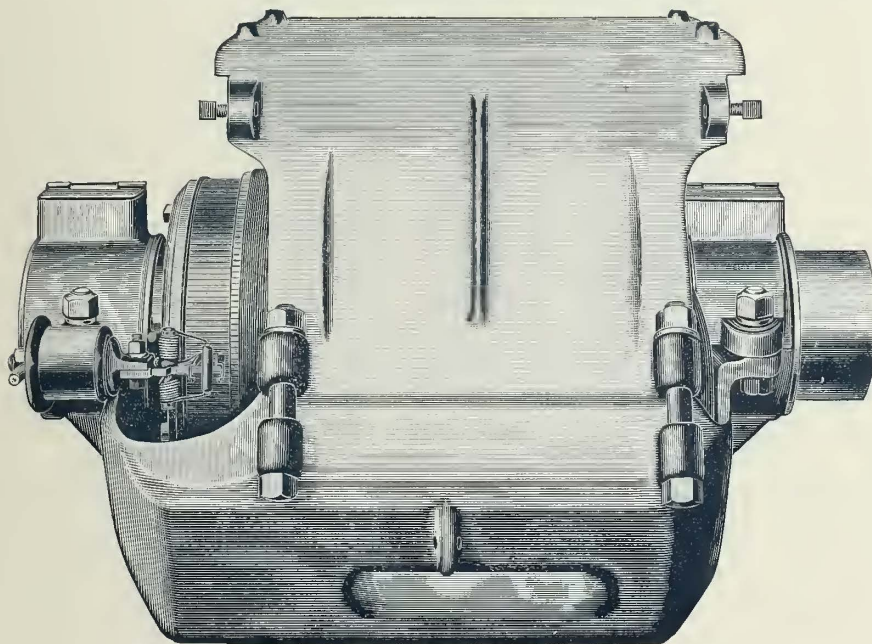
SKETCHES 7 TO 12.

automatic, and the machine is one of the great labor savers in the plant.

When the present visit to the works was made, one of the interesting operations to be seen in the gallery in the cathedral building was the winding of the 300 H. P. generator armature (sketch No. 11). The amount of work incident to this part of the machine seemed almost endless, as every step requires the most careful and painstaking attention. Each of the 150 bobbins terminates in two flexibles, and the mode in which the latter are con-

nected to the commutator is shown in sketch No. 12. Over the armature shaft is placed a wooden sleeve which is thoroughly taped. The flexibles, which are insulated carefully, are carried across the sleeve and are soldered to wires tapped into the commutator bars. After the connections are made the flexibles are carefully taped and bound.

Made from carefully worked out designs in a manufactory with a splendid machinery equipment, it is not surprising that the Short apparatus has been successful even though many of the first steps have been taken on the unlucky day of the week. But Friday is not regarded with suspicion by the Short company; in fact a contrary view obtains, and most of the new types have been originally started on the sixth day of the week. That he might bid defiance to the popular superstition and indulge in a pet theory of his own, some one in the Short company whose identity will not be disclosed here, caused



NEW GEARLESS MOTOR—END VIEW.

the initial trial of the gearless motor to be made at 11:40 Friday night in order that it might not be postponed till the following day.

A word about Professor Short's connection with the actual work in the manufactory: At the present time his attendance in the machine shop is not so constant as a year or more ago. His apparatus has reached the point of development at which the machines no longer require his careful, constant attention. But he has been an indefatigable worker; patient and persevering, he has worked out with marked success the problems that awaited his solution. Patience and good humor were the two traits that, one of the men assured the writer, had particularly attracted his attention as characteristic of Professor Short. After attacking a problem for a long time and finally seeing his ideas assembled in concrete form, he found more than once that a workman had made a botch of some incidental part that necessitated the postponement of the test and caused the loss of valuable time. Upon such occasions as this, the informant put it, "most inventors would execute the irritated dance of an infuriated ourang-outang," but Professor Short would always laugh at the mishap and simply remark: "Try it again." Professor Short's even temperament and his willingness to work have made him wonderfully popular with the

men, and at many different times they have proven themselves ready to perform services in the way of extra work at the cost of no little self sacrifice. Many a time it has been necessary to run the factory at night to rush through some special work, and the knowledge that it was for Professor Short caused the men to swallow cheerfully a large dose of overwork.

A NEW GEARLESS MOTOR.

The gearless motor is a machine peculiarly identified with the Short Electric Railway Co. It is only a little over a year ago that the first machine of this type was introduced, and while it proved under the severe conditions of actual service to be of exceptional efficiency, the inventor saw a chance for development and improvement.

The machine and the subsequent slightly modified types that quickly followed the introduction of the machine attracted such wide spread attention, and were so fully described, that a brief reference is essential in this connection only as prefatory to a description of a new gearless motor exhibited for the first time at the present convention. The original gearless was a four-pole machine flexibly mounted directly upon the car axle. The magnets were presented to the sides of the armature. As has been stated, this machine performed good work, but it was heavy and its construction was such that thirty-six inch wheels were necessary on the truck. The second type of machine was somewhat different in construction. The armature was mounted on a hollow shaft connected with the axle by means of a flexible driving device. The armature and magnets were practically the same as in the first machine, and as before, thirty-six inch wheels were necessary.

This machine was exhibited at the Pittsburgh convention of the American Street Railway Association a year ago, and was inspected with the greatest interest by railway men. In the next type the pole pieces were presented to the face of the armature instead of to the sides, and the armature was somewhat modified in form. Its face was wider, while the diameter was diminished so that thirty-three inch wheels could be used.

This brief description brings the development of the gearless up to the present latest type which is here illustrated for the first time. This motor is a six-pole machine weighing, complete, 2,300 lbs. The frame is cast from steel in two sections; the upper half is supported by the truck; the lower half is hinged to the upper, and may be swung down when a car is over a pit, so that inspection is rendered easy. The lower half of the frame is cast without any opening up to the level of the centre of the axle, so that the motor may run through water and slush without any possibility of their penetrating inside the frame. Practically, therefore, the machine may be considered a waterproof motor.

The armature is twenty-one inches in diameter, and, as in previous types, is mounted on a six-inch hollow shaft through which passes a four-inch axle. To the end of the armature shaft is a flexible driving device for connection with the car axle.

The diameter of the armature is sufficiently decreased

in the new type so that thirty-inch wheels may be used with a clearance of three inches between the bottom of the motor frame and the track.

As already stated, the machine has six poles which are presented to the face of the armature. The latter is built with ninety-two bobbins, with sixteen turns of wire on each, which are connected to 184 commutator bars. The armature is designed to run at 120 revolutions per minute when developing twenty horse power.

Two of these motors will exert an horizontal effort of 1,500 lbs. in starting a car with eighty amperes, and with from eighteen to twenty amperes will propel an ordinary car at a speed of about twenty miles an hour.

PROF. SIDNEY HOWE SHORT.

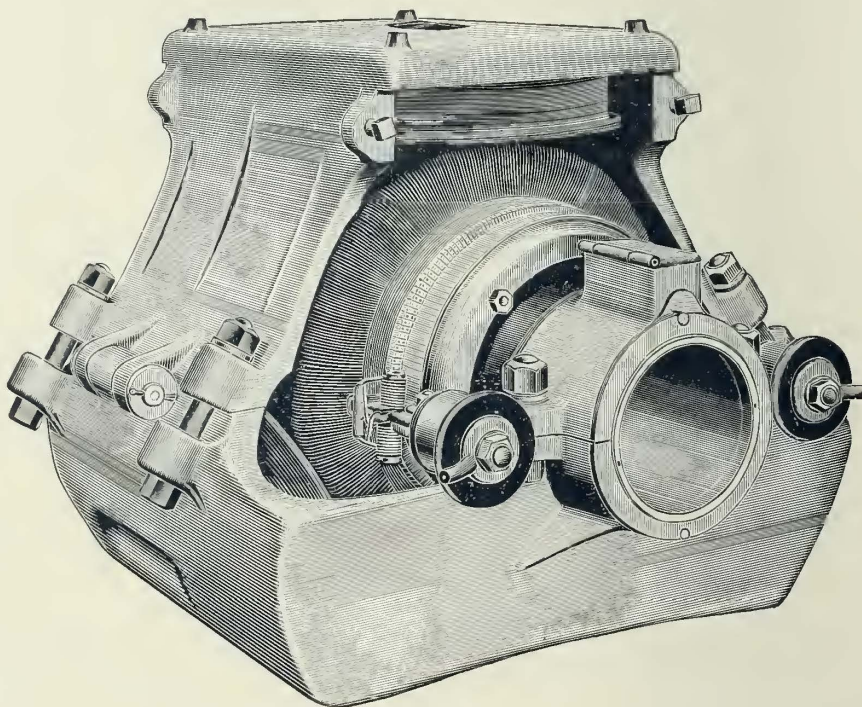
While the name of Prof. S. H. Short is familiar to everyone interested in the electric railway motor, the personal history of the man is known to but few. He is thoroughly identified with the development of a railway system whose sudden rise into popularity is the strongest proof of its excellence. He has been progressive as an inventor, as those most familiar with the development of the apparatus bearing his name best appreciate. Personally he is a worker of the most pronounced and aggressive type, and to his faithful industry and tireless patience, combined with his peculiar genius in his particular field, a great part of his marked success can be ascribed. By his associates and his employes he is held in the highest esteem, and the reason is not difficult to find. He is singularly unassuming and kindly in manner and blessed with a serviceable temper that stands the annoyances, delays and disappointments that invariably beset the inventor.

He was born in Columbus, O., in 1857, and received his early education in the public schools of that city. His first experiments in electricity commenced when he was a boy in kilts. His mother states that she found him in the yard one rainy day holding the upper part of a lightning rod away from the broken lower end, by means of a stick of wood, and watching the play of electricity across. He studied in the Capital University, and later in the Ohio State University where, after five years of study, he was graduated in 1880. His graduation was delayed one year, owing to the fact that Professor Mendenhall was called to the University of Tokio, Tokio, Japan, and that Mr. Short filled the position of laboratory director during the first year of his absence.

It is probable that his first interest in electrical matters was aroused when, a boy in the public school, he listened to Professor Mendenhall's recitations in physics. All his other school work was neglected for this pleasant pastime, and his time out of school was spent in utilizing the old wire and batteries he purchased from the Western Union Telegraph Co., and in constructing small devices with which he decorated his home; indeed all the money that he could earn by running errands was invested in material of this kind. At one time all the house clocks were connected with a device by which they could be wound at one time and from one place. This ingenious appliance lasted until a stroke of lightning ruined it and

at the same time all the house clocks. A system of burglar alarms was spread through the house, which caused much excitement on several occasions, but which was never called into use from the outside. He also began working with telegraphy, because of the interest inspired by Mr. Charlie Ross, at that time the head of the Western Union Telegraph Office in Columbus, O., and from whom he obtained supplies of worn-out material. At one time he had telegraphic sounders attached to the head and foot of his bed with wires running into the room through the windows.

While attending the Centennial in 1876 he carefully examined the Bell telephone of that date, and discovered that he had already constructed in the laboratory of the Ohio State University what was practically the same device; his apparatus, however, was used merely for transmitting sound, and so far as he remembers, no attempt



NEW GEARLESS MOTOR—SIDE VIEW.

was ever made to transmit speech over it. On his return to Columbus from Philadelphia, he perfected and patented a long distance telephone transmitter, of which the patent was subsequently sold to the Gold Stock Telegraph Co.

A vagrant interest in arc lamps, which at that time were coming into favor in Columbus, led to his device, (patent No. 209,625) of an arc lamp, but no use was ever made of the invention. During several summer vacations before his graduation, Mr. Short was employed in placing the electric light fixtures in the old Comstock Opera House, and also through the influence of a political friend high in authority in the State Capitol. The Opera House has since been burned, but the wiring in the State Capitol remains in use to this day.

The fascination exercised over him by Professor Mendenhall was continued in the State University, when the latter took the chair of physics. Here, in the well supplied physical and chemical laboratories he began the close and serious work of a student. Mr. Short spent almost his entire time, days, nights and Sundays, in the laboratory with Professor Mendenhall, and during the summer vacations traveled with him through the state, conducting the experiments for the lectures before teachers' in-

stitutes, which have made Professor Mendenhall one of the most popular of scientists throughout the state. The boy's ingenuity and skill in producing effects with meager appliances were shown very clearly on these trips, where his small outfit was set up and taken down in haste and adapted to the poor facilities which, at that time, were the rule, even in the best equipped schools of the state. An electric lantern and a large Grove battery were the most important pieces in his supply of apparatus. It was during one of these summer trips, when his work had been unusually severe and continuous, that the intense light from the lantern temporarily blinded the lad, and for two weeks much apprehension was felt lest his sight should be permanently impaired. This proved not to be the case, however, and he was soon busy with his work again.

After graduation, he went at the end of the summer vacation to the Denver University, of which he became vice-president and professor of physics and chemistry. He held the combined chair for two years, but by this time the work had so increased as to make it absolutely necessary for him to have assistants. Soon after reaching Denver, Mr. Short suffered from a violent attack of illness, caused by the poor water of the city. On his recovery he immediately made an analysis of the water, which, when published, threw the whole city into alarm and led to a controversy in which chemists in different parts of the United States, the city authorities, the water works' officials and public sentiment were all involved. The result was that one of the water works plants was shut down entirely, and provision was made with the utmost dispatch for an abundant supply of pure water which was obtained at some distance from the city. The prominence which he achieved during this controversy led to a great deal of chemical work during the next two or three years. He analyzed stomachs for traces of strychnine, soil for traces of silver, iron or gold, and as a result of these studies discovered on the plains just outside of the foothills and near Morrison, Colo., materials suitable for a cement of superior quality and higher grade than the celebrated "Portland." A company was immediately organized, and the work of manufacturing began. Almost the entire output of the works was sold to the Denver & Rio Grande Railway Co., which has since purchased the entire plant and is conducting the manufacture. Mr. Short also analyzed materials for glass, at the instance of a large company prepared to begin the manufacture of glass in or near Denver. This project never materialized, as the railway companies threatened to haul glass from the East free of charge rather than allow a rival plant to be established in the West.

He resigned the chair of chemistry in the Denver University in 1883. By a special arrangement with the Board of Trustees, his time during the years when he taught in the University was his own for personal work after three o'clock every afternoon; hence it was that while he was still in the University he had worked up his plan for an electric railway, building his first road—a single track with turn-outs—in the large basement room of the University building. This road was put in operation in the spring of 1885, and by its novelty attracted many visitors. It is safe to say that hundreds of people in Denver went round and round the old basement of the University on the crude car, which was set up over these first Short motors. Mr. Short wound both the motors and the dynamo in the laboratory, doing the work himself.

In 1885 his interest in practical electric railway work, and his confidence that he could succeed in it were strong enough to induce him to resign his position in the University. He immediately went to work on a surface road, conduit system, on Tremont Street. His next work was to lay an electric line built with a conduit on Fifteenth Street, running to Capitol Hill in one direction and across to North Denver in the other. This road, despite the almost insuperable obstacles in the way of operating a conduit system, was operated with series motors with some success for several months by the United States Electric Co., now the Denver Tramway Co. The power house, fitted up in temporary and inexpensive fashion, was on Fifteenth Street, at about the middle of the line. The success of series motors in connection with the conduit system, while encouraging to Mr. Short as an electrician, was not of sufficient importance to induce him to remain in Denver. In 1887, he returned to Columbus, O., and entered into partnership with N. B. Abbott, of the Abbott Paving Co., one of the most successful and best known business men in the state, the firm name being S. H. Short & Co. The first work of the firm was to construct a short line, two and a half miles in length, from the North High Street Railway to the Fair Grounds. On this line the overhead system was used with series motors and practically the same appliances that had been used in Denver. Leaving this road partially completed, Mr. Short went to St. Louis, Mo., in 1888, and constructed a line—an overhead series system—on South Broadway, which, although operated for more than a year with great success, was displaced to make room for an extended cable system. In June, 1889, he made Cleveland his home, where he organized the company which now bears his name, the Brush Electric Co., taking a large share of the stock, and contracting to do the manufacturing. Of Mr. Short's work in his present position an outline has been presented in the sketch of the Short company and, therefore, is omitted here.

He is a fellow in the American Society for the Advancement of Science, has the title of B. S. from his Alma Mater, belongs to the Cleveland Electric and Union and Country Clubs, and is a member of the Electrical Commission of the World's Fair.

J. POTTER.

Mr. J. Potter is president of the Short Electric Railway Co. and treasurer of the Brush Electric Co. He is a native of the state of Ohio, and son of the Rev. Dr. L. D. Potter, of Glendale, near Cincinnati, a man widely known in educational circles throughout the country. He was graduated with honors from Princeton College in 1877, and later received the degree of M. A. from the same institution. He had a strong taste for the natural sciences, and was selected by competitive examinations as a member of the scientific expedition sent out by Princeton Museum in 1877. For several years he was master in the noted Lawrenceville school, and subsequently read law, but was not admitted to the bar as he had determined to engage in commercial affairs. He became identified with the electrical industry in the fall of 1881, when he made an engagement with the Brush Electric Co., of Cleveland, to take charge of its business in Japan, China and other oriental countries. After several months of practical preparation in the Cleveland factories and Mr. Brush's laboratory, he sailed from San Francisco for Japan in April,

1882. Although several English companies had endeavored to get a foothold in the Orient, Mr. Potter was, in fact, the pioneer of the electrical industry in that part of the



J. POTTER,
PRESIDENT SHORT ELECTRIC RAILWAY CO.

world. He made his residence in Yokohama, and within a year had built up a large and lucrative business. He made large contracts with the Japanese government for lighting docks, arsenals, etc., and established the first central station electric lighting plants in Japan and China. In 1884 he was recalled to take the office of treasurer of the



EDWARD E. HIGGINS,
GENERAL MANAGER SHORT ELECTRIC RAILWAY CO.

Brush Electric Co. Shortly after his return he was elected director of the company. Mr. Potter was one of the incorporators of the Short Electric Railway Co., and became a director and vice-president. About six months ago he

was chosen president of that company. Mr. Potter manages the financial affairs of both the Short and Brush companies. Although a young man, he belongs to that small number of men who have been engaged in the electrical field from the beginning, and his name and face are familiar to almost all those engaged in electrical enterprises. He has been unusually successful as a financier, and is well known in financial circles in New York and Cleveland.

EDWARD E. HIGGINS.

Edward E. Higgins, the general manager of the Short Electric Railway Co., was born in Chelsea, Mass., in 1864. He attended the public schools of that place, and subsequently entered the Massachusetts Institute of Technology, from which he was graduated. He was connected with the Standard Electric Co., of Vermont, and left the position of assistant electrician to become the New York State agent of the Sprague Electric Railway Co., in 1888. Subsequently he was special agent of the railway department of the Edison company and resigned to accept the



WILLIAM HAZELTON, 3D.,
ASSISTANT GENERAL MANAGER SHORT ELECTRIC RAILWAY CO.

managership of the Short Electric Railway Co. Mr. Higgins has been for some time in Europe. He is a member of the New York, Buffalo and Cleveland Electric Clubs and of the Union League Club, of Cleveland.

WILLIAM HAZELTON 3d.

William Hazelton, 3d, is the assistant general manager of the Short Electric Railway Co. He is thirty-three years of age and was born in Philadelphia. He was educated at Swarthmore College, and was prepared for entrance to the Naval Academy at Annapolis, but decided to follow a business life. He was first identified with the electrical industry at the time the Sprague Electric Railway Co. was organized. The firm of Chadbourne, Hazelton & Co., of Philadelphia, represented that company in Pennsylvania, and made a splendid reputation in securing contracts. Subsequently this firm took hold of the Wenstrom motor, and later the partnership was dissolved. Mr. Hazelton accepted a position with the Short com-

pany, first representing the company in Pennsylvania. Subsequently he moved to Cleveland to accept the office that he now holds. He is a member of the Union League of Philadelphia, the Electric Club of New York, and the Cleveland Athletic Club.

S. M. HAMILL.

Mr. S. M. Hamill is the secretary and general manager of the Brush Electric Co. He was born in Lawrence-



S. M. HAMILL,

SECRETARY AND GENERAL MANAGER BRUSH ELECTRIC CO.

ville, N. J., and prepared for Princeton in the well known school in that place. He was graduated with the degree of B. A. by Princeton in the term of 1880, and since that time has received the degree of M. A. After leaving college he taught for three years in the Lawrenceville school, during a portion of which time he studied law. Having a desire for active business pursuits, and determined to go to work, he secured, in 1884, a position as clerk on the freight platform of the Chicago, Burlington & Quincy Railway Co., in East St. Louis, and subsequently became private secretary to the agent, clerk in the paymaster's office, and in the first vice-president's office in Chicago. In 1886 he was in charge of the large grain elevators owned by the Chicago, Burlington & Quincy Railway Co., in Peoria, Ill., from which place he went to Cleveland to accept the position of assistant secretary of the Brush Electric Co. Three years later he was elected secretary and moved to New York City and assumed charge of the general Eastern business of the company. At the last annual meeting of the company he was elected a director, secretary and general manager. Mr. Hamill is also president or secretary and director in a number of local electric light companies, and at present receiver of an electric company in Pittsburgh, Pa. While in Princeton he was one of the founders of the Ivy Club, and is a member of the Electric and University Clubs of New York, and of the Electric and Union and Country Clubs, of Cleveland.

FRED. A. SCHEFFLER.

Fred. A. Scheffler, the superintendent of the works of the Brush Electric Co., was born at Galion, O., December

20, 1858. The family removed to Paterson, N. J., when he was quite young, and he lived in that city until he was sixteen years of age. After graduating from the Paterson Seminary, he was engaged as a draughtsman in the repair shops of the Long Island Railroad shops at Hunter's Point, where he remained two and a half years. During the following years, until 1881, he was employed by the Rhode Island Locomotive Works, Brown & Sharpe Manufacturing Co., Harris-Corliss Engine Co., and James Beggs & Co., of New York. Mr. Scheffler entered the electrical field in 1881, accepting a position in the engineering branch of the isolated department of the Edison Electric Co., then at 65 Fifth Avenue. While in this capacity, he designed the mechanical part of the second electric locomotive built by Mr. Edison for his experimental work at Menlo Park. After four and a half years' service with the Edison company, Mr. Scheffler accepted the position of superintendent of the Erie City Iron Works. Six years later he was called to Pittsburgh, where he was acting superintendent of the Westinghouse Electric Co., until 1890, when he accepted the position he now holds.

REPRESENTATIVES.

No small share of the success of the Short Electric Railway Co. is due to the energetic efforts of its representatives. Among this number are: E. J. Wessels, general Eastern agent, New York; C. C. Curtiss, special agent, Cleveland; Frank A. Rogers, Cleveland.

BRUSH ELECTRIC CO.

In the sketch of the history of the Short Electric Railway Co., and in the description of the manufacture of



FRED. A. SCHEFFLER,

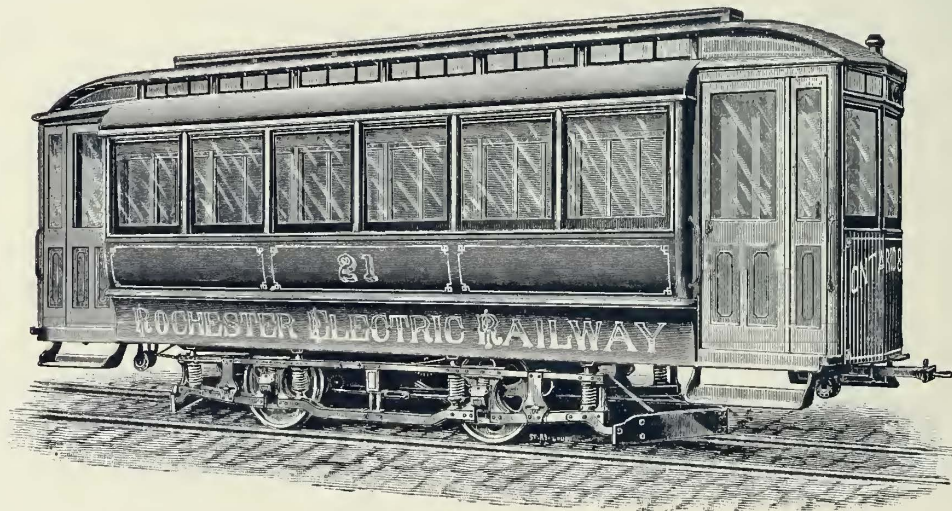
SUPERINTENDENT BRUSH ELECTRIC CO.

its apparatus, much has been written that might very properly be included in any reference to the Brush Electric Co. As it has already been stated, the latter corporation is largely interested in the Short company, and in its splendid plant the railway apparatus is constructed. The Brush Electric Co. is one of the pioneers in the electrical work, and the growth of its plant is a striking illustration

of the wonderful development of the electrical business. Although a pioneer, the history of the company does not extend farther back than 1876, when an electrical business was established by the Telegraph Supply Co. When Charles F. Brush became interested in the company, and when it was proposed to manufacture apparatus in accordance with his splendid inventions, a different corporation name was necessary, and a much greater capitalization was essential. In 1880, the name was changed to the Brush Electric Co., with a capital of \$3,000,000. George W. Stockly and Mr. Brush were the controlling spirits in the enterprise, and the former, until a comparatively recent date, was the president of the company. During the brief period since the company was formed, it has performed a large share of the work incident to revolutionizing the artificial illumination of the world. It has built up a business, in whose branches over \$25,000,000 is

invested, and its lights are shining in almost every large city in the United States and Canada, throughout Europe, in South America, China, Africa, Madagascar, New Zealand, Australia, India; in fact, where are Brush lamps not to be found?

In the reference to the Short company, a general description of the manufactory of the Brush Electric Co. was presented. The plant, which has grown as the business extended, now covers seven acres. Every facility that ingenuity can devise or money purchase for the manufacture of dynamo-electric machinery, lamps and carbons, has been added to the equipment. The buildings are: Main machine shop, 265 × 122 ft.; cathedral building, 200 × 100 ft.; power building, 120 × 110 ft.; carbon house, 600 × 62 ft.; pattern room and carpenter shop, 120 × 70 ft.; lumber room, 80 × 50 ft.; coke house, 160 × 60, and many other smaller structures.



ELECTRIC CAR EQUIPPED WITH SHORT MOTORS.

WALKER MANUFACTURING CO.

WHERE MACHINERY FOR CABLE RAILWAYS IS MADE.

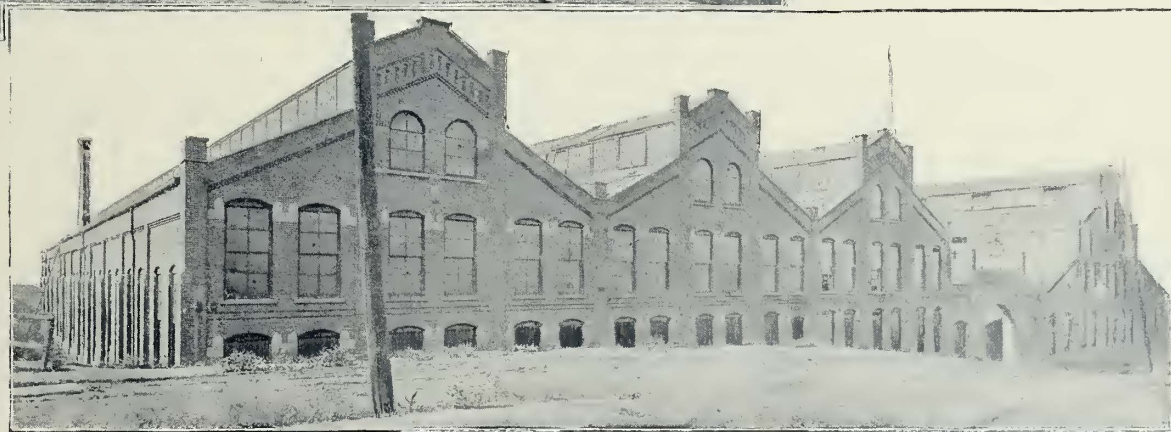
TO the cable engineer the most interesting works in Cleveland are those of the Walker Manufacturing Co. But a visit to the works is of interest not alone

last year. A view of the room is presented herewith. Mr. Walker is at his desk conversing with the manager, Mr. W. H. Bone, while Mr. Samuel Groves, Mr. Walker's assistant, stands at the right.



On the floor above the drawing office is located a roomy, well lighted and admirably designed apartment. The draughtsmen are divided into three sections. One division is engaged on cable machinery and general engine work under the supervision of Mr. Ernest C. Barth; a second group is occupied with hydraulic machinery and electric cranes under the direction of Mr. John R. Bitner; and a third is concerned with gears under the supervision of Mr. Robert Bone.

On the way to the machine shop



to those connected with cable plants; the character of the work performed, the ingenious devices employed, and the ponderous machinery in operation constitute features novel and interesting to every one in the least mechanically inclined. The great establishment, with its famous machine shops and foundries covers nine acres of ground, and forms a plant, which in point of arrangement and completeness of equipment, is unsurpassed in the United States, and probably in the world.

A person who visits the works ordinarily makes a beginning at the office of Mr. John Walker, the founder, general manager and vice-president of the company, where the essential credentials are to be secured. The office itself is an interesting place, with its models of rope drive and gear drive, cable machinery, differential drums, 1,000 H. P. friction clutch, and the almost priceless picture of James Watt's workshop, which Mr. Walker secured while traveling in Europe



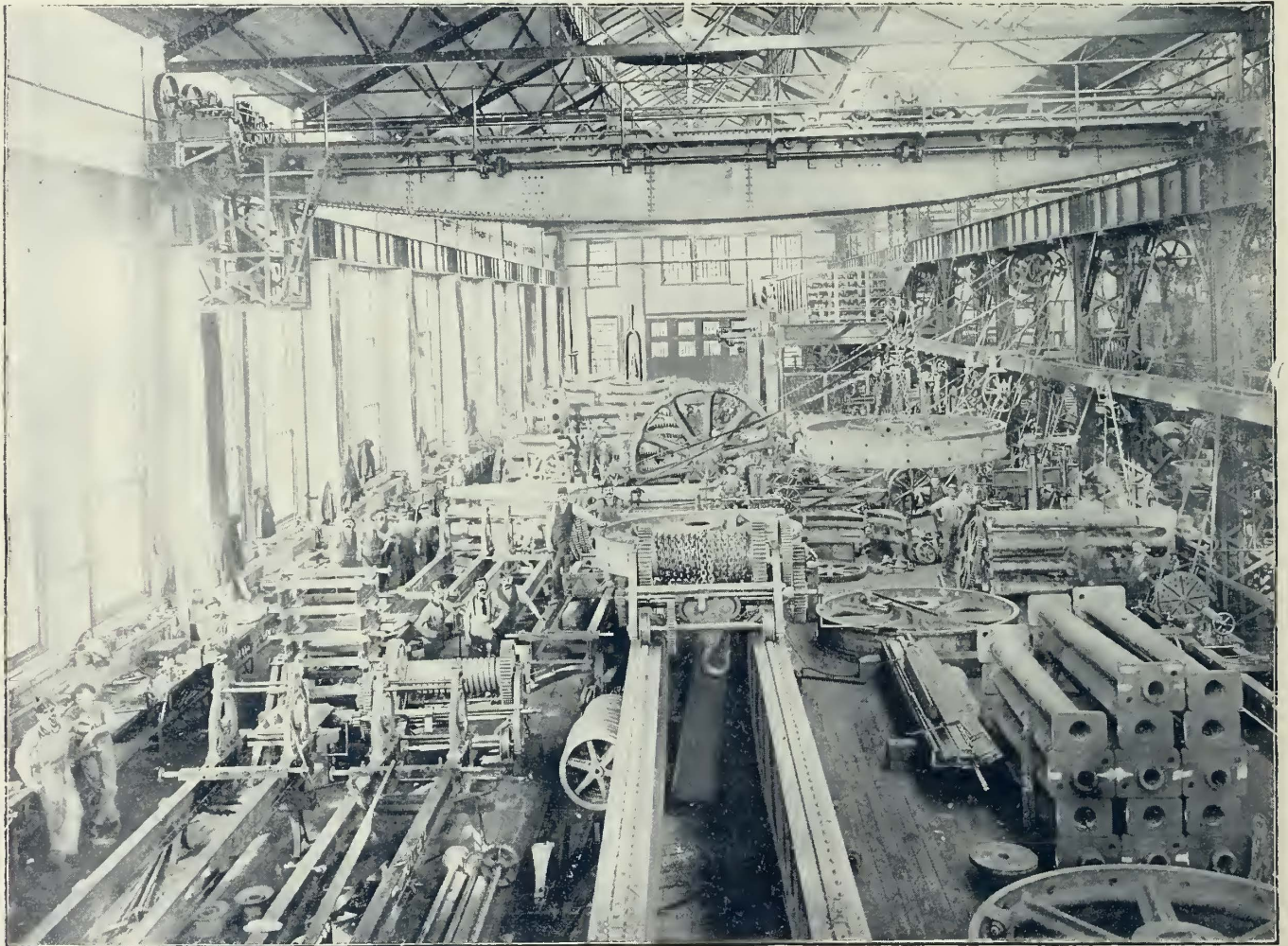
DRAGHTING ROOM—EXTERIOR OF MANUFACTORY—OFFICE OF MR. WALKER.

the visitor is conducted to a large room constructed like a vault, with heavily barred iron doors. Here are stored the designs and drawings of machinery now in operation the world over.

MACHINE SHOP.

The immense machine shop, said to be the finest in the United States, is 170 ft. in width, and is built in three bays each fifty-seven feet wide. Two are 288 ft. in length, and the third is 430 ft. long. The roof, which is supported between the sections by massive wrought iron pillars, is fifty-four feet high from the floor to the highest point,

In bay No. 1 was noticed a twenty-five ton, hand power, traveling crane, ready for shipment, which is to be set up in one of the new Chicago cable power houses. In process of construction were five large carriages and tension regulating appliances (Upton's patent) for the five sets of cable machinery to be operated in Baltimore. A short distance away were the massive bed plates or frames designed for the same plant. Each of the bed plates is forty-four feet long and twelve feet wide, cast in one piece, and weighs sixteen tons. The machinery, for some reason, could not be shipped at the time it was completed, and the question



BAY NO. 1—MACHINE SHOP.

and is constructed of iron. That the shop is well lighted may be judged from the fact that the glass in the roof cost \$1,400.

Each bay is provided with a thirty ton, rope power, traveling crane of improved construction built by the Walker company. The cranes are driven by a 24×48 in. Corliss engine, and the tension on the Manilla ropes is regulated by an ingenious device with triple sheaves fixed at the gable end of the shop.

It is not proposed to present a detailed description of the several departments of the works, but to note rather some of the work of interest to the railway engineer, which was in progress at the time the writer visited the manufactory. At the very outset the visitor receives two strong impressions; one, of the formidable character of the machinery designed to perform the heaviest kind of work, and one of the marvelous accuracy which is manifest in all the operations, no matter how large the scale.

of its disposition was rather serious. Mr. Walker conceived the idea of piling it up, as shown in the illustration, after it had been tested and approved.

One of the prominent features of bay No. 2 is a giant turning lathe with a seventy-two inch swing and a bed forty feet in length. It can carry between centres a shaft forging weighing twenty-five tons. To the left is a mammoth planer with a table twenty-seven feet long and twenty-six foot stroke. On the table were bolted eight large segments for a twenty-four foot rope pulley, the joints of which were simultaneously planed, thus insuring uniformity of cut and size throughout the series.

In the middle of the bay was a 1,000 H. P. friction clutch six feet by four inches, mounted upon a shaft eighteen inches in diameter and twenty-five feet in length. Near by is the floor where the huge clutches are assembled, fitted inside the rope drums and carefully tested.

Some idea of the amount of work performed in the

works may be gained from the statement that at this time the value of machinery being constructed in bay No. 3 aggregated \$149,000. There were to be seen, tier upon tier, rope drums, finished differential rings, fifty ton flywheels and steel gears awaiting shipment to cable stations in New York, Chicago and Baltimore.

In this part of the shop are turned, faced and bored the wrought iron rings for the Walker differential drums which have made the name of the company famous throughout the engineering world. An engraving of the latest design of drum is shown herewith. By the use of this invention in the power station, it is stated that the life of a steel cable is increased from six to twenty months with a saving in power of 37 per cent. With such a record for economy in material and power, it is not surprising that the differential drum has attained great popularity among cable engineers, and that it is regarded as one of the most essential and fundamental elements in a cable equipment. During the last five years 118 drums have been made, thirty-four of which have displaced solid

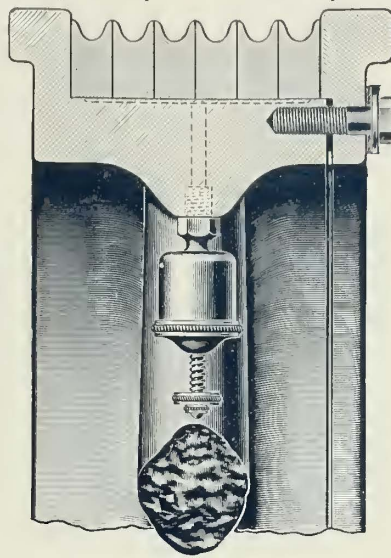
latest application is in the cable machinery on the top of the Catskill mountains.

It is predicted that a great field of usefulness for the drums will be found in factories and mills where rope transmission is employed, as no little trouble is now experienced as a result of the unequal strain on the individual ropes. The difficulty resulting from the stretching and wear of the ropes, causing excessive lengths and unequal diameters, may be overcome to a very large extent by the use of the differential drum.

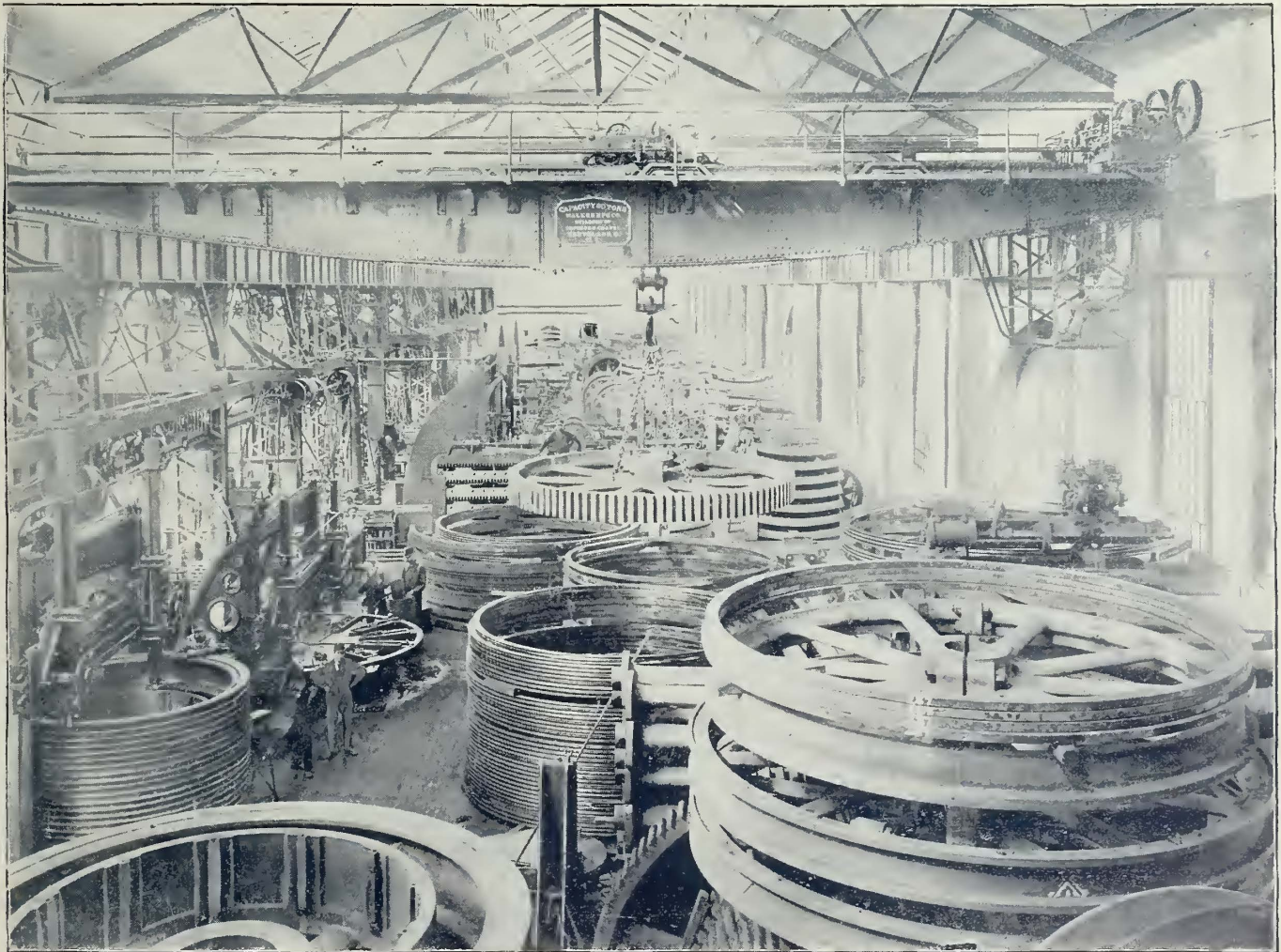
In bay No. 3 is also located the Gleason gear planer which was cutting the teeth of a steel pinion seventy inches in diameter and five in pitch.

Another machine of interest, because of its great dimensions, is the pit lathe, eighty-six feet in length, twelve feet wide and twenty-five feet deep. At the time the writer visited the works there were swung on their own shafts from the lathe two

huge rope driving pulleys twenty-four feet in diameter with eight grooves in each. As the pulleys revolve, the grooves are turned to a gauge by four tools at each side.



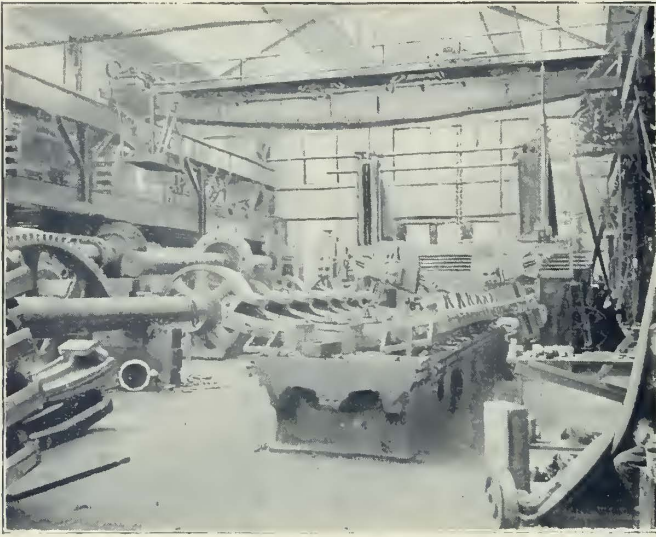
LATEST DESIGN WALKER DIFFERENTIAL RING.



BAY NO. 3—MACHINE SHOP.

drums, and at the present time forty-eight are in process of manufacture. The drum has recently been tried with success in the haulage plants in an English mine, and the

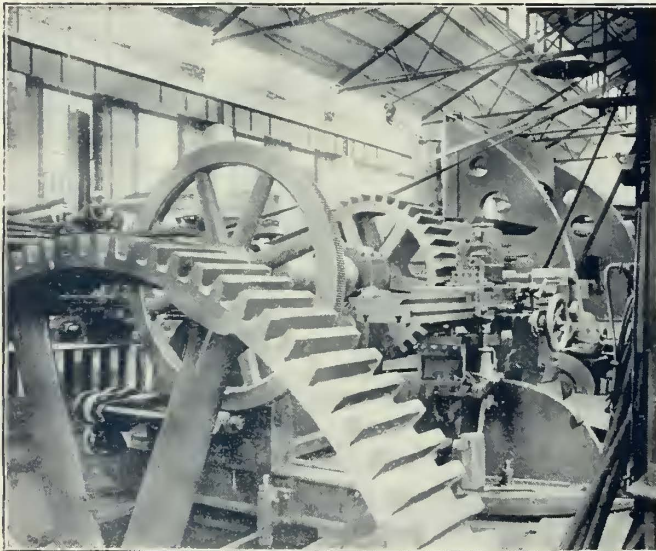
The rope drive pulleys built for a cable plant in New York City recently turned on the shaft are the largest ever made in this country, measuring thirty-two feet in diam-



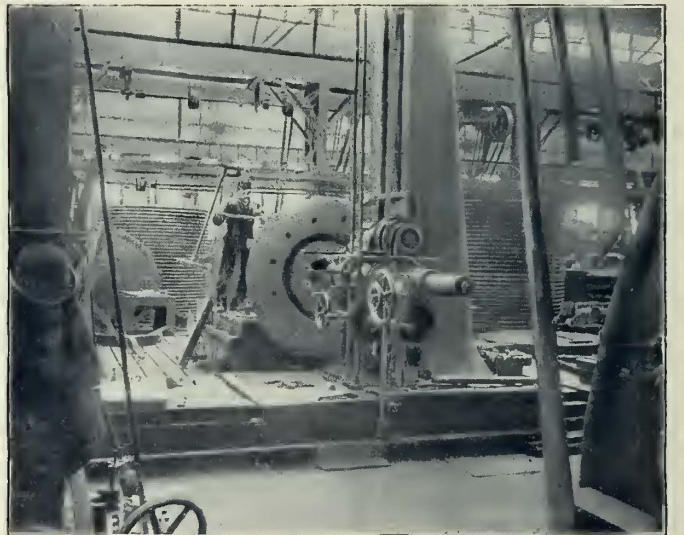
PLANING ANGLES CABLE DRUM SEGMENTS.



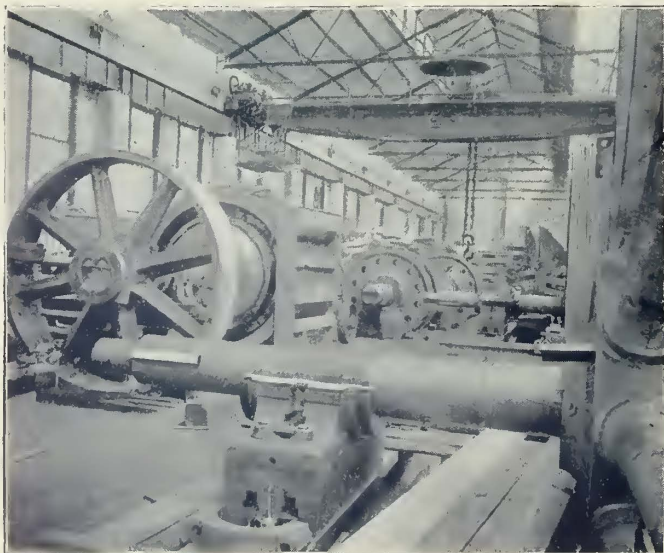
BUILDING UP A THIRTY TWO FOOT CABLE DRIVING DRUM.



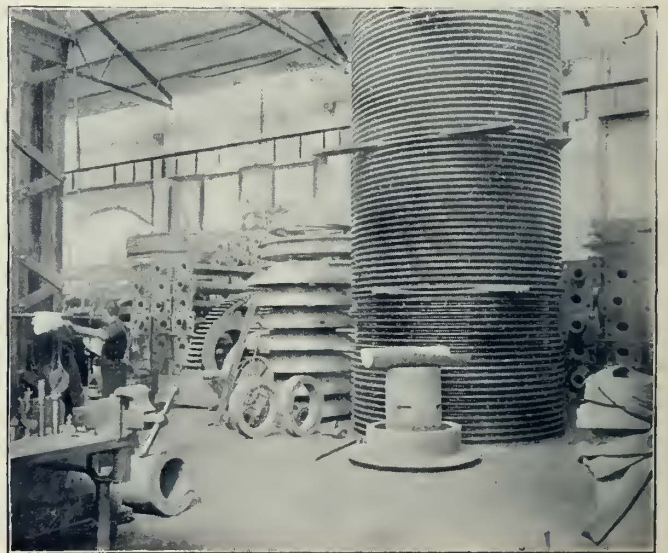
CUTTING PINION TEETH.



BORING A CLUTCH



TESTING A 1,000 H. P. CLUTCH.



PINIONS AND CLUTCHES FOR THE THIRD AVE. ROAD, NEW YORK.

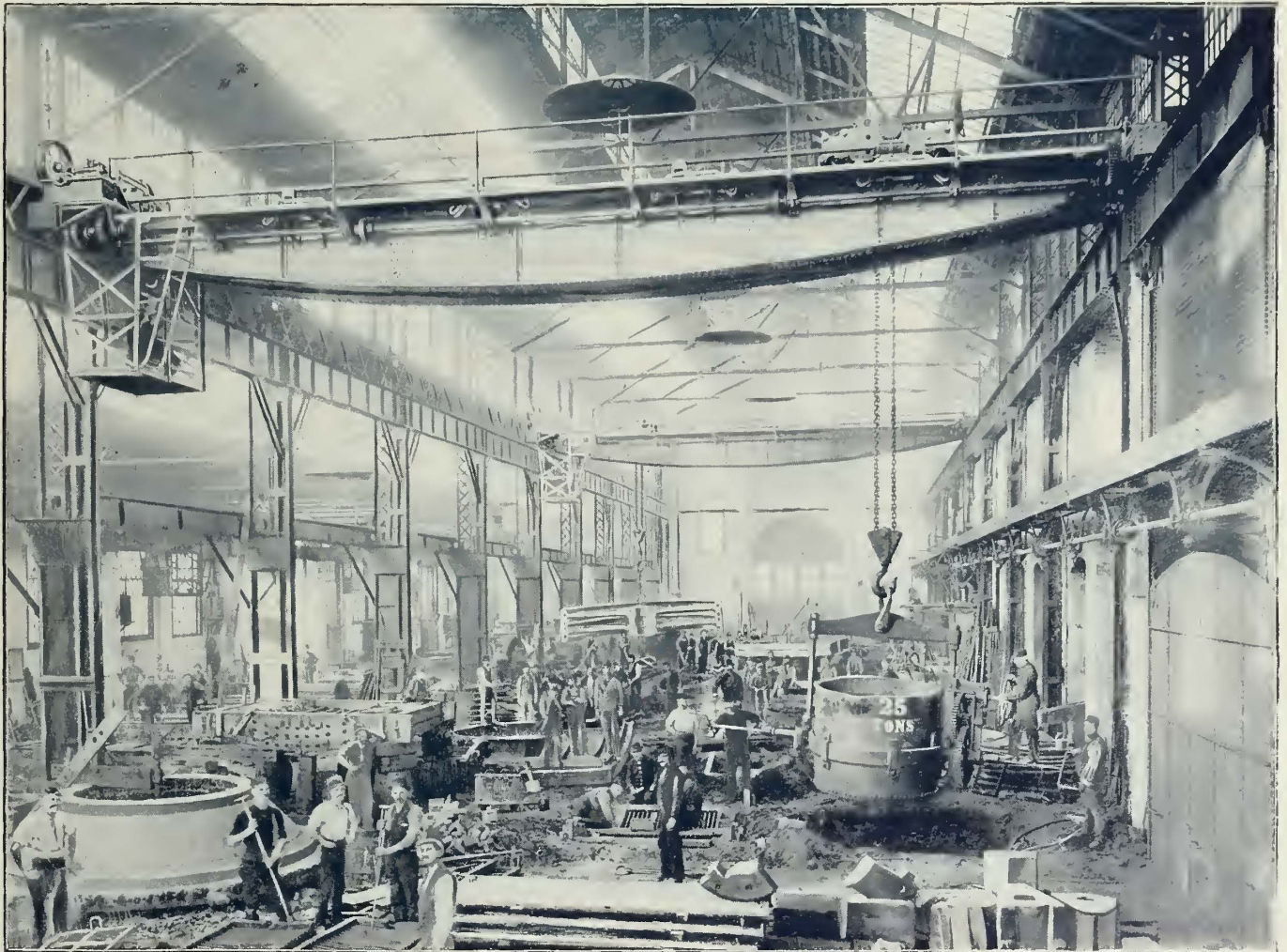
eter and eight feet four inches in width, with thirty-four rope grooves, and weighing, when complete, 104 tons each.

Opposite the pit lathe a 1,000 h. p., Weston-Walker friction clutch, the most powerful ever made for cable work, was tested. It was fitted inside a rope drum and turned in its axis on temporary journals at a speed of fifty revolutions per minute.

In an establishment in which ponderous weights must constantly be handled, shipping facilities are desirable and even necessary. The means adopted in the Walker shops are unique. A railway track passing through the building is sunk so that the car tracks are level with the floor. By this arrangement the loading of cars by means of traveling cranes is quickly and easily accom-

plished. One of the shipments for a New York road was to be seen in the yard. It consisted of a pair of centres, shaft and couplings for a rope pulley, and was all in one piece, weighing thirty-six tons.

casting vertically out of a pit and carry it from one end of the foundry to the other. The side bays are provided with two twelve ton traveling cranes, operated by separate engines. The absence of smoke, due to good ventilation, is remarkable, while the lighting during the day is all that could be desired, and in striking contrast to the gloom of the adjoining No. 2 foundry, with its limited window space and primitive wooden roof. The metal for the foundries is supplied from four Walker improved cupolas, two sixty inches in diameter and one seventy-two inches, the fourth eighty-four inches in diameter. The form and arrangement of the tuyeres is the result of long experience and scientific experiment. The cupolas are both rapid and economical, melting an average of 13.10 lbs.



FOUNDRY IN THE WALKER WORKS.

plished. One of the shipments for a New York road was to be seen in the yard. It consisted of a pair of centres, shaft and couplings for a rope pulley, and was all in one piece, weighing thirty-six tons.

THE FOUNDRY.

The foundry of the company, which has been described as the model plant of the kind in the United States, is 300 ft. long and 118 ft. wide, and is built in three bays, the centre one being fifty seven feet in width and forty-one feet in height to the tie beams and sixty-two feet to the highest point of the roof. Here are produced the huge castings for the ponderous appliances constructed in the machine shop. These immense weights are shifted by two thirty ton, rope power, traveling cranes, operated at such an altitude as to lift a twenty-four foot

of iron per pound of coke. Unlike most foundries, the system of fan blast is discarded, the blast being supplied from a vertical blowing engine of the type used in blast furnace plants. The two air cylinders are 48 × 30 ins., the steam cylinder 14 × 30 ins. The engine, which was built by the company, is extremely simple, and delivers a steady, even blast, ranging from five to eight ounces, with eminently satisfactory results.

All the coke, iron and limestone for cupolas is elevated by hydraulic power, developed in a fourteen inch accumulator of fourteen feet stroke, with an average pressure of 1,000 lbs. per square inch, by differential pumps working at a speed of 150 revolutions per minute, without shock or jar. The elevator is calculated to raise a load of 12,000 lbs. The core ovens and carriages are of the most modern design. The ovens are 24 × 30 ft. and

20×30 ft. respectively, and are heated by underground flues; the carriages are operated by gearing and crank handles, the old fashioned pinch bar being relegated to the memories of ancient days.

In various parts of the foundry are to be noticed mechanical sand sifters, working at 125 strokes a minute, evi-



J. B. PERKINS,
PRESIDENT WALKER MANUFACTURING CO.

dently excellent labor saving machines. The system of storing sand, is an economical and convenient system, and involves a series of brick vaults underneath the yard, with outlets into the foundry, and manholes for dumping the sand fixed in the yard floor. Large casting pits are located at various parts of the foundry floor, ranging from twenty-four to twelve feet diameter, and as deep as twenty-five feet. Facilities for casting are on a large scale, the capacities of the crane ladles ranging from three to twenty-five tons. They can be poured from either side, and the operating mechanism is safe, powerful and effective. The foundry is heated in winter by hot air, delivered from a Sturtevant blower, through an inlet forty-two inches square, which is capable of displacing 50,000 cu. ft. of air per minute. Probably the most interesting features in these foundries are the pulley moulding machines in No. 2, and the five gear moulding machines in No. 1. The accuracy and speed with which work is executed by these machines are marvelous.

A sketch of the Walker Manufacturing Co. would be manifestly incomplete if it excluded references to the men who have made it one of the most noted engineering companies in the country. The officers are: President, J. B. Perkins; vice-president, John Walker; manager of the works, W. H. Bone; secretary and treasurer, Z. M. Hubbell.

J. B. PERKINS.

Standing at the gateway on the northern side of the works the visitor obtains a view of one of the finest stretches of bay scenery in the country. On the cliffs, some two miles away, can be seen "Twin Elms," the handsome residence of J. B. Perkins, the president of the Walker Manufacturing Co., who owns nearly the whole of the lake frontage to be seen. Mr. Perkins has been prominently identified with the architectural improvements in Cleveland, and has built a number

of the largest business blocks in the city. He is a prime mover in the great scheme of environing the city by a boulevard thirty miles in length. He is president of the Hackney Hammer Co., and is largely interested in the Hill Clutch Works. His business enterprises are almost without number, and he is considered one of the ablest financiers of the state of Ohio. He still finds time, however, to raise fine horses. He is an expert horseman, and is at the head of the Cleveland cavalry troop. He is responsible for many deeds of philanthropy, but so unostentatiously are they performed, that few people ever learn of the facts.

JOHN WALKER.

John Walker, the founder and the vice-president, comes of a line of expert British mechanics, and was born August 3, 1847, at Middleborough, on the northeast coast of England. His father, James Walker, was a plain iron founder, who could sleek a mould, fix a core or pour a casting as well as any man in the iron districts of England. The son was educated first in a common school, and after a course of study in the private academy of Thomas Ainsworth, a teacher of the old school, he served seven years and a half apprenticeship in the workshops of Vaughan & Co., the largest iron concern in the world, with a capital of \$15,500,000.

When twenty-four years of age Mr. Walker came to the conclusion that his chance for advancement would be much greater in the United States than in England, and coming to this country he settled in Philadelphia. While he was in the employ of William Sellers & Co. of that city, he invented his famous gear scale for setting out graphically the form of teeth for gear wheels. Subsequently Mr. Walker was connected with Wright & Co. of Newburgh, N. Y., then with Poole & Hunt of Baltimore, and later with Nordyke & Marmon of Indianapolis. In 1882 he determined to organize a company for the manufacture of specialties under his own patent rights. He was successful in interesting Mr. J. B. Perkins, General Leggett, commissioner of patents under Grant, George W. Gardner, ex-mayor of Cleveland, Mr. H. T. Taylor and Mr. T. Kilpatrick, and September 20, 1882, a company was formed which is known the world over as the Walker Manufacturing Co.

It was almost five years after the company was formed, that the great invention was conceived with which Mr. Walker's name is identified, and for which the Walker Manufacturing Co. is specially renowned. At that time Mr. Walker happened to be in a cable power



JOHN WALKER,
VICE-PRESIDENT WALKER MANUFACTURING CO.

house in Kansas City, Mo., and was watching the sparks flying from the winding drums, due to the friction of the cables. The question arose, how could this disastrous wear and tear be prevented. On the spur of the moment he conceived the idea of a drum with differential rings. Going to his room at the hotel he made a sketch of his conception, and a photograph of the original drawing may be seen at the works to-day.

W. H. BONE.

The manager of the Walker Manufacturing Co., Mr. W. H. Bone, was born in Petersburg, Va., October 6, 1857. At the age of fifteen he entered the employ of Poole & Hunt as an apprentice draughtsman, and in the course of seven years obtained the rudiments of the extensive knowledge of gears and power transmitting machinery, which has since earned for him the title of a specialist in this branch of engineering. After three years as chief draughtsman with Nordyke & Marmon, of Indianapolis, he was induced by Mr. Walker, in 1882, to lend his aid to the small industry started on the southern shores of Lake Erie; and upon the re-organization of the company, on the present large scale, in 1890, he was appointed manager, which post he now fills, looking after the details of the business, and more particularly the gear department.

Z. M. HUBBELL.

The secretary and treasurer of the company, Mr. Z. M. Hubbell, was born September 16, 1843. He is one of the best authorities on matters financial in the Forest City, and is often engaged as an expert to unravel complicated accounts. Seven years' experience in the tax

true of all the Lake Shore cities. Chicago has grown from 30,000 to 1,400,000, if the school census is to be believed; Detroit from 21,000 to 206,000; Toledo from 3,829 to 83,000; Buffalo from 42,000 to 260,000. Without the co-operation of the Lake Shore road this prodigious development would have been out of the question. The most interesting portion of railway history of the West centers in the records of this company. The corporation is the result of the consolidation in 1869 of four different companies, and these latter came into existence after such a vast number of consolidations that one is bewildered in consulting the record.

The Lake Shore may be regarded as a Cleveland enterprise, as the general offices are located in the city at the corner of St. Clair and Seneca Streets. The company operate to-day a system of 1,445 miles, and the total mileage, including second and third tracks and sidings, is



W. H. BONE,

MANAGER WALKER MANUFACTURING CO.



Z. M. HUBBELL,

SECRETARY AND TREASURER WALKER MANUFACTURING CO.

office, besides extended service as freight agent and also cashier of the New York, Pennsylvania & Ohio Railway Co., has eminently fitted him for the important position which he now holds. He was interested in the company at the time of the organization of the Walker Manufacturing Co., and he largely planned its unique system of book-keeping and methods of finance. He is the private secretary of Mr. J. B. Perkins, has served two terms on the local Education Board, is a member of the Library Board and a member of the Order of Knights and Ladies of Honor.

Lake Shore & Michigan Southern.

The Lake Shore & Michigan Southern Railway Co. have contributed more than any railroad corporation to the prosperity and growth of Cleveland. Since the road connected Buffalo and Chicago in 1853, there has been a marvelous growth all along the line. In that period Cleveland has increased in population from 17,000 to 300,000, and the wealth of the city has multiplied in a far greater proportion. What is true of the Forest City is

2,512 miles, of which 92 per cent. is laid with steel rails. During 1891 a total of 12,000,000 tons of freight was moved and about 6,000,000 passengers were carried. The road is famed for its splendid passenger service and the speed of its trains. The board of directors is composed of William K. Vanderbilt, Cornelius Vanderbilt, Frederick W. Vanderbilt, Samuel F. Barger, John E. Burrill, Darius O. Mills, Edwin D. Worcester and Hamilton McK. Twombly, all of New York; Charles M. Reed of Erie, Pa.; Rasselas Brown of Warren, Pa.; John Newell of Cleveland, John De Koven of Chicago, Hon. James H. Reed of Pittsburgh. William K. Vanderbilt is chairman of the board, John Newell, president and general manager, and Edwin D. Worcester, vice-president, secretary and treasurer. The administrative details are in the hands of President John Newell, P. P. Wright assistant general manager; Nicholas Bartlett, local treasurer and assistant secretary; Addison Hills, assistant president; Cyrus P. Leland, auditor; W. H. Canniff, general superintendent; P. S. Blodgett, general freight agent, and A. J. Smith, general passenger and ticket agent.

The Ford-Washburn Storelectro Co.

The Ford-Washburn Storelectro Co. of Cleveland is best known to street railway men by its storage battery car, which has been running on the different lines in that city. Its operation has been satisfactory not only to the inventors but to street railway men. The car is twenty feet nine inches in length inside, twenty-eight feet over all, and was built by the J. G. Brill Co. It is now eight months since the car was put into service, and though subjected to severe tests, the batteries are in as good condition as when first used. The car is operated by a thirty-five horse power, Ford-Washburn, series wound motor weighing 2,000 lbs. The motor is geared to both axles, and can be run from either end in either direction, and at seven variations of speed, by an ingenious method of battery commutation.



GEORGE A. FORD.

The battery equipment consists of 180 cells of 150 ampere hours' capacity each. The cells are twelve inches in height and $4\frac{1}{2} \times 8$ ins., and each weighs, with acid and rubber box, forty pounds. The batteries are carried under the seats, and are slid on trays into position through suitable openings in the ends of the cars, instead of at the sides.

In view of the many failures that have attended storage battery traction, how happens it that the Ford-Washburn car has proved so successful in service? An answer to the query involves a reference to the causes of failure, and a description of the novel type of battery devised by George A. Ford and George A. Washburn. Generally, it may be said that the success of the car has been the result of the peculiar construction of the batteries. The ordinary form of battery is commonly short lived because of faults which are soon developed. Plates buckle as the result of the contraction and expansion of the material on the grids. When buckling does not occur, the active material is likely to become loose, and at the loose points sulphating begins. At the same time if any portion of the material falls out, the capacity of the cell is diminished, even if a short circuit with disastrous

results does not follow. With these causes at work the fact that the life of storage batteries of the ordinary form is usually short is not surprising.

To construct a battery in which these disintegrating causes would not be present was the problem that the inventors sought to solve. The result is a battery constructed on novel lines without grids and without plates. As the illustration shows, the cell contains six sets of elements, each corresponding to a pair of plates in the grid form. The positive and negative elements are separated by a thin porous cup through which the electrolyte may percolate, but which acts as an effective barrier to the passage of the active material. The porous cup is covered on the outside with a thick layer of active material around which is a sheet of perforated lead. The perforations admit of a free circulation of the acid. Within the porous cup is placed a sheet of

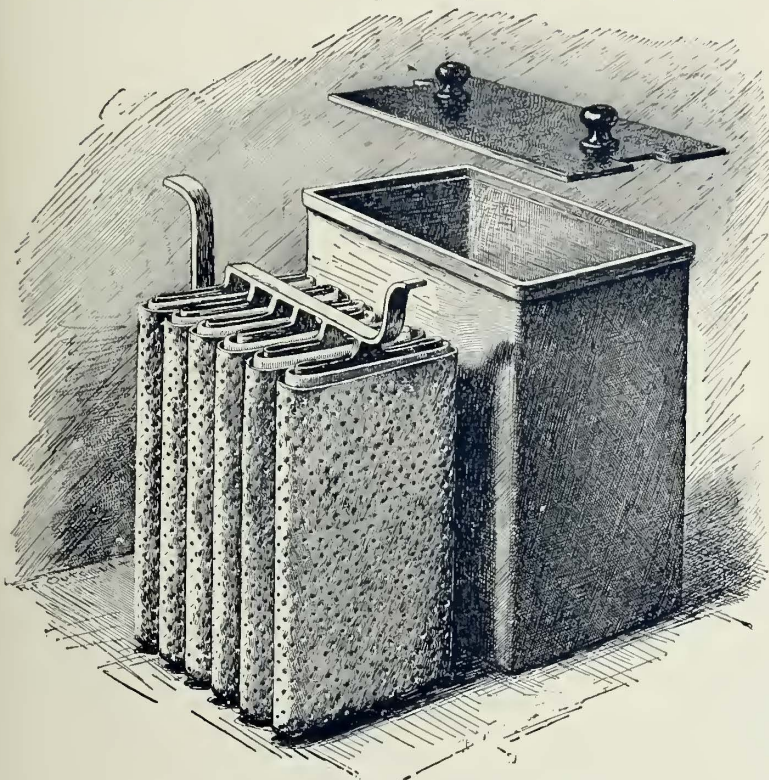


GEORGE A. WASHBURN.

lead similar to that on the outside, but smaller. The space between it and the cup is filled with active material. The sheets of lead act as conductors merely for the active material on each side of the cup, that on the outside forming the negative plate, and that on the inside the positive. All the negatives in a cell are connected by a strip at the bottom, which is extended to the top as shown at the left in the illustration, and the positives are similarly connected at the top, forming the positive pole. While by this construction buckling, loosening of active material and consequent short circuiting are prevented, it may be asked if, with the porous cup, the internal resistance is not high. The Ford-Washburn company answers the question in the negative, and to prove the statement asserts that discharges of the cell, on a dead short circuit, in the presence of experts, and through an ammeter of negligible resistance, have given readings up to 400 amperes, gradually declining to 350, where the ammeter needle stood for a time. It is evident that with an electromotive force of two volts and a current of 350 amperes, the internal and external resistance together cannot be more than .0058 ohm.

The car has made an excellent showing on the trial

trips, and has maintained a speed of from fifteen to twenty miles an hour. Upon a recent trip over the lines of the Woodland & West Side and East Cleveland street railway companies, the car, with



FORD-WASHBURN STORAGE BATTERY.

thirty-five passengers, covered sixteen miles, with an average ampere reading of 20, and voltmeter reading of 350, and 3.3 miles were run in twelve minutes; during the rest of the trip trolley cars were in the way. On the route named there are twenty-three sharp curves and ten

George G. Mulhern, superintendent of the Woodland Avenue & West Side Street Railway Co., of Cleveland, after riding on the car, wrote to the Ford-Washburn company his impressions of his inspection. He says, among other things: "It has thoroughly demonstrated its practicability for street car uses, both in the speed obtained and perfect control in operation. I have ridden as fast as twenty-five miles per hour on your car, and even at this rate of speed there seemed to be no material diminishing of the power. I have witnessed the stopping and starting of the car upon sharp curves and heavy grades, and this was accomplished without difficulty."

The Ford-Washburn Storelectro Co. engages in the construction of electrical machinery generally, with factory and offices at Frankfort Street. The officers of the company are: George A. Ford, president; J. F. Pankhurst, vice-president; W. H. Marshall, treasurer, and E. S. Ford, secretary; and the executive committee is composed of George A. Ford, L. A. Cobb, George Hoyt, J. F. Pankhurst and Luther Allen.

Handling Iron Ore.

The rapid unloading of vessels at the ore docks forms one of the most interesting sights in Cleveland. The means employed are, to be sure, not peculiar to the city, but in no place can the operation of the ingenious apparatus designed for hoisting and conveying ores, be seen to better advantage. The ore industry is an enormous one in Cleveland. Forty years ago the first shipment of ore from the mining districts of Michigan was received and consisted of half a dozen barrels weighing, perhaps, two tons. Since that time the shipments have reached the enormous total of 900,000 tons annually. By far the greatest proportion is handled by the buckets running on the slender movable bridge tramways similar to those



FORD-WASHBURN STORAGE BATTERY CAR.

grades, ranging from 2 to 5 per cent. The car has drawn a loaded trailer up a $1\frac{1}{2}$ per cent. grade at the rate of fifteen miles per hour. With one charging the car can run, it is said, on ordinary track, for a distance of forty miles. At a test made in Cleveland the cost of coal for charging the battery was one-half cent per car mile, with coal at \$1.40 per ton.

shown in the cut, page 15. The method of operation is exceedingly simple. The buckets are lowered by wire rope into the vessels, where they are filled by the shovellers. They are then hoisted to the tramway, and as the carriers may be tripped at any given point the contents may be deposited at the desired place. The total length of the tramways in use at the Cleveland & Pittsburgh

Railroad Co's docks at Cleveland is 300 ft. The system of handling ores is that of the Brown Hoisting & Conveying Machine Co., of Cleveland. With their machinery a vessel reaching its dock at 6 A. M. can leave at 6 P. M. after discharging 3,000 tons of ore. Fully 75 per cent. of all ore shipped on the lakes is handled by Brown machinery.

Fulton Foundry.

There is, doubtless, scarcely a street railway company in the country that has not at some time or other sustained relations with the proprietors of the Fulton Foundry of Cleveland. Coming into the field at an early date, and making a specialty of street railway work, the firm is well known the country over. The business was started in 1865, and Mr. S. M. Carpenter, who has been connected

with the manufacture of wheels. It is only by a combination that the best results can be obtained. By an extended series of experiments the proprietors of the Fulton Foundry hit upon a combination that has proved extraordinarily well adapted to the purpose. It produces an even chill, and it tends to reduce to a minimum chill checks. On the tread of the wheel a chill three-quarters of an inch in thickness is produced when at the same time the spokes and the hub are found to be of very soft metal. Where such results can be obtained, very little improvement can be expected in the manufacture of wheels.

The firm are now making a new wheel, devised by Mr. W. E. Haycox, with an independent brake rim. It is a well known fact that the wear of a brake shoe upon the tread materially lessens the life of a wheel. To prevent this shortening of life the independent rim has been



FULTON FOUNDRY

with the firm from the outset, is now the senior member. Associated with him at present are Mr. C. J. Langdon and Mr. W. E. Haycox.

From the first, the firm made car wheels and heavy castings for steam and street railways. At present the Fulton Foundry is, perhaps, best known by the truck that bears its name, but in addition there are manufactured in the plant crossings, switches, turnouts, chairs and knees, as well as wheels of peculiar construction.

The foundry, of which a view is presented herewith, is divided into three departments: Machine shop, wheel shop, foundry and wood working shop.

The machine shop is supplied with the latest improved appliances for performing the work in hand. Special tools are provided for turning axles, boring wheels and pressing them on axles, and for drilling, forging and finishing the iron work for motor trucks.

The wheel room is devoted entirely to the manufacture of wheels for use on street and steam railways. A superior grade of charcoal iron is employed for this purpose; in fact, it is stated by experts that the special combination of iron used by the Fulton foundry gives results that cannot be surpassed. It is a fact, perhaps, not universally known, that ores coming from different parts of the country cannot be successfully used separately in the

added. It is cast on the inside face of the wheel, having a diameter somewhat less than that of the wheel proper, so that it can readily pass guard rails on curves. It adds but a few extra pounds to the weight of the wheel, and is claimed to add from 60 to 70 per cent. to its life.

In the foundry all the heavy castings are made for railway work. These include crossings, crossovers, switches, curves, turnouts, chairs, knees, etc.

The wood working shop is devoted to the manufacture of trucks and small cars; the latter are made for a variety of uses. The trucks of the Fulton Foundry have gained a wide reputation for durability, and for the peculiar construction which calls for little in the way of repairs. One of the companies now using the truck on their lines recently made the statement that they proposed to dispense with the services of several truck repairers, as with the Fulton Foundry truck they were not required. One company states that a truck has been in constant use for fourteen months and has not been in the repair shop. The great feature of the truck consists in the fact that the frame is wood—white oak. With this framework it is claimed that the bolts hold better than with steel. The brake is strong and substantial, and without a superior for street car work.

The Robison patent drawbar, manufactured by the

Fulton Foundry, is giving entire satisfaction wherever it is in use, as it constitutes an absolutely tight coupling between motor and trail car. It is a radial drawbar, and when it is used cars can be backed around the shortest

drawbars, and the Woodland Avenue & West Side Street Railroad Co. have also ordered their equipment from the Fulton Foundry.

The Haycox patent brake head and slippers are manufactured by the firm. They are found to be most convenient and labor saving brake shoes. The brake head is made to fit any style of motor truck or horse car gear, while the slippers are all alike. This fact is especially appreciated by companies using several different trucks.

The Haycox door fastener is a well known product of the Fulton Foundry. It is used quite extensively by the East Cleveland Railroad Co., and by other roads throughout the country. Its special point of advantage lies in the fact that it holds the door in the desired position, *i. e.*, open or closed at all times and does not allow it to swing when the car is rounding curves. No lock or catch is required on the door, and it may be opened or closed very easily.

While the apparatus constructed by the Fulton Foundry is familiar, the men who conduct the enterprise are,



S. M. CARPENTER.

curve without danger of causing a car to leave the track. It is, unfortunately, the fact that when the link and pin are used, employes seem to manage to collect all pins on one car and all links on another. When the time to attach a trailer comes, either a link or a pin is missing, and there is, consequently, delay, to the great disgust of the passen-



W. E. HAYCOX.

perhaps, not so well known; for this reason short sketches of these gentlemen are herewith appended.

The senior member of the firm is Mr. S. M. Carpenter, a veteran in the business, who has a practical knowledge of it in all its details. He has been engaged in this particular work for an extended period, and to his careful supervision much of the success which has attended the introduction of the apparatus is due.

Mr. Carpenter was born January 8, 1817, in Franklin County, Mass. He started at work in a foundry at the age of seventeen, and he passed several years in Troy and Rochester, N. Y., and thence in 1840 he removed to Erie, Pa., where he resided for twelve years. In 1852 he became interested in the foundry business in Cleveland under the name of Carpenter, Gerry & Co. A small foundry was built and was devoted to the manufacture of railroad work. The plant was enlarged from time to time, but after ten years, on account of the ill health of Mr. Carpenter, the business was sold to Pettengill, Glass & Co. In 1865 the present Fulton Foundry was started by Mr. Car-



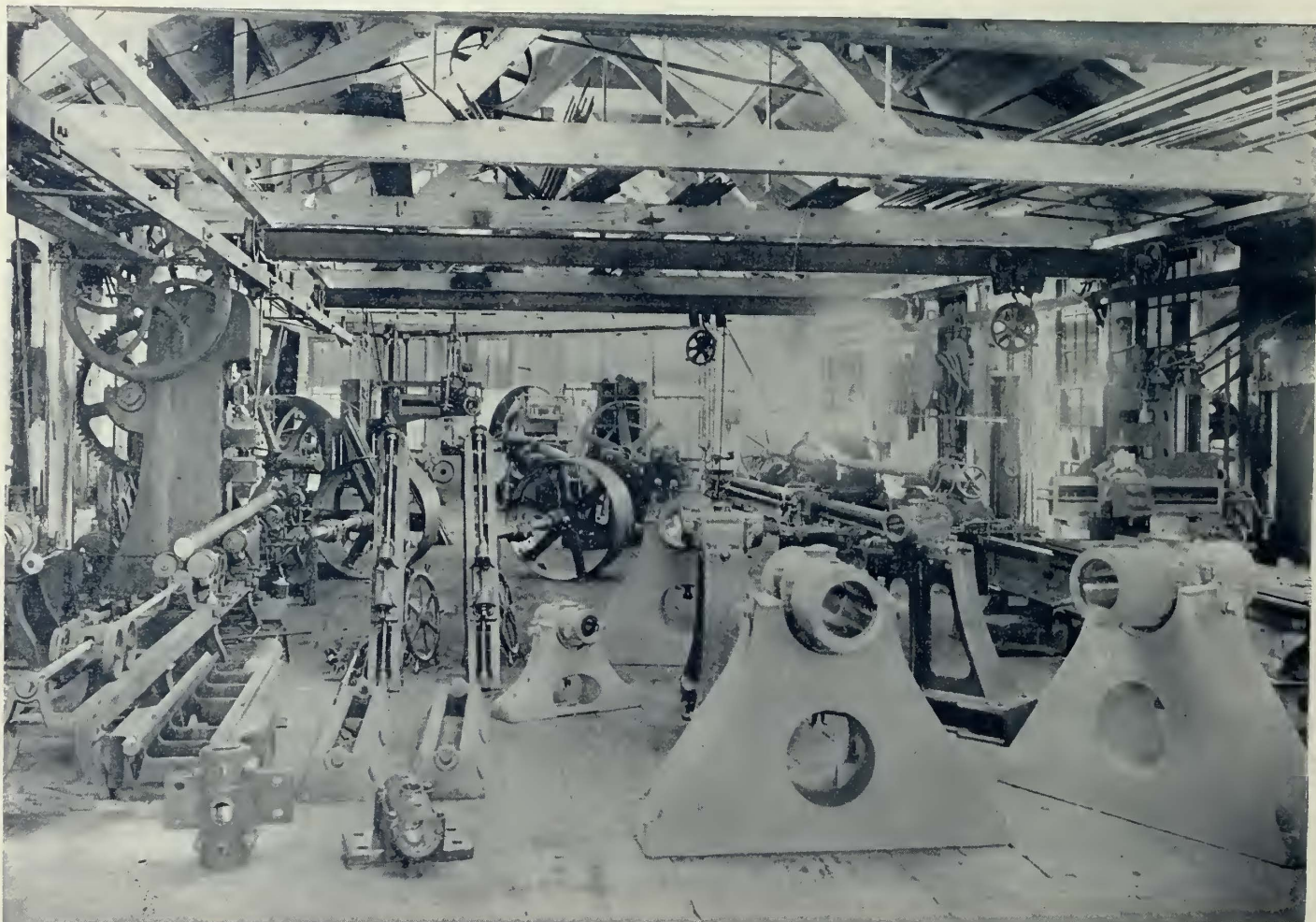
C. J. LANGDON.

gers. With the drawbar of the Fulton Foundry it is impossible for incidents of this kind to occur, as employes cannot detach any part of it, and it is always complete when it is necessary to attach a trailer. The cars of the East Cleveland Railroad Co. are equipped with these

penter, on the site of the present plant. After several years he acquired the entire interest in the business and retained the sole ownership until three years ago when Mr. C. J. Langdon was admitted to the partnership, and subsequently Mr. W. E. Haycox became a member of the firm.

Mr. C. J. Langdon, one of the junior partners in the firm, has a wide acquaintance with street railway men. He has charge more especially of the executive business. He was born in 1858, in Cleveland. He attended the public schools of the city from 1864 to 1873, after which he studied telegraphy, securing a position in five

ployes, a gift which he prizes very highly. The Belt Line, at the time, possessed the questionable distinction of being the worst street car railway in the country. Under Mr. Haycox's management a decided change for the better was brought about, and the line became known as one of the best horse roads in the United States. In 1890, the road was electrically equipped, and when Mr. Haycox left in the summer of that year, it was considered one of the best lines in the country, with the exception of the roadbed which was put in the best shape possible with the money allowed for the purpose. In 1891, he accepted the position of traveling agent of the Fulton Foundry, and



SHAFTING AND ERECTING DEPARTMENT.—HILL CLUTCH WORKS.

months. His duties as operator occupied him till 1881, when he accepted a position with the Fulton Foundry, and has been connected with the concern since that time.

Mr. W. E. Haycox has had an extended experience in practical street railway business, having worked his way through every grade of the service before his connection with the Fulton Foundry. He was born in Monmouthshire, England, in 1856, and came to this country with his parents in 1874. Three years later he began his street railway work as driver on the East Cleveland railroad. After a year at this work, he became a conductor, which position he held for five years, when he became assistant superintendent of the East Cleveland road. In 1886, he was one of the organizers of the East Cleveland Employees' Mutual Benefit Association, and was elected first president of the organization. In 1888, he accepted the superintendency of the Utica Belt Line, at Utica, N. Y., and upon his leaving the East Cleveland company, he was presented a handsome gold watch and chain by the company and the em-

ployee at the end of a year he was made a partner in the business. As a salesman Mr. Haycox has been unusually successful, and he has made a number of inventions which are well known to street railway men. Among these are his door fastener, patent brake shoe, the double tread wheel and others.

Hill Clutch Works.

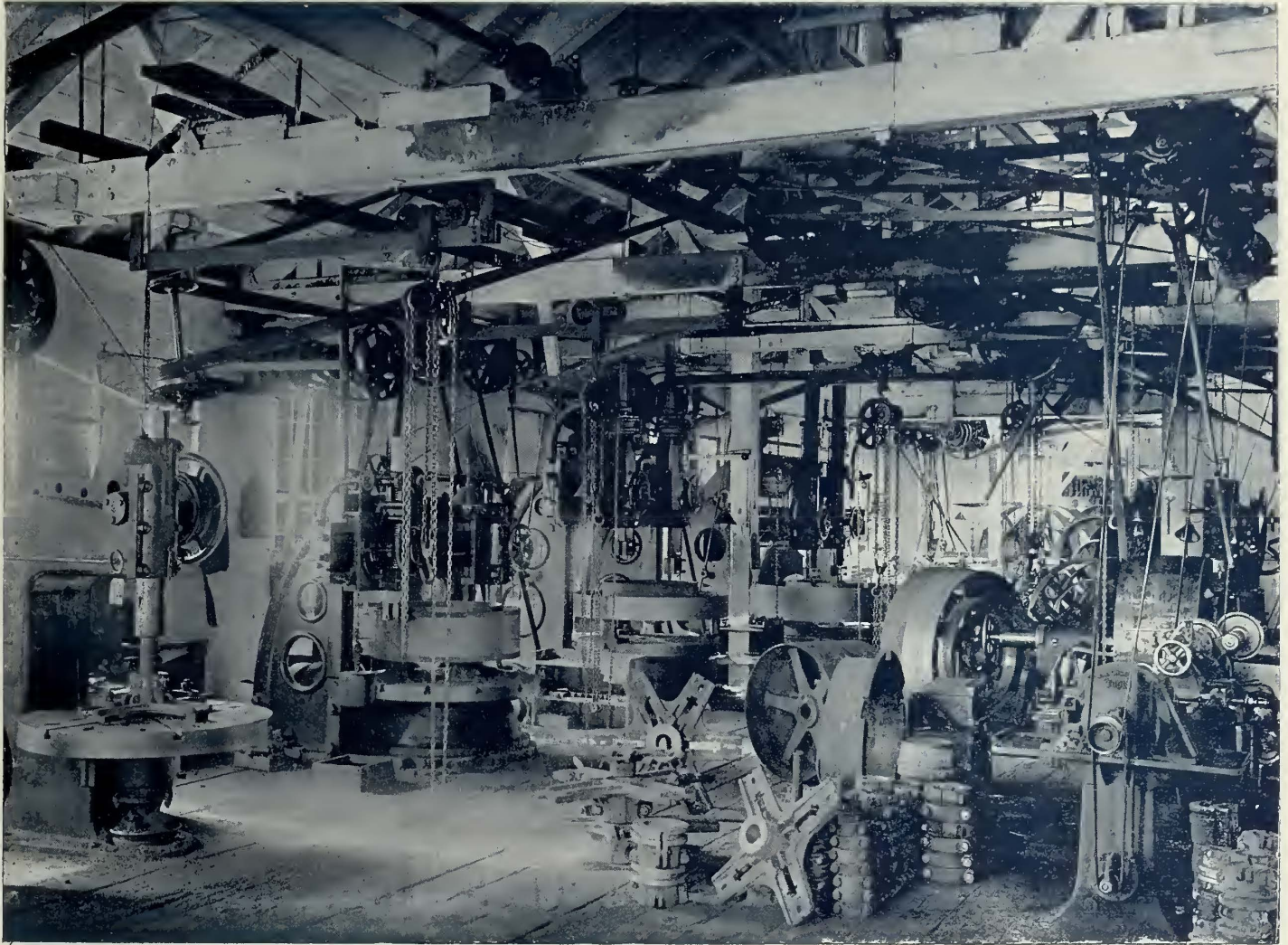
The Hill Clutch Works form one of the most prominent manufactories in Cleveland, especially in the estimation of street railway companies, in so many of whose power stations the Hill clutches and specialties are used. The plant is located on Waverly Avenue adjoining the works of the Walker Manufacturing Co., and the buildings contain an equipment of machinery complete in every particular. The accompanying views illustrate two of the departments, and give some idea of the character of the work undertaken.

In the first illustration is presented a view of the shafting and erecting room. In this department the shafting is received from the forges in the rough state. It is first placed in the large machine shown on the left, in which it is carefully straightened, and which is sufficiently powerful to straighten a shaft ten inches in diameter. The shaft is then taken to a lathe where it is turned perfectly true and then polished. The largest lathe will turn a shaft thirty-three feet long and twelve inches in diameter. The shaft is next carried to a machine in which the key seats are cut. This machine is located in

The shops and offices are lighted throughout by electricity.

Globe Iron Works Co.

The Globe Iron Works Co., which built the engines for the power plant of the Woodland Avenue & West Side Railroad Co., occupy the first place in ship building, one of the principal industries of Cleveland. The Globe Iron Works were established in 1853 for manufacturing marine boilers, machinery, etc., and in 1884 the Globe Ship



PART OF MACHINE SHOP—HILL CLUTCH WORKS.

the rear of the room. When this operation is completed the shaft is again taken to the straightener so that if it has been sprung in handling, the defect may be remedied.

In this department is also located a large open side planer used for planing clutches, floor stands or other large pieces of machinery, and in the rear of the room stands a radial drill of unusual size. In this room all apparatus constructed is assembled and tested so that any small mistakes may be discovered and corrected.

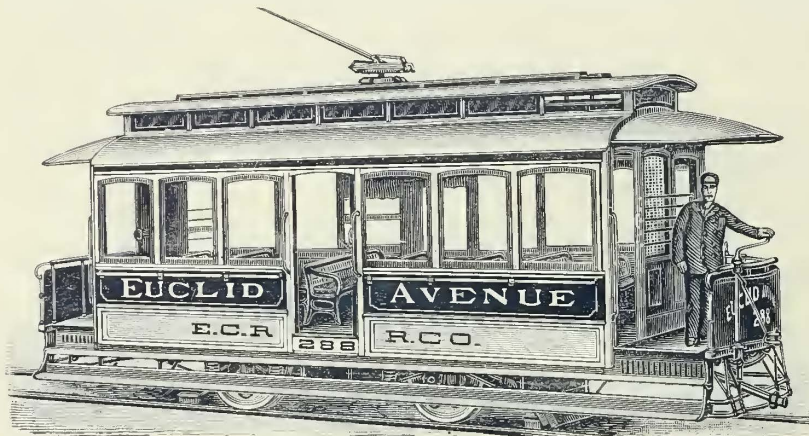
In the second illustration a part of the machine shop is shown. In this department are located the lathes, planers, mills, boring machines, key seat cutters and drills used in finishing the clutches, pulleys, bearings, floor stands, etc. In the back part of this room is a specially designed tool for turning off the wooden shoes used in the jaws of the clutches. When the wood blocks leave the machine they are absolutely true, so that when used the proper contact with the clutch ring is insured, and the wear on the shoes is reduced to a minimum.

Building Co., were organized to build iron and steel hulls for vessels, being the first corporation to engage in the business on the Ohio lake coast. The two companies were combined in 1886, forming the present corporation, with a capital of \$500,000. The office and works for the machinery department occupy the square bounded by Centre, Elm, Spruce and Hemlock Streets, while the foundry covers more than half a block on Centre, Elm, Spruce and Main Streets. The equipment of machinery for manufacturing is complete in every respect, and embraces steam cranes and overhead railways for moving ponderous weights. In the foundry are two cupolas, each of ten tons capacity.

The iron ship yard is located on the "Old River Bed" at the foot of Taylor Street where the company have space for constructing four large ships at a time.

The company employ 1,200 hands, their wages aggregating \$13,000 weekly. About 15,000 tons of metal are used annually, and 25,000 tons of coke are consumed during the same time.

Since July, 1886, the time of the incorporation, the company have launched forty-five large steel vessels averaging 3,000 tons each. They built the "Virginia", the crack boat of the Goodrich Transportation Co., of Chicago, which plies between Chicago and Milwaukee, and a number of smaller craft. The company have recently taken the contract for two large twin screw steamers, to cost \$500,000



MEHLING CAR, WITH SIDE ON

each, to ply between Buffalo and Duluth. They will be 360 ft. in length, and each ship will have an engine capacity of 6,600 H. P. The officers of the company are: President, H. M. Hanna; vice-president, J. F. Pankhurst; secretary, Luther Allen.

The Mehling Car.

The Mehling car, which is in use on the East Cleveland railroad, Cleveland, is intended for summer and winter use. It has been in regular service for several months on the Euclid Avenue line, and while the officers of the operating company were at first inclined to doubt if it would prove successful, time has proved that it is all that the inventor has claimed for it. Two views of the car are shown herewith, one with the side panels removed, fitting it for summer use, the other with the panels in position, adapting it for cold weather. At the present the car is enclosed, and it is noticeable that the panels cause no rattling. The removable panels are a feature of one side only; the windows on the other side are so large and are built so low in the body that when lowered the air has full sweep.

A peculiarity of the car is its construction with a side aisle which is narrower than that ordinarily allowed in a centre aisle car. No inconvenience results from the narrowness of the passageway, as with the arrangement of seats across the car the feet of passengers do not protrude into the aisle and form an obstruction. At the ends of the aisles ready exit is afforded by side doors opening on roomy platforms.

When the car is closed by the panels, a door is arranged at the side, making three doors in all. The car is built with straight sides, and its cost, it is stated, is not high. The inventor is J. A. Mehling who, with S. D. Dodge, of Cleveland, owns the patent.

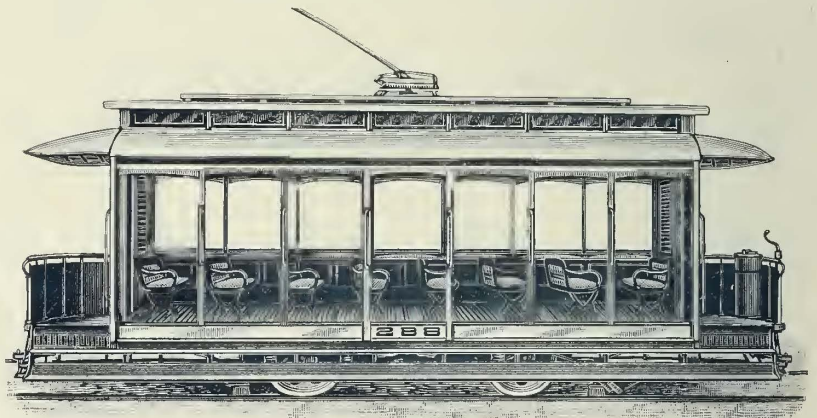
THE annual meeting of the Ohio State Tramway Association will be held at Zanesville, Wednesday, November 9, 1892.

Bodifield Belting Co.

Those who visit the street railway power stations in Cleveland will notice that in many cases belts made by the Bodifield Belting Co. connect engines to generators. They were organized less than four years ago, but they are transacting a large business in belts designed for all classes of work. The offices and manufactory are located at 26½ South Water Street, and the officers are: W. H. Peck, president; George P. Mills, vice-president; C. T. Bodifield, treasurer and general manager, and J. F. Sweeton, secretary. The manufacturing department occupies three floors.

They claim that their belts are especially adapted to street railway work, and certainly they have proved successful in this trying service. They furnished the East Cleveland Railroad Co. all the belts for their new power station, the order including two forty-eight inch belts, and six belts twenty-five inches in width. In the several power stations of

the Brooklyn Street Railway Co. twenty-five Bodifield belts, fourteen inches in width, are in use. In the plant of the East Liverpool & Wellsville Street Railway Co., the Short generators are connected to the engines by four twenty-four inch belts of the same make, and Bodifield belts are also employed in the station of the Atlanta & Chattahoochee River Railway Co., at Atlanta, Ga., where Short apparatus has been installed. The Bodifield company call the especial attention of visitors to the street railway convention to the belts in the East Cleveland company's power station near Cedar Avenue, which run the generators with remarkable ease.



MEHLING CAR, WITH SIDE OFF.

Dorner & Dutton.

For many substantial reasons the firm of Dorner & Dutton, of Cleveland, is well known to street railway men. Since the beginning of the present activity in the field, which commenced with the general introduction of electricity as a motive power, the firm have been manufacturing some of the most important essentials of street railway equipment, and have been supplying the demand for apparatus that would meet all requirements under the new and severe conditions of rapid transit service. There has been a marked improvement and development in their trucks and other devices. In their latest form of truck there is now little to be desired in the way of improvement.

The firm of Dorner & Dutton was formed five years ago. Before that time both partners were connected with the street railway department of Bowler & Co. Mr. Dorner had been associated ten years with that firm, and



H. A. DORNER.

he, consequently, has, as a result of his extended and practical experience, an intimate knowledge of the needs of street railway companies, and to his direction much of the success of the firm is to be ascribed.

Mr. Dutton is a street railway man. Until about seven years ago he was secretary and superintendent of



W. A. DUTTON.

the St. Clair Street Railway Co., of Cleveland. Prior to the formation of the partnership of Dorner & Dutton, he was connected with the Bowler Foundry, as has been already stated, and previously he held a position with the Hegley Journal Co.

The firm is, perhaps, best known for its electrical truck which, it is claimed, is giving satisfaction wherever it is in use. It is a solid forged, non-teetering truck, and the latest type is provided with elliptical springs. It is equipped with the Gairing patent brake which is extremely powerful and effective. All the cars of the Brooklyn and South Side street railroad companies, of Cleveland, are mounted on trucks of the firm's make, and it is in use in the following cities: Rochester, N. Y., St. Louis, Louisville, Johnstown, Pa., Fort Wayne, Evansville, Ind., Atlanta, Savannah, New Haven and other places.

The trucks are built at the firm's manufactory, 50-52 Fall Street, and the offices are located at the same place.

The wheel manufactory is located at Newburgh. The firm's wheels, which are cast from a special mixture of ores, have given remarkably good results in use.

Alfred G. Hathaway.

Alfred G. Hathaway, of Cleveland, manufacturer of railway specialties, is a practical street railway man, and



ALFRED G. HATHAWAY.

has a just appreciation of their requirements. For four years he was manager of the St. Clair Street Railroad of Cleveland. He has provided the street railways of Cleveland with many devices that are found of special value in the car houses. His transfer tables form an important part of the equipment of the well arranged car house of the Cleveland City Cable Railway Co. Cars coming into the city enter the car house, and are shifted from the incoming to the outgoing tracks by means of the transfer tables. Thirty of these devices are in use in Cleveland. Mr. Hathaway makes a specialty of wheel presses capable of handling wheels from the smallest to the largest size.

The Crossley Car Brake Co.

The Crossley rope friction brake, which is manufactured by the Crossley Car Brake Co., of 13 South Water Street, Cleveland, is now used on the Jennings Avenue line of the Brooklyn road. It is a device that is well worth examining. The friction of the rope on a

spool on the axle stops a car as quickly as may be desired, but at the same time without a jar. It might be assumed that the ropes would be speedily worn out, but practice proves that such is not the case. Mr. Crossley is authority for the statement that the cost for renewing ropes is by no means as great as that of the oil used for lubricating power brakes. The brake may be adapted for use with any style of motor or truck, and in addition to Cleveland it is used in Columbus, Chicago, Indianapolis and Aurora. D. A. Belden, general manager of the Aurora Street Railway Co., writes of the brake: "It is working to our entire satisfaction. If it proves as durable as it is simple and effective, it is all that could be desired for street railway service."

National Carbon Co.

The National Carbon Co. commenced business in 1886. At that date the entire consumption of electric light, and other forms of carbon, was very small. Goods were largely hand made, and consequently were high in price but poor in quality. At the outset the management of the company recognized that past methods of manufacture must be discarded, that only uniform goods of the best quality must be produced, and that manufacturing costs must be so reduced that the product could be sold at figures far lower than ever before known. In a new industry, where all the conditions were untried, this was a far easier problem to state than to solve. No one yet knew what constituted a good carbon, or realized that the production of perfect goods was an elaborate and many sided process, requiring very exact skill, mechanical, chemical and electrical. During a series of months in 1886 some of the principal obstacles were ascertained and overcome. New methods were introduced, special machinery was invented, and all the new devices that science and engineering skill could suggest were brought to bear. The results of this method were slow and costly, but sure. From the shipment of the first batch of high grade National carbons, the trade of the National Carbon Co. has grown. Each year has been a repetition of the first; a better carbon has been produced, and a larger demand has followed.

From time to time the plant was enlarged till no more contiguous real estate was available. A new factory was required, and the buildings are now in course of construction. The plant will be situated four miles west of the Public Square, at the corner of West Madison and Highland Avenues, on the Lake Shore & Michigan Southern Railroad. The site includes thirty acres, and several of the buildings, of which there will be a dozen in all, are nearing completion. The largest structure, which will be 600 ft. square, is half finished at the present time. The factory will have a capacity of 20,000,000 carbons monthly, sufficient to supply all required in the world.

All kinds of carbons are manufactured by the company. These include moulded carbons of the several sizes adapted to all high tension arc systems; forced carbons of all lengths and diameters adapted to low tension arc systems; hollow treated carbons for ordinary use on arc lamps on incandescent circuits; cored carbons for all places where the finest light attainable is demanded. The last style of carbons, until recently, was made only in Europe; the National Carbon Co now manufactures cored carbons of the highest grade, and is sending them abroad.

Street railway companies will be specially interested in the brushes made by the National Carbon Co. They are manufactured of the purest material, and are made in exact sizes. They are free from grit and do not, therefore, squeak, and are long lived. They are made in all sizes and plated with the desired coat of copper, with an accuracy of a thousandth of an inch.

The company makes carbon plates for batteries, carbon cups, buttons, disks for telephone transmitters, etc.

The officers are: W. H. Lawrence, president; Benj.



W. H. LAWRENCE,
PRESIDENT OF THE NATIONAL CARBON CO.

F. Miles, vice-president; W. C. Hayes, treasurer; H. E. Hackenberg, secretary; J. H. Osborne, superintendent; Clarence M. Barber, engineer.

W. H. LAWRENCE.

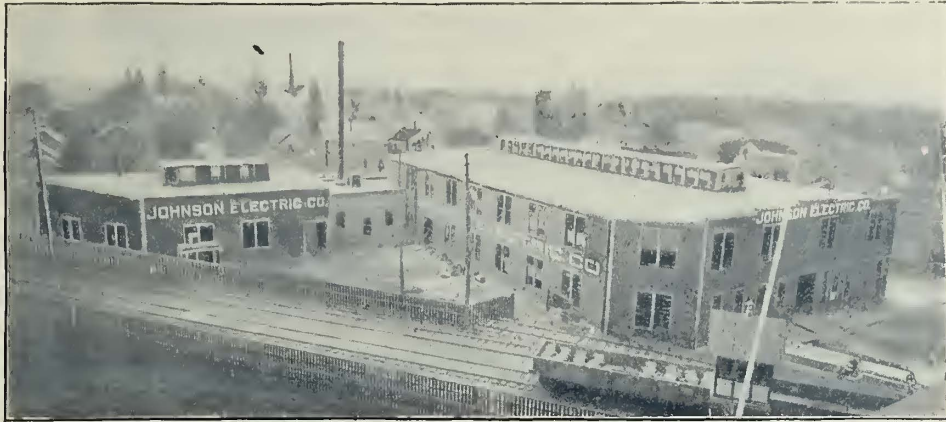
Mr. W. H. Lawrence, president of the company whose portrait is presented herewith, has never failed in anything he has undertaken. He was one of the founders of the Brush Electric Co., was largely interested in the Domestic Sewing Machine Co., and is a director of the Youngstown (O.) Street Railway Co.

Cleveland Rolling Mill Co.

Perhaps more than any one enterprise, the Cleveland Rolling Mill has contributed to build up the manufacturing interests of Cleveland. The business was started in 1857, by Chisholm, Jones & Co., who six years later incorporated the present company with a capital of \$4,000,000. The works occupy seventy-five acres at Newburgh, about five miles from the city, and give employment to 4,000 men. The plant is one of the most complete in the country, and it possesses a marvelous equipment of improved machinery. An adequate description of the works, which are one of the great sights of the city, is wholly out of the question in the limited space here available, but some idea of the gigantic character of the enterprise may be gained from the following figures: The Bessemer Steel Works, built in 1867 and 1868, have an annual capacity for the production of 150,000 net tons of Bessemer steel ingots, and their open hearth steel plants, built

in 1876 to 1878, have a capacity of 40,000 net tons of open hearth steel ingots. Their rail mills were built in

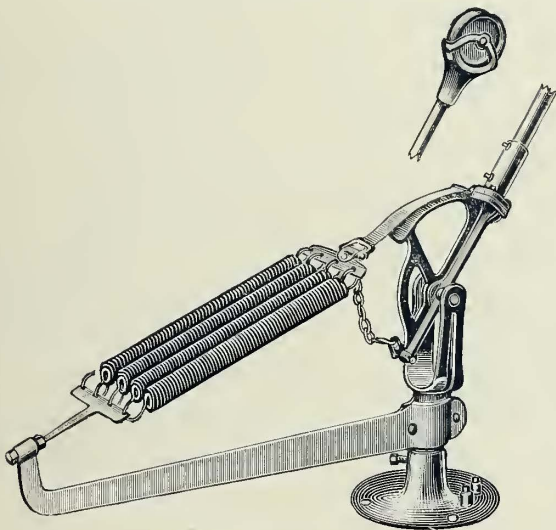
the best of shipping facilities are available. The company expects eventually to engage in the manufacture of electrical apparatus on an extensive scale and to build heavy electrical machinery. The building was erected with this purpose in view, so that an abundance of space is available for the increase of the manufacturing facilities. It is a two-story structure well arranged and well lighted, and the equipment of the machinery is of the most modern and improved description.



WORKS OF THE JOHNSON ELECTRIC CO.

1857, and have since been enlarged until they now have an annual capacity of 150,000 net tons of rails. The ca-

It may be stated generally that the company at present manufactures electric railway supplies of all kinds, and executes repair work on electrical machinery. It is prepared, however, to make contracts for the construction of electrical apparatus and machines of all kinds.



JOHNSON TROLLEY POLE.

The lower floor is used as a machine shop, and on the upper floor the armature and field winding department is located.

One of the accompanying cuts gives a view of the gear cutting department. The machines used for this work are of a special design which makes it possible to turn out the work in considerably less time than that ordinarily required. There is also in this department a complete equipment of drill presses, lathes and milling machines.

On the opposite side of the rooms are located the lathes in which the armature shafts are turned.

Among the specialties which the company makes is the trolley pole and base shown in the illustration. The features of this device are its strength and light weight. The pole is made of steel, and the adjustment is such that the wheel readily passes all overhead switch pans.

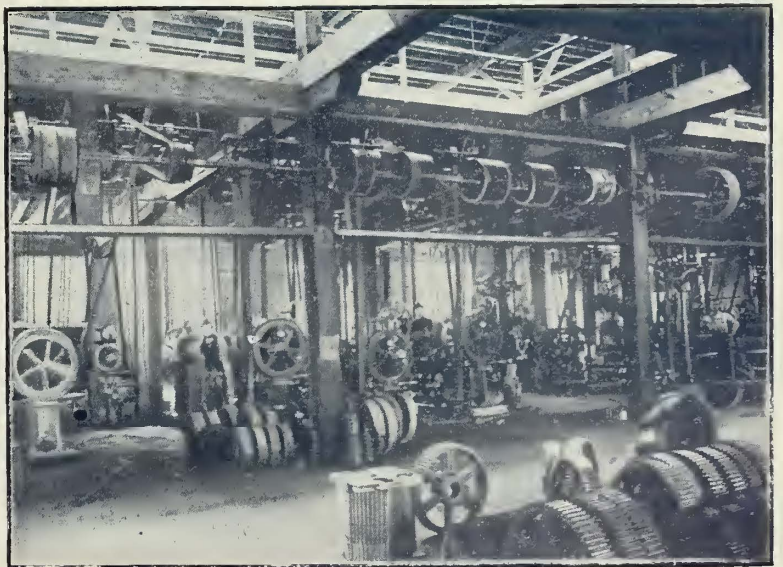
The company makes rawhide pinions, switches of all kinds, in fact all the supplies ordinarily required by an electric railway.

Those interested in the company are A. L. Johnson

capacity of the three rod mills is 125,000 net tons. The wire mills built in 1868 have an annual output of 60,000 tons of finished wire, and the plate mills equipped with six puddling furnaces, and four trains of rolls including a pug mill, which, with galvanizing works attached, have an annual output of 10,000 tons. They have also extensive foundry, forge and machine shops, a barbed wire factory and blast furnaces of improved construction, the latter having a total capacity of 80,000 net tons of Bessemer pig iron. The various products of the mills include wire, tire and spring steel, wire rods, merchant steel, galvanized and black sheet iron, steel plates, boiler and tank plates, corrugated roofing and siding, Siemens-Martin open hearth steel, Bessemer steel rails, blooms, structural shapes and barbed wire for fencing.

Johnson Electric Co.

The Johnson Electric Co., of Cleveland, is one of the comparatively new concerns in the city, but already it possesses an extensive plant and is turning out a large amount of work. The manufactory is located at Stanton Avenue and the C. & P. tracks, where

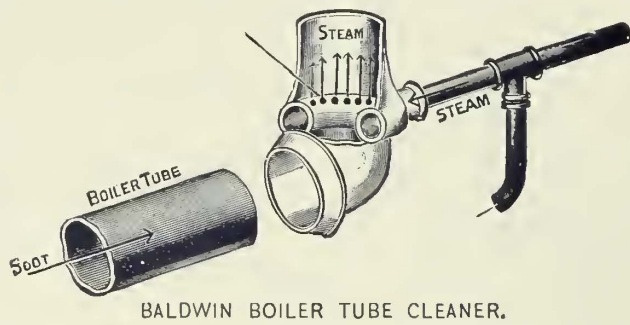


GEAR DEPARTMENT—JOHNSON ELECTRIC CO.

and Samuel Harris, both of whom are connected with the Brooklyn Street Railroad Co., and F. J. Lewis who is the general manager.

SAMUEL HARRIS.

One of the most experienced street railway men in Cleveland is Samuel Harris, superintendent of the Brooklyn and South Side street railroad companies, Cleveland. Mr. Harris is about 40 years of age.

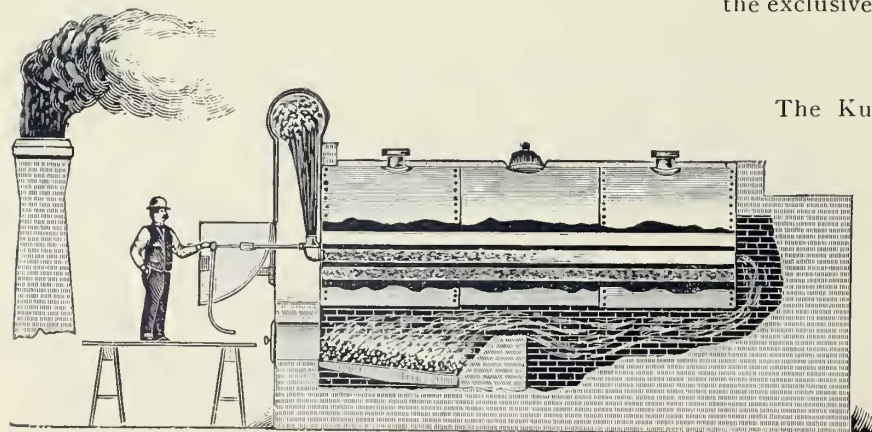


BALDWIN BOILER TUBE CLEANER.

Prior to entering the street railway business he was engaged in manufacturing, and subsequently started a machine shop in Cleveland. About this time Mr. Tom L. Johnson was working on his experimental cable road, and he secured Mr. Harris to assist him in its development. Upon the abandonment of this work, Mr. Harris was sent to Richmond, Va., Boston and other cities to investigate electricity as applied to street railroads. He spent six or eight weeks in the shops of the Thomson-Houston company before that company had motors in operation. He had charge of the practical work of equipping electrically the Johnson lines in Cleveland, and after they were in good working order he went to St. Louis and superintended the work of equipping electrically the Southern Railway there. He spent about a year in St. Louis, when he returned to Cleveland, and was appointed superintendent of the Brooklyn and South Side companies, succeeding Mr. Jilson J. Coleman, who had resigned to become general manager of the Toledo Electric Railway Co. As superintendent, Mr. Harris has the oversight of all the work on the road and in the shops of the Cleveland companies. He is associated with Mr. A. L. Johnson in the Johnson Electric Co. of Cleveland, and is the practical man of the concern.

Oliver P. Clay Co.

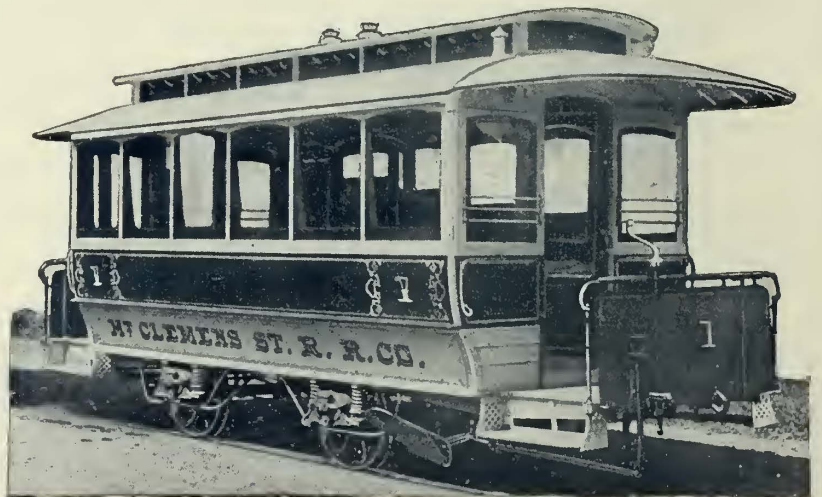
The vacuum boiler tube cleaner, illustrated in the engravings, is designed to overcome the constantly recurring difficulty which results from soot filling boiler tubes and gathering in large quantities at the back of the fire bridge wall, and at the back of the boiler. The heating surface of a boiler in this dirty condition is seriously impaired, and many devices are in use for cleaning out the tubes and chambers. The first illustration



APPLICATION OF THE BALDWIN BOILER TUBE CLEANER.

shows a section of boiler, and illustrates the manner of applying the Baldwin cleaner, the soot and dust being drawn out of the tubes into the chimney. From the section of the cleaner the principle of its action will be understood. It is made of a brass composition,

and is shaped like an elbow. It has a conical shaped mouth, for insertion in the tube. The steam is admitted into the back of the cleaner, and passes into an annular chamber, surrounding the passage for the gases and soot, with small perforations on the upper side. When the steam is turned on, it rushes upwards through these holes, and creates a vacuum, thereby drawing out all the accumulation of soot in the tube, in the direction of the natural draft, and sending it where it originally should have gone—up in the chimney. By this method no steam is admitted into the tube, and, therefore, no scale is formed, and the inside of the tube is always kept dry. The steam being wire drawn through the small apertures, is first superheated, and becomes thoroughly dry, so that the soot does not stick in the chimney or passages. One of the greatest advantages of this method lies in the fact that, the soot is drawn out in the direction of the draft, and is not blown about the boiler room or into the other tubes. This prevents, in a large measure, the disagreeable work



KUHLMAN CAR.

of cleaning out the back connection. By the use of the device the stack and combustion chambers are kept clean, and even the soot and dirt which accumulate back of the fire bridge wall will be drawn out.

The device is the invention of F. R. Baldwin, of New York City, while the Oliver P. Clay Co., of Cleveland O., is the exclusive manufacturer.

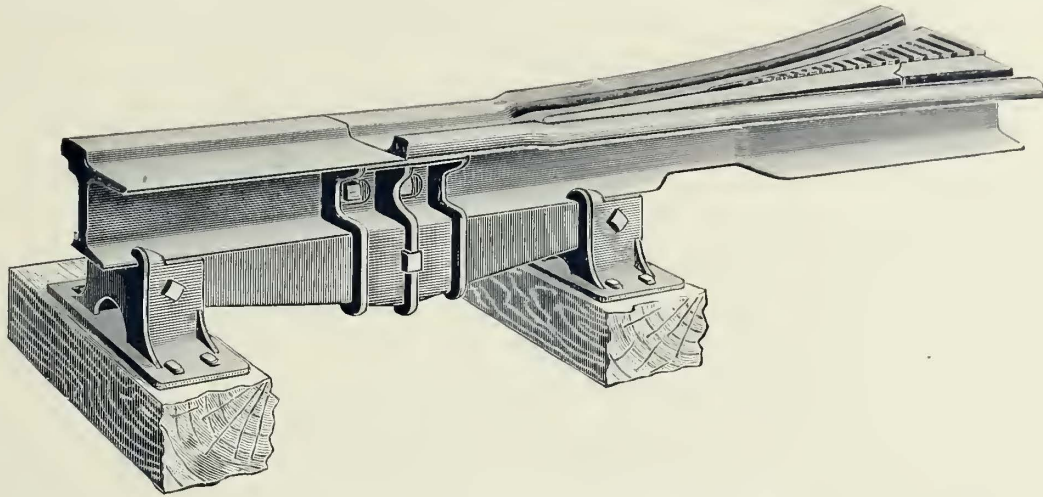
Kuhlman Co.

The Kuhlman Co., of Cleveland, builds car bodies to suit all kinds of trucks, and its work has given great satisfaction wherever it has been tried. The company will in all probability be compelled within a short time to increase the facilities, as a result of new contracts. The company will manufacture the Mehling car, designed for summer and winter use, illustrated in the September number of the STREET RAILWAY JOURNAL.

In the accompanying cut is presented a view of a car constructed by the company for use at Mt. Clemens, Mich. It is extremely handsome in appearance, and is carefully made in every respect. It is twenty-four feet in length, and the body is built sufficiently strong for use as a motor car. It is handsomely finished in mahogany, with birdseye maple ceilings. The seats are covered

with Wilton carpet, and the windows are of plate glass. The Kuhlman Co. is prepared to build cars of all kinds, but keeps nothing in stock. The Mehling cars are to be built for the East Cleveland Railroad Co., to which

lower edge of the joint bridge, binding the former to the latter as firmly as can be desired. The whole is bolted together so firmly that there is no chance for movement except that of expansion and contraction. The joint has



STANDARD JOINT APPLIED TO SWITCH POINT.

those desiring to learn more of the character of the work are referred.

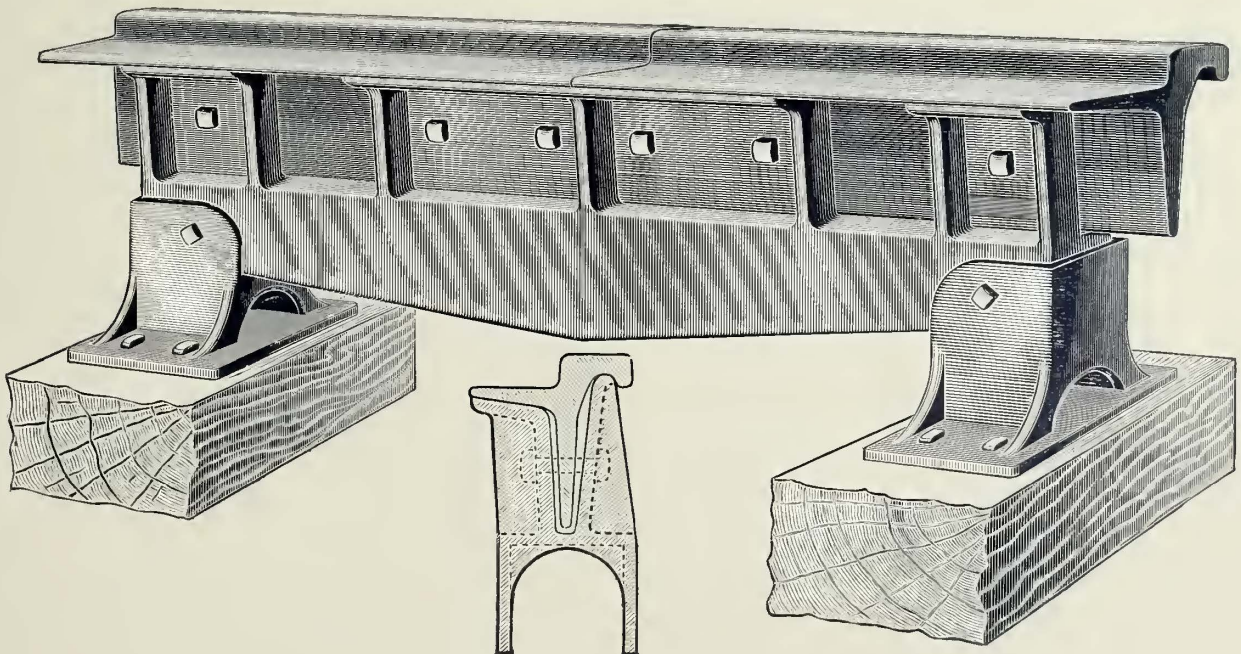
Mark & Sterling.

It is now generally realized that a good track is essential to the successful operation of an electric road. Among the firms making a specialty of track equipment is Mark & Sterling, whose office is located in the Society for Savings Building Cleveland. Among the specialties which they manufacture, much will be found of interest to street railway companies. In the limited space here available, it is possible to describe and illustrate only a few of these de-

been in continuous use for nearly two years, and, it is stated, without any perceptible wear whatever, forming as even a joint as when put in position.

With the joint shown in the second illustration, it is claimed that a three-point rail may be supported as well as a girder rail, and perform equally good service. The joint is supported on chairs, and its construction is such that the rail is upheld from the under side of the tram and head of the rail instead of resting on the lower point. Taper bolts are used, and the rail is drawn firmly down so as to seat on the under side of the tram.

The single brace chair, manufactured by the firm, is designed to take the place of tie rods, and may be used



JOINT BRIDGE FOR THREE - POINT RAIL.

vices. The standard joint is represented in the first illustration, and in this case it is applied to a switch point. It is claimed to possess substantial advantages over fish-plates or angle irons. The joint bridge is made of malleable iron supported by chairs of the same material, and the construction is such that the chairs on the ties form a perfectly even base for the rails. The chairs have side clips which engage with the base of the rails, and the

for special work, such as curves, switches or at points where a rail is to be subjected to unusually heavy strain. The brace chairs are made to engage with the web, or to fit under the head and they are made with a solid base, covering a space $5\frac{1}{2} \times 10$ ins. on the tie; the spike holes are staggered so as not to split the wood.

All the devices of the firm are made of malleable iron which they deem superior to wrought iron for a variety

of reasons. By using it they are enabled to produce special shapes and designs which it would be impracticable to attempt with wrought iron; besides it withstands the extreme cold better and lasts far longer when underground.

Mr. Mark is the original patentee of the rail chair with diagonal lips, the patent being granted September 18, 1883, and is the inventor of other successful devices for street railway purposes.

Brightman Stoker Co.

The Brightman mechanical stoker for steam boilers is an ingenious contrivance for feeding fuel to the furnace mechanically, and at a continuous and uniform rate. In any furnace all the fuel must be decomposed, or, in other words, converted into its constituent gases by heat before combustion can occur. A match is made of materials that are decomposed at a very low temperature, the slight friction of drawing it lightly over any moderately rough surface being sufficient to evolve inflammable gases that are ignited the instant they come in contact with the oxygen of the atmosphere; the combustion of these gases, trifling in quantity, produces heat sufficient to decompose the wood, and they in time, uniting with oxygen in the atmosphere, produce more heat, and it in turn decomposes any other contiguous fuel evolving other gases, requiring perhaps a higher temperature for their combustion than those evolved from the match. So the process goes on multiplying until the heat becomes sufficient to convert water-saturated coal, and even water itself, into their constituent gases which, coming into contact with the oxygen of the air in the presence of a high temperature, instantly unites with such oxygen. This multiplication goes on indefinitely, and, so far as we know, temperature is infinite. This union of the constituent gases of fuel with oxygen is what is known as "combustion." There is no other method of combustion of fuel in a furnace. Now, the more complete and perfect the union of the gases of the fuel with oxygen, the more perfect the combustion, and the more effective is the furnace in producing heat. The higher the temperature of the furnace, with a sufficient supply of oxygen, the more perfect is this union. If the combustion be imperfect by lack of oxygen or lack of heat, more or less of the combustible gases of the fuel pass unconsumed to the chimney and are wasted. This waste is frequently enormous, sometimes amounting to more than one-half the practically available heat value of the fuel used.

In an ordinary stove or boiler furnace it is necessary to open a door to admit the fuel. This admits a stream of cold air by which the temperature of the furnace is instantly reduced to a point below that essential for the ignition of certain of the gases; combustion of such gases ceases and they go directly to the chimney unconsumed. This waste goes on while the door is open, and continues after the door is closed, until the temperature is again raised to the point necessary to ignite the gases mentioned. Sometimes the air spaces in the grate bars are insufficient to admit the necessary quantity of air to furnish the oxygen required for the ignition of all the combustible gases, or the air spaces, while sufficient in aggregate area, may be so large as to admit the air in too large volumes, so that it cannot be sufficiently heated to unite with the fuel gases, and in such cases the result is in effect the same as in that of the open

door—the gases that do not receive their due ratio of oxygen at a high temperature pass to the chimney and are wasted. In estimating the importance of this waste, it should be remembered that all fuel in the furnace must be converted to gas before it can be burned. No fuel is burned otherwise.

The Brightman mechanical stoker furnace is designed to prevent the waste of fuel indicated above. There are no feeding doors to be opened. The fuel is delivered by the shovel or (where a large quantity of fuel is to be handled) by elevator and conveying machinery, to a hopper placed across the front of the furnace at a convenient height above the floor. From this hopper the coal is pushed into the furnace mechanically, the opening through which it passes being kept constantly filled with the entering fuel and sealing the opening against the entrance of air. This avoids the disastrous effect of the open doors used in ordinary furnaces.

The coal entering the furnace is delivered to the top of an inclined grate surface composed of grate bars having a longitudinal reciprocating motion which, together with gravity, causes the coal to move gradually and continuously toward the lower and rear end of the grate. The coal is consumed during its continuous passage from the front to the rear end of this inclined grate.

The grate is composed of longitudinal bars half an inch thick set up edgewise, each bar having on either side horizontally projecting lugs or shelves which interlock with each other in such a way as to form horizontal openings through which air is admitted to the furnace. These openings are small but very numerous, and aggregate more than 50 per cent. of the aggregate grate surface. The motion of the grate bars keeps these air spaces open and free from ashes and cinders, so that a sufficient supply of air is insured. The air openings are small enough to insure a sufficient heating of each air stream to effect combustion. To appreciate the importance of these features, it is well to remember that of all the air that enters a furnace only one-fifth part is oxygen and combustible; four-fifths is nitrogen and absolutely incom-
bustible. The oxygen only is available for combustion; the nitrogen necessarily passes through the fire and out of the chimney, carrying with it more or less of the heat generated by the combustion of the fuel.

Among the constituents of coal, carbon forms a large proportion. Under the influence of heat the carbon is dissociated from the hydrogen, oxygen and other gaseous elements composing the coal, and appears in the form of minute particles. These particles, when heated to a high temperature and brought into contact with oxygen, instantly combine with it, evolving great heat and forming carbonic acid gas. Carbonic acid gas is entirely colorless and transparent, and is the product of perfect combustion.

When a furnace door is opened a stream of cold air is admitted, which cools the gases and the particles of carbon so that the combination ceases. The particles of carbon are densely black, and discolor the carbonic acid, nitrogen and other gases and make smoke.

When a shovelful or more of coal is thrown into a hot fire, some of it is instantly decomposed by the intense heat, and usually a greater quantity of carbon is thrown off than can be supplied with the necessary oxygen for complete combustion, and the result is smoke.

Coal should be fed to a furnace constantly and at a

uniform rate, and the air should be admitted uniformly and in proportion to the rate of coal consumption.

When the coal, entering through the feed opening, reaches the front end of the grate in a Brightman stoker furnace, it is exposed to a high temperature from that moment until it is consumed. The hydro-carbon gases and the carbon particles are given off continuously and regularly, are abundantly and continuously supplied with oxygen at a high temperature, and the process of combustion is made constant and continuous, instead of spasmodic and intermittent. Gradually, the coal is deprived of its hydro-carbons and becomes coke. In this form it travels from the top to the bottom of the inclined grate gradually, uniting with the oxygen entering through the grate until it is consumed. This movement of the fuel towards the rear is effected by the continuous motion of the grate bars, and is capable of perfect regulation and control.

Experience has demonstrated that in consequence of the uniform temperature maintained in a Brightman stoker furnace, the useful life of the boiler is very much prolonged. The intermittent character of the fire in ordinary furnaces is injurious to the boiler by causing sudden expansions and contractions of the metal, loosening of rivets and tubes, and boiler repairs are constantly required. It is the experience of those who have used these machines that boilers equipped with Brightman's stokers and properly operated do not require repairs.

The capacity of a boiler for yielding steam is usually largely increased by applying a Brightman stoker. The Howard Plate Glass Co., of Pittsburgh, who, having operated four of these stokers for a year, have just purchased and are now erecting sixteen more, state that the boilers from which, when equipped with common grates they, with careful firing took 100 H. P. each, now with the Brightman stokers yield easily 150 H. P. each. The stokers also show over 18 per cent improvement in economy of fuel.

The Brightman stoker is applicable to any form of steam generator, and in many other situations where a high temperature, regularity of heat and a clear, smokeless fire are required, such as acid stills, roasting furnaces, kilns, ovens, etc., etc.

The Brightman stoker will conveniently handle and burn all sorts of refuse, such as tan bark, chips, coal yard dust, coke screenings, manure, garbage, and in short, anything combustible.

It is applicable to old or new boilers. The power required to drive it is trifling, averaging less than one-quarter of one horse power for each stoker.

It is very durable; there are scores of these machines that have now been in use over five years without any repairs whatever. It is a labor saver. In connection with the mechanical handling of coal and ashes it will save 80 per cent. of the labor required to attend a battery of, say, six or eight boilers. This machine is manufactured and sold solely by the Brightman Stoker Co., of Cleveland, O.

THE delegates and attendants at the Convention will visit the works of the Short and Brush companies on the afternoon of the first day of the meeting. The invitation of the Short Co. includes all who are in attendance, and it is expected that there will be a large gathering at the works. Lunch will be served and guests will have an opportunity to examine the several departments of the Brush plant.

EXHIBITION NOTES.

WITH
PARTIAL LIST OF EXHIBITORS
AND
BRIEF MENTION OF SOME OF THE SUPPLIES TO BE SHOWN
AT CLEVELAND.

Baltimore Car Wheel Works, Baltimore, Md.
Barnes Brake Co., Cleveland, O.
Billings & Spencer Co., Hartford, Conn.
Bodifield Belting Co., Cleveland, O.
Brightman Stoker Co., Cleveland, O.
Brooklyn Railway Supply Co., Stamford, Conn.
Brownell Car Co., St. Louis, Mo.
Brill, J. G. Co., Philadelphia, Pa.
Bruce, F. E., Agent Stirling Co., Cleveland, O.
Cleveland Frog & Crossing Co., Cleveland, O.
Crossley Car Brake Co., Cleveland, O.
Davis & Cook, Watertown, N. Y.
Detroit Electrical Works, Detroit, Mich.
Dorner & Dutton, Cleveland, O.
Duplex Street Railway Track Co., New York.
Esmond Street Rail Co., New York.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Ford-Washburn Storelectro Co., Cleveland, O.
Fulton Foundry Co., Cleveland, O.
General Electric Co., Boston Mass., and New York.
Genett Air Brake Co., New York and Chicago.
Gilbert Car Manufacturing Co., Troy, N. Y.
Graham, J. H., & Co., Chicago, Ill.
Griffin Wheel & Foundry Co., Chicago, Ill.
Hathaway, A. G., Cleveland, O.
Hill Clutch Works, Cleveland, O.
International Register Co., Chicago, Ill.
Jewell Belting Co., Hartford, Conn.
Johns, H. W., Manufacturing Co., New York.
Johnson Co., Johnstown, Pa.
Johnson Electric Co., Cleveland, O.
Jones' Sons, J. M., West Troy, N. Y.
Kuhlman Co., Cleveland, O.
Lamokin Car Works, Philadelphia and Chester, Pa.
Lewis & Fowler Girder Rail Co., Brooklyn, N. Y.
Lewis & Fowler Manufacturing Co., Brooklyn, N. Y.
Loomis, H. N., Hightstown, N. J.
Mark & Sterling, Cleveland, O.
McGuire Manufacturing Co., Chicago, Ill.
Meaker Manufacturing Co., Chicago, Ill.
Mehling Car Co., Cleveland, O.
Mitchell-Brandt Copper Co., Erie, Pa.
Morton Safety Heating Co., Baltimore, Md.
National Carbon Co., Cleveland, O.
New Departure Bell Co., Bristol, Conn.
New Process Raw Hide Co., Syracuse, N. Y.
New York Car Wheel Works, Buffalo, N. Y.
Nuttall, R. D., Co., Allegheny, Pa.
Okonite Co., Limited, New York.
Peckham Motor Truck & Wheel Co., Kingston, N. Y.
Pennsylvania Steel Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Pittsburgh Steel Hollow Ware Co., Pittsburgh, Pa.
Pomeroy & Fischer, New York.
Railway Equipment Co., Chicago, Ill.
Reliable Manufacturing Co., Boston, Mass.
Robinson Electric Truck & Supply Co., Boston, Mass.
Robinson Machine Co., Altoona, Pa.
Rochester Car Wheel Works, Rochester, N. Y.
St. Louis Car Co., St. Louis, Mo.
St. Louis Register Co., St. Louis, Mo.
Schieren, Chas. A., & Co., N. Y.
Scott, Charles, Spring Co., Philadelphia, Pa.
Short Electric Railway Co., Cleveland, O.
Sperry Electric Railway Co., Chicago, Ill.
Stephenson, John, Co., Limited, New York.
Taylor Truck Co., Troy, N. Y.
Walker Manufacturing Co., Cleveland, O.
Wall, P., Supply Manufacturing Co., Allegheny, Pa.

Walworth Manufacturing Co., Boston, Mass.
 Washburn & Moen Manufacturing Co., Worcester,
 Mass.
 Westinghouse Electric & Manufacturing Co., Pitts-
 burgh, Pa.
 Wharton, Wm., Jr., & Co., Philadelphia, Pa.

Convention Notes.

THE John Stephenson Co., of New York, will be represented, as usual, at the Convention, by D. W. Pugh.

THE Stratton separator made by the Stratton Separator Co., of 32 Cortlandt Street, New York, is giving great satisfaction in power stations.

IN the plant of the Brooklyn Street Railway Co. are a number of the well known Goubert feed water heaters, and they are used with great success.

THE Railway Equipment Co., of Chicago, will be represented at the Convention by W. R. Mason, general manager, W. L. Adams, J. F. Macartney and J. S. Gustin.

A. O. SCHOONMAKER, of New York, is calling special attention to the superior qualities of East India mica for insulating purposes. It is firm, strong, free from iron and splits easily, qualities that commend it to those engaged in electrical work.

THE Haas Distributing Car Heater Co., of Grand Crossing, Ill., has put on the market a new heater for which especial claims are made. The fact that it takes up little room, and that by its use heat is thoroughly distributed, are special features.

DELEGATES who visit Chicago will be likely to go to Pullman to examine the Patton motor in operation there. One of the last motors recently drew three loaded freight cars over the Pullman tracks at a rate of eighteen miles per hour. The motor will be shipped to Louisville.

A NEW electric wiring computer has recently been devised by William Cox, by means of which the sectional area and number can be accurately ascertained. It consists of foundation plate with revolving disk, both graduated. The device has been sold to the Okonite Co., of New York.

MANY of those who attend the Convention will go via the Pennsylvania road. This line offers such superior facilities that it is popular with travelers. The Pennsylvania company is noted for its elegant passenger coaches, and the excellence of the service in the dining cars, and the beauty of the scenery along the lines is known the world over.

IT is expected that many of the street railway men will visit Chicago to attend a part of the exercises incident upon the dedication of the World's Fair buildings. Those who make the trip will probably find it interesting to notice how well adapted the Accelerator cars on the North Side system are for the quick and safe transportation of crowds of people.

AMONG the cars to be exhibited at the Convention are the following: Prof. Short's private car, made by the Gilbert company, recently redecorated and mounted on an Anger truck; Short gearless car mounted on a Short truck; Short single reduction car mounted on Brill truck; Lamokin car with Robinson radial truck; Brownell car with Brownell truck; St. Louis Car Co.'s car.

THE Woodbridge & Turner Engineering Co., of New York, will be, as usual, represented at the Convention. The company has made a fine record, as the roads which they have built have been planned in accordance with the best ideas of engineering practice. The company takes contracts for the complete equipment of electric railways, and has several important roads under construction at the present time.

IN power stations, steam pipes are inspected carefully and kept in perfect condition, but the covering is frequently wholly neglected. One of the best coverings in the market is found in the combination of carbonate of magnesia and asbestos. It is exceedingly light, and therefore contains a relatively large amount of entrapped air, which is the best non-conductor of heat. Coverings of this kind, manufactured by Robert A. Keasbey of New York, are giving entire satisfaction.

THE Jarvis Engineering Co. of Boston, at the present time is calling attention to a number of specialties. The Sheffield shaking grate has met the requirements of steam users, and is giving satisfaction where it is in use. The Jarvis patent furnace, rocking grate bars, steam pumps, pop safety valves, sectional pipe covering, injectors, etc., have made the company famous. The company has recently installed special heavy engines for railway work at Millbury and Worcester, Mass.

THE Railway Equipment Co., of Chicago, will exhibit at the Convention a full line of their latest overhead equipment. This material has never been illustrated or advertised, for the reason that it has been impossible to fill the very large orders received this season. A large number of the best contracts awarded this year have been given with the stipulation that this material shall be used, and owners of railroads are assured of the best class of construction when using the new Type G material of the Railway Equipment Co.

FRANK A. MAGEE, of the E. S. Greeley & Co., of New York City, will represent his company at the Convention. The company has been in the supply business for twenty years, and is eminently fitted by this extended experience to provide the material best adapted for use in all branches of electrical work. The company has of late received many large orders for line material and construction supplies for street railways. Many of the exclusive specialties handled by the company have been found in actual experience to possess great merit.

THE Short Electric Railway Co. will make an interesting exhibit of motors and generators. The display will illustrate in a very striking manner the development of the Short Apparatus. The single reduction motors of thirty horse power and twenty horse power will be shown, as well as a standard fifteen horse power motor. The three forms of gearless motor will be exhibited, *i. e.*, the type of 1890, which was shown at Pittsburgh, the 1891 type and the latest machine of twenty-five horse power, which will be seen for the first time at this meeting. A generator of sixty-six horse power will be exhibited, and a 280 H. P. will be run as a motor.

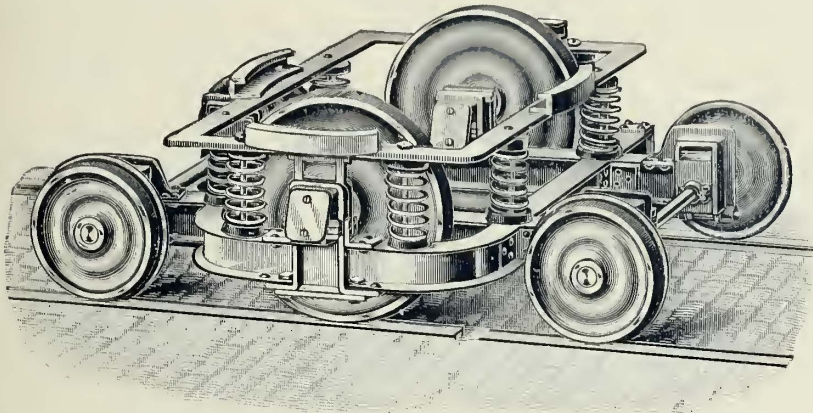
THE Railway Equipment Co. of Chicago, have brought prominently before the public the advantages of electric heating. Mr. Mason, the manager of the company, has made this branch of the business somewhat of a hobby, and last season equipped with heaters over 100 electric roads. Believing that a large sale would be the result of putting on the market a successful and economical electric heater, not only for street car use but for residences and domestic purposes generally, he has secured for the company the exclusive right to manufacture and sell throughout the world the patented devices for heating, invented by Mr. T. Ahearn of Ottawa, Can. All of these devices have been in continuous operation during the last year. A large and finely equipped factory has been started by the Railway Equipment Co. for the manufacture of all such devices, and large orders have already been received.

SILICON bronze when used for trolley wires possesses, it is claimed, many substantial advantages. Among these may be noted: First, a tensile strength of 80,000 lbs. per square inch, which is nearly twice that of large diameters of hard drawn copper wire. Second, a ductility of thirty to thirty-five twists in six inches on a No. 4 B. W. G. wire. This far exceeds the standard of any other metal of equal strength and diameter. Third, great resistance to wear, as a six and a third mile road operated since construction equivalent to 800,000 car miles, shows no appreciable wear on straightaway track. Fourth, absolute resistance to corrosion, which insures a perfect contact, even where the wire is used in mines and under other similar trying conditions. Fifth, freedom from breakage by surface abrasion, a frequent source of trouble with hard drawn copper wire. The wire is manufactured only by the Aluminum Brass & Bronze Co., of Bridgeport, Conn. J. L. Pryor represents the company in New York, at 53 Chambers Street, Stewart Building.

The Esmond Rocker-Link Cantilever Truck.

Among the exhibits at the coming Convention will be a model of the above named truck, an illustration of which is given herewith. This is a type of six wheel truck so designed that the principal weight is carried upon the central wheels, while the front and rear wheels, which may be of the same diameter as the central wheels or smaller, perform the ordinary functions of a pony truck; and at the same time, owing to the presence of rocker links upon the axle boxes, take up or destroy the lateral shock that ordinary trucks experience when passing

snaky track or entering curves. They also serve to keep the central wheels, which are ordinarily flangeless, upon the track. The front and rear axles are rigid vertically and longitudinally, but, owing to the rocker links, have a free lateral movement independent of each other or of the middle axle which is rigid to the truck frame in all directions.



ESMOND TRUCK.

The horizontal movement of the front and rear axles does not tend to raise the truck from its true horizontal line, however, as is the case with the ordinary swinging links, but the movement is against the gravity of their load, the same as if against a swinging link, so that the central wheels always remain in contact with the track, and their tractive force is not weakened.

The frame being practically a cantilever balanced upon the central wheels and provided with springs, and having the spiral springs placed in the bottom of the frame and not, as ordinarily, between the axle box and truck beam, does not permit the front or rear wheels to drop into depressions or joints in the rail, and these wheels also in turn carry the central wheels over depressions in the same manner, which prevents pounding at joints. The central wheels can be mounted on the same axle, or preferably, as in the illustration, on independent axles with interior journal boxes, which facilitates their movement upon curves.

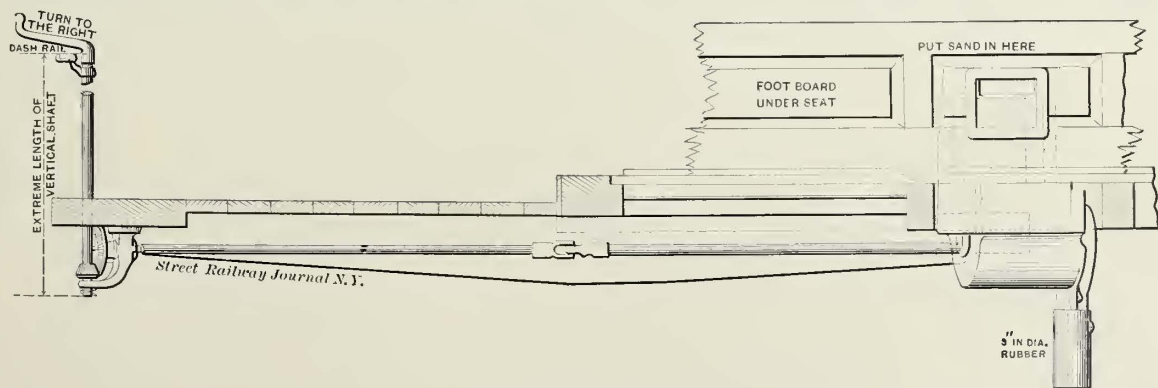
The truck is adapted to either steam, cable or electric traction, there being ample space within the frame for mounting the grip or the motors, which may be arranged to work independently on the separate axles or upon a single main driving axle.

The device is the invention of Mr. E. R. Esmond, and is being manufactured by the Esmond Street Rail Co., 106 Broadway, N. Y.

Wilson's Improved Auger-Feed Sand Box.

This sand box (Fig. 1), the makers claim, will operate under any and all conditions, whether the sand is dry or damp, packed or loose, or even slightly frozen, provided it is free from stones and pebbles. The mechanism consists of a spiral conveyor or auger (Fig. 2), which is located in the box and forces the sand out into the spout, but sand is delivered only when the auger is turned.

The conveyor, which is sufficiently large to prevent the sand from arching, is revolved by means of a countershaft having a knuckle joint,



AUGER-FEED SAND BOX.

to which power is transmitted through bevel gears from a vertical shaft and hand lever, which is located on the dash rail in about the same manner as is the brake lever. The box or hopper, which is larger at the bottom than at the top to prevent the sand from becoming lodged, may be attached to any type of car, and in any position under

the seat, on the right or left as is most desirable, and is filled through an aperture having a drop cover in the seat foot board, as shown in Fig. 1.

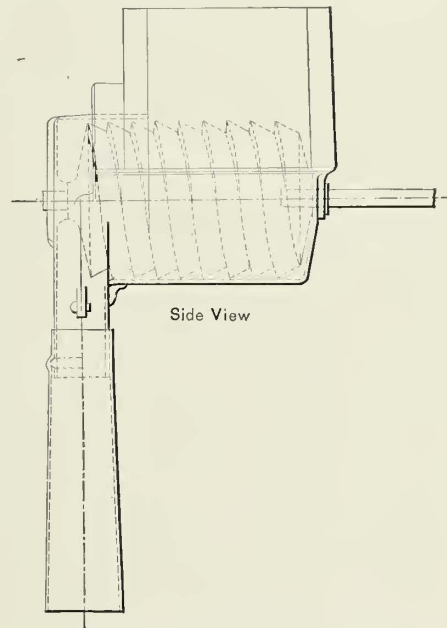
This is known as the Wilson Sand Box, and is manufactured by J. M. Jones' Sons, car builders, of West Troy, N. Y., who will have it on exhibition with other appliances at the Cleveland Convention.

Pennsylvania Iron Works.

By this title we do not refer to the iron industry of the state of Pennsylvania, for this would be a subject of such general import that few would care to read it, but our article relates to the manufacturing plant and business of the Pennsylvania Iron Works Co. in Philadelphia, which, although a comparatively young company, has attained great prominence in the manufacture of cable railway machinery, and as contractors for the designing and installation of extensive cable railway plants.

Although cable railway work is the most important branch of the company's business, it is not by any means confined to this line alone, but includes gas works machinery, engines, refrigerating and ice machinery, foundry, pattern and general machine work.

The works and general offices of the company are located at Fiftieth Street and Merion Avenue which, having been recently enlarged, embrace a group of large buildings containing mammoth floor space,



AUGER-FEED SAND BOX—SIDE VIEW.

and on the designing and arrangement of which the best architectural talent of the city was engaged. The different departments and of-

fices are so located on the first and second floors that ready access is had from one to the other, and are known as the machine shops, Nos. 1 and 2, erecting shop, foundry and ice machine department.

Building No. 1. It is 80 x 100 ft. and contains, on the first floor, machine shops Nos. 1 and 2. The former occupies about one-half of

the ground floor, and divides the second floor with the space allowed for the superintendent's office. Its equipment consists of various sizes of medium planers, drill presses, shapers, lathes, boring mills and special machinery. The third floor of this building is occupied by the draughting room and pattern shop.

Machine shop No. 2 starts in at the lower end of the building, and runs at right angles to machine shop No. 1, out to the railroad tracks, again making a right angle turn towards and to the end of the front of the building; part of this shop is occupied as the tool room, store room, engine and boiler rooms, while the rest contains large lathes, boring mills, etc., to which is brought from the foundry, through the erecting shop, the largest castings for finishing. A traveling crane, of two tons capacity, spans the width of this shop, runs its entire length and is in height forty feet from the floor. The shipping of the heavy work is done at the track end of this shop.

Next in line comes the erecting shop, a building 80 x 200 ft.; in it are located the largest lathes, boring mills, drill presses, etc., as well as pit lathes, etc. A traveling crane of thirty tons handles all the material brought to this building, and here the fitting up, testing, finishing, etc., of all work takes place.

One of the most important buildings is the foundry which occupies a floor space of 100 x 200 ft.; this building also contains a traveling crane of thirty tons, and one of fifteen tons capacity, as well as three of the largest "Colliau" cupolas with a melting capacity of 100 tons per day, besides the latest appliances for core making and moulding machines.

Across the street, the machine, blacksmith and welding shops are located; a space of 75 x 100 ft. is occupied here, and within the building the most adequate machinery has been supplied for the purposes intended. From the foregoing description the reader will learn that the equipment is such as enables the company to handle its products as expeditiously as possible, as well as to insure economical results in this respect.

To the westward of building No. 1, there now stands the new erecting shop, 230 x 65 ft. and 40 feet high between the floor level and the crane track.

This building was finished in August 1892, and contains a lathe pit capable of turning at one time two driving wheels up to forty feet in diameter, ten feet face and weighing 150 tons each. This shop also has an electrical traveling crane of Morgan make, twenty-five tons capacity and a movement of 400 ft. per minute, a Betts fourteen foot boring mill, a Bement 122 in. planer, and a Bement seventy-two foot lathe, besides slotting machines, turret lathes, milling machines, drill presses, etc.

This addition was found absolutely necessary, inasmuch as the company found that the building of the celebrated Boyle compression machines was attaining such proportions that it was absolutely imperative to increase the plant to take care of the rapidly growing business in this direction. These machines are made of from one ton ice making to 200 tons refrigerating capacity, and since the first of the

Baltimore, Md., the details of which have been given in various issues of the STREET RAILWAY JOURNAL.

The rapid and substantial growth of the company during the past six years, prompts our curiosity to learn something of its history, and upon inquiry we find that as early as 1886 the Pennsylvania Iron Works was located at Reading, Pa., and was operated by B. W. Grist & Co., Limited, and embraced a foundry and machine shop, the manufacture of self contained engines being a specialty. During the same year, in order to increase its facilities for the rapidly increasing general business, and in order to cater to the street railway trade, the firm having been incorporated under the laws of the State of Pennsylvania, and being aided by fresh capital, moved to Philadelphia and began the erection of buildings on the site above described, and in 1888 and 1889 the buildings were enlarged and the equipment increased, the last addition having been completed as late as August, 1892.

The prime mover and controlling spirit of the company is Mr. Benjamin W. Grist, now general manager and chief engineer of the



COOK PLUMB AND LEVEL.

company. Mr. Grist was born in Boston, England, in 1842, and learned the engineering trade in his native town, and gained a reputation as an "emergency" man. In 1868 he moved to America, and secured employment with Bement & Sons, in Philadelphia. Subsequently he was in the employ of the Weimer Machine Co., of Lebanon, Pa., the Lebanon Manufacturing Co., as superintendent, and the Mallet Foundry & Machine Co. of the same place, until he engaged in business for himself, as above noted.

But it is not to the efforts of the general manager alone that the company has been brought to its present position, but as well to Mr. W. L. Elkins, Jr., who, with others, has furnished the sinews of war, and whose energy has helped to bring the company to its present position of recognized importance. The services of the assistant engineer, Mr. E. A. Moore, have also contributed largely to the success of the firm, while the financial affairs are ably conducted by Mr. Howland Coit, secretary and treasurer.

Cook's Patent Levels.

The levels which are shown in the accompanying illustrations differ in several important particulars from the ordinary form. They are manufactured in accordance with the Cook patent, and are made by Davis & Cook, of Watertown, N. Y. One of the illustrations is of a plumb and level, and the other of a railway level. The tube carrying the bulb is set in a frame which is faced on each side with glass and can be seen from any position and from either side. The bulb



COOK TRACK LEVEL.

year 1892, ten plants have been contracted for and placed in satisfactory operation, aggregating 1,000 tons capacity.

In the line of engine building, the company makes a specialty of the improved Greene engines, and these are built for severe service and are fully guaranteed, as none but the best materials and workmanship enter into their construction. The same claims apply with equal truth to all the products of the company, and this is the chief reason why the firm has attained its wonderful success.

As above noted, the products which have contributed most to bring the reputation of the company to the attention of street railway men are their extensive cable contracts, this company having been the designers, contractors, builders and erectors of all the machinery contained in the cable power houses of the Broadway & Seventh Avenue Railroad Co. and the Third Avenue Railroad Co., of New York; the Madison and Washington Streets power stations of the West Chicago Street Railway Co., the two new stations now building, of this company, and the three power stations of the Baltimore Traction Co.,

tubes are also arranged so as to show their entire length, by which means the bulb can be seen from a distance and from overhead. The inside rings are made so as to revolve on their own centres for adjustment, and cannot get out of adjustment unless the set screws are moved. The levels are made in various sizes.

The Connelly Gas Motor.

In view of the recent adoption of the Connelly gas motor as a substitute for horses on the West and North Sides street car systems of Chicago, a brief history of this last successful competitor of the trolley and storage battery may not be out of place, especially when the magnitude of the intended change of power is considered, involving as it does the largest system of street cars in this or any other country, and the prominence which will be given to it by the World's Fair next year. Although the rights have been actually purchased by Mr. Yerkes for his companies, and work is being vigorously pushed upon the first

lot of these motors intended for one of the North Side lines (the first to be equipped) these facts have not been given the prominence which their importance deserves, and this is due not only to the well known conservative policy of Mr. Yerkes, but as well to the commendable spirit of the Connelly Motor Co., who desire to have a line fully equipped with motors, before calling the attention of the world to the merits of their system.

The adoption of a gas engine as impelling power for street cars did not originate with the inventor of this motor, as it had been tried before only to meet with disastrous failure. It remained for Mr. Connelly to supply the "missing link" in the solution of the problem, which was to apply the unvarying speed of a gas engine to the varying speed of a street car, and this he has done with most ingenious mechanism.

The gas engine employed in this motor is of the compound type, and exerts, it is claimed, about one half more power than other gas engines of the same weight. The special mechanism employed to transmit the power from the engine to the axle is positive in action, noiseless and durable. It prevents giving shock to the car in starting, and, above all other advantages, transmits the *maximum power* of the engine when driving the car at the *minimum rate* of speed. This is the distinguishing original feature of the Connelly system, and is what enables a Connelly motor of ten horse power to ascend grades and perform work impossible of accomplishment with other motors of thirty horse power. This was clearly demonstrated in Chicago by a Connelly motor taking a loaded trailer up the Dearborn Street Bridge grade (the heaviest in the city) with comparative ease, while the Belgium steam motor of three times the power was utterly *unable to propel itself* up the same grade.

The average horse car driver is fully competent to operate the motor which is controlled by one lever. The fuel consumed may be either oil gas, ordinary city gas, or naphtha vapor, according to the relative cheapness of each at such locations where the motor is employed. Sufficient gas can be carried for three hours' run, and the reservoir can be recharged in less than one minute. The record of several months' running of a motor in Chicago in regular service showed an average consumption of 1,000 ft. of gas for each seventy-five miles run. The average cost of city gas for power purposes is about \$1 per 1,000 ft. In Chicago natural gas is now being introduced, and will be used for operating the motors as long as the supply lasts. With this gas the daily cost of operating motors will be remarkably small.

It is now about seven years since Mr. Connelly first began to put his ideas into metal, and the result, the year following, was a motor which was run experimentally for some time on the Bath Beach road in Brooklyn. Defects of first construction were apparent however, and this was followed by a second and afterwards a third machine, each vastly superior to the one preceding.

About three years ago the attention of Mr. Yerkes was drawn to the Connelly motor, and in consequence two new motors were sent to Chicago and were operated for some months on the Lake Street line of the West Side, hauling passengers daily. Several mechanical defects and the more or less noisy working of the machinery served as obstacles to their adoption. The year following another motor of far better construction was put into service. This made a very fine record against adverse circumstances of track and inclement weather, and proved to the entire satisfaction of Mr. Yerkes and his officials that mechanically the motor was a practical success, but the odor from the exhaust made him hesitate to apply to the city authorities for permission to use it on their lines.

Nothing daunted, the Connelly company then applied themselves to the elimination of this remaining barrier to their success, and last fall another motor was sent to Chicago, this time being put in operation upon the North Side. The record of this last machine is worthy of remark, as showing the severe trial to which its powers were put. Running first upon different horse lines in the outskirts of the city until its reliability was demonstrated, it was then run for a week through the heart of the business section on Dearborn Street, crossing the Dearborn Street Bridge, as already referred to, and which, it may be added, has a double curve upon the grade. It was then put to work upon the Clark Street cable line at night, running on cable time, and regularly hauling passenger cars. Its final trip was over the Wells Street cable line during the daytime, hauling two loaded trailers at cable speed, and between cable trains, demonstrating its ability to do more than it was originally designed to accomplish.

As a result of this long and thorough series of trials which had lifted the motor out of the "experimental" into the "practical", Mr.

Yerkes purchased from the Connelly Motor Co. the entire rights for the state of Illinois, and immediately started a factory, which is to-day but the beginning of a large establishment, and it is his intention to build these motors as rapidly as possible, and lose no further time in replacing all the horses at present hauling cars upon his combined systems.

In a recent interview with a reporter of the *Chicago Tribune* the day after his return from Europe, Mr. Yerkes upon being asked if he had discovered anything new concerning motors in his travels abroad replied, "No. You do not have to go abroad to learn about motors. The only practical motor that I have knowledge of is the gas motor which we are using in Chicago. The gas motors we are building and using are not for our cable lines, but we intend to equip the feeding lines with them, and so get rid of all our horses."

It is expected that the Larrabee Street Line upon the North Side will be in operation with Connelly motors some time in October, and will then afford the street railway world an opportunity to judge for themselves, but in view of what has already been accomplished by it, and the fact that Mr. Yerkes has concluded to adopt it for his vast system, after experimenting for years certainly indicates that the long looked for independent motor is at last a practical commercial success.

A Steel City.

The site of the present city of Steelton, Pa., included, a score of years ago, nothing but farm land, and no one realized that the locality possessed splendid facilities for the prosecution of a great manufacturing industry. In the light of present knowledge the admirable situation can be readily appreciated, and its natural advantages afford an abundant explanation of the city's wonderful growth. It is located three miles from Harrisburg, on the banks of the Susquehanna, and its shipping facilities afforded by the main line of the Pennsylvania, a branch of the Philadelphia & Reading and the Pennsylvania Canal, are unsurpassed. To the north and south are found immense quarries of limestone suitable for building purposes, and for flux for iron furnaces. These advantages, together with the very liberal encouragement of the Pennsylvania Steel Co., have been instrumental in building up the place, and to-day it has a population of between 9,000 and 10,000 inhabitants. The town is well laid out with finely graded streets. The dwellings are handsome and substantial. The High School is one of the most complete public school buildings in the country. This structure was presented to the city by the Pennsylvania Steel Co., at the suggestion of the president, Major L. S. Bent.

This company was organized June 26, 1865, with a capital stock of \$200,000, which was subsequently increased to \$2,000,000. It was decided to adopt the Bessemer process of making steel, and excavations for the building were begun in January, 1866. The Bessemer plant was ready for operation in May, 1867, and on the twenty-fifth day of that month were made the first Bessemer steel ingots ever produced in the state. The total product for the first two years was 5,186 tons, which, while notable at the time, seems now quite inconsiderable; in fact, the average product for one month now exceeds the whole product for the first four years.

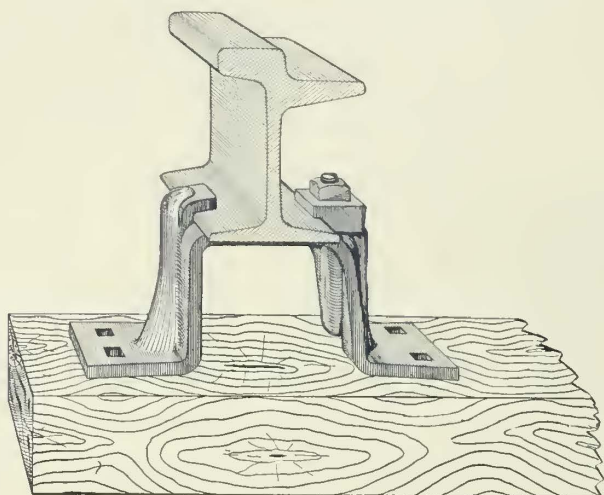
The land originally secured for the works embraced about eighty acres, but this has been increased by subsequent purchases to about 160 acres, all of which lies between the Pennsylvania Railroad and the Pennsylvania Canal. Measured along the line of the Pennsylvania Railroad, the plot extends nearly a mile and a half.

The amount of metal required for the furnaces, monthly, varies from 25,000 to 30,000 tons. The movement of this vast amount of material necessitates extensive facilities, and the company has over twenty locomotives of various sizes running on tracks whose aggregate length is thirty-five miles. The number of freight cars received and dispatched in some weeks exceeds 2,500.

The pay roll of the company embraces over 4,000 names, and the annual disbursement for labor exceeds \$1,500,000. It may be safely estimated that over 16,000 persons derive their support from this company's disbursement for labor alone. The works of the Maryland Steel Co. near Baltimore, an outgrowth of the Pennsylvania Steel Co., have been equipped with the most approved machinery and form the most complete plant of the kind in the United States, if not in the world. This company now handles all orders for heavy T rails, leaving the Steelton plant free to take up the manufacture of special shapes, light T rails, girder rails and other street railway appliances.

The supply of pure iron ore indispensable for the production of the requisite quality of iron necessary for the manufacture of street railway rails is obtained principally from the inexhaustible Juraqua

mines in the island of Cuba, which are owned in part by this company. A considerable quantity of ore is also obtained from Spain, Portugal and Africa. The ore is melted in four blast furnaces, and is then cast into pigs. The melted iron being released from the "blast



STEELTON RAIL CHAIR.

pots" runs down the centre trough, and branching out quickly fills the rows of moulds. Water is then played on the iron, and after being sufficiently cooled the pigs are broken loose from the moulds. The iron is next transported to the Bessemer mill.

In the converting department of the Steelton works the pig iron is melted in cupolas to insure the proper commingling of the various quantities of iron, and the metal is tapped from the cupolas into large receiving ladles mounted on scales, by which the contents is weighed. The ladle is elevated by a powerful hydraulic crane to such a sufficient height that the metal is discharged into the troughs or "runners," in which the metal is conveyed into the converting vessel.

The converters are large, heavy, egg-shaped appliances made of steel, lined with refractory material for withstanding heat, and provided with axles or trunnions on which they may be turned by hydraulic apparatus as the process requires. The lower part or bottom of the converter is made of perforated brick, called "tuyeres," through which the air passes into the converter, the air being conveyed by passages extending through the trunnions and connected to pipes leading from the blast engines.

The fused metal that flows into the mouth of the Bessemer converter must be transformed, but the process must not be carried too far, but must be arrested at the exact point where the iron becomes steel, as indicated by the color and quantity of the flame. The powerful blast of air required for this work—twenty-five to thirty pounds to the square inch—must always be sufficient to overcome the weight of the metal over each opening of the tuyeres. The metal having become steel is ready to be cast into ingots.

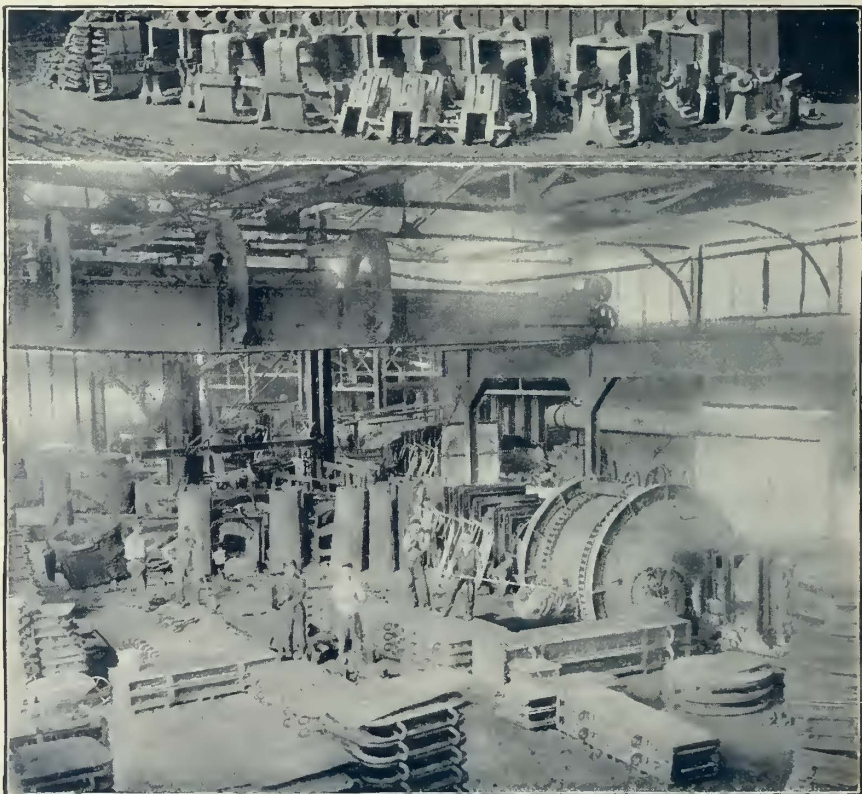
In front of the converters are circular pits into which the iron moulds are placed for the reception of the steel. The ladles into which the steel is poured are swung over the moulds and the steel is discharged into them through an opening in the bottom of the ladle. Each ingot contains sufficient metal to make several rails. After the steel has been in the moulds long enough to become congealed and sufficiently cool for handling, the moulds are stripped off and the ingots are loaded on cars for removal to the mills for rolling.

Each separate lot of steel is called a heat and receives a number. A sample is taken for chemical analysis and the number is finally stamped on the finished rails or other product into which the metal is worked. A careful record is made of the quality of the metal and other material facts relating to each heat. The handling of the ingots, ladles, moulds, etc., is effected by powerful hydraulic cranes.

The ingot now passes to the rolling mills which are located in a very handsome and substantial metal building, 810×200 ft. The ingots are reheated before blooming, the handling in and out of the furnace being effected by hydraulic cranes. The rolls of blooming mill No. 1, where all the ingots for girder rails are made into "blooms," are three-high and thirty-four inches in diameter, and driven by a massive upright engine of 600 H. P. The rolls are provided with the Fritz blooming table, by which two men are able to effect all the necessary handling of the ingots in and out of the rolls and deliver them after rolling to the massive shears, where they are cut into lengths suitable for rolling into rails. The blooms are now taken immediately to the heating furnaces adjacent to the rail rolls while as hot as possible, and are conveyed directly to the heating furnace on iron cars hauled by small locomotives. After being heated to the proper degree, they are placed on the tables or carriers and carried to the rail rolls operated by two powerful engines. After passing through the rolls nine to thirteen times, a bloom of steel, six or seven feet long and about seven inches square is transformed into a thirty foot length of girder rail ready for straightening and drilling.

The operation of rolling being finished, the rail is carried on rollers to a powerful and rapidly driven circular saw which at one sweep cuts and squares both ends of the rail. The rails for thirty foot lengths are cut about six inches longer to allow for shrinkage. From the saws the rails pass to a cambering machine, by which they are slightly curved, after which they are distributed on hot beds and allowed to cool. When cold they become nearly straight, owing to the unequal contraction between the heads and the base.

The next process is that of straightening the rails, which requires more careful manipulation than any of the other steps in the manufacture. The machines used for this work operate in a manner similar to that of die punches, and the rail is moved back and forth by hand under the continually moving arm of the press. Just the right bend is given to the rail by placing a chock of the proper thickness between the rail and the descending head. A few pinches here and here and the "kink" is quickly taken out. Holes are now drilled in



OPEN HEARTH FURNACE AND CASTINGS FOR EDISON MOTORS.

the end of the rail for joint plates, tie rods and bond wires. After being tested and accurately measured, the rails are ready for shipment or storing in the stock yard. Automatic loading machines are provided, by which the rails can be loaded directly on freight cars.

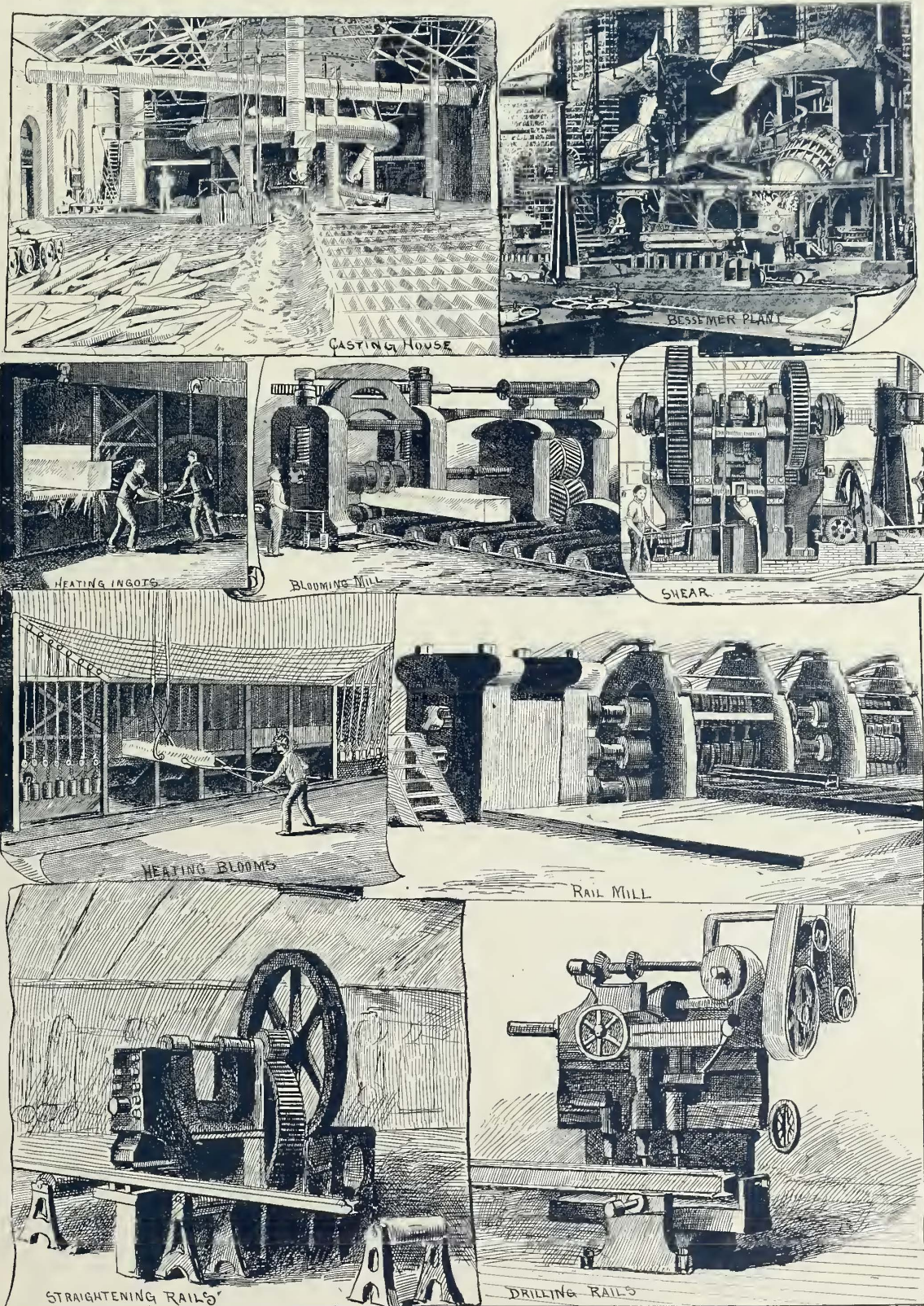
The tests applied by the Pennsylvania Steel Co. are exact, and eliminate almost the possibility of error. Every stage in the manufacture is under the supervision of an inspector, and if a flaw is discovered the work is condemned. The finished rails are subjected to a rigid inspection, and those not strictly up to the standard of "first class" are

rejected and classed as "seconds" which are sorted, and those having good heads are sold at a reduced price, their wearing capacity being ample for sidings and places where light traffic only is required.

Among the most important of the numerous departments of this work are the frog, switch and signal shops. This department is fully equipped with the most approved machinery. The shops are located in a handsome iron and steel building, the ground floors of which give a continuous floor space of 600 ft. in length and from 78 to 145 ft. in width.

One of the specialties manufactured by this company is the Steelton rail chair. This device is drop forged from the best quality of open hearth steel, and its method of fastening, shown in the cut, has proved under severe trials to be perfectly secure, and has shown a capacity to stand a vertical load of 32,000 lbs.

The company has in the course of construction a new open hearth plant and slabbing mill equipped with six of the most approved style of open hearth furnaces. This mill will be capable of producing universal slabs of any size desired.



SKETCHES IN THE PENNSYLVANIA STEEL WORKS.

Devices for Line Construction to be Exhibited by the General Electric Co.

In addition to motors and other apparatus to be exhibited at the Cleveland Convention, the General Electric Co. will show a new

ing during the last few months with a new insulator band, and some of the results are embodied in these new construction parts. The characteristic feature of these new devices lies in the fact that the material used for insulation is solid sheet mica. This material is recognized as possessing the highest insulating qualities of all substances

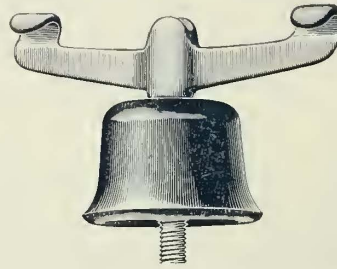


CAT. NO. 16826.



CAT. NO. 16692.

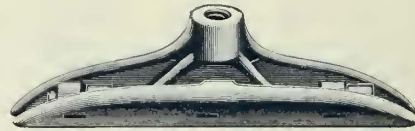
SINGLE CURVE BELL FOR AUTOMATIC EAR.



CAT. NO. 16686.
STRAIGHT LINE BELL INSULATOR
FOR STANDARD EARS.



CAT. NO. 16698.
BRACKET BELL INSULATOR
FOR AUTOMATIC EAR.



CAT. NO. 16723.
AUTOMATIC EAR.



CAT. NO. 16694.

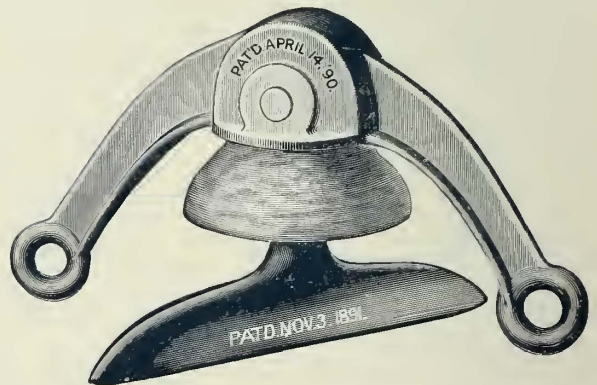
DOUBLE CURVE BELL INSULATOR FOR STANDARD EARS.



CAT. NO. 16704.
CEILING INSULATED SUSPENSION FOR AUTOMATIC EAR.



SINGLE CURVE INSULATED SUSPENSION FOR AUTOMATIC EAR.



DOUBLE CURVE INSULATED SUSPENSION FOR AUTOMATIC EAR.



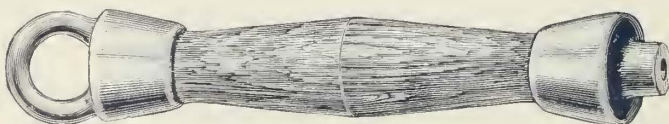
CAT. NO. 16718.

DUPLEX INSULATED SINGLE CURVE SUSPENSION FOR AUTOMATIC EAR.



CAT. NO. 16721.

SINGLE INSULATED CURVE SUSPENSION FOR STANDARD EARS.



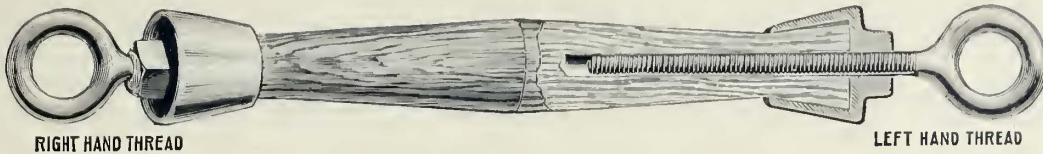
WOODEN INSULATOR FOR SINGLE CURVE SUSPENSION.



WOODEN STRAIN INSULATOR.

line of devices for overhead line construction for electric railways. The railway supply department of the company has been experiment

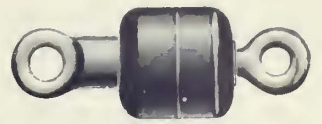
used in the manufacture of electrical devices, and, in addition, it will not deteriorate or disintegrate from age or the effects of weather.



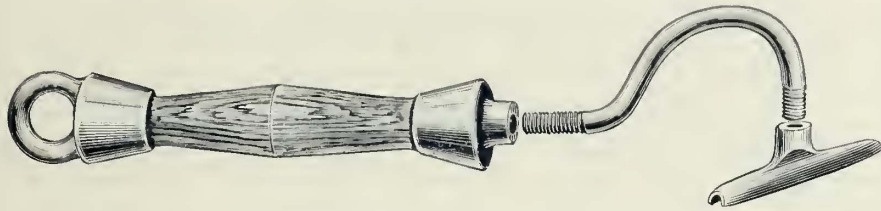
RIGHT HAND THREAD

LEFT HAND THREAD

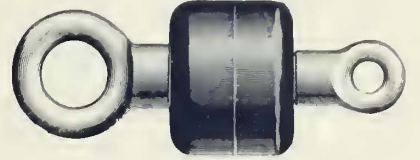
WOODEN INSULATING TURNBUCKLE.



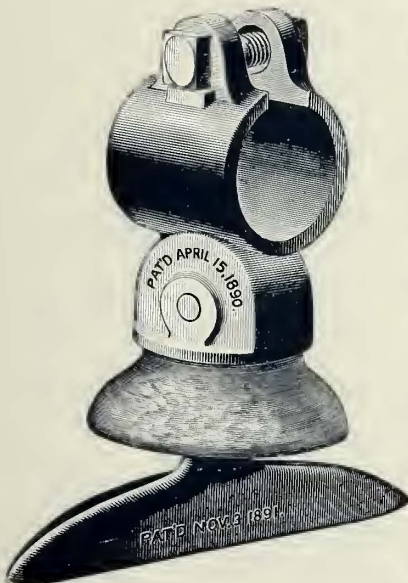
CAT. NO. 16741.
SMALL SHEET MICA STRAIN
INSULATOR WITH EYES.



SINGLE CURVE SUSPENSION WITH WOODEN INSULATION.



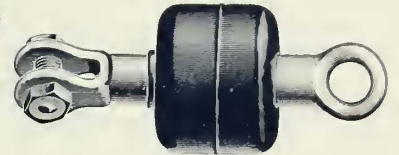
CAT. NO. 16748.
LARGE SHEET MICA STRAIN INSULATOR
WITH LARGE SOCKET EYE.



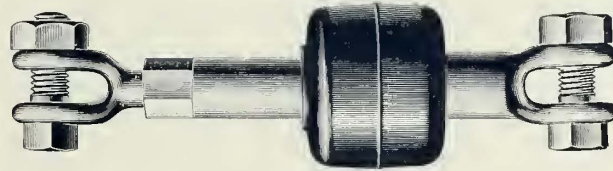
BRACKET INSULATED SUSPENSION FOR
AUTOMATIC EAR.



CAT. NO. 16738.
SHEET MICA INSULATING TURNBUCKLE WITH SOCKET
CLEVIS AND SCREW EYE.



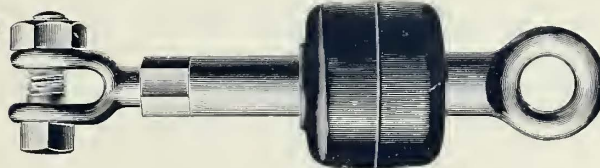
CAT. NO. 16747.
LARGE SHEET MICA STRAIN INSULATOR
WITH CLEVIS.



CAT. NO. 16736.
SHEET MICA INSULATING TURNBUCKLE WITH CLEVIS AT
EACH END.



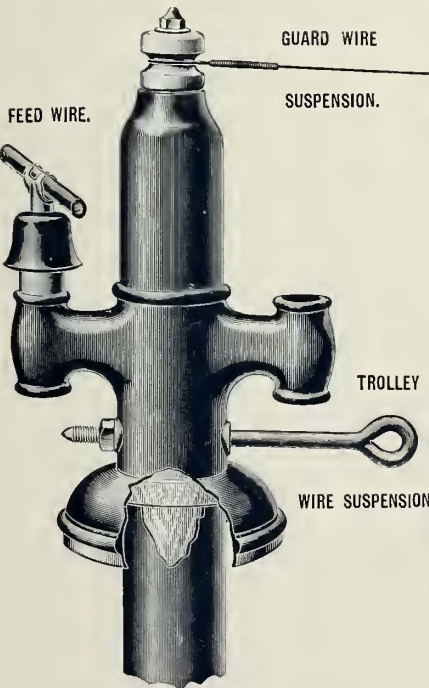
CAT. NO. 16745.
LARGE SHEET MICA STRAIN
WITH EYES.



CAT. NO. 16737.
SHEET MICA INSULATING TURNBUCKLE WITH SCREW
CLEVIS AND SOCKET EYE.



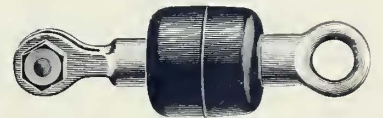
CAT. NO. 16745:
LARGE SHEET MICA STRAIN IN-
SULATOR WITH EYES.



CAT. NO. 16758.
MORRIS COMBINATION POLE TOP.



CAT. NO. 16732.
SHEET MICA INSULATING TURNBUCKLE WITH EYES.



CAT. NO. 16743.
SMALL SHEET MICA STRAIN INSULATOR
WITH CLEVIS AND SOCKET EYE.



CAT. NO. 16803.
SINGLE CURVE M. R. BELL INSULATOR FOR
AUTOMATIC EAR.



CAT. NO. 16750.
STRAIGHT LINE GUARD
WIRE BELL
SUSPENSION.



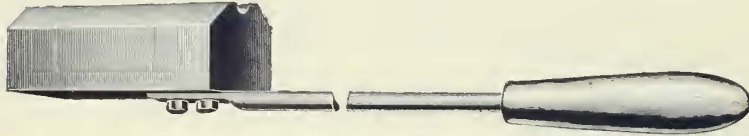
CAT. NO. 16806.
BRACKET M. R. BELL INSU-
LATOR FOR STANDARD
EARS.



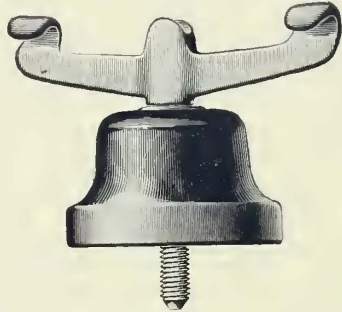
CAT. NO. 16788.
ELECTRICALLY WELDED RAIL BOND.

The new insulator, made in the form of a bell, is constructed as follows: A metal casting, as will be seen in the cut of the cross section, projects around under the head of the screw bolt which holds the trolley wire ear. The sheet mica is first placed in this casting, the screw bolt is then set in, and afterwards mica is put in until the casting is filled nearly to the top; then the metal piece into which is screwed the span wire clip or other suspension device, is set down on the mica, and the edges of the main casting turned over on it by hydraulic pressure. The whole device is folded, covered with an insu-

As it is often necessary to put guard wires over the trolley wire, devices have been designed for this purpose, resembling in all respects the bell insulator already described, with the exception that they are smaller in size and are fitted with a small double hook so that they hold the guard wire without the use of the ordinary ears.



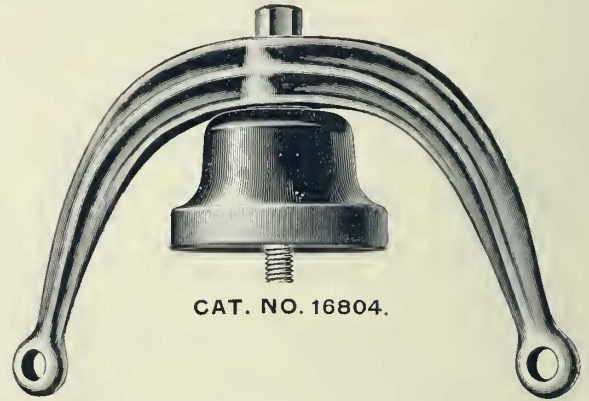
CAT. NO. 16762.
SOLDERING COPPER FOR RAILWAY WORK.



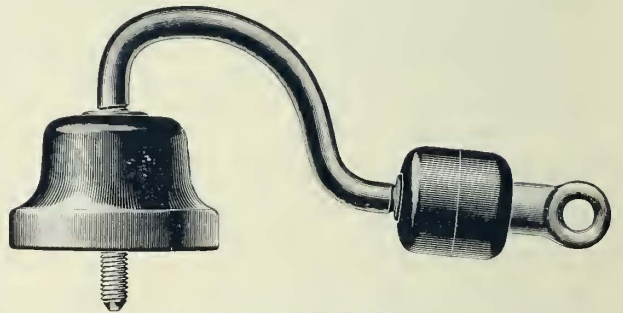
CAT. NO. 16801.
STRAIGHT LINE M. R. BELL INSULATOR FOR AUTOMATIC EAR.

lating composition which is perfectly impervious to the weather, which forms a secondary insulator and prevents any surface leakage.

There are two styles of this bell, both shown in the accompanying cuts, differing from each other, only that the larger size has a metal rim around its lower edge, which protects the composition covering from being chipped or broken, should the trolley wheel happen to slip from the wire under one of the insulators. Both forms of the bell are made with a square ended screw to hold the ordinary standard ears, and also with a longer pointed screw to fit the automatic ears.



CAT. NO. 16804.
DOUBLE CURVE M. R. BELL INSULATOR FOR STANDARD EARS.



CAT. NO. 16811.
M. R. DUPLEX, INSULATED, SINGLE CURVE SUSPENSION FOR AUTOMATIC EAR.

The span and strain wire insulators are constructed on exactly the same principle as the bell itself, and are manufactured in many different designs and combinations of clevis and eye so as to meet all possible conditions of overhead line construction.

