

THE ELECTRIC RAILWAY SYSTEMS OF COLUMBUS

Columbus in many respects is an ideal street railway city. The streets are laid out in the form of a Latin cross, the long stem being represented by High Street, which is the main business thoroughfare and runs practically north and south for a distance of 7 miles. The cross-arm is represented by Broad Street. The development of the city has been north and south and east and west along these two main lines, but the growth of the city is gradually filling up the corners made by the arms of the cross, so that eventually the city will represent a long and rather narrow rectangle.

This lay-out is conducive to short hauls, as the trends of traffic are to and from the outer ends of the main lines and the intersection at Broad and High Streets near the State capitol.

In arranging routes, it is the practice to run through cars, that is, cars start at the outer ends of the lines, carrying one load to the center of the city, where they discharge and pick up a new load, continuing on through the center of the city and out to the terminal on some other line.

From the intersection of High and Broad Streets, which is the geographical and commercial center of the city, seven parallel lines go east, four go north, two go west and two go south, thus serving the entire city and reaching every point direct. This concentration of cars on a section of High Street renders this line one of the heaviest street railway lines in the country, and, although the section of congestion is not as long as is found in other cities, High Street for several blocks north and south of the company's offices, during the rush hours, closely resembles Broadway, New York, as far as the number of cars passing in each direction is concerned. During the average day the schedule calls for about 2500 cars past this point in eighteen hours, and at peak hours cars pass at the rate of about three a minute. The traffic chart on Plate XVII. gives the distribution of cars over the system as called for by the evening hour schedule.

There are not less than six amusement grounds in the south and southeast sections, and there are two important parks in the north and northeast sections, namely, Olentangy and Indianola. The State Fair Grounds are also near these two last-mentioned parks, which makes an advantageous location for handling the large crowds during Fair Week. The company has handled to the Fair Grounds as many as 1,250,000 people in five days. Fair Week comes in the fall, after the principal parks are closed, so that the copper feeders and rolling stock which are required for handling the summer park business are utilized to good advantage during Fair Week.

The Columbus Company some years ago inaugurated a system of profit sharing with its employees, and it is believed this scheme has resulted not only in increasing the cordial relations prevailing between the men and the management, but has also tended to increase the efficiency and esprit de corps of the employees. The profit sharing dividend is paid on total amounts of wages earned at the same ratio of per cent as is paid to stockholders on the stock. The profit sharing extends to the employees of all departments of the organization. To be entitled to the dividend employees must have worked six months continuously prior to a dividend paying day, and an employee by leaving the service forfeits any further participation in the profit sharing. Both the management and the employees are enthusiastic over the results that have been achieved by this method of allowing the rank and file of the organization to participate in proportion to their wages in whatever profit the company may earn.

TRACK CONSTRUCTION

Until recently the entire street railway mileage in the city of Columbus was operated by two independent companies, namely, the Columbus Railway & Light Company and the Central Market Street Railway Company. The first named company was chartered in 1903 as a consolidation of certain prior companies, and its system includes all of the original street railway lines in the city. Practically all of these lines are 5-ft. 2-in. gage. The Central Market Street Railway Company was formerly a part of the "Appleyard System" and its tracks were laid primarily to give an entrance for the interurban lines into the city of Columbus. These tracks are 4-ft. 8½-in. gage. Since July 1 of the present year, the Columbus Railway & Light Company has been operating the Central Market system for the owners. The Columbus Railway system comprises 106½ miles, measured as single track, and the Central Market system comprises 29½ miles, giving a total of 136 miles. The accompanying table sets forth the distribution of the mileage on the wide gage lines.

STATEMENT OF MILEAGE, COLUMBUS RAILWAY & LIGHT COMPANY

	Within City Limits	Outside City Limits
Paved streets	67.086	.894
Unpaved streets	10.542	7.191
Roads	17.099
Park and Pr. R. of W.....	1.005	2.783
Total	78.633	27.967
Total for system, 106.604 miles.		

In Columbus will be found various styles of track construction, the system in this respect being somewhat out of the ordinary. The inset following page 594 illustrates graphically the different forms of track construction and the approximate quantity of each kind. The color scheme on this map illustrates the five predominating forms of track foundations, which are as follows: Concrete girder and steel angle bar tie construction; oak ties embedded in concrete, i. e., the timber has a foundation of 6 ins. of concrete, which extends upward and between the ties and is surfaced to a height to accommodate the kind of pavement to be laid; oak ties ballasted with crushed rock and a layer of cement concrete laid over the ballast to form the pavement foundation; oak ties ballasted with gravel and filled with gravel to form the pavement foundation; track construction in unimproved streets. The particular rail sections used in different locations are noted along the sides of the lines on the map.

The construction which has been followed during the last three or four years on the wide gage tracks in paved streets comprises a modified "Trilby" rail with concrete girders and steel angle-bar ties. This is now regarded as the standard track construction for city lines. The details are shown in the drawings on page 593. The procedure in laying this construction is about as follows:

After the old track work and pavement have been removed the grading is completed, in cases where brick pavement is to be laid, 11 ins. below the surface of the finished street, after which ditches or troughs are excavated under the location of each rail to a depth of 10 ins. below the bottom of the rail, the ditches being 18 ins. in width. The track work is then assembled and surfaced upon oak blocks cut from old oak ties. The

material for the concrete is then delivered by dump cars and piled along the side of the track. The dump cars travel over the rails that are supported on the oak blocks, and during this delivering of material the blocks settle into firm bearings under the track. When all the material has been delivered the track is gone over and shimmed to a true surface and line, care being taken to block the track work into line from the sides to prevent the heat of the sun from kinking the track. When all is ready for the concrete, the concrete boards are placed upon the rails, where the mixing is done by hand and the boards are pushed along upon the track as the work progresses. In connection with this work it has been found very important to leave the ends of the rails free, so that expansion will not create undue stresses while the concrete is being laid and is setting.

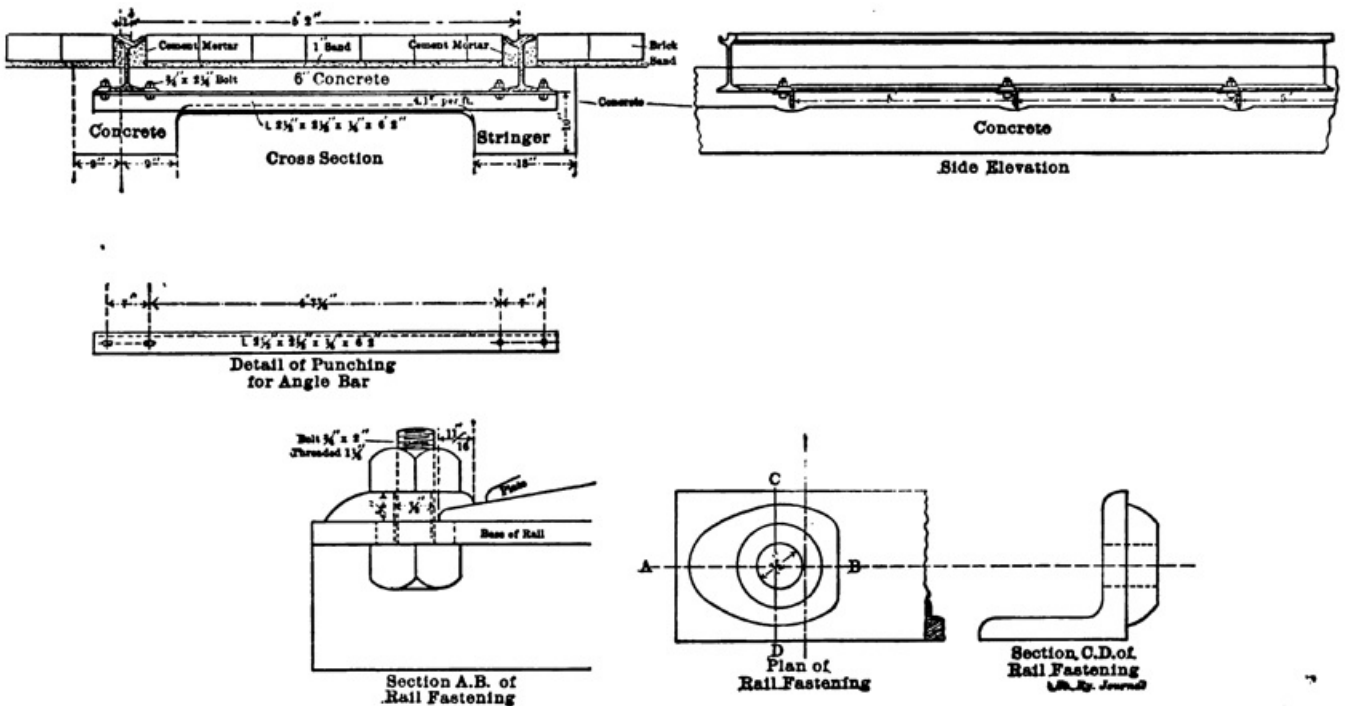
Construction similar to this was laid on State Street, from High to Fourth Streets, on the south track in 1898, and the track is in excellent condition to-day. This track was laid with ordinary six-hole standard joint plates. On more recent work the track is laid with continuous rail.

troller. The rear car has a controller of the K-10 drum type, and the motor circuits of the two cars are connected by means of jumpers between the cars.

The type M controller on the first car is the regular multiple-unit equipment for four motors. The wiring of this controller is identical with that of an ordinary four-motor equipment, with the exception that the leads for motors No. 3 and No. 4, instead of going to motors, are divided into a bus line extending the full length of the car and terminate in receptacles on each dash. On the rear car, wires leading from the receptacle on the dashes are tapped in on the motor leads, and other than this addition no changes from the usual K-10 controller wiring is made. The chief advantage of the use of the two different kinds of controllers is that the extra expense of installing a multiple-unit controller on the rear car is avoided.

SHOPS

The main repair shops for the Railway & Light Company are on Rose Avenue, about two miles east from the center of



DETAILS OF CONCRETE GIRDER TRACK CONSTRUCTION, COLUMBUS RAILWAY & LIGHT COMPANY

ROLLING STOCK

The Columbus Railway & Light Company owns about 300 cars of various designs and dimensions. The standard open car measures 40 ft. 9 in. The standard closed car measures 42 ft. over all.

All of the regular cars of the company are mounted on Brill maximum traction trucks. This type of truck has been adopted in Columbus, owing to the fact that the tracks are wide gage. The company also has a large number of single-truck cars which it uses on peak loads and during Fair Week.

It is necessary, owing to the climate in Columbus, to have a complete double equipment of open and closed cars for summer and winter service. The motor equipments are mostly G. E. 67, mounted two to the car. The company also has motors of the G. E. 52, 44 and 800, Westinghouse 49 and 12 types.

The company has recently worked out an ingenious method of running cars in trains in order to lessen the congestion on the principal streets, as well as to increase the carrying capacity during rush hours. Each car is equipped with two motors, and the first car of each train is provided with a multiple-unit con-

the city. In addition to the main shops and houses at this point, there are six operating houses scattered over the local system, in which it is the practice to do considerable inspection and light repair work. As the company has a complete equipment of open and closed cars, it is the practice to thoroughly overhaul the rolling stock once a year, during the change of seasons. All the regular repair work is done in the day time, and each car is pulled in not less than every two days for inspection and repair.

The main shop at Rose Avenue consists of a group of three buildings. The pits and truck room are located in the front wing. The machine shop occupies the ground floor of a three-story building, formerly an old horse-car barn. The second floor of this building contains the armature and field-coil rooms and the stock room. The carpenter shop is in a wing at the rear of the main building. The paint shop, foundry and blacksmith shops are in separate buildings a short distance from the main building. The plant has been developed with the growth of the system, and although all departments are now somewhat cramped, the rolling stock is kept in excellent condition. The machine shop equipment includes a wheel press, boring mill, sev-

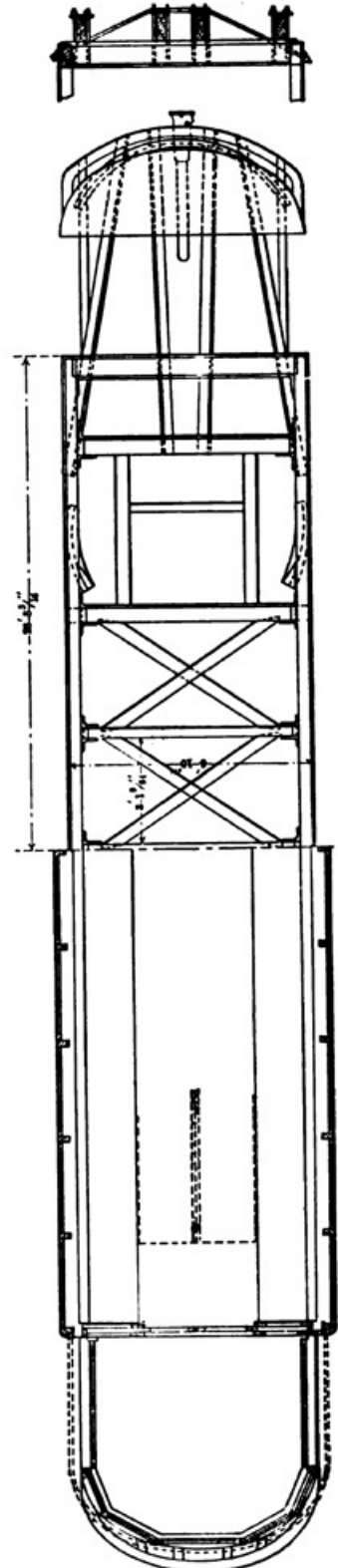
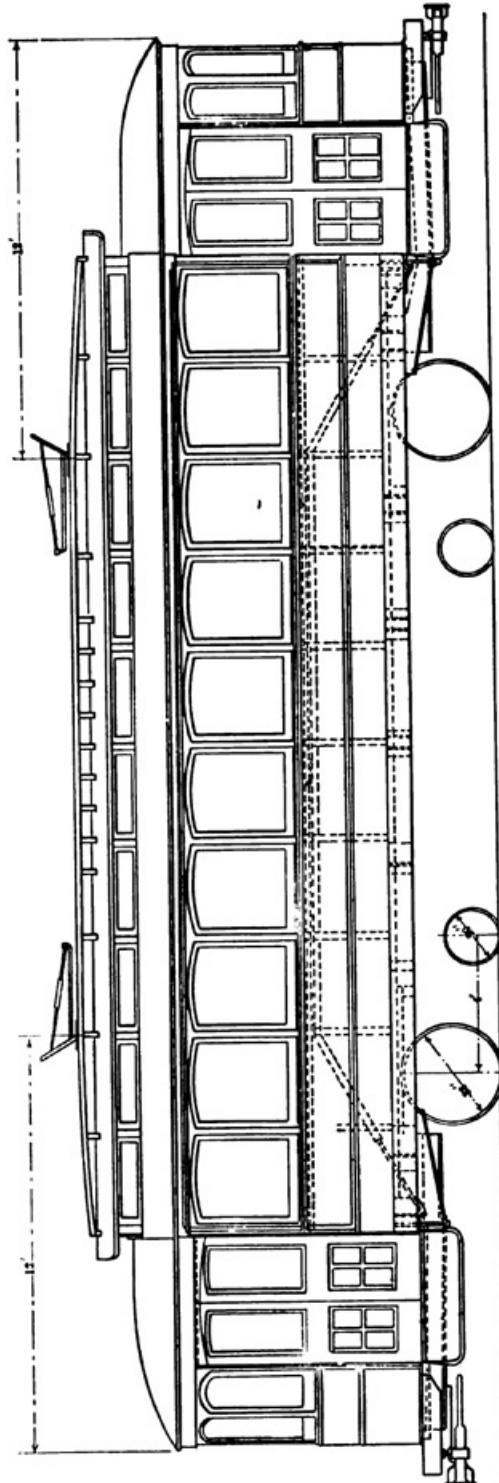
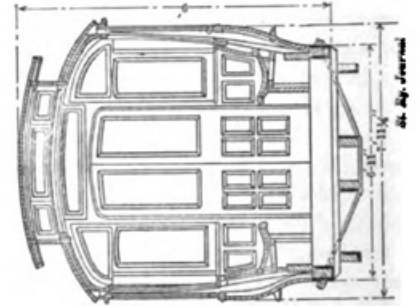
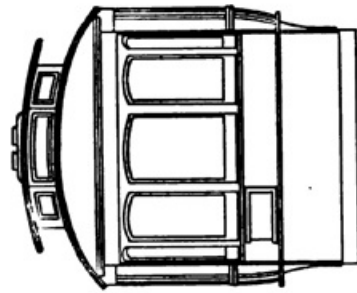
eral lathes, drills, bolt cutters, etc. In the carpenter shop are a complete set of tools, including a wood-worker, rip and cut-off saws, planer, etc. The paint shop has a capacity for only a few cars at a time, but here is done all the painting and retouching on 300 cars, and the excellent appearance of the rolling stock on the streets speaks well for the system used.

The shops are equipped with a number of labor-saving devices, of which, perhaps, the most interesting are the air hoists and cranes over the inspection pits for handling the truck and motor parts. There are two 6-in. air hoists which travel on circular cranes. These two circular tracks cover the entire width of the shop, the diameter of each circle being 24 ft., thus making it possible to pick up parts and material and deliver them at any point in the pits or on the floor. Each crane has two arms extending from the center to the circumference, these arms being pivoted at the center, with travelers at the outer ends. On the arms are also travelers from which the air hoists are suspended. These outfits were built in the company's shops and cost \$240 each complete, including air hoists and connections. The circular tracks are made from 8-in. I-beams, which are bent into proper shape on a wheel press. These circular cranes have the advantage of avoiding the necessity of posts in the center of the room. The cranes are of particular value in changing motors from one truck to another when the change from open to closed cars is being made. A direct-connected compressor supplies the hoists with air. A smaller circular crane of the same type is used in the armature room.

In addition to the circular travelers there are eight 9-in. hoists traveling on overhead tracks, for raising cars when trucks are to be changed.

A small but well-equipped brass foundry takes care of a remarkably large amount of work, and the company produces practically all of the brass castings required in the operation of the system, including rail bonds, trolley ears, trolley wheels, controller parts, etc.

The repair shop for the Central Market system is located in



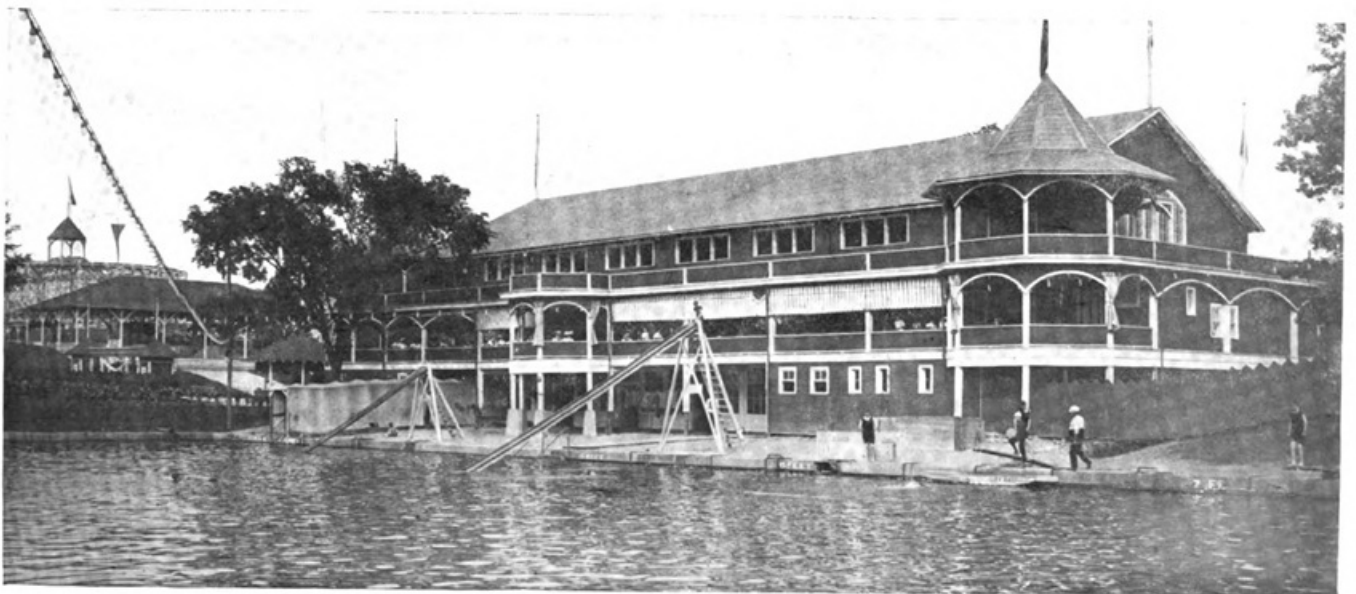
42-FT. CLOSED CAR, COLUMBUS RAILWAY & LIGHT COMPANY



THE COLONNADE AT OLENTANGY PARK, COLUMBUS



THE CASINO AT OLENTANGY PARK, COLUMBUS



THE SWIMMING POOL, BATH AND DANCING PAVILION, INDIANOLA PARK, COLUMBUS

Plate X



THE TUNNEL ON THE COLUMBUS, NEWARK & ZANESVILLE LINE



A PICTURESQUE SPOT ON THE COLUMBUS, NEWARK & ZANESVILLE LINE



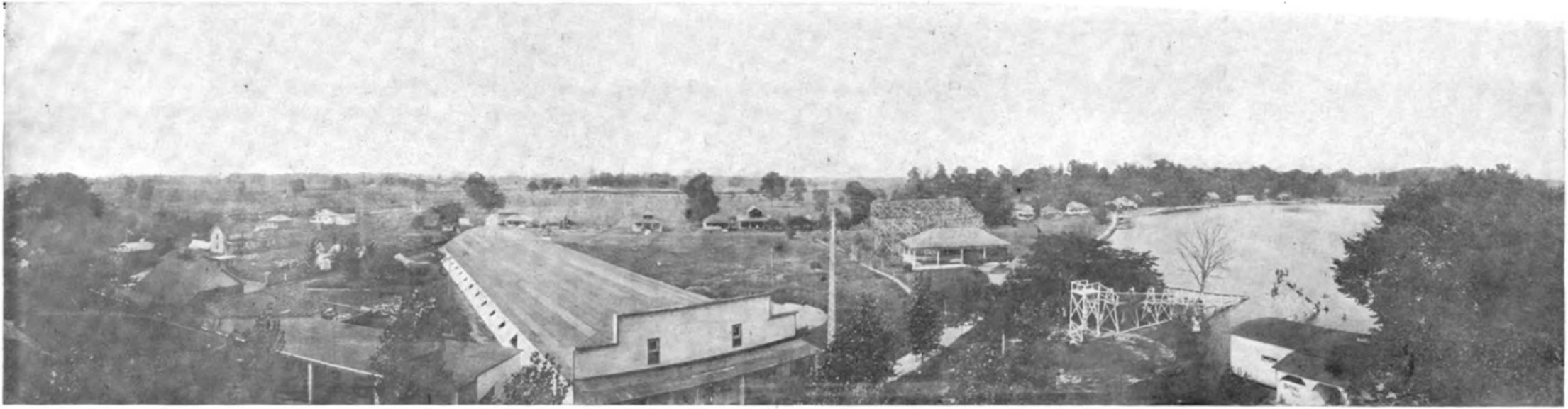
A BIT OF NATURE CAUGHT FROM THE CAR WINDOW ON THE COLUMBUS, NEWARK & ZANESVILLE LINE



VIEW ON LINE OF THE COLUMBUS, DELAWARE & MARION



VIEW ON LINE OF THE COLUMBUS, NEWARK & ZANESVILLE



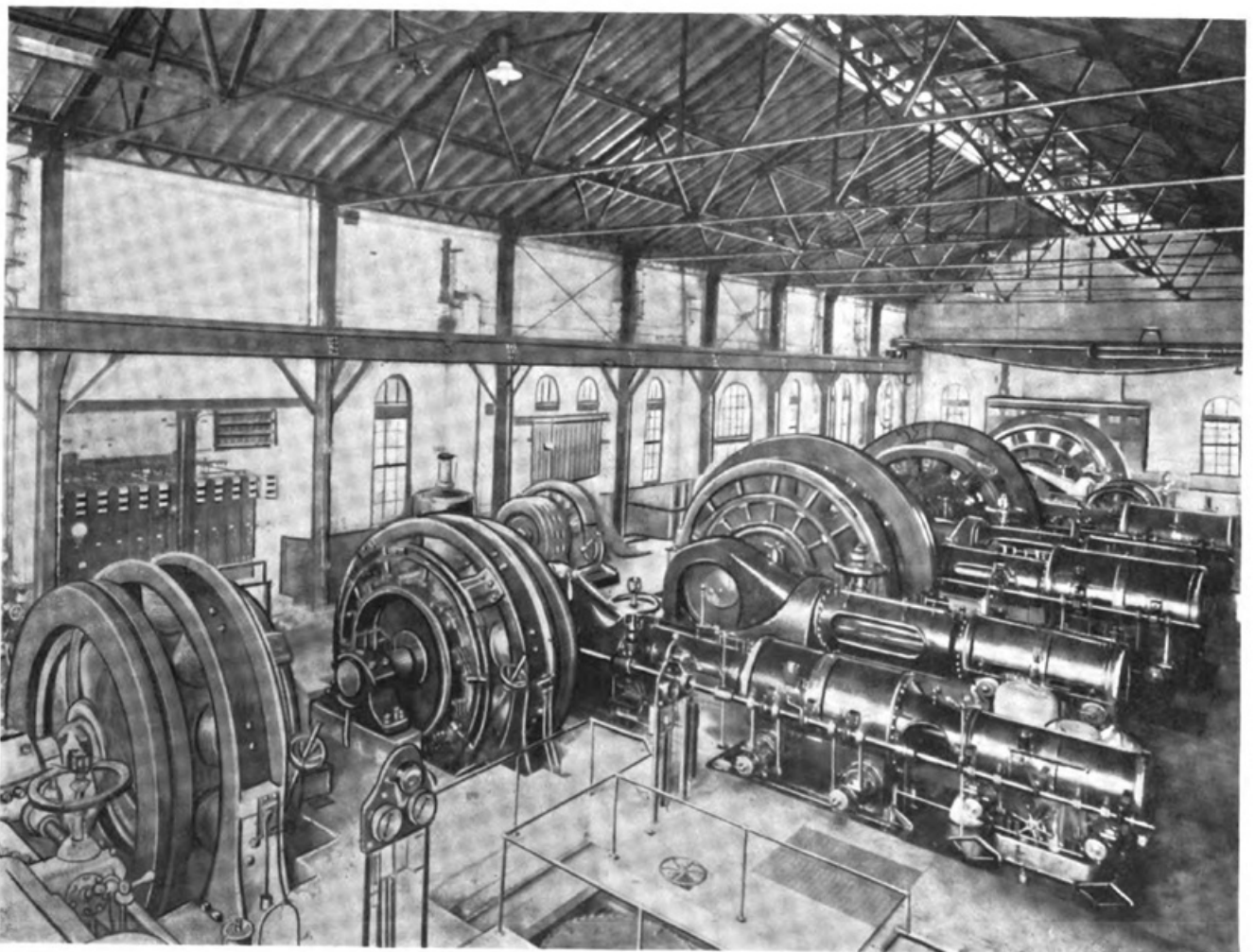
PANORAMA OF BUCKEYE LAKE, ON COLUMBUS, BUCKEYE LAKE & NEWARK



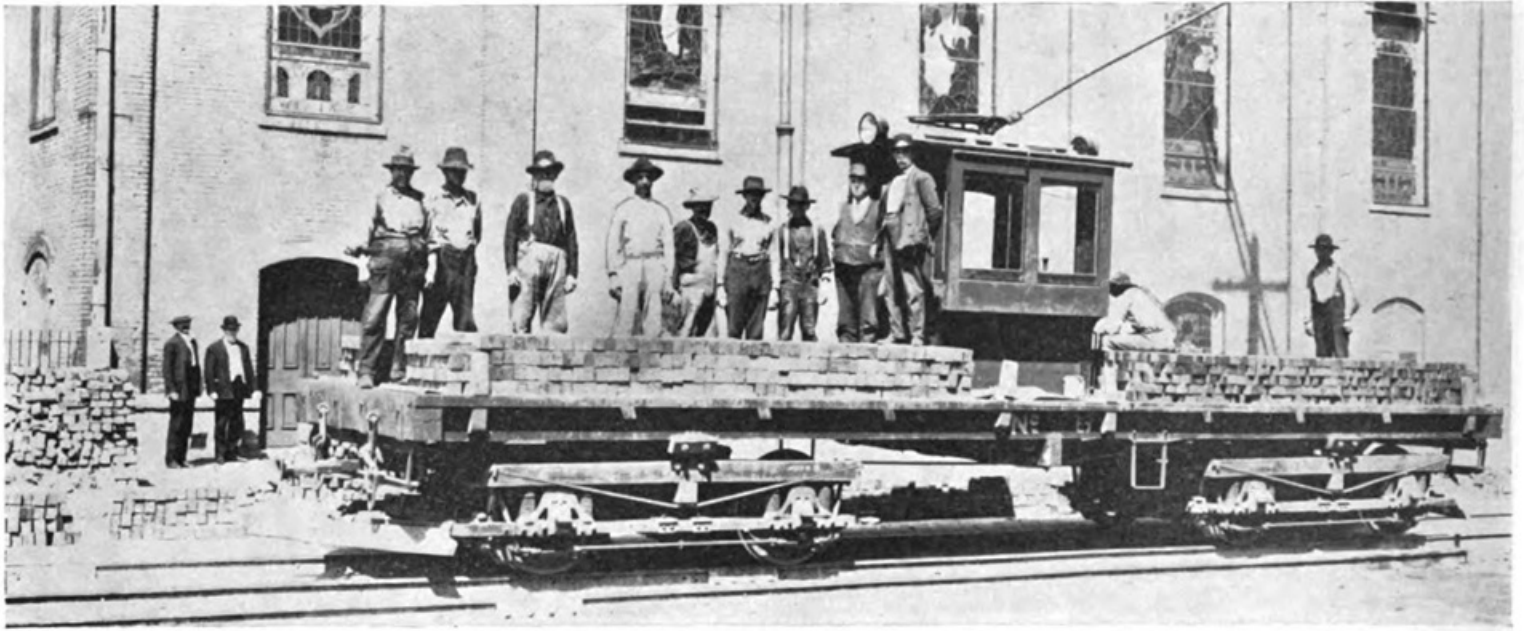
SCENE ON INTERURBAN LOOP, COLUMBUS



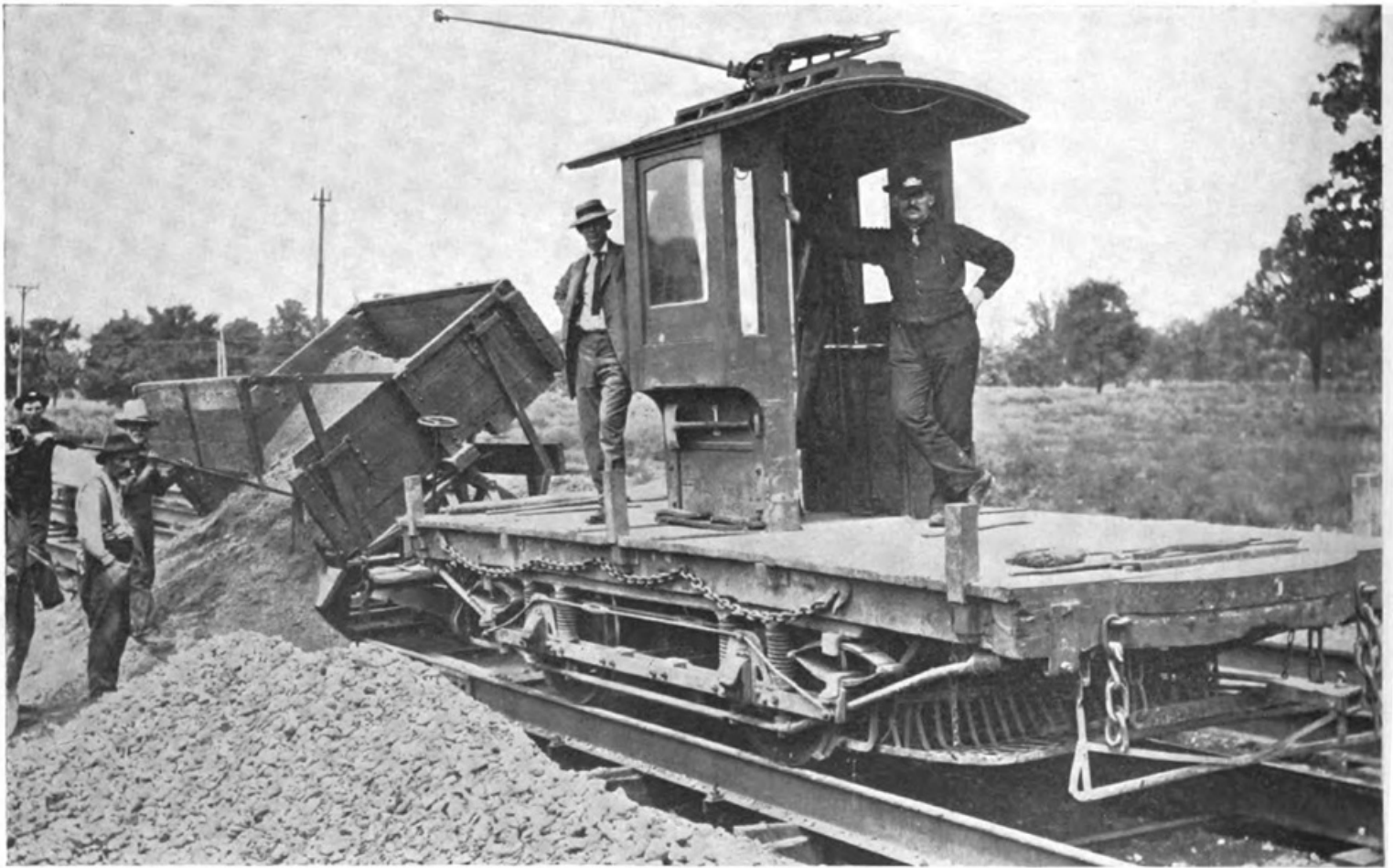
CAR HOUSE, CENTRAL MARKET LINES, COLUMBUS



INTERIOR SPRING STREET STATION, COLUMBUS RAILWAY & LIGHT COMPANY



DELIVERING BRICK WITH RAIL CAR FOR PAVING TRACKS IN COLUMBUS



CONCRETE GIRDER CONSTRUCTION IN COLUMBUS—DELIVERING MATERIAL WITH SIDE-DUMP CARS. ONE MOTOR CAR WILL PULL TWO DUMP CARS



CONCRETE GIRDER CONSTRUCTION IN COLUMBUS READY FOR CONCRETE



CONCRETE GIRDER CONSTRUCTION IN COLUMBUS. TO BE PAVED WITH BRICK. ONE TRACK CONCRETED. MATERIAL BEING DELIVERED IN OTHER TRACK



CONCRETE GIRDER CONSTRUCTION IN COLUMBUS. ASPHALT PAVEMENT COMPLETED, EXCEPT TOP COAT IN ONE TRACK



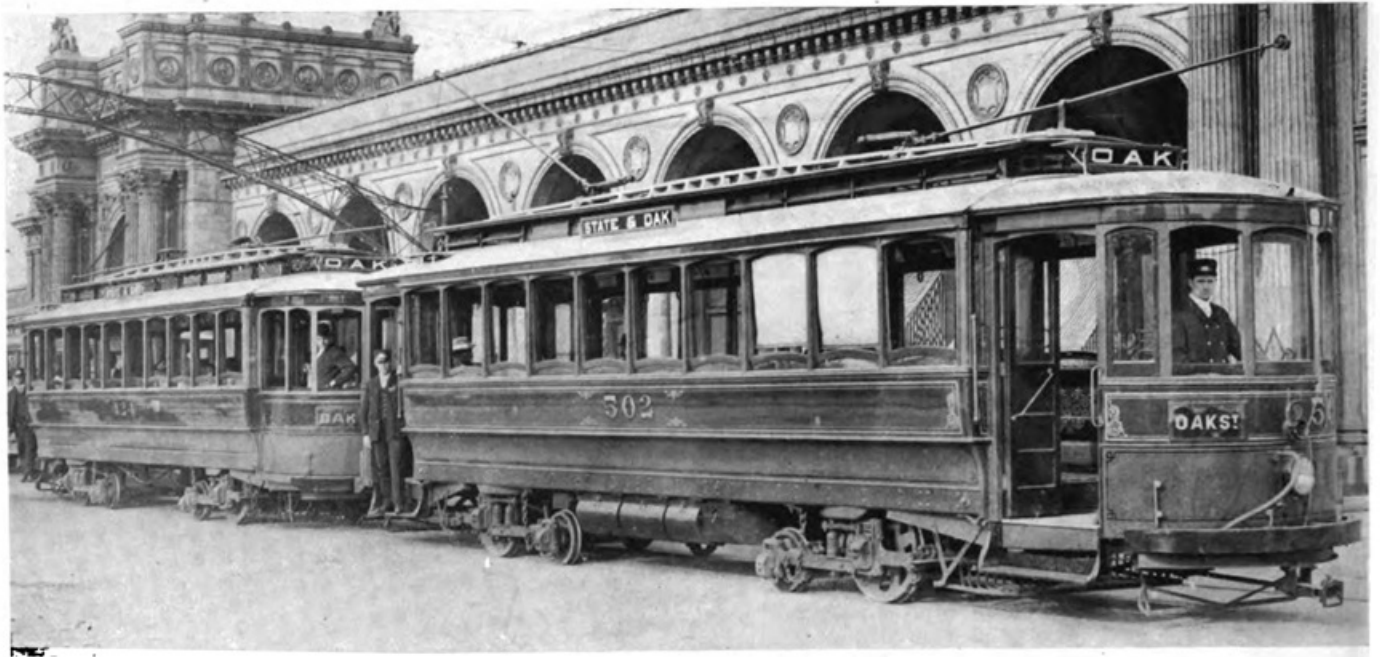
DOUBLE-GAGE TRACK IN COLUMBUS



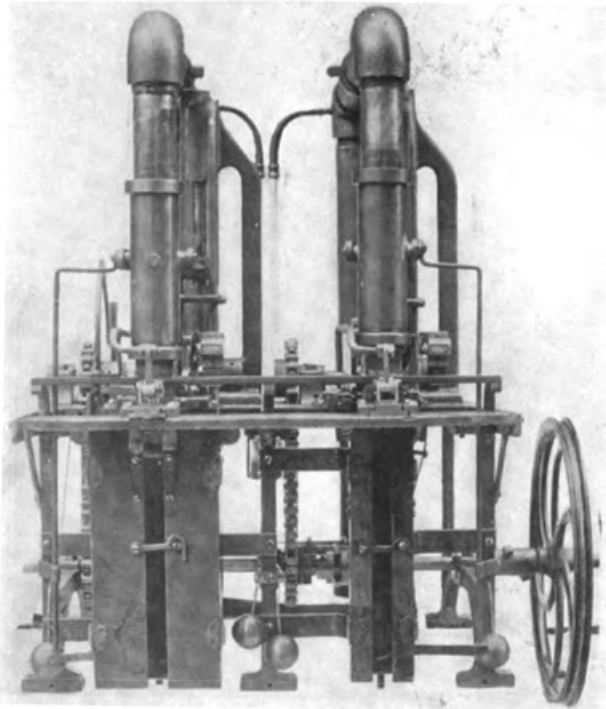
CAR SHOP, SHOWING CIRCULAR CRANES AND TRANSFER TABLE



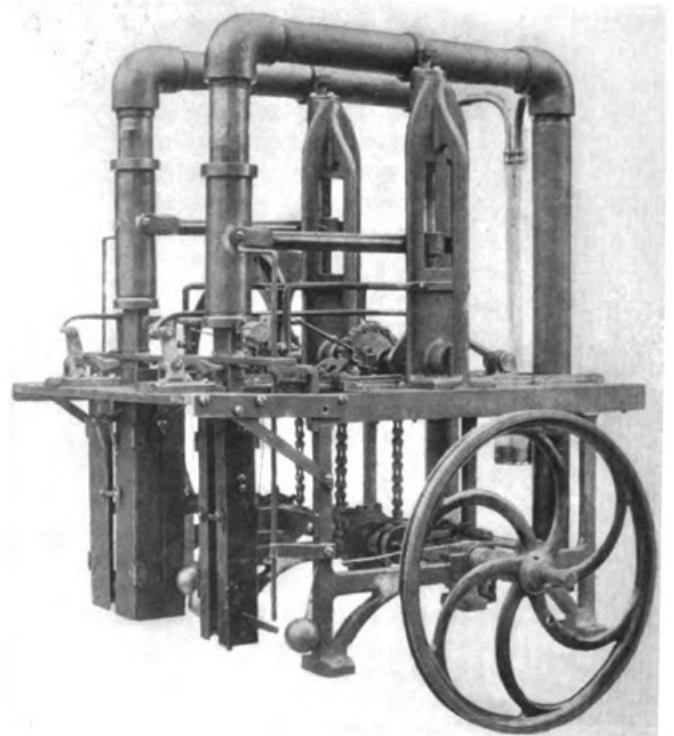
AUTOMOBILE STORAGE BATTERY STATION MAINTAINED BY COLUMBUS RAILWAY & LIGHT COMPANY



TWO-CAR TRAIN, WITH TWO MOTORS TO EACH CAR AND MULTIPLE-UNIT CONTROLLER ON FIRST CAR—USED IN CITY SERVICE BY COLUMBUS RAILWAY & LIGHT COMPANY



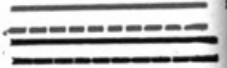
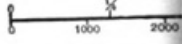
TICKET-COUNTING MACHINE USED BY COLUMBUS, NEWARK & ZANESVILLE



SIDE VIEW OF TICKET-COUNTING MACHINE

MA COLUMBI

Showing standard gauge
and wide gauge



Columbus, New Albany &
Johnstown Traction Co.

Urban-Mechanicsburg
Traction Co.

KING

6TH

RODRIGUEZ AV.

JOHNSTOWN

ATCHESON AVE.

NELSON AVE.

Nelsons Woods

Bullitt Park

Franklin
Park

Car House
& Signs

OAK
HOTEL
AVE.

Columbus, Buckeye Lake
& Newark Traction

Creele

STEELE AVE.

W. W. WILSON

CLARENCE
AVE.

PARSONS
AVE.

Driving Park

another part of the city and is used by some of the city cars, and by the interurbans, for such repairs as have to be made at this terminal. The shop is well equipped with tools and labor-saving devices.

The Columbus Railway & Light Company is using in its hurry-up repair service a gasoline automobile tower wagon, which has given satisfactory results for strictly city service, and is said to

held in reserve and is used only on peaks and in emergencies, a 500-kw National motor-generator set having been installed at this station for the purpose of taking current from the other stations and delivering direct current to the system in this district.

All of these stations are thoroughly tied together by a. c. and d. c. tie-lines, giving the greatest degree of flexibility and permitting of a number of combinations in the generation of current

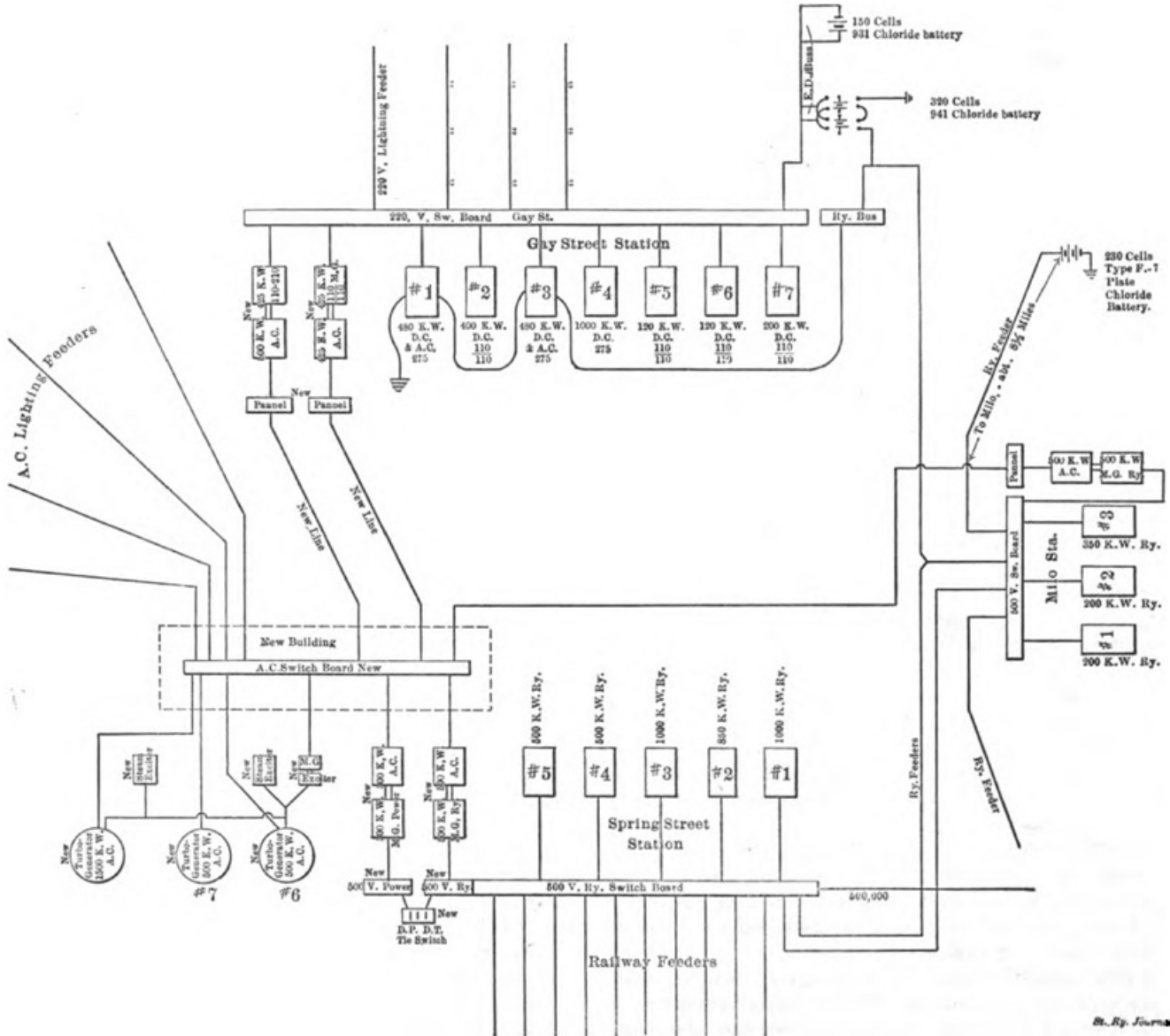


DIAGRAM SHOWING ALL TIE LINES BETWEEN POWER STATIONS, COLUMBUS RAILWAY & LIGHT COMPANY

make better time than horse-drawn tower wagons at an expense somewhat less than for teams.

POWER

The Columbus Railway & Light Company has four distinct power services, namely, 550-580-volt, d. c. current for railway purposes; 115-230-volt, d. c. current for Edison lighting system; 4100 a. c. current for lighting, and an independent insulated 550-volt power supply. The company owns four power houses, namely, Spring Street, known as Station No. 1; Gay Street, known as Station No. 2; Milo, known as Station No. 3, and a station formerly owned by the Central Market system, known as Station No. 4.

Most of the current for railway purposes is generated at Spring Street. Most of the current for lighting is generated at Gay Street. The generating apparatus at the Milo station is now

that assure economy and efficiency in the power supply and practically preclude the possibility of interruption to the railway, lighting or power service, through failure of lines or apparatus at any station.

The diagrammatic representation of the power lay-out given on this page, together with the map on Plate XVIII., showing the tie-lines between stations, will make clear the general power scheme.

In brief, it will be noticed that the Spring Street station contains five railway units, two of which are 500-kw, two are 1000-kw and one is a 840-kw unit. These machines handle the bulk of the railway load. There are also in this station two 500-kw Curtis turbo-generator sets which deliver alternating current at 4100 volts. There is room for an additional 1500-kw turbo-generator set. The high degree of flexibility previously

referred to is greatly increased by the use of motor-generator sets in the various stations. In the Spring Street station there is one 500-kw General Electric motor-generator set and one 300-kw General Electric motor-generator set, which can be used either to deliver railway current to the railway feeders or alternating current to the lighting system, as conditions may require. There is also one 150-kw General Electric booster-set, which can be so connected as to boost through any feeder panel at this station. This booster is used chiefly on the park lines in summer. The railway units at this station are driven by Green-Wheelock engines.

The Gay Street station contains the following generating apparatus:

Two 480-kw General Electric double-current machines, which can be used either to deliver direct or alternating current as required.

One 400-kw General Electric 110-volt, direct-current machine and one 1000-kw General Electric, 275-volt, direct-current machine for supplying the Edison lighting system.

There are also three other units, two of them consisting of two 60-kw Edison bipolar machines and one consisting of two 100-kw Edison bipolar machines for use on the Edison system.

In addition to the generating apparatus at this station there is one 500-kw, three-unit General Electric motor-generator set, the motor taking alternating current and driving the other two machines as generators, delivering 125-210 direct current to the Edison system. There is also one 500-kw General Electric two-unit motor-generator set, which is used in the same way. These sets can, of course, be reversed so as to take direct current and deliver alternating current.

To further increase the flexibility and efficiency of the power supply there have been installed at the Gay Street station two storage batteries, one comprising a 320-cell "Chloride Accumulator" battery, which may be used either to deliver 550 volts d. c. to the railway or 220 volts d. c. to the Edison lighting system. This is accomplished by operating the cells in series for railway work and in parallel sections for lighting. The battery in railway work has a capacity of 880-kw.

There is also a smaller battery, consisting of 150 cells, used on the Edison lighting system and supplied by one 50-kw, two-unit motor-generator set.

The possibilities that lie in this combination of d. c. and a. c. generating apparatus, motor-generator sets and storage batteries in securing any kind of current required, smoothing out peaks, and, at the same time, maintaining a good load factor on all machines, will be very evident.

As stated, at the Milo station, the generating apparatus, which consists of two 200-kw and one 400-kw railway generators, is held in reserve, and the station is used principally as a sub-station, there having been installed a 500-kw motor-generator set supplied by the National Brake & Electric Company. This set is of the three-bearing type, and consists of a 750-hp, three-phase, 60-cycle synchronous motor receiving current at 4100 volts and driving a 500-kw direct-current generator, which generates current at 575 volts and 870 amperes. This motor-generator set supplies the nearby territory and also feeds the line to Westerville. To improve the power situation on this Wester-

ville line there is a 230-cell storage battery located about 8½ miles from Milo station, and which is used as a floating battery on the line.

The apparatus in the Central Market station consists of two 325-kw and one 250-kw Westinghouse railway generators. There is also at this station a 240-kw storage battery, which is fed from a motor booster set, and is used for taking care of load fluctuations at this power house.

COLUMBUS AS AN INTERURBAN CENTER

Columbus is one of the principal interurban centers in the Central West. Eight lines radiate from the city in eight different directions, bringing it into intimate touch with the territory within a circle of 75 miles radius. Columbus is connected by through electric railway routes with Cincinnati and Indianapolis, and with only short links remaining to be built with Cleveland, Toledo, Detroit and Buffalo. The development of the interurban lines centering in Ohio's capital city has been so great that it is hard to realize the growth has taken place virtually within a period of four years. These lines give hourly passenger service, and are well built, well equipped and well managed. In a multiplicity of ways this frequent and close connection between the country and the city has had an enormously stimulating influence upon the development not only of the capital city itself, but also of the country districts and towns as well. The early morning cars bring in many people employed in the commerce of the city, and the cars later in the day bring in retail and wholesale purchasers from all the surrounding country, while thousands of the city people use the interurban cars in summer and in winter for pleasure and recreation, and as an important agency in their social life. Most of the lines maintain a freight and express service, bringing to the city the farm produce and products, and in exchange carrying to the farms and the country towns the manufactured articles and supplies furnished by the larger city.

Within a circle drawn around Columbus with a radius of 75 miles there are eighteen counties wholly included and twenty others partially so. Within this area there resides an estimated population of a million and a half of people, which, through the agency of the interurban lines, might, with no great stretch of the imagination, be included as the city's population, so close and intimate is the relation established. Within the circle there are thirty country seats and more than 100 additional towns and villages.

The following are the interurban roads immediately centering in Columbus: Columbus, Delaware & Marion Railway Company; Scioto Valley Traction Company; Columbus, London & Springfield Railway Company; Columbus, Newark & Zanesville Electric Railway Company (controls the Columbus, Buckeye Lake & Newark Traction Company); Columbus, Grove City & Southwestern Railway Company (operated by the Columbus, London & Springfield Railway Company); Columbus, Urbana & Western Railway Company; Columbus, New Albany & Johnstown Traction Company; Westerville and Arlington lines of the Columbus Railway & Light Company.

Many of the construction and operating features of these systems are reviewed in the following pages.