Street Railway Journal

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THE SYSTEM OF THE ATLANTA RAPID TRANSIT COMPANY

In 1890 a charter was procured for the Atlanta & Chattahoochee River Railway Company, by C. Jerome Simmons, Dr. W. A. Baker and Thomas Moore, the intention being to build an electric street railway from Atlanta, Ga., to the Chattahoochee River and possibly to Marietta. Franchises were granted by the City Council in April, 1891, allowing the road to be constructed along certain streets in the city of Atlanta. In July of the same year grading for the roadbed was begun and continued until that part of the work was completed, and about Oct. 1 the laying of the rails was commenced and practically completed by April, 1892. On May 8, 1892, cars were first operated. The road was then, in all, 10 miles in length, costing $210,000 to construct.

THE GEORGIA ELECTRIC LIGHT COMPANY'S PLANT WHICH FURNISHES POWER TO THE ATLANTA RAPID TRANSIT CO.

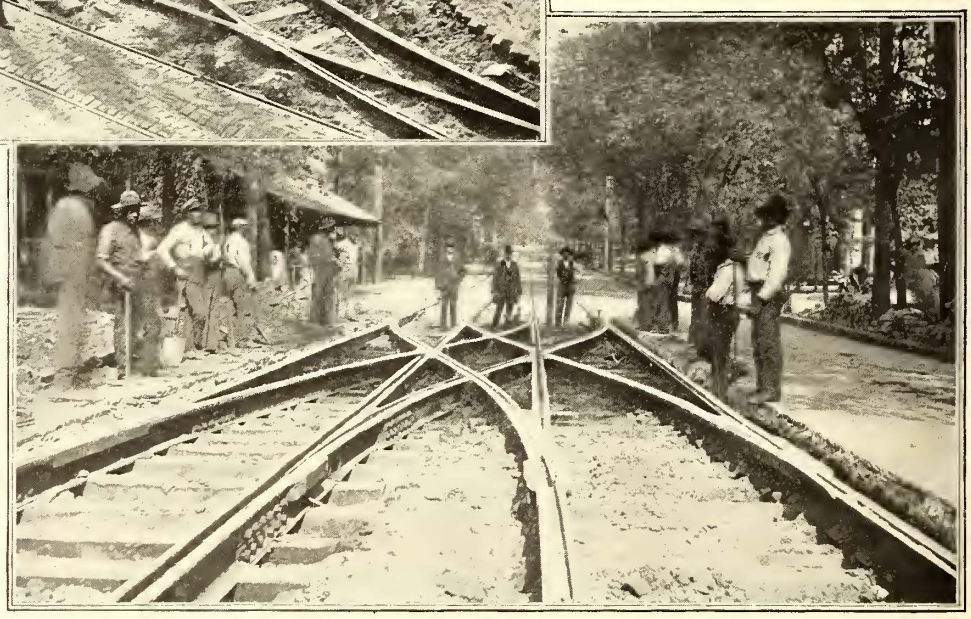
In June, 1892, the company was organized under a new charter granted by the Legislature in 1889, and was then known as the Collins Park & Belt Railroad Company. In 1899 the company was again reorganized under the same charter, changing its name to the Atlanta Rapid Transit Company, and commenced constructing lines of road in the city of Atlanta. At present the length of track consists of 35.6 miles. In the reorganization C. Jerome Simmons continued as president, and H. M. Atkinson, president of the Georgia Electric Light Company, assumed the duties of secretary and treasurer, Ford, Bacon & Davis, New York, being employed as engineers to plan and construct the system.

The lines as laid out have been chosen with great care and afford the most direct and quickest routes for the largest portion of the traffic. Terminating at parks or suburban towns they pass through the best residential and business districts to a main trunk line which passes near the Union Railroad station, and centrally through the entire shopping district. To complete the system many difficulties

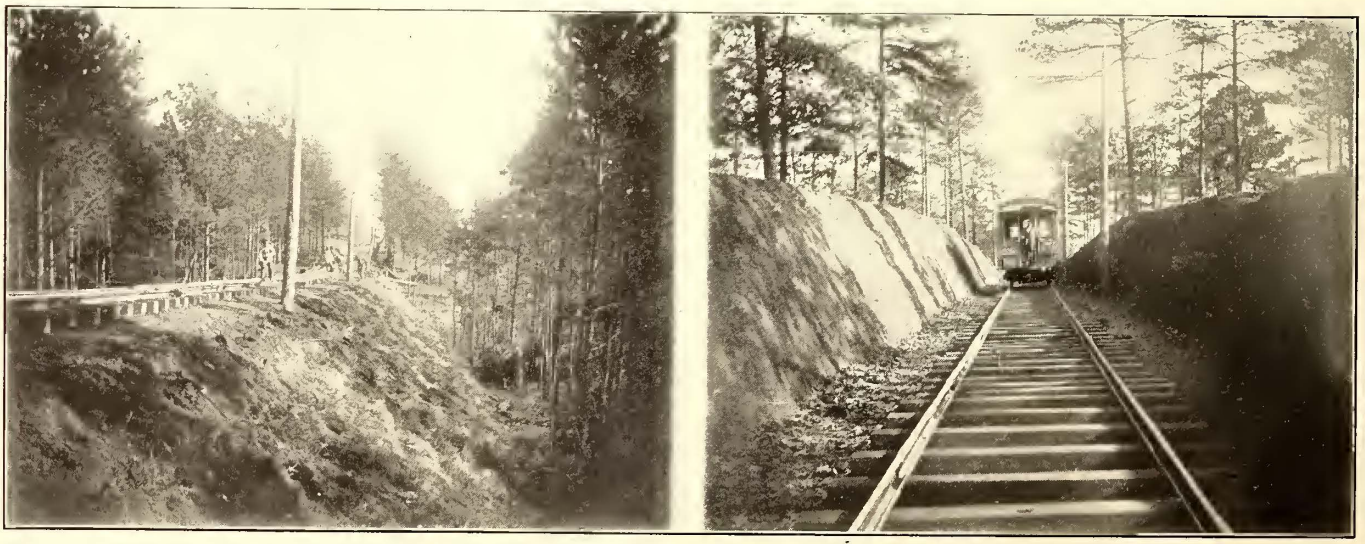
had to be overcome. Such evidences of public spirited liberality on the part of the railway company as the donation of $50,000 toward the building of a much-needed viaduct over a dangerous grade crossing, payment of taxes on a fair valuation of its franchises, and promises of improvement in service and equipment which have been rigidly adhered to in the smallest detail, have gained for the company the hearty support of the public as well as many franchises from the City Council for lines over those streets desired. The city had reserved the right to grant further franchises over any five continuous blocks then occupied by a street railway. Being necessary to run partly on the streets already taken by the tracks of the Atlanta Railway & Power Company, and in many cases over these tracks, the Rapid Transit Company, after its franchises had been granted, proceeded to have condemned and then purchased half-ownership in such lines as were necessary to complete its system. This, however, was not done without continued legal action, there having been up to the present date thirteen injunctions secured and dissolved, besides many suits and countersuits.

The main trunk line of the system connects the north and south half of Atlanta and crosses the railroads over the new viaduct, previously mentioned, which is now nearing completion. The bid for the construction of this viaduct, not including the part over the railroads for which the steam railroads themselves pay, was $49,000, so that the city of Atlanta gained a much-needed public improvement as well as a remainder of $1000 in cash out of the $50,000 in payment for the privilege of crossing the viaduct with a double line of street car tracks. Among other evidences of the methods of the company may be mentioned that it never tears up a street unless ready to begin and complete the work in a short space of time, and that it

LAYING SPECIAL WORK



A COMPOUND CROSS-OVER

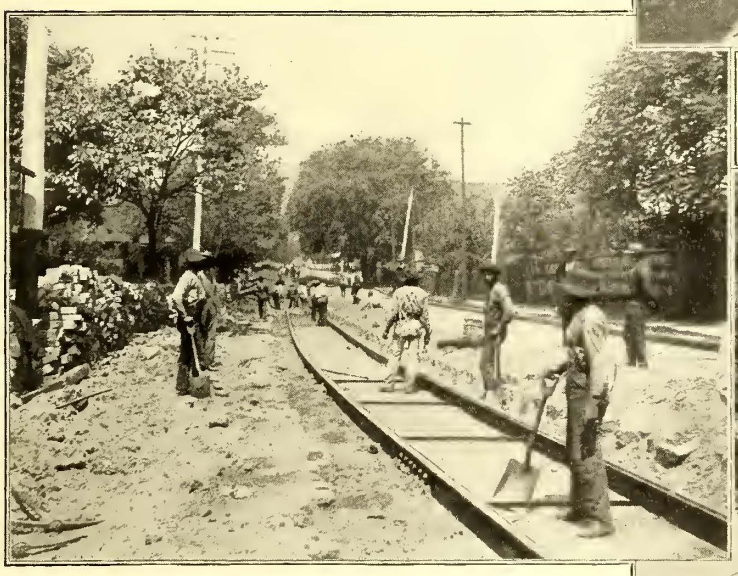


VIEWS ON DECATUR LINE—A FILL AND A CUT

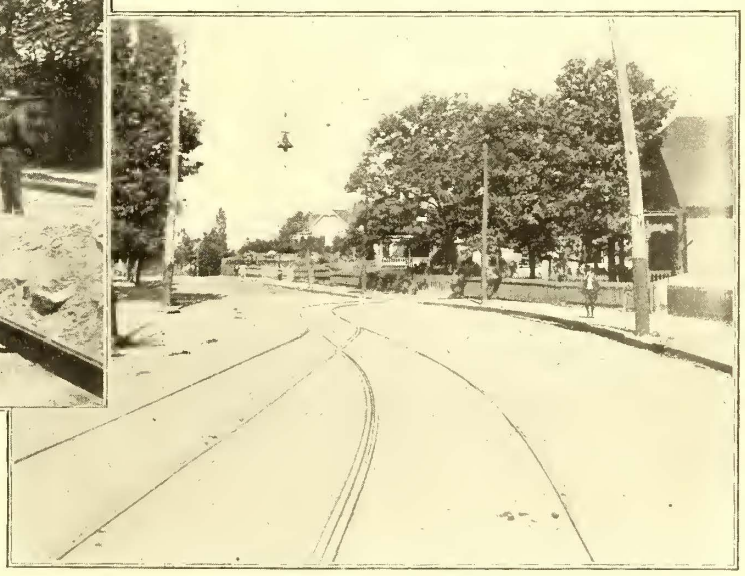
always leaves the street in better condition than it was before torn up; in fact, in many places the street has been graded and the entire pavement relaid with Belgian block Until the viaduct is completed so as to connect the north and south half of the systems, a charge of three tickets for 10 cents, virtually a 3-cent fare, is in force on all lines except the river line. After the viaduct allows of longer rides and a system of transfers, the fare will be raised to 5 cents. The cars and equipment are the best that can be purchased, and are run on close headway, everything possible having been done to create friends for the new system. The liberal patronage of the cars indicates that the public appreciates the excellent service given.

LAKEWOOD LINE

LAKEWOOD LINE



GRANT PARK LINE



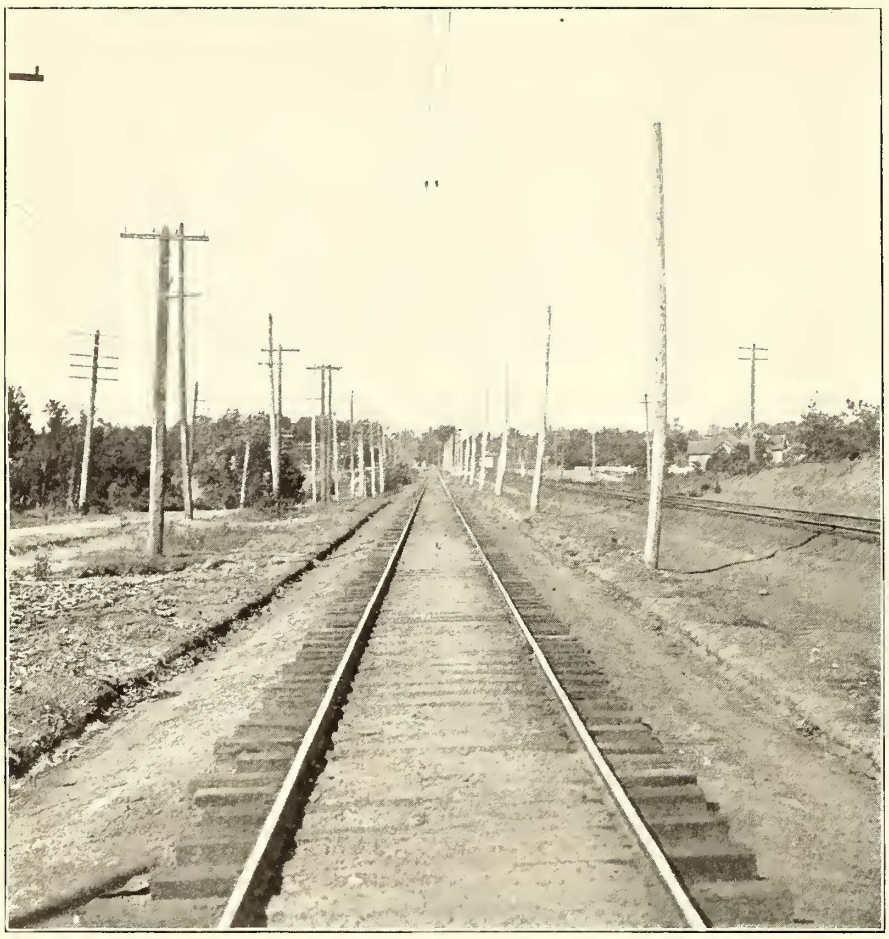
HOWELL STREET AND AUBURN AVENUE

Power is rented from the Georgia Electric Light Company, the generating plant having recently been enlarged so as to supply the railway company as well as a general increase in the demand for light and power. Railway power is taken from 750-kw General Electric railway generator, direct connected to a McIntosh, Seymour & Company engine, and from several smaller belted machines. The central station of the lighting company is a large, handsome, fireproof building, located near the center of the city. From it is supplied alternating current for lighting and power, and for constant-current series arc lighting and direct current for a 220-volt three-wire lighting system. A 300-kw Westinghouse rotary converter is installed as an auxiliary for furnishing railway power. The new main switchboard which has recently been installed consists of fifteen panels containing the regulating apparatus for the various types of service supplied, so that each is kept distinct from the others. The board is of entirely fireproof construction, and all instruments for the high-voltage panels are operated by secondary circuits from series and potential transformers, making it entirely safe. All of the high-voltage lines are provided with automatic oil-switch circuit breakers, and integrating wattmeters and recording meters are placed in the principal circuits.

The railway power switchboard consists of one standard generator panel of 1500 amps. capacity, five feeder panels of 600 amps. capacity, and three feeder panels of 300 amps. capacity. This switchboard is situated near the other, along the side of the dynamo room.

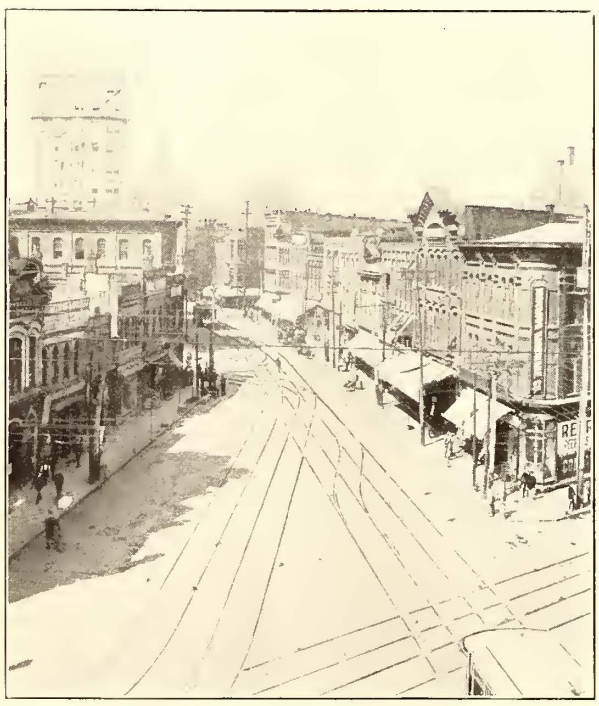
The Atlanta Rapid Transit Company supplies the Georgia Electric Light Company's plant with coal over a short

branch line which is used for freight only. The coal is hauled in the freight cars over this branch road, pushed up



TWO-WIRE CONSTRUCTION—DECATUR LINE

a trestle and dumped at the mouth of the boilers. The illustration of the power station on the first page shows the



SPECIAL WORK—PEACHTREE AND WALTON STREETS

trestle and its relation to the building. It is of very substantial construction, on concrete foundations. Interior cross bracing is used instead of batter posts, on account of side room. The trestle accommodates two tracks, one of which runs into a storage shed.

Atlanta is situated in what might be termed a rolling selection of country. There is perfect natural drainage, but not at any point along the lines of the Atlanta Rapid Transit Company is there a grade of more than 8.5 per cent. There is now completed and in operation six lines of railway with several other lines proposed, which, it is intended, shall be built soon.

The River Line, which is the longest yet operated, is 9 miles in length, and is mainly of dirt ballast. The rail used is 4900 ft., 88-lb. Lorain semi-grooved, in the city, and the remainder of the track is laid with $4\frac{1}{2}$-in. 54-lb. T-rail. This line terminates at Chattahoochee River Park, a resort owned and operated by the company.

The Juniper Street, or Exposition Park, line is 14,600 ft. long. About half of this line is laid with 88-lb. Lorain semi-grooved rail, and the other half with 7-in. T-rail. This line runs through the main residential district, and terminates at Exposition Park, where the Cotton States Exposition was held. This park is owned by the city, and restricted to the use of white persons, except during Fair season in the fall of the year.

The Forest Avenue line is a residential line, and is a straight stretch of 4000 ft. of track, laid with the 88-lb. semi-grooved rail.

Grant Park line is 13,200 ft. long, with 10,000 ft. of 88-lb. semi-grooved rail, and 3200 ft. of 7-in. T-rail, on stone ballast. Great expedition was shown in building the city portion, 4 miles of which was constructed at the rate of 1200 ft. per day. This line terminates at Grant Park, which is the most popular city park, containing, among other attractions, a very complete zoo, a cyclorama, lakes, etc.

On the Lakewood line 3800 ft. 88-lb. Lorain semi-

ONE OF THE WAITING STATIONS

grooved rail, 5400 ft. 7-in. T-rails and 15,960 ft. 60-lb. A. S. C. E. section rails are used. This line terminates at Lakewood Park, a resort controlled by the Atlanta Rapid

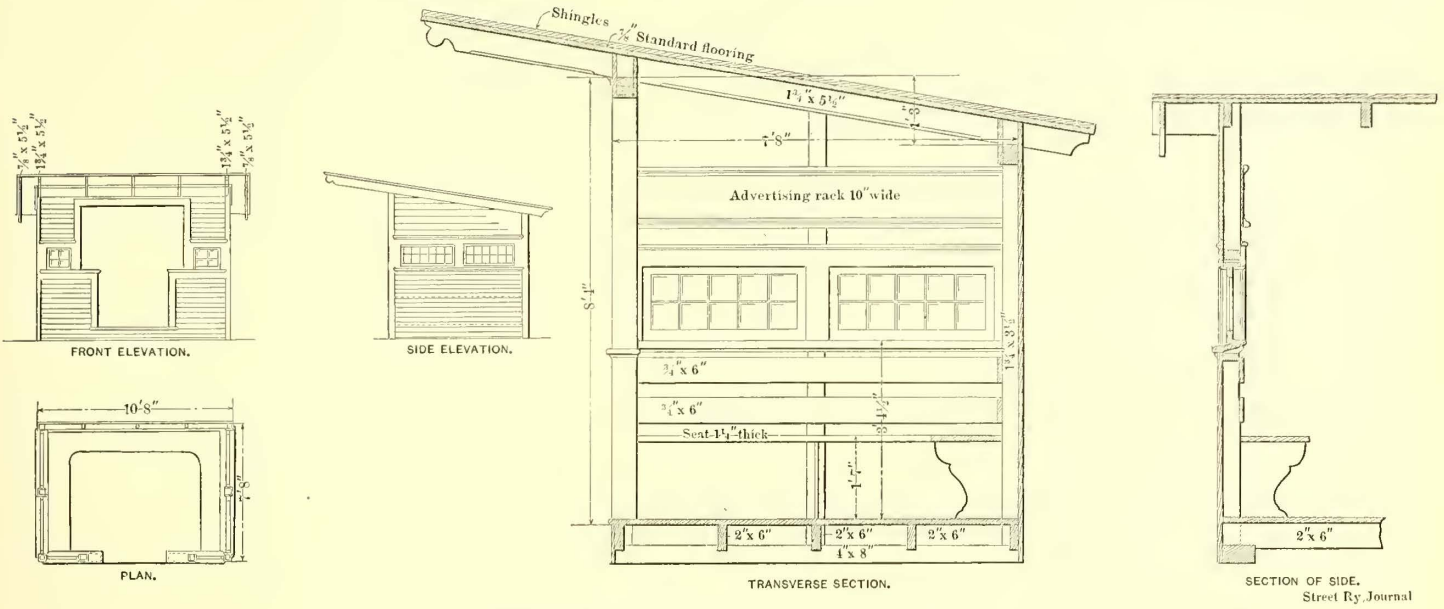
Transit Company, and at which next year it contemplates installing a number of select attractions.

The Decatur line is the main suburban line, and on it are run heavy double-truck cars, at a very fast schedule. It starts out with a double track, on Auburn Avenue, a paved street, is single on Howell Street, and crosses the main line of the Southern Railway at grade. This crossing is protected by Wharton electric-acting derailing switches. After passing the Southern Railroad, it enters the track and right of way of the Seaboard Air Line Railroad. This track is only used for freight, and then at night only. After leaving the Seaboard Air Line, the track is located on private right of way. In Decatur the line makes a loop, passing the railway station and the Agnes Scott Institute, a large college for girls, circles around through the main residential district, and returns by the County Court House.

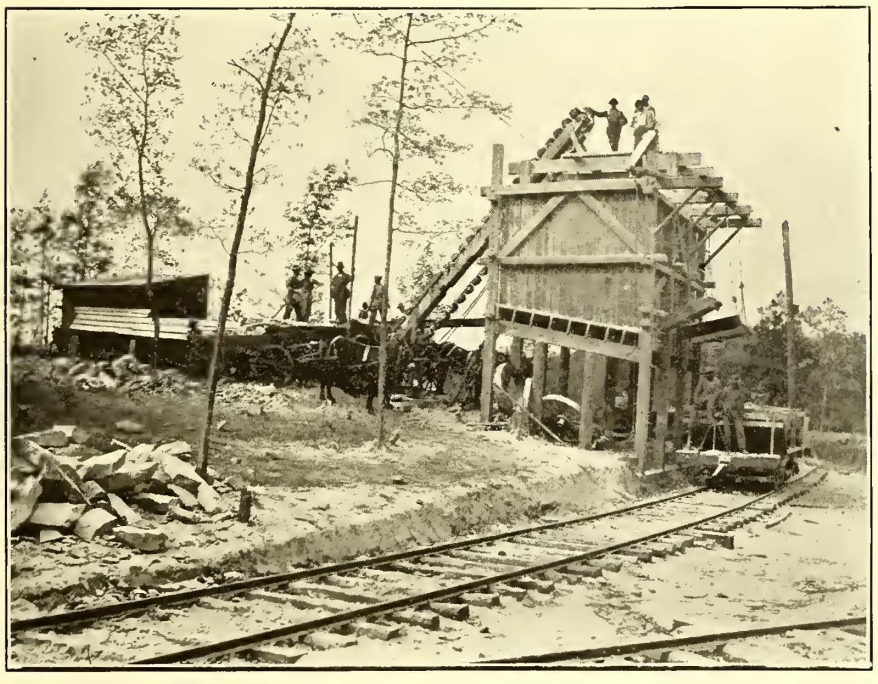
On that part of the Decatur line which is single track, the overhead work is of the two-trolley-wire type, obviating the use of overhead frogs and switches at the turnouts. The turnouts on this line are from 3000 ft. to 6000 ft. in length, which allows cars to pass at full speed, and avoids the ordinary delays at passing points, common to most single-track roads.

Spring split switches, with spring frogs, are installed on all the lines. Practically all special work in the city is Lorain Steel Company's guaranteed construction, there being 100 layouts altogether. All curves are spiralized from the shortest special-work radius to 3-deg. curves. The overhead work is supported by galvanized span wires, held by locust, cedar, or iron poles. The latter are used in the central district, and in the best residential district cedar poles are used exclusively. The central portion of the city is surrounded by an imaginary line, all territory included being said to be within the fire limits. In this section no overhead feeder wires are allowed, so that the trolley wire alone is used, it being No. 0000 B. & S. gage. Without the fire limits No. 00 is used. A large amount of the trolley wire is of the grooved type. Within the fire limits the lighting company has its system underground, in Camp single-duct conduits, made by the H. B. Camp Company, of Akron, Ohio, and these conduits will probably be used for the trolley feeders, should the traffic necessitate their installation.

The Weber rail-joint is used on the T-rail of the suburban lines, but ordinary fish-plates are used on the semi-grooved rail found in the city. Washburn & Moen Figure 8 bonds are installed, with 30-in. copper wire bonds at special work. All joints use a telltale on the bond, consisting of a device for determining at once whether the joint is installed properly. A piece of piano wire, 30 ins. long, is attached to each end of the bond, and protrudes at each end of the fish-plate, so that by walking along the track before the pavement is laid, the inspector can make sure that the bonds are in place. The wire is simply twisted around the bond, and the device has given great satisfaction,



DETAILS OF DESIGN FOR WAITING STATION



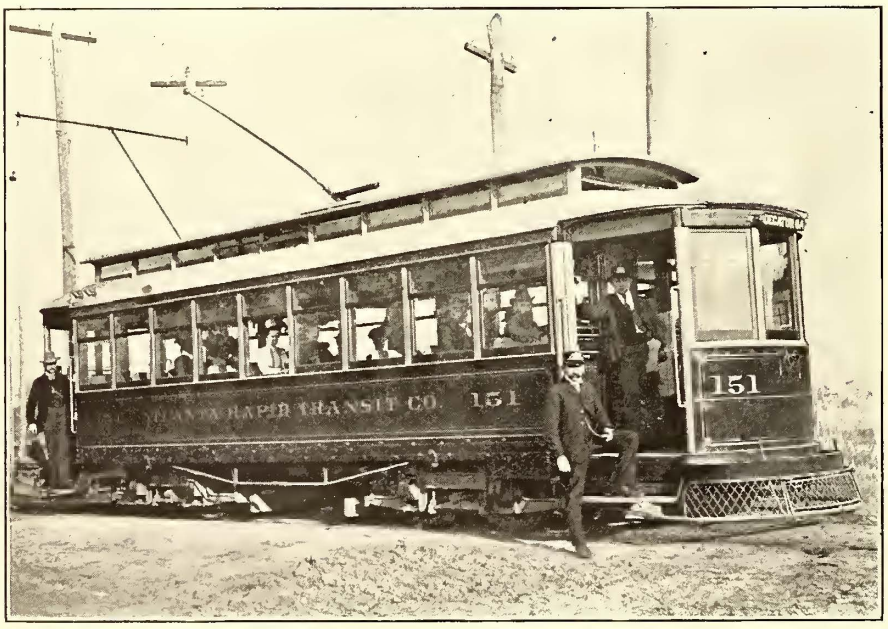
THE ROCK CRUSHER

All the cross-ties are of oak or pine, well seasoned. They are 7 ft. 6 ins. long, 6 ins. thick, and not less than 8 ins. face. Most of the track is ballasted with crushed stone or pyrites, and to some extent cinders are used. The Lakewood line is ballasted outside of the city limits entirely of crushed stone, crushed by the Rapid Transit Company at its own crushing plant, which is situated on this line. This crushing plant consists of a Champion No. 4

THE STANDARD SINGLE-TRUCK CAR

stone crusher, made by the Good Roads Machinery Company, Kennett Square, Pa., and driven by a 30-hp motor, taking current from the line. The storage bin has a capacity of 75 cu. yds. The crushed stone was all hauled in hopper cars, and deposited between the rails ready for tamping between the ties, so that from the time the rock was placed on the crusher platform it was not handled by the men again until it was placed ready for tamping.

Waiting stations are placed at convenient points all along the lines after leaving the city limits. Their general



DOUBLE-TRUCK CAR ON DECATUR LINE

design is shown in the accompanying engravings. At the end of the Lakewood line is a waiting station, which includes a rough shed, capable of holding four cars. It is equipped with a repair kit and small workshop at the end, so that any minor repairs can be made there. This car shed will be the headquarters of all cars at that end of the city during the erection of the viaduct.

The car house is on Butler Street, close to the center of the city. It is a frame building, 147 ft. x 168 ft., one story high, with graveled roof and galvanized iron sides. Here are situated the general offices of the company, the office of the superintendent, the receiving office, stock room, office of storekeeper, repair shop and paint shop. It contains seven tracks at present, but an addition is already contracted for, capable of accommodating four tracks more. There are nine pits. The equipment of the road consists at present of forty-five passenger cars and three work cars. Five of these cars are double-truck four-motor cars, equipped with Peckham trucks and the Price friction brake. The motor equipments are G. E.-1000 motors. All the car bodies are built from specifications of Ford, Bacon & Davis, by the American Car Company. With the exception of the five mentioned above the cars have single trucks, made by the Baltimore Car Wheel Company. The shops are equipped to do any repair work necessary. The road now operates thirty-three regular cars. All cars are fitted with overhead, automatic cut-out switches, also illuminated signs, made by the Hunter Illuminated Car Sign Company, Cincinnati, Ohio, and Wilson trolley pole catchers. The type of fender used is shown in the illustrations of the cars. The vestibules are open on the side, and vertical wheel brake handles are installed. All cars are fitted with International double-type registers.

The resident engineer in charge of the work of construction for Ford, Bacon & Davis was James A. Emery.

Electric Buses in Chicago

The People's Rapid Transit Company, of Chicago, has been organized with a capital stock of $500,000 to operate a line of electric buses between the heart of the business district and outlying points on the north, west and south sides. Thirty buses will be used in the opening service, extra conveyances to be added as conditions require.

The promoters calculate that the yearly income from the north division line at the start will be $312,075. Each bus will make thirty-eight trips daily, thirty minutes to a trip, and it is figured that at least 50 per cent of the seating capacity will be filled on each trip. Each bus will have a seating capacity of thirty people. The fare will be 5 cents. It is estimated that the daily cost of operating a bus will be $10.47, the items of expense being tabulated as follows: Conductor, nineteen hours, at 19 cents an hour, $3.61; motorman, nineteen hours, at 19 cents an hour, $3.61; labor handling batteries, 50 cents; electric power, $2.25, and repairs, 50 cents.

The buses will be after the fashion of Parisian boulevard cars, each having an upper deck. The equipment provides for an application of electrical power direct to the hubs of the four wheels, making each wheel an active driver.

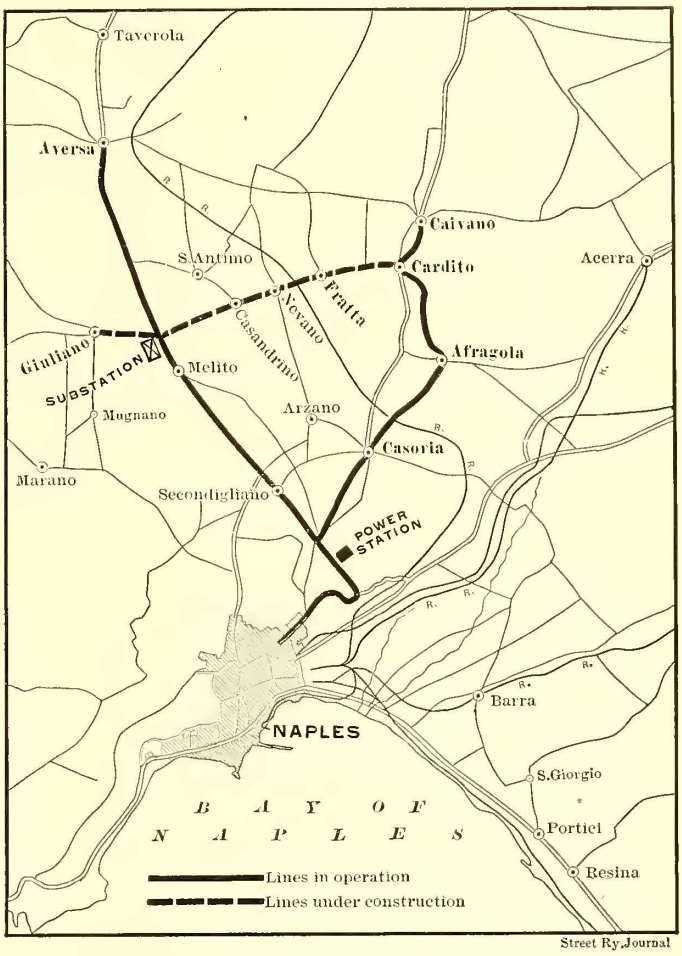
The Naples-Aversa-Caivano Interurban Electric Railway System

BY CESARE PIO

The density of population in the city of Naples and suburbs affords excellent traffic conditions for suburban electric railways. It will be not long before all the suburban steam railroads in the province of Naples will be transformed into electric roads, and many other new ones will be built. A great development is, therefore, going on in this part of the world under the most promising circumstances.

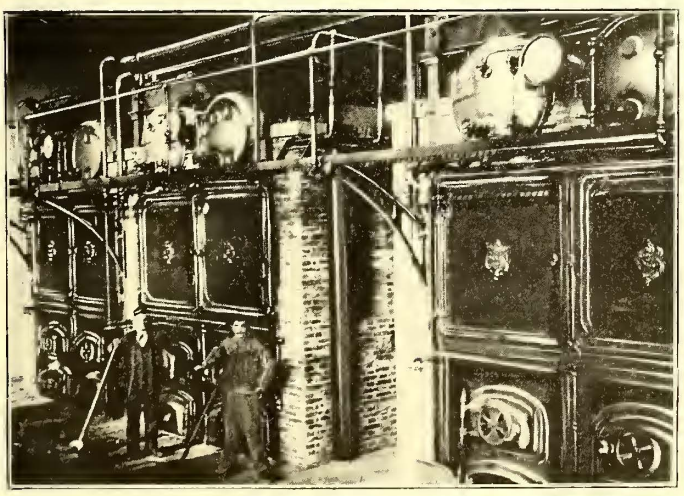
A good example of a modern railway of this character is that of the Société des Chemins de fer Provinciaux, connecting Naples with Aversa and Caivano. This line is owned by a Belgian company, with its headquarters in Brussels. The district through which it runs is a highly cultivated and thickly settled farming country. The densely populated region surrounding Naples offers great inducement to the building of extensions of the present road. The map presented herewith shows the present steam lines just changed to electric and the proposed electric lines to be constructed. The branch running from Naples to Aversa passes through the important towns of Capodichino, Secondigliano, Melito and Aversa, all with a larger population than is usual in a farming community; while the branch running from Naples to Caivano, which is identical with the Aversa line as far as Capodichino, runs northward, taking in the towns of S. Pietro, Casoria, Afragola, Cardito and Caivano. The towns and villages are comparatively close together, and are thus admirably situated for interurban traffic. The dotted lines of the map show electric lines which are to be constructed, for which concession has been already granted. The railway lines will connect the villages of Casavatore, Arzano, Grumo, Frattamaggiore, Licignano and Aversa, places which have been isolated and without any railway accommodation whatsoever.

The electric operation has but recently commenced, April 1, of the present year, being the date at which the work of conversion to electric traction was completed.

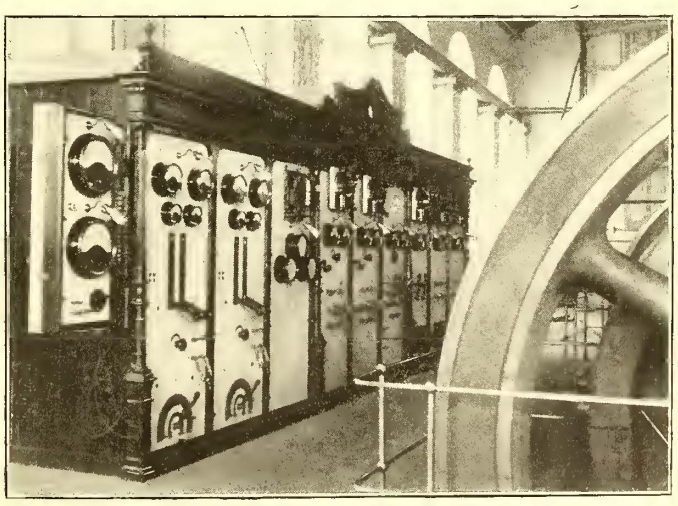


MAP SHOWING THE NAPLES AVERSA LINE

ing company was the provision of power upon economical terms for this extended line. It was necessary for electric current to be delivered at considerable distance from the power house at a low cost, in order that the trolley lines could be profitably extended into the country districts, and bring in remunerative traffic to the traction company. The application of three-phase, high-tension current has ren-



INTERIOR OF BOILER ROOM



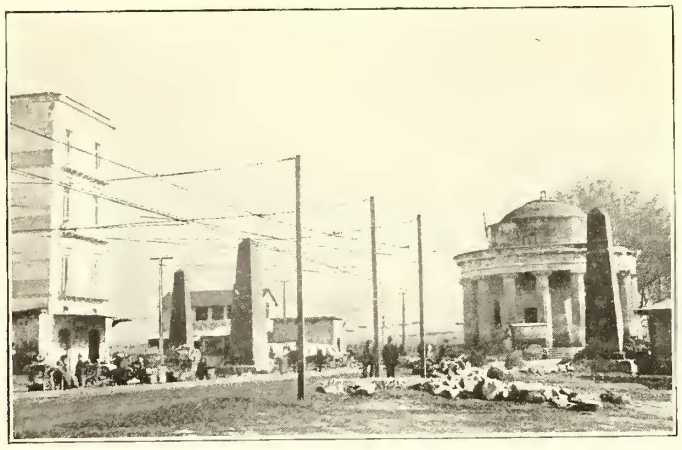
MAIN STATION SWITCH BOARD

The contract for the transformation of the road, for the erection of power house, sub-station, etc., and for the equipment of the electric rolling stock, was secured by the Union Elektricitäts Gesellschaft, of Berlin, which has a branch office in Naples, in charge of the construction.

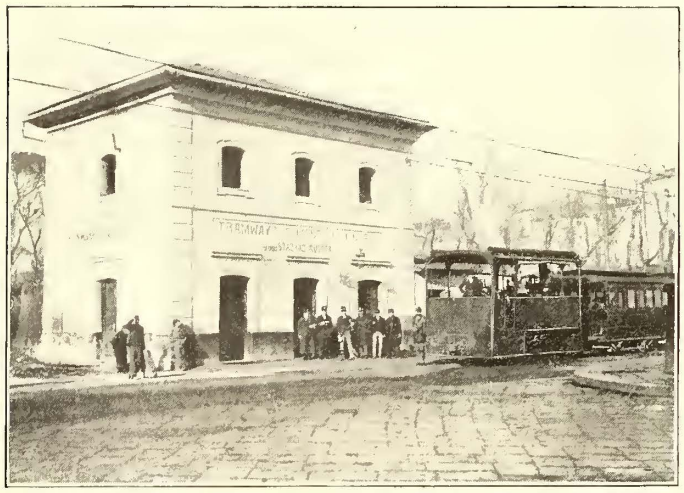
As the price of coal ranges from $9 to $10 per ton at Naples, the problem that presented itself to the constructdered it possible to supply current to this 30 miles of road from a single power station in connection with but one substation, located near Melito. Later, another sub-station will be erected at Afragola for feeding the branch of Acerra.

The power station is situated at Capodichino, near the old car houses and offices. The building is of tufa, a soft

material, much used on the masonry in the community of Naples, and the general dimensions of the station are 110 ft. x 100 ft. It is covered with a composition roof, supported by steel trusses. There is a brick base, 24 ft. high, for the chimney. The boiler room and the repairing shop



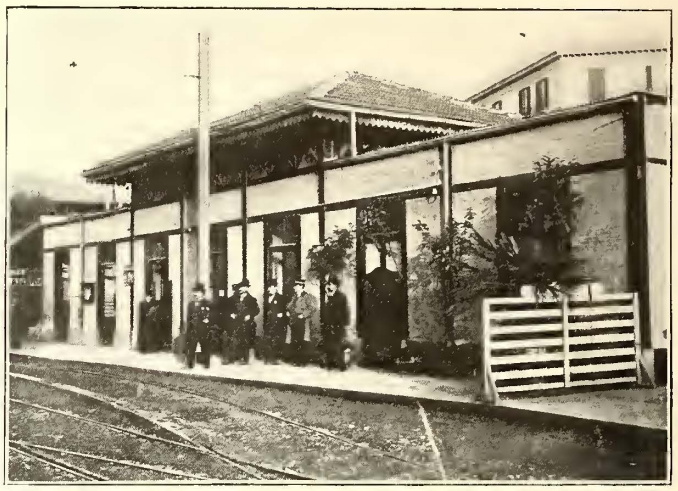
OVERHEAD CONSTRUCTION AT CAPODICHINO



AVERSA DEPOT, SHOWING OLD TYPE OF STEAM TRAIN

SUBSTATION AT MELITO

are attached to the engine room. Three Brunner Maschinen Aktiengesellschaft's steam engines are now installed. They are tandem-compound, condensing,, and each is capable of developing 350 hp, but there is room for three more engines, providing for future extension. The engines rest on brick foundation, 14 ft. deep, with 20 in. of concrete underneath, and on a gravel bed. The boilers are two in number, of 500 hp each, and furnished by Babcock & Wilcox. There is, of course, room provided for also doubling the boiler equipment. The piping is of the usual pattern adopted by German engineers The water for feeding the boilers is pumped from a well 550 ft. deep, by means of pumps operated by electric motors, the water being purified in special tanks before entering the boilers. In addition to these pumps, each boiler is furnished with an injector, so as to reduce the liability of a shutdown, on account of failure in the water supply, to a minimum. The



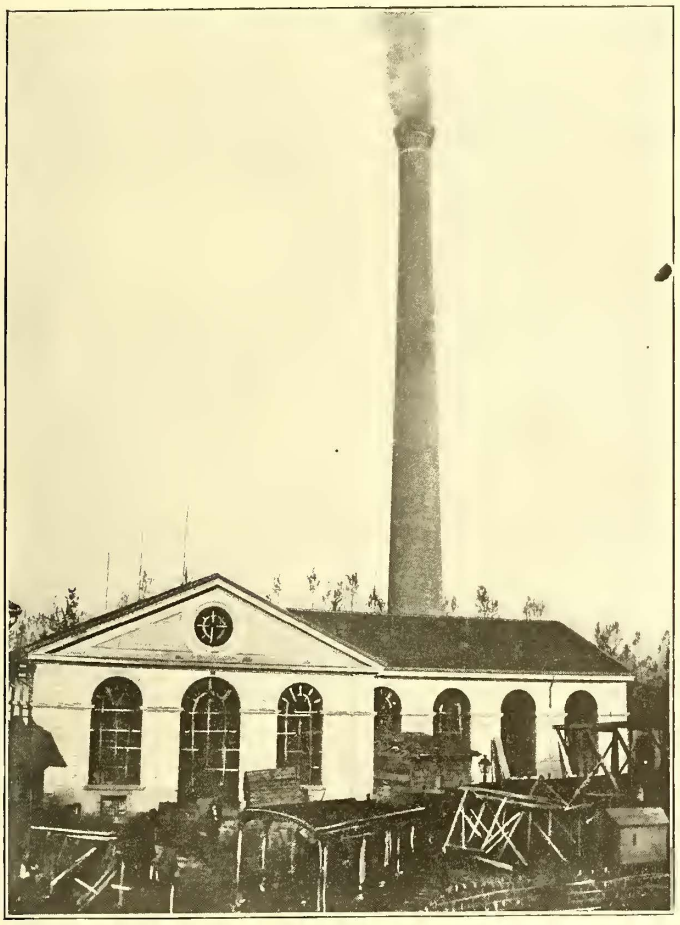
STATION AT CAIVANO

TERMINAL OF LINE AT AVERSA

water for condensing is cooled in a condensing tower, of the Kiessling type, an illustration of which is given.

The generators are of 225 kw each, and are direct-connected to the engines. One of the engines is connected to a direct-current, six-pole generator, running at 125 r. p. m., which feeds the first part of the line, *i. e.*, from Naples to the power station. A second engine is direct-connected to a 225-kw three-phase alternator, of the revolving field type, which has an e. m. f. of 5000 volts. The third engine, kept ordinarily as a reserve, is connected both to a direct-current generator and to a three-phase alternator, similar to those described, and can, therefore, in case of emergency, be used. The lighting of the engine room is done by inclosed arc lamps, the only ones of this type installed in Naples. The interior view of the engine room shows the somewhat elaborate scheme of ornamentation which has been adopted. On the front wall is a map showing the lines of the system, this map being framed with the seals of the different cities traversed by the railway lines. This

original idea gives to the room a very elegant appearance, as well as keeping the general plan of the road at all times before the engineer. The switchboard practically differs little from those employed in the usual American practice. As seen by the engraving, it is made on the panel system, and has a very handsome appearance. This is somewhat of a departure from European practice, where the tendency is to build monumental switchboards at much greater expense and diminished facility in reading the instruments or operating the switches. The small panel, which is seen on the left of the engraving, is the synchronising panel. This panel is hinged so as to be readily turned outward, and placed at a convenient angle to be observed by the

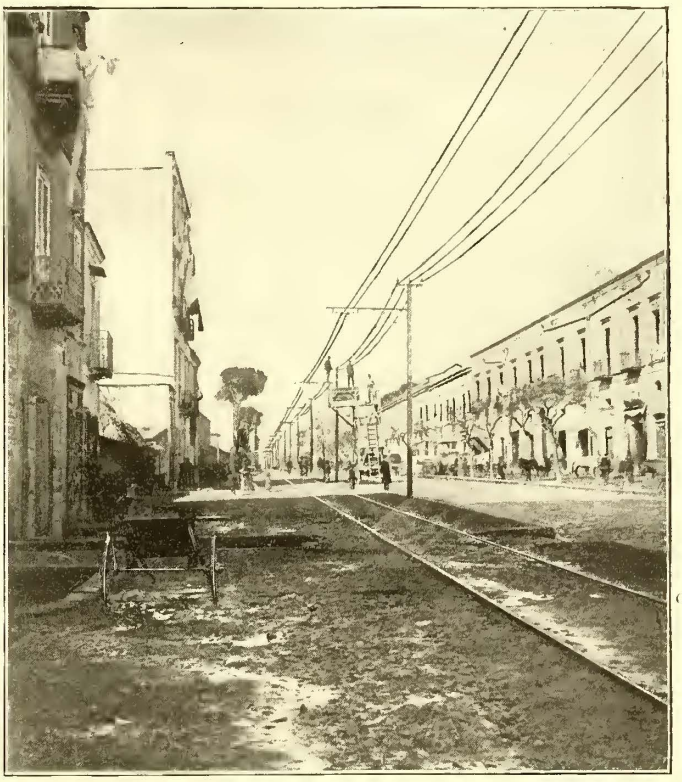


GENERAL VIEW OF STATION

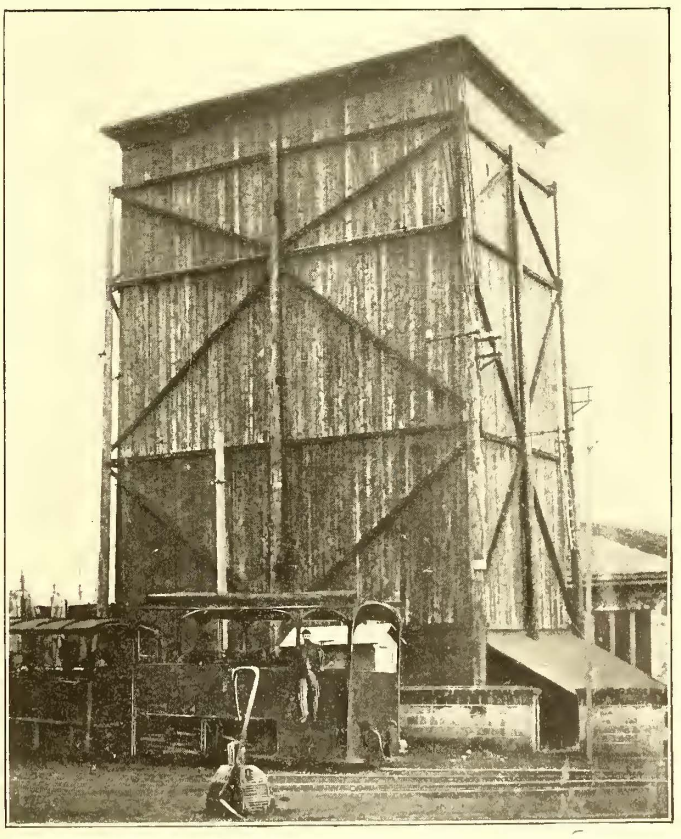
operator at the switches. The next two panels are for the high-tension service, and are provided with levers for handling the quick-break 5000-volt switches. Following are two panels for the direct-current generators, the other panels being for the direct-current feeders. The different apparatus is designed on American lines, and does not require special description.

The high-tension lines are protected by three 10,000-volt fuses of the Siemens & Halske type, encased in glass tubes. Transmission of current is made by three No. 4 bare copper wires, carried on Allgemeine Elektricitäts-Gesellschaft triple-petticoat porcelain insulators, to the Colonne di Giuliano sub-station. The wires are carried overhead on the same poles as the trolley wire. This pole line is composed of plain iron poles, with a cross section, in the form of a modified I-beam.

A characteristic feature of this high-tension line construction is the method of suspending the wires. It is known as the Gould system, and employs a safety device which is used on a few transmission lines in Germany, but has not found application in America. The different spans of wire are in separate lengths, clamped to special rings, fixed on top of the insulators. If a wire should break, thus taking the strain off the clamps, both pieces of the broken wire are released and drop to the ground. The Gould system makes it practically impossible for a live wire to reach



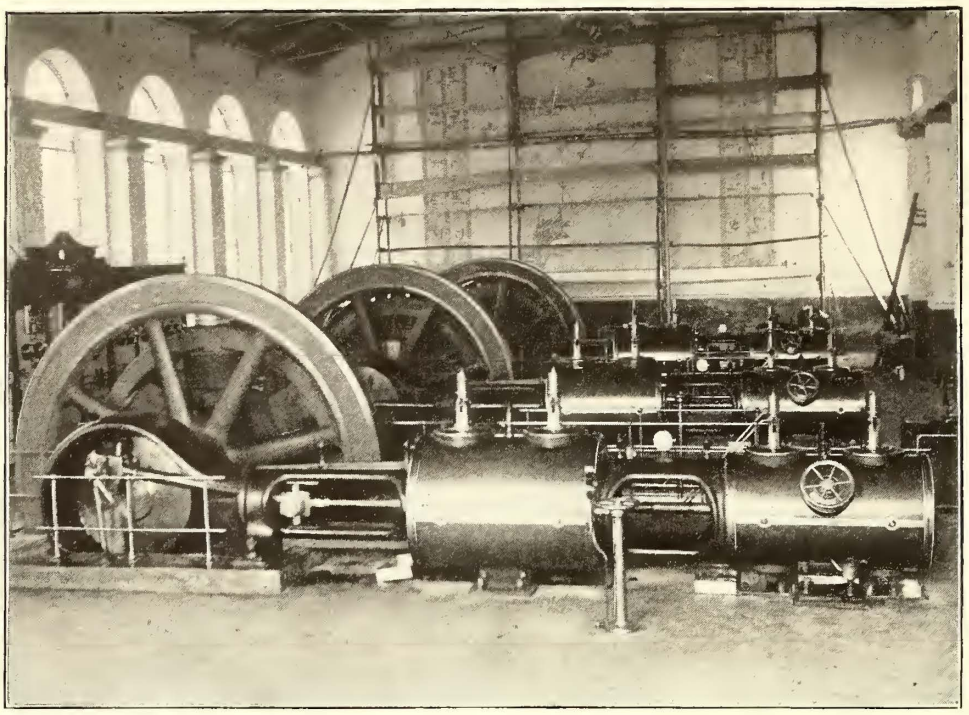
VIEW, SHOWING LINE CONSTRUCTION



CONDENSING COOLING TOWER

the ground, but requires great care in its installation to secure a presentable appearance, and is also liable to break down. A strong wind has been known to open up a section, and recently on the Aversa line a farmer with a high load of straw caused some 150 yds. of wire to fall, and shut

down that division of the road for an hour. Where the lines pass through the villages the poles are very high, sometimes reaching 65 ft., in order to prevent any danger from touching the wires. Lightning arresters of the Sie-



INTERIOR OF POWER STATION

ments & Halske type are installed. The line material is all of Union Electricitäts-Gesellschaft make, the trolley wire being No. 000. The track is laid with 56-lb., 60-ft. rails, on oak ties. The rails are electrically connected by Union bonds.

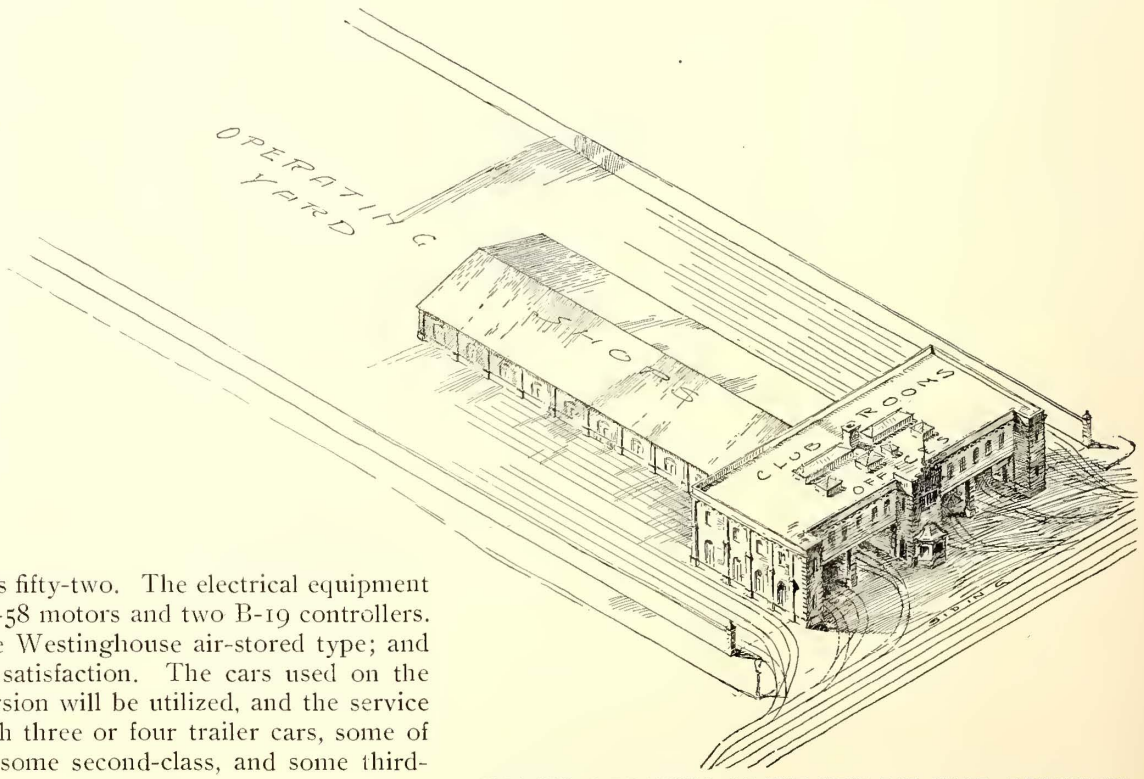
At the sub-station located at Melito there are two 135-hp synchronous motors, which receive the current directly from the transmission line, and they are direct-connected to 500-volt railway generators. A storage battery is kept as a reserve, and works in parallel with the generators. The engraving shows the outside structure.

The rolling stock at present consists of ten Rutelli cars, 35 ft. long, and weighing 20 tons each. The seating capacity is fifty-two. The electrical equipment consists of four G. E.-58 motors and two B-19 controllers. The brakes are of the Westinghouse air-stored type; and have given excellent satisfaction. The cars used on the road before its conversion will be utilized, and the service will be conducted with three or four trailer cars, some of which are first-class, some second-class, and some third-class.

Construction was commenced in August, 1900, and operation started in April, 1901. The manager of the company is Cav. Poulet, and the chief engineer of construction is Mr. Heinemann, of the Union Elektricitäts-Gesellschaft.

A New Car House for Brooklyn of Novel Design

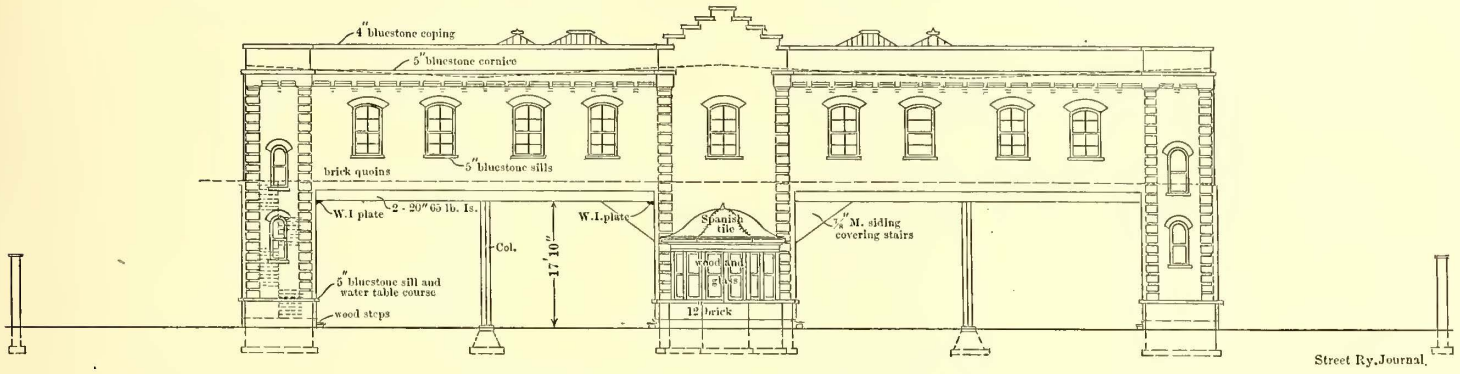
The destruction, by fire, of the Vernon Avenue car house of the Brooklyn Rapid Transit Company necessitated the immediate designing of a new structure to take its place. Work was begun, therefore, on the plans of a new car house, which has resulted in designs of a most novel character. The reproduced isometric sketch of the front portion of the new car storage, which is presented herewith, gives an excellent idea of the general plan of the building. It is the intention of the company to make the experiment of keeping its cars in an open yard instead of in enclosed sheds, but the walls of the yard are sufficiently high and substantial to enable them to be used for the walls of a covered building, if at some later date it is thought desirable to return to what is now the present practice of the company, of keeping its stored cars under cover. At the entrance to the yard is to be placed a building consisting of two sections; the front portion, which is two stories high, will contain the offices of the division superintendent, etc., and clubrooms for the employees. The rear section will be fitted up as a repair shop and equipped with all necessary appliances for the ordinary repairs which the cars are liable to require in service. This repair shop will form one of the series of sub-repair shops which the Brooklyn



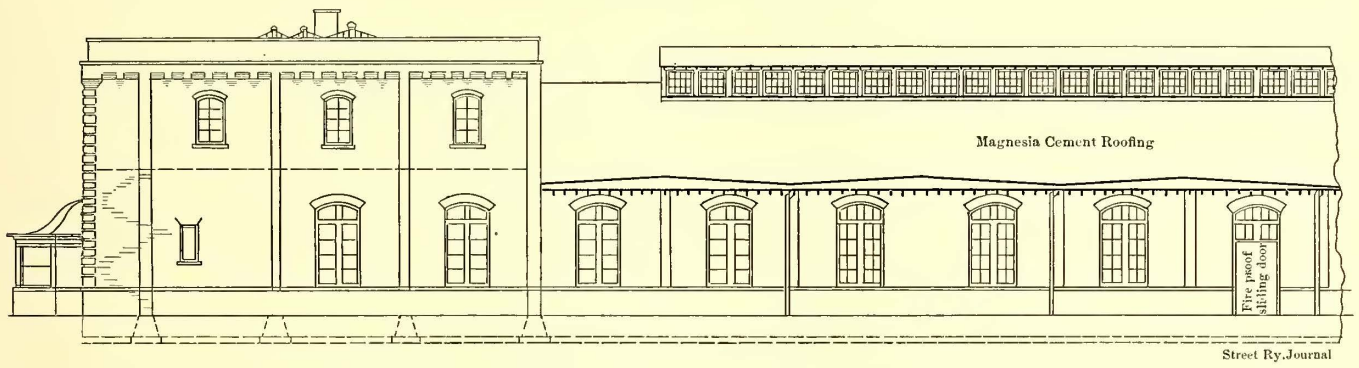
ISOMETRIC DRAWING OF THE NEW CAR YARD, BROOKLYN

Rapid Transit Company has distributed throughout the city, and which are under the control of the main repair shops at Fifty-Second Street and Second Avenue, a description of which was given in the Street Railway Journal last December.

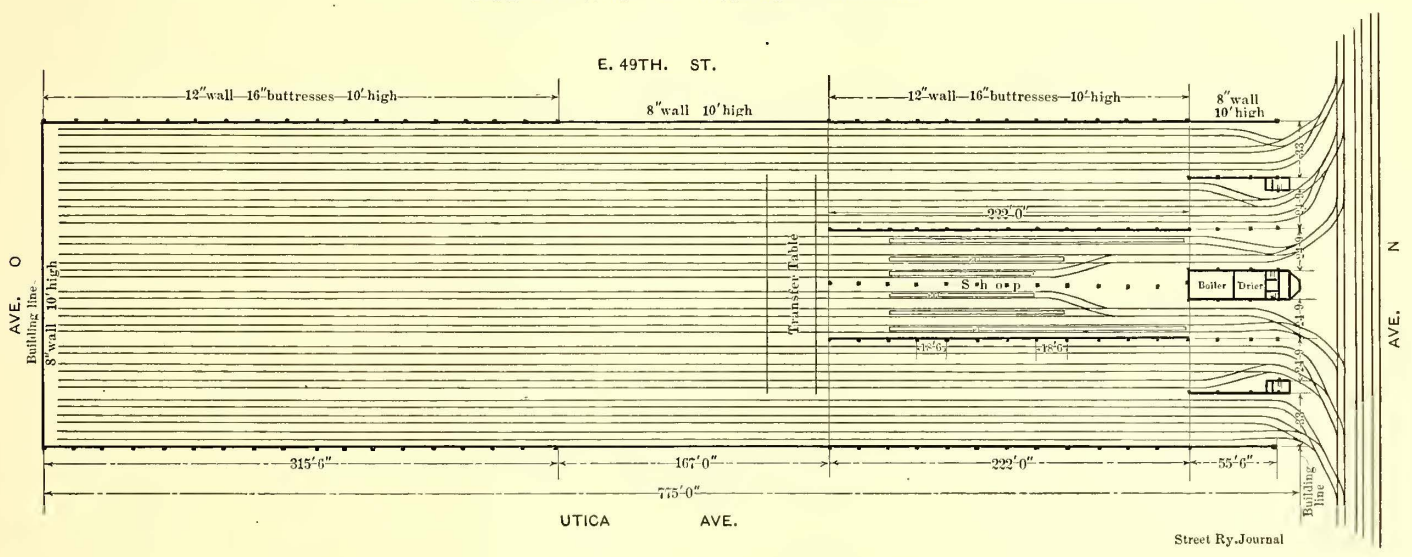
Since the burned car house on Flatbush Avenue, near Vernon Avenue, was constructed, the value of the site has increased greatly from the building up of the surrounding neighborhood as a residential quarter, and it has been thought advisable to build the new car house, if it may be so called, much further down Flatbush Avenue. For this purpose the old Suydam farm, an area of some two and a half acres on Avenue O and Flatbush Avenue, was purchased, and ground will soon be broken and building operations commenced. The old property is for sale.



FRONT ELEVATION OF PROPOSED BUILDING



SIDE ELEVATION OF PROPOSED BUILDING

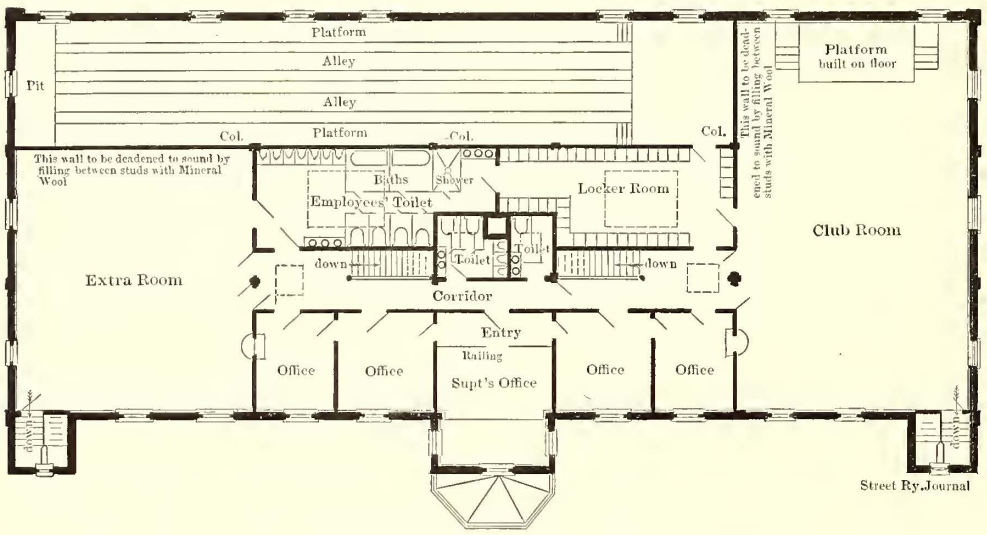


PLAN OF BUILDINGS AND YARDS

The walls of the yard are of red brick, and the same material is used in the construction of the shop and office building. The trimming throughout is of axe-finished bluestone, a combination which will fit in very well with the handsome architectural design of the buildings. The first floor of the front building is used for the most part to accommodate the tracks, as shown in the general plan of the yard. The central part, however, is occupied by a boiler room and a sand dryer, the front of this section being bowed out to make the starter's office. The floor of the boiler room, etc., is made of 4 ins. of concrete, as is also that of the shops in the rear. The two buildings will be effectually separated by Kinnear steel rolling doors, which will cut off all communication between the shop and the front building, making the passage of fire from one to the other impossible. Further potection is furnished on the second story by equipping each window with folding iron shutters. The second floor will be divided up, as shown in the plan, giving a finely arranged series of clubrooms for the motormen and conductors not on duty. At the rear is a double bowling alley completely equipped, and having sufficient space down each side to provide ample accommodations for spectators. The square rooms will be fitted up as reading, billiard and general lounging rooms, where the men will have everything necessary to pass a pleasant hour or two. The superintendent's office is at the front of the building immediately in the center. The toilet arrangements, bathrooms, locker rooms, etc., will be of the very highest order, and will be furnished with the most modern plumbing and other arrangements.

The walls of the rooms are to be plastered. All the woodwork on the second floor and other interior trimmings are to be of the best yellow pine, ample wainscoting being provided where desirable. The construction throughout is on the most approved fireproof principles, every precaution having been taken to prevent either the starting or spreading of a fire.

Nearly all the contracts for the work have been awarded, and its completion is expected at an early date. Many original ideas are incorporated in the design, the utility of which will be observed with interest. The custom of storing street railway cars under cover has become so general that it is quite an innovation



PLAN OF SECOND FLOOR

to build an open storage yard of this character for the purpose, although in steam railroad work it is not uncommon. The capacity of the new yard will be 296 open cars, or 314 closed cars in the yard and thirty-two cars of either type in the shop. This makes a total storing capacity of 328 open cars or 346 closed cars. This additional storage capacity is greatly needed at present by the company, and work will be pushed on the construction with the utmost rapidity. The accompanying illustrations were obtained through the courtesy of D. R. Collin, the architect of the Brooklyn Rapid Transit Company, who designed the building and yards.

No Fare for Sick Children

The St. Louis Transit Company, on July 23, posted a notice in all the cars operated by it that caused favorable comment in the city. It read:

During this period of excessive heat, and until further notice, children ten years of age or under and one member of the family whose parents are unable to pay transportation, will be permitted to ride free on Transit Company lines to Forest, O'Fallen, Tower Grove and Carondelet Parks, on presentation to the conductor of a doctor's certificate certifying that in his judgment these would be benefited by an outing. This order in effect on and after July 24.—St. Louis Transit Company.

First Vice-President Corwin H. Spencer said: "In discussing the matter it was suggested that a physician's certificate might cost more than fare for the little ones. We do not believe, however, that any doctor would ask compensation in a case like this."

Negotiations, it is understood, are being conducted by Wernher, Beit & Company, of London, who control the electric railway system of the City of Mexico, for disposing of the property to Americans.

The System of the Toledo and Monroe Railway

BY WILLIAM S. CONANT

In the rapid development of alternating-current transmission, in its application to interurban roads, each new railway put in operation affords an interesting field for a comparative study of methods. Such comparisons between the practice of different engineers and engineering contractors show that no sterotyped plan can be accepted as representing the best engineering skill, but that, as with the less complex direct-current plants, local conditions and the relationship of maximum to average load must determine the selection of machinery and the distribution of both high and low-tension copper.

On the first of April there was put in operation an electric road, known now as the Toledo & Monroe Railway, which is to form one end of a more extensive line connecting the cities of Detroit and Toledo. Cars are now running on an hourly schedule between Toledo and Monroe, Mich., where the power station is located. Here, as has elsewhere been successfully tried, the electric railway parallels existing steam roads. It will be particularly interesting to note the effect, if any, on the through traffic when the electric line is completed, because, in this case, two steam roads connect the terminal cities named, and a third follows the same general route as far as Monroe.

The logical point to obtain condensing water at least expense is that selected for the power house, and is where the road crosses the River Raisin. The Lake Erie shore is available for most of the route, and could have been used at a point a little more central, as the Detroit, Port Huron & Shore Line Railway has done on the shore of Lake St. Clair, but it would have been off the line and less accessible for coal delivery than the place actually selected.

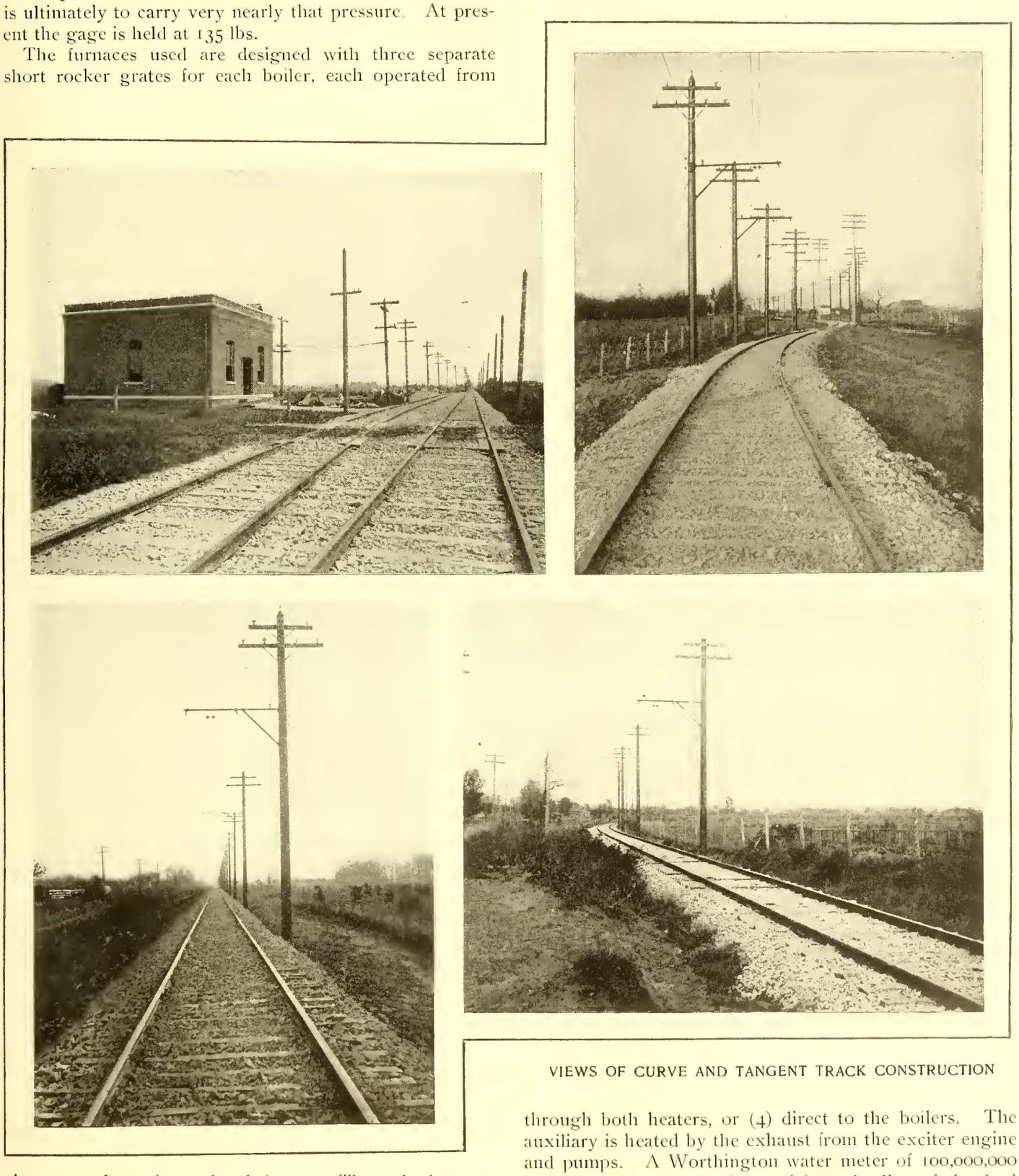
The power house is a handsome, roomy brick structure, 150 ft. wide and 109 ft. deep through engine and boiler room, and situated about 80 yds. from the river. A steel stack, with a bottom inside diameter of 9 ft. and a top inside diameter of 6 ft., rises at the middle of the power house to a height of 165 ft. above its base. It is built of steel sections, and long anchor bolts through cast-iron brackets hold it to a massive pier. No expense has been spared to make the foundations of machinery and buildings substantial and the drains and underground piping durable and permanent. The foundation for each piece of machinery, including boilers and stack, has been carried down independently of the wall footings to the underlying rock bed, and each course of brick thoroughly grouted. Two thousand and one hundred barrels of cement and over one and one-half million bricks were used in the construction of the power station and car house. A concrete floor covers both buildings. A division wall of brick carried to the roof trusses 50 ft. above, separates boiler and engine rooms of about equal size. Only one opening is left in this wall in order that the boiler-room dust may be minimized around the machinery.

Two breeching connections lead from the stack, one for future enlargement of the boiler plant, the other connected to tapered breeching running to the north end of the boiler

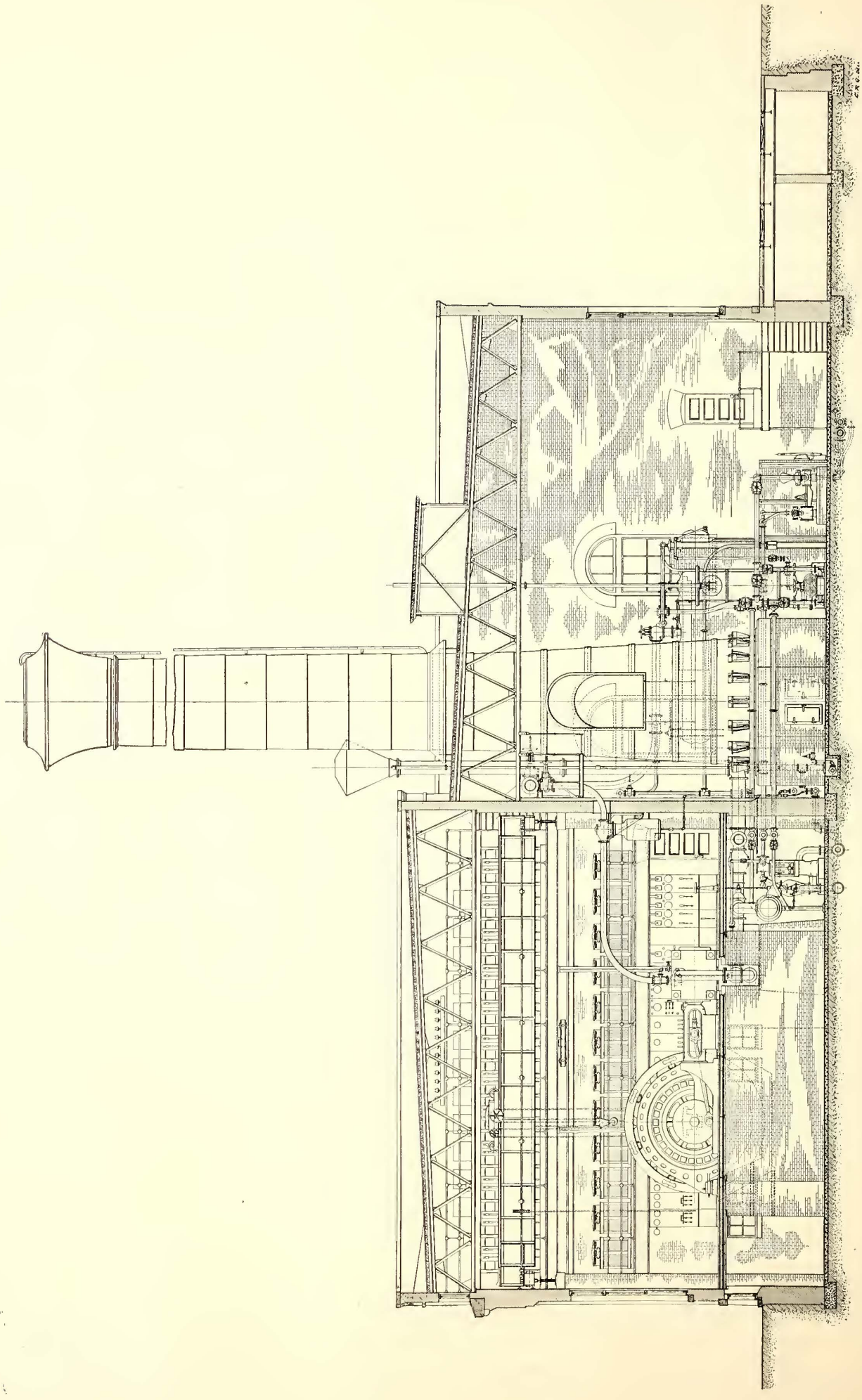
room, with branch flues to two 400-hp triple drum B. & W. boilers. The boilers are 21 ft. wide and 9 ft. high, and contain 189 water tubes 4 ins. in diameter. The steam drums are 23 ft. 3⅝ ins. long and 42 ins. in diameter. The boiler plant is built for 160 lbs. steam, and the intention is ultimately to carry very nearly that pressure. At present the gage is held at 135 lbs.

The furnaces used are designed with three separate short rocker grates for each boiler, each operated from the grate front by a hand lever. There is but one row of ash doors. Spencer automatic damper regulators control the draft. The coal used is West Virginia slack, and preparations are being made to have such a record of coal and ash weights, feed-water gallons and temperatures and chimney gas temperatures that the management will know what their power is costing them, and how to get full value for their fuel.

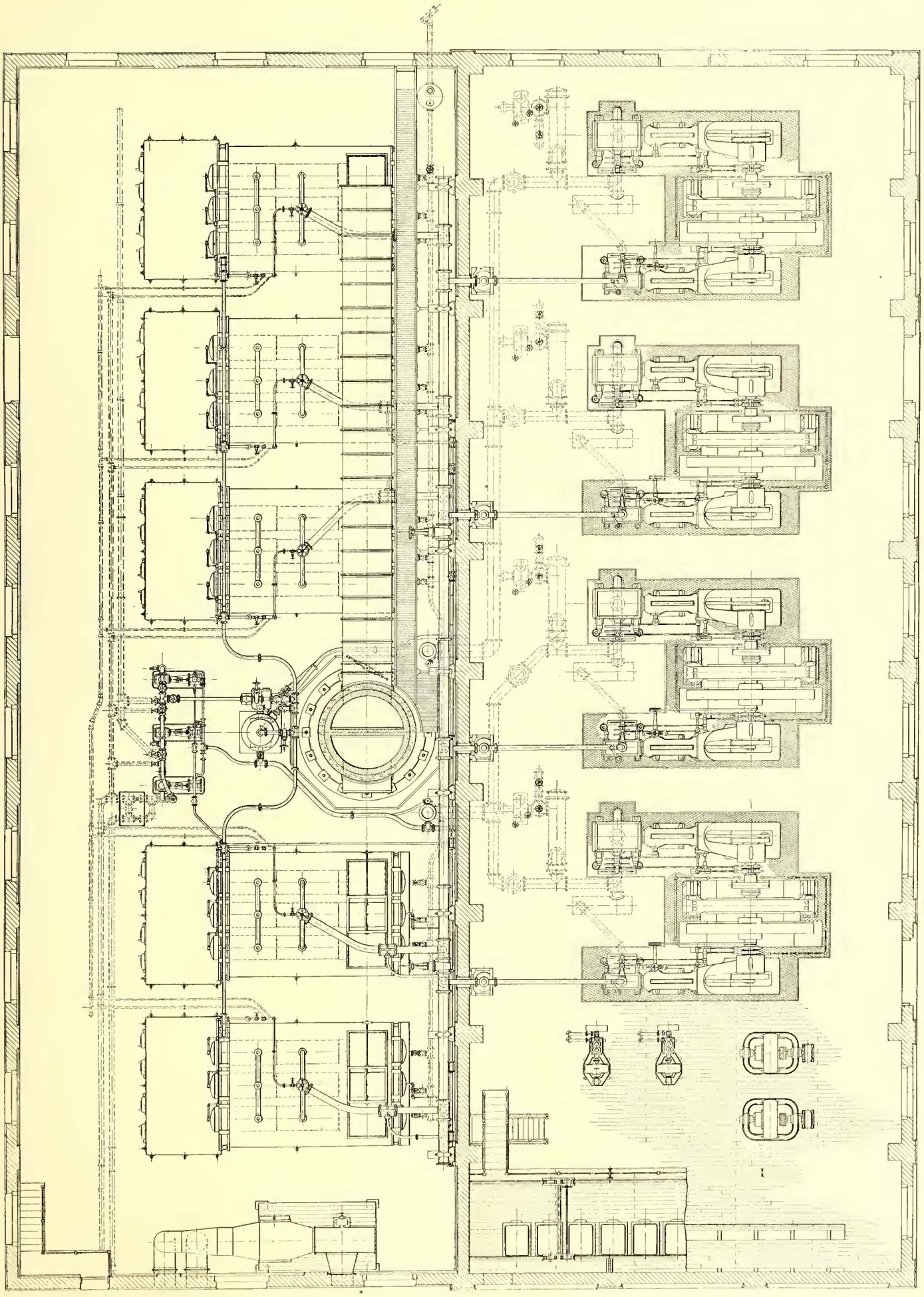
The methods employed in feeding the boilers afford the utmost flexibility, and by duplications and by-passes a practical guarantee against shut-downs is obtained. Two Blake 14-in. x 8-in x 12-in. single boiler feed pumps have been installed and piped, so that each or both can either supply a large gravity tank or else pump (1) through the primary heater, (2) through the auxiliary heater, (3) through both heaters, or (4) direct to the boilers. The auxiliary is heated by the exhaust from the exciter engine and pumps. A Worthington water meter of 100,000,000 cu. ft. capacity can be inserted into the line of the feed piping. The pump speed is controlled by a Fisher governor which throttles the steam supply when the feed-water reaches a given pressure. Penberthy auto-positive injectors are ready to fill the boilers when needed. City and river water are both available, the private supply for the pumps and condenser passing through a coarse and fine-mesh strainer at the receiving basin. All drips are carried back to the boilers by a 6-in. x 4-in. x 6-in. Blake automatic return tank pump.



VIEWS OF CURVE AND TANGENT TRACK CONSTRUCTION



CROSS SECTION OF POWER STATION THROUGH ENGINE AND BOILER ROOM



PLAN OF POWER STATION

A steam header runs along the partition wall near the ceiling, and is fed by long bend pipes. Gate valves are provided in each of these risers and along each section of the header. These latter valves are reached by an iron gallery suspended from the roof trusses. All steam and feed-water piping is extra strong, and valves and fittings are flanged and of "extra-heavy" weight. All the large valves in the plant are of Chapman manufacture, and the more important straightway valves are fitted with outside screw and yoke, and show at a glance whether open or shut. The blow-off valves at the back of the boilers are of the quick-opening lever type. The try cocks on the water gages are opened from the floor by extension rods. The steam piping, heaters and feed-water connections are covered with sectional asbestos fire felt made by the H. W. Johns Company. Goubert closed heaters have been installed, the primary supported by pipe standards in the engine room basement near the condenser, the auxiliary located in the boiler room. Excelsior boiler compound is being introduced into the feed-water at the auxiliary heater, by means of an automatic feed cup. Through the engine-room wall in the basement is a Blake independent, duplex, vertical air pump and jet condenser, and near it in the main engine exhaust is placed a relief valve, which will open quickly in case the vacuum is broken. Condenser suction and discharge piping is installed for four engines.

CAR HOUSE AT MONROE

The engine-room floor is made of concrete set in iron framework, and at one end of the room is the switchboard, with space for exciters and rotaries in front of it. There is room beyond this for four cross-compound engines, direct-connected to 400-kw alternators. Only one of these units is now in place, though another has been ordered, and its foundation is being built. A structural, channel-iron runway, supported by masonry pilasters, extends the whole length of the engine room, and carries a 20-ton hand-power traveling crane. An 18-in. and 36-in. x 42-in. compound condensing, heavy-duty Hamilton-Corliss engine, manufactured by the Houven, Owens & Rentschler Company, drives the generator. The makers rate this engine at 600 ihp at one-quarter cut-off, with a speed of 100 r.p.m. The generator is a 400-kw, three-phase, 3000-alternations, revolving-field Westinghouse machine. The armature yoke slips laterally on the bed-plate for convenience in making repairs. It requires about 12 kw to excite the generator at full load, and it is rated to deliver 608 amps. per terminal at 380 volts. The exciter is a 17½-kw Westinghouse, six-pole engine type, 125-volt generator, coupled direct to a vertical engine made by the B. F. Sturtevant Company, and running at 400 r. p. m. The rotary is a standard 200-kw Westinghouse machine.

The switchboard has seven panels, one exciter, one generator, one transformer, one load, two rotary and one feeder. All are standard Westinghouse sizes, made of blue Vermont marble 2 ins. thick and supported by an angle-iron frame work. The first generator panel contains an 800-amp. triple-pole, double-throw, quick-break, spade-handle switch, which throws the generator into either the high or low bus-bars. The high bus-bars connect into a bank of three auto-converters, which add 20 volts to the initial e. m. f. of the generator. There is also a synchronizing voltmeter on the panel, an ammeter across one phase, from which the total ampere output can be read, and an indicating wattmeter which is fitted with a thermometer and corrects for temperature. This instrument shows the real watts at any moment, while the ammeter takes into account also the wattless current generated. It is therefore evident that the power factor of the station can be obtained directly under any desired conditions. With only two cars running, the power factor was shown to be 91. Besides the above instruments there is a station voltmeter on a swinging bracket.

The second, or load, panel carries two polyphase Shallenberger recording wattmeters, one on the high bars and the other on the low bars, and another triple-pole switch which, however, is only single throw, and parallels the bus-bars.

On the third, or transformer, panel is mounted an ammeter, which reads the full alternating-current output of the station, and three single-pole, double-throw, quick-break, 800-amp. switches.

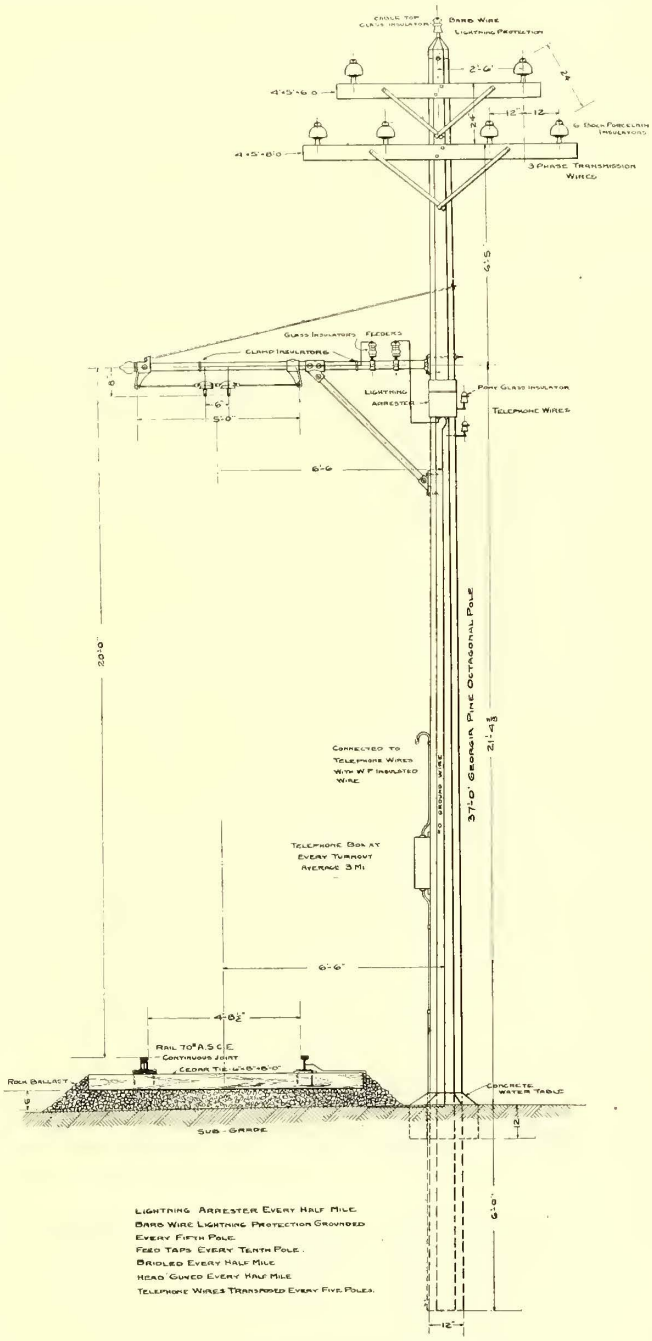
The alternating-current rotary panel contains a triple-pole

switch for the induction motor on the end of the rotary shaft, a triple-pole, single-throw, 400-amp., spade-handle switch for the rotary itself, and a double-throw, single-pole switch which connects the field of the rotary either short or long shunt. This last-named switch is used when the rotary is started from the direct-current end. It is first thrown to short shunt and the rotary brought up to speed as a shunt motor by gradually cutting out the resistance in a starting rheostat, which is in the main circuit. When up to speed the positive rotary switch is thrown in and the starting rheostat circuit opened. The speed can then be varied by means of the field rheostat giving a visible effect on the synchronizing lamps, and showing when to throw in the alternating-current rotary switch. The other method of starting the rotary from the alternating-current end requires the shunt switch to be left at long shunt, as though the rotary were a direct-current generator. The speed is raised by the induction motor, and when the lamps synchronize the alternating-current switch is closed. Preventive coils are connected across the shunt switch to avoid the flash discharge which would occur were the field circuit opened. On the direct-current rotary panel is also placed a Westinghouse circuit breaker of the latest pattern, suitable direct-current instruments and a single-pole negative switch to ground. A Wurts tank lightning arrester with choke coils is inserted in series on the positive side on the lead to the feeder panel. The last named contains a circuit breaker, an ammeter and a single-pole switch on each feeder.

There are three galleries directly above the switchboard. They are constructed with iron framework and cement arches. The first contains three 135-kw self-cooling Westinghouse transformers with wire-mesh ventilating hoods, and there is room for nine more of the same size. The transformers are wound in the ratio of forty to one, and step up to 15,000 volts. Provision has been made for a small traveling crane along the gallery. The transformer leads are delta connected on both primary and secondary. By the insertion of a knife switch on each lead, any transformer can be quickly cut out for repair, and, being mesh connected, the plant can go on working on the line with the two remaining transformers. Special transformer oil is used and piped to a reservoir in the basement. The transformer cases are tied together electrically, and grounded to avoid static discharge. In the second gallery is a wooden framework carrying lever pole Westinghouse circuit breakers, one for each high-tension feeder. The top gallery holds the lightning arresters and choke coils. The wiring runs without any loops directly from the generator to the switchboard, up through the several galleries and out to the line.

The power house is lighted by incandescent lamps from the exciter and enclosed arcs, five in series across the direct-current end of the rotary. All light wiring in the station and car house is done in Sprague iron conduit, attached to the brick and iron work with metal clips. The outlet boxes, switches and other fittings were purchased from the same manufacturer making the lighting system uniform. A small marble switchboard on iron supports carries incandescent and arc circuit switches.

The line to the sub-station, 12 miles south, is on octagonal Georgia pine poles, with some long cedar poles in the city of Monroe. The pine poles are 45 ft. long and painted black. Beyond the sub-station to the Michigan Central Belt Line in Toledo, 6 miles further, the poles are 30 ft. long. All are set 6 ft. deep with a concrete topping, making them so rigid that on curves no guys nor extra rake to the poles is needed. Every tenth pole has a head guy and bridal guys. Two cross arms, double-iron braced, carry the high-tension feeders, and the pins form an equilateral triangle. The feeders are No. 4 copper wire, except within the city, where No. 0 feeders are used. But one transmission circuit is employed, and it is not transposed throughout its entire length. Wooden pins and Boch triple petticoat insulators are used. The low-tension feeders are all No. 0000 wire. One extends 2 miles from the power house and the other connects the power house and the sub-station. The sub-station has three feeders; one



SECTION OF TRACK AND LINE

extends 2 miles north, one 2 miles south, and one 4½ miles south. Weatherproof covering is provided only in the city. Green glass railway insulators are used, and taps are made to the trolley every twentieth pole. Double trolleys of No. 00 hard-drawn copper are suspended from iron pipe extension brackets bolted through the poles. A Garton railway type lightning arrester is placed on every twentieth pole, and barbed wire is stretched along the pole tops and grounded down every fifth pole. Besides the usual rail ground, a tinned copped plate 2 ft. square is set 5 ft. deep near the pole. A private telephone line is strung on iron brackets driven into the poles just above

the extension brackets and transposed every fifth pole to avoid induction trouble.

The country through which the road runs is comparatively level, affording good alignment and easy grades. The maximum curvature is 6 degs., and the heaviest grade is less than 2 per cent. Culverts and bridge abutments are of concrete, with steel superstructure. The track is on private right of way; iron cattle guards are placed at road crossings, and the elimination of railroad grade crossings is a prominent feature of the construction.

There is now completed about 18 miles of single track, together with six sidings. The track consists of 70-lb. T-rails, heavily ballasted with broken limestone. Ties are of cedar and oak, and are of standard dimensions. The rails are pressed bonded inside the angle plates, and are cross connected at frequent intervals.

No all-copper return is considered necessary, but the rails and the negative rotary lead at the power station are given an effective running water ground in the river bed.

The rolling stock consists of four passenger cars, one chair car, one combined passenger and baggage car and one freight car. The passenger cars are 40 ft. long, with a smoking compartment at the forward end, and made by the Jewett Car Company, of Newark, Ohio. Electric heaters are wired under each seat, which are Wheeler reversible patent. The trucks are No. 26 Peckham, extra strong design, and Price friction brakes are used, besides the ordinary hand brakes. The electric equipment is four-motor—No. 56 Westinghouse motors (50 hp)—and K-14 controllers. Other appliances are Wagenhall's incandescent arc headlights, Nutall trolleys and Jenny couplers. The cars run very smoothly and at high speed, the regular schedule speed being at the rate of 38 miles per hour. The average number of stops for this schedule, however, is but two per mile.

The sub-station is a square brick building with three transformers and two rotaries, of the same sizes as in the power house, on the main floor, and the lightning arresters and circuit breakers in a low gallery at the back. The high-tension leads are brought into this gallery through clear glass tubes 2 ft. long and ½ in. thick, inserted through a stone block. The switchboard contains two alternating-current and two direct-current rotary panels and two feeder panels, all of which correspond to those before described. A tank arrester is inserted between the generator and feeder panels.

The car house, adjoining the power house, is also a brick building with iron roof trusses, but it has a galvanized iron roof and rear wall. An oil house of the same construction lies behind. There are two long car pits in the building in which there are eight registers per pit. The heating is done by forcing hot air through underground tile ducts from the boiler room, by means of a 72-in. Buffalo Forge Company pressure blower. The blower is run by a vertical engine of the same make, and the air forced through heater coils supplied by the exhaust from the engine. Live steam connection is also provided through a reducing pressure valve.

A locked switch is installed on a pole 100 ft. in front of the car house, where the cars switch into the yard, and this switch cuts out the trolley current on every track in the car house.

The road was designed and built by J. G. White & Company, whose Mr. Childs had charge of the installation.

Since the road was started it has been consolidated with the Detroit & Toledo Shore Line Railway Company. The manager of the Toledo & Monroe Railway, A. F. Edwards, has been retained by the consolidated interests.

Accounts Payable and the Voucher System

BY B. W. TINGLEY

To the professional accountant or to one who may be in charge of the thoroughly systematized accounts of a large street railway corporation many of the things treated of in this article may appear trite, but it is not for the information of such that this paper was written. They, presumably, have been thoroughly schooled in the science of corporate accounts and are perfectly capable of developing their own methods, but there is a large class of men otherwise well grounded in the ordinary fundamental rules of bookkeeping who find themselves by virtue of such knowledge placed in charge of the accounts of some smaller transportation company without having had the advantages of a preliminary training in corporation methods, or who, having such preliminary training, are making efforts to perfect their system.

It is for these that the suggestions embodied in this article have been compiled from actual practice with the hope that they may be found of value in their efforts to perfect themselves and their methods.

It would seem needless to urge co-operation between the various branches of the business and the accounting force, but the accountant must look the matter squarely in the face and realize that only too often he is *persona non grata* to the engineering or operating staff. Engineers and other technical men are apt to look only at the development and realization of their own plans without regard to cost or details of cost, and, to put it mildly, are generally inclined to look upon the accountant and his requests for data as somewhat of a bore.

There are some men who stand at the top of their profession technically, who can not be trusted to supervise expenditures, and the accountant has got to use all possible *finesse* in handling such if it is his misfortune to find them among the staff. His is a thankless job at the best, and the very ones who resent or neglect inquiry after details will be among the first to criticise if he should be unable to produce data of cost when called for. Engineers are prone to push improvements without due regard to the ultimate cost, a little here, a little there, mounts up in the final total in a surprising manner.

If the true facts were made public it is safe to say that fully 50 per cent of the failures of individuals and firms, and to a less degree of corporations, would be found to be primarily due to a lack of knowledge of the exact liabilities.

Most men will instinctively keep an accurate account of what may be due them, but there seems to be an inherent tendency in the majority of individuals, even in those at the managing end of some corporations, to let the accounts payable take care of themselves, trusting to luck that when the time comes for settlement the necessary funds will be on hand, and with the certainty that if they forget or overlook the account the creditor will not fail to remind them. The problem before us is, therefore, how can we best keep records of the accounts payable?

Every corporation, no matter how small, should have some one person who is held responsible for, and through whose hands all orders for materials must pass. This can either be a full-fledged purchasing agent, or, where the business done will not warrant such an official, can be a clerk subject to some higher officer. In the latter case, preferably the treasurer, as in this way the person responsible for the funds can more easily keep track of the requirements.

To the purchasing agent or clerk, as the case may be,

all bills should be sent immediately on their receipt, to be checked against the order and approved as to quantity, quality, price and authorization. He should keep a book, call it what you please, Bill, Record or Sundry Creditors, in which, after checking against order and before leaving his hands, every bill must be entered. In this book an account must be opened with everyone who renders a bill, and as the bills are rendered under their proper account, a memorandum as to the disposition made of the bill, *i. e.*, sent to storekeeper, constructing engineer, etc., as the case may be, for approval.

The writer has found that for this purpose an ordinary ledger ruled book answers every requirement, as it is only intended to be a temporary record to keep track of the bills while in process of approval, and is not connected with, or dependent on, any of the general account books. In a previous article on "The Store Room and Store Room Accounts," the advantages of a company having its own form for bills payable are set forth, and the remarks there made would apply here.

It is the purchasing agent's business to see that every bill is returned certified within a reasonable time and turned over to the accounting force. When this is done he makes a proper entry to this effect on his book and his responsibility for the bill ceases. While this, as stated, is not intended as a book of permanent record, it is ofttimes useful, aside from its primary use as memorandum, in case of a disputed account where the question of date of receipt of any given bill enters into the subject. When the time of closing the books comes around, annually or oftener, it is necessary that every bill covering the period should be in the accountant's hands, it is indispensable as a check.

It is the custom with many companies to have a rule requiring that bills for all goods delivered within any month must be rendered and received within a given time, generally five days, after the end of that month, in order to receive attention at the regular time of settlement, covering the accounts of such period. With this rule and one requiring the prompt return of all bills when approved, the accountant is enabled to show each month the true indebtedness incurred and unpaid for such period.

Under the voucher system of paying accounts when the bills reach the accounting department they are placed in a filing case in alphabetical order until the regular time for making out the voucher comes around, monthly or oftener, as the case may be, according to the volume of business. The primary object in the use of vouchers is to secure uniformity in the records and at the same time show to the disbursing officer a proper authorization for the payment of the account.

When we reach the shape that the voucher is to take there is chance for selection from a great variety of forms, all of which have their points of merit, while some are equally open to serious objections. The best plan is for the accountant to take some form that most nearly seems to meet his case, and from this elaborate until all the requirements of his particular company are filled. For large corporations the voucher that takes the place of a check is in many ways the best, but for the general run of corporations a simpler form to be accompanied by a check is preferable. Granting that the latter form is adopted, the next question that presents itself is: How shall the voucher be made out?

Some companies have the voucher made as an exact copy of the bill or bills covered by it. Others make it out "as per bill attached," simply carrying out the total amount and fastening the bill to the voucher either by paste or rivet. This method, while it saves clerical labor, is open to the great objection that the bills are liable to be detached and lost, and also that when several bills are attached to the same voucher it makes a bulky package to send through the mail and involves extra postage. Others, again, word the voucher "as per bill No. —— filed." This form saves labor and does away with the objections to the previous form, but still is open to criticism on the ground of inconvenience in case any details of a given account have to be traced, as the reference would have to be carried back of the voucher to the bill file. This, however, does not amount to a very serious objection, as the cases where accounts have to be traced do not, as a rule, amount to any great number in the ordinary course of business, but like the story of the man going to Texas in days gone by, when advised by his friends on the subject of going armed, "You may never want a gun, but when you do, you want it d——d bad." This objection can be removed by making it a rule to attach all bills to the voucher after the latter have been returned receipted. For any one of these methods of vouchering the same general form will answer:

Order No.....

The X, Y and Z Railway Co.

To.....

.....

Approved:

Entered in Voucher Record. Correct. { .....Gen. Mgr. .....Purch. Agent.
Folio.... Date....
Paid by Check No..... ..... Secretary.
Dated..... Payment Approved.....Treasurer.

....1901.

Received of the X, Y and Z Railway Company.....
.....Dollars
in full settlement of above account.
$..... ....

Please date, sign and return this receipt without delay to the Treasurer.....City.

SUGGESTED FORM FOR VOUCHER

The blank after "Approved" is for use when the approval of some higher official than those named in the form is wanted, *e. g.*, president or general manager. The back of the voucher can have a classification list printed thereon covering the standard railway accounts used, with a few blank lines for extras, or can be left entirely blank.

As the vouchers are intended to be a part of the permanent records, it is important that there be no break in the record, and it is therefore essential that they should all be receipted and filed in regular order. The size of the voucher should be such as will fit a regular official size envelope when folded once across, or double this size for a large voucher.

It would be supposed that in these enlightened days of the twentieth century that there would be no one in business who would fail to observe the ordinary courtesies of the business world and promptly return the receipt when an account is settled, yet it will be found that some men are either too ignorant or indifferent to attend to this simple matter without a reminder, such as is printed on the foot of the voucher. Even with this notice you can not always count on getting the receipted voucher back, and it will be found useful to have a lighter manilla envelope with

printed address of the treasurer enclosed with each voucher, when paid, through the mail. This envelope should be large enough to take the voucher without further folding, being just a shade smaller than the regular official envelope. By the use of your own envelope fitted to the voucher you also secure the probability of its return in same shape as sent out, in good condition for filing, otherwise it will probably be returned in a small business envelope folded in two or more ways, much distorted as to shape.

For his own protection the treasurer should insist that all vouchers be approved by at least two other officials before he makes payment. This, like all rules, is subject to exceptions in special cases, but should be imperative in all payments for materials, and under no circumstances where the voucher system is in use should the treasurer ever issue a check without a proper voucher in hand at time check is made out.

No....
To.....
.....
For.....
Amount $.....

Expense General.....	
Store Room.....	
Maint.—Way.....	
" Cars.....	
Petty Cash.....	
Etc	

FORM FOR BACK OF VOUCHER

One of the great advantages in the use of a voucher that takes the place of a check is the certainty that you will get it back properly receipted through your bank, but the other questions entering into the use of this form are such that it is not always feasible to use it.

Having decided upon the form that the voucher is to take, the next question is the recording of it in order that the charges covered may get upon the general books without unnecessary labor and in a concise form. To effect this, the best method is by the use of a Voucher Record Book. It is quite possible to adopt the use of vouchers to secure uniformity and proper certification of accounts without using the Voucher Record, but such use is very much like the play of "Hamlet," with Hamlet left out.

The Voucher Record is one of the greatest labor-saving devices that an accountant can make use of. By posting directly from it, one entry monthly to each account covered by its classification will cover all indebtedness incurred for such account and will do away with long and cumbersome journal entries, and in a business of any magnitude will save considerable clerical labor. The book should have not over fifty lines to the page, and should be sufficiently wide to provide columns for all the standard accounts, with a few blank ones for special accounts. Headings of all regular accounts should be printed, and as an aid to carry the extension across the page, every fifth faint line may be ruled either in darker blue or light red. As a further aid, where the number of accounts necessitates a very wide book, the faint lines can be numbered on each page from the top down, but this will hardly be found necessary for any book that is less than 4 ft. wide when open, which will be ample for all ordinary requirements.

After the vouchers are made out and before they are sent to the various officers for approval, they must be entered upon the Record Book, being numbered consecutively. The headings, as shown, are self-explanatory, and footings of the various classification columns must equal the footing of the one headed Amount.

Postings are made direct to the several Ledger Accounts at the end of the month. The total of the Amount column being posted to Sundry Creditors' Account which, as the total payments as shown by the Cash Book are charged to that account, will show the floating indebtedness whenever the books are balanced.

By handling the accounts in this manner, but one posting is required each month for the credit side of the Cash Book.

As the bills are supposed to be in proper shape as to price, etc., before they reach the accounting department, it is very rare that any change is made in the face of the voucher, but to allow for any such contingency, the column headed "Deductions" is provided; in this any change in the amount of the voucher is to be noted in red ink and must be corrected on Ledger by Journal Entry.

Occasionally deductions are made for discount offered by some creditor, who, for his own reasons, desires the payment of his account ahead of the regular time, but where the company has a regular rule for discounting all bills the deductions should be made before entry of voucher on the Record.

This raises the question of having a hard and fast rule of discount for all bills which must always remain a matter of policy which the officers of every company must decide for themselves, but it is in the opinion of the writer a rule where the advantages are often outweighed by the trouble

Date	Voucher Number	In whose Favor	What for	Amount	Deduction	Date Paid	Returned	Petty Cash	Expense General	Store Room	Etc.	Etc.	Etc.
Totals.....													
Posted Ledger Folio..													

FORM OF VOUCHER RECORD BOOK

that may arise in times of money stringency and the reflections that will be made as to the company's solvency if for any reason it suspends the discount.

The date of payment of the voucher is obtained from the Cash Book and entered in proper column.

If within a reasonable time after such date the voucher is not returned receipted, steps should be taken to follow it up by correspondence. If the original can not be found a duplicate should be made up and receipt secured if possible. If from any cause the original or a duplicate receipt can not be obtained a memoranda to that effect should be filed with the Receipted Vouchers in the proper sequence with copies of correspondence attached.

If thought desirable it would be perfectly feasible to have all vouchers for material, requiring the purchasing agent's approval, made out in his department and the original bills remain on file in his custody. In this case he would approve vouchers before passing to the accountant. No mention has been made of any voucher except for material purchased, but the proper development of the system requires that every disbursement shall be represented by a voucher, therefore one must be made out for all items of petty cash, payments under contract, pay rolls, salaries, advances on account of expenses to officers and others entitled to expense money, etc., and proper distribution of the charges made in same manner as for the material vouchers.

How to Make Non-Paying Roads Pay

BY H. S. COOPER

IX. Maintenance—Standardization

With the class of roads under consideration it is generally the case that the equipment of most or all departments—power station, line, track, cars, trucks and their electrical equipments—is a mixed one, it being the exception to find one where such equipment is standard for each department, viz.: Where all the track or line, or all of the cars or their trucks, or the electrical equipment of them, or the power station, are of the same make, size, style or type. Even where they have originally been so, various causes have led to the installation of different apparatus or materials until in many cases the property is an historical museum of most of the "has-beens" of the street-railway field, with the logical result that a very large number of extra repair and renewal parts have to be kept in stock. In one road known to the writer there are, on 7 miles of track, six different sections and weights of rails, five different types of special work, two sizes of trolley wire and eight different types of fittings for it! Among the twenty cars there are four makes and eight types, there are four makes and six types of trucks, three makes and five types and sizes of motors! In the power station are two makes and three sizes of engines, two makes, three sizes and two types of boilers, three makes and two sizes of generators! In consequence the quantity and variety of repair and renewal parts that have to be carried in stock is simply appalling for the size of the road, to say nothing of the special tools and appliances used on them and the difficulty and expense of training new men to the multiplicity of their use, the chances for errors in parts or materials greatly similar and the difficulty in maintaining such supplies in a normal, yet reasonable, quantity.

In some few cases this has been unavoidable to a certain extent; apparatus or materials of the same make, size or type as the original installation have either been unattainable at reasonable prices or in decent condition, or the original type was such that duplicates of it were undesirable on any terms. Lack of means and the prevailing plentifulness and cheapness of second-hand apparatus and materials has also led many roads to buy "any old" make or type simply because they were "so cheap" or "such a bargain;" forgetting that the "first cost" is not always a criterion of the real cost when maintenance is thoroughly understood and considered.

Again, during the last two or three years, the difficulty of obtaining reasonably prompt delivery of new and modern apparatus in small orders has been so great that it has been a case of Hobson's choice when change, increase or extension has been suddenly settled on. This dilemma is often largely the fault of the owners who are generally only too willing to put off the decision to purchase until the very last moment and then—get left. There are few managers or superintendents who, if left alone, will make such an error; as a rule, they generally "holler before they're hurt!"

It is often a grave question to the management as to the relative economy of the two courses when the question comes up as to addition, extension or substitution. Whether the superior simplicity, efficiency, durability, or ease and cheapness of repair of the newer or more modern apparatus or materials will counterbalance the cost of keeping and using one or more extra and entirely different set of repair or renewal parts, with the necessary special tools or appliances for their handling and the cost of training the employees to their use and operation, is a question that should be very carefully considered by the owners or managers *before* the purchase is made.

Here again, local conditions and needs must be taken into consideration. If the equipment of the department that is to be increased or partly replaced is fairly modern, efficient and suited to its purpose; if the repair or renewal parts for it may be obtained promptly and at a reasonable cost; if the addition or substitution is a small proportion of the whole equipment of that department, or if the increase or substitution is only a temporary matter to tide over until some intended radical change or increase is to be made, then, in either of these cases there is a good reason for the installation of identical apparatus or materials, even if it *is* "behind the times" and somewhat deficient in efficiency, durability or ease of repair, for in such cases the single item of simplicity in the keeping and handling of repair and renewal parts and the attendant tools and labor will probably more than compensate for the other adverse conditions.

On the other hand, if the equipment or materials in use are notoriously and plainly inefficient or expensive to maintain; if they are, as a whole, in bad condition; if repairs and renewals are unobtainable except by long delay or excessive cost; if a large percentage of addition or substitution has to be made, or if no further addition or change is expected to be made for a long period, then it is wise to very fully consider if it will not pay in the end to purchase different and more modern or efficient apparatus or materials, even though by doing so the stock of repair and renewal parts has to be duplicated or triplicated.

If the latter course is determined on it must, however, be done with a final and definite end in view. To buy the most modern and efficient apparatus of one make, size or type this year, and to find, in the increase forced on you next year, that you are compelled to put in an entirely different make, size or type, is to avoid only one of the evils, it is "swapping the devil for his imps"! The end in view should be finally to make the equipment of each and every department as nearly "standard" as is possible, and to this future end a great many other things may be sacrificed with remunerative results. To do this generally needs both foresight, thorough local and technical knowl-

edge—and great patience, "snap judgment" must be avoided, unpractical and untechnical officers and officials held in leash and glib-tongued salesmen temporarily discouraged with a club, and at times even the urgent demands of the public and the press will have to remain unsatisfied until the future policy and practice have been fully determined. At such times "make haste slowly" must be the motto, for it is at such times that the manager has the chance to "show his mettle" and to make—or mar—himself.

Aside from the standardizing of the original machinery and appliances comes that of maintenance, the standardizing of all repair and renewal parts, tools and auxiliary appliances and materials, and to this branch less attention is paid than even to the other. It is no uncommon thing in even otherwise well-managed roads to find the bolts in use with all sorts and numbers of threads, the nuts of all varieties of sizes—and also of threads, brasses and bearings having to be "fitted" to their journals every time they are changed or renewed, wheels having to be rebored or axles "rough-punched" to get a proper "pressure fit," "shims" and "dutchmen" used in all sorts of places, "fits" made with a drift-pin and a sledge and templets, jigs and gages conspicuous by their absence. Such a state of affairs always means time, labor and materials lost and wasted, and yet this can be avoided even in the smallest and poorest road by a continuous and unremitting effort in the right direction—that of standardization.

Take that commonest and most abused of all repair parts, the ordinary machine bolt. In the small roads, if it is not raked out of the scrap-pile, cobbled up in the shop forge or gouged out of a bar of cheap, rough iron with a dull die, it is bought as needed of the local hardware dealer. Either is bad, but the last is generally worse, for the most ignorant person on earth in regard to the fine points of bolts is generally their retailer; to him a bolt is a bolt so long as it has a head, thread and nut, he buys them by the keg as cheap as possible, and such things as "standard" threads or dimensions of head or nut or accuracy of fit are refinements that make him suspicious of the man that asks them. Even with large roads which buy their bolts wholesale there is often a tendency to consider the price and neglect the specifications. As bolts enter so greatly into *all* repairs and renewals, as their use—the putting on and taking off of the nuts or the tightening or loosening of the bolt itself—are things which have to be done so frequently in every department, it would seem that of all matters this would have received the most attention, that every effort would be made to make its operation as simple, quick and easy as possible. And yet in nine shops out of ten where a truck, a motor or a piece of machinery is to be taken apart or put together, the bolts will cause the greatest loss of time, temper, skin and profanity.

It does not pay to use poor bolts nor to misuse good ones. It does not pay to buy any old bolt, to buy bolts at retail of retailers or—except in special cases, in some finished or special bolts and on very large roads—it does not pay to make bolts.

At the present time there are a dozen firms who make a specialty of manufacturing bolts, *good* bolts, bolts with head and nut and body and thread exact to a standard, where any nut will fit any bolt with either "wrench" or "finger-fit," and every bolt will fit its hole to one-sixty-fourth of an inch. For a very small additional cost they will "chamfer" the nuts and heads and "face" the nuts, and for a slight difference in discount they will sell you less than "keg" lots, and the total of all this will be a large per cent less than the retailer will charge for the things he calls bolts. In addition to this you will be enabled to discard monkey and Stilson-wrenches, pipe-tongs, cold-chisels and sledges as a means of tightening or loosening a bolt or nut, and will need only two flat wrenches to each size of bolt—one for square and one for hexagon shape; for all bolts of the same size will have similar sized heads and nuts, the "chamfer" on the head or nut guides the wrench to its position, the "facing" of the nut insures an even bearing on the threads and a straight pull on the bolt, while the "finger-fit" enables the nut to be rapidly run on or off.

In any shop or department where a careful account of the stock used has been kept, the number, size, length and kind of bolt used within any period in the past should be able to be ascertained, and from this record and with a knowledge of future work, it should be easy for the foreman of such shop or department to make up an estimate of the number, size and kind of bolts that he will need within, say, three or six months, or even a year, and it will pay any road which has not previously done so, to standardize this estimate as to sizes of heads, nuts, thread and threads, order it of some good *manufacturer,* duplicate these exact bolts when more are needed and discard and scrap every bolt in use which does not agree with these dimensions. When its whole system of bolts is thus standardized there need be no more hunting of bolts to fit certain holes or nuts, or of nuts to fit certain bolts or studs, no more "twisting off" of bolts, of "cutting off" of nuts, no more "whacking off" of corners of head and nut with cold-chisel or pipe-tongs, no more big bills for monkey-wrenches, no more skinned knuckes and "bolt-profanity," for, if care and common sense is used, a bolt or a nut can then be tightened, loosened or "set" with ease and certainty—and a fit.

The use of the United States or Franklin Institute system of threads—both as to shape and number per inch—is now so universal in this country that its use as a standard goes without saying. In the matter of dimensions of heads and nuts there are at present two standards, the Manufacturers, which is an arbitrary one, and has no reason for being, except its existence, and the United States, which has for its reason, maximum strength with minimum waste metal. The "chamfering" or "cupping" of the head or nut prevents sharp corners to catch clothes or waste, serves to guide the wrench to its place, adds to the neatness of appearance, and, in certain cases, serves to "lock" the nut. The "facing" of the nut enables it to be more easily started on the bolt, insures an even bearing and a straight pull, and the "finish" on the end of the bolt facilitates its entrance into hole or nut and greatly obviates injury to its thread.

Therefore, if any road is using unstandard bolts, it will pay—over and over again—to standardize them as soon as possible and also to invest in a set of flat-steel wrenches, both straight and "S," square and hexagon, to fit them, and also to buy a full set of the best adjustable dies and of nut-taps—of exact same thread and threads as the bolts—with which to "clean up" any threads which may accidentally become injured. These tools must not be used to make the bolts and nuts fit, they must do it without that, neither must they be used to cut bolts or tap nuts out of rough iron, nor must Tom, Dick or Harry be allowed to use them "promiscuous," they are to be used only for the purpose above.

The useful strength of a bolt or nut is only that of the perfection of its thread, therefore it is neither wisdom nor economy to use a nut with worn thread on a new bolt or vice versa, neither is it economy to use any bolt or nut when the threads plainly show great wear. To many, a bolt or nut is sacred as long as it has a spiral streak on it, or inside it, but even bolts and nuts will "turn" if so trodden on, and loose cross-arms, hammering rail-joints, dropped motors, and rattling trucks will soon attest that "turning"!

The New York Central Tunnel Problem

Conway Center, N. H., June 23, 1901.

Editors Street Railway Journal:

My attention has been repeatedly called of late to the conditions existing in the New York Central tunnel, and the determined efforts that are being made to force their amelioration. The present state of affairs seems so impossible of toleration that the public has been moved to savage criticism of the officials of the offending road, and drastic legal measures to compel improvements. Yet, in fairness, it should be remembered that the nuisance has grown so gradually, keeping pace with the growth of the metropolis, and its need for railway communications, that it has reached its present proportions without at any particular time showing so marked an increase as to fix the attention of either public or officials. When trains were relatively few the tunnel was, according to its kind, fairly well ventilated. Even to-day it is in far less serious case than the St. Clair tunnel at Port Huron, and others that might be mentioned. I do not wonder that the officials of the road, however earnestly they may desire improvements, shrink before the magnitude of the problem that confronts them. With more than 550 trains per day to take care of, to say nothing of switching engines, the volume of smoke and furnace gases evolved is something truly prodigious, and I do not think it too much to say that any scheme of artificial ventilation would be foredoomed to failure.

The most that could be hoped from such steps would be a temporary amelioration of conditions, passing back to hopelessness with a slight increase of traffic. The only real remedy lies in the complete abolition of the production of smoke in the tunnel by the adoption of some other means of traction than locomotives. And here again the proportions of the problem are somewhat appalling. Were the tunnel a comparatively simple affair, like that at Baltimore, where four electric locomotives do the entire work, or like many another tunnel where similar facilities would be adequate, the most direct and commonplace application of electric traction would be adequate for the work. Unhappily, in the New York case not only is the number of trains prodigious, but the yard work is particularly complicated.

Besides, the stop for change of motive power at the end of the tunnel is a serious matter, particularly for the crowded suburban traffic, which is yearly growing more important. Really, the first step forward should be the conversion of this suburban work to electric motive power. This once accomplished, the rest of the trains could be pulled through by electric shifting engines without any particular difficulty. In fact, the establishment of electric traction on the suburban lines forms the whole problem to be solved, for here lie all the difficulties. The practical issue is reduced to the following: Given a crowded terminus, with a complex yard, followed by a long tunnel, shared with a great and important through service, how can heavy suburban work best be accomplished by electric traction?

There are no precedents of any value for the solution. There is not now in existence anything approaching a railroad yard equipped for electric traction, nor is there even any important suburban service, other than fairly underground, or actually elevated, carried exclusively on by electric traction. Of surface roads doing an enormous tramway business there are many, and there are a few lines doing the same class of work that would be required near New York, but none of them uses tracks in common with through trains, or has to run into a complicated terminus. Experience on elevated roads shows clearly enough that electric traction is entirely adequate to meet the traffic conditions of the heaviest suburban work, but the crux of the whole matter lies in the arrangement of the working conductors in a crowded terminus and along a surface suburban system.

For elevated and underground work the third-rail system, in its simplest form, has been thoroughly tried, and has proved entirely adequate. Its application to surface roads, however, has not, up to the present time, been proved to be entirely economical and trustworthy. Several third-rail roads of moderate length have been operated with some considerable measure of success, but full data as regards leakage, accidents and interruptions of service due to causes connected with the location of the working conductors have not been made public. Such as have transpired are not altogether reassuring, and there are no signs that the number of such roads will rapidly increase. Nor has anyone yet had the hardihood to install a third-rail system in the complicated tangle of switches in a terminal yard. It is safe to say that the unguarded third rail, as usually installed, is entirely unsuited to such a location, and that its use there would border on criminal carelessness. Nevertheless I regard it as entirely practicable to install, even under such trying conditions, a system of working conductors which would prove entirely safe and completely reliable. With a reasonable amount of engineering skill even a third-rail system can be made safe and secure in its insulation, although I am by no means convinced that it is the best way out of the difficulty. I may say right here that I have no interest in and am not here hinting at any of the sectionalized-conductor schemes which have been exploited of late, or at any other time. The path of the art is fringed by their wrecks already, and newcomers must prove their right to succeed by most patient effort.

The solution of the problem that confronts the New York Central officials demands not so much new inventions as good, sound, hard-headed engineering skill, not afraid to take radical measures, if need be, and fully conscious of the importance of careful and thorough construction. The electrical conduit system of traction got black eyes without number for ten years or so, and finally won out, when its backers really backed it.

But our railway friends must not suppose that the adoption of any system of placing the working conductors will enable them all to wake up some morning and find a fully-grown traction system in operation. Railway operation is a fine art, and if the apparatus is changed, so also must be some of the methods. They can if they wish pick flaws in any electric system which human ingenuity could suggest, and are fully capable, if they have to, of taking that same system and making an operative success of it, if the motive power is all right. And the motive power can be made all right by methods now thoroughly tried, so that if they can not get good service they will have only themselves to thank.

In other words, from the engineering standpoint the tunnel and suburban service presents no serious difficulties, although, like most large problems, it involves some unwonted conditions. It can be accomplished without interruption of traffic, and offers the only full and permanent solution of the smoke problem, which has brought the whole matter into ungrateful prominence. It can not be done in a week, nor at a cost of $1.89 per rod, but it can be done thoroughly, and without unreasonable expenditure, for the benefits to be secured. The present situation is unworthy of the metropolis, and the progress which, in other respects, it represents. The existing nuisance is bound to be abolished in the near future, and with its exit will appear a new era in suburban rapid transit.

Louis Bell.

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Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the Journal *when of general interest, otherwise by letter.*

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It is always interesting to note the hold which conservatism has on modern practice, especially where the evolution of such practice can be followed step by step from its origin. An example of this tendency, in the development of the railway business, is shown in the construction of our car houses. Nearly all the original horse car lines were successors to omnibus routes, and in many cases took over the horses and houses of the old company. What was more natural, therefore, than that the cars should occupy the same place in the houses that the omnibuses had filled, necessitating extensions of the buildings as the service grew, and that after the advent of electric traction the same system of car "barns" should have remained? In the new car storage yards which we describe on another page General Manager Brackenridge, of the Brooklyn Rapid Transit Company, has made a radical innovation in street railway practice, the result of which will be closely watched by contemporary roads. It can be said in favor of this plan that the steam railroad companies have followed it successfully, and there is certainly a large saving of expense in building a yard of this kind and a practical immunity from fire. The Brooklyn Rapid Transit engineers claim that it is absurd that a car which is exposed to the weather one-half or three-quarters of its life should be housed under a shed the remainder of the time. The new car house, or yard, is certainly an innovation, and if cars can be kept "in the open" satisfactorily when not in use, the plan will be a popular one.

If the valuations placed on street railways by the tax assessors in New York State represented the true values of the properties in question, the owners would be very much richer than they now feel that they are. It is often very gratifying to have some outside party estimate the value of one's property higher than the owner himself considers that it is worth, but when this evaluation is made the basis for taxation, the action is a practical confiscation of private property, if the evaluation so reached is excessive. There can be no doubt that there is a growing tendency in the United States to shift the burden of raising municipal and State revenues from the individuals on to the corporations. This purpose was definitely announced by the State authorities of New York during the sessions of the last Legislature, and when that body adjourned it left a heritage of many corporation tax bills, while the regular State tax rate, as a consequence, was the lowest for many years. Such a course will naturally appeal to the majority of voters, who, as a rule, do not worry if some one else has to pay the greater part of their taxes, and is popular, also, with the tax collectors, as corporations can not as easily hide their property or claim nonresidence as can individuals. Street railway companies are necessarily particularly exposed to concerted attacks of this kind, not only because their property is absolutely irremovable from the State, but also because the idea has been generally fostered that they possess some peculiar privileges in the use of the streets, for which they have not paid, and that, consequently, any tax they may be assessed, no matter how large, is still an inadequate return for the "franchises" which they enjoy.

* * *

Although New York State in particular was referred to above as adopting an hostile attitude toward the street railway companies within its boundaries, it is by no means the only body which is taking this position. The same policy is being pursued in other States and cities, among others in Cleveland, where the subject has become acute during the past month. Here, under the direction of the new Mayor, Tom L. Johnson, an extended investigation has been conducted on the valuations of the different properties for purposes of taxation. Experts were called in, and last week, as a result of the hearing, the valuation of one of the properties was raised about 1000 per cent. By means of a temporary injunction the other road has prevented the assessors from increasing the assessment on its property, alleging the latter were prejudiced in the matter, and so could not give an unbiased opinion of its value, so that the subject will be transferred to the courts.

As the high-tax propaganda seems to be growing in extent, and as excessive demands from street railway companies are threatened in many quarters, it is well to consider the subject carefully. We believe that much of the persecution of street railway corporations in this way can be defeated at law, but it is also true that one aspect of the situation has not been given the attention which its importance deserves, either by the municipal or State authorities, or by the railway companies themselves. We refer to the serious question of the deterioration of all apparatus which is constantly going on, not only from use, but from the advances made in the art. Depreciation, as used in this connection, signifies more than maintenance or repair; it means in its broadest sense a constant charge against the property, and consequently a legitimate deduction from gross receipts before the true earning power of the property can be determined. It is hardly twelve years ago that nearly every important street railway was being operated by horses with 16-ft. cars and on 40 to 50-lb. tram rail; the only exceptions were where the enormously expensive cable railways had been installed. The change to electricity necessitated the abandonment of this entire investment, and while another such radical upheaval in street railway motive power seems now hardly possible, certainly in the immediate future, it is undeniable that improvements in track construction, rolling stock and other equipment are inevitable. Each year, then, reduces the value of the railway by (1) breakage, which is a measurable amount, and usually figures in the accounts as repairs; (2) by the reduction in the total life of each part, which is a less definite quantity, and can be called "depreciation from use," and (3) by the growing antiquity of the apparatus from improvements in the art, which amount is even less easy to calculate than the preceding, and can be termed "depreciation from age." It is these two latter items that have not been given the consideration which they deserve. If they appear at all in the annual statements, it is usually in an inconsiderable way, but they are paid for as actually as any other part of the equipment. An allowance for them at their true value should be made by those who wish to determine the real earning power of a property, and such allowance will often make a considerable difference in the net receipts.

Ever since the street car was introduced as a mode of conveyance in the public streets the courts in every State of the Union have rendered decisions upon the question as to what is the "ordinary use" of the highway. As far back as the early sixties the courts laid down the general proposition, that, as civilization advanced and new means of conveyance were adopted by the public, the uses to which the street might be put would necessarily be constantly and materially enlarged. Gas, water, steam and air pipes and electric wires all demand accommodation.

Judge Emott, of the New York Court of Appeals, said in 1863: "Any judge who should attempt to define such limits [of the ordinary uses to which streets may be put] by his own knowledge or experience at the present day, while he would no doubt go far beyond what his predecessor might have dreamed of a century ago, would, with as little doubt, be left far in the background in the progress of civilization and improvement, which is to take place in the hundred years to come." And later on in his opinion he says that the use of the horse car is not "inconsistent with the ordinary use of the street by common vehicles. * * * I do not attach any importance to the motive power [in that case it was horse-power]. It is said that the presence of the rails is dangerous, if not injurious to the horses and other vehicles, but so are various descriptions of pavements which are in more or less frequent use." (People *vs.* Kerr, 27 N. Y., 188). When the electrical roads were constructed the question arose between the companies and abutting owners as to whether the use did not impose an additional burden upon the street, and in almost every jurisdiction in the country except, perhaps, New York and Nebraska, it was held that they did not impose an additional burden, but that the poles and wires were "helps to the public in exercising their right of passage over the street * * * and they have been placed in the street to facilitate its use as a public way and thus add to its utility and convenience." (Halsey *vs.* R. R. Co., 47 N. J. Equity, 380.) So that now the general doctrine may be stated as it was in a Ohio case, as follows: "The main purpose of streets or highways being to facilitate travel and transportation, new and improved agencies for effecting that purpose must be presumed to have been in contemplation, in addition to those in existence when the ways were established." In this connection, of course, the courts will presently have to pass upon the question of automobiles and traction engines, and when these assume gigantic proportions or emit unusual noises, it will become a question of how far they promote ordinary travel upon the street, and of how far they impede it.

An interesting question arises where a bridge, viaduct or embankment is fitted for light traffic and perhaps even for heavy traffic, but proves inadequate to the strain imposed upon it by heavily-laden electric cars with their burden of metal contained in the motors and trucks. Is there an obligation upon the town to repair the bridges, viaducts and embankments and keep them up to the point of safety for such traffic on the ground that it is "ordinary traffic"? In most cases this question does not arise, because it is carefully provided for in the franchise or charter granted to the road when it receives the privilege of laying tracks. The question has been raised, but we are not aware of any decision bearing directly upon this question, and it may be that the courts will define "ordinary travel" somewhat differently when it arises in this way between the municipal or town authorities and the railway company from the definition they give to the same words when used in an action for an injunction brought by an abutting property owner because of the use of the street by a railway company. We are awaiting with some interest the result of controversies upon this question which are likely to presently find their way into the courts.

A Hundred Miles an Hour

Bluffing is the finest essence of the greatest American game; it is the trade-mark of the free West and the family motto of the effete East, and thus, perhaps, it is only natural that its all-abiding presence should have entered the electrical arts. It is now more than a decade since the ancient sages and prophets of electric traction shaded their eyes with trembling hands and spied in the dust of the horizon a space-devouring electric train with an eye

of flame and an insatiable appetite for watts. It was coming, they said, tossing the miles into a whirling trail of dust, and it were well to clear the track and get locomotives and other perishable bric-a-brac out of the way. Through the succeeding years we have been inwardly bracing ourselves for the triumphant entry of that hundred-mile-an-hour train. But we have waited in vain with the patience of St. Simon Stylites. The conversion of the trunk lines of this country to electric power has not yet come.

By this statement we mean in no way to minimize the enormous strides which the science of electric traction has accomplished during the last ten years. It has revolutionized urban and suburban transportation, and has brought with it a host of benefits to city and country dwellers which seemed absolutely unattainable a decade and a half ago. But it is undeniably a far cry from the largest electric railway enterprise at present carried out to the most modest of the high-speed projects that have been before the public eye. And the discrepancy between promise and fulfilment is one that should be explained. More than ten years ago the experiments of Crosby made it certain that electric traction at very high speeds was, as an engineering feat, entirely practicable, even with the means then at hand. His results in determining air resistance removed the only really doubtful factor from the problem, and the experience of more recent years with locomotives has confirmed these results in the fullest and most satisfactory manner. Further, no engineer is to-day disposed to deny that the electric motor has certain very marked and decisive advantages for such work. It renders the whole weight of the locomotive, or, with multiple-unit control, of the entire train available for traction, facilitates braking by the generator function of the motors, and greatly facilitates the reduction of dead weight to be dragged. At the present time there has been long enough experience with long power transmission lines to show that the continuous supply of large amounts of energy over long sections of line is a very simple and easy matter, and that the efficiency of such a transmission is high enough to utilize fuel more economically than is possible with locomotives, even setting aside the great advantage to be gained by the use of water power.

The cost of the conducting system, once a matter of very grave import, has subsided in these days of high voltages into comparative moderation, and is likely to subside still further. And finally, the trials carried out abroad within the past year or two have shown conclusively that energy at very high voltage can readily be taken to the motors by a flying contact with trolley wheel or shoe, so that the transmission line and the working conductor may be one and the same.

The fact is, that, with the light upon the subject now available, it is not too much to say that an electric train at 100 miles per hour not only is entirely practicable, but involves very little of an experimental character. One might almost go further and say that the only difficulties worth serious consideration are those involved in the track and roadbed, which, of course, are quite apart from the motive power, except as the electric motor has somewhat the advantage in the lessened pounding of the rails. Yet, in spite of all this, the high-speed electric road is to-day seemingly further from accomplishment in this country than it was seven or eight years ago. Abroad it seems to have been taken up with some prospect of success, particularly by the Studien Gesellschaft, an association of the German electrical companies, on the Berlin-Zossen line, and it would be far from surprising to see the first success reached on the Continent.

The reason for such a state of things is not altogether obvious. It apparently is a commercial rather than a technical difficulty that stands in the way, and the difficulty seems to be a curiously composite one. Are we to suppose that no one wishes to travel at such speed, or that, wishing it, the cost would be found to be prohibitive? Certainly we have seldom seen an American business man who wished to travel by a slow train if a faster were available, and the agreements between railroads as to rates plainly show that the public considers the quicker routes desirable, even if the difference in time be only 10 or 15 per cent. The same argument against higher speed has been used against every advance for half a century past, and in every case competition has forced the improvement and the public has welcomed it. As to the matter of cost, it is absurd to suppose that fast express trains would be running to-day if, everything considered, they did not pay. You can not convince the American public by any amount of juggling with statistics that the existing railroads are regularly running trains at a loss out of philanthropic enthusiasm. Directly or indirectly, good service pays, and it is fairly demonstrable that the cost of electric service at 100 miles an hour would not be largely in excess—per passenger carried—of the cost of the existing fast express service between large centers. Moreover, extra fares would be gladly paid for the sake of the time gained. Time is money to a business man, and if he could step aboard a train in Chicago at 5 p. m. and be landed in New York at 8 a. m., he would save an entire business day over the present trip. And the speed thereby implied would be considerably under the 100 miles an hour that seems a worthy objective point; in fact, less than 70 miles per hour, including stops.

In this hypothetical trip is perhaps the key to one of the problems of high-speed traction. Most of the fast electric lines projected have been of moderate length, and hence the total saving of time could not be very great. It would be easily within the bounds of possibility to establish a running time of an hour between Philadelphia and New York, yet the saving over the present trains would hardly be sufficient to count for much. On the other hand, a line from New York to Washington or to Boston would be worth the while, since a business day would be made available to the traveler from either terminus. *A fortiori*, the New York-Chicago line would meet a real want.

Another difficulty is the tremendous opposition that would be put up by existing railroads against the establishment of such fast service. But even this difficulty is not insuperable, for railroads now and then fall out, and some existing line may take the initiative. Some political economist has shrewdly remarked that when great combinations fall a-fighting the public gets square for all it has lost by their previous amity, and some turn of the wheel may bring the franchises for a great fast line into hands able and willing to utilize them. And perhaps our 100-mile-an-hour train may have to await such a fortunate chance, though the engineering part of the problem is practically solved to-day.

High-Speed Electric Traction Between Milan and the Italian Lakes

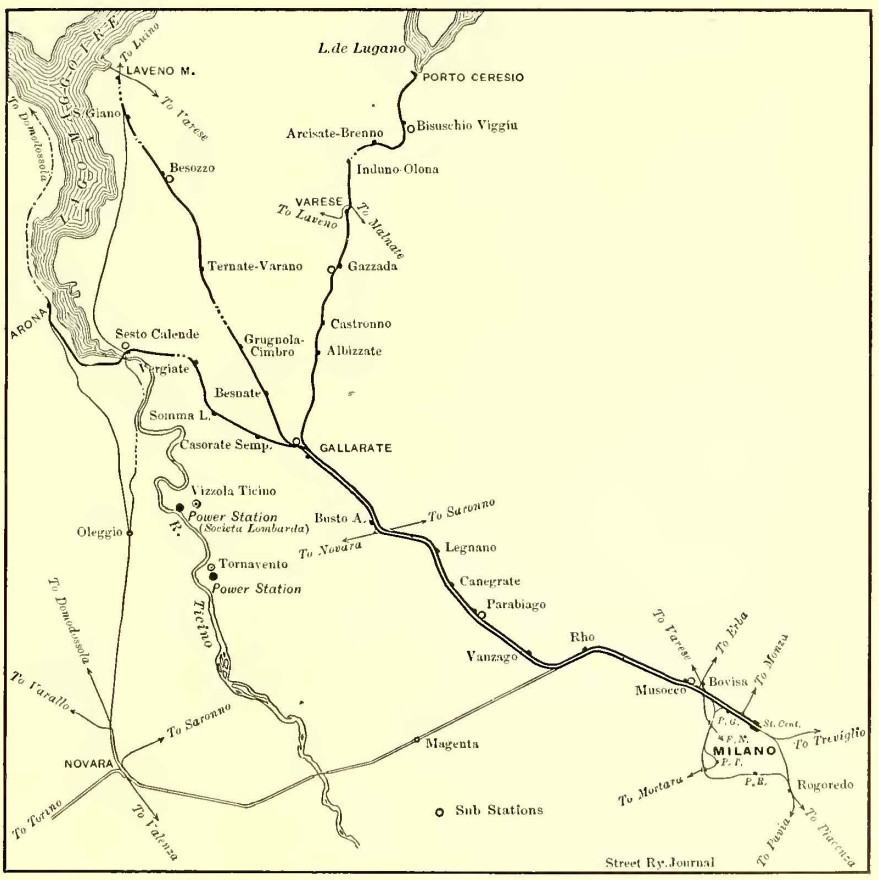
During the past few months several articles concerning various electric traction installations in the Kingdom of Italy have appeared in this paper, showing that not only are the number of urban installations rapidly increasing, but also that there exists a decided tendency on the part of the railroad companies to transform the more important of their secondary lines from steam into electric traction.

A STRETCH OF TYPICAL TRACK AND LINE

ONE OF THE SUBSTATIONS

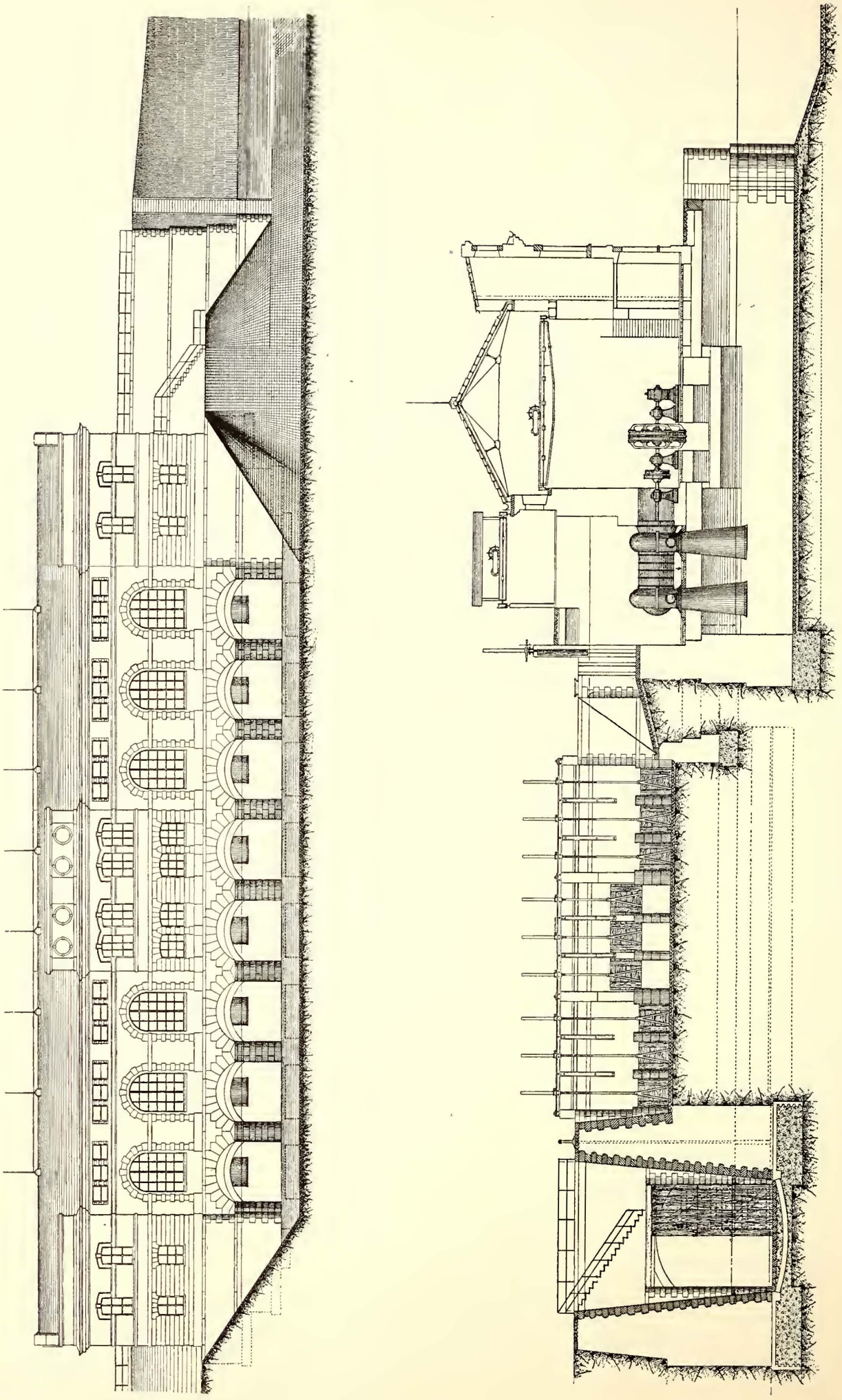
As far back as December, 1898, the Italian Railway Company (Società Italiana per la Strada Ferrata del Mediterraneo) opened an accumulator car service on the line between Milan and Monza, a distance of about 9 miles. This installation, however, was made more by way of experiment than anything else, in order to ascertain the practicability of this method of traction on secondary lines demanding an infrequent service. Since then more ambitious projects have been studied, with the object of introducing electric traction on lines of considerable length and importance, having a heavy passenger and freight traffic. Some of these schemes have been discarded for the present, as for instance, the Naples-Castellammare and the Giovi (Genoa-Turin) lines, but some others have been carried out, or are at present under consideration or construction. On the Bologna-San Felice line, a distance of 26 miles, a service with accumulator cars has been started quite recently, and the electrification of the lines Lecco-Sondrio (Adriatic Railroad Company) and Milan-Varese-Porto-Ceresio (Mediterranean Company) is now taking place.

This impetus to the introduction of electric traction on existing steam roads is due, in a great measure, to the possibility of utilizing the hydraulic resources in which Italy abounds. The various railroad companies are especially favored in this respect, as the government, which is the proprietor of all the large railroad lines, the exploitation of which it sublets to private companies, has passed a law by which all demands for new concessions of water power must be approved by the Ministry of Finance. Before such concessions are granted, the railway authorities are consulted, and have the right to reserve the whole or part of the water power in question, if the possibility of utilizing it for some future electric railway installations can be shown. From an engineering point of view this transformation from steam to electricity seems a wise measure when one considers the high cost of coal, which must necessarily be imported from abroad. As the cost of developing the water power will be comparatively small in most cases, rapid progress will undoubtedly be made in the near future in introducing electric traction, even on long trunk lines, which may be within a practical zone of transmission.



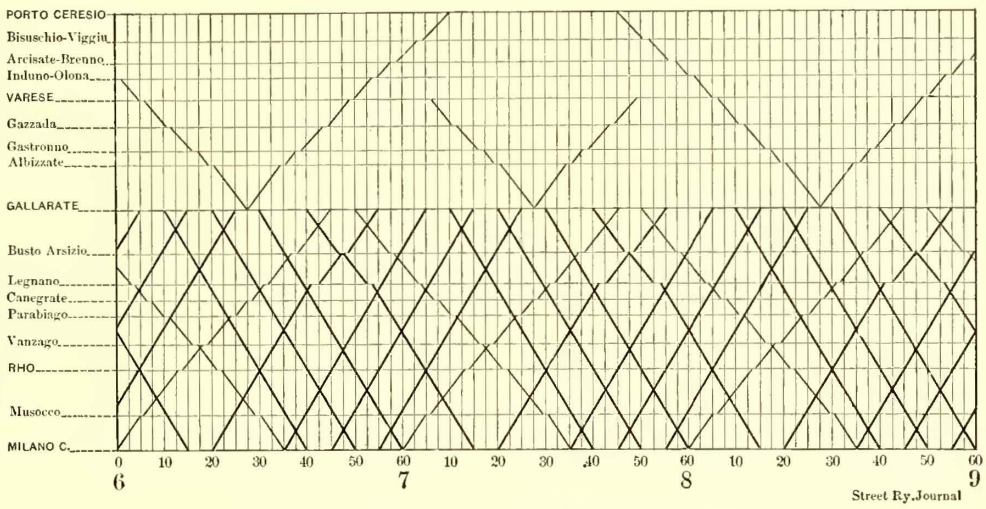
MAP OF MILAN-GALLARATE-PORTO CERESIO RAILWAY

The company, "Strada Ferrata del Mediterraneo," which operates the railway lines in the western half of the Italian peninsula, realized some time ago that radical measures would have to be adopted to meet the ever-increasing passenger traffic on the line connecting Milan, Gallarate, Varese and Porto Ceresio. This road is the main outlet from Milan to the most important industrial district of Northern



SIDE ELEVATION AND SECTION OF HYDRAULIC PLANT

Italy, and the densely populated lake district around Lake Maggiore and Lake Lugano, a line demanding a frequent and rapid service, especially throughout the summer months. It was mainly due to the initiative of Commendatore Guiseppe Oliva, the director general of this company, that the adoption of electric traction on this line was decided upon, and after due consideration, the government and railway authorities approved and indorsed the project of a rotary-converter sub-station and third-rail system worked out and presented by the Compagnie d'Electricité Thomson-Houston de la Méditerranée, a company affiliated with the General Electric Company, of this country. This scheme did not include the construction of a central station, as it was planned to buy the necessary power from an hydraulic plant, which was to be installed by a private company. Since then, the railway company itself has decided to develop the power of the Ticino River, placing the central station at Tornavento. As, however, it will take some time to complete the hydraulic installation, a steam plant is to be started this summer. All electric machinery for the central station, sub-stations and motor equipments were manufactured by the General Electric Company.



DIAGRAMATICAL TIME TABLE

THE LINE

The steam railroad line, Milan-Gallarate-Porto Ceresio, which has been transformed to electric traction, has branch roads from Gallarate to Laveno and Arona, which will be electrically equipped next year. High-tension transmission lines run from the central station at Tornavento to five rotary-converter sub-stations, along the line supplying current to the third rail..

Data such as total or partial distances, grades, etc., can be found in the following table:

TABLE SHOWING DISTANCES, GRADES, ETC.

Stations	Distances in km	Distances in miles	Average grade	Maximum grade	Minimum radius of curves
Milan	0	0	%	%	
Musocco	5.88	3.67	.153	.2	
Rhò	13.54	8.46	.230	.4	800 m. (2625 ft.)
Parabiago ..	22.55	16.09	.330	.6	
Legano.....	27.98	17.49	.460	.6	
Busto	33.10	20.69	.330	.6	
Gallarate ...	40.30	25.19	.222	.6	
Gazzada	54.31	33.94	.850	1.0	
Varese	58.74	36.71	.473	1.0	
Bisuschio ...	68.61	42.88	.292	1.2	300 m. (984 ft.)
Porto Ceresio	73.02	45.64	1.52	2.0	

From Milan to about 3 miles beyond Varese the line rises continually; from this point on to Porto Ceresio the line descends rapidly.

OPERATION

In order to amply provide for the increase of passenger traffic to be foreseen, the entire converter system has been laid out to correspond to a maximum train schedule. This schedule, however, will not be enforced this year, since the temporary central station will not have sufficient capacity to furnish power for such a load as is assumed.

Each train will be composed of two cars of the type shown in the illustration, one being a motor car, the second a trailer. The seating capacity of each car is sixty-three, standing room being twelve for the motor car, and twenty-seven for the trailer, making a total of 165 passengers per train. The weight of the motor car when fully loaded will be about 43 tons, and that of the trailer 30 tons, making a total maximum train weight of about 73 tons.

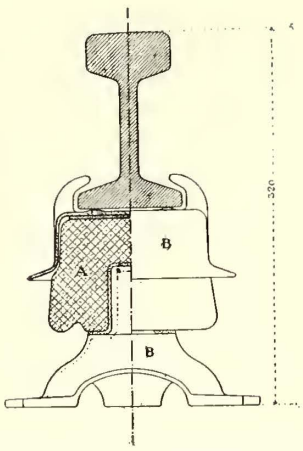
From the proposed train schedule the distance between Milan and Gallarate (25 miles) must be covered by an express train in thirty minutes, making a commercial speed between these two points of 50 miles per hour, and a possible maximum of 55 miles to 60 miles per hour on an average up-grade of .284 per cent. On account of the steeper grades and lighter track construction on the line from Gallarate to Porto Ceresio, trains will run at half this speed after leaving Castronno. The schedule and train composition above mentioned are based on the maximum traffic to be expected, such as on holidays and Saturday and Sunday suburban service during the summer months. The motor car alone, with a reduced schedule, will, in all probability, suffice for the demand of ordinary days and winter traffic.

THE STEAM GENERATING PLANT

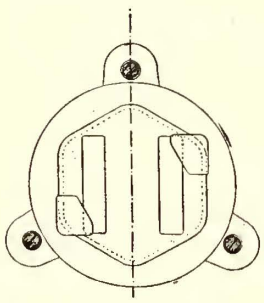
The steam engine plant erected at Tornavento is so located as to adjoin that of the water power plant, which is to eventually furnish power for this installation and others in the neighborhood, and when the latter is finished the steam installation will act as reserve. The boiler plant consists of eight multi-tubular boilers, working at a pressure of 180 lbs. per sq. in., three batteries of economizers, two duplex pumps and accessories.

The three steam engines are of the Corliss type, horizontal tandem-compound, and capable of developing 1410 hp, at a pressure of 165 lbs., with an admission of 27 per cent in the large cylinder. The inside diameters of cylinders are: High pressure, 0.725 m; low pressure, 1.200 m; stroke, 1.35 m. The engines run at 94 r. p. m.

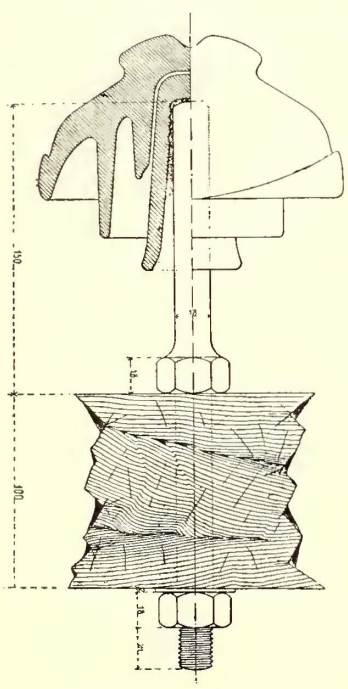
To guard against possible "hunting" of the generators when working in parallel, and in order to remain within as small a limit as possible of angular variation compatible with good construction, a heavy fly-wheel, weighing 36 tons, with a diameter of 18 ft., is placed on the shaft of each engine. Should this precaution not be found adequate to prevent hunting, the governor of each engine can be provided with a special arrangement, making it comparatively insensible to instantaneous fluctuations of load. The running of alternators in parallel when direct coupled to tandem instead of cross-compound engines will probably give some trouble to the engineers, and the operation of the plant will, therefore, be watched with considerable interest. Two small vertical tandem compound-engines



HALF SECTION AND SIDE ELEVATION OF ONE FORM OF THIRD-RAIL INSULATOR

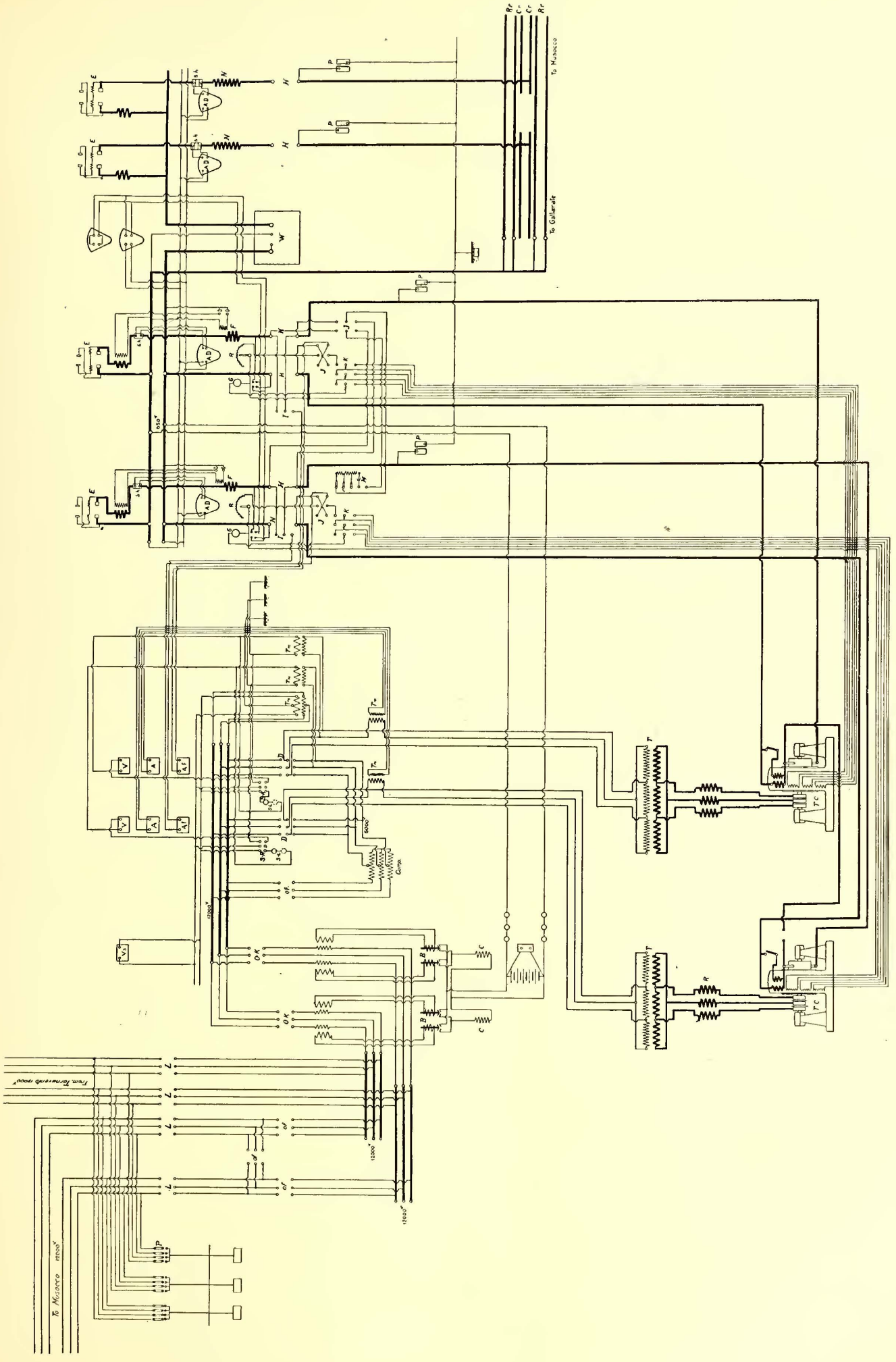


PLAN OF THIRD-RAIL INSULATOR SHOWN ABOVE



HALF SECTION AND SIDE ELEVATION OF TRANSMISSION LINE INSULATOR

DIAGRAM OF CONNECTIONS OF CENTRAL STATION SWITCH BOARD

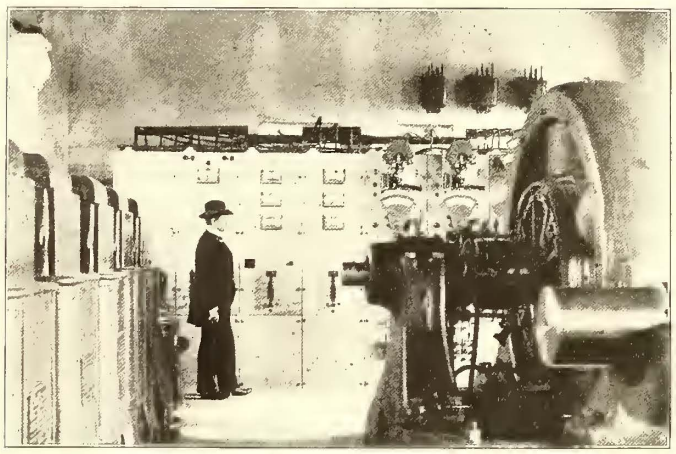


DISTRIBUTION DIAGRAM OF SUB-STATIONS

serve to drive the exciters. They are run at 270 r. p. m., and are capable of developing 85 effective horse-power at a pressure of 165 lbs.

The entire steam engine plant was furnished by the Italian manufacturing company, Franco Fosi & Company, of Lugano.

To each of the large steam engines mentioned above is directly coupled a three-phase alternator of the revolving field type, capable of giving a normal output of 750 kw, with non-inductive load, overload of 25 per cent for two hours and an instantaneous overload of 40 per cent. The field winding is distributed over thirty-two spools, giving, at the normal speed of 94 r. p. m., a frequency of 25 cycles per second. The armature is wound to generate 13,000 volts directly. To each of the two vertical steam engines is directly connected a six-pole direct-current generator of



INTERIOR OF SUB-STATION, PARABIAGA

75 kw normal output, and 125 volts, which are used as exciters.

The high-tension conductors, which connect the generator armatures to the switchboard, run underneath the floor, supported on porcelain insulators. The switchboard is composed of nine panels, of which one is for the two exciters, three high-tension generator panels, one totalizer to measure the total output of the station, and four line panels, that is, two panels for each of the duplicate transmission lines running to Gallarate and Parabiago. A lever-operated oil circuit-breaker for 13,000 volts is placed in the circuit of each generator. No fuses of any kind have been introduced into the high-tension circuits. To guard the station against short-circuits, or overloads from without, each out-going line panel is provided with a lever-operated oil circuit-breaker, having attached an automatic overload device, which trips the circuit-breaker, opening the circuit when the current on the corresponding line exceeds a predetermined limit. These switches are of the plunger type recently developed by the General Electric Company. All oil switches are placed in fireproof compartments, about 4 ft. behind the panels, and operated from the front of the board by means of a system of levers passing underneath the switchboard gallery.

By the ample use of potential and current transformers for the instruments, all danger connected with the manipulation of high-tension currents has been removed from the front of the board.

The station is protected against lightning by 15,000-volt lightning arresters of the Wirt metallic ball type.

HIGH-TENSION TRANSMISSION LINES

The high-tension transmission construction is nearly all made in duplicate. From Tornavento two three-phase lines, consisting of No. 3 B. & S. wire, strung on wooden poles, run across country to the Gallarate sub-station. From Tornavento to Parabigo the transmission line is also in duplicate, the wires here being about No. 00. The duplicate lines running from Gallarate to Bisuschio are of No. 6 wire, and from sub-station Parabiago to the station of Rhò about No. 3. These lines are run alongside of the railroad tracks. At Rhò the latter line proceeds to Musocco over private property.

In order to render possible the cutting out of any one of the duplicate lines between any of the sub-stations, while power is still on, in case of a ground, broken wire, etc., the lines running into and out of the sub-stations at Gallarate, Parabiago and Gazzada are led through lever-operated oil circuit-breakers of the knife-blade type. Although the region covered by this railroad is visited by frequent and severe thunderstorms, especially around Varese, it was thought sufficient to protect the high-tension lines at the various sub-stations only. Calculating with the maximum load to be expected at the sub-station with a maximum service, as proposed in the official schedule, the CR drop between the extreme sub-stations of Bisuschio and Musocco, with the duplicate lines in parallel, will be about 9.5 per cent, and the maximum CR drop, taking the starting currents into consideration, will probably not exceed 12 per cent to 13 per cent.

SUB-STATIONS

In all there are five rotary-converter sub-stations located at convenient points along the line. In the case of the sub-stations at Gallarate, Parabiago and Musocco, the high-tension current entering the sub-station proper, that is after leaving the double high-tension distribution bus-bars, is led from either one of these bus-bars to one or the other of two automatic high-tension oil circuit breakers.

After leaving these switches the current goes directly into the primaries of the transformers, in case the rotary converters are running, or, if the rotary converters are being started up from the alternating-current end, the current first traverses the starting compensator. There are seven air-blast transformers (one in reserve) in each of these stations. Each has a normal output of 180 kw, and reduces the high-tension voltage of 12,000 volts to 420 volts. The current passes through reactive coils before entering the rotary converters, where it is transformed to direct current at a tension of 650 volts.

In each of these three stations there are two 12-pole rotary converters of 500 kw normal output, 25 per cent overload for two hours, and 40 per cent instantaneous overload. Their speed is 500 r. p. m. Each converter circuit is connected to a separate bank of transformers, so that no switches have been introduced into the circuits.

The switchboard contains a direct-current panel for each converter, including the usual regulating apparatus and switches for the starting rheostat.

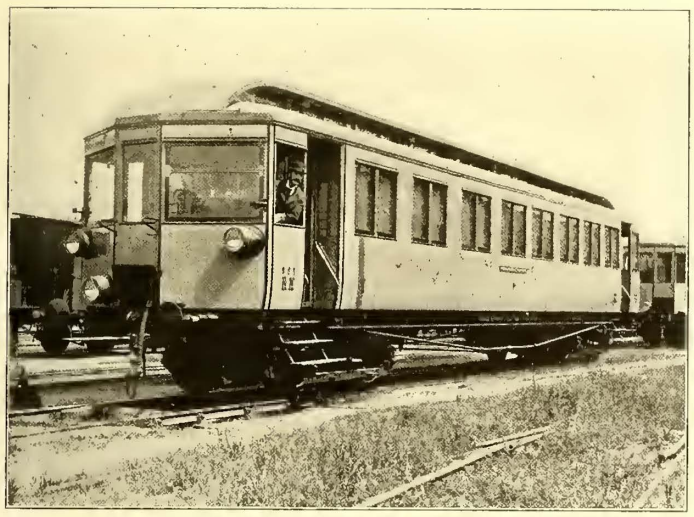
The current is led from the direct-current bus to one total output panel, and from thence distributed to the third rail by two feeder panels. On both the direct-current, rotary-converter panels, as well as each of the feeder panels, there are automatic circuit breakers of the magnetic-blowout type, thus completely guarding the station against overloads or short circuits on the direct-current system. The same arrangement as in the central station of placing the oil switches in fireproof compartments, and eliminating all danger of high-tension currents from the front of the switchboard, has been followed in the sub-stations.

The fields of the rotary converters are provided with both series and shunt windings. The shunt field is divided into four different sections, so as to reduce the effect of the high voltages which are induced in the fields when the

armature is started up from the alternating-current side. Provisions have been made to enable the starting up of a converter, either from the alternating-current or direct current sides, as the case may require.

One of the illustrations shows a part of the interior of the Parabiago sub-station. The capacity of the converters was planned sufficiently large to enable one machine in each of the three larger sub-stations to take care of the ordinary service, the second acting as a reserve in case of a breakdown or during moments of maximum service.

The original project of the entire installation was based upon a maximum train weight of 65 tons. In consequence the Gazzada and Bisuschio sub-stations were laid out to contain one 250-kw rotary converter, 750 r. p. m., four oil-



A MOTOR CAR

cooled transformers (one as reserve), reactances, compensators, etc., necessary switchboard. The general arrangement of switches and connections, etc., is the same as that of the larger stations. The railway company then decided to increase the train weight from 65 tons to 75 tons. While the capacity of the three larger sub-stations was sufficiently great to permit of the increase, this was not the case with the two smaller sub-stations, and as the load on the latter will be intermittent and fluctuating, it has been thought better to install a 275 amp.-hour storage battery in both Gazzada and Bisuschio. Inasmuch as the rotary converters were compounded to give a constant direct-current voltage, a motor-driven booster had to be inserted in series with the battery to give the necessary regulation.

The batteries and boosters were furnished by the Tudor Accumulator Company, of London.

ROLLING STOCK

The car bodies and trucks were designed by the engineers of the railroad company, and built by the Officine Meccaniche, of Milan. There are to be twenty motor cars, and as many trailers, all of which will be divided into separate compartments. Each will contain two first-class compartments, one a smoking compartment, having a seating capacity of sixteen places, the other a non-smoker of eight places; two third-class compartments, one having a seating capacity of twenty-three places for smokers, the other sixteen places for non-smokers; and two vestibules at each extremity of the car furnishing standing room. In the case of the motor car, these vestibules are divided into two parts, one reserved for the motorman, the other as standing room for passengers.

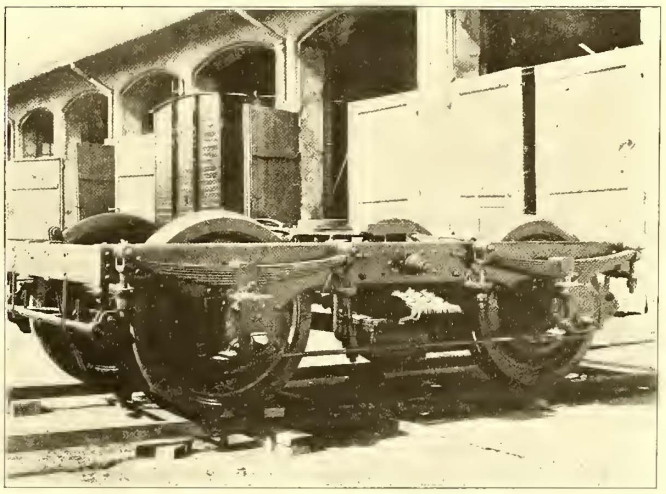
The motor and controller equipment of each motor car consists of four G. E.-55 motors, with two L-3 controllers, two automatic circuit breakers, etc. The rating for each motor is 160 hp for one hour, with a rise of 75 degs. Cent., at 500 volts. This would be rather a large amount of power for trains of this size, if it were not for the high speeds of 55 miles to 60 miles per hour, which the trains will have to maintain for the greater part of the distance between Milan and Gallarate, and the numerous stops and rapid acceleration necessary. To give a greater security against damage from overheating, the armature coils have been mica insulated. A complete Westinghouse air brake equipment has been provided for each car, consisting of a motor air compressor set of 4 hp, and two large reservoirs, with the necessary accessories. A small cylinder is also connected to this system to provide air for the whistle.

The contact shoes, which collect the current from the third rail, are supported by an iron beam, fastened to the journal boxes of the trucks, the desired stability being thus assured. As the third rail is placed only on one side of the track, a contact shoe is provided on either side of each truck. Where there are comparatively short interruptions of the third rail, due to switchings and cross-overs, contact with the third rail for at least one of them is also assured.

Three incandescent lamps, with reflectors, have been provided for either end of the motor and trailer cars, to serve as signal lights. The rule has been established that two lamps should be lighted at the head of each train and three at the rear. A simple scheme of connections and switching makes this possible, either when the train is composed of two cars or of the motor car alone.

THE TRACK AND THIRD RAIL

The contact rail, by means of which the energy is supplied to the motor car, consists of an ordinary T-rail, 90



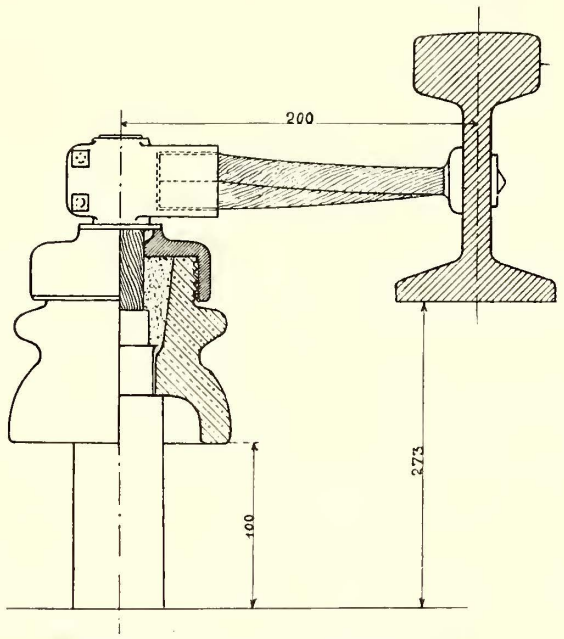
TRUCK FOR HIGH-SPEED CARS

lbs. per yard, 38 ft. in length, placed alongside of the track and supported at intervals of about 12 ft., on "reconstructed granite" insulators.

The rail is placed on the iron cap of the insulator in such a manner as to give sufficient playroom to allow for the longitudinal displacement due to expansion and contraction of the rails, as well as the slight vertical displacement of the insulator when the wheels of the train pass over the corresponding cross ties. The rails are connected by a flexible copper bond of a section of 200 sq. mm, distance between center of heads being 6 ins. To guard against the creeping on grades, ten rail lengths are tightly fastened together by fish-plates, and anchored at the middle point. To provide for the expansion and contraction, due to the variation of temperature for such a length of rail, specially flexible bonds are placed underneath the fish-plates at the extremity of each section, giving a maximum play of 3½

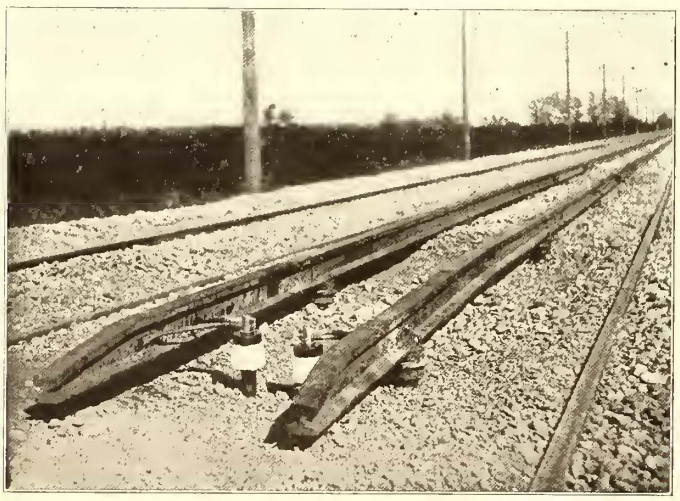
ins. On the section Milan-Gallarate, where the line consists of two tracks, the two third rails are cross-connected at intervals of 300 ft. to 350 ft., by 0000 B. & S. solid crown bonds. In crossings and switchings, where the rail has necessarily to be interrupted, the continuity of the circuit is maintained by a 400 sq. mm armored cable.

The ratio of conductivity of the third rail, as compared



ONE TYPE OF THIRD-RAIL INSULATOR

with copper, is 1 to 11. No feeders have been provided, the various sub-stations feeding directly into the third-rail system. At each sub-station the third rail is sectionalized, each side being fed from its corresponding feeder panel. All the sub-stations will thus work in parallel on the direct-current side, as well as on the high-tension alternating side. Therefore, it may happen that, should the high-



CONNECTIONS BETWEEN THIRD RAIL AND UNDERGROUND CABLES

tension circuit be automatically opened in one of the sub-stations and the direct-current circuit remain closed, the rotary converters of the station would draw current from this third rail, and start to run as direct-current motors with the series field in opposition to the shunt. To eliminate this source of danger, a reverse-current relay has been attached to the automatic circuit breakers on the direct-current converter panels, which, by means of an auxiliary shunt coil, trips the circuit breakers when the current tends to reverse its normal direction of flow.

The track is laid with rails weighing 72 lbs. per yard, placed on wooden cross ties. The length of rails for the new track laid between Rhò and Gallarate is 38 ft., the remainder have a length of 30 ft. The rails are bonded with single 0000 B. & S. solid crown bonds, and the rails and tracks cross-connected with the same size of bonds, at intervals of 325 ft.

The conductivity of the track rails varies from 1:11 to 1:13.5 that of copper.

The roadbed between Milan and Gallarate is well ballasted, and comparatively strong, lending itself very well to a high-speed service. Beyond Gallarate, however, high grades and frequent sharp curves make high speeds prohibitive.

Electric Railway Construction in New York State

Attention is again being called to the rapidity with which applications for franchises for electric railways are being made through the central part of New York State, and the possibility of enjoying, at no far distant date, a trip from New York to Buffalo by trolley. In fact, every part of the State is experiencing a boom in electric railway construction.

The electric railways are creeping up the valley of the Hudson River toward Albany, and already there is a road from Albany to Hudson. The Railroad Commissioners have granted an application for the construction of a road between Albany and Pittsfield, Mass., and at the latter place this road will connect with a line to Boston. Albany is connected with Lake George by an electric railway, and westward of Albany the electric railways are creeping in fast between it and Buffalo and toward Cleveland. The new Albany and Schenectady line is nearly completed, and the Schenectady and Amsterdam lines will soon be connected, work on this line being in progress. Work is also going on between Fonda and Amsterdam. Utica, with its suburban roads, within a few months, it is said, will have an electric line extending as far eastward as Little Falls. Then a line goes northwestward from Utica as far as Oriskany, and will soon reach Rome. The local company at Oneida intends connecting Rome and Syracuse. The Monroe County Electric Belt Line Company intends to build a line from Rochester to Fairport, 10 miles on the road to Syracuse, and from Rochester, the Buffalo, Rochester & Niagara Falls Electric Railway, which recently received the authority of the Railroad Commissioners, will be a line to connect Buffalo, Rochester, Niagara Falls and other points. Beyond Buffalo there are two lines to Hamburg, and it is reported that one of these lines will be extended to Angola and Silver Creek, while the Dunkirk line may be extended toward Buffola.

Emergency Service on the Brooklyn Rapid Transit

President J. L. Greatsinger, of the Brooklyn Rapid Transit, has approved plans for a number of emergency stations, to be built by that company in various sections of Brooklyn and the outlying districts. These stations are to be used as headquarters for the emergency crews, composed of repair men and linemen employed by the company. The first of the new stations is to be built on Flushing Avenue, between Nostrand and Marcy Avenues, on the site of the old Flushing Avenue car houses.

The buildings will all be of one general design, and fitted up with all the latest appliances and appurtenances for the purposes for which they are intended. On the ground floor will be room for two emergency wagons and stables for horses. Several automobile emergency wagons have also been contracted for and are under construction.

The Interurban Electric Railways of Ohio

BY GEORGE S. DAVIS

The spirit of electric railway building is pervading the entire country, hardly any section having a considerable population being without some projects of this kind, but it is claimed, and with good reason, that in no other section has the development reached so promising a stage as in Ohio. Unless there is a reaction against electric railway enterprises, and this contingency is not feared for some time to come, it is claimed that within two or three years the electric railways of Ohio will closely rival in mileage the steam roads of that State. This may seem an astonishing proposition in view of the fact that Ohio ranks among the first States in the Union in respect to railways, having something like 9000 miles of steam road in operation, but a glance at the accompanying map and the consideration of a few figures on the subject will prove that the statement is not far from correct. At the present time there are in operation in the cities and towns of Ohio 898 miles of electric railways; Cleveland and Cincinnati each having over 200 miles of track, and Toledo and Columbus about 100 miles each. Of the interurban roads running from one town to another there are in operation, according to latest estimates, 868 miles, while there are in actual process of construction no less than 1435 miles of road. Before referring to the roads which are being projected, it will add weight to these figures to consider a bit of information furnished the writer by the Secretary of State, who has charge of all incorporations. He states that from Nov. 15, 1898, to Nov. 15, 1899, there were incorporated in Ohio forty-two railways, with capital stock amounting to $15,666,000; increase of capital stock for the same period, $2,180,000; Nov. 15, 1899 to Nov. 15, 1900, thirty-three railways, with $10,352,000 capital stock, and $5,915,000 increase of capital stock, and from Nov. 15, 1900, to July 1, 1901, sixty-nine railways, with $25,579,000 capital stock, and $8,947,000 increase of capital stock. The aggregate of the above indicates that in less than three years, 144 companies, with $51,597,000 capital stock have been organized in Ohio to build electric railways in that State, not to mention several which have been incorporated in other States for the same purpose, while various companies interested in the business have during that period increased their capital stock $17,042,000. As many of the companies now operating lines in Ohio were organized prior to 1898, it will be seen that the vast majority of projects are still incomplete. Of course there is no doubt that a number of these companies have already dropped out of the field, but after careful researches, covering a period of nearly two years, the writer figures that franchises and rights of way have been secured or are being secured for 4800 miles of road on which no work other than surveying, and in some cases grading, has been done. Of course, it is not claimed that all of these projects will be carried out; far from it. Hardly a week passes but there are reorganizations or consolidations, but the fact remains that every portion of Ohio, excepting possibly a small section of the central portion of the State, which is very hilly, and a strip through the southern portion, which is sparsely settled, is being crossed and recrossed by electric railway projects.

In some portions of the State, notably in the northern central portion and in the vicinity of Cincinnati, there are more electric railway projects than could be kept track of by a United States census official. New companies are organized; they consolidate with some other project, and then they both give up the fight, and their places are taken by others. In some counties electric railway promoters are more numerous than tramps in hard times, and the situation is aptly described by a country newspaper, located in the northern part of the State, in this manner: "Electric railway men are thicker than flies in summer these days, and they appear to have entirely superseded the lightning rod agents of former days. The progressive farmers in these parts all have special rooms set for conferences with railway promoters, and hardly a day passes but they are called into use. A well dressed stranger drives up, and the farmer at once ushers him into the conference room, where paper and pen are kept. The right of way through farm or along highway is signed, and the promoter passes on to the next with neatness and despatch. Thus far nothing has been seen of cars hereabouts, but if the farmers keep on granting rights of way, it is hoped that some day the real thing will materialize."

In a number of places there are two or more companies fighting for the same route; some of them having actually commenced construction work. Up to a few days ago there was a route between Tiffin and Port Clinton, which was being fought for by three different companies. Each was determined to build, and each had crews of men at work grading. It is understood that two of them have now so far secured the advantage over the others that one of them agreed to sell out. Within the last two or three weeks no less than four companies have sold out or reached amicable agreements with rival companies, so that only one line will be built. On the other hand, there are at present a number of routes which are being built by two or more strong companies, which show no sign of yielding, having announced that they will build and operate their lines, no matter what is done by rival companies. It would seem that the only logical outcome of such rivalry is consolidation, as it has already been proven in one or two instances in this State that two lines between the same points are not profitable; it was only very recently that two roads which have been in operation for several years consolidated because neither was paying. Electric railway financiers of long experience say that no matter what may be the population of two towns, they would not consider it a good investment to parallel a road which is in successful operation, since the operating line can, at a comparatively small expense, increase its facilities to take care of all possible demands, whereas the new line must build from the ground up.

The strong rivalry for territory is bound to have one good effect, however, and that is, it is tending to improve the character and construction of new lines. It is safe to say that one-half of the lines now projected in Ohio are being promoted by people who have little or no capital. The promoters secure the consents of property owners, get franchises from towns and counties, make preliminary surveys, and then appeal to the financiers. If the project is taken up, and the road is built, the promoters secure a block of stock, and perhaps good positions for their trouble; if not, their grants soon expire, and they are out their time and expenses. For this reason it is now a question of presenting to the capitalists the most inviting proposition. Time was when a franchise for a line along the highway was eagerly sought for, but these days a private right of way through farms, or, at least, along the highway inside the fences is generally demanded. Options are secured on the private right of way, and if the road is built, it is bought for all time, whereas the highway franchises are usually granted only for twenty-five years. To permit of competition with the railways, high speed is necessary, and this can only be obtained on private right of way. On the whole, the "pike" roads are rapidly falling into disrepute, and it is probable that few of them will be built in the

future. Some of the latest examples of electric railway construction in this State, compare favorably with the best steam roads. Lines are now being built which are carefully graded and ballasted; 60-lb., 70-lb., and, in some cases, 80-lb. rails are used, and curves and grades are practically eliminated. Roads which will operate at 60 miles and 70 miles an hour, with third-rail system, with through sleeping and dining cars, are being freely talked of, but they are still for the future.

For the present the more conservative and successful lines are satisfied with from 30 miles to 35 miles an hour, with little or no attempt to compete for time with the steam roads. In this connection it might be stated that the ideas of various promoters appear to differ widely on the question of the future of electric railways. By some it is claimed that the day is not far distant when electric lines will be operating through trains with sleeping and dining cars, and will compete in every respect with the through steam trunk lines, and it appears that a number of projectors are building with such plans in view. On the other hand, many practical electric railway people claim that the traction lines are opening up a field which is entirely distinct and outside the province of steam roads. It is claimed that, except in a limited degree, the traction lines are not, and never will be, in competition with steam roads, but that each has a distinct field, which will be worked hand in hand. It is claimed that the majority of electric lines now in operation serve as feeders to the steam roads, taking care of a class of business which, while it has heretofore, through necessity, fallen to the steam roads, has never been profitable, and is one which they are now more than willing to turn over to the new industry. Such a statement may be contrary to the general belief that the traction lines are making deep inroads into the profits of the steam roads, and in this respect a recent interview with a high official of the Lake Shore & Michigan Southern Railway, one of the leading trunk lines, is of interest. He said: "If trunk lines could abolish short hauls and frequent stops, it would mean money in the pockets of stockholders. The short haul is a drain, and if the electric roads will take care of this class of business, it will prove a boon to us. I believe the ideal arrangement would be to have the electric roads act as feeders to the steam roads. Travelers could be brought from the towns into the larger cities on the electric cars, and take through fast trains for distant points. In Cleveland, for instance, we would be glad if an arrangement could be made with the traction companies to bring into the city passengers from points within 50 miles or so, in order that it would not be necessary to stop trains between, say, Erie and Cleveland and Cleveland and Toledo. The frequent stops between these points by some of our trains cost us more than the additional traffic amounts to."

Unfortunately for the steam roads, however, they are not all trunk lines, and it is doubtful if the managements of some of the shorter and less important lines which are bound to lose much of their business to the traction lines will coincide with these views. While it will relieve them of passenger business, which may or may not have been profitable, it will also take away from them a large amount of freight business.

Under a recent decision of the Supreme Court of Ohio the carrying of freight through city streets, where franchises have been secured, was declared perfectly legal, and nearly all the roads in operation are now employing combination cars, and hauling large quantities of package freight. A number of roads have recently inaugurated exclusive freight car service, and this branch is proving a profitable and important factor in the business of nearly all lines; the writer has in mind a road in which the package freight business furnishes one-third of the gross receipts. Where this practice will end, no one seems willing to predict. It is entering largely into the plans of every promotor of electric railways in Ohio at the present time, and that it is bound to draw from the steam roads much of the business which has been theirs in the past can not be questioned.

And it is a noticeable fact that the majority of the very people who at present contend that the electric roads are to act as feeders to the steam roads are projecting systems of traction lines, which, when connected, will give through lines, running clear across the State, connecting all the important centers. One of these systems is already over 300 miles in length, while there will be several which will be 200 miles or more long. It is said that it is not the intention at present to operate through cars the length of these lines, but it is clear that the day is not far distant when this will be done, and in order to compete for through traffic, no expense is being spared to provide perfect track and roadbed, and speedy equipment. One feature which has always hindered the speed of interurban roads is that in running into or passing through the larger cities the cars have been operated by the city roads on the same schedule as the local cars, so that it frequently happens that it requires almost as long to run the 5 miles or 6 miles into the center of the city as for 30 miles or 35 miles in the country over private right of way. In some of the cities, Cincinnati and Columbus, for instance, the interurbans have been kept out of the center of the city, because the city lines have a wide gage track, and declined to make satisfactory terms for an adjustment of the matter. In Columbus this has been obviated by an interurban company securing its own right of way through the city.

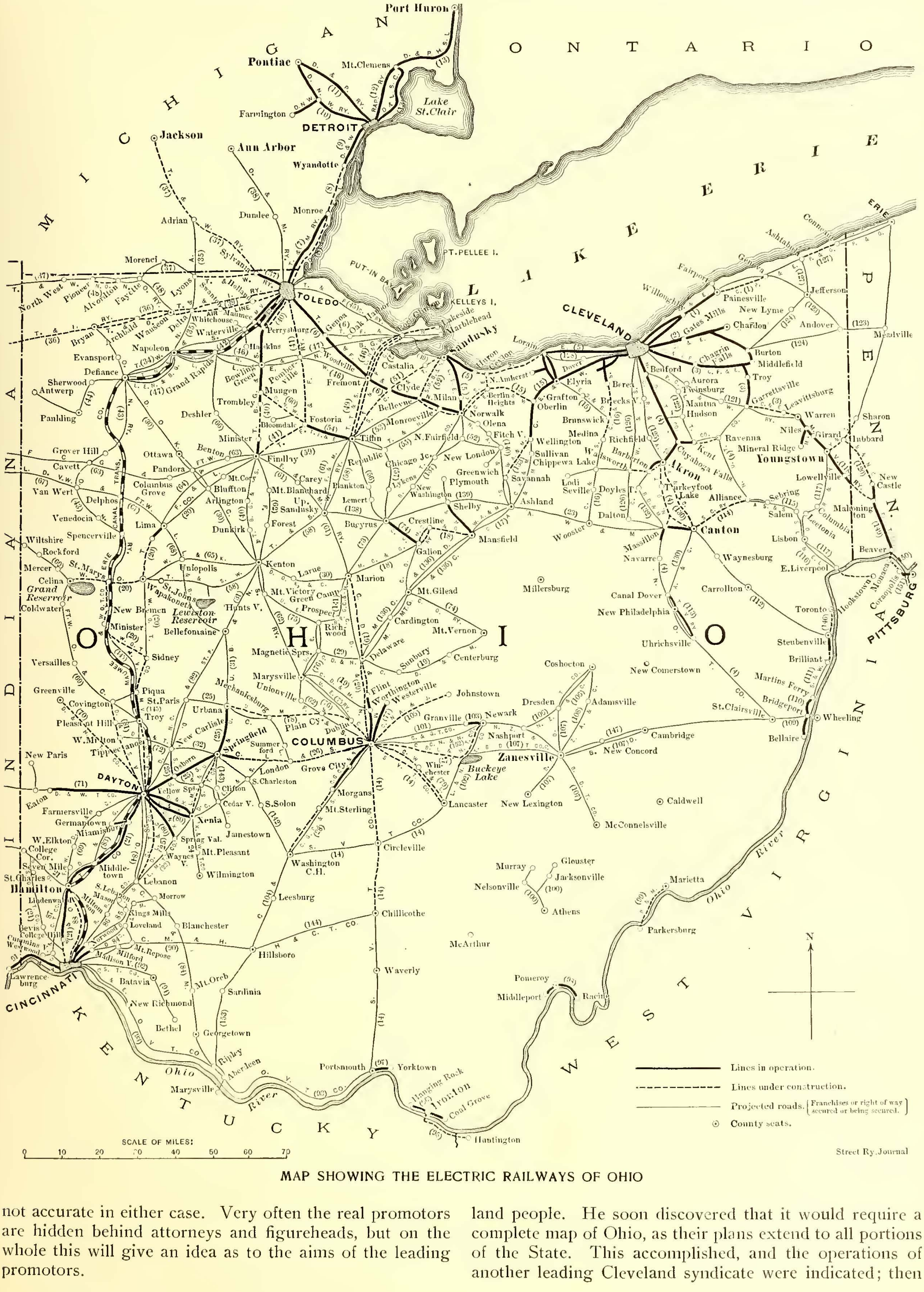
Many of the new electric railways are filling a long-felt want by opening up territory which has never been traversed by steam roads, while nearly all of them will prove of inestimable value in providing short cuts from one town to another. It will be noticed that the general trend of electric lines is from north to south, whereas the majority of steam trunk lines have an easterly and westerly direction; hence the electric lines are furnishing short routes between towns on different trunk lines, which heretofore have only been accessible by driving, or long and circuitous travel by railway.

In a word, the electric lines will tend to divert to the natural centers, business which heretofore has been forced to follow the steam roads, and in this way they are bound to be an all important factor in the development of the State.

Just at present the greatest retarding influence to this development is the inability to secure material promptly. Never, even in the palmy days of steam road building, has there been such a demand for ties, rails, etc. It is said that rails can not be guaranteed for delivery inside of six months, while car manufacturers and builders of engines, boilers and electrical equipment are requiring longer time on deliveries than ever before. Even labor is scarce, and companies which are pushing construction work would frequently employ twice as many men and teams if they could get them.

Before going into the subject of the various roads, it is well to state that this is not claimed to be an accurate and infallible review of the situation in Ohio. It is safe to say that nothing of the kind could be compiled at this time, since, as has been intimated, the majority of projects are still in an embryo stage, and the severe competition for territory makes promotors extremely backward about outlining their plans. Sometimes, however, they take the

other tangent and describe their project as through a powerful telescope; then they reverse the telescope and describe the efforts of rival promotors. Naturally they are



MAP SHOWING THE ELECTRIC RAILWAYS OF OHIO

not accurate in either case. Very often the real promotors are hidden behind attorneys and figureheads, but on the whole this will give an idea as to the aims of the leading promotors.

An article on Ohio electric railways was first suggested to the writer in an attempt to draw a map showing the operations of a large syndicate, which is headed by Cleveland people. He soon discovered that it would require a complete map of Ohio, as their plans extend to all portions of the State. This accomplished, and the operations of another leading Cleveland syndicate were indicated; then

those of all the known promotors from the Forest City were included, until it became evident that Cleveland is the corner-stone of the entire institution in Ohio, and it only required the insertion of a few more lines to cover all of the known projects of the State.

Numerous Cleveland investors have had their attention called to electric railway projects through the fact that some of the earliest and most successful examples of suburban lines were built radiating from that point. These roads have been extended from time to time, until, as intimated, Cleveland systems are covering not only the entire State of Ohio, but are extending into other States and distant sections of the country. As in all industries, there are acknowledged leaders in this movement, and at the present time the operations of Cleveland people are controlled by two distinct and leading syndicates, and a dozen or more smaller ones.

H. A. EVERETT

It is almost unnecessary to state that the most important and best known of these syndicates is popularly known as the Everett-Moore syndicate, which is composed largely of capitalists who own the largest local system in Cleveland, known as the Cleveland Electric Railway Company. Of late the movements of this syndicate have been heralded throughout the length and breadth of the country. During the past few months scarcely a day has passed but there have been reports of Everett-Moore purchases, and although as a matter of fact its efforts of late have been confined almost entirely to Ohio and Michigan, there have been rumors from all parts of the country as to the alleged plans of these people. It is a matter of interest to note that in the telephone field the syndicate is equally as important, if not more so, as in the line in question, as it is building up an independent system, covering the whole of Ohio and a portion of Michigan.

Just who constitute the Everett-Moore syndicate is a matter which has caused much discussion; on the whole, it is an ambiguous term. It is not a closed corporation in any sense of the word, but consists of a group of men, nearly all Clevelanders, who invest in projects established or promoted by H. A. Everett and E. W. Moore. These gentlemen are generally supposed to have control of nearly all the interests with which they are identified, but as a matter of fact, this is not the case. Neither are the interests of the two gentlemen identical. For instance, Mr. Everett has important interests in electric railways at Winnipeg, London, Montreal and Toronto, in which Mr. Moore is not interested, while Mr. Moore has a controlling interest in systems at Wheeling, W. Va., and Syracuse, N. Y., with which Mr. Everett is not connected. In the case of a number of different roads which have recently passed into the hands of Everett-Moore control, the former owners have not disposed of all of their interests, but have simply exchanged some of their stock for that of other Everett-Moore projects. In this way the personnel of the "syndicate" has recently been greatly enlarged. It is generally supposed that the recent moves made by this syndicate have been financed by New York bankers, but is understood that this is not the case; the majority of the stock having been easily subscribed among Cleveland people. Just at present the leading people in the syndicate have under consideration plans for the formation of a controlling organization for the purpose of handling its bonds.

Among the best known and most influential capitalists who are heavily interested in Everett-Moore enterprises are Barney Mahler, Ralph A. Harmon, Charles W. Wason, W. H. Lamprecht, C. W. Collister, J. B. Hanna, C. H. Price, E. G. Tillotson, H. Clark Ford, H. A. Sherwin, and H. P. McIntosh, of Cleveland, and J. R. Nutt and James Christy, of Akron. These gentlemen are collectively interested in all of the projects, although not individually. Some of them are also interested in what is known as the Pomeroy-Mandelbaum syndicate, which is the strongest rival of the Everett-Moore syndicate in Ohio.

It is claimed that the Everett-Moore syndicate controls fully 1500 miles of electric railways, either building and in operation. This includes the local lines in Cleveland, Detroit, Toledo, Akron and Sandusky, the interests above mentioned as being held by Messers. Everett and Moore, as well as projects in various portions of the country which will be referred to later, the exact status of which are not known. Of the main system of Everett-Moore interurban roads it is figured that there are 506 miles in operation, 232 miles under actual construction, and 305 miles proposed, with move made toward securing right of way. The system includes all the roads radiating from Cleveland, with the exception of the Cleveland, Elyria & Western Railway, and nearly all of those radiating from Detroit, with a connecting link between. The most easterly terminus of the system is Youngstown, which is to be reached by a traffic arrangement over a short section of another road, while the northwestern terminus is Port Huron, Mich.; a thorough line over 360 miles in length, fully completed, except for a short section between Lorain and Sandusky, and another between Monroe and Detroit, both of which will soon be closed. The connecting link in this great system was the Toledo, Fremont & Norwalk Railway (No. 6), and the series of deals for the control of this property have extended over several months. A number of times it was reported that the deal had been closed, but it was just as often denied within a day or so. It is said that the Comstock Construction Company, of Detroit, which built and owned the road, set its price, and held out until the syndicate came to its terms; appreciating that it would be cheaper for the syndicate to buy the line than to parallel it and stand a fight. It is understood that the price paid for the property was about $3,350,000. It is said that the Toledo Traction Company and the lighting plant cost $11,000,000, while the Detroit properties are said to have cost about $40,000,000, which give some idea as to the ability of this syndicate to finance its propositions.

E. W. MOORE

As to the future, the syndicate has much in view. Along the lake shore to the east the line at present reaches Painesville, and is being built to Ashtabula. It is said Buffalo is the ultimate terminus, and is understood that rights-of-way men working in the interests of the syndicate are

already engaged on the route in Pennsylvania and New York States. South of Cleveland the system reaches Barberton, and is building to Canton and Massillon. It is understood that it is the intention to extend the Massillon branch to St. Clairsville to connect with a line being built out of Wheeling by the Wheeling Traction Company, in which Mr. Moore is interested. From Columbus to the southern extremity of the State there is a line in process of construction, with a branch to Lancaster. Undoubtedly this road will be connected with the line extending south from Cleveland, giving the syndicate a system extending clear across the State from north to south. In Michigan it is understood that the syndicate is figuring on properties besides those already secured, and two of them which are under consideration will give a line from Detroit to Bay City. There is talk that the Youngstown line will be extended to Pittsburgh, but this is denied by Mr. Moore. It is true, nevertheless, that there will shortly be a through line between Cleveland and Pittsburgh, as shown on the map, by way of the Beaver Valley Traction Company (No. 149), and the Monaca & Coraopolis Railway (No. 150), which is under construction, and which will connect with the lines of the Southern Traction Company (No. 151), running into Pittsburgh.

The lines of the Everett-Moore syndicate, as designated on the map are as follows: Cleveland, Painesville & Eastern Railway (No. 1), 50 miles in operation, 20 miles building, 20 miles contemplated; Cleveland & Eastern Railway (No. 2), 40 miles in operation; Cleveland & Chagrin Falls Railway, and the Chagrin Falls & Eastern Railway (practically one line) (No. 3), 45 miles in operation, 15 miles building; Northern Ohio Traction Company (No. 4), 45 miles in operation, 50 miles building, 120 miles contemplated; Lake Shore Electric Railway (a recent consolidation of the Lorain & Cleveland, Sandusky & Interurban, and the Sandusky, Norwalk & Southern) (No. 5), 55 miles in operation, 37 miles building; Toledo, Fremont & Norwalk Railway (No. 6), 60 miles in operation, 35 miles contemplated; Toledo & Monroe Railway (No. 7), 23 miles in operation; Detroit & Toledo Shore Line (No. 8), 38 miles building; Detroit & Wyandotte Railway (No. 9), 11 miles in operation; Detroit & North Western Railway (No 10), 60 miles in operation; Detroit & Pontiac Railway No. 11), 30 miles in operation; Rapid Railway (No. 12), 17 miles in operation; Detroit & Port Huron Short Line (No. 13), 110 miles in operation; Scioto Valley Traction Company (No. 14), 75 miles building, 90 miles contemplated. It is stated that in the near future the lines in Michigan are to be consolidated and controlled as a part of the Detroit United Railways.

F. J. POMEROY

The Cleveland, Elyria & Western Railway Company, which built the first suburban line running into Cleveland, formed the nucleus of what is known as the Pomeroy-Mandelbaum syndicate. Strictly speaking, it applies to the properties which are promoted by the Pomeroys and their associates, or financed by M. J. Mandelbaum & Company; F. T. Pomeroy and M. J. Mandelbaum being interested in practically the same line of projects, so far as electric railways are concerned. Others who are prominent in the syndicate are: A. H. Pomeroy, O. D. Pomeroy, A. E. Atkins, Will Christy, H. C. Lang, L. M. Coe, L. J. Wolf, H. Q. Sangeant, S. C. Smith, M. A. Sprague, F. D. Carpenter, and E. F. Schneider.

The Pomeroy-Mandelbaum syndicate is also working on a system of roads which will extend clear across the State, and the system in Ohio promises to be even more extensive than that of the Everett-Moore syndicate. This indicates that, despite the fact the members of the two syndicates are closely allied, the various interests being so intermingled that it is almost impossible to separate them, there is still an individuality about the two syndicates. Evidence of this is shown from the fact that the Lake Shore Electric Railway, an Everett-Moore road, and the Cleveland, Elyria & Western Railway, a Pomeroy-Mandelbaum road, are building parallel lines within a stone's throw of each other for a distance of 10 miles, between Berlin Heights and Norwalk. Despite the fact that there are stockholders who are interested in both roads, and an amicable arrangement would save a large sum of money, it is now evident that each will build its own road between these points. It is said that the secret of this particular contention is that each set of managers believes the other is encroaching on his territory. It is said that when the two syndicates first commenced business, an understanding was arrived at, whereby the Pomeroy-Mandelbaum syndicate should build in a southwesterly direction from Cleveland, while the Everett-Moore crowd were to control the territory directly south and directly west. The clash came when both proposed building to Norwalk, and now neither will yield the point.

M. J. MANDELBAUM

The chief project of the Pomeroy-Mandelbaum syndicate has in contemplation a road from Cincinnati to Toledo, and from Cincinnati to Cleveland, with probably a line from Cleveland to Columbus. The Cleveland, Elyria & Western Railway (No. 15) has 65 miles in operation, 33 miles building, and 17 miles contemplated; the contemplated line being a spur line, which will be known as the Elyria, Grafton & Southern Railway. The C. E. & W. gives a road from Cleveland to Norwalk. In the western part of the State is the Western Ohio Railway (No. 20), 5 miles of which has just been placed in operation, 40 miles building, and 85 miles contemplated. When completed this line will extend from Findlay to Piqua, by way of Lima, Wapakoneta, St. Marys, New Bremen, Minister and Sidney. There will also be a direct line from Wapakoneta to Sidney, and a northern extension from Findlay to Toledo. The latter route has not been settled on; it may be built, or an existing line may be purchased. Between Piqua and Dayton there is a break which will be filled by the purchase, or perhaps traffic arrangement, of two lines, one in operation and the other nearly completed. From Dayton, reaching almost to Cincinnati, is the Southern Ohio Traction Company's line (No. 21), which is considered one of the best properties in the State. This company has 64 miles in operation, 5 miles building (giving entrance to Cincinnati), and 65 miles contemplated; the latter being two spur lines, or feeders. One of them will be known as the Hamilton, Oxford & Western Railway, extending from Hamilton to Connersville, Ind., and the other from Cincinnati to connect with the above line at College Corner to be known as the Cincinnati, Venice & Western Railway.

It is believed the Western Ohio Railway, and the Cleveland, Elyria & Western Railway, will be connected by an extension from Norwalk to Findlay, by way of Tiffin, and it is reported that right of way is already being secured, but this is denied. From the Berea branch of the C. E. & W. is being built the Cleveland & Southern Railway (No. 16). This will be in operation to Medina before many months, and will be extended to Wooster. The Cleveland, Ashland & Mansfield Railway (No. 17) will extend from the Wellington branch of the C. E. & W. to Mansfield, 38 miles contemplated. At the latter point it will connect with the Mansfield, Crestline & Galion Railway (No. 18), of which 18 miles are building. It is the intention to extend this line to Marion, 20 miles, where it would connect with the Columbus, Delaware & Marion Railway (No. 19). This road is being promoted by F. D. Simons and L. A. Simons, of Columbus, and J. W. Holcomb and J. Lattimer, of Cleveland, but it is thought they are backed by the Pomeroy-Mandelbaum syndicate, and that eventually the road will become a part of the system. The Cleveland, Delaware & Marion Railway (No. 19) includes a direct line to Marion and spur lines to Mt. Vernon and Marysville. Twelve miles of this is in operation, being an old line, the Columbus, Clintonville & Worthington, which was purchased some time ago; 35 miles are in process of construction, and 75 miles are contemplated. This line, with the others mentioned, would give a through line from Cleveland to Columbus. In addition to this there is the Little Miami Traction Company (No. 22), which is under construction from Springfield to Xenia, and which will be extended eventually to Lebanon, and possibly to Cincinnati. There is also an east and west line, the Ashland, Wooster & Massillon Railway (No. 23), which will connect two of the syndicate's north and south roads. This line is promoted by Colonel Hurd, Judge Dissette and others, who have been identified with lines built by the syndicate, and it is understood that it will be included in the system.

A. E. APPLEYARD

As outlined above, the system of the Pomeroy-Mandelbaum syndicate includes 146 miles of road in operation, 148 miles under construction, and 351 miles contemplated. It will be noticed that as is the case of the Everett-Moore lines, all roads lead to Cleveland, the "Rome" of Northern Ohio. The members of both syndicates are enthusiastic in their belief that Cleveland is bound to become a great city. A railway map will show that fully a score of the leading towns of this section of the State have been comparatively isolated from the State Metropolis, and their business has followed the course of the east and west trunk lines to Toledo or Pittsburgh. With good connection for Cleveland, their business will be turned in that dire tion, it is believed.

While not strictly a traction line, the Maumee & Erie Canal Transportation Company may well be considered under this head. As is generally known, the proposition contemplates the operation by electric motors running on tracks, of canal boats. The canal, which is indicated in the map by a special dotted line, extends from Toledo to Cincinnati. The company is capitalized at $3,000,000, and is composed of nearly all of the members of both the large Cleveland syndicates. Work has already been started on the track, which is to follow the canal tow path, and it is expected a section of the canal will be in operation by electricity before the close of this year. Contrary to general opinion, this will be strictly a freight proposition.

Although it is impossible to consider them at this time, it is of interest to note the members of the two syndicates are backing a dozen or more important electric railway projects in various portions of the country, notably in the Fox River Valley in Illinois, the Richmond & Petersburg Railway in Virginia, the Baltimore & Washington Railway in Maryland, and a line from Decatur, Ill., to Springfield and Bloomington. Another group of promoters who are doing much toward building up the State is what is popularly known as the Appleyard syndicate, which proposes making Columbus, the State capital, the hub of an extensive system of roads. The popular conception of this syndicate is incorrect, as there are several lines which are being built or contemplated by some of the leading members of the syndicate, but which are not strictly Appleyard syndicate properties. Eventually they may become so, but this is not a matter of certainty.

The first of the Appleyard roads, the Dayton, Springfield & Urbana Railway (No. 25), was promoted several years ago by John G. Webb, a prominent business man of Springfield, and J. S. Harshman, a millionaire capitalist of that city. Mr. Harshman is now president of all the roads included in the syndicate, while Mr. Webb fills the position of treasurer of the various lines. The financing of this project was placed in the hands of A. E. Appleyard, a Bostonian, who has financed and built a number of electric railways in various portions of the country, and who has since been the financial head of the syndicate. In the present enterprises Mr. Appleyard represents a number of Boston capitalists, and it is the financing of the projects which gives the group its title.

The second line of the group was the Columbus, London & Springfield Railway (No. 26), which is now nearing completion, being in operation for a short distance at each end. This line is being built under the supervision of H. A. Fisher, one who has had long experience in railway building, and who now has the general management of the various projects of the syndicate. Besides Messrs. Appleyard, Webb, Harshman and Fisher, there are interested in the properties of the syndicate: Emmett Tompkins, Charles A. Alderman, F. J. Green, John M. Good and others, of Columbus and Springfield.

The complete system in operation and projected, controlled by Mr. Appleyard's interests, includes the Dayton, Springfield & Urbana Railway (No. 25), with branches, 51 miles in operation, 2 miles building; the Columbus, London & Springfield Railway (No. 26), with branches, 14 miles in operation, and 38 miles building; the Columbus, Grove City & Southwestern Railway (No. 28), 14 miles in operation, and 25 miles contemplated; the Urbana, Bellefontaine & Northern Railway (No. 31), 20 miles contemplated; and the Springfield & Western Railway (No. 32), 15 miles contemplated. The Columbus, Buckeye Lake & Newark Traction Company (No. 27) is being built by Mr. Appleyard for Tucker, Anthony & Company, of Boston, and from an operating standpoint it is a part of the syndicate system. It will be 45 miles in length. Construction work is being pushed on the lines building, and it is stated that the system will be in full operation between Newark and Dayton within the next two months.

In building into Columbus, the syndicate secured the

right to, and has constructed, a loop surrounding the State capital, in the very heart of the city, and has lines radiating from this loop in all directions to the city limits; thus providing for the greatest possible development of the interurban proposition in the Capitol City. This method of operating was made necessary on account of the broad gage tracks of the city system of roads.

The lines building and proposed by the individual members of the syndicate, but having no direct connection with it, are also very extensive.

Recently Mr. Appleyard secured control of the Dayton, Lebanon & Cincinnati Railway, a steam road extending from Dayton to Lebanon. It is understood that it is to be equipped for electricity, and it will form an important addition to the system promoted by these people, giving, as it does, a link in the direction of Cincinnati. It is also reported that Mr. Appleyard is endeavoring to secure control of another short steam road in that vicinity, which would give entrance to the former metropolis. The Dayton, Lebanon & Cincinnati Railway is shown in the map as being under construction. Several of the members of the syndicate have recently organized the Dayton, Springfield & Urbana Southwestern Railway, with a view to building several short lines radiating from Springfield. J. S. Harshman, John G. Webb, H. A. Fisher, with James Loren, of Columbus, are actively interested in the Columbus, Delaware & Northern Traction Company (No. 29), which is engaged in building a line between Columbus, Delaware & Marion, with a view to bringing into Columbus several lines from the northern part of the State, which are headed in that direction. This line closely parallels the Columbus, Delaware & Marion Railway (No. 19), and the struggle between the two strong companies promises to be long and interesting. The former company has secured control of the local lines in Delaware, giving a route through that city, while the latter has purchased the Worthington, Clintonville & Columbus Railway, a short line operating to Worthington, with another short line extending to Flint.

Chief among the lines which will connect with the Columbus, Delaware & Northern Railway is the Defiance, Ottawa, Kenton & Columbus Railway (No. 30), recently organized by H. A. Fisher, D. J. Ryan, George H. Jones, John H. Sheets, Nelson Mathews and others. Considerable right of way has been secured for this line, which will be one of the longest in the State. The exact route has not yet been determined, but it will connect with the Columbus, Delaware & Northern at either Marion or Columbus.

The lines in which the above group of promoters are interested include 80 miles in operation, 125 miles building and about 300 miles contemplated. Toledo is the center of operations for several syndicates which are extending their lines into Michigan and Indiana, as well as to all parts of Ohio.

One of the most attractive propositions in the State is the Toledo & Western Railway (No. 37), which is owned by a syndicate composed of Luther Allen, Judge C. M. Stone, N. O. Stone, I. N. Topliff, F. C. McMillen and J. R. Seagrave, of Cleveland, and F. E. Seagrave, of Toledo. The line will cover a very rich section of farming country which heretofore has been almost isolated. Thirty years ago this section was known as the "Black Swamp," but drainage and irrigation has made it what is claimed to be, without exception the most productive spot in the country. The line is in operation to Sylvania, 10 miles from Toledo, and it is claimed the returns for this strip thus far have exceeded all expectations. At this point one branch extends into Michigan, and the other on through northern Ohio into Indiana; it is said that the western terminus will be Goshen. This section will be placed in operation to Lyons, 35 miles, in the near future. The Michigan division will extend to Adrian, and eventually to Jackson. A rival of this project was the Northern Ohio Railway Company (No. 48), which proposed to build from Wauseon to Fayette, and then parallel the Toledo & Western Railway, into Indiana. Considerable work was done between Fayette and Pioneer, but it is reported that very recently the promoters have effected a consolidation of interests with the Toledo & Western. W. H. Cummer, G. W. Kurtz, J. W. Cable and A. C. Van Dreisden, of Toledo, were the promoters.

The Toledo & Maumee Valley Railway (No. 35) operates two lines, paralleling the Maumee River, forming a loop at Perrysburg. The road is owned by A. K. Detwiler, G. G. Metzger, G. K. Detwiler, C. P. Griffin and others. They have commenced work on an extension of this road, which will be known as the Toledo, Waterville & Southern Railway (No. 34), following the Maumee River, and touching Waterville, Grand Rapids, Napoleon and Defiance. Portions of this route are being contested by three other companies. The line will be 65 miles long, 10 miles of which will shortly be in operation. From Napoleon this syndicate also proposes to build a north and south road, which will extend to Adrian, Mich. (No. 35), touching Wauseon, Delta and Lyons; it will be 40 miles long. The same people are also promoting the Toledo & Indiana Railway (No. 36), which is to parallel the Lake Shore Railway (steam) from Toledo to Bryan, and on into Indiana, the western terminus not having been announced. Considerable right of way has been secured, and work has been started near Swanton. Despite this fact this project has a rival, which is said to be even further along in its construction work, and is said to have placed contracts for all material. The second line is the Toledo & Bryan Air Line (No. 39), which is promoted by J. L. Yost, W. C. Brewer, J. C. Bonner, Milton Taylor, William P. Heston, R. G. Kerlin, John G. Adams and other prominent Toledo people. Both companies are pushing construction, and the result will probably be a survival of the fittest.

H. A. FISHER

The Toledo, Waterville & Southern Railway (No. 34) also has a rival in the Toledo, Napoleon & Defiance Railway (No. 42), which has been working over practically the same route. This fight has been long and exciting. In some places one secured the franchise and the other proposed to build around the town, while in the next place it was vice versa. In one town the competition was so fierce that one of the companies agreed to handle local traffic free of charge to secure the franchise. The Toledo, Napoleon & Defiance Railway was promoted by Richard Hattersley, Charles E. Sutton, John F. Kumler, H. C. Webster and others, of Toledo. It has been reported very recently that the promoters have sold out their franchises to Cleveland people, but this can not be verified.

The Toledo, Bowling Green & Southern Railway (No. 40) is the result of the recent purchase and consolidation of the Findlay Street Railway, and the Toledo, Bowling Green & Fremont Railway. The new owners are H. Burk-

hold and George Kerper, of Cincinnati, who owned the Findlay Street Railway. A stretch of 12 miles between Trombley and Mortimer is being built to connect the two lines. The company has also announced that it will build its own line into the center of Toledo; heretofore cars have been operated over the tracks of the Toledo & Maumee Valley Railway (No. 33), from Perrysburg. It is also stated that the line will eventually be extended from Findlay to Kenton, 35 miles.

It is said that the Michigan & Ohio Railway Company, which was incorporated some months ago by Judge J. W. Donovan, W. L. Robinson, Milton Carmichael and W. H. Ashwell, of Detroit, will build a system extending from Toledo to Dundee, Ypsilanti and Ann Arbor, Mich. (No. 38). It is understood that these parties have been attempting to effect a consolidation with the Shore Acres Railway Company, a company which is building a short line from Toledo to a pleasure resort on the lake shore near the State line.

The Ohio Northern Railway (No. 43) is the outgrowth of a project for a line from Bryan to Defiance. It is said that construction work will start in the near future, and that the line is to be extended south from Defiance to St. Marys, where it will connect with the Western Ohio Railway (No. 20). The line will be 80 miles in length and right of way is being secured by way of Grover Hill, Van Wert and Spencerville. The promoters are E. W. Frink and A. J. Prentice, of Cleveland; W. D. Sherwood, Elias Bartholomew and others, of Lima.

The Toledo, Fostoria & Findlay Railway (No. 41) is practically completed between Findlay and Fostoria, and work has been started between Toledo and Findlay. There is to be a spur line to Prairie Depot, and the road will have a mileage of 55 miles. It is being built by the Dover Construction Company, of Canal Dover, and it is owned by E. A. Wentz, Samuel Croxton, E. Reeves and others of that place. It is financed by the Western Reserve Trust Company, of Cleveland. Capital stock, $1,500,000.

E. J. Frost, of Defiance, is promoting a line to extend from Defiance to Antwerp, touching Paulding, Hicksville and Sherwood (No. 44). It will be 35 miles long.

The lake shore route from Toledo to Port Clinton, touching a rich and isolated fruit belt, has long been looked upon as a fine opening for an electric line and several companies have projected lines through this territory. The most promising appears to be the Toledo & Port Clinton Interurban Railway (No. 45). G. W. Acker, C. Dedean, W. B. Geroe, L. Galshall, T. J. Smith and others, of Toledo, are the promoters.

The Lakeside, Napoleon & Western Railway (No. 46) and the Lake Erie, Bowling Green & Napoleon Railway (No. 47) are rivals for an east and west line extending from Port Clinton to Pemberville, Bowling Green, Grand Rapids, Napoleon and Defiance. Between Port Clinton and Pemberville, it is understood the former will go by way of Fremont and the latter by way of Woodville. The former company was organized some months ago by G. H. Brown, of Fort Wayne; N. A. Clemons, Port Clinton; Morris Reese, Pemberville; D. Black and L. C. Cole, of Bowling Green, and S. W. Heller, of Toledo. It is claimed that all rights of way have been secured and that 25 miles of grading has been done. Between Port Clinton and Fremont, the company did considerable construction work, but it is understood that it has recently sold out this section to a rival company for the same route. The Lake Erie, Bowling Green & Napoleon Railway was organized a short time ago by Luther Black, Dr. J. H. Whitehead, R. A. Beatty, G. W. Loomis, A. E. Royce, F. M. Young, M. L. Case, Wesley Powell, F. W. Dunn, Dr. W. M. Tuller, Dr. F. W. Rogers, D. B. Whipple and others, of Bowling Green.

The Toledo, Tiffin & Sandusky Railway (No. 49) was organized about a year ago to build a system centering from Port Clinton, with lines extending to Toledo, Tiffin and Sandusky. The promoters are J. F. Bunn and George D. Loomis, of Tiffin; B. W. Wilson, of Port Clinton, who are said to be backed by New York and Chicago people. A large amount of grading has been done between Tiffin and Port Clinton, this being one of three lines working on the same route.

The Kerline Brothers Company, of Toledo, promoters of the Tiffin & Port Clinton Railway (No. 50) evidently propose to build a line between the two towns despite competition. They are pushing construction work, and it is reported that they have bought out the Lakeside, Napoleon & Western Railway (No. 46), which has been working over the same route. They have also the local line in Fremont.

The Sandusky, Clyde & Tiffin Railway (No. 51) has started grading on a line from Tiffin to Sandusky. Promoters are: J. C. Parker, I. S. Comstock, W. W. Johnson and G. L. Butler, of Sandusky.

The Sandusky, Bellevue, Monroeville & Norwalk Railway (No. 52) is another road in which construction work has been delayed for some time. The proposed route is from Sandusky to Bellevue and then to Norwalk, paralleling the Toledo, Fremont & Norwalk Railway (No. 6). Spur lines are to extend from Norwalk to Chicago Junction, New London and other towns. A large amount of construction work was done last year and a power house was partially completed, but it is understood that work has been stopped since that time. The promoters are Clark Rude and W. E. Guerin, of Sandusky; J. McLean and J. L. Dailey, of Philadelphia. It is claimed the road will be completed.

Tiffin promises to be one of the most important centers in the State. Besides the lines previously mentioned, there are the following: The Tiffin, Fostoria & Eastern (No. 54), in operation to Fostoria, owned by S. B. Sneath and others, of Tiffin; the Tiffin & Southwestern Railway (No. 58), which will be 75 miles long, extending to Wapakoneta, by way of Kenton and Upper Sandusky, with a spur line to Lewiston Reservoir, and promoted by Henry Price and J. B. Seymour, of Kenton; W. S. Rogers and C. W. Timmerman, of Wapakoneta; L. Selle, of Tiffin, and Robert Carve, of Upper Sandusky; the Tiffin & Findlay Railway (No. 59), promoted by local people; the Tiffin, Republic & Bucyrus (No. 57), promoted by E. B. Finley, of Tiffin; the Tiffin, Plankton & Bucyrus Railway (No. 56), promoted by Wert Brothers, of Tiffin; the Tiffin & Norwalk Railway (No. 55), which is promoted by S. W. Owen, of Tiffin, also a branch of the Findlay & Marion Railway (No. 61), will probably be built from Upper Sandusky to Tiffin. The Findlay & Marion Railway (No. 61) is promoted by M. A. Smalley, C. E. Schwartzbaugh, of Toledo; Allen Smalley, Upper Sandusky; Asa Jones and J. H. Ruhlman, of Youngstown; J. Blackford and David Joy, of Findlay. A private right of way has been purchased.

The Findlay, Columbus Grove & Fort Wayne Railway (No. 63) will be 110 miles long. It is promoted by H. W. Begg, Columbus Grove; H. H. Day, Pandora; J. A. Kimmell and C. E. Niles, of Findlay. Incorporated for $500,000. The Findlay & Lima Railway (No. 64) is projected to parallel the Western Ohio Railway (No. 20) between Findlay and Lima, and there have been sharp contests for right of way. J. S. Neeley, A. D. Miller, Frank Seiber, T. D. Robb and Louis Koch were the incorporators. H. J. McGowan, of Indianapolis, is said to be interested.

The Findlay & Southern Railway (No. 62) promises to be a very important line. It will extend from Findlay to Columbus, 90 miles, and nearly all rights of way have been secured. R. Rosentock, of Cleveland; J. Odenbaugh, of Sandusky; H. D. Hammond, Mount Blanchard, are the promoters. Barney & Company, Philadelphia, are said to be financing the project. The Ohio Northwestern Railway (No. 60) is under construction from Fostoria to Mungen, where it will connect with the Toledo, Bowling Green & Southern Railway (No. 40). It is said the line will be extended to Napoleon. W. B. Marks, Levi Harbaugh, W. D. Clark and others, of Fostoria, are the promoters. Findlay people are promoting a line to extend from Findlay to Deshler and Grand Rapids (No. 66). The Wapakoneta & Kenton Railway (No. 65) is promoted by J. H. Goeke, C. T. Kolter, S. A. Haskins, H. C. Settgage and W. C. Brorein.

Another line which will extend into Indiana is the Lima, Delphos, Van Wert & Fort Wayne Railway (No. 69). It will be 75 miles long and is promoted by A. C. Parmenter and D. J. Cable, of Lima, and Henry Neff, J. B. Kerr, W. P. Heston, and W. F. Numan, of Toledo. It will parallel the Pennsylvania Railway (steam). The Lima, Lewiston & Bellefontaine Railway (No. 68) will extend from Lima to Bellefontaine, touching Lewiston Reservoir. W. W. Fisher, Bellefontaine, is president; W. P. Heston, Toledo, vice-president; X. H. Holler, Lima, secretary, and J. M. Boose, Lima, treasurer. Right of way has been secured.

Probably the longest single line in the country is proposed by the Fort Wayne, Dayton & Cincinnati Traction Company. The main line (No. 69) will extend from Fort Wayne to Cincinnati, something over 200 miles, and it is claimed there will be branches in Ohio and Indiana which will give the system 350 miles. The main line is to be operated from a single power house at Celina, on Grand Reservoir, and it is claimed that options on nearly all the right of way have been secured. It is stated that trains drawn by electric locomotives will be used and that freight trains, as well as passenger, will be operated. The company is incorporated in South Dakota and Ohio with $1,000,000 capital stock. Officers are: Dr. S. M. George, Dayton, president; D. W. La Fetra, New York, vice-president; Charles L. Hyde, Pierre, S. D., second vice-president; C. W. Gephard, Dayton, secretary-treasurer; Ira Hodgson, Dayton, chief engineer.

The Miami Valley Railway Company operates a line from Troy to Piqua (No. 145), a distance of 15 miles, and proposes to extend on to Minster, 23 miles. This line, with the Dayton & Troy Railway (No.72), forms a connecting link for the system of the Pomeroy-Mandelbaum syndicate, and it is understood that overtures are being made for its purchase. W. P. Orr and others, of Piqua, are the owners.

Dayton is the center of a system of interurban roads which is probably equaled by no other city of double its size in the country, and if proposed roads are built it will closely rival Cleveland as a terminus. The majority of the lines centering in Dayton have been built by local people. Besides the Southern Ohio Traction Company's line (No. 21) and the Dayton, Springfield & Urbana Railway (No. 25), the following roads are in operation, or practically so: The Dayton & Xenia Traction Company (No. 80), three lines recently consolidated, aggregating 49 miles in operation, owned by Thomas T. Robinson and others, of Boston; the Dayton & Western Traction Company (No. 71), completed to Eaton, and to be extended to Richmond, and the Dayton & Troy Railway (No. 72), under construction to Troy and nearly completed, owned by V. Winters, C. B. Clegg, D. B. Corwin and others, of Dayton; these people also own the Dayton City Railway and the Oakwood Street Railway, local lines; the Dayton & Northern Traction Company (No. 71), nearly completed to Greenville, 41 miles, owned by Dr. J. E. Lowes and others, of Dayton. The Dayton & Stillwater Valley Railway (No. 81) was promoted by Judge Dennis Dwyer and Albert Emanuel, but it has recently been sold to the Robinson syndicate, of Boston. It is under construction, 25 miles, and 15 miles are contemplated. The Dayton, New Carlisle & St. Paris Railway (No. 82) is promoted by C. E. Layton, H. N. Reynolds, John A. Brake, B. H. Rannels and others, of Dayton. It is said it will extend to Bellefontaine. The Dayton, Cincinnati & Maysville Railway (No. 84) is promoted by E. D. Smith, D. W. Hogan, H. L. Day, W. V. Whitaker and others, of Blanchester; H. W. Blair, S. Woodward and H. F. Anderson, of Morrow; John Moore, of Georgetown, and F. M. Conden, of Cincinnati. The proposed road will be about 110 miles long, extending from Dayton to the Ohio River at Aberdeen, with a branch from Morrow to Cincinnati. A number of franchises have been secured. The Dayton, Germantown & Hamilton Railway (No. 83) has secured a private right of way between Dayton and Middletown, and it is claimed the road will be built at once. It is one of several proposed competitors of the Southern Ohio Traction Company (No. 21), and it is promoted by J. O. Arnold and T. C. Lindsey, of Dayton. It is said to be backed by the Cincinnati, Hamilton & Dayton Railway (steam), which has lost much suburban business to the Southern Ohio Traction Company, and it has recently absorbed a small line in Middletown, which was owned by the steam line company. It is said the road will be extended to Cincinnati.

The development of interurban business in the vicinity of Cincinnati, the former State metropolis, has been surprisingly slow, one principal reason being because of the fact that interurban roads have been unable to gain entrance to the business, or even residence section of the city; the city lines have a broad gage and decline to arbitrate matters with the interurbans. Now, however, it appears that they are making up for lost time, and at present there are more electric railway projects in Hamilton County than in any other in the State. The Southern Ohio Traction Company (No. 21) operates only to College Hill, 9 miles from the center of the city, but it has recently purchased a short steam road which will bring it within 5 miles of the center. The Cincinnati, Lawrenceburg & Aurora Railway (No. 91), extending into Indiana, 34 miles in length, is the only other line at present in operation. It is owned by J. C. Hooven, Stanley Shaffer and others, of Hamilton. The Mill Creek Valley Railway (No. 88), another competitor for the Southern Ohio Traction Company, is completed nearly to Hamilton, cars being in operation a portion of the distance. It is controlled by H. Burkhold and H. H. Hoffman, of Cincinnati. There are two companies contesting for the same route between Cincinnati, Lebanon and Dayton (No. 85), and each has secured certain franchises. One of the projects is headed by Wayland P. Sunderland and H. Wolff, and the other by James B. Swing, T. R. French, C. A. Bosworth and others. The route passes through a large number of suburban towns. A syndicate composed of Lee Brooks, Charles Davis, Guy Mallon, James Kennedy, J. M. Hutton, G. R. Scrugham, Ellis Kinkhead and others, has recently incorporated three roads, the Suburban Traction Company (No. 92), the Cincinnati & Eastern Railway (No. 94), and the Rapid Railway Company (No. 86). The first will extend to Batavia and Bethel, the second to New Richmond, and the third to Lebanon, and perhaps to Dayton. The Cleveland & Cincinnati Railway (No. 87) is a road concerning which there

is considerable comment regarding its plans. It is said to be incorporated under the laws governing steam roads, and it is claimed that steam, as well as electricity, will be used. It has applied for franchises for several short lines in Hamilton County, and for a line paralleling the Southern Ohio Traction Company to Hamilton and Dayton. The promoters are Powell Crossley, W. F. Hart, D. H. Hunt, E. G. Simon and others, of Cincinnati.

The Cincinnati & Columbus Traction Company (route not shown) proposes to build a direct line from Cincinnati to Columbus. The promoters are Henry Burkhold, Philip Swing, Richard E. Swing, Frank Dune and others, of Cincinnati. The Ohio Valley Interurban Railway Company is being promoted by John Kilgore, formerly at the head of the Cincinnati Street Railway Company, who is said to contemplate a line following the Ohio Valley to Portsmouth (No. 93), with lines in the city. The Cincinnati, Milford & Loveland Railway (No. 89), and the Cincinnati, Milford & Hillsboro Railway (No. 90) touch a number of good towns in the Little Miami Valley. The latter will extend to Hillsboro, and is being promoted by W. F. Roudebush, of Batavia; W. D. Murphey, of Milford; H. McKeehan and H. M. Huggins, of Cincinnati. H. M. Huggins is also interested in the Hillsboro & Ohio River Traction Company (No. 153), which was recently organized by Charles Orr, Thomas H. Hogsett and Monroe Warner, of Cleveland; James E. McDermott and O. Z. Blair, of Cincinnati. The line will extend from Hillsboro to Aberdeen, and eventually it will be extended north to Lebanon to connect with the Xenia & Wilmington Traction Company (No. 24), which is promoted by Charles Orr, Thomas H. Hogsett, H. M. Yost and William Sage, of Cleveland, and John P. Martin, of Springfield. This line in turn will connect with the Little Miami Traction Company (No. 22), building from Springfield to Dayton, which was promoted by John P. Martin and Charles Orr, and is now controlled by the Pomeroy-Mandelbaum syndicate. It is believed that these four proposed lines will eventually be turned over to the Pomeroy-Mandelbaum syndicate.

From Hillsboro to Chillicothe a road will be built by the Hillsboro & Chillicothe Traction Company (No. 144), which is promoted by Charles H. Hoyt, W. H. Wallace and J. C. Short, of Hillsboro. This project has been financed by New York people and it is said work will start at once.

The Columbus & Southern Railway (No. 104) recently turned over its franchises in the Scioto Valley to the Scioto Valley Traction Company (No. 14), and is now working on a road from Hillsboro to Washington Court House and Columbus. It will parallel the Columbus, Grove City & Southwestern Railway (No. 28), and it is claimed that construction work has started near Mount Sterling. The officers are: J. M. Wilson, president; Z. F. Downs, vice-president; H. F. Hoffman, treasurer; Smiley Caldwell, secretary; all of Columbus.

Columbus is to have several lines besides those of the Appleyard interests, although the Columbus & Westerville (No. 77), which is owned by the Columbus Railway Company, is the only one in operation. The Urbana, Mechanicsburg & Columbus Railway (No. 78) is under construction, and it will have a competitor in a branch of the Columbus, London & Springfield Railway (No. 26), which is also being built; the former line was promoted by Gen. A. J. Axline, of Columbus. Two companies are also constructing lines between Columbus and Lancaster; the Scioto Valley Traction Company (No. 14), previously referred to, and the Columbus, Winchester & Lancaster Railway (No. 79). This line is being built by T. A. Simons, E. D. Simons, D. C. Beggs, Howard Park, W. G. Boland and others who are interested in the Columbus, Delaware & Marion Railway (No. 19). It is claimed that the entire right of way has been secured and construction work has been started. Work is also being pushed on the Columbus, New Albany & Johnstown Railway (No. 105), which is promoted by Columbus people. Thomas N. Fordyce, of Detroit, is in charge of construction work. The Columbus & Granville Traction Company (No. 101) has recently been organized by F. W. Douthart, New York; M. M. Jillett, Newark; W. H. Jones, L. F. Keisweter and John Field, Columbus, and John Thor, Baltimore. The line will connect with the Newark & Granville Railway (No. 103), which is in operation.

The Columbus, Newark & Eastern Railway, just incorporated by R. H. York, H. J. Uhl, Martin Horr, A. G. Collins and A. R. Horr, of Cleveland, also proposes to build from Columbus to Newark, making three lines between these points, although in different routes.

A franchise for a line between Newark and Lancaster (No. 102) has been held for some time by the Lancaster & Newark Traction Company, but it is said that this has been turned over to a new company recently incorporated as the Ohio Central Railway Company, which proposes to build a through line from Columbus to Bridgeport. The promoters of this company are: J. S. Sites, Charles A. Spenny, W. B. Cosgrove and Henry C. Werner, of Columbus. The Richwood, Marysville & Columbus Railway (No. 76) proposes to build a line to Byhalia and Kenton. Promoters: John Hendrixon, N. E. Niggitt, William King, F. V. Fullington and R. L. Woodburn. The Union Electric Railway (No. 75), incorporated in Delaware, holds franchises for an extensive system north of Columbus. C. N. Buchanan, of Pittsburgh, is president, and Thomas N. Kerr, Columbus, secretary.

Zanesville promises to be the center of an important system. The Black Diamond Traction Company (No. 107) is securing franchises for 150 miles of proposed roads radiating from Zanesville. It is claimed they will extend to Hebron, to Dresden and Coshocton, to Cambridge, to McConnelsville and to New Lexington. On the line to Cambridge this company has a competitor in a company promoted by L. C. Taylor and John S. Black, of Zanesville, who propose to build a line from Zanesville to St. Clairsville and Bridgeport (No. 147). Both companies hold extensive franchises. The Newark, Zanesville & Coshocton Railway (No. 106) proposes to build from Newark to Zanesville with a branch from Nashport to Coshocton. Franchises have been secured in several places. Promoters: J. H. Ickes, Charles H. Hunt, J. K. Hamill, C. H. Seidel and W. O. Littick. Then there is the Zanesville, Adamsville & Coshocton Railway (No. 108), which is promoted by J. B. Wilson, E. G. Abbott and H. E. Bucker, of Zanesville.

In the Ohio River Valley are several lines in operation and others being built. The Camden Interstate Railway (No. 95), extending from Huntington, W. Va., to Catlettsburg, Ky., and Ironton, Ohio, 12 miles, is being built. The Ironton Electric Railway (No. 96) extends 6 miles on either side of Ironton. It is owned by J. T. Byron, of Ironton. At Portsmouth there is a short line in operation (No. 97). The Pomeroy & Middleport Railway (No. 98), operating 12 miles, is owned by Judge D. A. Russell, of Pomeroy. From Marietta to Parkersburg there is a 15-mile road under construction and owned by Parkersburg people. The Athens, Nelsonville & Hocking Valley Traction Company will build lines from Athens to Nelsonville and Glouster (No. 100). Promoters: Thomas Selz, S. R. Pine, N. C. Hanning, and Robert Klein, of Dayton, and H. H. Homing, Athens. The Wheeling Traction Company,

which is controlled by E. W. Moore, of Cleveland, is building a line from Bridgeport to St. Clairsville (No. 109), and from Steubenville to Bridgeport (No. 111). It is understood that it controls the Bellaire, Bridgeport & Martin's Ferry Railway (No. 110), which operates a 12-mile road. The Steubenville, Mingoe & Ohio Valley Traction Company (No. 146) operates 5 miles, and is building a 10-mile extension to Brilliant. J. M. Ferguson has secured right of way for a line from Steubenville to Canton (No. 112) by way of Carrollton and Waynesburg.

In addition to those previously referred to, there are several roads which have Cleveland in view as a terminus. The Cleveland & Warren Railway (No. 121) is promoted by Senator Martin Dodge, who proposes to build a direct line from Cleveland to Warren. He has secured considerable right of way and franchises at several points. The Portage Lakes Traction Company (No. 122) holds franchises in several towns. It is promoted by Judge J. Lamson, V. C. Taylor and Carl Nau, of Cleveland. The Cleveland, Wadsworth & Southern Railway (No. 126), was organized recently by E. A. Akers, G. F. Anthony, W. H. Hill, C. S. Horner and others, of Cleveland, to build a line from that place to West Lebanon with branches to Akron and Massillon. The Cleveland, Richfield & Akron Railway (No. 125) is promoted by T. C. Childs, of Akron, who is having a contest with other promoters, supposed to represent the Everett-Moore syndicate, for a franchise over the same route. The route is shorter than that operated by the Northern Ohio Traction Company (No. 4). Mr. Childs was also the promoter of the Akron & Canton Railway (No. 130), which is competing with the Northern Ohio Traction Company (No. 4) for a line between Akron and Canton, both having commenced construction work. It is promoted by a strong syndicate composed of P. L. Saltenstall and C. Eldridge, of Boston; L. E. Meyers, Chicago; William Hoover, New Berlin, and Charles Kolp, J. C. Welty and A. C. Brant, of Canton. It is claimed that an extensive system is to be built which will extend from Cleveland to Columbus, by way of Canton, New Philadelphia, Canal Dover, Coshocton, Zanesville and Newark. It is supposed that some of the lines being built on this route are backed by the syndicate. Franchises have been secured for an extension of the Canton line to New Philadelphia. A portion of this route is already covered by the Tuscarawas Railway (No. 113), which is owned by F. T. Pomeroy, of Cleveland; 10 miles of road are in operation.

From Canton to Alliance and Sebring a line is under construction by the Stark Electric Railway (No. 114). C. Morley, of Cleveland, and R. Jacobs, of Canton, are promoting the enterprise, backed by Cleveland capitalists. A rival of this line for the portion of its route is the Alliance, Sebring & Salem Railway (No. 116), promoted by J. C. Whitela and H. T. Dempsey, of Beaver Falls, Pa.; Herman Klein, of Allegheny, and C. A. McDonald, of Pittsburgh. The same people are promoting the Coropolis & Monica Railway (No. 151), connecting the two Pennsylvania towns.

The roads radiating from Youngstown are controlled by two strong syndicates. The Mahoning Valley Railway Company (No. 118) operates 31 miles from Warren to Lowellville, and is building extensions to Leavittsburg and to New Castle. The system includes several short spur lines, and the Youngstown city lines. It is owned by Myron T. Herrick, James Parmely and B. F. Miles, of Cleveland. The Youngstown & Sharon Railway (No. 119) and the Sharon & New Castle Railway (No. 120) are a part of the system being built by the Penhale-Devitt syndicate, of New York and Chicago, which has been buying up a large amount of electric lighting and railway property in Eastern Pennsylvania and in the vicinity of Youngstown. It is said that under an arrangement with A. M. and J. K. Jolley, of Pittsburgh, and Richard Quay and S. Battles, of Philadelphia, who are also building roads in Eastern Pennsylvania, the syndicate will have lines from Youngstown to Pittsburg, and from Youngstown to Erie, Pa.; some of them being already under construction. Several lines have been projected from Salem to East Liverpool, and several franchises have been granted to different parties, but it is believed that the Salem, Lisbon & East Liverpool Railway (No. 116), which is promoted by U. G. Smith, F. N. Hait, Charles Taylor, George H. Billman and H. H. Poppleton, of Cleveland, have the advantage. The line has been surveyed and it is said construction work will start in the near future.

The Ohio River & Youngstown Railway (No. 117) was recently organized by Walter S. Snyder, W. E. Nye, Albert Fassig, George E. Long, John Patterson, of Youngstown, to build a line from Youngstown to East Liverpool. An extensive system of franchises was secured a year ago in the northeastern corner of the State by Eugene Rowdon, of Windsor; W. H. Dodge, of New Lyme, and S. L. Osborn, of Andover, representing the Burton, Jefferson & Andover Railway (No. 124). It is believed these people are simply speculating in franchises, as they have recently sold a franchise from Jefferson to Ashtabula to the Pennsylvania & Ohio Railway (No. 127), which is building between Conneaut and Ashtabula, and they are said to be endeavoring to sell a franchise from Burton to Andover and Meadville, Pa., to the Cleveland & Eastern Railway (No. 2), which would give the latter a through line from Cleveland to Meadeville. The Pennsylvania & Ohio Railway (No. 127), above mentioned, has 4 miles in operation, 15 miles under construction, and it contemplates building an extension east to Erie, and another west to Painesville. It is owned by Thomas Fricker, of Ashtabula. Another string of franchises are held by P. W. Tuttle, C. W. Goodrich, C. E. Barnum and F. S. Turner, of Geneva, and L. B. Stanley, of Collinwood. They contemplate a line from Painesville, through Geneva, Jefferson and Andover to Meadeville, Pa. (No. 123), and it is understood that they have done considerable grading in order to hold their franchises.

Between Lorain and Elyria there is in operation the Lorain Street Railway (No. 129), one of the oldest interurbans in the State and said to be the first to inaugurate a 3-cent fare for local traffic. This was done recently, and the dissatisfaction caused thereby among the citizens of Elyria was recently referred to in the STREET RAILWAY JOURNAL. The road is owned by P. S. Du Pont.

Residents of Lorain and Dover are securing right of way for a line from South Lorain to Cleveland (No. 128). The road has been incorporated under the title of the Cleveland & South Lorain Traction Company, by Charles W. Wells, James H. Burke, Edwin H. Richards, H. A. Beekerman and Frank W. Nowak. Reuben Hall and Calvin Pease are the promoters, and the capital stock is $500,000. The Lorain & Cleveland Railway (No. 5) and the Cleveland, Elyria & Western Railway (No. 15) already operate between these points.

The Canton-Massillon Railway (No. 131) has recently been placed in operation between these two towns. It is 12 miles in length and an extension is being built to Navarre, 5 miles. It is owned by Thomas Lynch, E. Fogel and other Canton people. The Barberton, Doylestown & Massillon Railway (No. 132) holds franchises for 20 miles of road. A. E. Townsend, of Barberton, is the promoter.

T. Y. McCray, L. D. McCray, F. T. Boles and F. D. Campbell are securing franchises for about 75 miles of road between Wellington, Mansfield, Mount Gilead and Colum-

bus. It is said that considerable grading has been done at various points. A rival of this road is the Mansfield, Cardington & Delaware Railway (No. 136), which was recently organized with A. A. Whitney, Mount Gilead, president; R. F. Chase, Cardington, vice-president; C. W. Schaff, Mount Gilead, secretary, and W. A. James, Cardington, treasurer. The Citizen's Railway Company, of Mansfield, has just completed and placed in operation a 14-mile extension to Shelby (No. 134). It is to be extended to Plymouth, 7 miles. S. N. Ford, Mansfield, is president.

Work is to be started in the near future on the Buckeye Traction Company's line (No. 137), which will extend from Bucyrus to Norwalk. H. G. Flickinger, S. J. Kibler, R. V. Sears, W. A. Blicke and others, of Bucyrus and Norwalk, are promoters. The Ohio Central Traction Company, of Bucyrus (No. 74), operates a line to Galion, and is building to Crestline, paralleling the line being built by the Pomeroy-Mandelbaum syndicate. It is said that an extension will be built from Galion to Mount Vernon. Franchises for lines radiating from Bucyrus are being secured as follows: Bucyrus to Marion (No. 73), ex-Attorney-General Frank Monnett, Columbus; Upper Sandusky to Bucyrus (No. 138), W. G. Gear, of Upper Sandusky; Bucyrus to Ashland (No. 139).

The Norwalk, Ashland & Southern Railway (No. 140) was organized some time ago by Judge C. P. Wickham, C. F. Jackson and H. A. Thomas, of Ashland, and Josephus Clark, of New London. It is claimed that work will start in the near future. The Marion, Green Camp, Prospect & Richwood Railway (No. 142) is being promoted by French Crow, J. N. Scott, James Moore and F. E. Guthrey, of Marion.

A right of way for a line from Springfield to Washington Court House (No. 142) is being secured by L. H. Houston, Edward Houston, J. F. Rankin and S. B. Rankin, of South Charleston, and D. I. Worthington, of Washington Court House. Harry Frye, Jr., of Springfield, is securing a right of way from Springfield to Clifton and Cedarville (No. 143). The Dayton, Springfield & Urbana Railway (No. 25) is securing a similar right of way. The Hamilton & Lebanon Railway (No. 148) is promoted by Frank M. Hughes, of Hamilton. It is understood that construction work has been started.

The members of the Everett-Moore syndicate, of Cleveland, were in New York the past week arranging the details for the consolidation into one company of the various interests which have recently been acquired by the syndicate. The syndicate controls nineteen electric railway, light, heat and power companies in, between and radiating out from Cleveland, Toledo and Detroit, with a total capitalization of in the neighborhood of $100,000,000. It is stated that new stock will be issued to the individual stockholders now in the companies now controlled by the syndicate. It is stated that the syndicate has under contemplation the purchase of a number of additional properties in Ohio and Michigan.

The following is a list of the principal towns and cities in Ohio, with their populations:

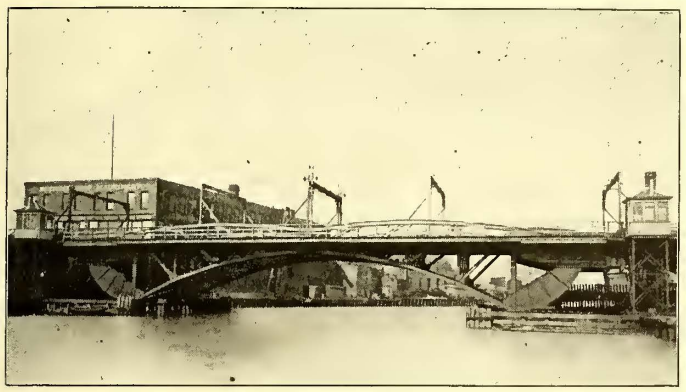
Aberdeen	711
Ada	2,576
Adamsville	201
Akron City	42,728
Alliance	8,974
Alvordton	482
Andover	815
Antwerp	1,206
Archbold	958
Ashland	4,087
Ashtabula	12,949
Athens	3,066
Barberton	4,354
Bedford	1,486
Bellaire	9,912
Bellefontaine	6,649
Bellevue	4,101
Berea	2,510
Berlin Heights	625
Bethel	850
Blanchester	1,788
Bloomdale	740
Bluffton	1,783
Bowling Green	5,067
Bridgeport	3,963
Brilliant	646
Bryan	3,131
Bucyrus	6,560
Burton	727
Cadiz	1,755
Caldwell	927
Cambridge	8,241
Canal Dover	5,422
Canal Winchester	662
Canton	30,667
Cardington	1,354
Carrollton	1,271
Carthage	2,559
Cedarville	1,189
Celina	2,815
Chagrin Falls	1,586
Chardon	1,360
Chicago Junction	2,348
Chillicothe	12,976
Cincinnati	325,902
Circleville	6,991
Cleveland	381,768
Clyde	2,515
College Corner	378
College Hill	1,104
Collinwood	3,639
Columbiana	1,339
Columbus	125,560
Columbus Grove	1,935
Conneaut	7,133
Coshocton	6,473
Crestline	3,282
Cuyahoga Falls	3,186
Dayton	85,333
Defiance	7,579
Delaware	7,940
Delphos	4,517
Dennison	3,763
Deshler	1,628
Doylestown	1,057
Dresden	1,600
East Liverpool	16,485
Eaton	3,155
Elmore	1,025
Elyria	8,791
Fairport	2,073
Findlay	17,613
Forest	1,155
Fostoria	7,730
Frazeysburg	730
Fremont	8,439
Galion	7,282
Gallipolis	5,432
Garrettsville	1,145
Geneva	2,342
Genoa	824
Georgetown	1,529
Germantown	1,702
Grafton	1,098
Grand Rapids	549
Granville	1,425
Green Camp	369
Greenville	5,501
Greenwich	849
Grove City	656
Hamilton	23,914
Hebron	455
Hillsboro	4,535
Hiram	659
Hubbard	1,230
Hudson	983
Huron	1,708
Ironton	11,868
Jackson	4,672
Jefferson	1,319
Jerry City	555
Johnstown	638
Kent	4,541
Kenton	6,852
Lancaster	8,991
Lebanon	2,867
Leetonia	2,744
Lima	21,723
Lisbon	3,330
Lodi	846
Logan	3,480
London	3,511
Lorain	16,028
McConnelsville	1,825
Madison	768
Mansfield	17,640
Mantua	743
Marietta	13,348
Marion	11,862
Martin's Ferry	7,760
Marysville	3,048
Massillon	11,944
Maumee	1,856
Mechanicsburg	1,617
Medina	2,232
Mentor	624
Miamisburg	3,941
Middletown	9,215
Milan	653
Mingo Junction	2,954
Minster	1,465
Monroeville	1,211
Montpelier	1,869
Morrow	869
Moscow	475
Mt. Blanchard	456
Mt. Gilead	1,528
Mt. Vernon	6,633
Napoleon	3,639
Nashville	766
Navarre	963
Nelsonville	5,421
New Albany	224
Newark	18,157
New Bremen	1,318
New Carlisle	995
New Comerstown	2,659
New London	1,180
New Paris	790
New Philadelphia	6,213
Niles	7,468
North Amherst	1,758
North Baltimore	3,561
Norwalk	7,074
Oak Harbor	1,631
Oberlin	4,082
Orrville	1,901
Ottawa	2,322
Oxford	2,009
Painesville	5,024
Pandora	409
Paulding	2,080
Pemberville	1,081
Perrysburg	1,766
Piqua	12,172
Plain City	1,432
Plymouth	1,154
Pomeroy	4,639
Portsmouth	17,870
Prospect	983
Put-in-Bay	317
Ravenna	4,003
Republic	656
Richwood	1,640
Ripley	2,248
St. Marys	5,359
St. Paris	1,222
Salem	7,582
Sandusky	19,664
Sebring	387
Seven Mile	256
Seville	602
Shelby	4,685
Sidney	5,688
South Charleston	1,096
Spencerville	1,874
Springfield	38,253
Spring Valley	522
Steubenville	14,349
Stryker	1,206
Sunbury	464
Swanton	887
Tiffin	10,989
Tippecanoe	1,703
Toledo	131,822
Toronto	3,526
Trenton	387
Troy	5,881
Uhrichsville	4,582
Upper Sandusky	3,355
Urbana	6,808
Van Wert	6,422
Vermilion	1,184
Wadsworth	1,764
Wapakoneta	3,915
Warren	8,529
Washington Court House	5,751
Waterville	703
Wauseon	2,148
Waverly	1,854
Waynesburg	613
Wellington	2,094
Wellsville	6,146
Willoughby	1,753
Wilmington	3,613
Woodville	831
Wooster	6,063
Worthington	443
Xenia	8,696
Yellow Springs	1,371
Youngstown	44,885
Zanesville	23,538

New Underground for London

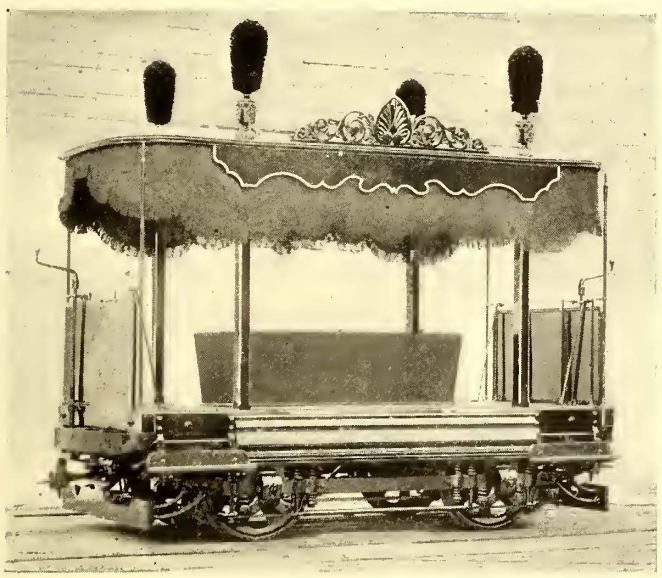
The Parliamentary Committee on Underground Railway Schemes in London has a report which recommends the construction of a new line from Hammersmith, along Piccadilly, to the city with a branch from Piccadilly Circus to the Angel Inn at Islington. At a meeting of the shareholders of the Metropolitan Underground Railway, July 26, Col. Mellor, the chairman, in discussing the electrification of the line, said that the Ganz tender stood out from all others by reason of simplicity and economy. The company's experts who were sent to Buda-Pest to examine the Ganz system there reported that it possessed features of such novelty and importance as to amount practically to a new departure in electric traction.

Artistic Street Railway Bridges

The Scherzer Rolling Lift Bridge Company, of Chicago, is securing contracts for designing many of the most important bridges which the city of Chicago is contemplating building. The old style center-pier structures that span the Chicago River are to be replaced by the Scherzer movable span bridges. Among the advantages of these bridges are the superior speed with which the bridge can be opened and closed, the free open channel which admits boats of large size, and the fact that no car or wagon can be shoved into the river when the bridge is open. Some time ago at Cleveland, Ohio, while the draw at the viaduct was open, a loaded street car plunged into the river, causing a great loss of life. Last winter in Chicago a team went into the Chicago River while a bridge was open. The driver escaped, but the team was lost. Such accidents are impossible where the Scherzer bridges are in use. For some years the Metropolitan Railway, of Chicago, has used a Scherzer bridge to cross the river, and the ease and speed with which it is handled, together with the advantages of the unobstructed channel, have led the city to decide on replacing the old center-pier structures with the modern Scherzer bridges.



SCHERZER ROLLING LIFT BRIDGE—CLOSED AND OPEN



SECOND-CLASS FUNERAL CAR

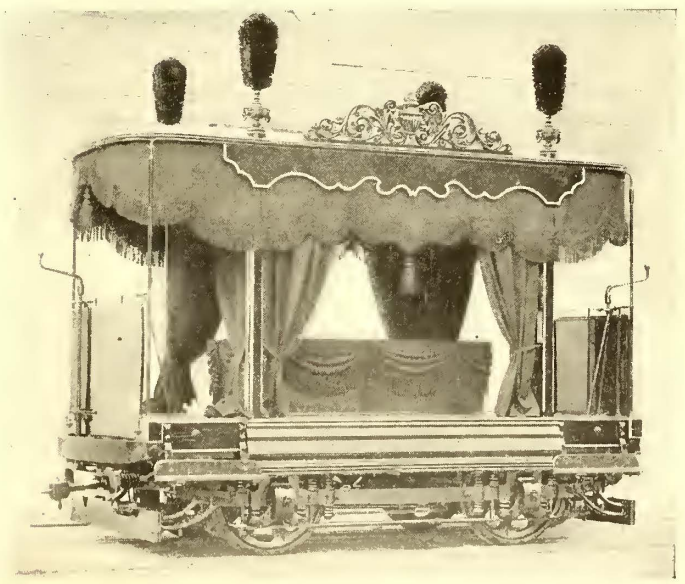
Some years ago the Pennsylvania Railroad Company constructed a bridge across the Potomac River a short distance above the historic old Long Bridge. A stone causeway was built through the shallow portion of the river and a swinging span was left for the passage of boats near the Virginia shore. In course of time the sediment brought down by the river formed a great marsh above and below the bridge, which was detrimental to the health of Washington. Congress appropriated large sums of money to build a sea wall around these flats, the river was then dredged and the dredgings deposited within the wall, forming several hundred acres of ground, which is now in use as a park. But the Long Bridge is more or less unsightly, and the Scherzer Bridge Company is now proposing to span the Potomac with one of its modern, artistic structures, which will be a credit to the city and a convenience to the navigators, as well as those who use the bridge. The plans have not yet been accepted, but the general recognition of the company's product, both from the Washington officials and engineers, will probably result in the building of one of the improved types of bridges.

First and Second-Class Electric Funeral Cars For Mexico

The engravings which are presented on this page show a type of electric funeral car used in Mexico. In that city the operation of funeral cars drawn by horses has proved very profitable, and some views of the different styles used have been published. With the inauguration of electric service it was decided to continue the practice which is popular in Mexico, and orders were consequently placed with the J. G. Brill Company for some motor cars.

In general the funeral car is a short four-wheeled affair, measuring about 13 ft. over the dashers and 6 ft. 2 ins. in width, with a canopy and lambrequins. The sides are open and the center has a bier for the reception of the casket. The trucks have Brill solid-forged frames and are of the No. 21-E pattern, with the usual arrangement of springs. The cars shown are both fitted with GE-1000 motors. In order to make the length as short as possible, full elliptic springs, instead of the half elliptic commonly used, are placed at the ends.

In the first-class car the decoration is a little more elaborate than that of the other; curtains are draped at the corners, the bier is draped and the carving on each side of the roof much more elaborate. The roof inside is finished in white and gold; outside there is the usual trolley board. The car, in most respects, so far as mechanical and operating details, as well as finish, is like an ordinary coach. The funeral car in Mexico is as much a necessity as the public hearse in cities of the United States. Cars for this general purpose have been used by some railroads in the United States and have been found to be profitable as well as useful.



FIRST-CLASS FUNERAL CAR

Handsome Car for Peoria

The Peoria & Pekin Terminal Railway Company has recently received from the American Car Company, of St. Louis, a number of very handsome double-truck combination passenger and baggage cars, illustrated herewith. The principal dimensions of these cars are as follows: Length of car body over bumpers, 41 ft. 6 ins.; length of body over passenger compartment, 19 ft. 6 ins.; length of car over smoker compartment, 9 ft.; length of body over motorman's cab and baggage compartment, 6 ft. 6 ins.; length of rear platform, 4 ft.; width of car body at sills over siding, 8 ft.; height of car from under side sills to top of roof, 9 ft.; height of car from floor to ceiling at center, inside, 8 ft. 4 ins.

PASSENGER AND BAGGAGE CAR FOR PEORIA

INTERIOR OF PEORIA CAR

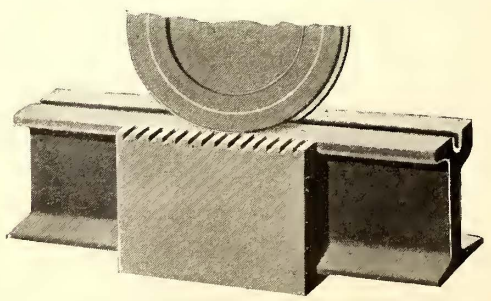
The seating capacity of the regular passenger compartment in the car is twenty-eight passengers, and that of the smoking compartment is twelve passengers. The ceiling is of three-ply bird's-eye maple veneer, neatly decorated, and the inside finish is in solid cherry. Double doors of the twin automatic type are used at the ends and between the compartments. The vestibule at the front end of the car is fitted with a three-drop sash. The rear is finished up inside with cherry in the same way as the interior finish of the passenger car. The front vestibule outside of the baggage compartment is finished with tongued and grooved quartered oak in their natural color.

Contracts for Car Equipments of the New York Elevated Railways

The Manhattan Railway Company, of New York, has now given out nearly all the contracts for equipping its rolling stock with apparatus suitable to the electric operation of its lines. The latest one to be awarded is that for 800 trucks, and was divided into two equal parts, one-half going to the American Car & Foundry Company, St. Louis, Mo., and the other half to the Wason Manufacturing Company, Springfield, Mass. The trucks are to be made from designs of the engineers of the railway. The wheels and axles for these trucks will be furnished by the Steel Tired Wheel Company. The contracts for 1600 motors and multiple-unit control equipments for 1200 cars to the General Electric Company, and for coupler equipments to supply 1100 cars to the W. T. Van Dorn Company, have already been mentioned in these pages. The gates already in use will probably be retained, so that with the exception of brakes and heaters practically all competition for Manhattan rolling-stock contracts is over.

Cast-Welded Rail-Joints

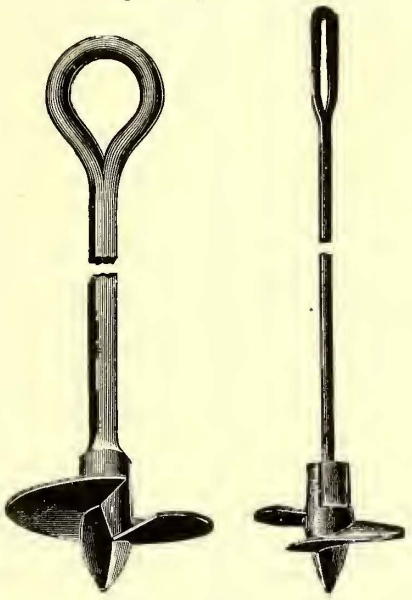
General Manager J. P. Heil, of the Heil Rail-Joint Welding Company, has been engaged in this business for the past eight years. He is, comparatively speaking, quite a young man, but is evidently a master of his business, having executed contracts for welding joints in many of the principal cities of the United States and South America. It is understood that the company is amply financed, and the business of welding the rail-joints of street railways, thus making a continuous rail and preventing stray currents, has become one of such importance that it has a large field to work. In some cities the gas and water companies are going so far as to demand it to avoid the electrolysis of the underground pipes. An efficient cast-welded joint will also lengthen the life of the rail. Mr. Heil claims to have made the first cast-welded joints in St. Louis in 1894 for the Citizens' Street Railroad Company. He also claims to have improved the original cast-welding machines materially, and has added a sand blast, by which in pouring in the metal the joint is thoroughly cleaned, thus making a perfect connection. An emery wheel with flexible shaft arrangements is used for grinding the joints, and all the other machinery used is thoroughly up to date. The joint, 12 ins. to 14 ins. long, is made square in order that a tie may be placed beneath it, and that the pavement may fit the joint properly. Its general appearance is shown in the accompanying engraving. The company guarantees that there is a fusion of the cast iron and steel in all welds. Mr. Heil has designed a clamp which effectually prevents the buckling of the joint when the molten metal is poured in, always hitherto a serious difficulty to overcome. Steel shims are also inserted where rails are closely connected. The address of the Heil Rail-Joint Company is Milwaukee, Wis.



COMPLETED RAIL-JOINT

The Stombaugh Guy Anchor

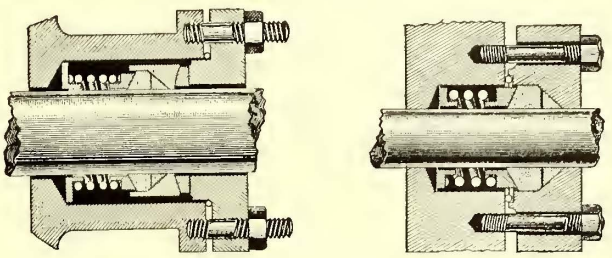
The Stombaugh guy anchor is especially intended for use where a strong anchorage is required for the guy ropes of poles, stacks, etc. It is so designed that it can be put in place with the least amount of exertion by simply screwing it into the earth, and it forms an efficient means of holding the end of the guy without tearing up the ground to any extent. This latter property makes it very useful in places where the owners of the land object to the necessary excavation for the planting of dead men or other anchors. The accompanying illustrations show the appearance of these anchors and the simplicity of their construction. In order to adapt the device to all kinds of service the manufacturers make them in several different sizes, but all are of practically the same design. The many places where an anchor of this kind will be of service are evident, and the sole distributing agents, W. N. Matthews & Brothers, of St. Louis, Mo., are placing this type successfully on a large number of street railways throughout the country. The large size shown can be screwed into the ground without auxiliary apparatus, but a wrench consisting of a T made from steel pipe and fitted at its lower end with a socket, which engages in the recess on the anchor-head, shown in the engraving, is necessary with the smaller sizes. The diameters of the anchor discs range from 3½ ins. to 12 ins., and, complete with head, the weight is from 2½ lbs. to 78 lbs.



TWO TYPES OF ANCHORS

An Efficient Metallic Steam Packing

The importance of having a reliable packing for piston-rods and Corliss valve-stems is appreciated by every central-station engineer, and the success which has attended the use of the packing illustrated in the accompanying engravings makes it of interest. This is a purely metallic packing, the steam-tight joints connected with it consisting of cone-shaped faces ground to an accurate fit. In the packing, the portion which fits closely around the piston-rod or valve-stem is made in segments of Babbitt metal, which are forced into a cone-shaped receptacle of a ring in the stuffing box by a strong spiral spring. The segmental construction of the Babbitt packing allows it to be easily renewed at small expense without removing the piston-rod from the piston, and the segments can easily be kept in stock for immediate application should the necessity arise. The segments fit loosely within each other, so that as they wear, the cones maintain an efficient steam joint at the bearing surfaces. The Babbitt metal packing is made in two portions. An outer retaining ring, beveled the same as the interior segments, holds the packing in place, and breaks the joints with the segments so that no steam can escape at those outlets. The packing requires no oil cups, the lubrication of the cylinder being sufficient to provide for its operation. At the end of the device is a spherical ground washer, the plane face of which is a ground joint made to fit the gland. The spherical face fits a corresponding bevel in the casing of the packing ring, so that any lack in the perfect alignment of the engine parts will be allowed for by the packing, the only wearing portions being the Babbitt metal ring. A cheap and durable packing is thus produced. As the steam pressure assisting the spiral spring is the main force to hold the packing tight against the rod or the valve-stem, when the steam is exhausted the compression is released and the power of the engine greatly added to. This device was invented and patented by C. Lee Cook, of Louisville, Ky., and has been in use over six years. It is being put upon the market by the inventor and patentee, who has recently secured large orders from many of the large engine companies and machine works of the country, besides having been called upon to furnish the metallic packing to a large number of central station and manufacturing plants.



METALLIC STEAM PACKING

Double-Fan Rotary Snow Plow

The Peckham Truck Company has brought out a new type of the well-known Ruggles rotary plow, of which it is the sole manufacturer. The chief characteristic of this plow is the fact that it has double fans, instead of the single fan used in prior construction. The advantage claimed for this design is that the fans cut closer to the track and nearer the bottom of the scoop, and so prevent the snow from clogging in the sweepers. The blades of the fan are of steel, and are guaranteed against snow and ice for two years. As in the plows using single fans, the snow is picked up and thrown out of the top of the machine in either direction desired, and is spread evenly over the adjoining ground. The use of the plow dispenses entirely with the employment of brooms, and the plow can clear drifts as deep as 10 ft. and of any length.

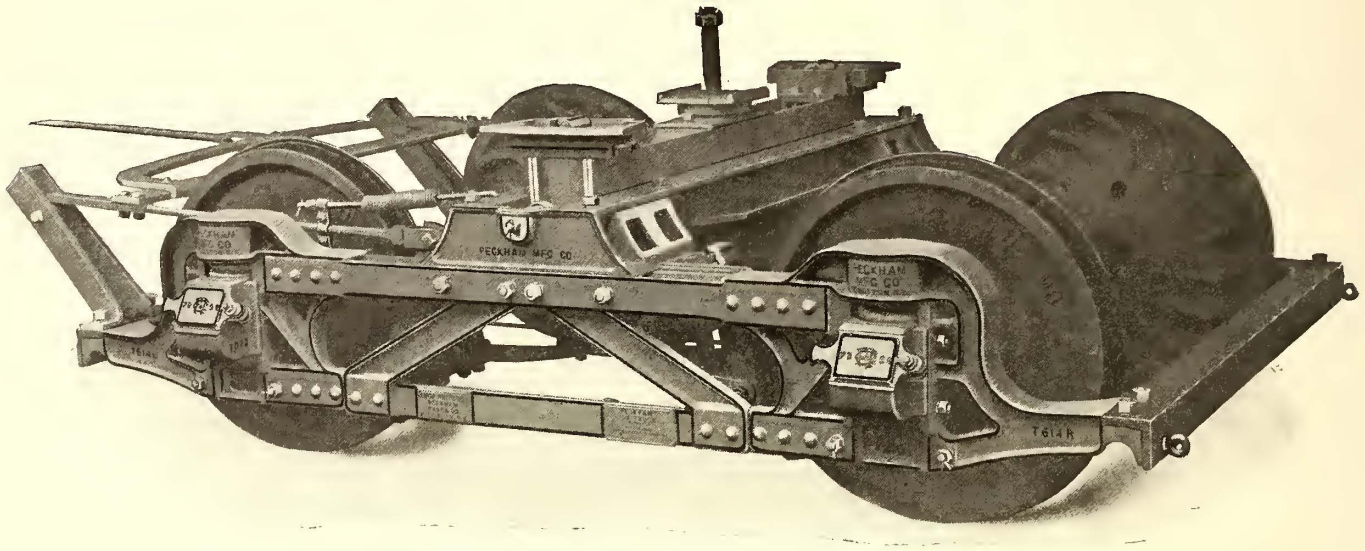
The plow is double ended; that is, there are fans at each end, and it can be run in either direction. The fans are not driven from the car axles, but by separate motors, which are usually secured by taking them off the summer equipment. The method of connecting the motors with the fan shafts is to use shafts with clutch couplings extended through the plow. The motors can then be connected to run the cutters at either end. The plow is especially adapted for suburban and interurban railways having long runs, where frequent service can not be relied upon to keep the road open.

The number of Ruggles plows sold last fall were very largely in excess of those ordered in previous years, and the plow promises to have an increased popularity this season.

NEW ROTARY SNOW PLOW

The New Peckham Extra Strong, Long-Wheel Base, No. 26 Double Truck

In the article published elsewhere in this issue on the Toledo & Monroe Electric Railway mention is made of the use there of the Peckham "extra-strong" long wheel base double truck, No. 26. This truck, which is giving excellent satisfaction on the road in question, is of a new type designed by Mr. Peckham expressly for high-speed suburban and interurban cars, running from 40 to 60 miles an hour.



EXTRA STRONG, LONG WHEEL BASE TRUCK

The side frames of this truck are of the well-known Peckham patent bridge-truss construction, connected at the ends with cross-bars of angle bar shape, secured to the ends of the side frames, and so made that the angle bars fit perfectly on to the ends of the side frames, which are machined to fit them. The angle cross-bars are secured to the ends of the side frames by machine-turned bolts driven into reamed holes. The ends of the side frames are so constructed as to reduce their height to less than 15 ins.

This truck is equipped with Peckham's patent swing bolster, which is supported upon a combination of spiral and elliptic springs, the spiral springs being located at the ends of the bolster and the elliptic springs in the center. These springs are so adjusted that the weight of the empty car body is supported by the elliptic springs, and the spiral springs reinforce the elliptic, as the load of the car increases. The bolster is supported upon links, which are hung from the transom bars. Buffer springs are provided to prevent excessive movement of the bolster, which is rigidly secured between angle transom bars sufficiently strong to prevent any possibility of their becoming bent or warped. The transom bars are secured to the side frames by a strong ribbed casting secured in place, upon the side frame, by machined bolts, driven in reamed holes, to insure a perfect fit. The transom castings are of semi-steel and so constructed as to distribute the weight of the bolster evenly upon the side frames.

The brake is of an improved type, constructed with the shoes bearing upon the inside of the wheels, so that no rods have to be removed when taking out the wheels. The brake-shoe link hangers are so designed as always to prevent the clattering of brake-shoes, and are made in one piece with an adjustable clip, so that the wear can be taken up. The release springs are connected to the top of the live lever, so that they require no adjustment when the shoes are adjusted, and they can not cause the shoes to drag on the wheels. The shoes can be easily adjusted without placing the car over a pit, which is sometimes necessary on long suburban lines.

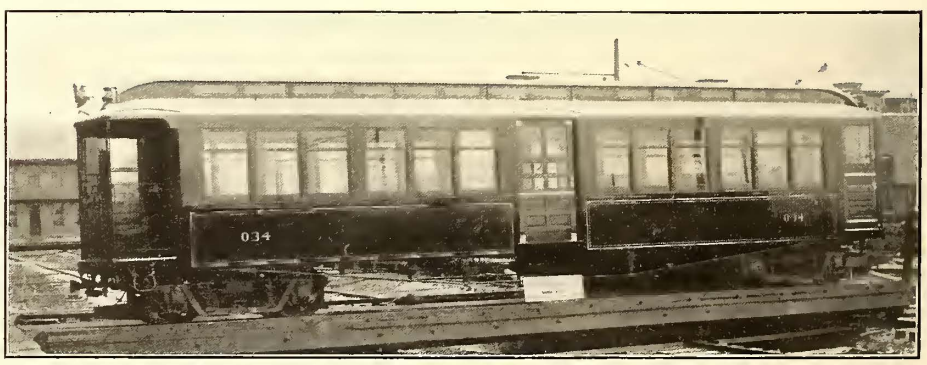
Extra strong construction throughout is used, and all parts are well fitted. All rivets are driven hot, at a pressure of 30 tons, by pneumatic process. This truck has ample strength for carrying cars 60 ft. long at high speed. Compared with its carrying capacity it is a very light truck. With 5-in. axles and 800-lb. steel wheels, it weighs 7866 lbs., and with 4-in. axles and 443-lb. cast-iron wheels, it weighs 6440 lbs.

The Cleveland & Eastern Railroad Company has been operating these No. 26 trucks for about six months, and in a recent letter R. L. Andrews, general manager and purchasing agent of the company, says that he finds them to be the most satisfactory truck he has ever tried. He says they run free, start quickly and have all the qualities that will please a motorman. This company has never had a particle of trouble with the trucks leaving the track in any manner, although the cars run at a very high rate of speed. He says that he has seen the trucks going at the rate of 72½ miles per hour without showing any danger and does not believe they can be recommended too highly for suburban work.

The new Peckham works at Kingston are equipped with special tools and appliances for the manufacture of these trucks, all wearing parts are carefully machine fitted, and bolt holes reamed to fit the machine-fitted bolts in their construction.

Elevated Cars for Boston

The Boston Elevated Railway Company has recently received from the St. Louis Car Company forty-five double-truck vestibule motor coaches, one of which is shown in the accompanying view.



ELEVATED CAR FOR BOSTON

The car body is 38 ft. 4½ ins. long. The platforms are 4 ft. each, making a total length from out to out of 46 ft. 4½ ins. The car is 8 ft. 7 ins. wide. The bottom construction is of compound wood and iron type. The side sills are composed of 3 ins. x 8 ins. Southern pine and 6-in. channel on the inside. The center sills are 5-in. steel I-beams. The end sills are also compound construction. The body bolsters are made of wrought steel built up with malleable-iron castings. The needle beams are 5-in. steel I-beams, all properly trussed, and the entire floor is properly braced with cross timbers, making one of the most rigid constructed bottoms ever put in elevated cars.

Each diagonal corner is fitted with a motorman's cab having doors on both sides; the opposite doors are arranged in two sections. If desirable the upper half can be swung inward and folded

against body of car or both sections can be swung inward and folded in a similar way. When doors are so opened an automatic folding gate takes the place of doors. In the motorman's cab an end compartment is provided under the roof for electric heater, motor and light switches. This compartment is lined with ⅜-in. asbestos. The other side of the car is provided with folding gates and the other end of the car with rail and safety chains. In addition to this, safety gates are also provided for the open section.

The outside construction, as seen from view of car, is straight panel tongued and grooved and the posts and braces are filled in with extra heavy blocking. The cars are painted in Aurora red, striped in gold. The inside finish of the car is of best African mahogany, finished in natural color. The ceiling is sky blue, neatly decorated and ornamented. All sashes are glazed with ¼-in. plate glass made to raise and fitted with necessary latches and springs. Curtains of pantasote are used with automatic fixtures.

The seats are longitudinal, are canvas lined spring rattan, and the section next to the doors is provided with a fireproof compartment for the large Sprague controller, lightning arresters, resistances, etc. This compartment is also lined with ⅜-in. asbestos. The bell cord in hung through center of car on brass bell-cord hangers. The trimmings throughout are of solid bronze, highly polished in latest style. The aisle is covered with floor mats. The light is equally distributed through the car, and electric headlights located over hoods and electric-sign lights are provided on each end. In fact, the car is a handsome, up-to-date car in every respect.

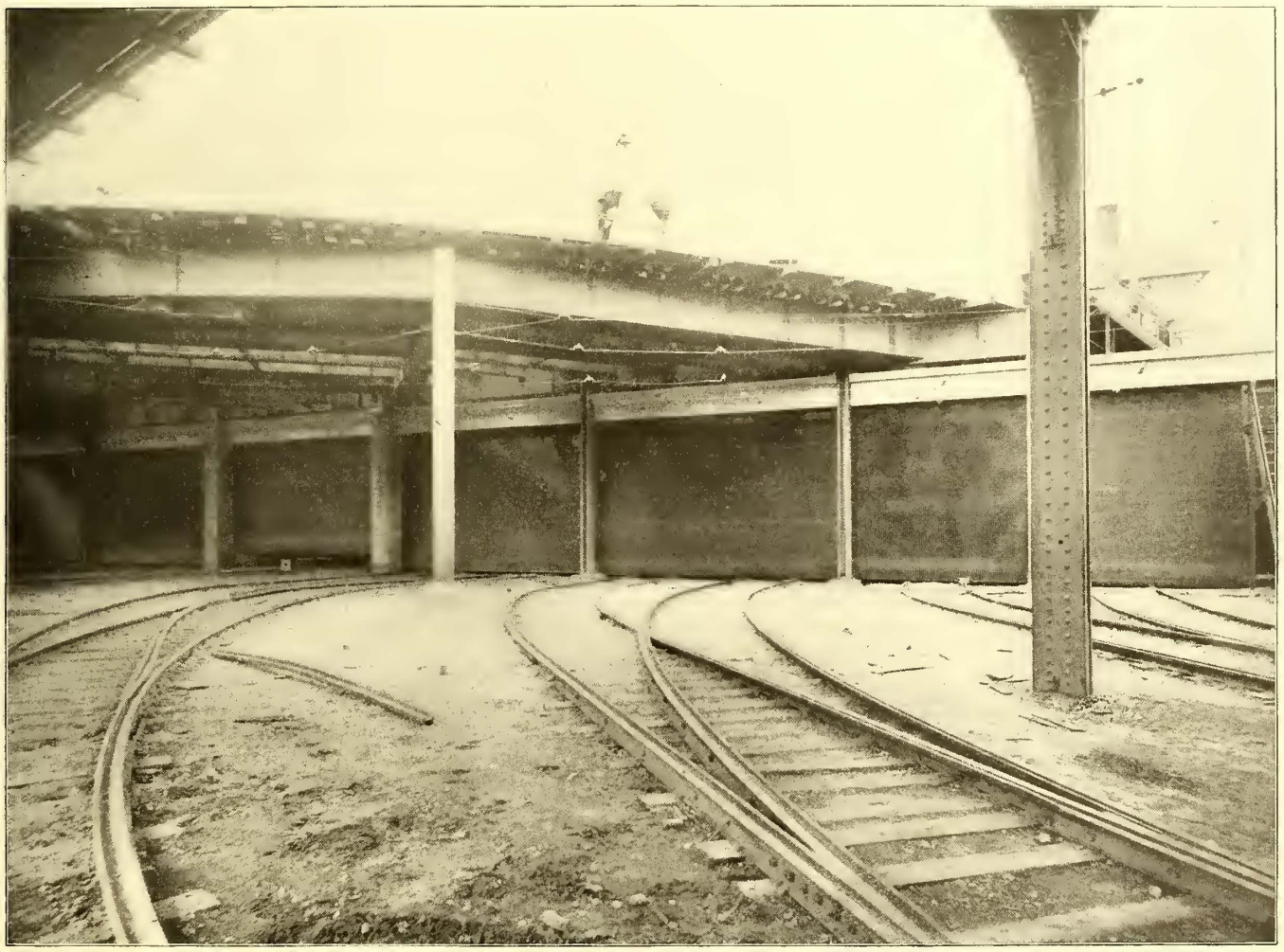
Injunction Against Increased Taxation in Cleveland

On July 23 Judge Ford, of the Common Pleas Court, in Cleveland, issued an injunction restraining the City Annual Board of Equalization from increasing the tax value of the Cleveland Electric Railway Company, otherwise known as the Big Consolidated Company, above the figures returned by the officials of that corporation.

The street railway company alleged in its petition that Mayor Johnson induced five members of the Board of Equalization to resign several months ago so he could appoint men of his choice. These new members were influenced by the Mayor, it was charged, to act in an unusual and unfair manner in equalizing the tax values of corporations.

Steel Rolling Doors in Boston

The car houses of the Boston Elevated Railroad Company, Boston, Mass., are nearly all equipped with steel rolling doors. The entrance of the surface lines into the Sullivan Square car house is shown in the accompanying engraving. The ground floor of this building is utilized for the surface cars, while the second floor is splendidly fitted and arranged for the elevated trains. The entire front of both stories, as well as interior partition walls, has been furnished with Kinnear steel rolling car-house doors made by the Kinnear Manufacturing Company, of Columbus, Ohio. The doors on the ground floor are equipped with the Kinnear trolley-wire connection, which provides for an uninterrupted current with the doors in any position, and which was described some months ago in these pages.



ENTRANCE FOR SURFACE CARS TO SULLIVAN SQUARE CAR HOUSE

The larger portion of these doors are 24 ft. to 28 ft. in width by 14 ft. to 17 ft. high, and each door operates with the greatest possible ease and speed, the Kinnear apparatus for raising and lowering being most perfectly designed.

The Kinnear doors are being very largely used for car houses, and among the important contracts recently closed by the company are two through its London house for a tramway shed at Cardiff, and another large car house at Nottingham, England. The contract for the immense doors for the car houses of the Rochester Street Railway Company has also been awarded this company.

New Cars for New York

The Metropolitan Street Railway Company, of New York, has ordered from the J. G. Brill Company 200 new double-truck cars for its Broadway division. They are to be delivered by Oct. 1. The reason given for the non-use of double-truck cars on this line heretofore is that they could not pass each other on the curves. Owing to the change from cable to electricity, it will be an easy matter to spread the tracks at these points, so that no difficulty will now be experienced.

Waste Heat Engines

It has long been generally conceded that the limit of extension of the temperature range of the steam engine, and thus of its efficiency, is reached, on the exhaust side, in the temperature of the hot-well of its condenser. The remarkable increase in steam-engine efficiencies of recent years has been developed entirely along the line of raising the initial temperature, yet with all the progress through higher pressures, superheated steam, more economical cut-offs, or multiple expansions, there is always an important and inevitable loss of heat energy when the steam, having expanded in the cylinders, is exhausted and condensed back into water by being cooled in the condenser. The difficulty of so adjusting conditions as to obtain much lower temperatures in the hot-well than about 100 to 140 degs. F. has rendered those temperatures the accustomed final temperatures in condensing practice, and the corresponding latent heat of the steam, given up upon the change of form from steam to hot water is, in the greater part, wasted. Hence, a successful attempt at the utilization of the heat still remaining in exhaust steam, which means practically an extension of the heat range, and thus of the efficiency of the steam engine, can not fail to be of widespread interest to the engineering profession.

The recent tests by Prof. E. Josse, head of the mechanical laboratory of the Royal Technical High School, Berlin, upon engines designed to utilize the waste heat of the steam engine prove conclusively that the temperature range, and thus the efficiency, of the steam engine is capable of considerable increase on the exhaust side beyond its present generally accepted limits. The principle involved in his tests is an original and interesting process of utilizing the heat going to waste in exhaust steam for the evaporation of a liquid having a boiling point very much lower than water and then making use of the compressed vapor, which is the joint discovery of G. Behrend, a Hamburg engineer, and Dr. Zimmerman, of Ludwigshafen, and was patented in 1889. An engine was designed and erected for this purpose in the laboratory of the Technical High School, and also a similar, but much larger, one in the central station of the Berlin Electrical Works, both of which have been thoroughly tested for efficiency and endurance with most gratifying results, sufficient savings being effected in each case to warrant a general adoption of the principle.

The method in which the heat energy of the exhaust steam is utilized is as follows: After the steam has expanded in the cylinders of the steam engine, it is exhausted into a surface condenser in which the cooling liquid is a liquid with a low temperature boiling point. The steam is thus condensed in the same manner as in ordinary water condenser practice, but here the volatile liquid absorbs the ejected latent heat of the condensing steam and itself vaporizes, producing pressure. The pressure of this vapor is then utilized expansively in a specially constructed engine, after which it is exhausted into a water-cooled surface condenser, to condense it back into liquid form again ready to be pumped into the steam condenser for continuation of its cycle.

Ammonia and sulphur-dioxide (frequently called "sulphurous acid") are both capable of being used for this purpose, but it has been found most advantageous to use sulphur-dioxide, as the pressures of its vapors correspond to the temperatures to be dealt with are more easily handled. It is also commercially practicable for use as it is cheap and easily obtainable, and if not allowed to become oxidized by contact with air or water, it does not corrode the containing vessels, being inactive upon cast-iron, wrought-iron, bronze, etc. Furthermore, it has a peculiar advantage for use in the cylinder of a reciprocating engine of possessing a viscous consistency so as to be self-lubricating; this is a most desirable feature in using the liquid over and over again as it thus does not become contaminated with lubricating oils.

The addition of this auxiliary involves a comparatively small outlay. In place of the regular steam condenser is substituted a well-made and very carefully fitted surface condenser in which the sulphur-dioxide liquid condenses the steam and itself vaporizes. The pressure of this vapor is utilized in an auxiliary engine which may be connected directly to the main engine's shaft, or to be used independently, as desired. The vapor exhausted from this engine is condensed in another water-cooled condenser of like perfection of make and fitting, the liquid sulphur-dioxide being pumped back into the steam condenser to repeat the cycle. The auxiliary engine requires special design in the way of extra long stuffing boxes for the piston and valve rods to prevent the escape of the vapor on account of its extremely obnoxious odor. The condensers require perfect fitting to prevent the admixture of water with the sulphur-dioxide which would cause it to be oxidized to sulphurous acid which attacks metal. In short, the entire sulphur-dioxide system must be of the most perfect mechanical construction. However, with the best of materials and workmanship, it is claimed that the extra cost of the auxiliary plant is insignificant as compared with the saving effected. Prof. Josse estimates, partly from completed plants and partly from guaranteed offers, that a combined steam and waste heat plant for 1600 hp would cost only about 3 per cent more than a plain steam plant of like power, while the running cost would be over one-fourth less.

Actual tests upon the waste-heat engine in the Technical High School laboratory showed a steam consumption of only 8.34 lbs. per ihp-hour for its most favorable working, which is remarkable for a 150-hp engine, being much below the economies of our largest modern engines. However, that particular test was made after the engine had just been overhauled, so that its valves were in very good condition. Tests under more general conditions and also with lower vacuums showed somewhat poorer results, yet, withal, the performance of the combined engine was satisfactory and surprisingly economical throughout. Some care has to be taken in adjusting the vacuum so that the auxiliary engine may be able to make use of all the vapor generated for best economy, yet with the proper relations adjusted, it would seem that the best results might thereafter be obtained at all loads without further adjustment.

Indeed, no objections to the results obtained in these tests are apparent, the utmost care and detail having been observed in every particular. There is one consideration that is not entertained by Prof. Josse in the comparisons with plain steam plants in respect to the displacement of the feed-water heater and its economy. However, to offset this, is the possibility of entering the steam jacket and trap drains into the vaporizing condenser, thus effecting a slight gain by raising the vaporizing temperature. Thus the waste-heat engine appears to be very potent in economical working, and its adaptibility to all classes of existing steam engines should insure its general adoption, as it would prove a profitable investment in most cases even if it effected one-half the saving claimed for it, or 20 per cent of the original running cost. The existing prejudices against the use of sulphur-dioxide as dangerous have been proven unworthy of consideration with the apparatus in experienced hands. Prof. Josse suggests the possibility of utilizing in the same way the heat of the waste gases from boiler furnaces and gas engines.

The Westinghouse Exhibits at the Pan-American Exposition

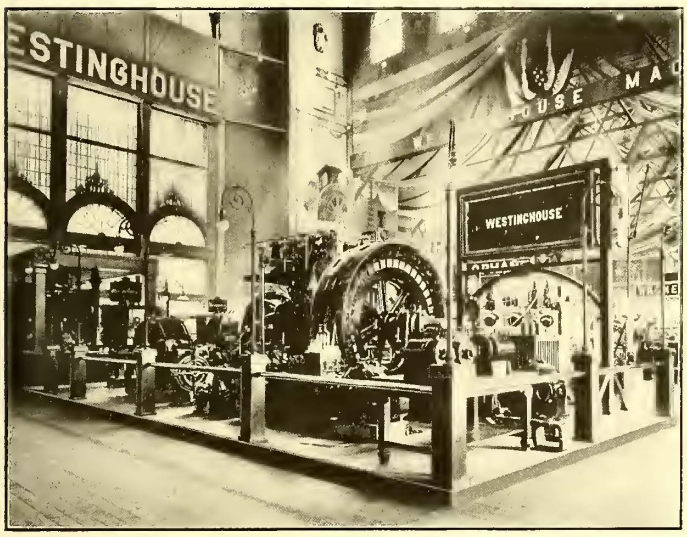
It is not too much to say that the exhibits of the Westinghouse Companies are worthy of the Exposition as a whole. It was in a broad and liberal spirit that these companies decided to make an exhibit at the Pan-American, for in the city of Buffalo and vicinity the Westinghouse Electric & Manufacturing Company alone has over 150,000 hp of electrical machinery in operation, including the ten 5000-hp generators which it installed at Niagara Falls, at a time when the largest electrical machine built was about 2000 hp in capacity. It is this installation that has made possible the most brilliantly lighted of expositions and contributed so greatly to its successful operation.

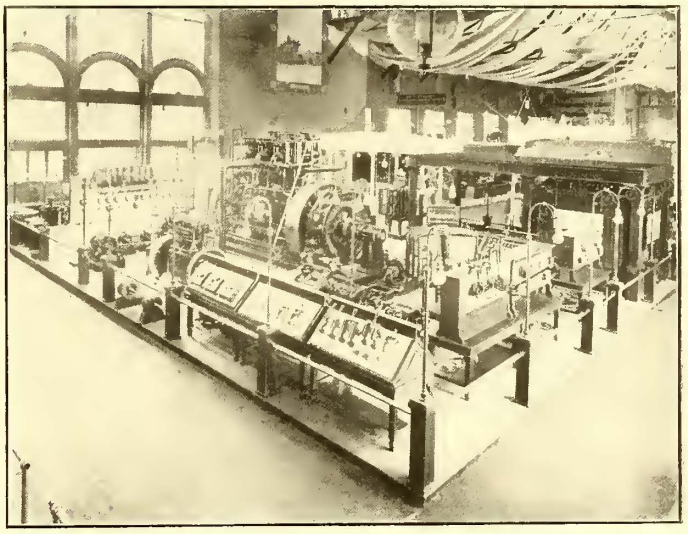
To the visitor at the Pan-American Exposition the numerous industrial enterprises associated with the name Westinghouse are in the main familiar. Almost every traveler by rail knows that his safety and comfort are in a large measure due to the Westinghouse air brake, which for thirty years has been the standard appliance for arresting the motion of trains. 1,250,000 of these brakes are now in service throughout the world. Those familiar with engineering affairs are acquainted with the very extended use of the steam and gas engines built by the Westinghouse Machine Company. Those who use electrical machinery, whether for lighting, power or traction, know the apparatus built by the Westinghouse Electric & Manufacturing Company. Equally well known are Westinghouse, Church, Kerr & Company, whose work practically covers the entire field of engineering as applied to power systems and their application to transportation, lighting and industry; the Union Switch & Signal Company, manufacturer of every known variety of automatic and semi-automatic railroad signals, maker of frogs and switches, and of mechanical, pneumatic and electrical interlocking mechanisms of all kinds; the Sawyer-Man Electric Company, maker of incandescent lamps, whose product has been on the market for over twenty years. These are the Westinghouse Companies that have joined in a common exhibit.

Beneath the central dome of the Electricity Building and to the right and left of the main entrance to the Railway Exhibits Building, occupying in all over 6000 sq. ft. of space, and truly representing the progressive spirit of this century, the exhibits of these companies have been placed. The dome of the Electricity Building is tastefully draped with hanging green and lavender bunting, making a background upon which numerous strings of Nernst lamps festoon off from a large 2000-cp lamp placed in the

center. There are over one hundred 400-cp Nernst lamps that contribute to this illumination, which is the first public exhibition of the Nernst lamp in America and a notable introduction of one of the greatest developments that has ever been made in electric lighting.

The operation of two gas-engine generating sets is one of the features of greatest interest in Electricity Building. The large unit consists of a 300-hp, three-cylinder, 4-cycle gas engine, direct coupled to 2200-volt, two-phase, revolving-field alternator. The smaller unit is a three-cylinder, 4-cycle gas engine, direct connected to a 125-volt, direct-current generator. The power furnished by





TWO VIEWS OF THE WESTINGHOUSE EXHIBIT IN ELECTRICITY BUILDING

the large unit is employed partly in supplying current to 130 Nernst lamps at 220 volts, and partly in operating numerous Westinghouse induction motors applied to stationary service. The small gas-engine generating set is used for exciting the large alternating-current generator, for lighting the switchboard, and for charging the storage sparking outfits for both gas engines. It is used also for operating the motor-generator outfit and for lighting four large electric signs, two of which are placed over the main entrances of Electricity Building. The switchboard for controlling these generators is equipped with the latest type of measuring instruments, switches, circuit breakers and auxiliary apparatus. Other standard switchboards for lighting and power service are in place. A 375-kw alternator, revolving field type, 7200 alternations, is of particular interest.

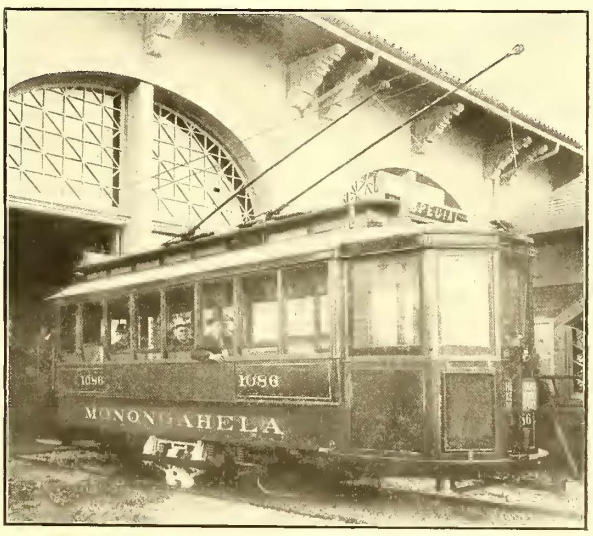
Of transformers there are to be seen a complete set of the company's O. D. transformers from ¼-kw to 50-kw capacity; two sizes of manhole-type transformers, and two 100-kw self-cooling, oil-insulated transformers. The latter are used to lower the voltage of the 180-kw machine from 2200 volts to 110 volts, at which potential they supply the four incandescent signs. These transformers present no radical departure from the excellent type which the Westinghouse Company has standardized. One of the most novel attractions in Electricity Building is a high voltage sign consisting of two large glass plates covered on the back with metal foil, with the name "Westinghouse" in its center, and connected to an alternating pressure having a maximum of 40,000 volts which is applied between the foil on the back and the metal letters on the front. As the potential is raised a fringe of violet light appears about the letters which, gradually increasing in intensity, culminates in a myriad-branched lightning discharge that plays continuously over the surface of the plate and is accompanied by a continuous crash not unlike thunder.

Among the railway motors included in the Railway Exhibit are a Westinghouse 56 motor for heavy suburban and interurban service, a 50-C motor for heavy railway service, and a 69 motor for city and suburban service. These motors are split horizontally with their suspension on the lower half of the field. The pole faces are smooth and unbroken, and the armature possesses a ventilated winding. The 50-C motor is provided with a special cradle suspension from the car axle, thus removing the not inconsiderable weight of the motors from the car truck. This arrangement minimizes the wear of the rails, increases the life of the wheels and, what is most important, makes an easy riding car. There is also a large number of induction motors.

The company also exhibits a complete line of detail apparatus, including meters, lightning arresters, fuse blocks, switches, circuit breakers, etc. Included in this comprehensive and interesting section are two large revolving photograph stands containing a great number of pictures which illustrate engineering work of importance, as well as various electrical and mechanical installations of the several companies.

In the Railway Exhibits Building, which is properly defined as containing all flanged wheel exhibits, we find in the southeast end the exhibit of the Westinghouse Air Brake Company. A rack representing a six-car train, including the locomotive, is equipped with the high-speed brake and shows the proper method of application and operation.

The Westinghouse electric brake and car-heating apparatus, described in these pages last month, is shown in full operation at the Exhibition. A standard single-truck electric car is in constant service on a track extending from the main exhibit in the Railway Exhibits Building to a point east of the building some 250 ft. This car is equipped with the electric brake and car heater complete, and is in charge of a regular street-car motorman, who is in readiness at any time to demonstrate the operation of the system to those interested. When in action powerful magnets force the brake friction shoes upon the rails and set up a strong magnetic attraction between the shoes and the rails, while at the same time the drag or



CAR SHOWING BRAKE IN OPERATION

back action of these magnet shoes throws in action a system of levers that apply to the wheels brake-shoes of the regular type. The current for exciting the magnets is supplied by the motor which, through the proper wiring of the controllers, is at this time operated as a generator. With this electric brake system it is claimed to be impossible to skid the wheels, and any degree of braking power is secured from the slightest effect up to a braking effect exceeding the weight of the equipment. A double track of the maximum traction type equipped with two 40-hp motors and with the electric brake is also operated on a short section of track by a stationary controller. This equipment shows the enormous braking power of the apparatus and the absolute freedom from skidding of the wheels. The smooth action of this brake is one of its chief features, there being no shock or sudden jolts during its application.

NEWS OF THE WEEK

Lively Times Expected in Pittsburgh

Public indignation is at its height at Pittsburgh, and there are evidences that the applicants for elevated and surface railway franchises under the Focht and Emory laws will meet with stronger opposition than did those for similar grants in Philadelphia. A meeting of the Council was to have been held last week, and the franchise question was then to have come before the Council; but the meeting was postponed, and the Council will not convene until September, thus giving the vigilance committee, organized by the citizens, time in which to thoroughly organize and prepare a plan of campaign. It is generally expected that when the franchise question is formally considered by that body there will be the most exciting times ever witnessed in the Council.

Sale of a San Francisco Road

It is stated that the purchase of the Sutter Street Railway, of San Francisco, by the Baltimore syndicate, which recently purchased the San Francisco & San Mateo Electric Railway Company, of San Francisco, was finally consummated last week. The syndicate, which has so recently put through the purchase of these two San Francisco roads, is said to be practically the same as that which so successfully conducted the St. Louis and Baltimore consolidations, and the plan, it is reported, is to secure control and consolidation of all the San Francisco roads with the exception of the Market Street Railway. The Sutter Street Railway operates a 12-mile cable line. It has a capital stock of $2,000,000, on which 5 per cent dividends have been paid for several years, and has outstanding $1,000,000 first mortgage gold 5 per cent bonds; $213,100 of the $231,080 outstanding stock of the Sutro road is also owned by the Sutter Street Company.

Plans for the Consolidation of the Everett-Moore Lines

The Everett-Moore syndicate, it is reported, has changed its plans, as previously announced, and will consolidate its lines in three sections, the headquarters of the three divisions being Detroit, Toledo and Cleveland. According to the announcement made a few weeks ago, the plan of the syndicate was to consolidate all the lines into a single company. The properties which have been secured by the syndicate in Michigan are already under the control of the Detroit United Railways Company, which operates the Detroit city system. The Toledo Railway & Lighting Company was recently organized with $12,000,000 capital, and this company will control the local Toledo lines with the roads radiating from that city. It only remains to consolidate the Cleveland city lines and the roads radiating from that city. Later, it is said, the idea of centralizing the entire properties will be carried out, but it will require two or three years to perfect this plan. The report that the syndicate has secured control of the Cleveland City Railway Company has been confirmed by leading members of the syndicate, but denied by Vice-President Emery, of the Cleveland City Railway Company.

It is stated that the position of general manager of the consolidated Cleveland properties has been offered to J. C. Hutchins, general manager of the Detroit United Railways, he being, it was claimed, one of a very few persons capable of handling an enormous system which would include both city and interurban roads. It is understood, however, that Mr. Hutchins has declined to accept the position, and his refusal is said to have caused the syndicate to decide on the plan of keeping each Cleveland property separate and distinct. In a general way there will be a Cleveland group, and all financial business of the corporations will be done through this company; but the individuality will be maintained with the present division heads. The latter part of last week Messrs. Everett and Moore visited Detroit, and, it is reported, perfected arrangements for the purchase of, and secured options on, the properties of the Detroit, Rochester, Romeo & Lake Orion Railway Company; Detroit, Utica & Romeo Railway Company, and the Detroit Northern Company. The latter is new and has only a few miles of track completed. The Detroit, Rochester, Romeo & Lake Orion Railway Company has about 90 miles of track and is capitalized at $1,000,000, having $3,000,000 in bonds. The Detroit, Utica & Romeo Railway Company has 7 miles of track and is capitalized at about $400,000. The report of these purchases has, however, not been verified.

Ganz System for London Underground ?

Special cable despatches to the daily papers state that at a meeting of the stockholders of the Metropolitan Railway, held July 26, the electric traction dispute was the principal topic of discussion. The action of the directors of the Metropolitan, in opposing the proposals made by Charles T. Yerkes to electrify the road, was approved, and the chairman of the meeting, detailing the negotiations between Mr. Yerkes and the Metropolitan Railway, said that expert electricians of both the Metropolitan District and the Metropolitan Railways had approved the Ganz system of electric traction, and that when Mr. Yerkes came upon the scene he had won over the Metropolitan District to the system he approved. The despatches further state that the chairman said his company was advised that the cost of the Ganz system would be from 30 per cent to 40 per cent below that of the system advocated by Mr. Yerkes, and that when the Parliamentary Committee having the matter in charge had settled the question of a system the Metropolitan Railway was ready to carry this system into effect.

Mayor Harrison's Message—Chicago

The twenty-fifth annual report of the Department of Public Works, Chicago, is a well-bound, handsomely illustrated volume containing a great deal of useful information. Mayor Harrison discusses the street railway field briefly and clearly on pages 16 and 17. As to the extension of existing street railway franchises, he says that "the terms offered by the present or succeeding Council must of stern necessity be accepted." He also says: "There is nothing in the ninety-nine-year act to prevent the city from granting franchises to competent companies to duplicate every mile of rail now laid in the city, and that by a new car license ordinance the city could secure compensation for the use of its highways."

Mayor Harrison scouts the idea that citizens of Chicago contemplate confiscation, but public opinion makes the following demands: (1) Compensation to the city based upon a percentage of gross receipts. (2) Reduction of fare during the rush hours of the day. (3) Betterment of accommodations. (4) District waiver of all claims under the ninety-nine-year act. (5) Provision for municipal acquirement of the properties at expiration of the grant.

The grooved rail is insisted upon, the cables are decried as antiquated, and he thinks that it and the overhead trolley should be succeeded by the underground trolley. The recommendations of the Street Railway Commission are not entirely acceptable to the Mayor, but are recommended as a whole.

Serious Interruption of Traffic on the Brooklyn Bridge

Considerable anxiety was manifested last week by Brooklynites over a slight accident to the Brooklyn Bridge. On Wednesday, July 24, shortly before six o'clock, and during one of the busiest times, it was discovered that near the center of the span one of the steel bands encircling the northern main cable and several of the "suspenders" or vertical rods supporting the roadway had broken.

Not knowing how serious the trouble might prove the authorities immediately ordered all traffic of the Bridge trains and trolley cars to be interrupted until an investigation could be made, but fortunately placed no ban upon pedestrians or vehicles. A large force of police was called to the scene, but the crowd adapted itself to the circumstances and walked across without creating any disturbance. The immense numbers that passed over on foot may be judged from the fact that the central promenade was insufficient for their accommodation, and many were forced to use the roadway, so that had it been decided to close the Bridge entirely, one of the most disastrous "jams" that ever occurred in this locality would have undoubtedly resulted, both at the Bridge terminal and at the ferries, which, as it was, could not cope with the situation and satisfactorily supply transportation to those who had hastened thither upon learning the conditions existing at the Bridge. An inspection of the damaged structure was immediately made, and after the rush hours were entirely over a few shuttle trains and trolley cars were run on the southern side. Several other breaks were found in the immediate vicinity of those first discovered, but the exact number has not been officially reported, although it is probably between eight and twelve, and repairs were immediately commenced. Full traffic was resumed in a day or two, but it is considerably lighter than usual, as many persons still prefer to use the ferries until they feel assured that the structure has been thoroughly reinforced. Some three years ago the buckling of one of the Bridge girders created a considerable sensation, but as no harm seemed to have been done, the defective member was not even replaced and the incident forgotten. It occurred at a period of protracted heat similar to that which has been visiting New York City recently, and the cause of the trouble was ascribed, probably with reason, to the unequal expansion of the connected parts. In the present case, however, a somewhat startling dissimilarity of opinion as to the cause of the failure seems to exist among those engineers and officials who have the care of the Bridge in their charge, if the interviews with them as published in the daily press are to be believed, and has called forth much unfavorable editorial comment. An inquiry by a board of experts is demanded, and not until after such an inspection can it be safely said whether the breaks were due to unequal expansion, incompetent or neglectful management, overloading of the structure, or some other cause. The pecuniary loss to the Brooklyn Rapid Transit Company from the total suspension of traffic and the subsequent delay in regaining its normal patronage will be many thousands of dollars. One lesson taught by this indication of weakness in the Brooklyn Bridge is, however, realized by all—more bridges are greatly needed across the East River, and work on those under construction and contemplated should proced with all possible expedition.

Annual Report of the Chicago Union Traction Company

The annual meeting of the Chicago Union Traction Company was held at Chicago, July 23, and in the STREET RAILWAY JOURNAL for July 27 the annual report of the company was printed and mention was made that the directors had been re-elected. The operating report caused considerable comment in financial circles, and to augment the report already published in the STREET RAILWAY JOURNAL, the detailed report of the company is presented herewith, together with the president's address to the stockholders. No balance sheet was given with the report. The president, in his address, said:

"The last twelve months have been eventful in many respects in the management of your properties. It has been a period of adversities such as we may safely hope hereafter to escape. One year ago we were confronted with conditions that were anything but encouraging. The operation of the Northwestern Elevated Road through our territory resulted in a direct loss in traffic of from $1,500 to $2,000 daily, which, together with the unsettled labor question the greater part of the year and with the losses attendant upon the suspension of building operations, materially affected our receipts. In addition to this loss of traffic, operating expenses were increased by raising the wages of the employees of the North Side lines to conform to the rate paid by the larger West Side system.

"While the foregoing items of loss and expense prevent our showing an increase of receipts as compared with the year previous, nevertheless we have met all our fixed charges, paid the first quarterly dividend on our preferred stock, maintained our credit, improved the efficiency and standard of our rolling stock, roadbed and general equipment, and are now able to show a surplus of $12,650.

"The physical condition of the company is better than at any time heretofore. During the year fifty large double-truck box cars and fifteen large double-truck open cars, of the most modern types, have been added to our rolling-stock equipment. Several miles of track have been extended into new territory. A large amount of reconstruction of track and roadbed has been acomplished, so that to-day our right of way shows a decided improvement over conditions existing last year.

"Among the economies effected during the year were the consolidation of the car shops and storehouses; the centralization of North Side electric cars in a newly constructed car house of almost unlimited capacity, and the disposal, by lease, of all unused real estate upon a self-sustaining basis. We have also thoroughly overhauled our electric power houses and installed new machinery, which has resulted in a large saving in the cost of production of power and a marked increase in the efficiency of the several plants.

"The most amicable relations exist between the company and its employees. Our trainmen are neater in appearance, more gentlemanly in conduct, more solicitous for the welfare of our patrons and more careful of our property than ever before. This has resulted in a more reliable and satisfactory service, which we believe has tended to lessen criticism and create a kindlier feeling in the minds of those of our patrons who appreciate the difficulties of operating this great street railway system under the existing conditions.

"Judging from the month of June (which was the closing month of the fiscal year) and from the first twenty-two days of the present month, everything indicates that the company will have a much more prosperous year than at any time heretofore. I feel safe in predicting that the expenses and receipts for the current year will be highly satisfactory to the stockholders of this company when the report is made to them in July, 1902.

A comparative statement of the earnings of the company for the years 1901 and 1900 are as follows:

Year ending June 30	1901	1900
Earnings:		
Passenger receipts	$7,269,816	$7,468,798
Chartered cars	4,222	2,122
Mail	15,101	6,478
Gross	$7,289,139	$7,477,398
Expenses:		
Maintenance way and structure	$198,929	$193,667
Maintenance equipment	351,938	381,083
Transportation	2,735,362	2,619,647
General	655,965	567,400
Total operating	$3,942,194	$3,761,797
Net earnings	3,346,945	3,715,601
Other Income:		
Advertising	$33,525	$33,577
Rents, lands and buildings	33,564	35,622
Rents, tracks and terminals	10,000	10,000
From stocks and bonds owned and leased	778,215	764,603
Interest on deposits and loans	12,417	17,690
Miscellaneous	1,287	2,441
Premium on bonds sold	662	4,417
Total, other income	$869,671	$868,350
Gross income	4,216,616	4,583,951
Charges:		
Taxes	$320,296	$246,034
Interest on loans	70,196	41,777
Rentals	3,665,080	3,688,452
Premium on bonds bought	2,469	3,613
Total	$4,058,041	$3,979,876
Net income	158,575	604,075
Preference dividend paid	150,000	600,000
Surplus for year	$8,575	$4,075
Per cent op. exp. to gross	54.1	50.3

Dr. Edson on the Park Avenue Tunnel

Dr. Cyrus Edson, former president of the New York Board of Health, reported last week to the assistant District-Attorney and the Grand Jury concerning his investigations of the New York Central's Park Avenue tunnel, the condition of which he compared to the Black Hole of Calcutta. Dr. Edson said in part:

"As a result of my inspections, which have extended over a considerable period of time, I would state that in my opinion the said tunnel is the cause of a very serious public nuisance, affecting the health and comfort of a very large number of persons. This public nuisance is mainly caused (*a*) by the gases of combustion, containing carbon monoxide, carbon dioxide, sulphur dioxide and other deleterious gases entering the passenger cars which pass through the tunnel, (*b*) by lack of proper ventilation in the tunnel and (*c*) of the cars during their transit through the tunnel.

"According to Parks, one of the most eminent authorities, human beings require about 60 cu. ft. of air per minute for respiratory purposes to maintain the body and health. When a car such as I have described contains sixty-four persons, these persons require at this rate over 1950 cu. ft. per minute, or nearly 8000 cu. ft. in four minutes. The cubic contents of the car, however, are less than 500 cu. ft., and this air is still further vitiated by the leakage of gases of combustion which are given off by locomotives and densely fill the tunnel and enter through cracks and crevices of the car. In a number of inspections made by me I invariably noticed many of the passengers coughing violently before the train had passed through the tunnel, and this was plainly excited by the irritant effect of the gases I have named on the respiratory organs. I have further noticed a great increase in pulse rate and in respiratory rate of passengers subjected to these conditions.

"It has not been uncommon for very high temperatures to be noted on warm days in these cars while passing through the tunnel; for example, I myself have noted in the cars of the New York & New Haven Railroad a temperature of 111 degs., with a high percentage of humidity. I am informed on credible authority, and can produce the information in the form of sworn testimony, that the temperature of 118 degs. has been noted during the past month in one of the trains passing through the tunnel. The gases of combustion which are plainly apparent to the senses while the cars are passing through the tunnel are mainly carbon monoxide, carbon dioxide and sulphur dioxide. All these gases are poisonous and in sufficient amount will destroy animal life. Carbon monoxide is the most poisonous of the three. Five-tenths of 1 per cent of this gas will destroy animal life very rapidly. Symptoms of poisoning from breathing small amounts of this gas for even a short time are dizziness, headache, nausea, vomiting, debility, dry irritating cough and a train of symptoms similar to those of malaria.

"My attention has been called by Prof. Doremus, with whom I have been associated in the performance of this work, to a comparison between the conditions existing in the cars passing through the tunnel, and those in the celebrated Black Hole of Calcutta. Briefly, in the latter case, 146 persons were thrown into a room the size of an 18-ft. cube, at eight o'clock in the evening. This room contained a door and two small windows. The latter were open. A simple calculation will show that each of these 146 had in this room about 38 cu. ft. of air space, and yet by 11.15 P. M. all were dead but twenty-six, most of whom afterward succumbed to fever. The only causes operating to effect this in the case of the Black Hole was carbon dioxide and the exhaustion of the oxygen of the air. There were, however, two small windows to effect ventilation. In the case of the cars passing through the tunnel, there is about 56 cu. ft. of air per passenger, when the car is full, and no ventilation whatever, and a leakage into the car of vitiating gases of combustion.

"In my opinion the condition of the cars in passing through the tunnel is worse for the period of passage than those which were obtained in the Black Hole at Calcutta during a corresponding period. * * * The continued effect of two trips daily through the tunnel, in my opinion, will debilitate and weaken all but the strongest and most vigorous persons."

New Publications

Central Station Experiences, 1901. 106 pages. Illustrated. Price, boards, 75 cents; cloth, $1. Publishing by the Power Publishing Company, New York.

This interesting little volume contains reprints of the articles of the same title recently published monthly in *Power,* and is a series of narratives on the trials and tribulations of a steam engineer while learning to run an electric station. The engineer in charge of the plant is ever beset with difficulties and always at the opportune moment the engineer who installed the apparatus appears and helps him to solve the problems with which he is confronted. The stories are written in the vernacular of the dynamo room and carry the reader through the vicissitudes accompanying the growth of a central station in a country town.

Specifications for Steel Bridges. By J. A. L. Waddell, C. E., B. A. Sc., Ma. E., 1900. 188 pages. Price, $1.25. Published by John Wiley & Sons, New York.

The author and publishers of "De Pontibus" have reprinted separately the specifications given in that work in this smaller volume to supply the demand by draftsmen and computers for those specifications alone. A few changes have been made to bring the matter up to date, and the necessary tables and diagrams are included. Mr. Waddell has had an extensive experience in this branch of engineering, and all the material contained in his book is not only based upon actual practice, but has been successfully applied in a large number of cases covering a period of over four years. The specifications cover the subjects of railroad draw spans, highway bridges and viaducts, the manufacture, shipment and erection of bridges, trestles, elevated railroads, etc., and others that are as important to engineers engaged in the designing of such structures.

Inventor's Manual: How to Work a Patent to Make It Pay, 1901. 115 pages, Price, $1. Published by Norman W. Henley & Company, New York.

The title page of the "Manual" states that it was written by an experienced and successful inventor and is intended as a guide for the perfecting of inventions, the obtaining of patents and the disposing of them. The author has condensed a great deal of such legal information regarding patents, contracts, etc., as an inventor requires into a small space. Some useful hints are given regarding the exploitation of new devices and the reader receives much good advice on the subject of moderation in estimating the value of one's own inventions.

PERSONAL MENTION

MR. W. B. GREENLAW, of Dallas, has been appointed general manager of the Glenwood & Polytechnic Street Railway Company, of Fort Worth.

MR. F. A. ESTEP, president of the R. D. Nuttall Company, of Pittsburgh, sailed for Europe, July 24, on the White Star Steamship "Oceanic." His company already enjoys a large foreign business, and Mr. Estep will visit both England and the Continent in the interests of his company.

MR. W. D. KEENE has resigned as superintendent of the Columbus Railroad Company, of Columbus, Ga. Mr. Keene has been connected with the Columbus Railroad since 1888, and by diligent, unceasing work and strict attention to details, advanced himself from a menial position in the construction department of the company to one of great responsibility. Mr. Keene was most popular with the employees of the company, and they presented him with a handsome watch when he formally retired from the company.

CONSTRUCTION NOTES

LUPTON, COL.—L. C. Winbourne, a well-known local capitalist, is interested in a plan to construct an electric railway from Lupton to Estes Park. The distance between the two points is 60 miles. Estes Park is one of Colorado's most popular pleasure resorts.

IDAHO SPRINGS, COL.—S. N. Simpson, of Kansas City, is interested in a plan to construct an electric railway from Kansas City to Flirtation Peak, where it is proposed to lay out a pleasure park.

RICHMOND, IND.—The Richmond Street & Interurban Railroad Company has begun work on the extension of its lines west to Centreville. The road will be ready for operation by Nov. 1.

DES MOINES, IA.—Work has been begun on the foundation of a $25,000 car house to be built by the Des Moines Street Railway Company at the corner of Twenty-Fourth Street and Ingersoll Avenue. The house will be built in sections, and the first section will be completed about Sept. 15. It will cost between $5,000 and $7,000. It will be built of brick, and will accommodate twenty-five of the new park cars now being built by the company at its Des Moines shops, of which ten are already completed and seven are in the service of the company now. Ingersoll and Valley Junction and University Place cars will be housed in the new houses. The foundations, upon which work has been begun, are for a building 250 ft. long by 50 ft. wide. It will be curved, the outer and inner edges forming the arcs of two immense circles. It will stand at the south end of a large plat of ground owned by the company, extending from Ingersoll Avenue to High Street, and from Twenty-Fourth to Twenty-Fifth Street. The lower front of this tract has been the property of the street car company for some years. The plans for the building provide for an addition equal to the first section, and for a third section of almost equal size. When the whole is completed there will be room enough for one hundred cars in the Ingersoll Avenue houses.