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## Handling Traffic in Confined Areas

The problem of handling large crowds of people in confined areas at stations, terminals, parks, tunnel entrances and other points where direct connection is made between tracks and streets is always a serious one, and in New York at present is especially acute. Two phases are represented in this city to a greater extent than in any other place in the world; the terminal problem as illustrated at the New York end of the Brooklyn Bridge and the station problem of the New York Subway. The latter has been made the subject of a report by B. J. Arnold to the Public Service Commission of the First District of New York State. This report, which is published in abstract elsewhere in this issue, represents the result of a preliminary study only of the subject by Mr. Arnold, and the suggestions contained in it are intended to effect improvements which can be put immediately into force. Others which should result in a more radical amelioration of the conditions now existing will be taken up later.

In his analysis, Mr. Arnold confines his attention practically to a single point: that is, the means for expediting the discharge and receipt of passengers at the stations. It is well known that the number of persons who transfer between local and express trains at express stations far exceeds any estimates which were made at the time that the subway was designed. Much of this is unnecessary, but it is by no means uncommon for a considerable percentage of the passengers on a local train to transfer to an express train at one express stop and transfer back to a local train at the next express stop, hoping thereby, but usually in vain, to economize a minute or two. This practice cannot be prevented without interfering with the ease of transfer of those who have a legitimate reason for doing so, but it adds very much to the complications and delays at the stations.

Mr. Arnold's first suggested remedy is the employment of special attendants, clothed with police power, at the principal express stations, to control the entrance and exit of passengers and, if necessary, enforce order among the unruly. This plan has been followed in Boston for some time, and has recently been put into force in New York.

Although, so far as we know, no accurate measurement of the increase in "passenger station output" on either of these rapid transit systems, during periods of heavy travel, by the help of these men has been made, it is remarkable how much a few alert platform men can do to shorten station stops. Each passenger who remains on a small platform a moment longer than is absolutely necessary in times of heavy travel is a contributory cause toward congestion and possible costly accident. Strangers who are uncertain how to select the train they desire, and other hesitating patrons, can be directed into their proper channels by the station men, who can also often greatly accelerate the train movement by distributing waiting passengers evenly between the points at which the train must be boarded. The men can be greatly assisted in their duties, however, by the presence of plainly lettered directions in the stations and destination signs on the trains. Everyone cannot be expected to know the meaning of the marker lights, and the character of each train should be quickly evident, from signs at its front end and also on its side, to those waiting in the stations.

It is believed that with the help of these men and the adoption of strict rules in regard to the length of station stops, the latter can be reduced by arbitrarily closing the doors at the end of 45 seconds after they have been opened. This may occasion a short delay to some of the laggards,

but will greatly increase the number of cars passing each station within a given time.

Mr. Arnold's second recommendation is, briefly, that a reduction can be made in the length of the block between trains entering and leaving the stations. His third suggestion for improvement is the introduction of side doors, which will greatly assist in the facile movement of passengers, but would also necessarily reduce the seating capacity of the cars, as the side doors would have to take the place of the present cross seats. The desirability of adopting this plan is a question, as Mr. Arnold expresses it, of policy and not of engineering, so that he thought it better for the Commission first to express a wish as to which result it prefers. Under the conditions which exist, it is impossible to secure both the maximum seating capacity and the quickest transit, but, as the report points out, a large number of the passengers in the rush hours stand now; moreover, owing to the large number of people who transfer, it is usually possible for one who continues in the same car to secure a seat after an express stop, and the distances as a whole are short. In other words, immediate reform can be made in the length of stops, and this question is one largely of public education and preference. We trust that the Commission will act upon the suggestions to secure an increase in carrying capacity of the subway, and will also push forward other plans for immediate relief, such as increasing the capacity of the elevated structures, until additional transit lines in New York City are available.

## Competition in Electric Railway Traffic

The influence of competition in determining the volume of traffic on an electric railway system is often overlooked by managers closely occupied in taking care of the business which naturally comes to their roads. So rapid has been the growth of many American communities that the local and interurban facilities provided in thickly settled territory have been hard pressed to keep up with the yearly increase of passenger travel, and in places where freight and express service have been inaugurated, vigorously advertised and energetically handled, there has been even less incentive to go down into the roots of the passenger traffic question with the hope of analyzing competition sufficiently to secure a greater volume of business. This is shown by the service given on many suburban and interurban lines, which is little faster than the same lines provided five or ten years ago. It seems as though many companies do not yet appreciate the magnitude of the competition which they are facing in passenger service, though plenty of half-formed ideas may be lying dormant.

If rush of business can be accepted as a legitimate excuse for overlooking this question of passenger competition during the past few years, the present temporary breathing time in the financing of new construction projects is certainly an admirable interval to devote in part to these considerations. The edge of competition is becoming sharper, especially in the old-established communities provided with several parallel or semi-parallel transportation services in the same territory. The manufacturer who is offered more business than he can handle devotes a large share of his energy in times of easy money to the extension of his physical plant to meet the demand for excess output; but when the time comes for going after business to keep the existing equipment fully at work, he realizes as not before the influence of tangible and intangible competition, and if far-sighted, sets himself at work to overcome it. The same policy can be followed with good results in the electric traction field when the conditions permit the expenditure of the necessary time and study.

Like the steam road, the trolley system is reasonably certain of a large patronage regardless of general business conditions, given the character of service which will attract travel. Gross earnings may be greater when the entire country is working overtime on production, but net profits are not entirely a function of gross income. The ideal of the traffic manager or division superintendent, whatever may be his title in specific cases, must be to work his rolling stock and track to the saturation point represented by maximum profit; and at times when the full resources of an operating organization are not demanded, every passenger who can be made to patronize a particular line instead of a rival route, whether that route could have been covered by a steam, electric, automobile, horse operated or pedestrian trip, is worth far more to the enterprising and progressive railway organization than in times when it has more business offered than it can profitably handle. The traffic load factor is quite as much worth pushing up to a high percentage as the load factors of individual engines and generators in the power plants, and the stimulation of shopping travel during the light hours of the day by deflecting riders from a competitive steam service, for instance, is far more desirable than the expenditure of the same energy on the rush hour patronage.

Additional facilities create traffic where none existed before, but if an electric road could only handle the new business resulting from its installation it is doubtful if it would be a paying proposition. The use of electric power enables giving to the public quick, frequent service at a lower operating cost, and total expense for transportation than can be offered by steam locomotives, and it is this quicker and more frequent service which causes the usual large increase in passenger traffic. While it is true, and a blessing to the steam road that in many cases existing trolley parallels have not so much captured traffic from the former as they have developed a new class of business, it remains a significant fact that every passenger who rides between his origin and destination by steam when he might be induced to go by trolley, is so much a loss to the competing trolley line, and axiomatic as this might appear, it is not always appreciated by interurban and suburban electric roads, if the character of service offered is any index.

The selection of a given route by a passenger depends upon several factors, which vary in influence according to the personal equation and circumstances of each prospective patron. The total time from origin to destination, the total cost from point of departure to destination, the accessibility of the line at each end, frequency of the service, character of rolling stock and stations, comfort of the roadbed and track, terminal facilities and transfer privileges, all carry weight. Consciously or unconsciously many a patron sums up these points before deciding quickly what route to take. No proper study of competitive routes

can therefore be made until these points are lined up for each method and facility of transit offered. Seldom will it be found that a single route combines all the principal advantages. House-to-house service inevitably means slower schedule speeds, while, on the other hand, a frequent service means less total time consumed in the complete journey. A tendency of a fast line to give a tardy service with delayed trains may be offset by the slower, yet more frequent and reliable service of a competing trolley route. If commutation traffic is desired on a suburban or interurban line, the special factor which appeals to this class of service must be accentuated. If fast through traffic in limited service is the object, all needless local stops must be cut out. The practice of stopping through interurban cars outbound to receive passengers only, and inbound to deliver only, between city limits and urban terminals, is a recent wise step to accomplish the separation of local short distance traffic from through business. The data which one accumulates in traffic analysis are certain to be suggestive in studying how to meet competition, and are well worth taking trouble to secure on every growing road.

## Electric Traction and Civic Betterments.

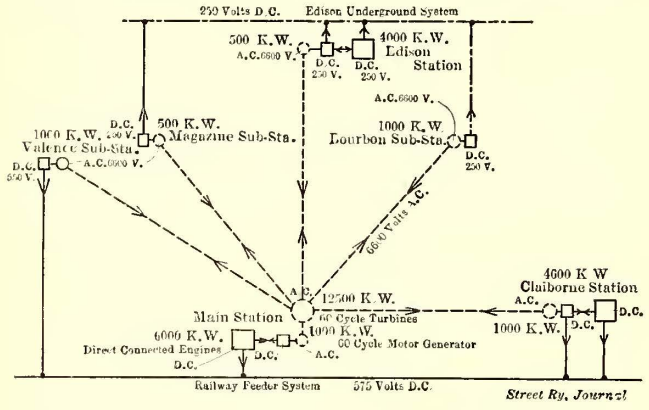
In the movements now under way to promote the appearance of large cities, from the æsthetic standpoint, it is gratifying to note that electric traction is receiving more and more consideration from civic committees and landscape architects charged with the duty of making specific recommendations toward municipal betterments. We hear little in these days about the erstwhile ugliness of the overhead trolley, for it has been demonstrated time and again that poles and fittings can be designed in an attractive form as easily as in crude, inartistic shapes; and if properly maintained by operating companies, they need be no more objectionable than gas and electric light posts, patrol boxes and other public utilities. Mr. Wilson, of the Twin City Rapid Transit Company, sounded a note worth listening to at the recent Atlantic City Convention when he urged the importance of maintaining a clean and attractive roadbed, and it is equally true that public sentiment appreciates efforts to keep the overhead construction taut, ragged ends cut short, frayed insulation replaced, and poles painted and erect. It costs money to do this, but there is a direct connection between a refusal of a valuable franchise in a residence section and the failure on the part of a company to realize the importance of meeting legitimate demands for neat and workmanlike construction on all its routes.

In this connection the close of the recent park season suggests the wisdom of paying more attention next year to the appearance of engineering features along the routes leading to the open-air resorts. There is no doubt that some of the money expended on the park proper might in some cases be more effectively applied to the straightening out of overhead feeder lines either at the park or near-by. To avoid the appearance of crude, temporary work is a great gain. It is certainly incongruous to spend thousands of dollars upon lawns, sylvan paths, flower beds and conservatories and to fail to maintain a high standard of appearance in the feeders and service wires which must enter or pass the park. Sometimes a sub-station or a power plant has to be located near or in a park property, and in such cases too much care cannot be taken to avoid the frame structure, galvanized-iron type of building and to carry the feeders and transmission circuits on the poles with mathematical precision as to spacing and sag. At modest expense the walls of an otherwise unsightly building can be gradually covered with ivy, and in designing new fireproof structures for the housing of transformers and other apparatus the use of concrete or stone walls with red-tiled roofs enables the building to be set down in the most attractive part of the reservation without detriment to the natural beauty of the spot. Anyone who has ever seen the Metropolitan Water Board's pumping stations in the Chestnut Hill and Middlesex Fells districts near Boston will realize the truth of this statement.

The influence of the extending trolley lines from urban centers into the suburbs has often been cited as a force for good in relief of congested population, and now that steam railroad electrification is well under way it is worth noting that in this latest development of electric traction we have a still more interesting example of a revolution in transportation methods working for civic betterment. This has been appreciated recently by the Hamilton Club of Chicago, an influential organization which has formulated a civic programme for promoting the beauty of the Western metropolis. It gives first place to the abatement of the smoke nuisance, sensibly urging it "so far as may be practicable and consistent with the maintenance of industrial prosperity and without unnecessary hardship to owners of factories and office and apartment buildings. To promote the reduction of the smoke nuisance the club proposes the diffusion of knowledge concerning the best practical means for the consumption of fuel, the use of better grades of coal and the instruction of engineers and firemen in the management of steam plants, and the substitution of electric power for steam on all locomotives employed in suburban traffic, bringing with it, so far as possible, the elimination of all steam locomotives within the city limits." Unnecessary noises and odors are also objects of attack. It is significant that the use of electric power on the railroads and industrially is in entire accord with these progressive ideas. The indications on every hand are that the cost of handling heavy traffic per unit by electricity will not exceed, and may be less, than with steam, and in the general field of industrial power there is a most marked saving by electricity. Perhaps the most striking instance of the increasing economy of electricity at hand at this moment is found in the recent report of the Canadian Civil Service Commission, which has been investigating the increased cost of living in the Ottawa region during the past ten years. While rentals advanced from 25 to 36 per cent, and staple foods and fuels some 30 per cent, electricity has been cut 52 per cent in rates; and it is well known that large reductions have also been made in the important cities of the United States. By the extension of routes and multiplication of transfer points the trolley systems also have virtually decreased their prices per mile traveled. These improvements are of enormous benefit to the public through the power of electric traction to bring city and suburbs closer together, no less than from the standpoint of æsthetics. They should be given due weight when operating companies are subjected to the attacks of unscrupulous politicians and reformers who play to the gallery alone.

## THE RECONSTRUCTION OF THE POWER SYSTEM OF THE NEW ORLEANS RAILWAY & LIGHT COMPANY

The electric railways and the gas and electric lighting properties of New Orleans were until a few years ago operated by a number of separate companies with independent generating and power plants. Since the consolidation of the companies into the New Orleans Railways



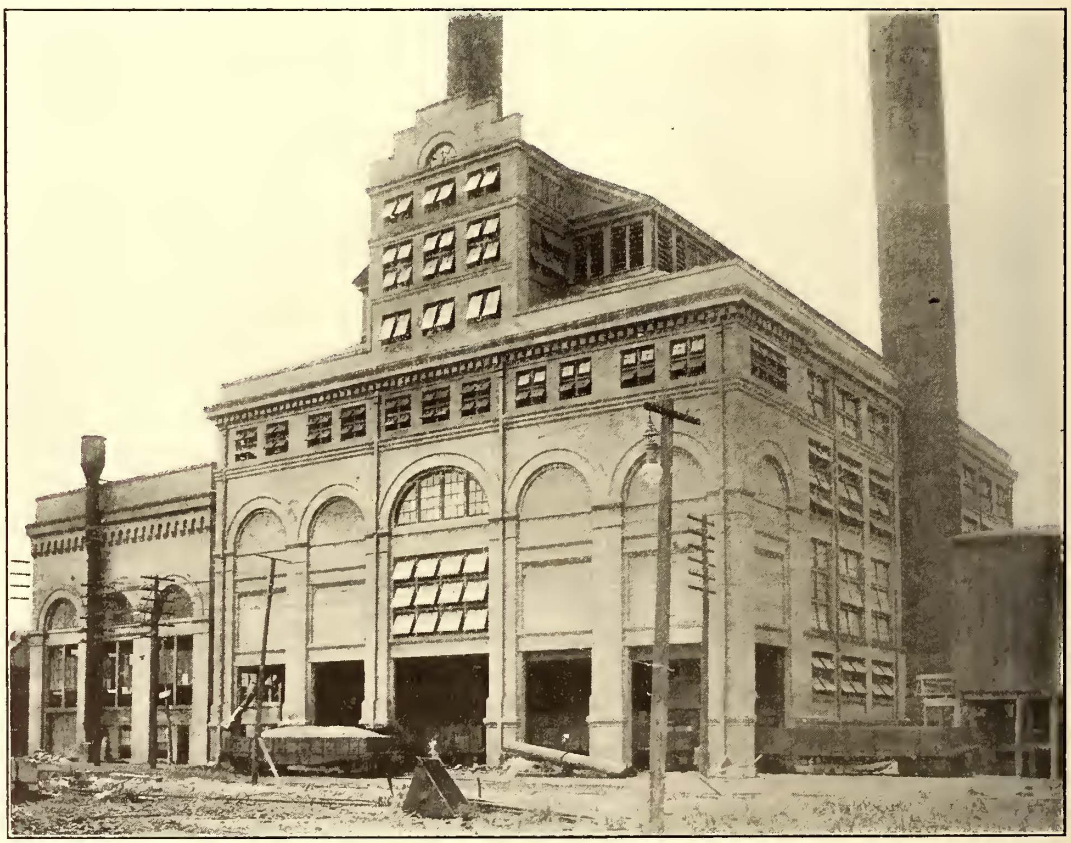

PLAN OF POWER DISTRIBUTION IN NEW ORLEANS

Company—changed later into the New Orleans Railway & Light Company—steady progress has been made in the elimination of the smaller and less economical stations and in centralizing the work of producing energy for railway, lighting and power in large new generating plants. The New Orleans Railway & Light Company engaged, in 1903, the firm of Sanderson & Porter, New York, as consulting and designing engineers and subsequently placed with them as constructing engineers the work of executing their comprehensive plans for the enlargement and reconstruction of the power generating and distributing systems. In carrying out these plans the station capacity on the sites of two of the former stations has been greatly increased, sub-stations have been erected preparatory to abandoning small generating stations, over 100 miles of underground duct have been constructed and a complete new street lighting system of 3000 series alternating arc lamps, specified by the city of New Orleans when inviting bids for the city lighting, has been installed.

The single central station plan was not adopted for the reason that such would have necessitated the abandonment of two modern generating stations, and because in some areas the distribution of the railway load made it more economical to generate direct current near the points of heavy consumption rather than to produce alternating current in one central station with high tension transmission and conversion to direct current in sub-stations located at the points of consumption. The lesser likelihood of complete shut-downs in cases of station troubles was another consideration.

The system as reconstructed comprises one direct-current commercial lighting station and one direct-current railway station in the congested districts, and one large alternating-current station to feed the balance of the territory and the outlying districts. This station also contains 6000 kw of direct-current generators for feeding the railway lines in its vicinity. The three stations have an aggregate capacity of 25,000 kw. As the load increases and the system is extended additional sub-stations are to be built and the capacity of the main or alternating-current power station is to be increased up to 50,000 kw. It is not necessary that new generating stations be built until this capacity is reached.

Both 2300-volt and 6600-volt, 60-cycle alternating current and 250-volt and 600-volt direct current are now generated. By means of static transformers between the two alternating-current voltages and motor-generator sets between the alternating and direct current systems, the generators in any station may be used to supply current for the commercial, arc lighting or the company's railway services.



EXTERIOR OF THE CENTRAL POWER STATION, SHOWING THE TYPE OF CONSTRUCTION AND COAL RECEIVING ARRANGEMENTS

The magnitude of the initial and ultimate investment involved for apparatus and the importance of handling the varied services in the most reliable and economical manner were governing factors in settling upon the frequency and voltage characteristics of the generating and distributing systems. The far-reaching importance of correctly

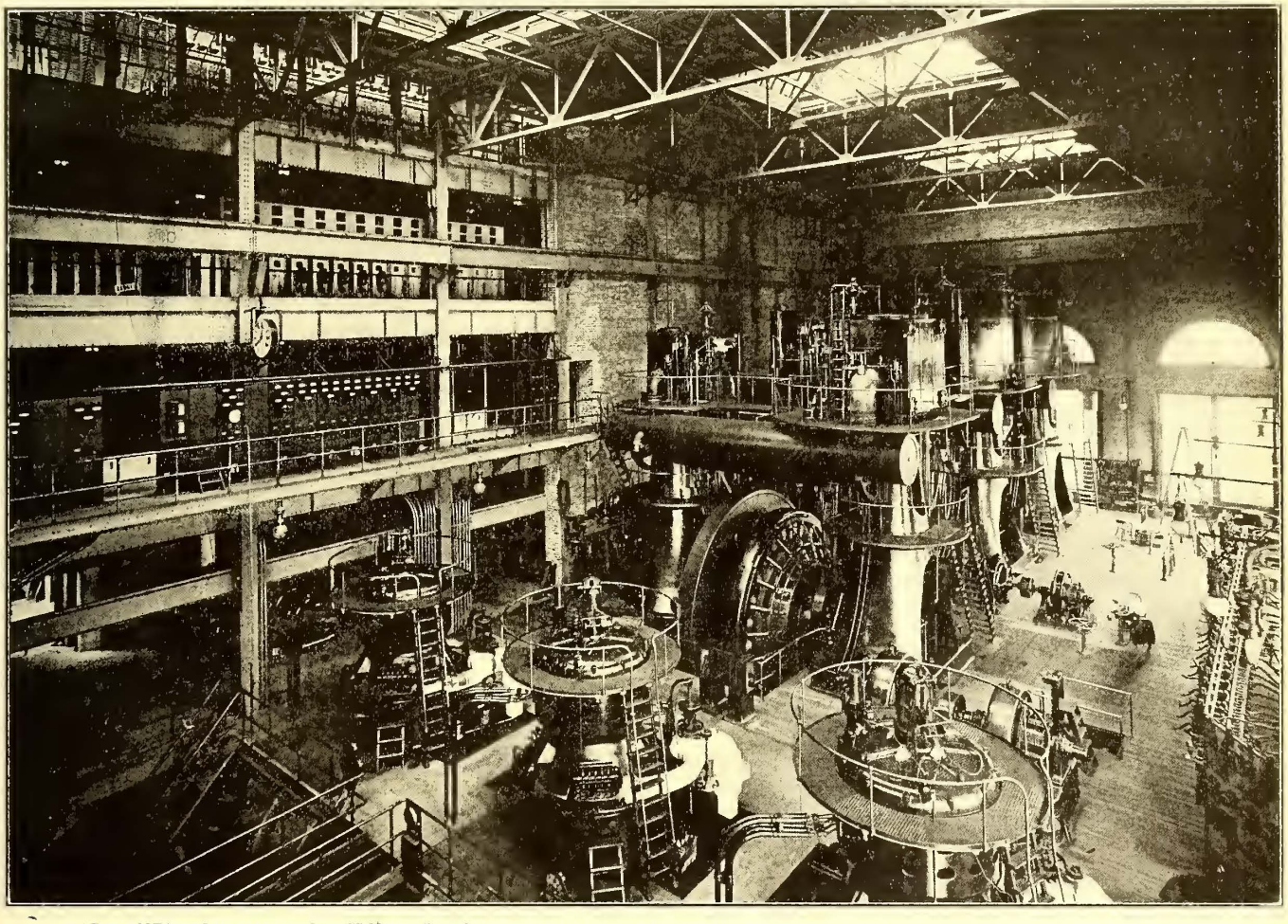
establishing these essentials was early recognized and the decision to adopt a frequency of 60 cycles for the alternating service was finally made as a result of careful deliberation and study of all possible methods. This frequency has been made standard for alternating power required for lighting and railway service.

The decision against 25-cycle frequency was based upon the much greater cost of such installation, which would have involved heavy expense for frequency changing apparatus for the large amount of the service requiring 60 cycles, and the unsuitability of 25 cycles for the operation of incandescent and arc lamps.

By using only one alternating-current generating frequency the load factor on the station and on the generating units was much improved, with resulting large savings in the cost of generated power, and the idle investment in reserve apparatus was minimized. The large sub-station energy loss which would have resulted from the use of such frequency changes as would have been necessary had 25-cycle generation been adopted was saved by the adoption of a uniform 60-cycle frequency.

It is believed that the higher frequency standard more nearly satisfies all of the present and future requirements and that it will show a decidedly higher all-round efficiency, everything considered, than 25 cycles or a combination of 25-cycle and 60-cycle generation. Furthermore, increase in business is largely dependent upon adopting a system which will involve the least first cost of installation to the consumer. The lower cost of 60-cycle motors constitutes an important factor viewed from the standpoint of the operating company.

Sixty-six hundred volts was adopted as being a thoroughly standardized commercial voltage, for which motor generator sets of 500 kw and upward could be readily wound, so eliminating sub-station transformers. The transmission distances, being relatively short, did not call for a higher voltage than 6600, which would permit sending the maximum desired amount of energy through any individual feeder with small energy loss. The frequent flooding of the underground conduits by heavy rains, which, for short periods, may overtax the capacity of the drainage system, rendered expedient the adoption of a moderate voltage, involving no particular difficulties for insulation under these conditions.



PART INTERIOR VIEW OF CENTRAL POWER STATION, SHOWING RECIPROCATING ENGINES, TURBINES, SWITCH BOARD GALLERIES, ETC.

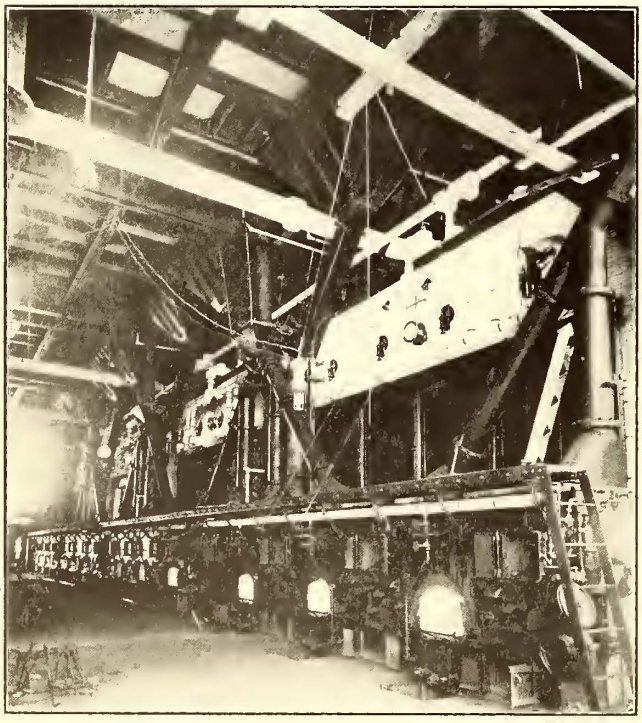
### THE CENTRAL STATION.

The recent work has involved the construction of practically an entirely new station at Market and South Peters Streets, on the Mississippi River, about two miles upstream from the business center of the city. The station now contains 17,800 kw and provisions have been made for an ultimate capacity of 50,000 kw. In the STREET RAILWAY JOURNAL of Sept. 18, 1904, a description of the then existing plant stated that it contained two 2250-kw Westinghouse and one 1500-kw General Electric railway generating units driven by Allis-Chalmers vertical compound engines, contained in a new building and supplied with steam from boilers in an adjacent old station. The building now forms a portion of the generating room of the new station.

### THE BUILDING FOUNDATION

The new station building is a brick, steel and concrete structure. The portion built measures 181 ft. by 212 ft. and is 122 ft. high. When extended 92 ft. or to full length as planned it will be 273 ft. long. It is supported on approximately 4000 round piles driven on about 3-ft. centers. The piles are 50 ft. long and some were set 30 ft. below the surface or were driven to a total penetration of 80 ft. In excavating for foundations and trenches for pipes the surrounding earth was assumed to be of liquid form weighing 120 lbs. per cu. ft. Excavations were protected by 6-in. grooved piling 30 ft. to 50 ft. in length with splines measuring 2 ins. by 4 ins. to insure alignment and tight joints. Where possible excavating was done by means of an orange peel digger and the earth was removed by a tramway. The piles were capped with a reinforced concrete mat approximately 6 ft. thick.

The average load over the entire foundation is something less than 2000 lbs. per sq. ft., but at points the load concentrates and is very much above this figure. At such points twisted steel rods, varying in number with the leads, were used to reinforce the concrete mat.



BOILER ROOM OF THE MAIN OR MARKET STREET STATION

### CONDENSER INTAKES

Plans provide for the ultimate installation of four 72-in. pipes to serve as condenser intake and discharge pipes. All four pipes have been extended through the levee, three have been installed under the boiler room and one intake and one discharge pipe have been placed under the railway tracks between the boiler room and the levee. The pipes are made in 30-ft. lengths of ½-in. riveted steel. A protective coating 1/16 in. thick was applied to them by dipping the sections into a hot compound. Lead gaskets are used between the flanged joints and the sections are fastened together with galvanized bolts.

Special provisions have been made for removing sand and silt from the pipes. Water jets supplied with water from a fire pump have been installed at 10-ft. intervals in the bottom of the pipes and by a system of valves the intake and discharge pipes may be connected at the station end with an Allis-Chalmers propeller circulating pump so located in the connection that a flow of from 8 to 10 ft. per second can be produced through the pipes. The pump is driven by a 700-hp, 550-volt G. E. motor. When the pipes are to be cleaned the jets are first operated to loosen the deposit, and this is then washed out by the flow from the pump. The pipes terminate at the river end in concrete wells, that for the intakes being provided with three sizes of screens.

### THE BUILDING

The building is constructed with a steel frame work with brick walls built in. The roof is of Ludowici and of book tile with a composition top coating. Bunkers and floors are of reinforced concrete. With regard to steel and roof construction the building may be said to consist of three parts, the generator room, the double-deck boiler room and an intermediate section occupied by switchboard apparatus, shop and offices and toilet rooms. The adoption of this arrangement of buildings permitted the successful execution of the new construction without interference with the operation of units which were required in service by the haevy increases of load. Through monitors and pivoted windows ample facilities are furnished for proper ventilation. The accompanying inset opposite page 1094 of this number shows a complete cross-section of this station.

### STACKS

The two steel stacks erected are 15 ft. in diameter and extend 273 ft. above the street level. Both are brick lined to the roof line. Plans provide for the later erection of two additional similar stacks when building is extended.

### THE BOILER HOUSE

The present building provides for sixteen 900-hp boilers. Twelve such units of the Babcock & Wilcox Company's make are now installed. They are located on two decks in double rows facing each other and parallel to the generator room wall. They are of forged steel header type constructed for 200 lbs. pressure and are fitted with B. & W. bent tube superheaters designed for 150 deg. superheat. Behind them are Sturtevant economizers, there being one economizer with 4900 sq. ft. of heating surface to each two boilers. The scrapers of the economizers are driven by induction motors.

The boiler plant is equipped with thirty-six 300-hp Murphy smokeless furnaces and stokers, set three in a battery under each boiler. Coal is fed to the furnaces through down spouts extending from the overhead bunkers. Provision has been made to later install scales in each down spout. Ashes from the furnaces fall direct into a hopper underneath, while the fine ashes drawn over the bridge wall and the soot accumulations are carried into this hopper by a motor-driven screw conveyor.

### FEED WATER

Boiler feed water is obtained from two 750-ft. wells, one 6 and one 8 ins. in diameter, having a combined capacity of over 1800 gals. per minute. Water is raised with air furnished by two Ingersoll-Sergeant air compressors installed in a compressor room in the boiler room basement. The water is discharged either into tanks in the basement of the boiler room or into a stand pipe of 60,000 gals. capacity located near the building. The boilers are fed by one 1000-gal. per minute D'Olier steam turbine-driven centrifugal pump and three Epping Carpenter pumps with cylinders 16 ins. by 10 ins. by 16 ins. These pumps are of the pot

valve type with outside end packed plungers designed for a working pressure of 250 lbs. and are fitted with automatic pressure regulating governors. Connections are arranged so that the water may be forced either through the economizers or direct into the boilers. All of the boiler feed piping is of cast iron or brass.

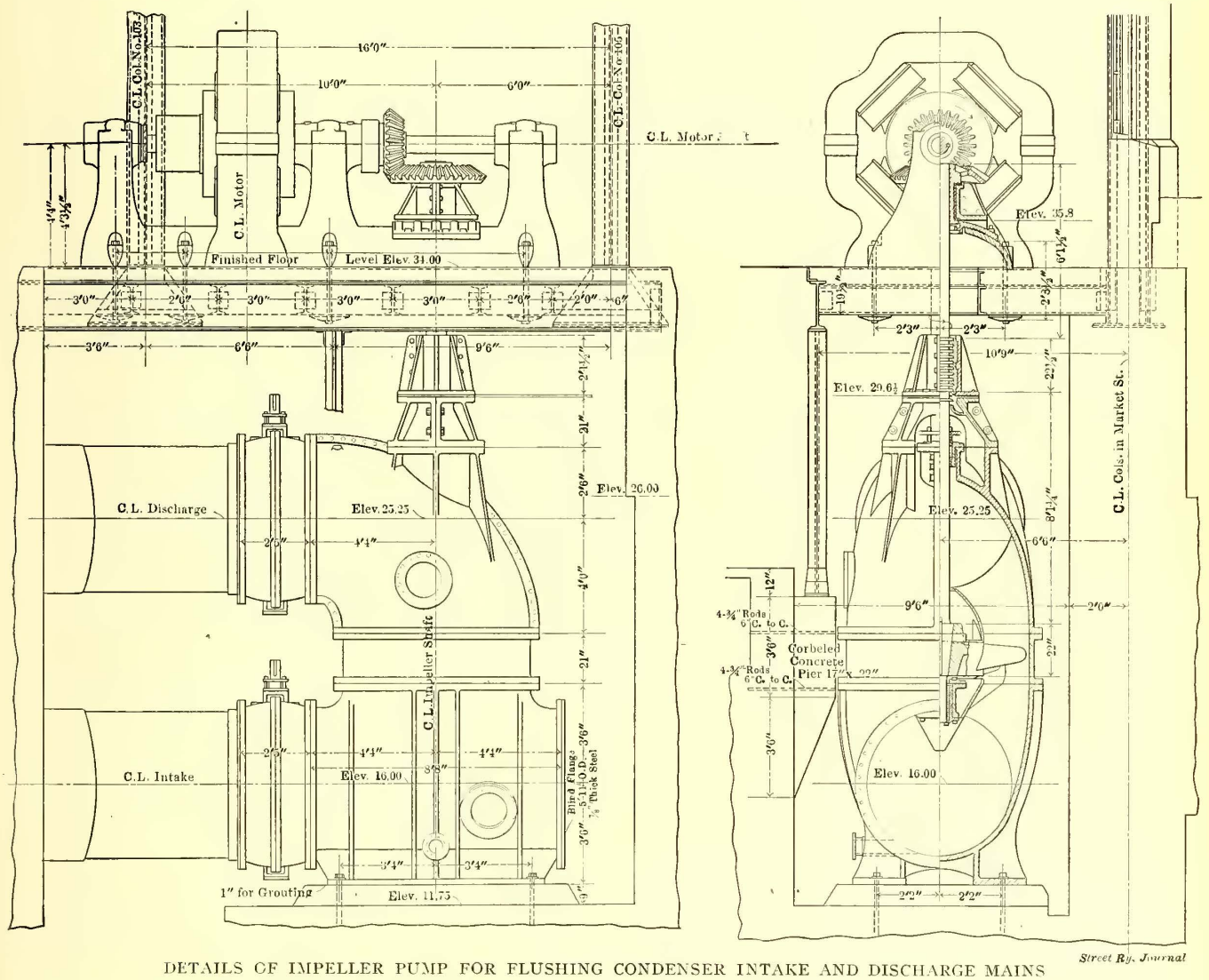
### COAL AND ASH HANDLING APPARATUS

A switch extending along the east end of the station contains a 100-ton track scale and all cars are weighed before and after being unloaded. The cars are run on a sheltered track under the ash bunker at the end of the boiler house and unloaded into a hopper beneath the track. After passing through a crusher provided with an adjustable positive feed the coal is carried by a bucket elevator to the top of the boiler house structure where it is discharged on a belt conveyor and distributed to any predetermined part of the coal bunkers by an automatic unloader. A 35-hp, 550-volt, direct-current motor drives the crusher and both belt and bucket conveyor.

The initial coal-handling plant has a capacity of 100 tons per hour and the plans provide for a duplicate equipment of equal capacity. The initial coal bunkers hold 2000 tons and those of the ultimate building will store about 5000 tons. Additional storage capacity is provided in a vacant lot near the station, coal being conveyed to and from this storage space in electric cars. Dock privileges have been obtained from the city and a portion of the plant for unloading river coal from boats has been erected. This has a rated capacity of 200 tons per hour.

Small side dump cars operating on tracks in the basement underneath the ash hoppers convey the contents of these hoppers to the east end of the building where the ashes are dumped into an automatic skip. This skip bucket of 60 cu. ft. capacity hoists the ashes to the top of the boiler room and dumps them into a bunker built over the coal switch. Ashes are discharged by gravity from bunker direct into steam or electric cars and conveyed to the suburbs to be used in track construction or filling.

The coal and ash handling conveyors, as well as the ash railway in the basement, were furnished by Heyl & Patterson, of Pittsburg.




DETAILS OF IMPELLER PUMP FOR FLUSHING CONDENSER INTAKE AND DISCHARGE MAINS

### STEAM PIPING

All high pressure piping is of standard lap weld mild steel with Van Stone type of joints. All fittings and valve bodies are of cast steel. The high pressure steam valves are especially designed for use with superheated steam at 200 lbs. pressure and have extra long necks at the stuffing boxes. Large steam valves are motor operated. Most of the valves are of chapman make, and the balance was furnished by the Pittsburg Valve, Foundry & Construction Company.

The boilers on the upper deck feed through lines passing down behind them into headers running the full length of the boiler room in the rear of those boilers on the lower deck. These headers also receive the steam of the lower

deck boilers. Crossover pipes running just underneath the second floor connect the header most distant from the generator room with that one nearest to it, which may be regarded as the main steam header. Steam mains to both reciprocating engines and turbines pass through the boiler room wall and underneath the generator room floor to their respective units.

Connections from the headers behind the boilers drop through the floor to mains supplying the auxiliary apparatus. Extensions continue through the basement wall to serve the engines driving the condenser pumps, etc.

### TURBINES

In the new portion of the generator room there are installed three General Electric 1500-kw, three-phase, 60-cycle, 2300-volt Curtis turbines. A 3000-kw and a 5000-kw similar three-phase, 60-cycle, 6600-volt turbine of the same make are also provided for in the initial building; the 3000-kw unit is now in operation, and the 5000-kw unit is under construction.

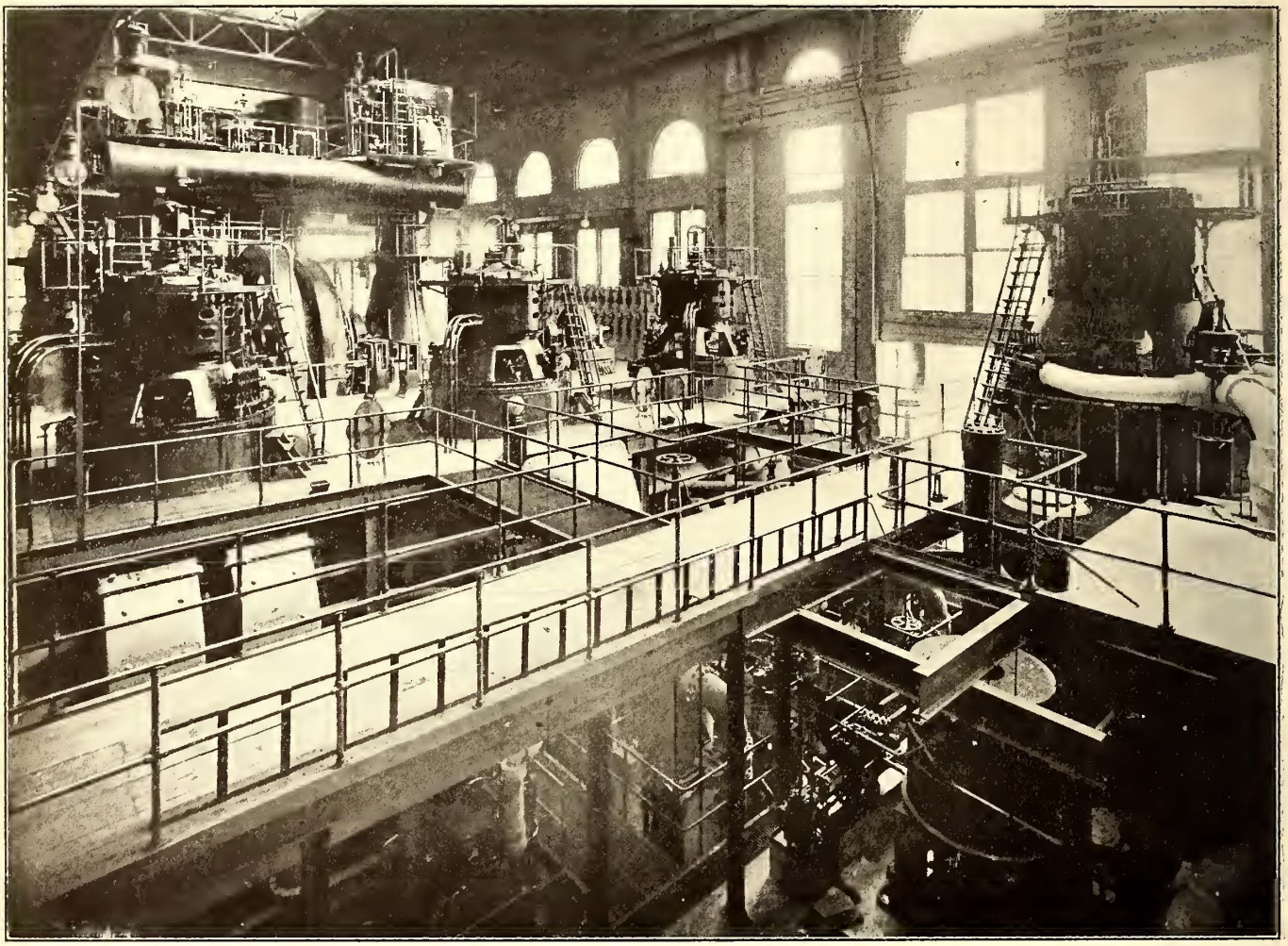
One common oiling system with one accumulator serves the step bearings of the three 1500-kw turbines. A separate oiling system with an accumulator is provided for the two larger turbines. The oil pumps and other auxiliary apparatus except exciters are located in the basement.

### MOTOR GENERATORS

Three motor generator sets now operating on other service, each consisting of 500-kw, 2300-volt synchronous motors and 600-volt direct-current generators may be installed on the main floor alongside the exciters under the bus structures and will permit transferring 1500 kw capacity from either the a. c. or d. c. portion of the station.

### CONDENSERS AND EXCITERS.

Past difficulties in the operation of surface condensers using the silt and clay bearing water of the lower Mississippi River led to the initial adoption of Dean and Allis jet condensers on the engines and Alberger jet condensers on three of the turbines. One 1500-kw turbine was provided with a corresponding specially designed Alberger surface condenser. The jet condensers of the 1500-kw turbines are connected to 12-in. centrifugal pumps and of the 3000-kw condenser to a 16-in. pump. All the circulating pumps are driven by single cylinder Buckeye engines. The turbine condensers are each served by Alberger dry vacuum pumps which may be run separately or on a common vacuum system, by sectionalizing valves and cross connections.



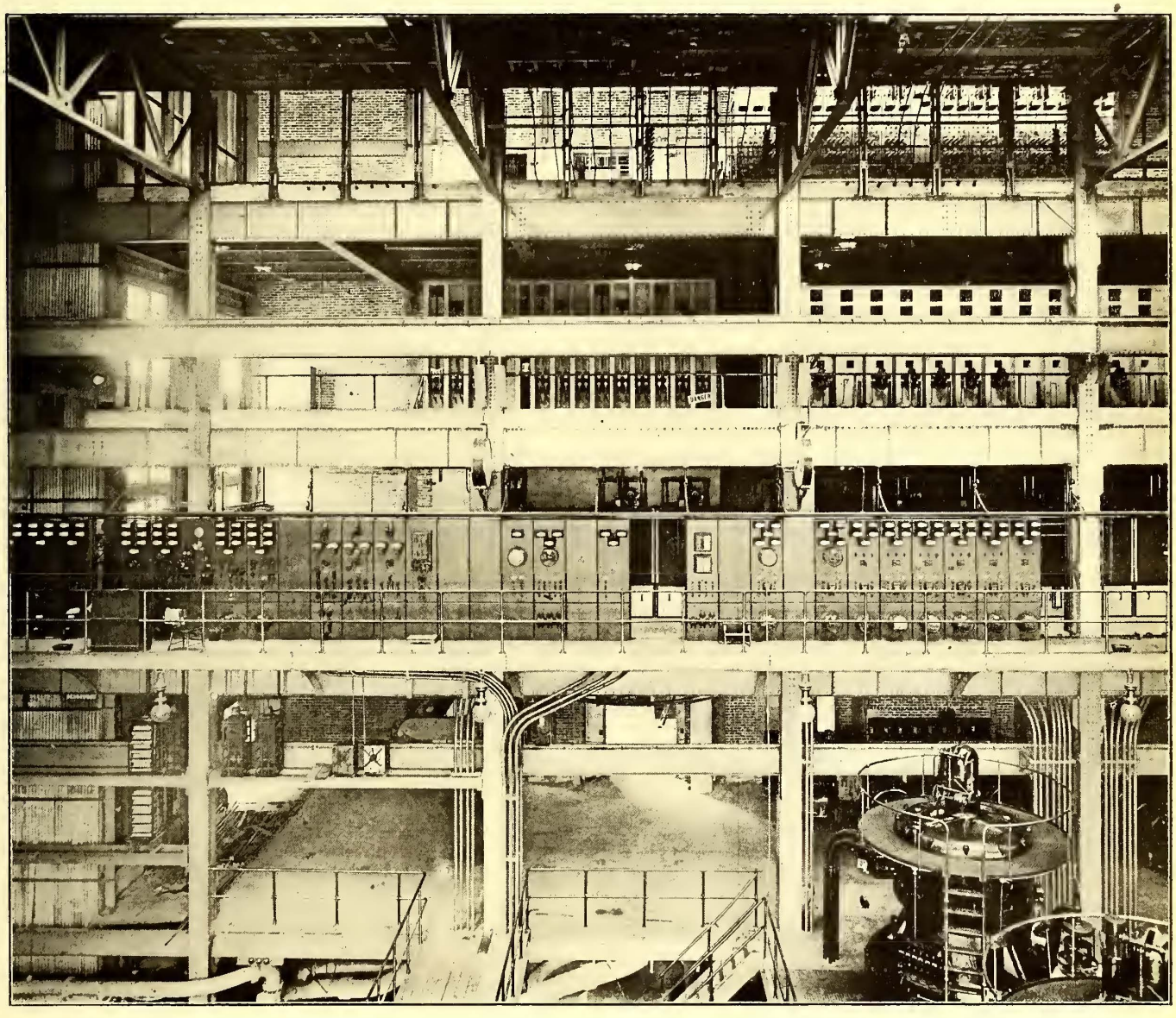
INTERIOR OF CENTRAL STATION, SHOWING TURBINES AND AUXILIARY CONNECTIONS BELOW MAIN FLOOR

The exciter equipment installed consists of an 80-kw induction motor-driven exciter and a 75-kw exciter driven by a two-stage horizontal Curtis turbine. The exciters are connected to a double bus system and voltage regulation is effected by a Tirrill regulator built for four exciters. Plans provide for two additional 150-kw exciter sets which will be installed near those already in operation on the main floor underneath the switch structure.

### SWITCHBOARD AND CONTROL APPARATUS

The switchboard proper is located on an overhanging balcony at the same height as the second floor of that

section of the building between the boiler and generator room. From his position on the balcony the operator has a general view of the entire operating floor. Behind the switchboard are the generator switch and bus structures. On the floor above are similar structures for feeder busses and switches and there is also located on such floor 2300-volt regulators for the commercial feeder circuits. On the fourth or top floor is an arc light sub-station. All main and high-tension switches are of the oil break type con-



A VIEW ALONG ONE OF THE WALLS OF THE CENTRAL POWER STATION, SHOWING THE GALLERIES FOR CARRYING THE TRANSFORMERS, SWITCHBOARDS, ETC., TOGETHER WITH THE CABLE ARRANGEMENT

trolled from the main switchboard by pilot switches. Both generator and feeder bus-bars are in duplicate and all may be sectionalized.

The floors on which the switch-control apparatus is located are constructed with a view of facilitating repairs should it ever become necessary to get at the cable or conduits. The I-beams support a 6-in. solid concrete floor. On this is a 11-in. loose filling, in which the conduits are laid, this being covered with a 4-in. concrete floor.

The bus and cell structures are built in groups with the main and auxiliary bus structures flanking a common passageway on the second floor and the feeder bus structures similarly arranged on the third floor. The structures are of concrete with the exception that the tops and bottoms of the generator and sectionalizing switch compartments are of Alberene stone. The structures are reinforced by iron rods running through the barriers from top to bottom. The generator leads are carried down under the generator room floor from the generator terminals to junction boxes and then up the building columns in brass conduit direct to the type H generator switches of the main generator and auxiliary busses. A group switch connects the 2300-volt main generator bus to a main feeder bus on the floor above and a similar switch connects the generator auxiliary bus with an emergency feeder bus. The 6600-volt generator and auxiliary busses are permanently connected to extensions of these busses in structures on the floor above and from which the feeders are taken off. The 6600-volt and the 2300-volt bus systems are connected by two 1500-kw oil-insulated, water-cooled, three-phase transformers, located in the basement.

### CONTROL PANELS

The generator control panels are located at the west end of the initial switchboard, the plans providing for the installation of 6600-volt feeder panels west of them, so that they will be centrally located with respect to the ultimate swichboard. To the east of the generator panels are ex-

citer and house service panels and space for three synchronous motor and three railway generator panels.

### FEEDERS

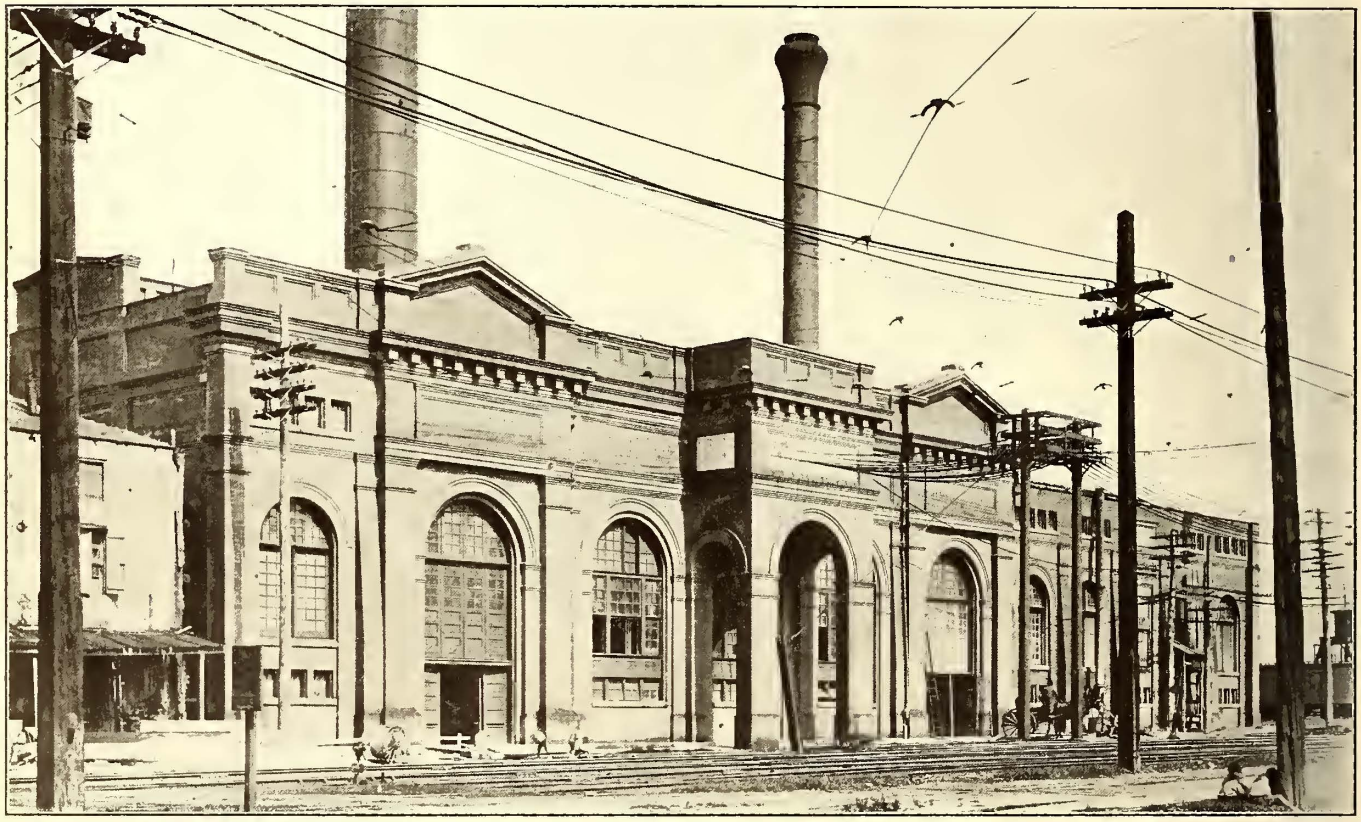
The construction permits feeders leaving the station in underground conduits. They now leave overhead connecting with pole lines, those for the down-town district continuing overhead to a terminal house located about a mile distant from the station at the edge of the underground district.

From the feeder busses the arc light lines pass to the constant-current alternating-current arc regulators on the top floor, there being provision for 22 feeders in the substation. The 2300-volt feeders for the commercial lighting load pass through I. R. T. oil-insulated, water-cooled regulators manufactured by the General Electric Company.

built in line with the original station, the old plant reconstructed and 3200 kw of engine-driven, direct-current railway units, 1000 kw of railway motor-generator sets, with the requisite switchboard and steam generating plant, have been newly installed as below described.

### THE BUILDING

The building as reconstructed is shown in an accompanying reproduction. The exterior walls and the interior walls of the engine room are of salmon pressed brick laid in cement mortar. The walls of the engine room, which are entirely of brick, support the crane runway and the roof trusses. A steel framework, into which the brick walls of the boiler room are built, support the coal bunkers and the economizers. The floors are of slate-colored concrete and the roof consists of 2½ ins. of concrete with a 1-in. top coating. Free circulation of air is provided in the



VIEW OF FRONT OF THE CLAIBORNE POWER HOUSE

### OFFICES AND MACHINE SHOP

The space east of the switchboard and bus structures is devoted to offices, a machine shop, toilet and wash rooms, which contain needle baths and porcelain finish wash troughs supplied with hot and cold water and are furnished with expanded metal lockers. Separate toilet and wash rooms are provided for the colored firemen.

### LIGHTING

General lighting of the generator room is effected by arc lamps supported on wall brackets. The boiler room and switchboard structure are lighted with incandescent lamps.

### THE CLAIBORNE STATION

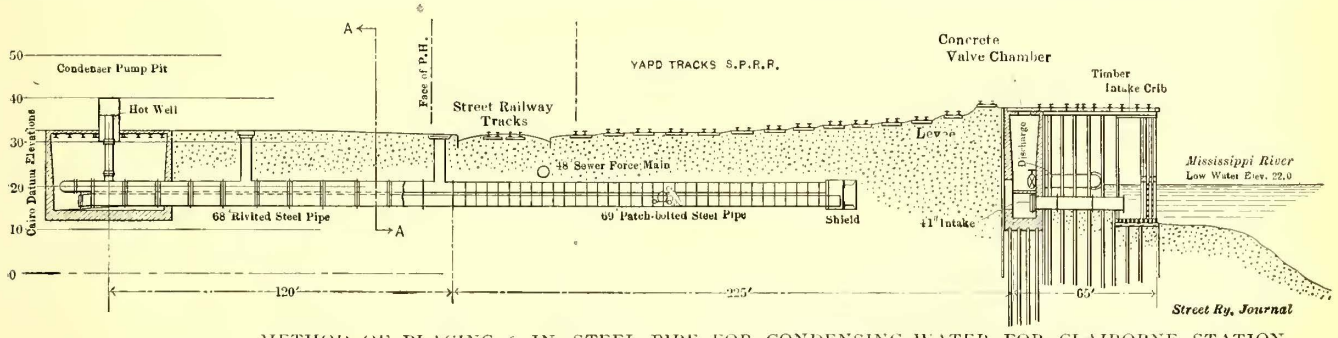
The Claiborne station is located at Elysian Fields Street and the river, about two miles below the Main or Market Street station. It is essentially a direct-current station. The original portion, built about nine years ago, contains two 300-kw and one 850-kw General Electric railway generators direct connected to Allis-Chalmers compound engines, and four 350-hp Edgemoor boilers. A new station has been

building by liberal window openings and by monitors in the roof, which extend the full length of the building over both the engine and boiler rooms. The building is constructed on piles placed approximately 4 ft. apart except where the loads did not warrant such spacing.

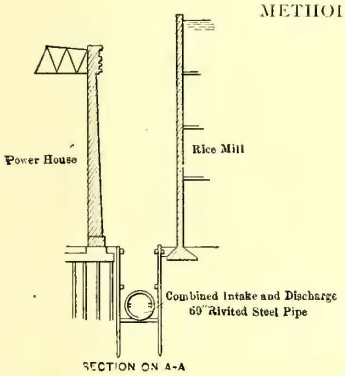
### CONDENSER INTAKE

The construction of the condenser intake and discharge is worthy of note. They are combined in one riveted and patch-bolted steel pipe or tunnel 69 ins. in diameter in which a horizontal separator or diaphragm is placed across the middle. The diaphragm is of creosoted pine 6 ins. thick. The lower and upper halves of the pipe serve respectively as the intake and discharge passages. This tunnel was run under seventeen railroad tracks, it being necessary that the traffic over these tracks should not be inconvenienced. Excavating was done from the interior by the tunnel shield method without surface openings and without interruption to traffic. The pipe terminates at the river and in a concrete well built just outside the levee.

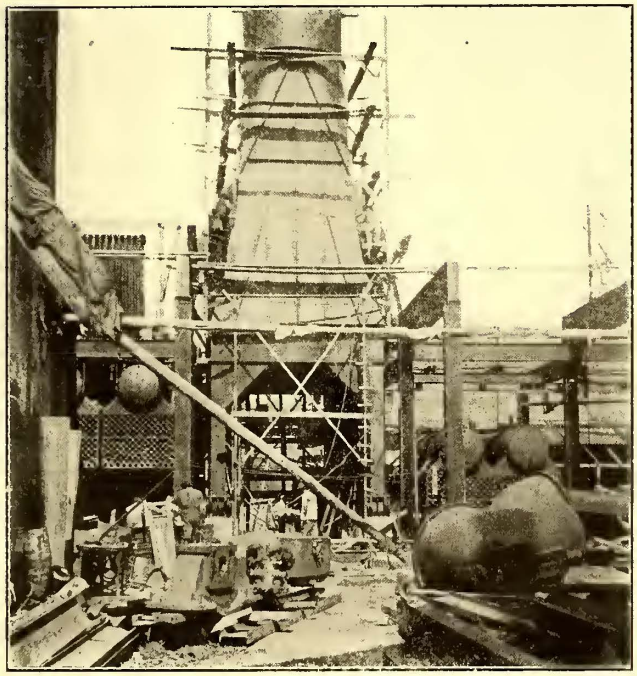
The well has a horizontal partition to separate the incoming from the discharged water and is used as a valve chamber to shut the water off from the pipes. In this installation the plan described in connection with the main station for washing silt out of the pipe has been followed. At the station end a valve controlled connection between



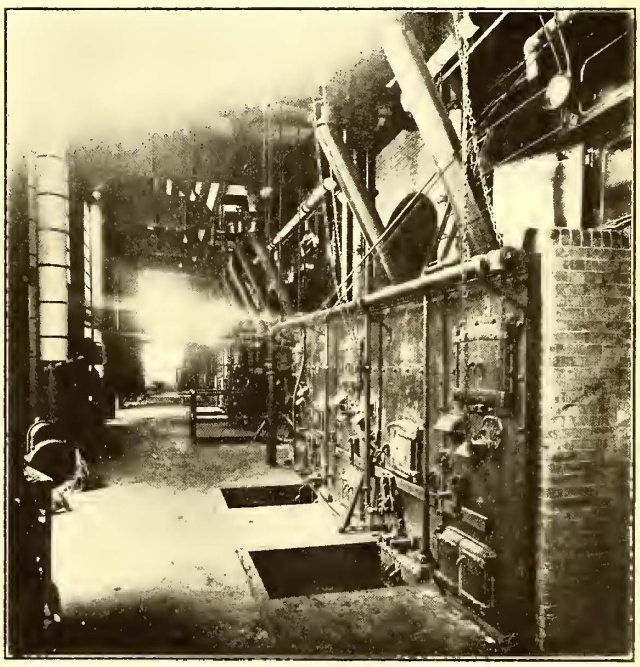

METHOD OF PLACING 69-IN. STEEL PIPE FOR CONDENSING WATER FOR CLAIBORNE STATION




gives considerable additional floor space in the boiler room. The stack is supported on four steel columns, which extend from the boiler room floor to the base of the stack at about the height of the top of the boilers. The columns are stiffened with concrete and the lower portion of the structure is arched over with salmon-colored brick. The stack is of steel 11 ft. in diameter and 175 ft. high. The base is square and has no base ring. The side sheets are riveted directly between channel framing at the base.



STEELWORK OF CLAIBORNE POWER HOUSE STACK



IN THE BOILER ROOM OF THE CLAIBORNE STATION

the intake and discharge sections contains a 36-in. centrifugal pump operated by a 300-hp motor to draw water in through the upper half and force it through the lower half of the pipe tunnel. The intake pipe was made by James McNeil & Bro. Company, of Pittsburg, and the protective coating by the American Asphaltum & Rubber Company, of Chicago.

### THE STACK

The method adopted for supporting the one steel stack which extends through the central portion of the room

### THE BOILER ROOM

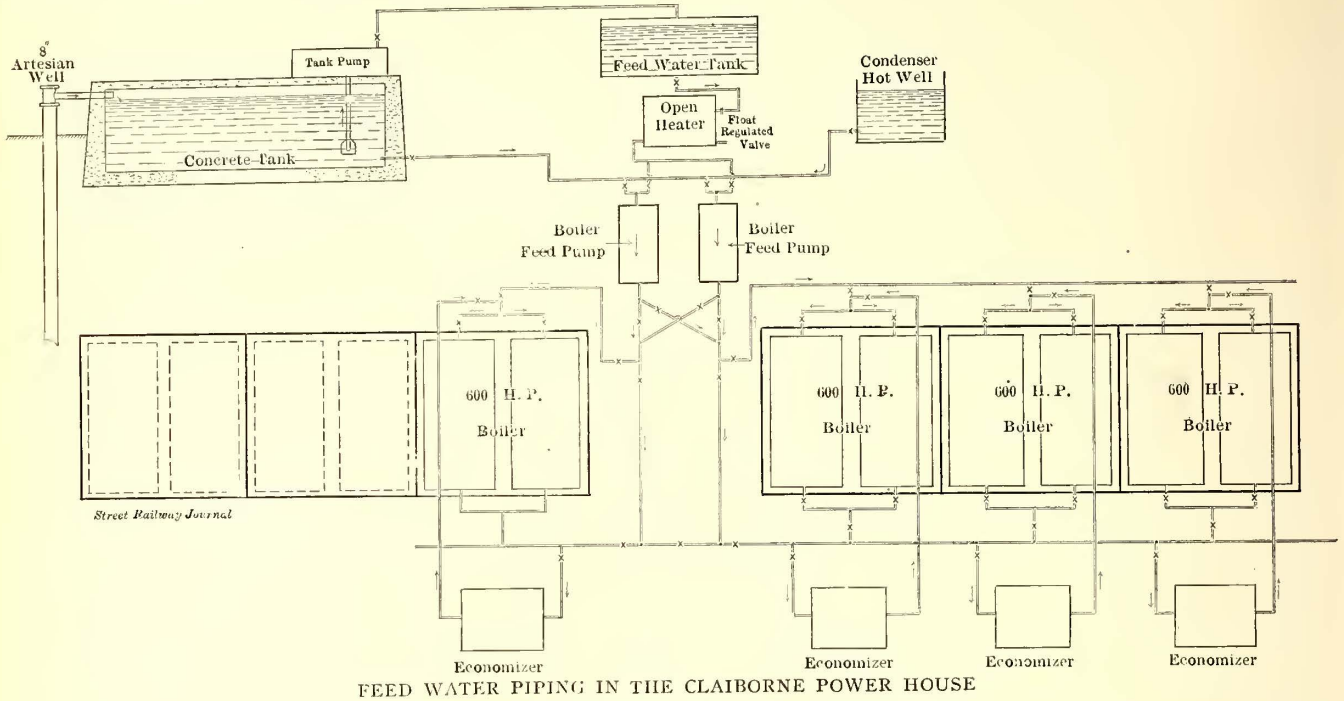
The boilers are installed in one row parallel to the engine room wall. For ventilation the wall opposite the furnaces is open to a point 8 or 10 ft. above the floor. The four 600-hp Heine boilers are each equipped with two 6-ft. by 8-ft. Murphy automatic furnaces and stokers of a design similar to those in the main station. The concrete bunkers located above the open space in front of the boilers have a capacity of six tons per running foot, or a capacity of 100 tons per boiler. Over the rear of the boilers in the new section are installed four Sturtevant economizers. They are so set and piped that a boiler and an economizer constitute a single unit, but the flue connections are such that any one economizer may be cut out without interfering with the use of the corresponding boiler. When one is cut out the water for all of the boilers may be passed through those economizers remaining in service. The economizers are cut out by means of an interlocking

mechanism operated by a lever from the boiler room floor.

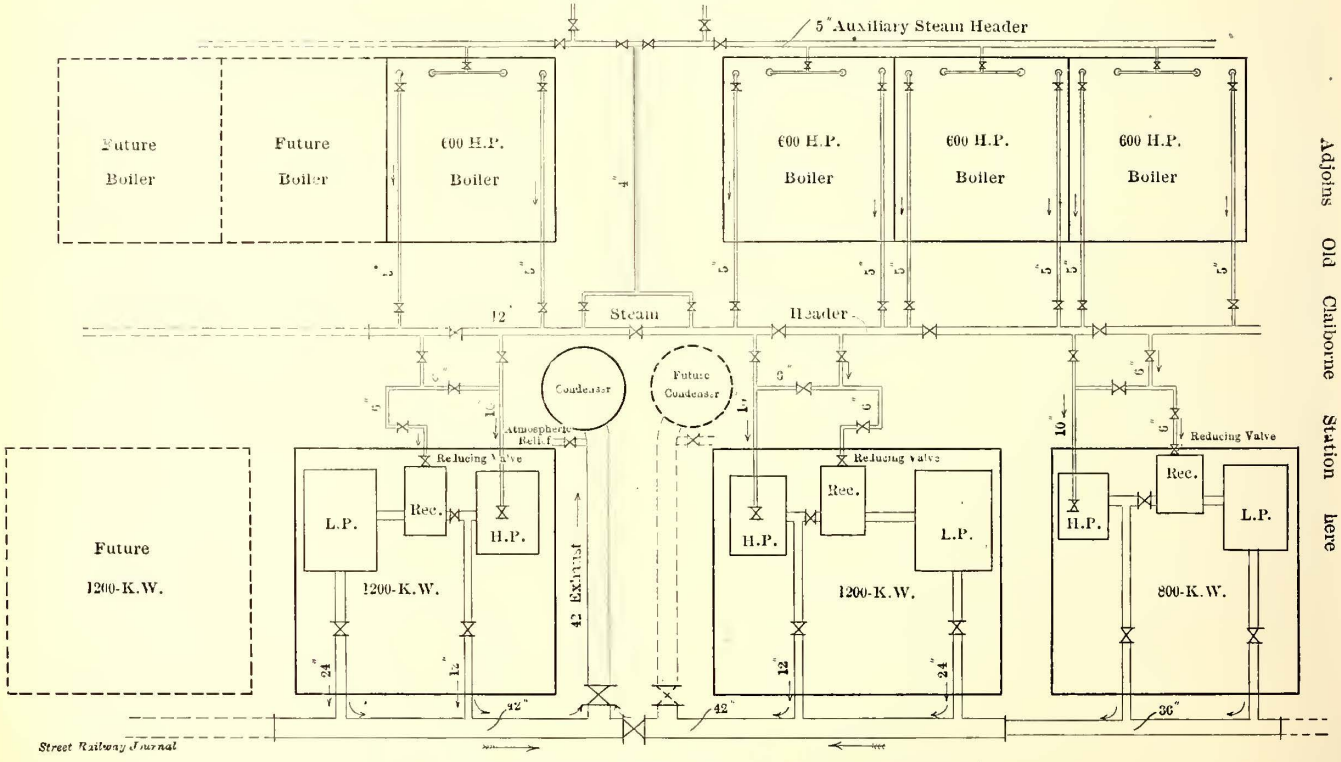
BOILER FEED

Feed water obtained from an 8-in. artesian well 500 ft. deep is forced into a concrete storage tank 12′ x 40′ x 4′ deep, located under the floor at the northwest corner of the building. A low pressure pump raises the water into an elevated tank from which it flows by gravity through the Cochrane open heaters. The boiler feed pumps then force it through the economizers into the boilers. If desired the heater may be passed and the water pumped direct from the concrete tank into the economizers.

Duplicate feed lines run in front and in the rear of the boilers, and each line has two connections to each boiler. By opening and closing proper valves each feed line may be fed by separate pumps so that it is possible to supply hot and cold water to separate boilers simultaneously. The air compressor equipment for supplying the artesian wells consists of two Ingersoll-Sergeant single-stage machines. Both are installled in the boiler room basement adjacent to the Dean Bros. low duty pump, and the two 10-in. x 17-in. x 7¾-in. x 15-in. compound duplex direct acting Worthington boiler feed pumps.




FEED WATER PIPING IN THE CLAIBORNE POWER HOUSE




MAIN ENGINE PIPING IN THE CLAIBORNE POWER HOUSE

COAL AND ASH HANDLING APPARATUS

At present coal is delivered to the station in wagons and dumped into a crusher hopper outside the building. A siding is planned along the boiler room wall for the delivery of coal in cars. The coal handling plant is similar to

the one at the main station, in that a bucket conveyor elevates the crushed coal to a point above the bunkers, where it is discharged on a belt conveyor. This belt distributes the coal to the several bunkers. The coal crushing and handling plant has a capacity of 50 tons per hour. The ash handling plant is also similar to that one at the main station. The arrangement of ash hoppers and screw conveyors under the boilers is practically the same, and a car and a skip bucket convey the ashes to an overhead bunker. The conveying apparatus was made by the Minneapolis Steel & Machinery Company.

### STEAM PIPING

The high pressure steam lines are of standard lap-welded steel, with Van Stone type of joints for sizes 7 ins. and above. The main header is 12 ins. in diameter, and runs along the rear of the boilers about six feet from the floor. In order to clear the passageway between boiler and engine room under the stack and to provide for expansion, the header is broken into two 8-in. pipes which arch in a semicircle above the opening in the wall at this point. Valves in the header permit it to be sectionalized at every boiler. A section of the main header may be removed entirely without interfering with the operation of the plant. Two boiler lines which drop down from each boiler are connected one on either side of the sectionalizing valves, and each engine may be supplied with steam from either of two adjacent engines. With one section of the main header cut out, the pressure in the two disconnected sections would be equalized through a 5-in. auxiliary header, which runs in front of the boilers, and which has connections to each boiler and to the main header at the central point. Steam for all of the auxiliary apparatus in the boiler-room is taken off this smaller header. The engine mains pass directly through the boiler room wall to the separate units. Valves located in the boiler room are controlled through extended stems from the engine room.

### GENERATING UNITS

The two 1200-kw units installed in the new portion of the building consist of Filer & Stowell horizontal cross compound condensing engines and Westinghouse 600-volt generators. The 850-kw unit is an Allis-Chalmers cross-compound engine with General Electric similar generator. Plans provide for the installation of an additional 800-kw unit now in another station.

### CONDENSER

A 42-in. header in the basement of the engine room receives the exhaust steam from all of the engines in the new portion of the plant, and it will eventually take the exhaust of the old engines. This header is connected with a 42-in. Alberger barometric condenser located just above the north wall of the boiler room. Condenser water is furnished by either of two centrifugal pumps, each driven by a Buckeye simple engine, and located in a pump pit in the basement. One 10 x 24 x 24 Alberger dry vacuum pumps are located on the boiler room floor under the smokestack. The exhaust mains are provided with atmospheric relief valves designed by Sanderson & Porter.

### OILING SYSTEM

Oil is supplied to engine bearings by mains of a central gravity system which consists of an elevated tank located near the smokestack, a White Star filter and cooler in the basement, and two 5-in. x 2¾-in. x 3-in. Worthington duplex oil pumps.

### MOTOR GENERATOR SETS

The station is tied electrically to the other stations of the system through two 500-kw motor generator sets consisting of 6600-volt synchronous motors and 600-volt d. c. generators.

### CONTROL APPARATUS

In addition to direct current, both 2300-volt and 6600-volt alternating current are handled in the station. Two 6600-volt 3-conductor 4-0 cables enter the station underground from the main station, and two outgoing 2300 circuits extend under the river to Algiers. An arc light substation of 770 lamps capacity, using 2300 volts primary, is located in the station. All apparatus is controlled from a switchboard on a gallery alongside the front wall of the building, and opposite the tower already referred to. The gallery, which is partly supported on steel posts, has a concrete floor, and is reached by an iron stairway. The switchboard panels are well lighted by lamps in a trough reflector,

BOILER ROOM OF BARONNE STREET STATION.

which also serves to protect the board from the crane cables.

The direct-current portion of the switchboard contains eight d. c. generators and twelve feeder panels. The positive d. c. switches are located on the board, but the negative and equalizer bus switches are installed on pedestals on the main floor, near each generator, and are motor-operated through control switches on the switchboard panels. A storage battery of fifty-five 10-ampere Chloride Accumulator cells, operates the remote control switches. This battery is charged by a 125-volt generator driven by a small Westinghouse standard engine. Current for station lighting is obtained from two 2300 to 110 volt step down transformers, the three-wire system of circuits being used. Provision is made for later supplying the 60-cycle lighting of this section of the city from a distributing switchboard in this station.

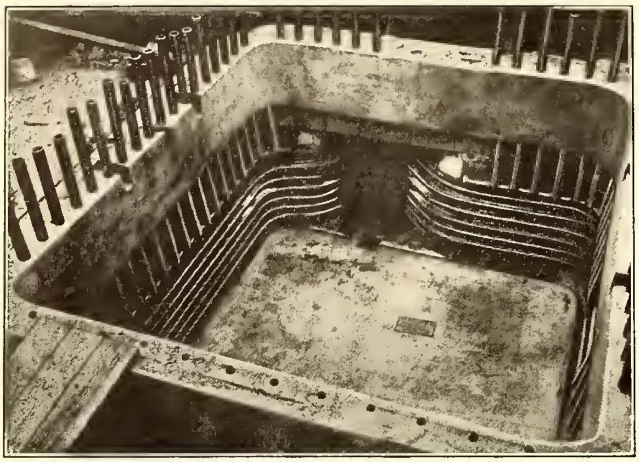
### BARONNE STREET STATION

Practically the only important changes made in the 250-volt d. c. Edison station, known as the Baronne Street station, has been to equip the boilers with Murphy furnaces and mechanical stokers. In order to provide sufficient stoker capacity it was found necessary to install three stokers under each battery of two boilers, and this required

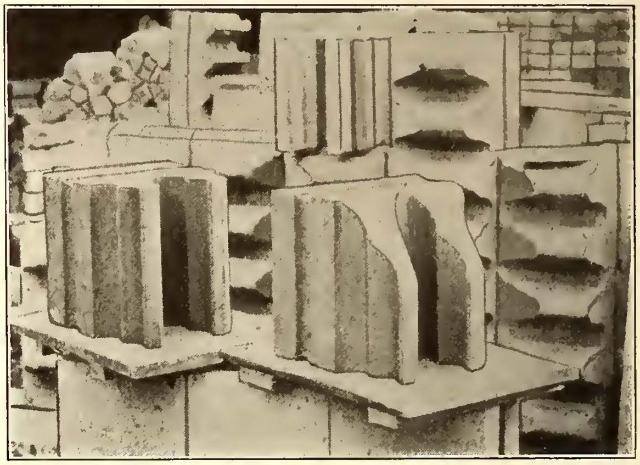
that a portion of the center wall between the boilers be specially supported from the boiler room girders.

VALENCE SUB-STATION

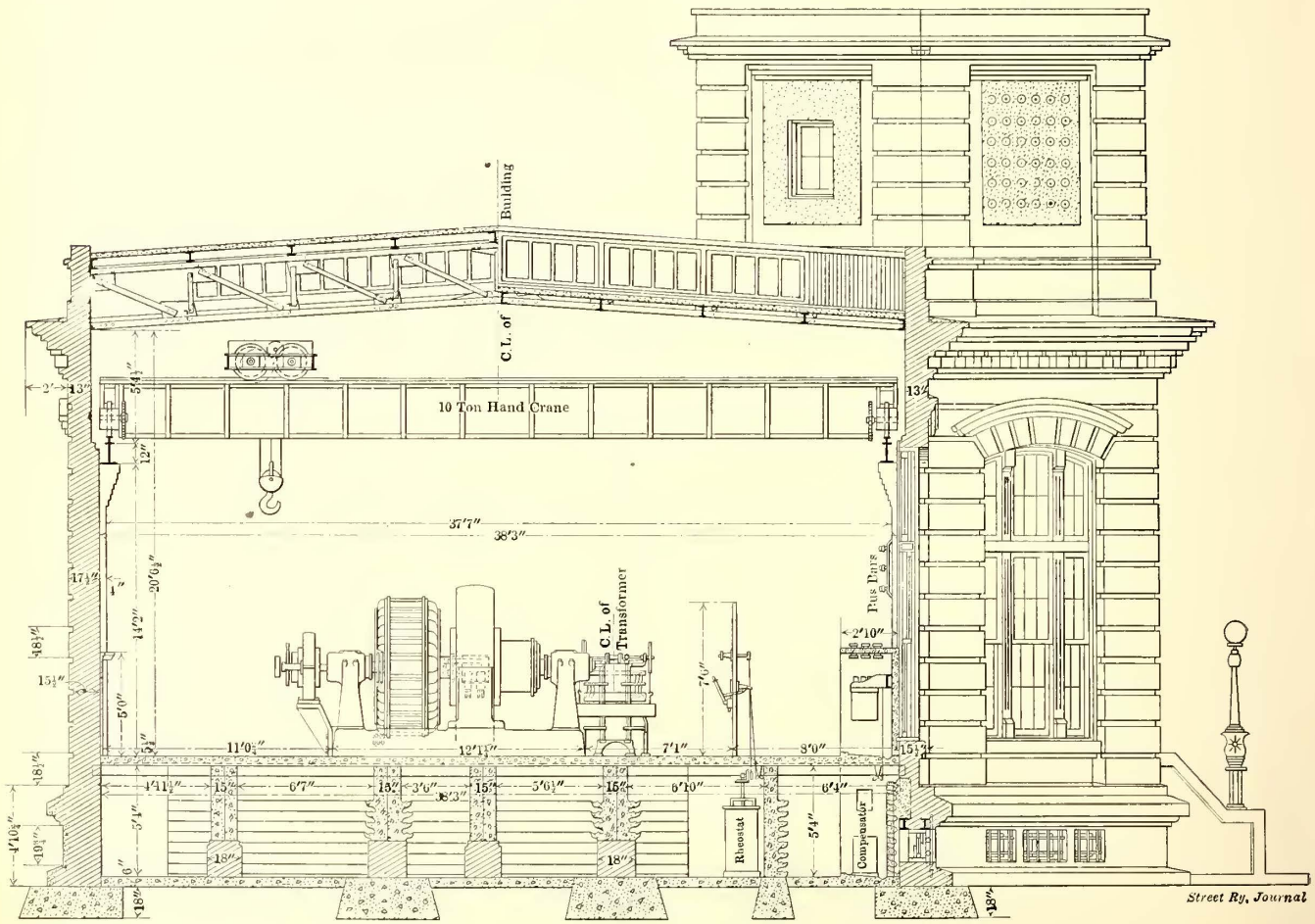
This is the first recently constructed permanent sub-station, and the only one yet finished excepting those in the power stations. It is located in the western portion of the city, at Valence and Franklin Streets, and about three miles northwest of the Market Street Station. It is a combination arc lighting and railway sub-station, and at present contains six 110-lamp arc-light transformers and two 500-kw motor generator sets. Provision is also made for its future use as a commercial lighting sub-station. The building is a brick and concrete and steel structure. It is rectangular except for an extension at one corner, the lower portion of which serves as an entrance and the upper portion as a cable tower. The exterior is of salmon pressed brick, with cement trimmings. A temporary rear wall was built with a view to future extensions.



BASEMENT OF THE HOWARD AVENUE TERMINAL HOUSE



CONCRETE BLOCKS AND CABLE SHELVES USED IN SUB-STATION MANHOLES AND TERMINAL HOUSES




SECTION THROUGH LINE A-B-C-D FLOOR PLAN

CROSS SECTION, SHOWING ARRANGEMENT OF APPARATUS AT VALENCE STREET SUB-STATION

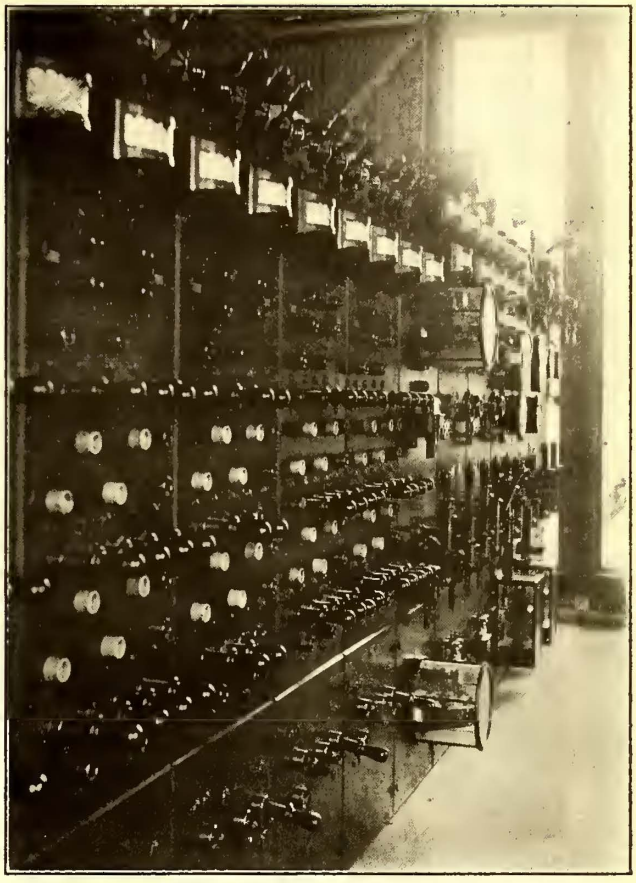
A three-conductor 4-0 6600-volt and a 2300-volt feeder from the Market Street station enter one side of the tower already referred to. On the opposite side are the outgoing feeders. Disconnecting knife switches and lightning arrest-

ers are installed on iron framework on the walls. From the tower the high-tension feeders drop to bare busses on the wall behind the switchboard. They then go to hand-operated oil switches installed in cement cells just under the busses. The leads are then carried under the floor to the synchronous motor generator sets. Excitation for these is obtained from small generators mounted on the end of the shaft of each machine. Either exciter is of sufficient capacity to serve both machines. The units are arranged to be started from either the a. c. or the d. c. end.

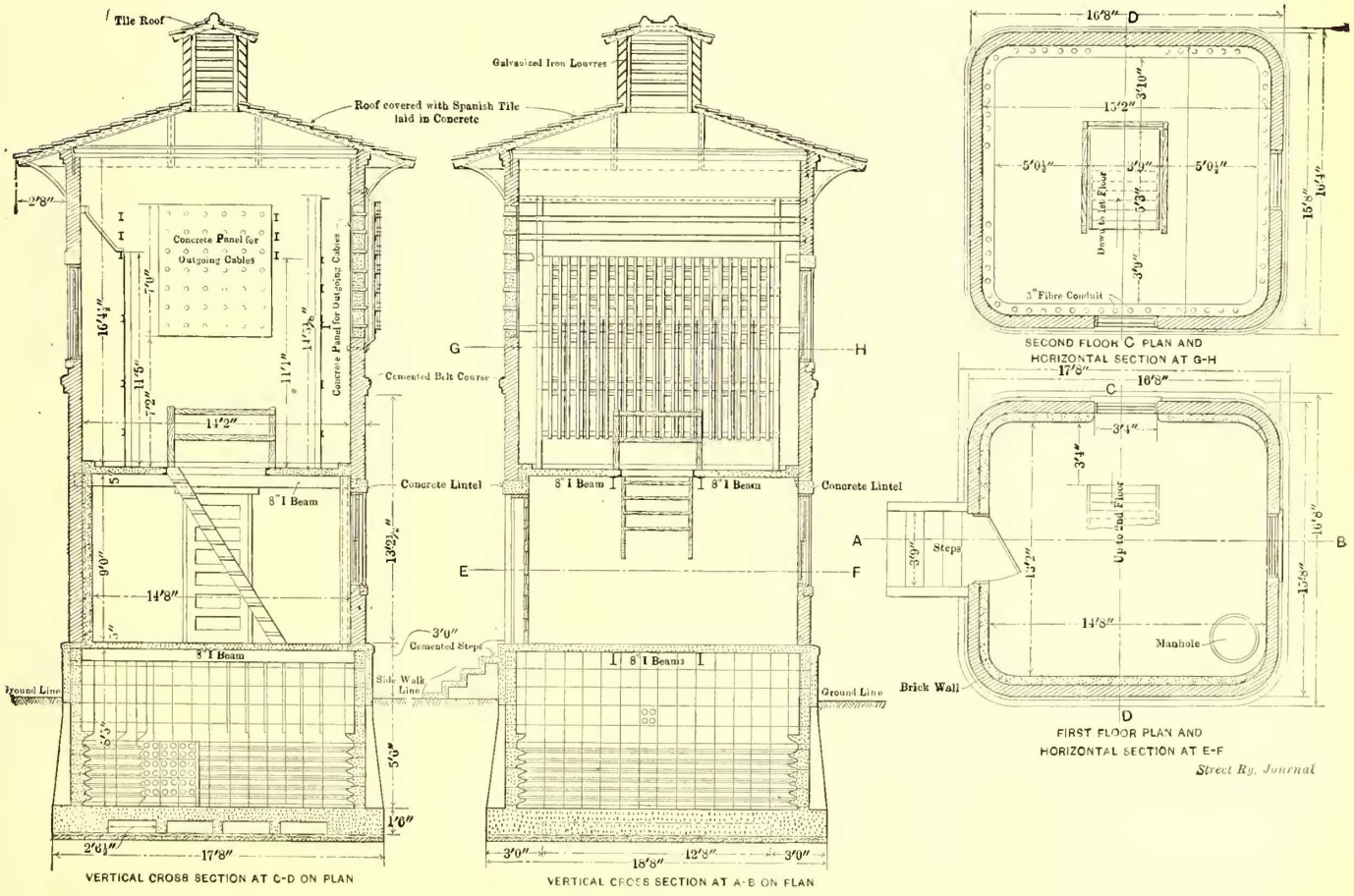
The railway switchboard contains two feeder and two generator panels. On it are installed high tension time limit relays, ammeters for each leg of the incoming lines and a synchronism indicator. Rheostats and compensators are located in the basement under the switchboard. The panels of the arc light switchboard located alongside the railway board carry time limit relays. Two wattmeters are installed in series on the incoming 2300-volt lines, one wattmeter checking the other. All cables in the basement are carried on cable rocks made of concrete blocks about one foot long and containing two shelves, which are wide enough to carry two 1,000,000 c. m. cables. A 4-hp Allis-Chalmers air compressor installed in connection with two storage tanks in the basement is used for cleaning machines. A 15-ton hand-operated crane built by the Brown Hoisting Company spans the room. Lighting is effected with arc lights.

### MAGAZINE STREET SUB-STATION

A temporary sub-station for commercial lighting has been installed in an existing building on Magazine street, near Poydras. This sub-station contains a 500-kw motor genera-



SWITCHBOARD IN THE VALENCE SUB-STATION

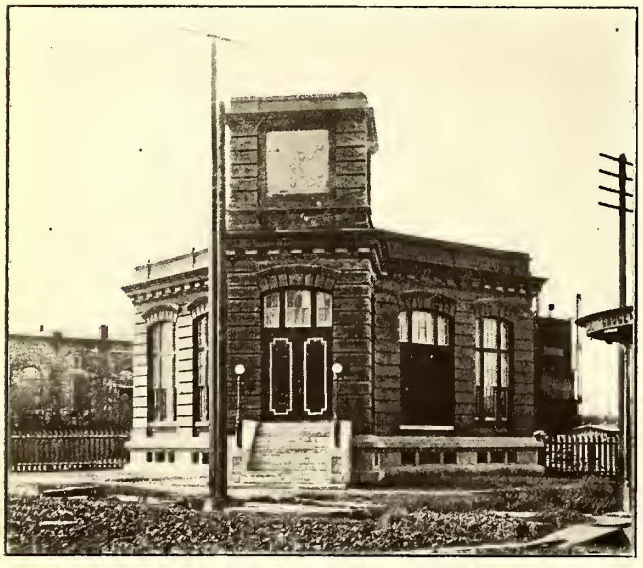



PLANS AND SECTION OF THE HOWARD AVENUE TERMINAL HOUSE

tor set, consisting of a 6600-volt synchronous motor and a 250-volt d. c. generator, which feeds across the outside wires of the Edison three-wire power and lighting system covering the downtown district.

BOURBON SUB-STATION

There is now being installed in this sub-station a 1000-kw synchronous motor generator set, 6600 volts A. C. to 250 volts D. C., for supplying a section of the underground system. The present sub-station building is temporary, but the foundations and sub-grade work is of permanent character, and will constitute a part of the ultimate sub-station construction aggregating some 5000 kilowatts capacity.



CORNER VIEW OF THE VALENCE SUB-STATION

DRYADES SUB-STATION

This sub-station is an installation containing arc light constant current transformers aggregating 660 lights; also one 500-kw motor generator set operating in conjunction with the steam-driven generator in the Edison Station.

CONDUIT SYSTEM

In the downtown district the high-tension connections between all the power stations and sub-stations are underground. The recent work by Sanderson & Porter has included the construction of about 600,000 duct feet of conduit, and approximately 150 manholes. This was necessitated by the extension of the underground district to about double its former area.

The ducts are of 3-in. fiber conduit laid with one inch of gravel concrete between ducts, and with approximately four inches on all sides. The larger portion of the system was of four duct runs and ranged up to thirty-six ducts.

The manholes were usually located at street corners, but additional ones were occasionally built in the middle of long blocks. The manholes are made largely of molded concrete blocks, which, in addition to forming walls, carry projections which serve as shelves for the cables, and act as barriers between adjacent cables. The blocks are practically watertight, and it was found that manholes could be built quicker with them than with brick. The manholes are drained, and in some instances 4-in. glazed tile were used under the ducts to serve as drains from one manhole to another. All drains are provided with rubber ball check valves, which prevent water backing up.

THE TERMINAL HOUSE

The overhead lines from the main generating station, extending into the underground district, are carried into a terminal house about one mile from such station. This is a two-story and basement fireproof brick and concrete structure 15 ft. 8 ins. square. The overhead lines enter the upper room, on the walls of which disconnecting knife switches are installed on frames with slate barriers between them. The arrangement for the arc light circuits is such that one incoming line may be split into two outgoing circuits. The lines pass down to the basement in lead-covered cables. The basement is built of the concrete blocks used in manhole construction, and on the shelves formed by these the lead cables are distributed to their respective outgoing conduits.

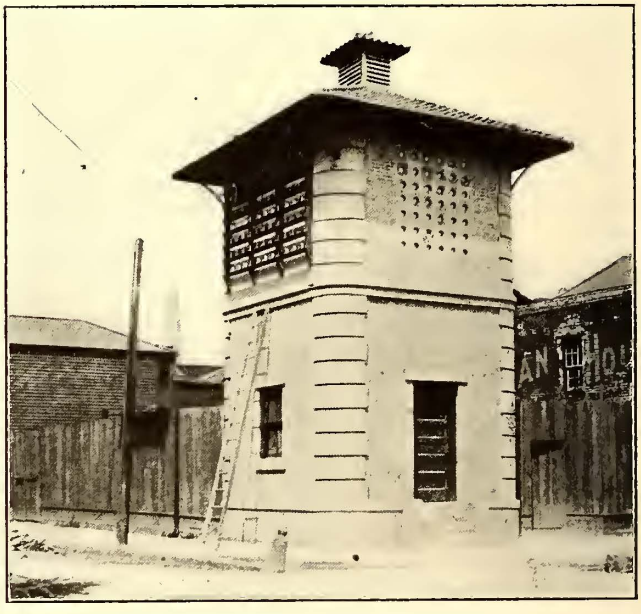
ALGIERS FEEDERS AND SUB-STATION

Reference has already been made to the 2300-volt a. c. submarine line extending from the Claiborne station to Algiers, a suburb of New Orleans, on the opposite side of the Mississippi River. In addition a 2300-volt submarine line is run under the river from the main station at Market Street. All are 2-0, three-conductor, stranded, rubber insulated cables protected by an armor of galvanized wire, and are anchored at three points in the river bed.

On the Algiers side of the river the cables are brought up into a terminal house, and are then carried overhead to the sub-station of the Algiers Railway & Light Company.

ARC LIGHT CIRCUITS

The arc light sub-stations are used with the new arc system of street illumination installed by Sanderson & Porter. This includes approximately 3000 series alternating inclosed arc lamps especially designed to meet the city specifications.



HOWARD AVENUE TERMINAL HOUSE

The above described improvements in New Orleans have been designed and executed by the engineering and construction organization of Sanderson & Porter, New York. Their New Orleans office—W. A. Haller, resident engineer—has substantially completed all the work herein described in such manner as will readily permit enlargements from time to time.

The work has benefited greatly by the cordial co-operation which has existed between the representatives of the constructors and the officials of the New Orleans Railway & Light Company, the latter, particularly, including E. C. Foster, president; J. H. DeGrange, vice-president; A. L. Black, engineer, and E. B. McKinney, supt. of power.

# MAIN POWER STATION

OF

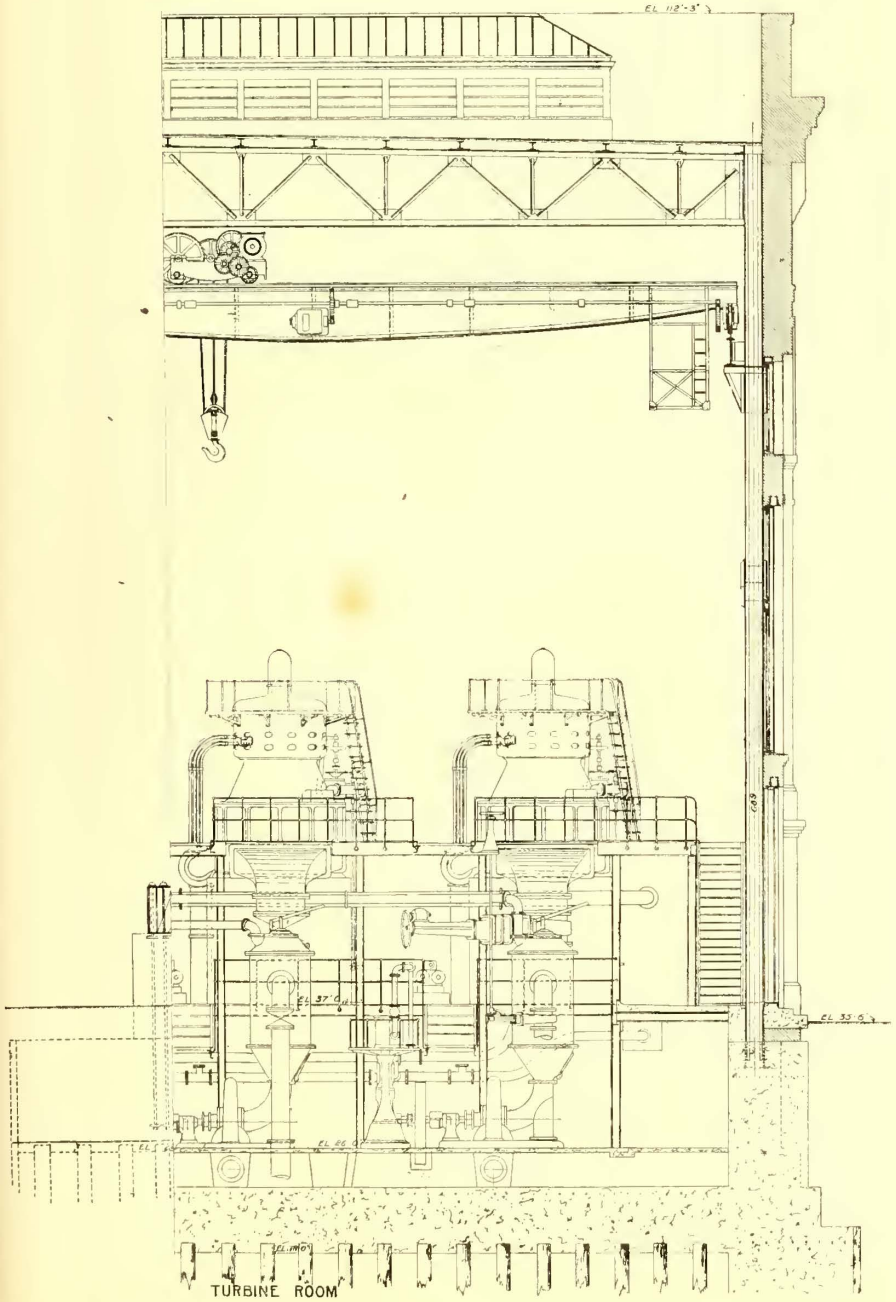
# EW ORLEANS RAILWAY & LIGHT CO.

NEW ORLEANS, LA.

DESIGNED & BUILT BY

SANDERSON & PORTER

NEW YORK



# MAIN POWER STATION
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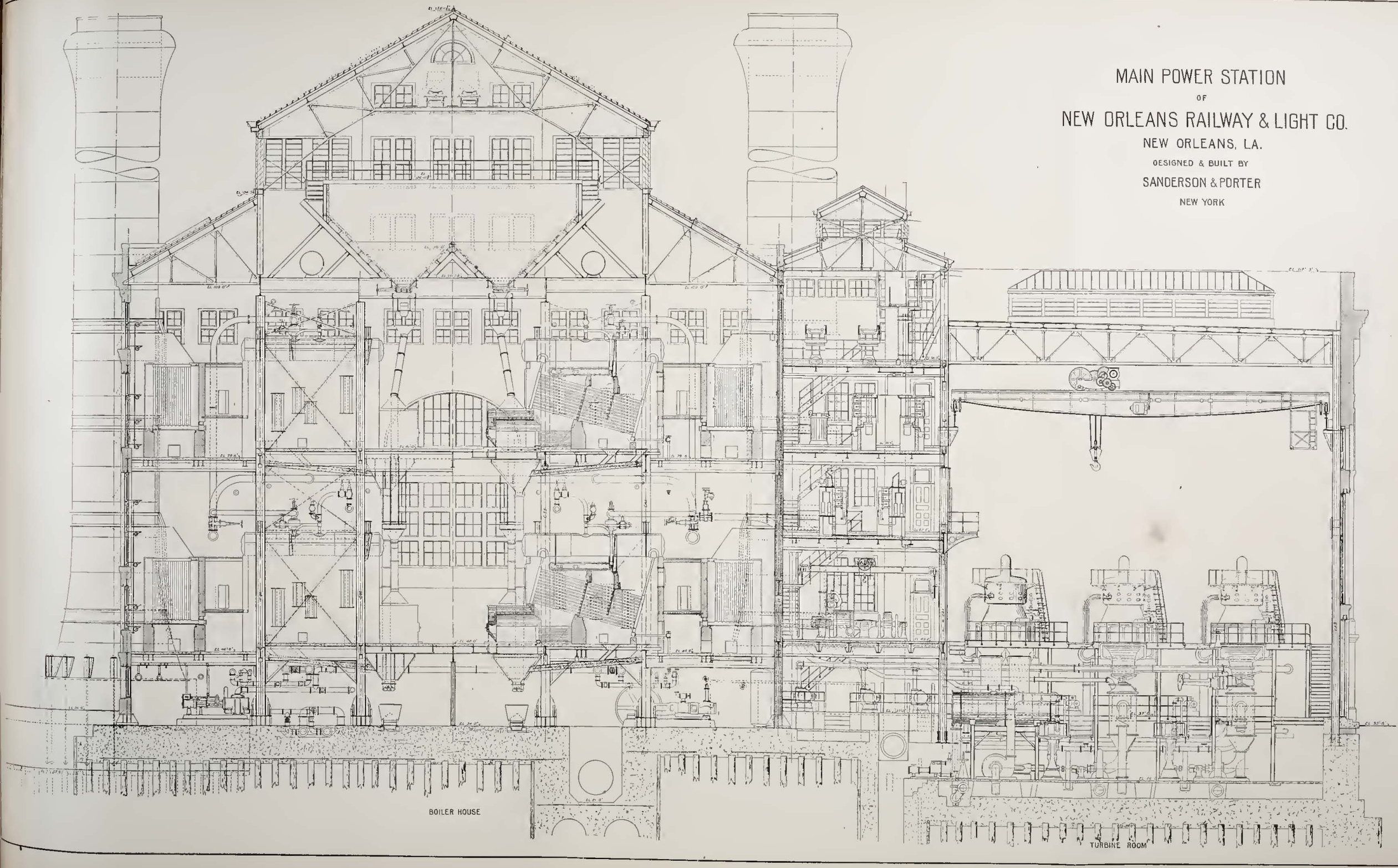


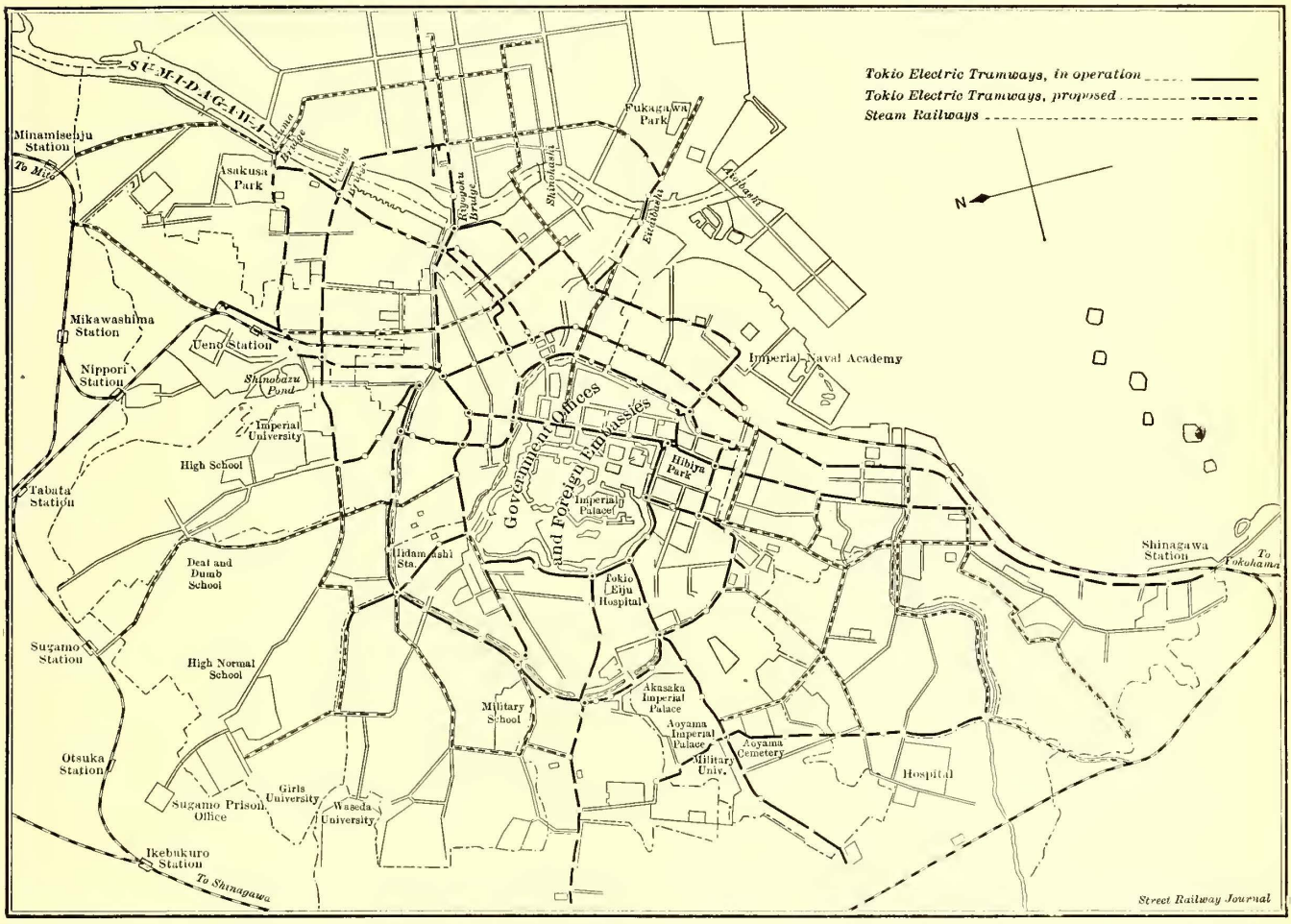
## THE TOKIO ELECTRIC STREET RAILWAY COMPANY

BY HENRY K. BRENT

The deepest impression acquired from reading about this new-old country, Japan, is that, in all phases of its social, civil and economic life, it is undergoing a rapid and wonderful transition. Actual observation transforms the impression into conviction, for on every hand are mingled traces of the old and evidences of the new, made possible by and after the visit of Commodore Perry in 1853. The next fifteen years, though replete with important treaties with foreign nations, were marked primarily by internal upheavals, and it was not until 1868, when the Shogunate was overthrown and the Mikado became Emperor in fact as well as in name, that the seeds were planted from which have been reaped year by year Japan's rich harvest of social, civil and economic progress. In 1871 feudalism was abolished, and in 1889 a constitution was adopted. That Japan has within the past forty years perfected many of her natural native products her large exports bear witness. That she intends to develop her hitherto latent potentialities is illustrated by her great importation of wheels, both mental and mechanical, from all parts of the globe, analyzing and discarding, retaining and applying those suited to her peculiar needs. So far she has combed with a very fine comb American and European ideas, originating little but selecting masterfully. And consequently in the Tokio Electric Railway Company are found many American and many European ideas carefully chosen and excellently practiced by Nippon.

Street cars drawn by horses were introduced in Tokio in 1882, but, although there were several companies, only a small part of the city was covered. In 1903 the number of companies was reduced to three and all the roads electrified. These roads were united under one management in September, 1906, and now constitute the Tokio Tetsudo Kaisha, or Tokio Electric Street Railway Company. It is a joint stock corporation operating under a perpetual franchise from the city, and managed by a board of directors chosen by the stockholders. The company was organized by Japanese, and likewise is managed by them in all its departments.

The capitalization of the company is yen 33,000,000, or $16,500,000, consisting entirely of common stock, without either bonds or preferred stock, upon which there is an annual dividend of 9 per cent, paid twice a year. Practically the entire amount is held by local investors. It is quoted on the Tokio Exchange at 64, par value yen 50. The management and operation expenses are 50 per cent. Of the net receipts 10 per cent annually must go to the reserve fund, and one-third of the remainder to the city for the use of the streets. The amount so paid to the city for the last fiscal twelve months was yen 330,000; gross receipts yen 5,000,000.




MAP OF TOKIO, SHOWING THE PRESENT AND PROPOSED ELECTRIC RAILWAY FACILITIES, LOCATION OF IMPORTANT BUILDINGS, PARKS, ETC.

The total length of the system, exclusive of suburban connections, is 90 miles with proposed extensions of 80 miles. On account of the width of the streets the track is narrow-gage, but the body of the cars is almost as wide as broad-gage cars, and in this respect the cars resemble those used in Denver. Although the rails are light the track is kept in splendid condition by a large number of inspectors

and workmen. All the cars (there are no open ones and about seven hundred in daily use), were constructed in Japan, and in size range from the dinky seen in our smaller cities to the large cars of metropolitan type. A noticeable feature is the frequency with which cars run, which shows not only their popularity with the public, but also the regard of the company for the comfort of its patrons, for, though the cars are often crowded, strap hanging is the exception instead of the rule. As one result of this popularity, the number of jinrickshas has decreased within a few years from 40,000 to 20,000 vehicles, and the number of men so engaged from 50,000 to 25,000. This example of the displacement of human motive power by machinery is a typical illustration of the conditions of modern Japan, and the resulting idleness of many thousand workers is the great reason for the large emigration now going on. It is fortunate for Japan that Korea, her nearest neighbor, has remained for so many centuries a Hermit Kingdom, undeveloped from within and unexploited from without. The great natural resources and fertility of that peninsula offer an outlet for the energies of her ever increasing number of unemployed, which most likely accounts for Japan's present not entirely altruistic interest in that country.

The popularity of this comparatively new method of transportation is shown in a practical and desirable manner by the average daily number of passengers carried, about 300,000. The busiest months are March and April, the flower months, when thousands and thousands of people go daily from park to park to see the cherry blossoms and other plants in bloom at that season: a manifestation of Japan's aesthetic temperament, which at the same time redounds to the benefit of the coffers of the traction company, a source of revenue not found in American cities, even in Chicago. During this period cars are transferred from other divisions to accommodate the increased park traffic. Conditions of congestion similar to these, but due to dissimilar causes, in our American cities are being carefully studied by Traffic Manager Nambu and his associate officers. On account of its topography New York City offers an unlike problem, and more attention is being given to the methods of such cities as Boston, St. Louis and New Orleans. A study of the traffic conditions of the latter city, with its splendid loop system centering on Canal Street, would probably assist in solving Tokio's difficulty. With the increasing traffic and additional mileage under construction and proposed, the company must soon make a new arrangement of its lines by divisions. One of the greatest obstacles encountered in this matter is the lack of trained men for division superintendents. This difficulty has thrown upon the present traffic superintendent not only the ordinary duties incumbent upon the position, but also the care of the details of operation. But already the merits are known of placing the responsibility of operation upon division superintendents subject to such general supervision as may be necessary, and it is only a matter of time before the company will put into practice a bonus or merit system in the form of increased pay for each employe upon the best operated division, according to the classification of the employe as to efficiency and length of service.

The crews are dressed in the customary blue uniforms with brass buttons. Two bells to start and one to stop are used, but the cars do not stop at every corner, since, on account of the inequality in the length of the blocks, such an arrangement would be unsatisfactory. Stopping places are indicated by notices painted on the trolley posts along the street, and occur at regular intervals, sometimes in the middle of a block. Following the English law of the road the cars use the left-hand track instead of the right as in America. On each car, except the very small ones, are two conductors, one inside to collect the fares, and one on the back end to look after the trolley, to start and stop the car, to assist passengers on and off, etc.

The fare from any point in the city to any other point is 5 sen, equivalent to 2½ cents in American money. Transfers are given to all intersecting lines, and a transfer upon a transfer is allowed where that is desired. Upon handing the fare to the conductor he holds up the coin, states the amount, and inquires whether one ticket, or more than one if the coin be 10 sen or more, or a transfer is wanted. This is done in order to prevent short-changing by the conductor, and should a conductor fail to name the amount of a coin received and a dispute arise as to the change, the conductor at his own loss must make good to the passenger. The money received is deposited in a small leather satchel suspended from the neck of the conductor. In appearance and size it is similar to the hand bags in such general use by the good dames of Boston. So no bold Bostonian, unanchored from the sacred precincts of Beacon Hill and the hallowed shadows of the State House, need feel homesick if he will only go to Tokio and ride in a street car.

After ascertaining that only one is desired the conductor then tears from a perforated sheet a single ticket, which he punches and hands to the passenger. This ticket is collected by the conductor on the back platform and must be produced before the passenger may alight, the ticket then being deposited in a box on the car for that purpose. The tickets are numbered consecutively, and all must be accounted for at the end of the day's run. This method, like all others yet devised, does not prevent theft by the conductors and in order to avoid the repeated use of a ticket and collusion between the conductors it is necessary to employ a large number of spotters. A conductor detected of theft forfeits the entire amount of his deposit, yen 7, and is discharged, but not prosecuted. As no fare register is used the company does not have the advantage of that mechanical assistance, and must depend in calculating its daily receipts solely upon the number of tickets issued and collected.

If placed unexpected on a street corner with ears closed and gaze concentrated upon a passing car, an American would not realize he was in Tokio. But with open ears and gaze diverted for only one second he would know he was in the Far East. The shrill whistles which he so often hears are not those of policemen or wheelmen, but are the signals of blind shampooers soliciting attention. The click, click, click on the hard road (there are few side walks) is the noise made by the wooden clogs (stilt-like shoes) of pedestrians, a sound resembling the sabots in a Dutch city, but not so loud.

When the car comes to a standstill it may be necessary to wait until a woman gets aboard; a long process in any country regardless of nationality, but especially long in Japan on account of the awkward shoes worn. Upon entering the car, if she intends to ride only a few blocks, she rests merely on the edge of the seat, for with her baby strapped to her shoulders she cannot lean back. But if she is to go some distance the child is swung around on her lap, nursed and otherwise attended to as occasion may require. There are generally a number of European-dressed natives in the car, but most of the passengers wear kimonos, and as the men sit with their knees crossed their bare legs are exposed in a way which to us seems very unconventional. Some passengers prefer to sit on the seats tailor-

fashion, while others prefer to kneel on them and look out of the windows. Of course in modern Japan one expects, and does find advertisements in the top sides of the cars. But instead of leather straps for support when the cars are crowded, bamboo loops are used, and as the people are small in stature, especially the women, these loops come only about to the chest of an American or European of ordinary height. Although the cars have glass windows very few of the houses, except the official buildings and Europeanized shops along the Ginza, the Broadway of Tokio, have them. Paper still serves the purpose of glass in this respect, and, as paper is not visually transparent, the fronts of the shops in order to display their wares are open to the street. At night the electric lights of the cars compete with myriads of paper lanterns along the way; paper lanterns everywhere, one being carried even by the mounted policeman at the end of the line in the suburbs. The floors are not covered with gratings as with us, since the clogs worn would catch in the cracks and make walking in the cars almost impossible.

Although the Tetsudo Kaisha is an up-to-date street car company in most particulars, it does not offer to the tourist the facilities of a sight-seeing car. Yet Seattle does, and both Tokio and Seattle are equally on the Pacific. Maybe the difference is because Seattle claims that within a short time she will also be on the Atlantic, and in advance has already adopted some of the methods of her future neighbors. But whatever the reason, the tourist who would see Tokio by street car must do so independent of the company's assistance, and consequently make many changes and many mistakes. But search as he may in every quarter of Tokio's one hundred square miles, the sightseer will not discover so queer a car as the one in Denver which goes up hill by horse power, and down hill by gravity with the horse on the rear platform. Nor will he find so great a fraud as the one in one of the western cities in the United States, where at the bottom of a steep inclined track in the center of the city the gullible Easterner is invited to enter a car, and, free of charge, ride to the top to view the wonderful new city below; though no fare is charged for the ascent, ten cents must be paid in order to descend. Curious and interesting as are these two street car novelties, they fade into insignificance compared to the surprise felt at hearing a delinquent Chinaman and a conductor disputing in Pigeon-English, the only language common to them. And indeed, whether the passenger be an Asiastic or European, unless he speak Japanese, he must in all cases resort to English, which, aside from the native tongue, is the only language widely understood in the Empire. Take courage, Americans and Missourians who visit Japan, and have no hesitation about riding on the street cars in this great capital where your own language has already preceded you.

The visitor to a Tokio shop is surprised at the large number of clerks, but when he visits a native factory surprise develops into amazement at the swarms of workmen seen. The same conditions exists in the street car company, for, including its office force, the number of employes is about seven thousand, divided as follows:

| | |
|---|---|
| 246 Inspectors. | 583 Yardmen. |
| 1873 Motormen. | 376 Linemen. |
| 73 Apprentice Motormen. | 277 Trackmen. |
| 1910 Conductors. | 57 Power Station Men. |
| 116 Apprentice Conductors. | 30 Lighting Station Men. |
| 152 Barn Mechanics. | 274 Construction Men. |
| 337 Switchmen. | 445 Painters and Carpenters. |

With the exception of the motormen and conductors, whose hours depend upon the number of miles in their respective runs, the average work day is ten hours. Motormen and conductors are expected to do about sixty miles in a day of eleven hours. For more than eleven hours they are paid for extra time. Twenty minutes only are allowed for lunch, but at the end of each round trip six minutes are permitted for smoking. The runs are continuous, and are not broken by the two hours' relief crews as in America.

Motormen and conductors receive the same wages, which are founded upon a minimum basis of yen 12 per month. But the amounts differ, and depend upon which one of the six classes they belong to, the classification being made according to efficiency and length of service. The amounts average from yen 16 per month for class one, to yen 21 for class six, a difference of yen 1 per class. The wages, aside from the guarantee of yen 12, are regulated somewhat upon the co-operative plan, and are governed by the daily receipts of the company, 9 per cent of the net receipts being set aside by the company to be distributed as wages. After deducting the total aggregate of the guaranteed sum, the remainder is distributed in the form of a bonus, the amount of bonus to each conductor and motorman being apportioned according to his classification. But before becoming a motorman or conductor the applicant must undergo examinations similar to those in the United States, viz., as to character, general intelligence and good health. If satisfactory he becomes an apprentice for six weeks at yen 9 per month and no bonus, and then a first-class employe.

The average living expenses for an employe per month are: yen 3 house rent, yen 9 food, yen 3 clothes and yen 1 incidentals, a total of yen 16, the same amount as is received by a motorman or conductor of the first class. It does not require the aid of an abacus, the Japanese calculating machine, to determine how much is left for savings at this ratio of living expenses to wages. But, nevertheless, in order to create the spirit of saving among those who now have nothing to save, and to encourage the spirit among those who are so fortunate as to possess a little surplus, the company has under consideration and will probably establish a savings department similar to those in some of the European companies. Already it is beginning to realize the advantage of taking an interest in its employes in addition to its merely official relation to them. It retains its own physicians who, for a very small fee, are at the service of its employes, and in case of bona fide illness the wages are continued until the employe is able to resume work. Where permanent injury occurs a lump sum is given to the man, or to his family in case of his death. Usually, however, the amount is very small, seldom exceeding yen 250 or yen 300.

Although there are at present no labor organizations, such as unions, in Japan, the discontent of laboring classes throughout the world has made its appearance even here. In May of this year occurred the violent strike and rioting at the great Ashio copper mine, about twelve hours distant from Tokio. The strike was the result of a demand for increased wages, and during its progress much valuable machinery and other property were destroyed. The leaders were severely punished, and three hundred participants were imprisoned for longer or shorter terms according to their activity. Industrial disturbances of similar but less violent character have occurred elsewhere. As yet the railroads and traction companies have been free from them. The mental attitude, however, of all working classes is changing. Fifteen years ago the watchword for them in Japan was, not rights, but duties. To-day it is different. With the new spirit of enterprise and combination among her capitalists, will there also appear the corresponding spirit of organization among her laboring people? Will

Japan be able to devise a means of preventing conflicts between employers and employes? Or is she so far committed to her policy of imitation and adoption that she must take what is bad as well as what is good in the industrial progress of foreign nations? Her labor history will be watched with interest, and in no department of her industrial life will the relations between employer and employe be of greater importance than in her traction companies, both on account of their semi-public character, the large number of men engaged in them, and because of their vital importance to the comfort of their respective communities.

INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY.
STANDARD TIRE. No. 21105B.

| PUT IN | | REMOVED | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Car No. | Date | Measurement | Date | Cause | Measurements | No. Days in Service | No. Miles | Tire Loss | Work Done by |
| 52 | July 3, 1905 | 33.82 | December 12, 1905 | Sh Flg. | 33.03 | 141 | 42,000 | .39 | |
| 52 | December 20, 1905 | 33.03 | May 3, 1905 | Change | 32.15 | 105 | 29,000 | .39 | |
| 52 (1) | May 13, 1905 | 32.15 | June 30, 1906 | Sh. Flg. | 31.43 | 35 | 9,000 | .31 | |
| 52 | June 30, 1906 | 31.43 | | | | | | | |

## STEEL TIRE PRACTICE IN THE SHOPS OF THE INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY

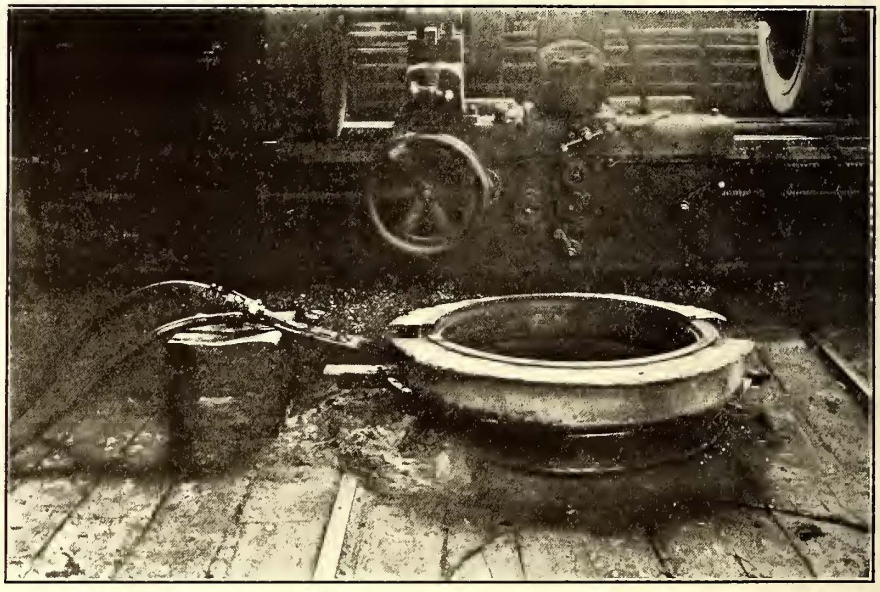
Practice regarding steel tires as followed in the shops of the Indianapolis & Northwestern Traction Company at Lebanon, Ind., is especially good, and some of the details may be of interest to others. The method of removing tires from and replacing them on their centers which was devised by Leverett M. Clark, formerly master mechanic, who is now with the Indianapolis Traction & Terminal Company, and L. W. Hayes, the present master mechanic, and the manner in which record of the turnings and mileage of the tires is kept, are well worth noting. Comparatively new tires are removed in about eight minutes at a total cost of 13 cents for both labor and fuel. A shorter time is required to remove thin tires. As about one-half gallon of crude petroleum at 3¾ cents per gallon is used in removing a tire, the cost of fuel for the operation is less than 2 cents.

The apparatus necessary consists of two tanks for the storage of oil, a double burner, as shown in the illustration, and two asbestos-lined, semi-circular, sheet-iron troughs, which are put around the wheel. The wheel centers are fitted with 3-in. tires fastened with riveted double-lipped retaining rings. When tires are to be removed, the rings are taken off, and usually it is necessary to put the wheels in a lathe and turn off the inner edge of the tire, which overhangs the center. The semi-circular covers shown in the illustration are then put around the tire. These covers are so made as to prevent to a great degree the dissipation of heat. Each encloses somewhat less than half the diameter of the tire, so that when they are in position there is sufficient space between them to permit the burner to be inserted, as shown in the illustration. This burner is supplied by means of a hose with oil from the storage tanks and a hose for the compressed air. Globe valves and angle cocks permit the supply of both oil and air to be controlled.

The intensity of the heat expands the tire the proper amount in a very few minutes.

The two tanks in which the oil is stored are similar to the tanks used in connection with air-brake systems on cars and are of about 5 cu. ft. capacity each. Because of the small expense and trouble occasioned by the removal of tires, it is the custom when flanges wear sharp on one side of the truck to remove each tire and mount it on the mate center. This practice removes the necessity of turning as much metal off the wheel as would otherwise be necessary.

A careful record of each tire is kept. As all the tires in use on the system are of the same dimension, the cards on which the record is kept were much simplified by leaving off all blanks regarding dimensions. The data kept on the cards may be observed in the reproduction presented herewith. The data on this card, however, show a tire of average wear. The cause for removal is frequently sharp flanges. The cause "change" shows that the tire was changed from one center to the mate one because of sharp flanges of the mate center. Wherever possible, the tires are kept on the same pair of wheels and the wheels in the same truck. By so doing the manner in which the wheels wear often indicates trucks faulty in alignment or otherwise. New tires are 34 ins. in diameter and 3 ins. thick. They are worn down to a diameter of 31 ins., or to a thickness of 1 in., before being discarded. When kept in service beyond this point there is a tendency for the outside corner of the tire immediately over the retaining ring to break off. The average mileage obtained is from 16,000 to 20,000 miles per turning. The turnings are from ¼ to ⅜ in. thick, so that the life of the tire is from 80,000 to 150,000 miles.

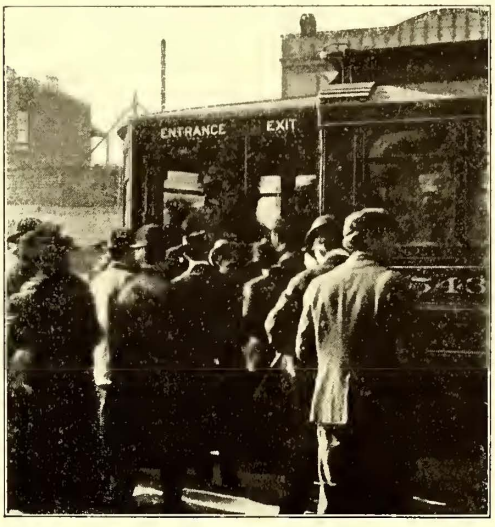


EXPANDING TIRE ON INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY

## THE RESULTS WITH THE PAY-AS-YOU-ENTER CARS IN CHICAGO

The STREET RAILWAY JOURNAL is able to present this week the first pictures that have thus far appeared in the technical press of the workings in operation in Chicago of the new pay-as-you-enter cars, placed in service for the first time in that city on the Cottage Grove Avenue line on Sunday, Nov. 24. Supplementing, as they do, the previous particulars of operation of this type of car in Montreal, as given in the STREET RAILWAY JOURNAL, they more than bear out the record for service previously established in Montreal, this despite the fact that the conditions in Chicago are much more severe. It is not meant by this that there are not difficulties still to be overcome in the operation of the cars. Rather is it to reiterate the statement made by President Mitten, of the Chicago City Railway Company, that the inauguration of the service was attended with even a greater measure of success than was anticipated, and that the drawbacks are not inherent, but remediable when the traveling public still further realizes the significance of the change.

The preparation by the company for the service has been reviewed in these columns. One feature of this work, however, deserves further consideration, because of its bearing on the success that attended the beginning of service. This was the effort made by the company thoroughly to acquaint the public with the workings of the system before putting the cars into operation. In this work a four-page illustrated circular was made to play an important part. This circular, distributed among the company's patrons, contained on the first page a picture of a complete car, on the second and third pages pictures of the rear platform empty, except for the conductor, and the rear platform with conductor effectually blocking the entrance and requesting passengers on the street to take the next car. On the fourth page was a floor diagram of the car showing, by means of arrows, the movement of passengers when entering or leaving cars, with the place distinctly marked on the front platform that is intended for smokers. There is also no dearth of signs on the cars, this means being taken advantage of especially to bring to the attention of patrons the desirability of having their fare ready when boarding the cars. Later, when the public becomes better acquainted with the operation of the cars it is proposed to limit the number of passengers to a car to eighty.



PAY-AS-YOU-ENTER CAR LOADING AT A TRANSFER POINT.

The Chicago press in general has made favorable comments both editorially and in the news columns. The "Union Leader," the official journal of the Chicago car men, declares itself as favorable to the cars, and commends the closed vestibule feature and the heaters for the benefit of the motorman and the conductor.

President Mitten reports increased returns from the Cottage Grove Avenue line since the cars were put into operation, but at present he is unable to determine to what the increase is due. It may be due, to some extent, at least, to curiosity. On the Wabash Avenue line the new cars are sandwiched in with those of the older type, but seem to load and unload at least as rapidly as the latter, if not more so.

Within the next sixty days the Indiana Avenue line, which parallels the Cottage Grove line, will be supplied with cars. There will then be a total of 300 pay-as-you-enter cars in operation in Chicago.


PAY-AS-YOU-ENTER CAR LOADING AT SIXTY-THIRD STREET AND COTTAGE GROVE AVENUE ON FIRST DAY OF OPERATION.

The Illinois Traction Company has announced a number of changes in its personnel. The office of assistant general superintendent, which has been filled by A. C. Murray, has been abolished, and Mr. Murray has been appointed assistant to General Manager L. E. Wischer, in charge of the executive office at Springfield. W. W. Street will continue at Staunton as superintendent of the Springfield & Northeastern and the St. Louis & Northeastern, as the southern lines are known. Mr. Street will appoint A. P. Monroe assistant superintendent. Master Mechanic F. T. Thomas will sever his connection with the company and will go to the Cleveland & Southwestern Traction Company, with headquarters at Elyria, Ohio. He will be succeeded by W. O. Plunkett, who was formerly in charge of the shops at Riverton, Ill. The auditing department will be concentrated at Champaign, and the branch offices abolished. L. A. Rodger, auditor for the southern division, has been assigned to the main office.

## IMPORTANT ELECTRICAL CONSTRUCTION AT BUENOS AIRES

Buenos Aires, which was founded in 1535, had, in the year 1870, a population of some 180,000 inhabitants. To-day, according to official statistics, the population within the city limits exceeds 1,100,000. The rate of increase, due to natural causes and to emigration, amounts to doubling every thirteen years. In a period of five years, the increase is equivalent to the whole of the population of a large capital like Lima. After Paris, Buenos Aires is the largest Latin capital of the world, and by reason of its many fine buildings, its splendid avenues and parks, and the organization of its public services, lays a very strong claim to be called the "Paris" of South America.

CHAIAISTA STATION AND CEMETERY FROM EAST

Like most cities of relatively recent creation in the new hemisphere, Buenos Aires has had the advantage over older historical European cities, inasmuch as it has benefited, free of all experimental costs, by the latest improved inventions connected with public works. At the same time, however, it must be recognized that the citizens of the Argentine capital have been very much alive to the possibilities of modern engineering and modern business methods, and the marvelous progress of the city is due to their foresight and energy. One of the greatest difficulties has been the meeting of the constantly increasing requirements of the rapidly growing country, and capital for all kinds of public services.

An account was published in the Street Railway Journal for June 1, 1907, of the general tramway situation in Buenos Aires, but no attempt was made to describe in detail the system of any individual company. Nevertheless, many of them will bear study owing to the special conditions existing in Argentina. One of the most interesting is that of the Buenos Aires Lacroze Tramway Company, the only native Argentine tramway company in the city, and the only line running a high-speed suburban service on American lines, with private right of way and cars equipped for a maximum speed of fifty miles per hour.

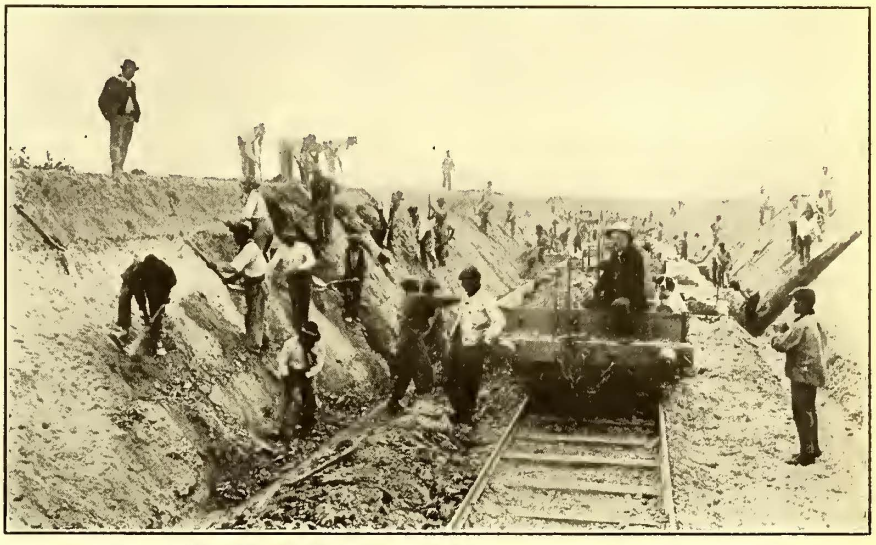
This was originally organized by one of the pioneers of tramway traction in Buenos Aires, Federico Lacroze. The first line which he built he afterward sold to the Anglo-Argentine Company, and has been the nucleus of the very large system now operated by that company. He then organized the "Rural Tramways," and, in addition, extended his lines many miles into the country, at a time when the other companies did not realize the importance of possessing adequate suburban communication. The whole undertaking grew to a point when it became necessary to form two different systems, viz., the city tramway lines, now known under the name of the Buenos Aires

TERMINAL STATION OF THE LACROZE TRAMWAYS AT MEDRANO AND CORRIENTES STREETS, BUENOS AIRES

Lacroze Tramways, and a steam railway line 220 km in length, long known as the Tramway Rural à Vapor, but recently organized into a new company called Ferro Carril Central de Buenos Aires, Limitada.

One interesting point in connection with the original franchise was, that it was granted to the concessionaire under the obligation of the exclusive use of horse traction. The reason given by the authorities for this stipulation was, that it was necessary to develop the national industry of the country, which at that time depended almost entirely upon horse breeding. The tramway was extended by degrees under the old concession for a distance of upward of 100 miles into the country, and there can be no doubt that it holds the record for long distance horse railway, as well as the first tramway to run a sleeping car over its lines. At a later date the authorities recognized that, for the purpose of giving an efficient service, it was necessary to grant a permission to use mechanical traction, and steam locomotives were employed.

The development of the business of the Tramway Rural in the hands of Federico Lacroze, became, at his death, still more important in those of his active and energetic sons. Their first step was to enter into a contract, in the year 1905, with J. G. White & Company, of London, for the reconstruction and electrification of the old city lines, which were double track. The work was commenced in March, 1906, and before the end of that year the new power house, with a capacity of 2,250 kw, was in running order—an achievement which, considering the labor troubles and the port congestion, may well be considered a record for rapid construction. Part of the lines was opened formally to public traffic on March 10, 1907. The original lines consisted of 40 km of track, owned by the company, and 10 km held jointly with other companies and on lease. J. G. White & Company are now engaged in extending these lines a further 40 km, and for the purpose of serving these new lines, another 750-kw set is being added to the station.



GANG AT WORK TRANSPORTING EARTH FOR AN EMBANKMENT

THE LACROZE TRAMWAY COMPANY'S STATION AT CUYO AND MEDRANO STREETS, BUENOS AIRES

### TRACK AND OVERHEAD EQUIPMENT

All the lines are standard gage and laid with 87-lb. rails. The first shipments of rails were 45 ft. in length, but on account of shipping difficulties, the length was reduced to 40 ft. The rails are laid on concrete stringers, 6 ins. in depth and 18 ins. in width. Tie-bars, placed at intervals of 3 ft. 9 ins., are used, with continuous joints. All the special work was supplied by Hadfield's Steel Foundry Company, Limited, and the United States Steel Products Export Company.

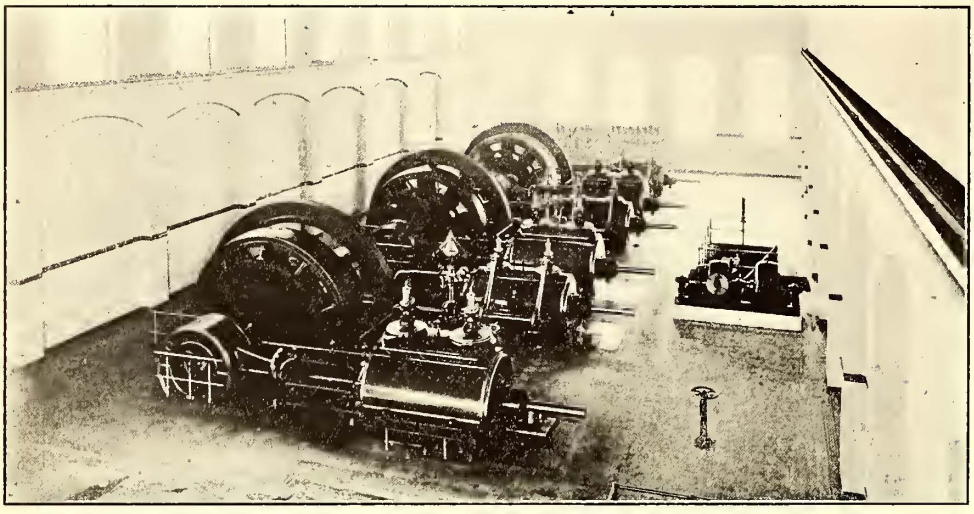
The overhead equipment consists of side poles with span wire construction, center poles, side-pole construction with bracket arms, and a few rosettes. The trolley wire is No. 00 B. & S.

### POWER STATION

The power house is of brick, with an exterior plastering usual to the country. The buildings comprise an engine room, 58 m x 17 m; a boiler room, 40 m x 9½ m, and a coal storage of the same size. The brick chimney is 47.50 m in height.

The engine room contains three 1100-ihp horizontal cross-compound engines by Carels Fréres, Belgium, constructed after the Sulzer patent; these coupled to a 750-kw General Electric generator. The consumption of the engines averages 22 lbs. of steam per kw-hour, with a load factor approximately 40 per cent. Each engine has its

own condenser. The air pumps are of the Edwards type, independently driven by steam engines supplied by Allen & Company. Worthington centrifugals are used for circulating pumps, each capable of dealing with 1000 gals. per minute, and are driven direct by electric motors. The switchboard was supplied by the British Westinghouse Company. A Board of Trade panel is used with a 60-kw



INTERIOR OF POWER STATION OF THE LACROZE TRAMWAYS

negative booster of the Electric Construction Company's make. A 25-ton crane traverses the engine room.

The boiler room contains five marine type boilers by Babcock & Wilcox, fitted with their well-known superheaters, having a heating surface of 630 sq. ft. Each boiler is capable of evaporating 12,000 lbs. of water per hour, the grate area and heating surface being 49 sq. ft. and 2480 sq. ft. respectively. The three feed pumps installed are of the Worthington duplex type. A Wheeler feed-water heater and two cooling towers are used.


FOUR-MOTOR, DOUBLE TRUCK CAR FOR THE LACROZE TRAMWAYS

The feeders were supplied by Callender's Cable & Construction Company, and are paper insulated, lead covered, and are drawn into Sykes' stoneware conduits.

### ROLLING STOCK

The rolling stock for city purposes will consist of 140 cars of the semi-convertible type, supplied by the J. G. Brill Company, and with seating accommodation for thirty-two persons. The interior fitting is mahogany; the exterior coloring is green and cream. Each car is equipped with two 40-hp motors supplied by the British Westinghouse Company. In addition to the city cars, there will be at first ten interurban cars, which will seat forty-four people, and will be fitted with four 50-hp motors.

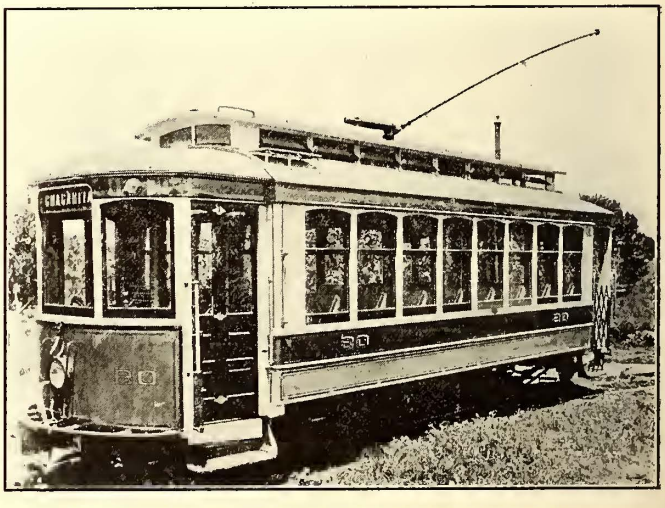
Electric locomotives will also be used for hauling freight trains. They are being supplied by Dick, Kerr & Company, and will be equipped with four 50-hp motors.

C. E. d'Ornellas acted as superintendent in charge of the above work for J. G. White & Company, Limited.

### FERRO CARRIL CENTRAL DE BUENOS AIRES

This is the steam railway already mentioned, which extends westward and northwestward in the Province of Buenos Aires, a distance of 174 km, with one branch 44 km and another 3 km long. It traverses one of the most fertile districts in the Argentine.

The history of the railway is believed to be quite unique, in that it was constructed as an extension of an urban horse tramway from the surplus earnings of the latter, and was operated as a horse tramway for goods and passengers for a considerable distance in a then thinly settled country. Buenos Aires province is one of those regions where it is cheaper to build a railway than a good road. Construction proceeded as fast as earnings became available for that purpose. From 1885 to 1892, 144 km were built. By 1897 the present system of 221 km was entirely in opera-



STANDARD SINGLE TRUCK CAR FOR LACROZE TRAMWAYS

tion. The early type of construction was necessarily very economical, the rails weighed 30 lbs. to the yard, the sleepers were creosoted yellow pine 2 m long, and the bridges were supported by wooden stringers. Earthwork was avoided as much as possible, the track being laid practically upon the ground.

It became evident as early as 1891 that it would be necessary to introduce steam traction in order to cope with

the traffic. Accordingly, eight 16-ton saddle-tank engines were bought from the H. K. Porter Company, of Pittsburg, and the bridges were strengthened to receive them. With the earnings of these eight locomotives, supplemented in 1896 by three 18-ton passenger locomotives, the railway was rapidly developed, grades were reduced, rolling stock purchased, a handsome new passenger station built at the Buenos Aires terminus, and 97 km of track were relaid with 50-lb. rails. Other important improvements are being made.

Partly in connection with this general plan of reconstruction, partly as an outgrowth of the recent electrification of the Lacroze City Tramways, the company is equipping about 11 km of double track at its Buenos Aires terminal for a high-speed electric service, which will be operated by the Tramways Company. This engineering and construction work is also being done by J. G. White & Company, of London.

## THE MILWAUKEE NORTHERN RAILWAY

On Monday, Oct. 28, the Milwaukee Northern Railway, one of the best constructed and efficiently operated lines in the West, sent the first cars over its tracks from the town of Cedarburg, 19 miles north of Milwaukee, into the city on a regular hourly schedule, and a few days later the entire road was in operation as far as Port Washington. This system, which has Milwaukee as its southern terminal, is designed to bring Port Washington, Sheboygan, Fond du Lac, West Bend and numerous other towns and villages into closer communication with the metropolis of the State; and the district thus thrown open to traffic, as shown in the accompanying map, is extensive, rich and populous. Milwaukee merchants, through the agency of the new road, are placed directly in touch with fully 100,000 people more than those whom they have heretofore supplied. In addition to the places above mentioned, constant and rapid communication is established between this large central market and the towns of Thiensville, Grafton, Cedar Grove, Barton, Kewaskum and Campbellsport, as well as the rural communities lying between and adjacent to them.

### ROADBED AND CROSSINGS

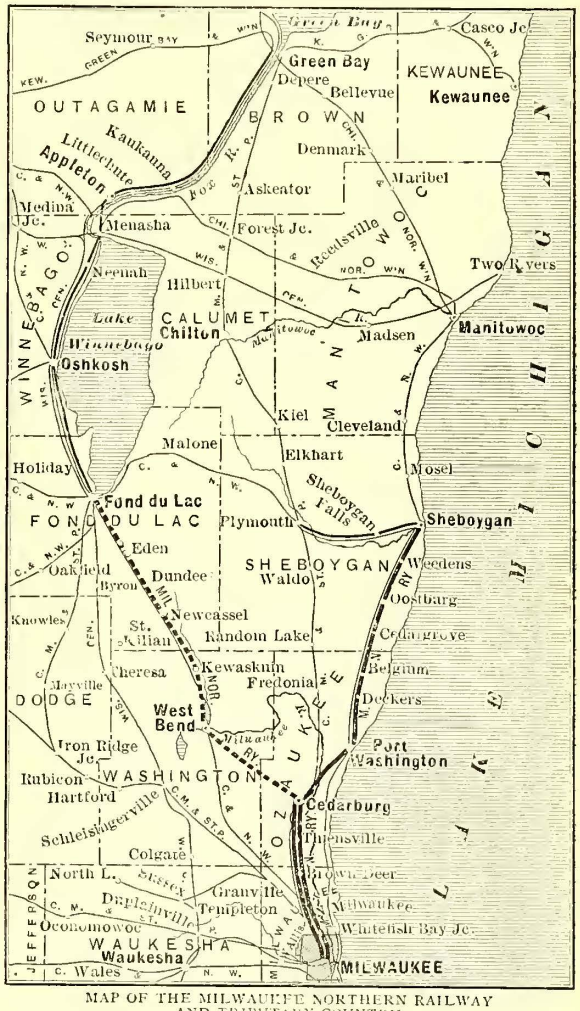
Except for the short distances in the centers of some of the larger towns, the Milwaukee Northern roadbed is located on its own right of way. The general absence of grade crossings and curves is a feature which goes far to insure safety from accident and to permit a high speed schedule. Where the right of way crosses the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railroad tracks, subways, steel bridges with masonry abutments, or viaducts are used. Just south of the depot at Port Washington the line runs under the Chicago & Northwestern Railroad, through a subway spanned by a steel and concrete bridge, and the same road is similarly crossed about a mile and a half from the Milwaukee city limits. A steel viaduct 765 ft. long has been built over the St. Paul tracks at Grafton and another 654 ft. long in the town of Mequon, about 4 miles south of Cedarburg.

### TRACK AND ROADWAY

The total initial trackage is 30 miles, while the line still to be completed will have 112 miles of track. The right of way is 66 ft. wide, and, except in the limits of the towns along the route, is owned by the Milwaukee Northern Company. The type of rail used is A. S. C. E. 70-lb. T-rail outside of cities, and Pennsylvania Steel Company 7-in., 95-lb. T-rail in cities. The rail bonds are soldered in the web of the rail under the standard 6-hole angle bars, used to join the rails.

The roadbed is ballasted with gravel, using 3000 yds. per mile. Cedar ties are used on the straight-line construction and oak ties for the curves. Cedar poles, with side-arm construction, are used on the private right of way; and wrought-iron posts, with span construction, in the cities. Spans are 105 ft. long on straight line. The general plan of the overhead construction may be clearly seen in the accompanying illustrations. Outside of cities the maximum curve is 4 degs. and the maximum grade 3 per cent.

Telephone wires are also strung along the right of way and communication with stations can be opened directly from any car by means of pole and hook connection on the Stromberg-Carlson system.




MAP OF THE MILWAUKEE NORTHERN RAILWAY AND TRIBUTARY COUNTRY

Scale of Miles 0 2 4 6 8

Milwaukee Northern Railway

Operating Interurban Railways

Street Railway Journal

ROUTE AND CONNECTIONS OF THE MILWAUKEE NORTHERN RAILWAY

### POWER EQUIPMENT

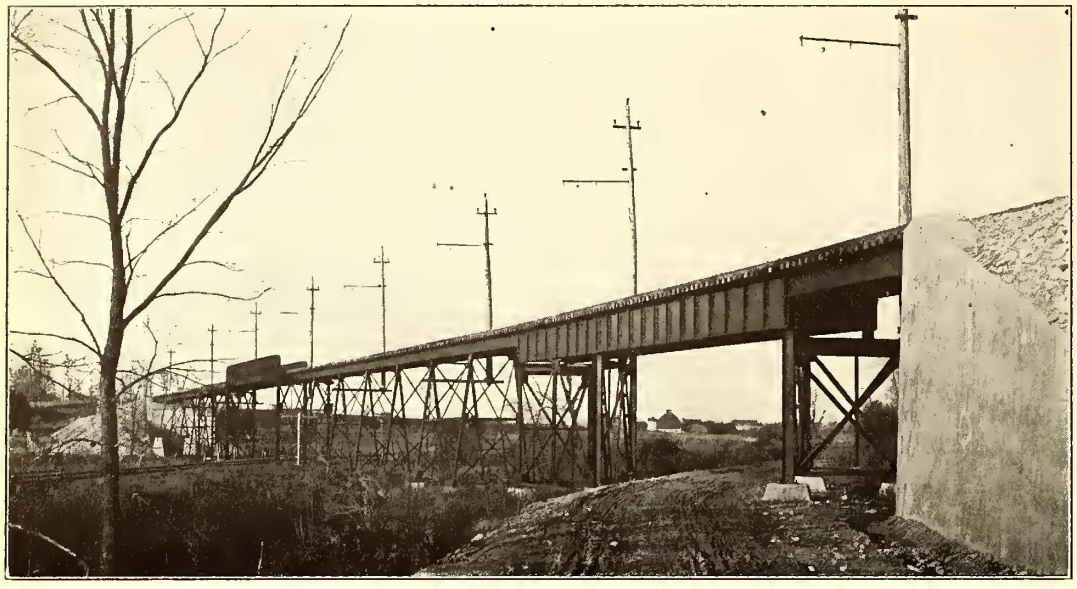
The feature of the equipment of the Milwaukee Northern Railway which has attracted especial attention from the engineering public and users of power is the fact that the motive power of the road is furnished by gas-engine-driven electric generating units of a size heretofore unknown to the traction interests of this country.

The main power plant is at Port Washington, on the harbor front, where the handling of coal, unloaded directly from Lake Michigan steamers at the company's docks, is very economical and convenient. Two buildings comprise the power plant proper, one for the producers and one for

the engines, generators, switchboards and protective apparatus. Both structures are of concrete, steel and brick construction and placed approximately 50 ft. apart. The gas-supply main is run outside of and along the entire length of the power house from the producer plant.

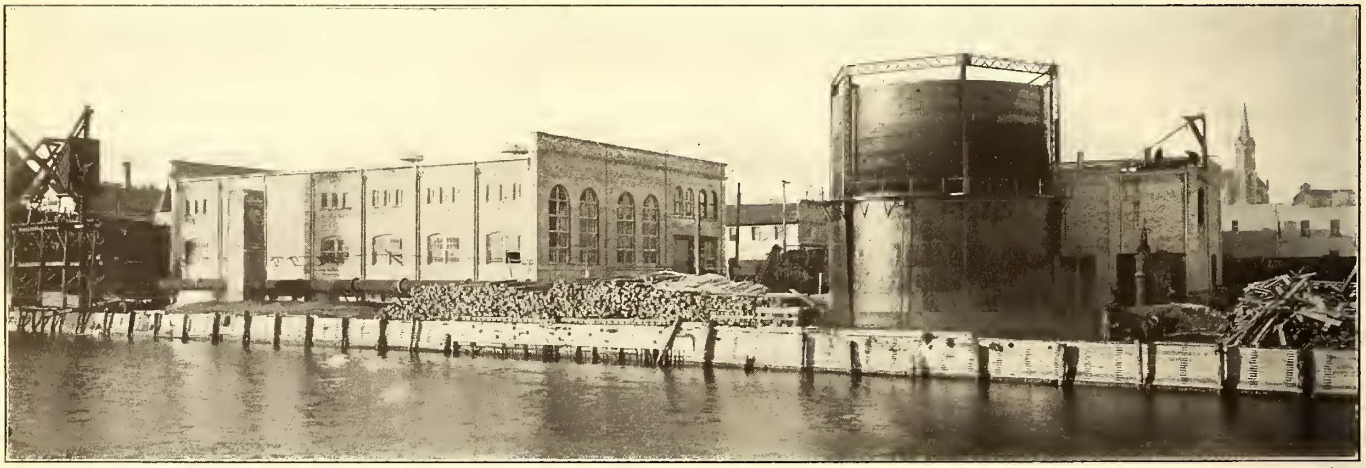
GAS ENGINE GENERATING UNITS

The generating units are three in number, each of 1000 kw capacity, two of which are now installed; the third will be set up shortly. Each unit consists of a twin tandem horizontal double-acting Allis-Chalmers gas engine direct connected to a 405-volt, 25-cycle, Allis-Chalmers alternator. Although the rating of each unit is given as 1000 kilowatts, both engine and generator were designed with large overload capacities, the engine being capable of developing upward of 2000 horse-power and the generator having a corresponding capacity. Each engine has four cylinders, 32 ins. in diameter by 42-in. stroke, and operates at 107 revolutions per minute.



VIADUCT OVER THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY

The valve gear is of the engine-builder's standard cut-off type and the engine operates with constant compression, thus tending to insure smooth running under the highly variable loads to which it is subjected. The inlet gear is extremely simple, consisting of a main inlet valve of the single-beat poppet type, eccentric operated, thus insuring long life and quiet running. The mixture of the air and gas is thoroughly effected before entering the cylinder by an annular mixing chamber located under the main inlet bonnet; the design and operation of this device are such that, at the instant of closing of the main inlet valve, there is practically no explosive mixture left outside the cylinder. The gas valve is of the double-beat poppet type controlled by a variable lift rolling lever operated by a single link connection to the main inlet gear, the lift of the valve and consequently the amount of gas admitted and the time of admission being regulated by the governor. The exhaust gear is of the single beat poppet valve type, eccentric operated, and is in this respect a duplicate of the main inlet gear. A distinctive feature of this gas engine is the location of this exhaust bonnet with its valve at the bottom of the cylinder, where all the dirt is removed by the action of the exhaust gases; and the provision of a substantial jack to lower the entire exhaust mechanism out of place to allow inspection and regrinding of the valve, which also serves to swing the valve chamber, with the valve and its operating mechanism complete, out to one side, where it can be reached by the crane hoist. The removal of one pin, either in the inlet or exhaust mechanism, is all that is necessary to allow the removal of either the inlet or exhaust bonnets, with their valves and entire operating mechanism, without disturbing any adjustment whatever.



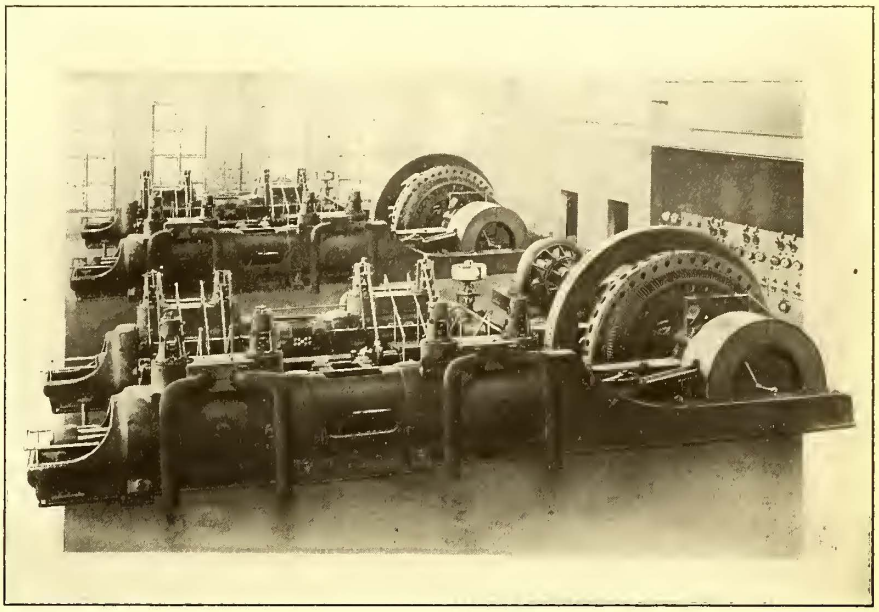
POWER HOUSE AND GAS PRODUCER PLANT OF THE MILWAUKEE NORTHERN RAILWAY AT PORT WASHINGTON, WIS.

The igniters are electrically controlled and so arranged that the time of ignition may be regulated by a single hand wheel. Direct current at 60 volts is used in the ignition system. Duplicate igniters are provided at each end of the cylinder to insure prompt firing of low heat value gases and also to avoid shut downs due to short circuit.

The air-starting device consists of a small poppet inlet air

valve at each end of each cylinder, with a main distributing valve operated by the layshaft. Air is admitted to each cylinder in turn at what would be the explosion stroke. As the high compression carried prevents the engine from stopping on the dead center, this arrangement insures the prompt starting of even a tandem engine without the use of a barring gear. The Port Washington engines being twin tandem will, of course, start from any position.

The engines are said to be exceptionally heavy and rigid, the weight being concentrated in the frame cylinders and tie pieces in the direct line of the stresses to which an engine of this type is subjected. The engine frame illustrates the difference between American and European practice in gas-engine design. This frame is designed for a side crank in place of the double-throw crank, which is the standard practice abroad. The stresses transmitted to the frame in a side-crank gas engine are very great, but, even in the largest sized gas engines, they are no greater than this company has for many years successfully provided for in its steam-engine practice. This is contrary to popular belief, but the stresses cared for in the engines operating the New York Subway, for example, are as great as any that the gas engine is ordinarily called upon to sustain.



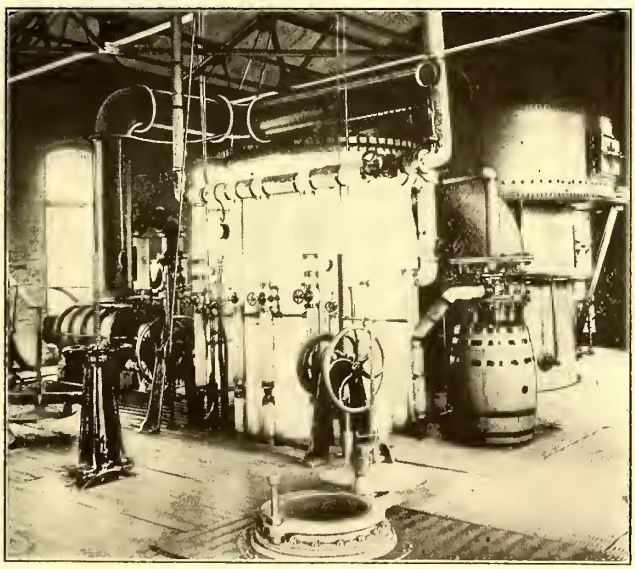
INTERIOR OF POWER STATION, SHOWING THE GAS ENGINES, MAIN GENERATORS, ONE OF THE EXCITERS, ETC.

The jaw, which is subjected to a peculiarly severe stress, is made in a form to insure maximum strength of the casting, and is further strengthened by two steel tie bolts carried above the shaft, which are made of sufficient size to carry their proportion of the load without appreciable elongation. This construction eliminates entirely any bending stresses in the frame at this point.

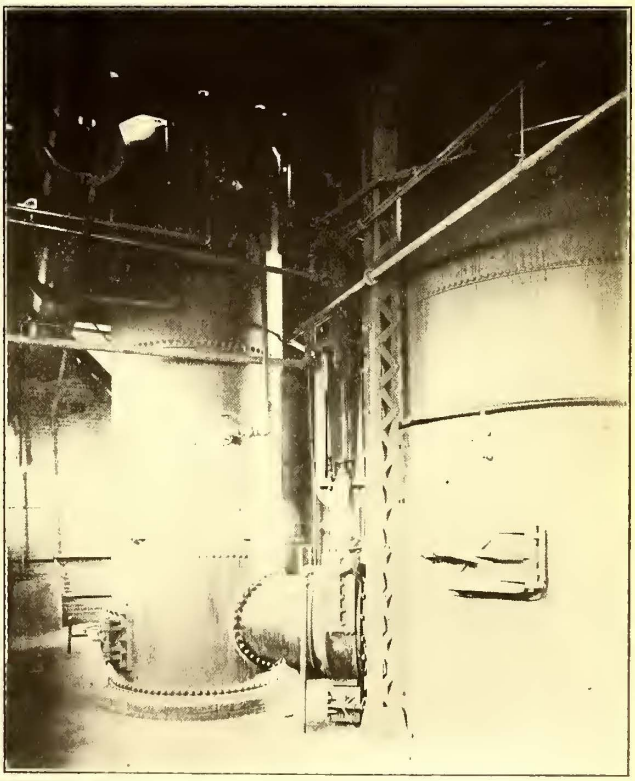
The load at the present time is extremely variable, swinging from less than one-half to 50 per cent overload, with momentary peaks greatly in excess of this. It is only by a study of the switchboard instruments, however, that this is apparent, as the engine is said to handle the maximum overloads as quietly and with the same freedom from vibration that characterizes its operation under normal conditions. To the observer there is no outward indication of the magnitude of the forces at work. The engine turns its centers as quietly as a slow-running Corliss engine, and is as indifferent to the rapid changes in load, impressing one with the tremendous reserve power possessed by each unit.

All wearing surfaces, including the main bearings, slides, crank and cross-head pins, are arranged for a continuous oiling system and the cylinders are lubricated by carefully timed admission of the cylinder oil, Richardson sightfeed oil pumps being used.

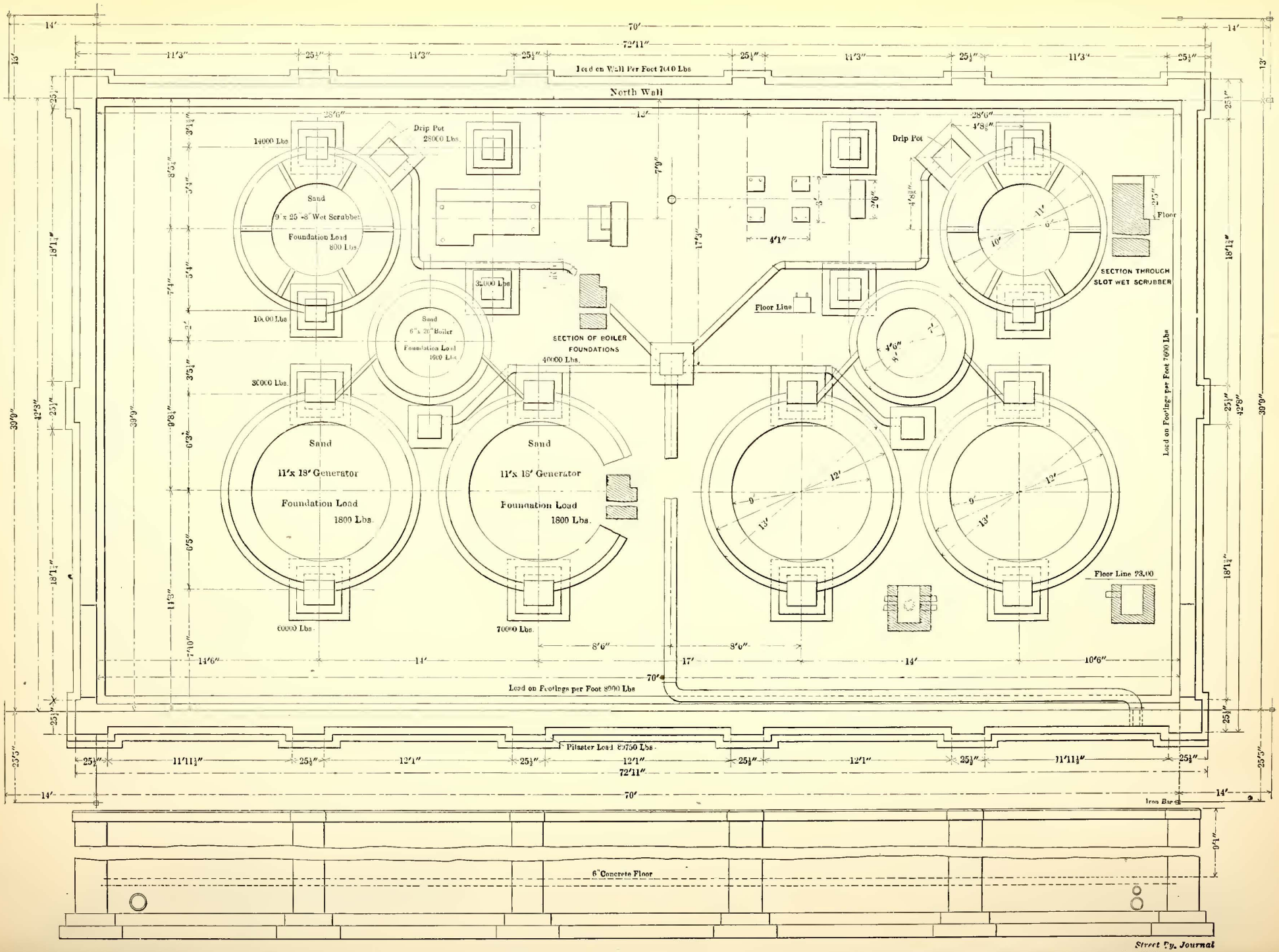
The water cooling system includes ample provision for cooling the cylinder walls, cylinder heads, pistons, piston



OPERATING FLOOR OF PRODUCER PLANT



GENERATOR ROOM OF PRODUCER PLANT




GENERAL PLAN AND METHOD OF CARRYING FOUNDATIONS IN THE PRODUCER SECTION OF THE MILWAUKEE NORTHERN RAILWAY'S POWER PLANT

rods, exhaust valves and exhaust bonnets. Water is circulated by means of two Morris and two Deming pumps, each driven by an Allis-Chalmers induction motor.

### PRODUCER GAS SUPPLY

The gas for the engines is furnished by producers operating on the well-known Loomis-Pettibone system. The present installation comprises two generating units, each consisting of a pair of gas producers connected to a common economizer, wet scrubber and exhaust. The gas is delivered into a holder of 30,000 cu. ft. capacity. The normal rating of the present plant is 4000 hp, and it has a capacity of 25 per cent overload for five hours.

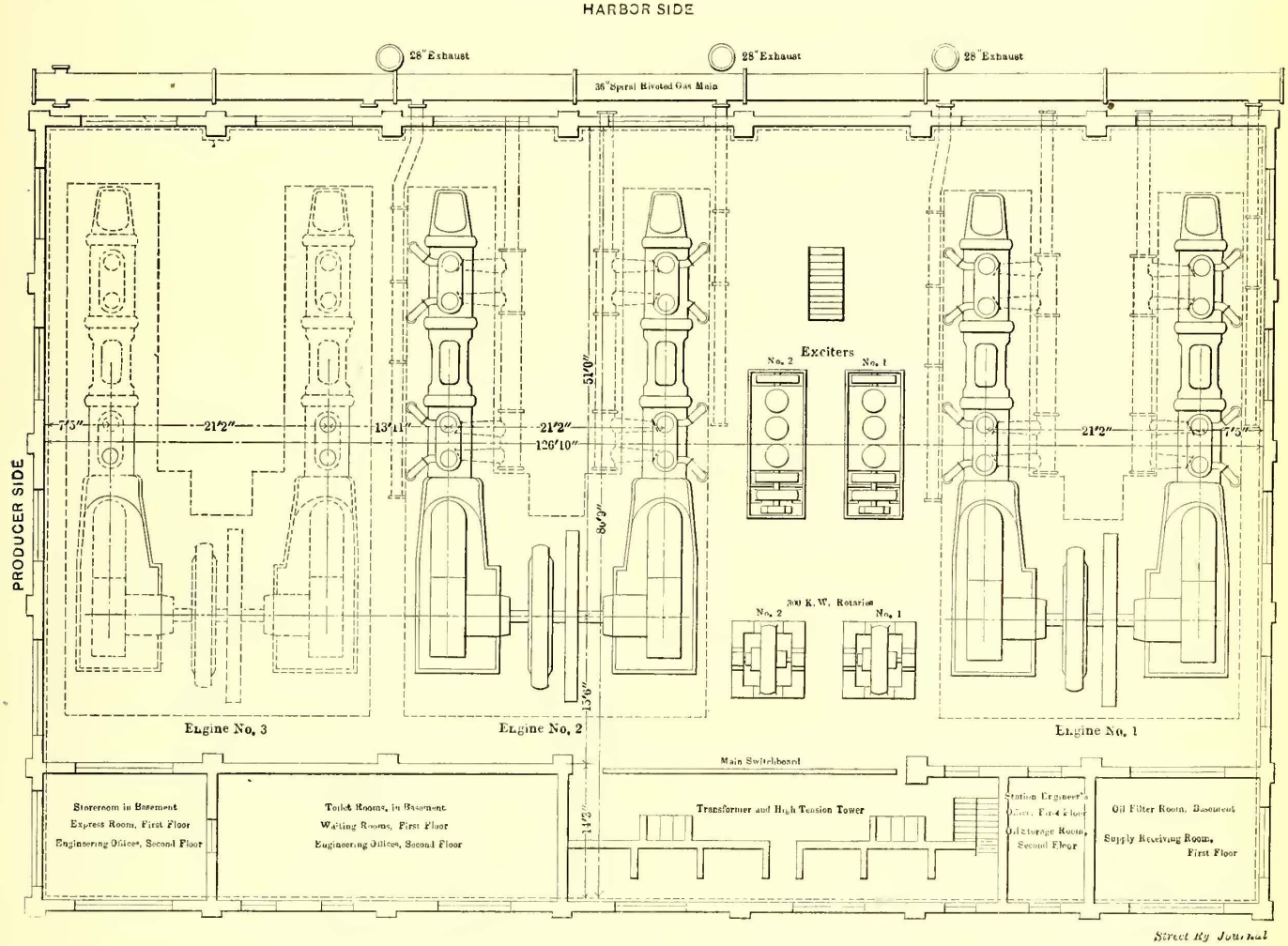
The brick building containing the apparatus is divided into a basement 19 ft. deep and a single story about 14 ft. high to the eaves. The operating or charging floor is about 6 ft. above the level of the ground outside the building. A coal tank 50 ft. long is on the operating floor, with openings in front of the charging doors of the gas producers, thus bringing the fuel to points convenient to the man operating the gas plant. Hocking Valley bituminous slack coal, containing about 11,500 British thermal units per pound, is the fuel ordinarily used.

The plant is operated on the down-draft principle, the air being admitted through the charging door at the top of each producer, the necessary suction being caused by an exhauster located beyond the wet scrubber. By this method the volatile matter and distillates are drawn through the deep bed of incandescent fuel and gasified, thus avoiding any tar extracting machinery, and enabling the system to produce gas obtaining 80 per cent of the heat units possessed by the fuel used. Reverse runs of steam, generated by the gas passing through the economizer, or waste heat boiler, are occasionally made for the purpose of breaking up the fuel bed. The water gas made by this process mixes with the producer gas in the holder and slightly enriches it. The average calorific value of the gas as delivered from the holder is 125 B. T. U. per cu. ft. The gas mains leading to the engines are equipped with Ludlow valves.

### ELECTRICAL FEATURES OF THE POWER STATION

The electrical features of the equipment may be briefly described as follows: Three-phase current is generated in the power house at 405 volts and 60 cycles by direct-coupled alternating-current generators, each of 1000-kw normal capacity. These machines are of a special type developed for use with its gas engines by the Allis-Chalmers Company.

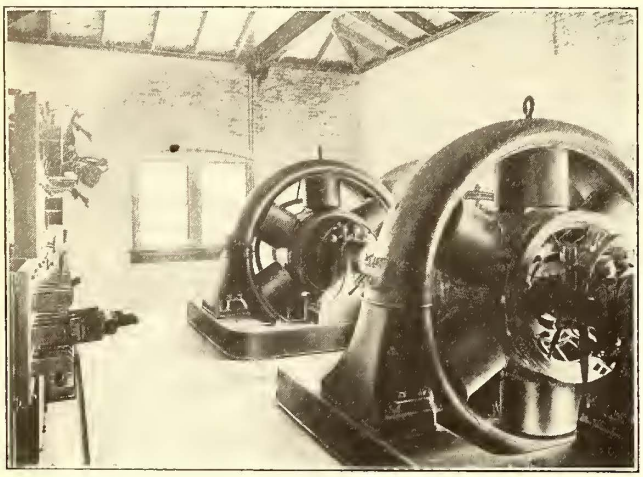
The laminated stator core is held in a heavy box yoke, designed to allow full circulation of air around all parts. The core punchings are held in place by means of dovetails, and the armature windings are placed in open slots in the inner poriphery of the stator core. The coils are held firmly in place by wedges and, on account of the open-slot construction, can be readily replaced in case of damage. The field poles are mounted on a cast-iron spider, and so arranged that they can be removed; the exciting coils are of copper, strip-wound edge. The revolving fields are of special construction. The field poles are of solid cast steel, and are bolted to a heavy cast-iron spider; they can, therefore, be readily removed in case it is necessary




PLAN OF ENGINE SECTION OF THE MILWAUKEE NORTHERN RAILWAY'S POWER HOUSE

to get at a field coil. The field windings are held in place partly by the projecting pole tips and partly by brass rings running completely around the rotor on each side and fastened to the tip of the poles by long brass screws. This construction, combined with the solid poles, gives a large damping effect, prevents hunting, and aids in securing parallel operation.

These generators will deliver their rated output of 1000 kw continuously at 90 per cent power factor with a rise in temperature not exceeding 35 deg. C.; 50 per cent greater current for two hours following a full-load run, with a temperature rise not exceeding 50 deg. C. Current for excitation is furnished by two 50-kw, 120-volt, d. c.



TWO 400-KW ROTARIES IN THE CEDARBURG SUB-STATION

generators driven by vertical gas engines. These do not appear in the engraving of the station interior, being temporarily in a different position from that shown by the plan.

The current from the main generators is delivered to a six-panel switchboard, having three generators, one exciter and two transformer panels, which contain all the necessary switches, circuit-breakers, and instruments for properly handling and regulating the equipment.

From the switchboard the current is carried to the step-up transformers and also to the rotary transformer switchboard. There are seven step-up transformers of 500-kw capacity each, arranged in two banks of three each, with one held as a reserve. These transformers raise the voltage from 405 volts to a maximum of 22,000 volts, with intermediate tap to allow the voltage to be varied if desired. The current is carried from each bank of transformers to the high-tension bus through three oil switches of 40 amp. capacity each in each circuit; in addition to plug switches at each transformer to allow for speedily cutting out any transformer in case of break-down. From the high-tension bus three transmission lines are led away, each with automatic oil circuit-breakers of 40 amp. capacity in circuit. The station apparatus is protected from lightning by an equipment of low equivalent lightning arresters and oil-immersed choke coils connected to the high-tension bus.

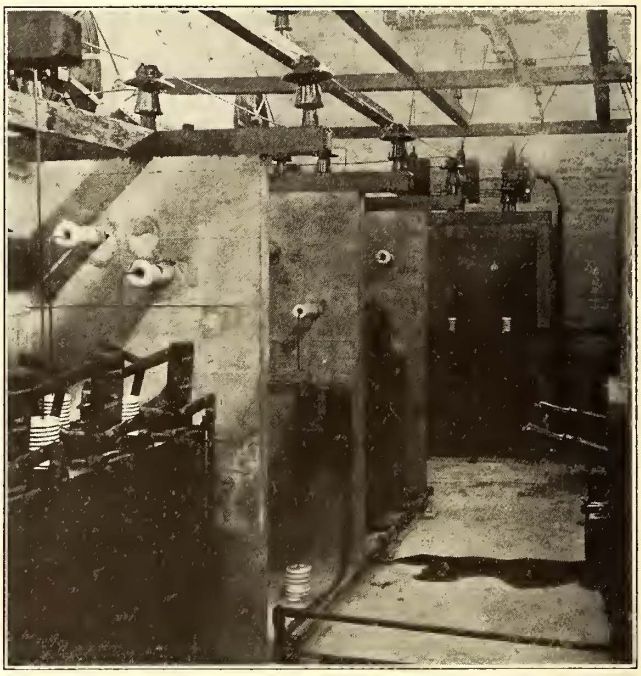
For supplying nearby portions of the line, two 300-kw rotary converters are provided in the main station. These have six poles and run at 500 r. p. m., taking three-phase alternating current at 405 volts and delivering direct current at 650 volts. The converters are connected to a six-panel switchboard having two alternating-current rotary panels, two direct-current rotary panels and two direct-current feeder panels with two feeder circuits, which contain all necessary switches, circuit-breaker, and instruments for handling and regulating the current and apparatus. The converters are protected from lightning by arresters on each feeder circuit.

### SUB-STATIONS

There are eight sub-stations, located at the following points along the right of way: Burleigh, Cedarburg, Georgia Avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport, two of which have each two 400-kw, 650-volt, rotary converters and six 125-kw, 22,000/405-volt, step-down, oil-cooled static transformers. The remaining six sub-stations each have two 300-kw, 650-volt, rotary converters and six 100-kw, 22,000/405-volt, step-down, oil-cooled static transformers of the same company's build.

Each sub-station is protected against lightning by three 22,000-volt, low-equivalent lightning arresters and auxiliary apparatus; each sub-station has an eight-panel switchboard, having two alternating-current rotary panels, two alternating-current starting panels, two direct-current rotary panels and two feeder panels except in the Cedarburg sub-station, where there are three feeder panels.

All sub-stations have 22,000-volt, 20-ampere automatic oil breakers on outgoing transmission lines and on the transformer circuits, except at Cedarburg, which has 40-ampere breakers on outgoing transmission lines. The Cedarburg sub-station has also 22,000-volt, 40-ampere oil switches on the incoming transmission lines and three 2000-



HIGH-TENSION SWITCHES IN THE CEDARBURG SUB-STATION

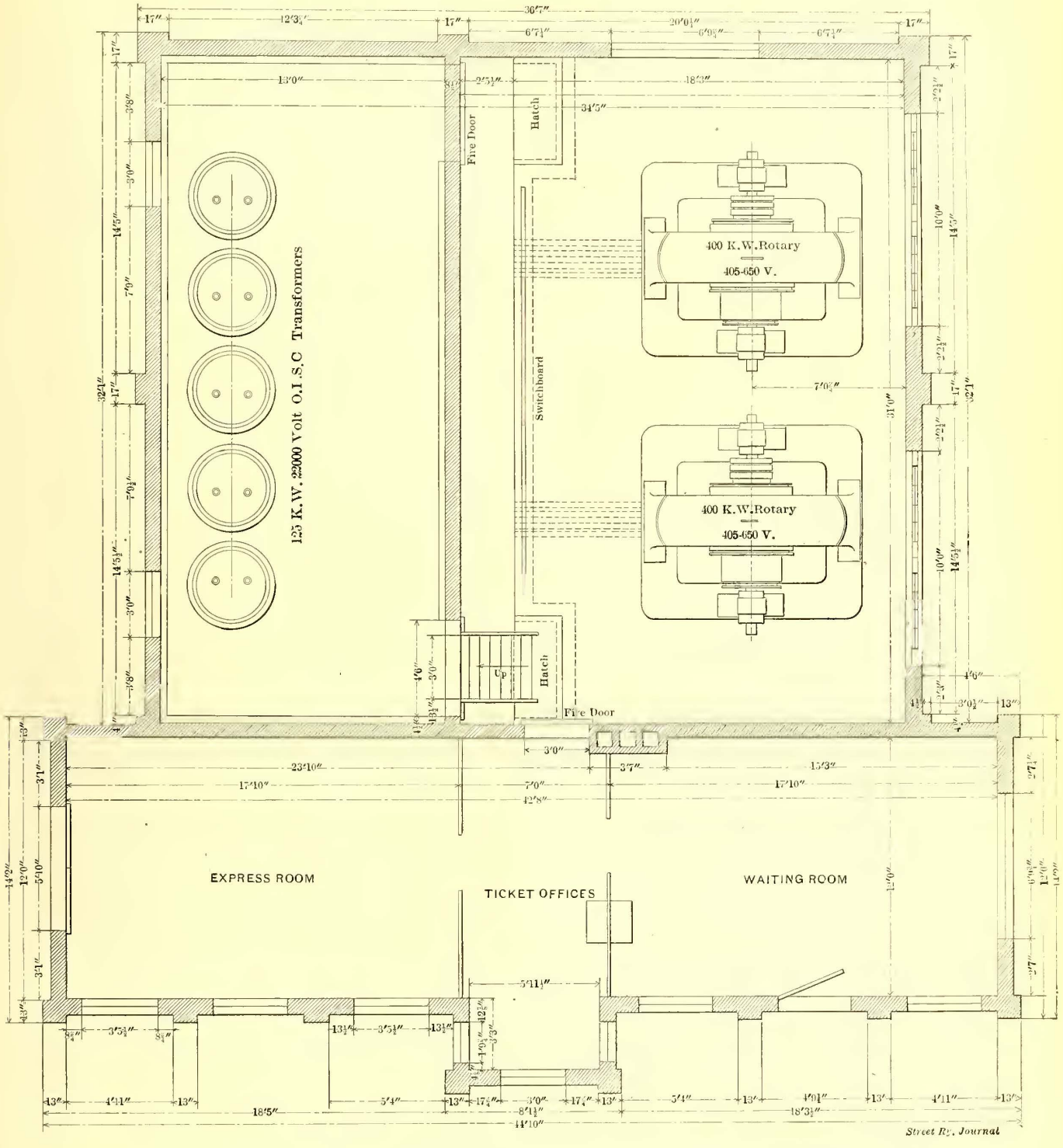
volt, 20-ampere automatic oil circuit breakers in the high-tension equalizing bus. The low-tension cables are triple-braided, weather-proof wire, supported on insulators, the insulated covering being relied upon only for protection from accidental contact and as a spacer. All high-tension wires are bare mounted on suitable insulators.

### ROLLING STOCK

The present rolling stock consists of eight heavy inter-urban cars of the type known as the semi-empire Pullman, built by the Niles Car Manufacturing Company, of Niles, Ohio. They are handsomely upholstered, commodious and fitted with every means of comfort and convenience, including toilet room, electric heaters, overhead bundle racks,

coat hooks and lights of high candle-power. These cars, which have seating accommodation for fifty-two passengers, are 50 ft. 4 ins. in length and 8 ft. 10 ins. in width over all. Cars weigh, including trucks and motors, 70,000 lbs., and there are two 75-hp motors on each truck. The wheel base is 6 ft. 8½ ins. The schedule speed is 25 miles per hour, including stops, with a possible maximum speed of 54 miles per hour. The wheels are 36 ins. diameter. The cars are equipped with straight air-brake equipments manufactured by the Allis-Chalmers Company including the latter's new style "OB" pneumatic governor and type "J" emergency valve. At the forward end of each car is a spacious smoking compartment, and, partitioned off from this, directly behind the motorman, there has been left a space for trunks and express packages. On each station platform may be seen a light Fairbanks-Morse truck for handling freight and baggage.

The cars used in the local service within the city limits of Milwaukee are duplicates of the ones used in the city of Detroit, with open rear platforms divided by a railing. These cars are equipped with 40-hp motors. The cars are 41 ft. long and 8 ft. 5 ins. wide, and have rattan seats placed crosswise. They are single-ended, with the motorman's vestibule entirely segregated from the platform. Each of these cars is equipped with Allis-Chalmers air brakes. There are eight of these cars provided. The regu-




PLAN OF COMBINED ROTARY CONVERTER STATION, PASSENGER OFFICE AND EXPRESS ROOM

lar service will call for four in operation, maintaining a 15-minute headway. Schedule speed within the city of Milwaukee will be about ten miles per hour.

SCHEDULES

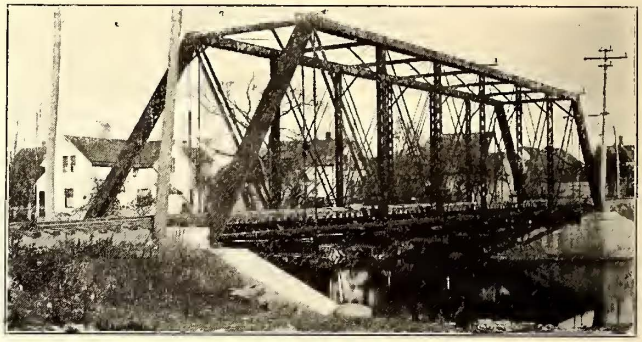
The present schedule to Cedarburg includes sixteen trips, made hourly during the day, beginning at 6 a. m. from Cedarburg into Milwaukee, and ending with the last trip

ONE OF THE EIGHT SUB-STATIONS ON THE MILWAUKEE NORTHERN RAILWAY

at 11:25 p. m. out from the city. The line over the remaining 10 miles to Port Washington is also now in operation, cars running every hour, and the line to Sheboygan is expected to be completed by April, 1908.

Mileage is offered in a series of 1000, 500 and 100-mile books, fixing the minimum fee at 1.3 cents per mile for the 1000-mile books. The highest charge made is a cash fare of 2 cents per mile, and cash fare receipts are redeemable at any ticket office for 10 per cent of their value, if presented in 5-cent units. Depots are provided at all of the chief towns on the right of way in connection with substations, built of brick, steel and concrete. Shelters will be provided at all highway crossings from which cars can be signaled, and these highways are numbered consecutively and plainly indicated by sign posts. The company has provided car houses and repair shops at Cedarburg, substantially built of brick and steel, the equipment of which is thoroughly modern. Additional car sheds are now being erected in the city of Milwaukee for rolling stock used in light service on the lines of this company.

One of the provisions in the franchise granted by the city of Milwaukee to the Milwaukee Northern Railway stipulates that 3-cent fares shall be granted within the city limits of Milwaukee on the city cars. It is provided, however, that a cash fare on both city and interurban cars shall be 5 cents, and that the company shall sell strips of tickets, eight coupons to the strip, for 25 cents, good only on the local city cars, making the cost of each ride 3⅛ cents. These tickets are being sold by the company at its stations, as well as by conductors on the cars. While the franchise makes this stipulation only for transportation within the city limits of Milwaukee, the company has taken an unusual step in extending the privilege granted by this

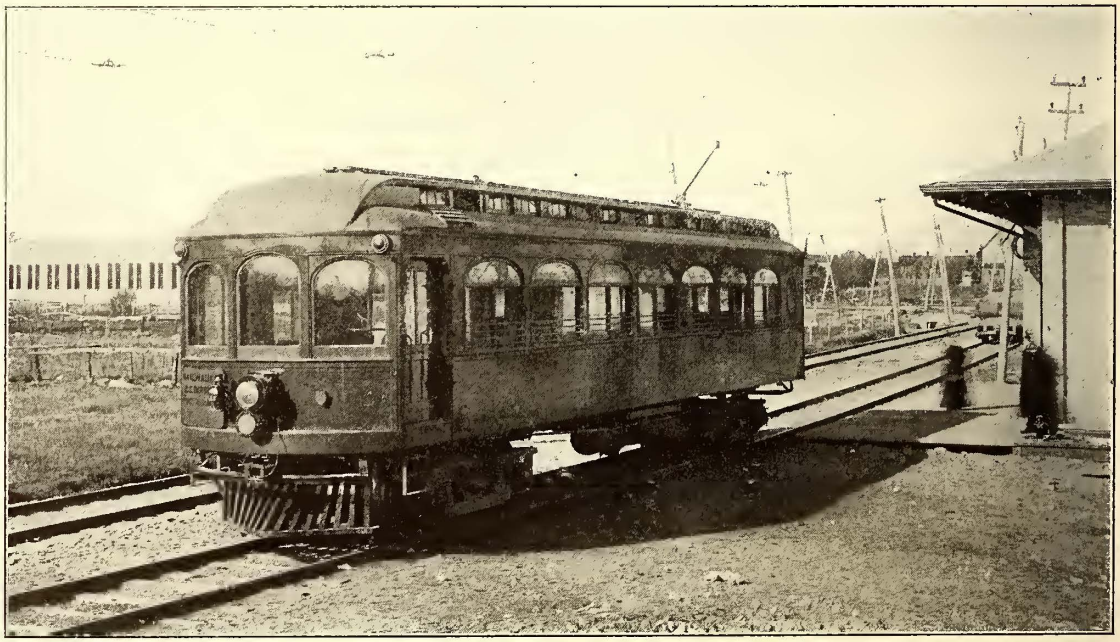


BRIDGE OVER THE MILWAUKEE RIVER AT CEDARBURG

low rate. The run of the city cars includes about a mile outside of the city limits, and the company will accept these 3-cent tickets, good over the entire run of its city cars, a distance of 4.3 miles.

ENGINEERS AND CONTRACTORS

Comstock-Haigh-Walker Company of Detroit, engineers and contractors, have had complete charge of the design and building of the system under the direct supervision of F. W. Walker as engineer. The following officials are also active in the operation of the road: W. A. Comstock, president; Henry A. Haigh, treasurer; Ernest Gonzenbach, general manager, and H. J. Pagel, operating superintendent.



STANDARD INTERURBAN CAR OF THE MILWAUKEE NORTHE RN RAILWAY LEAVING A STATION

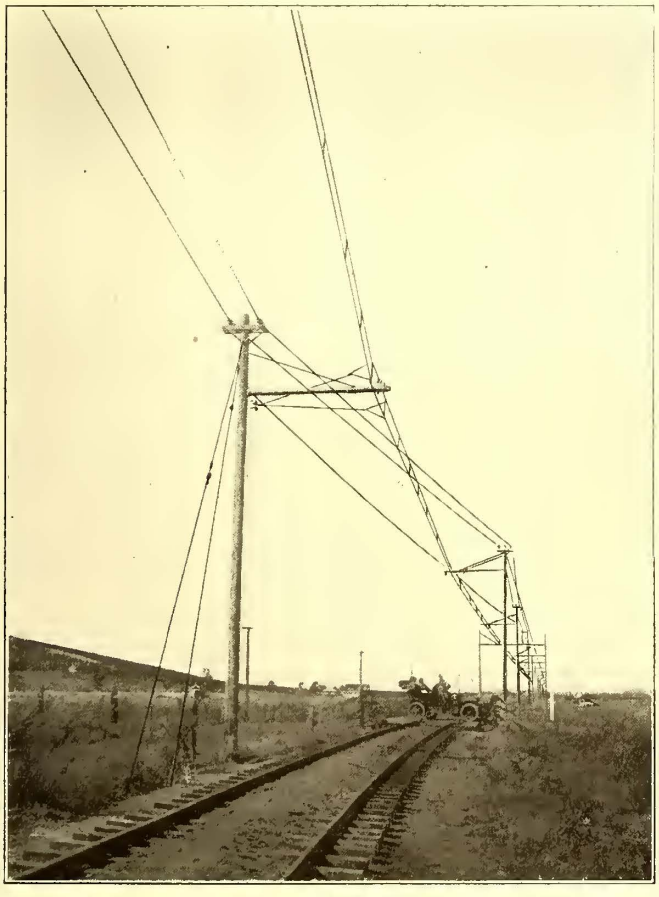
To each of these officials credit is due for the successful completion of the line and its present efficiency.

As will be seen from the foregoing, the greater part of the road's equipment, including all of its power and electrical machinery, was purchased either in Milwaukee or along the right of way, rendering the Milwaukee-Northern distinctively a "home-made" system. Auxiliary apparatus includes the coal-handling plant furnished by the Industrial Works, Bay City, Mich.; cranes in the power-

house and car-repair shops built by the Whiting Foundry Equipment Company, Harvey, Ill.; oil filters from the factory of Van Dyck-Churchill Company, New York City; trucks built by the American Locomotive Company, Schenectady, N. Y., and the New York Car & Truck Company, Kingston, N. Y.; sweepers furnished by McGuire-Cummings Company, Chicago; shop machinery from the Niles-Bement-Pond Company, New York City; overhead material, J. M. friction tape and Noark enclosed fuses supplied by the H. W. Johns-Manville Company, of New York.

## OVERHEAD CONSTRUCTION ON A FIFTEEN-CYCLE SINGLE-PHASE RAILWAY IN CALIFORNIA

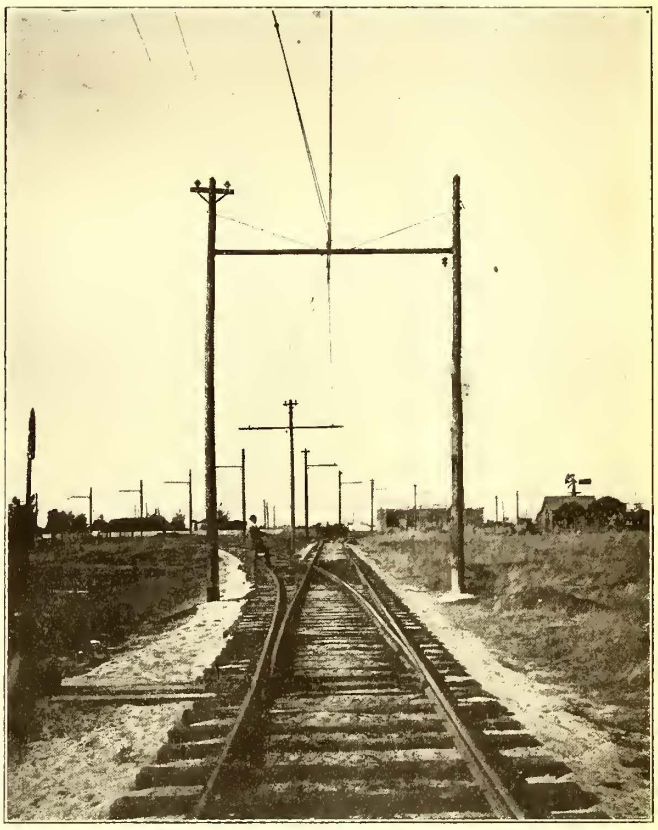
A new departure in single-phase railway operation is presented by the new line between Visalia and Lemon Cove, Cal. This is a subsidiary line of the Southern Pacific Railway Company, and is notable from the fact that it is the first application in this country of 15-cycle alternating current to railway work. The undertaking involved the electrification of 10 miles of steam road, in addition to the new construction, making in all some 23 miles of track. Catenary overhead construction is employed throughout, the current being collected by means of a pantograph trolley. The overhead material for this line was furnished by the Ohio Brass Company, and the accompanying engravings show a number of the interesting features of the work.



CURVE CONSTRUCTION, SHOWING BRIDLE PULL-OVER ON FIRST POLE AND STEADY BRACKET ON SECOND POLE.

On the main line the poles are of peeled redwood 36 ft. long, with 14-in. base and 7-in. top. They are imbedded in concrete to a depth of 6 ft. The poles are spaced 120 ft. apart on tangents and on curves of less than 4 degs. On curves not sharper than 6 degs. the spacing is 100 ft., and this is cut down to 60 ft. on curves up to 18 degs.

The messenger wire is 7/16 in. high-strength steel, extra galvanized, and is strung with a sag of approximately 11 ins. in the 120-ft. spans, the distance between messenger and trolley at the bracket being 17 ins. Ohio Brass standard catenary suspensions are used throughout, being spaced 10 ft. apart. This suspension consists of a ½-in. rod carrying at the lower end a three-screw Detroit clamp, and at the upper end a double-hook messenger clip. When in position the suspension rod is threaded through the messenger clip boss, the end of the rod firmly engaging the messenger and locking the suspension in place.

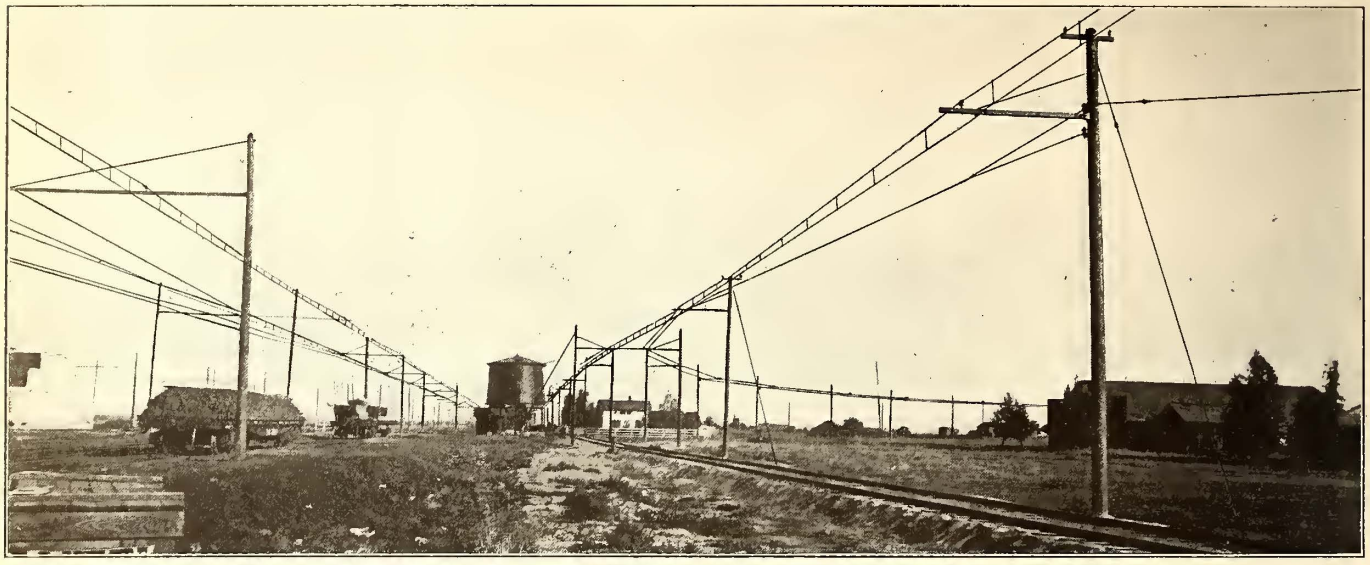


SPECIAL CONSTRUCTION AT BRANCH IN LINE, SHOWING DOUBLE-POLE BRACKET AND BRIDLE PULL-OVERS.

Brackets are made up with a 4 in. x 4 in. x 10 ft. Oregon pine arm attached to the pole by a malleable casting, a ⅝-in. rod serving to support the outer end. The messenger is carried on top of the arm on a porcelain cable insulator. At intervals of about 120 ft. a steady bracket is installed to prevent swinging of the trolley. This bracket differs from the standard type in that the messenger is carried below the arm on a strand supported from two skirted insulators, the trolley wire being steadied from the same insulators.

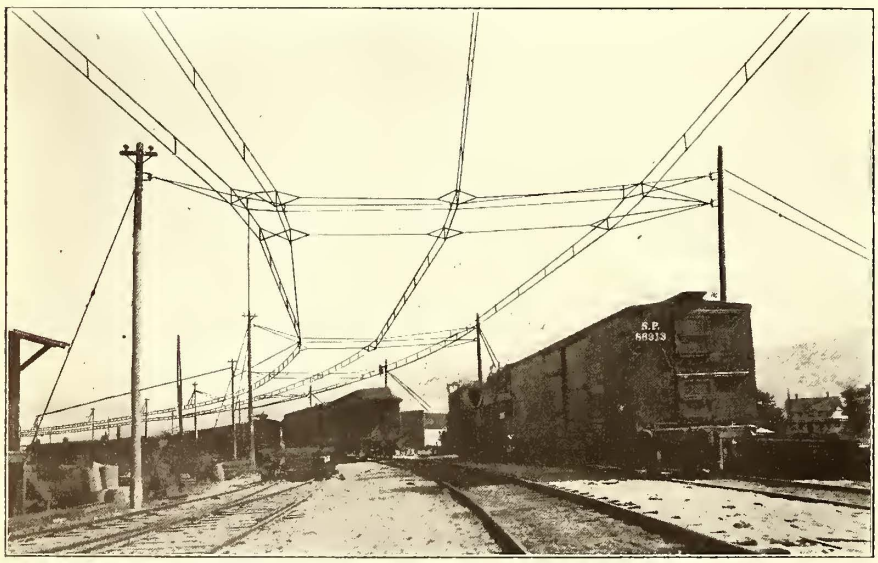
At curves both the trolley wire and messenger wire are pulled over by bridle guys extending from the nearest trolley suspension on each side of the bracket to a porcelain strain insulator fastened to the pole by ⅝ in. x 15½ in. eyebolts. This construction is shown at the nearest bracket in one of the accompanying engravings. The insulators are of the skirted type, 10,000 volts working capacity. They are 5¾ ins. in diameter and 6 ins. in height. Strain pins used in connection with these insulators are of cold-rolled machine steel, and are provided with flexible fiber sleeves which act as a cushion between the pin and the porcelain insulator.

Bracket construction is used on both the single and double track sections. There are, however, certain sections with three and four tracks, where the overhead work is carried on cross spans. These spans, as shown in the illustrations, are supported from skirted type porcelain strain insulators which are mounted on steel tubing pins and are attached to the poles with heavy eyebolts, similar to those used on curve pull-overs. A test of one of these spans, covering four tracks, showed that a tension stress of 2400 lbs. was developed in the span wire.



VIEW SHOWING BRACKET AND CURVE CONSTRUCTION

The poles are guyed by means of 7/16 galvanized steel wire strand, the lower end of which is secured to a ½ in. x 6 ft. anchor rod. A 12 in. x 12 in. x ½ in. steel anchor plate is used in combination with the anchor rod, the rod being buried for practically its entire length. At certain points where the ground is soft these anchor plates were imbedded in concrete. Within the city limits of Visalia an ordinance prevents the use of guys, and it was, therefore, necessary to erect steel poles of sufficient strength to be self-sustaining. Throughout the line, ample insulation has been provided to insure successful operation at 3300 volts, which is the trolley potential. Originally the road was bonded with beveled terminal foot bonds which have since been reinforced by Ohio Brass Company 34-in. "all wire" cable bonds installed around the joint plates. Westinghouse 15 cycle a. c. motors will be used on the cars.



CROSS-SPAN SUSPENSION FOR THREE TRACKS

Local conditions presented a number of complex problems, but James H. Crosett, superintendent of the Visalia Electric Railway, has solved them all very successfully.

## CHANGES IN THE PERSONNEL OF THE LEXINGTON & INTERURBAN COMPANY

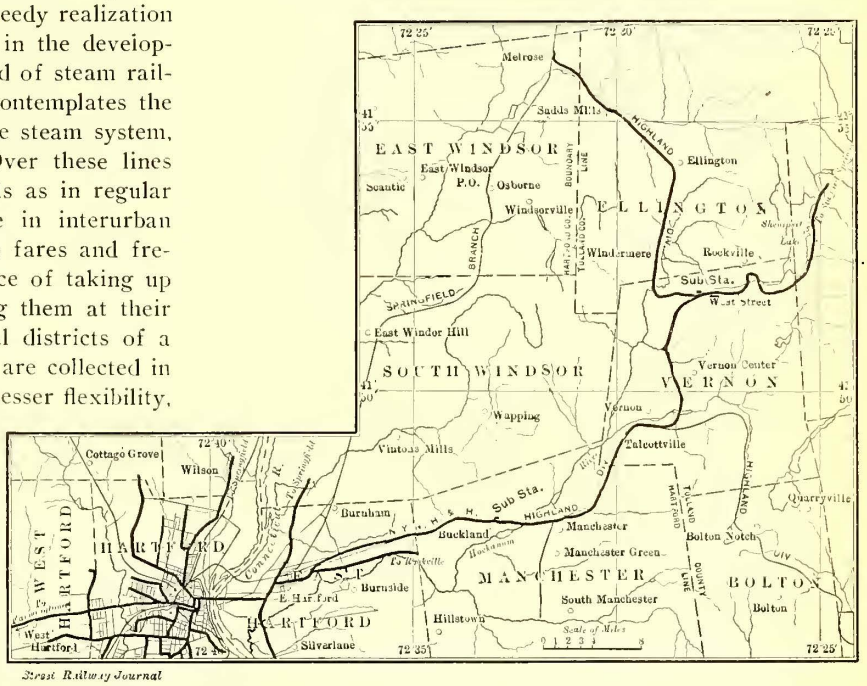
At the meeting of the board of directors of the Lexington & Interurban Railway Company, held last week, a number of changes in the operating and executive staff was announced. Louis Des Cognets resigned as vice-president to give his attention to private interests, and John Blair Macafee, representing Chandler Bros. & Company, of Philadelphia and New York, was chosen to succeed him and to have charge of the operation of the company's lines. Mr. Des Cognets will remain on the board of directors. Robert T. Gunn, who has accepted a position with the Fort Wayne & Wabash Valley Railway, presented his resignation as general manager. J. B. Crawford, until recently superintendent of transportation of the Fort Wayne & Wabash Valley, was chosen to fill the place vacated by Mr. Gunn. O. R. Bilbrow, for some time with the Central Mississippi Railway, was chosen auditor. While the financial condition of the company and its operation were found satisfactory, the executive officers, following the general idea of retrenchment, are said to have agreed to waive their salaries for the present. No further construction work will be considered at this time, but the service to Frankfort will be increased, and the running time of the cars decreased in order to take better care of the growing business.

The new school for instruction which has been instituted under the auspices of the Utica & Mohawk Valley Railway Company at the Utica & Mohawk Valley Railway Employees' Association rooms promises to be very successful.

## THE HARTFORD, VERNON AND MELROSE ELECTRIFICATION

The plans for handling local, suburban and interurban traffic centering at Hartford now in process of development by the New Haven interests indicate the speedy realization of a new stage of the highest importance in the development both of more efficient local transit, and of steam railroad electrification. The general scheme contemplates the electrification of various branch lines of the steam system, together with parts of the main lines. Over these lines single cars will be run at frequent intervals as in regular interurban practice. The great advantage in interurban practice has been the combination of cheap fares and frequent service with the increased convenience of taking up passengers near their homes and delivering them at their destinations in the shopping and residential districts of a city. Correspondingly, outward passengers are collected in the same way. The steam lines with their lesser flexibility, have been heavily handicapped in meeting such competition.

In the work at Hartford, the desired flexibility is to be secured by electrification. Instead of terminating their routes at the local steam railroad station, cars will leave the steam tracks at a convenient point and enter upon the city streets, taking their passengers directly into the heart of the shopping section and transferring to the local lines to all parts of the city. The unified electric system contering at Hartford will include various interurban lines that have been acquired, and will extend to Springfield on both sides of the Connecticut River. The promise that the importance of Hartford as a shopping and business center will be greatly increased by these new transit facilities can hardly fail to be realized, and an admirable aspect of the plan is the economy effected by utilizing existing steam car tracks for interurban traffic, thus saving the construction of expensive parallel lines that easily and inexpensively can be met by the simple expedient of connecting with the local trolley tracks. Much the same plan is now in service on the West Shore lines between Utica and Syracuse, as described in the Oct. 12 issue of the STREET RAILWAY JOURNAL.




*Street Railway Journal*

MAP SHOWING THE HARTFORD, VERNON & MELROSE ELECTRIFICATION OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD SYSTEM

DOUBLE TRACK CURVE SPAN CONSTRUCTION

The Hartford, Vernon & Melrose electrification is the latest step taken in the carrying out of the foregoing policy. This

work is being done by the Connecticut Company under the general direction of Vice-President E. H. McHenry, of the New York, New Haven & Hartford Railroad, and the line is nearly ready for service. The route begins in Hartford and follows the tracks of the Hartford Street Railway Company for 2.5 miles to East Burnside. At this point the cars will be deflected to the steam railroad right of way connecting Hartford, Manchester and Willimantic, and forming a part of the New Haven Company's Poughkeepsie Bridge to Boston line. From East Burnside the cars will be operated on steam railroad rules through Buckland, Manchester and Talcottville to Vernon Jc., a distance of about 10 miles. At Vernon Jc. the line swings to the north and passes to Rockville and Melrose over a single-track branch 13 miles long. Electrification is under way on the 10 miles of double-track line between East Burnside and Vernon Jc., and on the single-track branch to Melrose. The city of Manchester, population 10,000, is served by the double-track route, and is located 6 miles east of East Burnside. Rockville, population 8000, is located on the branch 4.5 miles north of Vernon Jc.

TYPICAL CATENARY CONSTRUCTION IN TOWNS

Power is at present supplied to the line from the Commerce Street plant of the Hartford Electric Light Company through an 11,000-volt three-phase transmission line composed of two No. 4 circuits which deliver current to sub-stations at Buckland and Rockville. At present this is a 60-cycle supply, but the company contemplates changing its source of power to its own 25-cycle plant in Hartford in the near future. Step-down transformers and rotary converters are located in each sub-station, and the distribution of power to the rolling stock is carried out at 600 volts direct-current by standard General Electric Company catenary construction, as shown in the accompanying illustration. About 33 miles of catenary are erected in toto. Work was started in the spring of 1906.

The catenary construction is erected with 150-ft. spans and three-point suspension, the poles being spaced 10 ft. from the center of the nearest track. The tracks are 12 ft. apart on centers and the minimum double-track span is 35 ft. The messenger wire is a 3/8-in. steel cable, and the poles are of chestnut, 35 ft. long on the average and 7 ins. in tip diameters. The ears are soldered at the anchors to prevent slipping, and the erection was carried out by a tower train with caboose, flat and tower cars. The wires of the transmission line are spaced on 28-in. equilateral triangles. The rails on the line are mainly old 78-lb. sections with 4-bolt fish plates too tight for concealed bonds. The bonds have therefore been strapped around the outside of the fish plates and painted black for inconspicuousness. Two No. 0000 cable bonds are used at each joint. The track is cross bonded every 2000 ft. with a No. 0000 jumper.

The cars used are similar to those employed on the Middletown-Berlin electrical division of the company and described in the Street Railway Journal for Sept. 21.

The Buckland sub-station is a one-story brick building 42 ft. long by 22 ft. wide. It contains at present one 60-cycle 200-kw Westinghouse rotary converter and a General Electric 25-cycle machine of the same capacity, which latter is not yet operated. The Westinghouse unit is supplied with power by three 75-kw oil insulated transformers which are to be removed, together with their rotary, when the change is made to 25 cycles. This unit will be replaced by three 75-kw General Electric transformers and a second General Electric 200-kw rotary. The transformers for the first General Electric rotary are already installed. At Buckland the direct-current feeders of the road are brought to a common bus through knife switches, so that any section can be cut open in either direction.

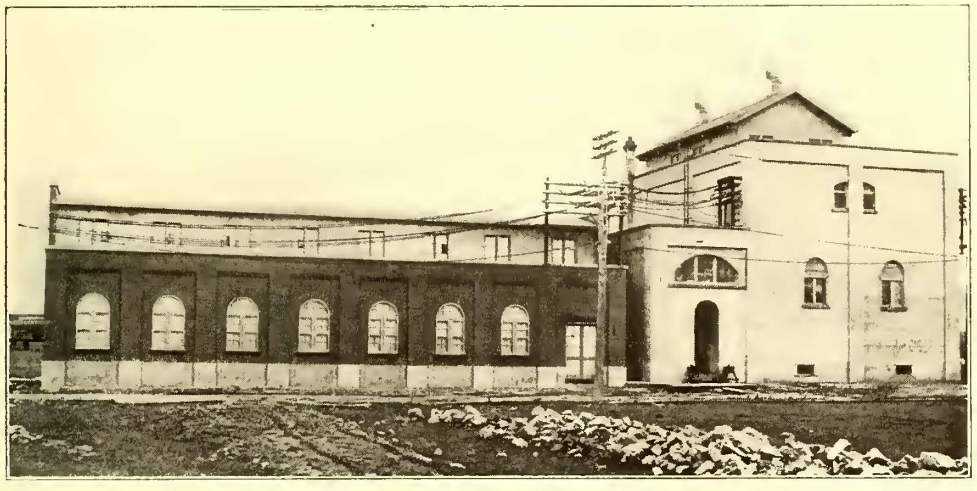
The Rockville or West Street sub-station is also a one-story brick building, 63 ft. x 22 ft., located about 3 miles east of Vernon. It operates at present a 300-kw and a 200-kw, 60-cycle Westinghouse rotary with six step-down transformers. These are to be replaced by a 200-kw General Electric 25-cycle converter, and space is provided for two more 200-kw rotaries of the same style. An 80-kw Westinghouse booster is in service at this sub-station to supply a proper working voltage at various points on the Strafford Springs trolley line outside of Rockville. The entire electrified section of the Hartford, Vernon & Melrose is fed from the sub-stations by two 500,000 circ. mil. feeders.

The coupons on the Underground Railways of London 5 per cent profit-sharing notes, due on Dec. 1, it is formally announced, will be purchased at their face value by Speyer & Company in New York, and by Speyer Brothers, of London, and Lazard Speyer-Ellissen, of Frankfort. It is also announced that the directors have practically completed plans for the extension and conversion of this note issue, and for providing further moneys for the requirements of the company. The plan will be published and submitted to the approval of the note and shareholders as soon as the necessary arrangements have been made. Meanwhile, Speyer & Company invite the deposit of the notes of the company with the Guaranty Trust Company under an agreement of deposit dated Dec. 1. The step is taken, it is said, to assure continuity of policy of management, to the end that the company may be in a position of greater strength.

## MONTREAL SUB-STATIONS AND OTHER POWER SUPPLY

In addition to the large direct-current power station, described in the STREET RAILWAY JOURNAL of Nov. 9, the Montreal Street Railway Company has erected three sub-stations during the last two years to operate motor-generator sets driven by alternating current transmitted from Shawinigan Falls and other points. All of the sub-stations are conveniently located at the terminals of city lines.

The first station is on Glen Avenue, near St. James Street, opposite the St. Henry car houses, and supplies the western section of the system; the second station is at the corner of St. Denis and Comte Avenue, north of the company's St. Denis car house, and supplies lines in the northern section of Montreal; and the third station adjoins the Shawinigan Water Power Company's station at Hochelaga and supplies the lines in the eastern section.



ST. DENIS BRICK BATTERY HOUSE AND CONCRETE SUB-STATION

Besides the foregoing, the company has a steam plant and sub-station on William Street, where it receives 5000 horse-power measured on the direct-current side, and a steam plant at Point aux Trembles. The latter contains one 350-kw and one 200-kw belt-driven G. E. generators, the first driven by a tandem, cross-compound engine and the second by an ordinary cross-compound engine.

### THE ST. DENIS STATION

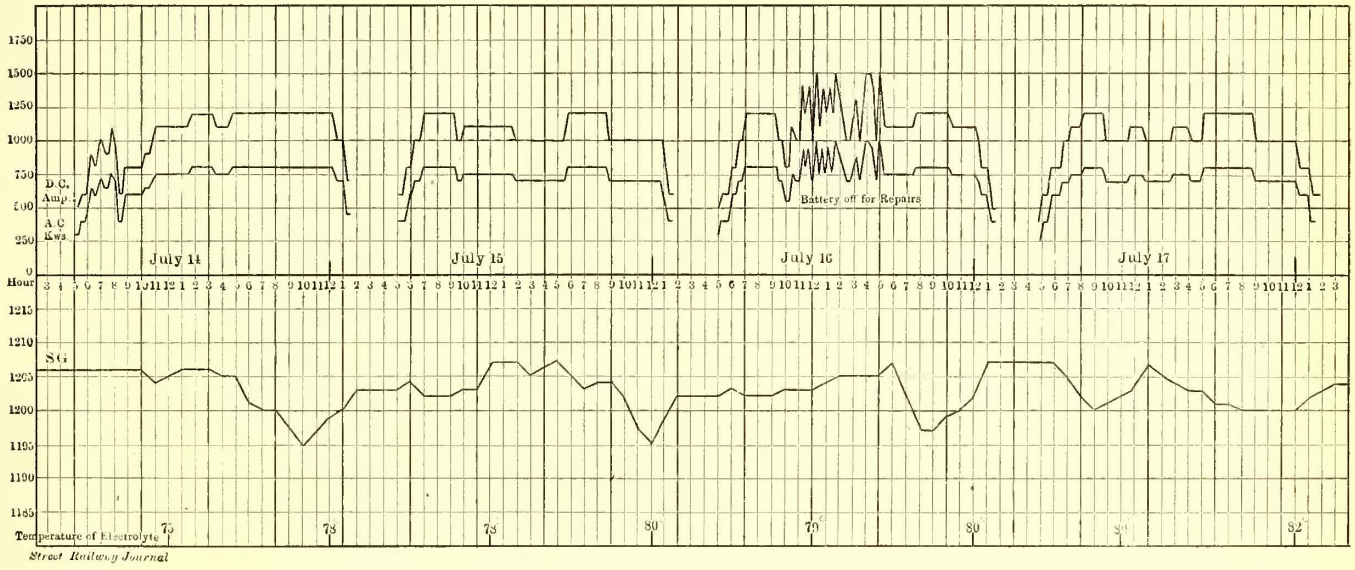
The St. Denis sub-station is a concrete structure throughout and houses four 500-kw d. c. units consisting of one Allis-Chalmers Bullock, one General Electric and two Westinghouse generators, each direct-connected to a 710-hp induction motor receiving 2300-volt, 60-cycle, three-phase current from Shawinigan Falls. The switchboard, as shown in the interior view, is mounted on a platform 8 ft. above the main floor, the space below being utilized as a closed concrete compartment for the incoming and outgoing feeders. The main room is spanned by a 40,000-lb. crane. It will be noted that provision for extra ventilation has been made by installing two chimney-vane ventilators in the roof.

The storage-battery house adjoining this sub-station is a splendid example of what such a structure should be. Like the Shawinigen battery building shown in one of the illustrations it is 20 ft. high on the sides with a wide monitor roof. As both the walls and monitors have numerous windows, the interior possesses a far more cheerful appearance than is customary. At night only is it necessary to use drop lights for illumination.

The battery fumes are effectually disposed of by motor-driven fans, while absolute cleanliness is maintained by frequently flushing the tile flooring from water connections placed in the room. The building is heated by steam pipes so arranged in racks that they may be easily removed and repainted outside the building with acid-resisting paints at the end of every winter. The steam mains are covered with an acid-proof composition and are not removed.

The boosters and regulating switchboard are situated in an adjacent room. The latter is separated from the battery section by a double door so connected that both cannot be open at the same time.

The battery installation consists of 280 Chloride accumu-

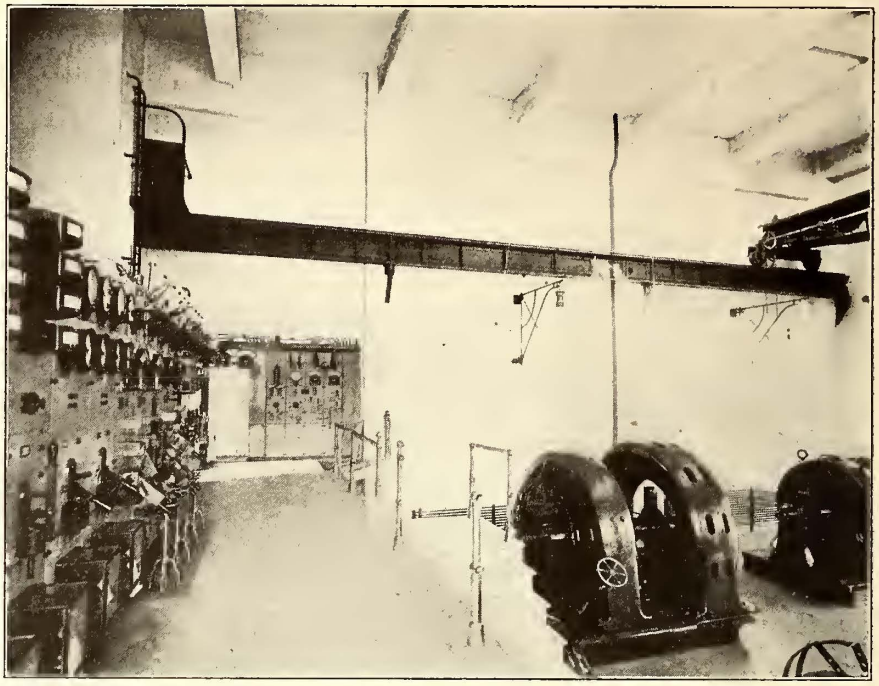



LOAD CURVES AT THE ST. DENIS STATION WITH AND WITHOUT THE BATTERY

lators. At 550 to 600 volts, this outfit will give 1400 amps. for 20 minutes, 720 amps. for one hour, 345 amps for three hours, and 180 amps. for eight hours. The accompanying load curves of this battery for July 14, 15, 16 and 17 are published to show both the usual performance of the battery and the effect of its absence for one day. In this connection, it is worth noting that the company has cut down evaporation losses about 50 per cent by using glass covers on the cells.

The Shawinigan and St. Henry stations are built of brick. The former belongs to the Shawinigan Falls Power Company, which has installed therein three 1000-kw rotary converters. The storage-battery equipment belongs to the Montreal Street Railway Company, and is a duplicate of the St. Denis installation.

The St. Henry sub-station contains a storage battery like that at St. Denis. The machinery installed consists of three 500-kw induction-motor sets, operated by alternating current from the 2300-volt, three-phase, 60-cycle transmission line from Lachine Rapids.

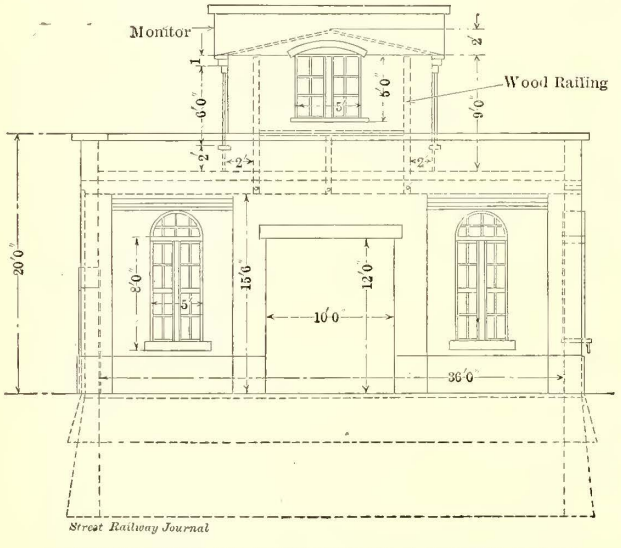


INTERIOR OF ST. DENIS SUB-STATION, SHOWING SWITCHBOARDS ON PLATFORM

## MEETING OF WISCONSIN ASSOCIATION

The first annual convention of the Wisconsin Electric & Interurban Railway Association was held in the Stephenson Building, Milwaukee, Nov. 13. The organization is composed of twenty-five railways and is represented by 100 members. The following officers were elected: B. L. Parker, secretary Green Bay Traction Company, president; Ernest Gonzenbach, vice-president Sheboygan Electric Railway & Light Company and general manager Milwaukee Northern Railway, vice-president; George B. Wheeler, secretary and manager Chippewa Valley Electric Railroad Company, second vice-president; P. H. Korst, secretary and manager Janesville Electric Company, third vice-president; Clement C. Smith, president Columbia Construction Company, Milwaukee, secretary-treasurer.

The discussion following the election touched upon railway taxation, rate commission rulings, and the building and operating of electric plants and railways. None of the interurban lines have been detrimentally affected by rulings of the railroad commission, it was said. It was intimated, however, that if certain questions recently brought before the commission regarding the operation of non-paying spurs are acted upon in accordance with the wishes of petitioners, the companies will suffer. The meeting adjourned at 4 o'clock, after which the members went over the new Milwaukee-Northern line, inspecting stations and the power house at Port Washington. The association selected Milwaukee as its permanent headquarters. Efforts will be made to induce managers of municipal electric plants of all kinds to affiliate with the association, and take an active interest in its affairs. The next meeting of the association will be held in Milwaukee in November, 1908.




CROSS-SECTION OF SHAWINIGAN BATTERY ROOM

INTERIOR OF ST. DENIS BATTERY HOUSE.

## ARNOLD REPORT ON SUBWAY CONDITIONS

In a preliminary report which he has submitted to the Public Service Commission of the First District of New York, Bion J. Arnold, who was engaged to look into conditions prevailing in the Subway, suggests two means of improving the service on that line. Mr. Arnold, with a corps of assistants, has been at work since Oct. 4 investigating the entire Subway, and recommends the employment of station guards and the summary closing of the doors to secure shorter stops. He also indicates in his report that he rather favors the installation of the side-door cars. He states that he has received every assistance from the Interborough management. He has to propose, he says, minor changes relating to methods of operation only, by which, in his opinion, 25 per cent more cars can be operated in the rush hours. He then reviews the present conditions, and asserts that in rush hours, so far from the two-minute express headway being maintained, not more than twenty-five express trains pass the Grand Central in an hour.

Many of the delays, Mr. Arnold asserts, are due to the time taken for loading and unloading, "and are caused largely by the policy in vogue of holding the trains at stations until all the doors are jammed full of passengers in an attempt to clear the platforms."

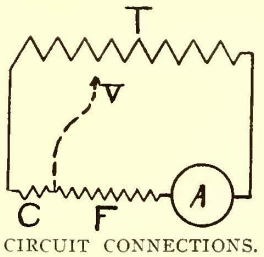
"This policy," says Mr. Arnold, "should be changed to one starting the trains within a fixed time after they have stopped." He gives this period of time as forty-five seconds, and adds that this will permit of the northbound expresses at night reaching the Grand Central only partly loaded, as some of the would-be passengers will be shut out at Fourteenth Street. At each express station, he says, there ought to be dispatchers who would sound a gong when forty seconds had expired after the train arrived, giving five seconds for the closing of the doors. Subsequently, he continues, indicators could be placed in the stations which would inform passengers how long a time remained before the train started. In addition the company should have police assistance at crowded stations to enforce these regulations and properly to control such individuals as may, from selfish motives, interfere with the prompt closing of the doors.

Suggestions as to the block signals concern simply the signals near express stations. At present the signals hold the train following a train in a station until the train ahead had completely cleared the station platform after being dispatched. Mr. Arnold thinks it would be advantageous to allow the second train to proceed toward the platform before the first train has completely cleared the platform. At present, with an eight-car train it requires from 22 to 25 seconds after a train starts to get the signal which allows the following train to proceed. It then requires a certain length of time for the following train to pull into the platform and come to a stop. At the Grand Central Station this amounts to 50 seconds for a northbound train. By making the change suggested 15 seconds could be saved. Mr. Arnold recommends that the Commission take this subject up with the company. If the latter fails to submit some feasible plan he will offer one or more which seem to him to meet the conditions.

Mr. Arnold says he cannot reach a conclusion as to the advisability of changing the type of car in the Subway in favor of the side-door variety until he has seen the effect of the minor changes he has set forth. There will always be a problem as to where to draw the line between seating capacity and standing room, and he goes on to say that the only feasible method of increasing the seating capacity is to have more cross seats in the cars, a plan that would necessitate more time for unloading and loading. He discusses at length the desirability of providing as great a number of passengers as possible with seats, but regards the plan of "a seat for everybody" as unfeasible. He continues: "If the principle of a slight reduction in the seating capacity of the present cars can be accepted as permissible and adopted, increased carrying capacity can be obtained by eliminating all or part of the present cross seats. The elimination of these cross seats makes it practicable to introduce center side doors into the present cars should this change be found necessary later. In case it is found that the traffic cannot be properly handled and the forty-five-second limit for station stops hereinbefore mentioned maintained with the present end-door cars, the use of these center doors in connection with the absence of the cross seats will make it practicable to load and unload so rapidly that this limit can be maintained." The question of a larger standing load, however, is one of public policy rather than of engineering feasibility. He thinks, therefore, that the Commission should first pass upon it and indicate their wishes to him.

## ALTERNATING-CURRENT RAILWAY MOTORS

The section of the A. I. E. E. at the University of Illinois was favored on Nov. 27 with a lecture by Dr. C. P. Steinmetz on "Single-Phase Alternating-Current Railway Motors." Dr. Steinmetz first classified all motors under two heads—series and shunt motors. In shunt-wound direct-current motors the armature reaction which causes sparking at the commutator is taken care of by the shifting of the brushes if a motor always operates in one direction. If it must operate in two directions, the brushes have to be placed at the middle point between the poles. To prevent sparking in motors which must be reversed and must consequently have their brushes at a fixed position, the commutating-pole type of motor is being introduced.



CIRCUIT CONNECTIONS.

Any direct-current series motor will run with alternating current if its magnetic structure is properly constructed to prevent heating from the alternating flux. To obtain a large power-factor, the number of turns in the armature should bear as high a ratio as possible to those in the field coils; the air-gap should be small. The sparking caused by the alternating field flux has been minimized by the use of resistance in the leads between the armature and the commutator segments. Dr. Steinmetz stated that the space is too limited in a railway motor for such leads with sufficient radiating area. While good results are being obtained with them, they are not desirable, and are a source of danger when the motor is overloaded.

He then took up the theory of the repulsion motor. In an alternating-current transformer the magnetic flux is 90 time-degrees behind the primary e. m. f. and 90 time-degrees ahead of the secondary e. m. f. In the repulsion motor the stator coils are connected to the alternating-current source of supply when the brushes are short-circuited. In such a motor the stator coils act as the primary and the rotor coils as the secondary of the transformer. The rotational flux in the rotor is displaced 90 time-and-space degrees from the main flux, and acts to assist good and sparkless

commutation. When at a standstill, the repulsion type of motor acts exactly as a series motor, being no better and no worse. After it begins to rotate, the repulsion motor produces a commutating field. At synchronism the commutation is perfect, but at speeds above synchronism, the commutation becomes worse, so that when revolving at double synchronism the plain repulsion motor sparks badly. He then described what he termed the series-repulsion motor, in which controller connections are employed which make it a repulsion motor at low speeds and a series motor with compensating field coils to improve commutation at high speeds. To illustrate the circuit connections at high speed he used the accompanying circuit diagram, in which $A$ is the armature of a series motor, $F$ the field coils and $C$ the compensating coils for securing good commutation. $T$ is the secondary of a transformer supplying energy to the motor. $V$ is a variable connection, by which a larger or smaller proportion of the total voltage of the transformer can be impressed on the compensating field coils.

As to desirable frequencies for railway motors, Dr. Steinmetz said that motors ranging from 75 to 200 hp can be made to commutate in a satisfactory manner at speeds between 600 and 1600 r. p. m. on 25-cycle circuits. This answers the practical requirements. On 15-cycle circuits motors commutate well at speeds as low as 360 r. p. m. A 25-cycle installation would be superior in total economy for small motors. For very heavy locomotives the case possibly may be different, but he questioned whether a frequency of 25 cycles is not a low enough frequency for all purposes.

## THE PAY-AS-YOU-ENTER CAR COMPANY

The success of the pay-as-you-enter car idea in the places where it has been tried has led to the organization of a company to conduct the business in the United States, where the design, as in Canada, has been fully covered by patents. As a result, the Pay-As-You-Enter Car Company has been organized under the laws of New Jersey, with headquarters at 26 Cortlandt Street, New York. The president of the company is Duncan McDonald, general manager of the Montreal Street Railway Company, and the manager is Thomas W. Casey. Mr. Casey, who resigned his position as purchasing agent of the Montreal Street Railway Company to conduct the affairs of the new company, has been engaged in street railroading for the past sixteen years, having been connected with the mechanical, stores and operating departments of the Montreal Street Railway Company. Among the directors of the American Pay-As-You-Enter Car Company are: W. G. Ross, R. L. McDuffie, Philip Gossler and Jacob Wendell. The company does not propose to manufacture cars, but will grant licenses to build cars under its patents to car builders, operating companies and others.

## STANDARD CLASSIFICATION OF ACCOUNTS

The members of the joint committee to represent the street railway companies, the Railroad Commissioners' Association and the Interstate Commerce Commission, decided upon at the meeting of these various interests at Washington, on Nov. 22, were appointed last week. The committee consists of the following:

Representing the American Street and Interurban Railway Association, Chas. O. Kruger, of the Philadelphia Rapid Transit Company.

Representing the American Street and Interurban Railway Accountants' Association, W. F. Ham, of Washington.

Representing the Street Railway Association of the State of New York, C. Loomis Allen, of Utica.

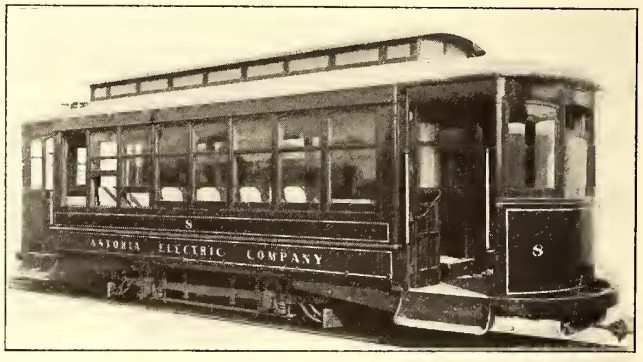
Representing the Interstate Commerce Commission, C. F. Balch, of Washington.

Representing the American Association of Railroad Commissioners, Wm. J. Meyers, of Albany, and W. O. Seymour, of Connecticut.

This committee has been engaged in conference in Washington all this week and its report was not completed in time for publication in this issue of the paper. The committee expects, however, to be able to complete its work and have its report ready for submission at the general conference, which is to be held at the rooms of the Interstate Commerce Commission, in Washington, on Dec. 10.

## SEMI-CONVERTIBLE CARS FOR ASTORIA, ORE.

An article recently appeared in the Street Railway Journal descriptive of the semi-convertible cars for Portland, Ore., in which mention was made of the fact that all the important systems in Oregon operated with this type of car. The last road to receive semi-convertible cars was the Astoria Electric Company, although the builders, the American Car Company, made shipment at practically the same time as the cars for Eugene, also in Oregon, were ready to go forward. Astoria is a flourishing seaside resort




CAR FOR ASTORIA, ORE.

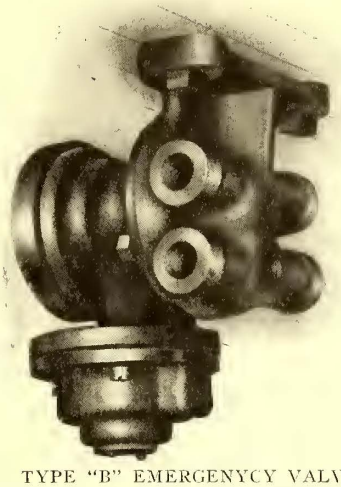
with a climate that makes the semi-convertible car particularly desirable for service, and especially during the rainy season. At present the system consists of five miles of tracks, over which nine motor cars and six trail cars are operated, aside from the three new semi-convertibles just placed in service. The dimensions of the new cars are as follows: Length over end panels, 20 ft. 8 ins.; over crown pieces, 30 ft. 8 ins.; width over sills, including panels, 7 ft. 9½ ins.; over posts at belt, 8 ft.; height from floor to ceiling, 8 ft. 4¾ ins.; from track to under side of sills, 25⅛ ins.; size of side sills, 3⅜ ins. x 5 ins.; end sills, 3½ ins. x 6⅝ ins.; sills, 6 ins. x ⅜ ins. x 3½ ins. angle iron. Inside finish of cars, cherry; ceilings of 3-ply birch. The seats are of Brill make, as are also the numerous specialties used throughout, namely, angle iron bumpers, gongs, signal bells, etc. The trucks are the No. 21-E pattern.

## ACQUITTAL IN SAN FRANCISCO

Gen. Tirey L. Ford, general counsel of the United Railroads of San Francisco, was acquitted on Dec. 3 of the charge of having bribed a former supervisor to vote for an overhead trolley franchise. The verdict gave general satisfaction, and is taken as an indication that any attempt to hold other railway officials upon charges of a similar character will be equally unsuccessful.

## A NEW COMBINATION AUTOMATIC AND STRAIGHT AIR BRAKE SYSTEM

An air-brake system combining the desirable features of automatic and straight air, without complicating the piping or valves to any extent, was exhibited at the recent Atlantic City Convention by the National Brake & Electric Company, of Milwaukee, and is practically identical with the ordinary straight-air systems, except that the company's new type "B" emergency valve is used in connection with the brake cylinder, and a few modifications have been made in the motorman's straight-air valve to give the necessary refinements.

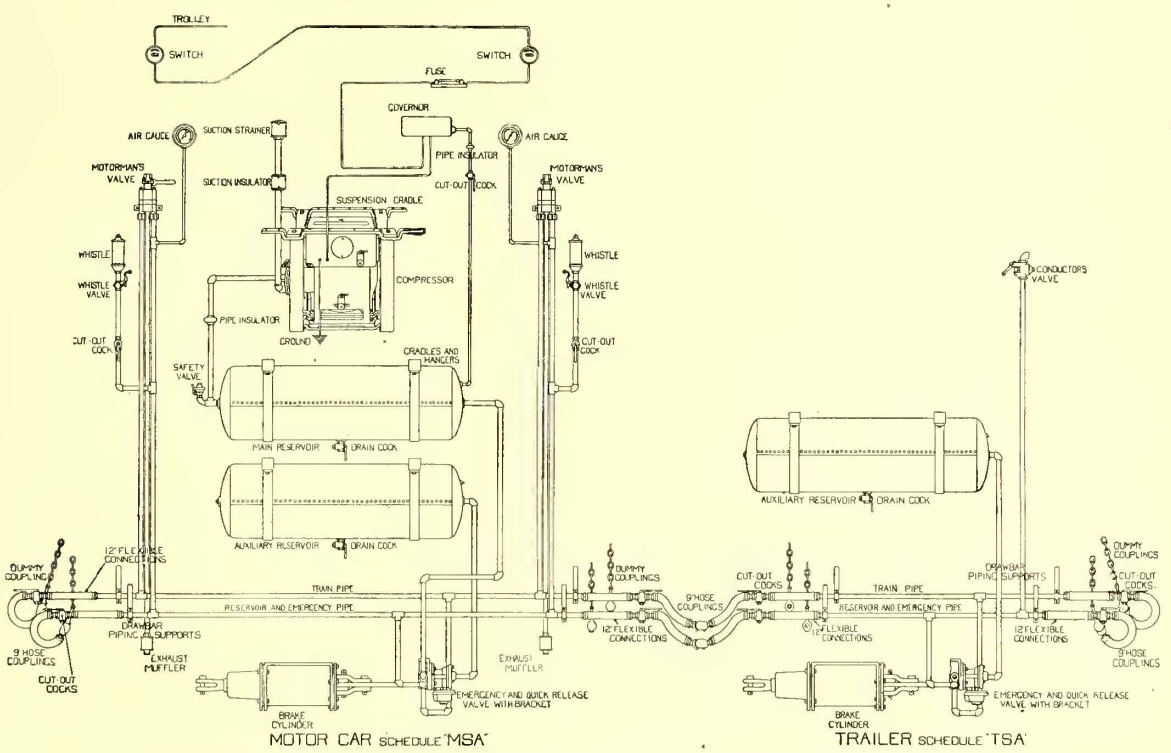


TYPE "B" EMERGENCY VALVE

This motorman's valve has three set and two release positions in addition to that of lap position. The first position on moving the handle to right from center or lap position gives a restricted opening between reservoir and straight air train pipe, so that the brake cylinder pressure may be raised gradually. A further movement to the right uncovers the greater area of the service port, allowing the brake cylinder and the main reservoir to equalize as quickly as is possible with straight-air systems. The next position to the right of this, or the extreme position, causes a rapid reduction to be made in the emergency line, thus rapidly destroying the pressure on the emergency line side of the emergency valve piston, causing the then greater auxiliary reservoir pressure to move the emergency valve piston to full outward position, thereby disconnecting the brake cylinder from the straight-air train line and connecting the auxiliary reservoir directly to brake cylinder. In this position maximum brake cylinder pressure is reached much more quickly, due to the short distance the air has to travel from source of supply, than would be possible should all brake cylinder air have to pass through the train pipe line and motorman's valve, as when applied with the usual straight-air method.

A graduated release is obtained by moving the handle of the motorman's valve to the left of the lap position, which connects the brake cylinder to atmosphere through the exhaust port in the motorman's valve. In this way the total volume of air in the brake cylinder is allowed to pass out through the train pipe. Should a quick release be desired, the motorman's valve handle is moved to the left to the next position. This further increases the opening of the exhaust port, thus making a heavy reduction in the train pipe and causing the quick release mechanism of the emergency valve to connect each brake cylinder to atmosphere locally. This system, it will be seen, gives either a graduated set or release by straight-air operation, or a quick set and release by automatic operation. This system also possesses all the safety features of automatic air, such as automatically setting the brakes in case of train parting, or broken pipe line, etc. A feature of this system is that practically no complications are introduced other than those present in straight-air brake systems.

S. J. Hill, general manager of the Youngstown & Southern Railway, reports that since the conversion of the road from steam to electric operation the receipts have increased 250 per cent. When steam was the motive power four trains were operated each way per day. Since conversion, however, electric cars are operated hourly from 5 a. m. to 7 p. m., and cars are sent out of terminals at 9 and 11 p. m. The increase has been mainly in the passenger receipts.




EMERGENCY STRAIGHT-AIR BRAKE EQUIPMENT FOR MOTOR CAR AND TRAILER

# LONDON LETTER

A most unfortunate accident took place last month on the electrified portion of the Metropolitan Railway at the West Hampstead Station. At the inquest it transpired that the fault was clearly that of the signalman at the West Hampstead Station. A train from Baker Street was at this station, but the fog was so thick that the signalman did not see that the train had not left the station. He evidently imagined that it had left the station and let an incoming train from Baker Street come on, with the result that there was a rear-end collision in which three persons were killed and thirteen injured. It was, indeed, fortunate that the accident occurred to a train on the outward journey from Baker Street, as very few passengers were in either train. It is interesting to note that since the electrification of a considerable number of different lines there have been comparatively few accidents on the electrified portions of the lines. With regard to the accidents which resulted fatally on account of the fact that the lines were electrically equipped, a recent Board of Trade return gives the number for the years 1904, 1905, 1906 and down to the end of August of this year, as sixteen killed and seventy-one injured by actual contact with the live third-rail. The fatalities included four railway servants and twelve trespassers; and the injured, forty servants, one passenger, five persons on business, and twenty-five trespassers. The largest number of casualties occurred on the North-Eastern system—namely, eight killed and twenty-eight injured—the next in order being the Lancashire & Yorkshire, with five killed and nineteen injured. The return for the whole period for the London underground lines is as follows: District, two killed, nine injured; Metropolitan & Great Central Joint, one killed, one injured; Metropolitan, six injured, Metropolitan & Great Western Joint, two injured; City & South London, Great Northern & City, and Metropolitan District Joint, one injured each.

The affairs of the Underground Electric Railways of London, Ltd., formed by Mr. Yerkes, and which has electrified the Metropolitan District Railway and built a number of tubes in London, would appear not to have prospered to the extent that was anticipated. The profit-sharing notes are now to be had on the market at anywhere from 30 to 40 per cent of the par value, and it would appear that more capital would have to be raised to enable the company to pay for certain work still to be accomplished and to meet certain charges. It seems a sad state of affairs, but the condition of the company is no worse than that of many of the other transportation companies in London. What the solution of the matter will eventually be it is extremely difficult to foresee. An interesting case was recently decided in favor of the Underground Electric Railways Company in one of the London police courts, that enterprising company having been summoned for permitting black smoke to issue from the chimneys of its generating station at Chelsea. The usual sort of evidence was put in for the prosecutor, whereas the Underground Company put in a vast amount of evidence of a scientific character showing that its station was constructed on the most modern and up-to-date lines. The magistrate dismissed the summons with 300 guineas costs against the Chelsea Borough Council, which was responsible for the case, and stated that, in his opinion, the works of the generating station at Chelsea were as perfect as science could possibly make them, and that it was quite evident to him that the prosecution ought never to have been brought on such slender and unsatisfactory evidence as the Borough Council had produced.

Some disappointment has been felt in the south of London by the decision of the London County Council to abandon for this year the construction of electric tramways from West Norwood to the Crystal Palace. A system of tramways to the Crystal Palace has been a crying need for years, and it seemed this year that the work would be put in hand. The governors of the Dulwich College Estates, however, have successfully opposed the scheme, so that for the present the Crystal Palace will have to go without its tramway system. Perhaps the reason of the abandonment of this most important scheme was on account of the route selected, and next year undoubtedly Parliamentary sanction will be sought for a route to the top of the Palace Hill by Central Hill and Westow Hill, which would appear to be a more natural route and one which will not be so vigorously opposed. The Council has, however, recently decided to proceed at once with the construction of a tramway from Hammersmith Broadway to the county boundary at Harrow Road, Harlesden, which decision has come to a certain extent as a surprise, as there were other routes which would appear to have been more pressing. This new route, however, is made necessary by the fact that next year there will be held at Shepherds Bush the Franco-British Exhibition, and by the construction of this tramway it will assist in opening up that vicinity to the large suburbs of the west of London. The overhead system is to be adopted on this portion, the London County Council fortunately not having met with any urgent obstruction in this particular case.

After a good deal of tribulation, permission has now been granted by the Board of Trade for the Council to proceed with its work of construction in connection with the Mile End and Bow Road tramways in the east of London, which section, as recently stated in this column, is to be equipped with the G. B. surface contact system from Aldgate to Bow. So much opposition, however, was made to the system that the Board of Trade was requested to act in the matter, and it is only within the last week or so that its permission has been secured. The work, however, has now been commenced, and it will not be long before Londoners are able to see this extremely interesting system in active operation.

The tunneling under the Strand and Wellington Street, which is to connect the Victoria Embankment with the Aldwych subway, is now nearing completion. For some months past the entrance to the tunnel has been visible from the Embankment at the west side of Waterloo Bridge, and by the first of the year it is expected that the work will be completely finished. The single-deck cars which will be used for this purpose have commenced a service temporarily from the Embankment to Woolwich, so that when the connection is made they will be all ready to be put into immediate service. The newly electrified system between Highgate and Highbury has also now been completed, and the first car, containing officials of the London County Council and representatives of the contractors, Dick, Kerr & Company, was watched with considerable interest in this busy section of the northern suburbs of London. As has already been stated, this system connects with the Middlesex County lines, which run out as far as High Barnet, so that it is now possible to travel to that picturesque town all the way from the city by electric railway.

Taken altogether, however, some disappointment is felt at the lack of enterprise shown by the Moderates, who are now in power in the Council, and at the discussion of the recent tramways account and in interviews to the press, some of the leading representatives of the Progressives, who are now in the minority, have been airing their views on the subject. Instead of spending about half a million next year, some of the more progressive of the members are loudly complaining that two millions ought to be spent, as there are still, according to them, 50 miles of tramways which ought to be electrified as soon as it is possible to accomplish the work. The writer heartily agrees with the Progressives in this statement, as there are miles and miles of antiquated horse tramways still left, especially in the north of London, and many new routes which ought to be equipped with electricity. When the whole of London is equipped with electric tramways, there is no doubt they will pay and pay handsomely, and it ought to be an easy matter to regulate the fare so that there is plenty of money for renewals, depreciation and reserve, while leaving a comfortable balance.

With regard to the two recent accidents which occurred to tramways a month or two ago, the report of the Board of Trade inspector who investigated the Bradford accident states that the inspector is of the opinion that the leading axle broke at the curve and that the hand brake became useless and, to a large extent, the electric brakes as well. The inspector goes on to state that what is required for cars on a steep gradient is a mechanical slipper brake that could be applied instantaneously, as once a car gets out of control on a steep grade it is impossible to stop it with the brakes at present in ordinary use. As to the Halifax accident, a sensational piece of evidence was given by one of the passengers at the inquest, in which he stated that he had frequently known the car to run backward on this particularly steep grade where the accident occurred, and the coroner came to the conclusion that the brakes had been improperly applied. Mr. Spencer, the company manager, explained also that the car in question was fitted with a running-back device, an invention of the rolling stock superintendent, and a device that is in use in many towns, but the driver, in his opinion, evidently did not know that such a

device had been applied to the controller and operated the controller in the ordinary way. The Halifax Tramways Committee, after the result of the inquest, decided to recommend the Town Council to ask the Board of Trade to nominate a mechanical engineer and an electrical engineer to report on the cars, brakes and working of the Halifax Tramways system and to suggest any improvements for the safety of the traveling public, but a reply has just been received from the Board of Trade intimating that it desires to reserve its impartiality and suggesting that the corporation should approach the Society of Electrical Engineers and Mechanical Engineers or the Tramways Association with a view to the nomination of such experts.

The press has lately contained many stories about the contract which Bruce, Peebles & Company, of Edinburgh and London, have recently secured for the electrification of the tramways of Moscow at a cost of about £2,000,000. We understand from Bruce, Peebles & Company that the statement is substantially correct, but that, unfortunately, it is somewhat premature as yet, as many details have yet to be settled and certain financial conditions are attached to the contract. It is evident to all, of course, that the financing of such a contract is a serious problem and that the conditions at present are adverse to the raising of such an amount of money. We are advised, however, that doubtless everything will be fulfilled later on, but that at present no details of any kind are available.

Morecambe Town Council has unanimously decided to promote a bill in Parliament authorizing it to purchase, construct and work tramways. At present the system of tramways along the sea front is by horse traction, and is run by a private company, whose lease has expired. The corporation is now seeking to acquire the undertaking in the Morecambe district, with a view to electrification. While the Council is unanimous in the acquisition of the tramways, opinion is divided as to electrifying them.

At a recent meeting of the tramways committee of the York Corporation, held at the Guildhall, the electrification of the tramway system was under consideration, and it was unanimously decided to proceed with the work by means of a Light Railway Order.

Leith Town Council has agreed to take steps for a provisional order for the proposed tramway extension, and also to resume negotiations with Edinburgh with a view to coming to some arrangement regarding the mutual roads. The feeling was that should no satisfactory arrangement be come to with the city, the proposal to extend the tramways to the Edinburgh territory will be dropped, and that the Leith Town Council will go on with the extension from Newhaven to Granton.

The Board of Trade recently made an official and satisfactory inspection of the new tramway route of the Torquay corporation tramways from the Mallock Memorial to St. Marychurch Town Hall by way of Babbacombe Road, Wellswood and Babbacombe. The piece of track inspected is a little over 2 miles in length, and has some rather steep gradients, the most elevated point being about 380 ft. above sea level. Its completion will extend the length of the tramway routes in Torquay to slightly over 4 miles, and the new line opens up a good portion of the residential part of the borough. The route is certainly a very beautiful one, opening up many peeps of the bay and the beautiful scenery at Bishopstown and Ilsham which cannot be seen by the pedestrian. With the opening of this piece of track the company will have completed the routes sanctioned by the corporation, and it may be expected that within a short time application will be made to the local authority for its consent to the commencement of work upon the Torbay Road. Like the sections which are already in operation, this new section is also operated on the Dolter surface-contact system.

After the Metropolitan District Railway had been electrified, it soon became apparent that the rails were wearing out very fast, very much faster than under the old system of steam traction, due it was supposed to a variety of causes, such as the rapid acceleration of the trains and the use of more powerful brakes in stopping the trains. The wheels also are smaller and the trucks on which the cars run and the length of the wheel base have much to do with the wear of the rails, a considerable side wear also having been noticed. A new rail has, therefore, been adopted with a great deal of success, so far as can be gathered at present. This rail is on what is known as the Sandberg system, and is the invention of C. P. Sandberg, who has devoted a lifetime to the study of steel for this particular purpose. It would appear that the ordinary rail in use is, as a rule, too soft, the rails for steam traction containing frequently about 0.5 per cent of carbon, while rails on the Sandberg system contain as much as 0.72 per cent of carbon, which has the effect of hardening the rail, while a considerable portion of silicon is also added to produce toughness. Very hard manganese check rails are also now being used with great success, the effect of the wear and tear on these rails when made of ordinary steel being altogether too great.

Another half mile is added, Nov. 30, to London's system of electric transit. This is a spur from the Strand to Holborn, where connection is made for Finsbury Park on the north and Hammersmith or Brompton on the west. It is the third cross-town line in operation between the Strand and the northern suburbs and is likely to command a large traffic as a branch of the Great Northern, Piccadilly & Brompton system of tubes.

A. C. S.

## PETITION FILED FOR POSSESSION OF THE CHICAGO UNION TRACTION COMPANY

The Chicago Railways Company has filed a petition in the United States Circuit Court for an order of possession of the Union Traction and underlying companies. The hearing, which has been set for Dec. 9 by Judge Grosscup, will be a formal one, as objections by stockholders and holders of indebtedness, have been overcome. The petition for possession asks for a lease by the receivers to the new company of all the street car tracks, cars running on them, and other property. The lease is to be operative pending a sale by foreclosure proceedings. The plan is to have the Chicago Railways Company bid them in and thus acquire actual and permanent ownership.

## CROSSING STOPS IN INDIANA

Hereafter all locomotive engineers and interurban motormen will be required to stop their trains or cars at all track crossings outside the limits of cities and towns in the State, where the crossing is not guarded by a switchman or watchman, or by a mechanical device recognized by the laws of the State as making the crossing safe. This decision was announced Nov. 25 by the Indiana Railroad Commission. At a conference of railroad managers and attorneys and the members of the commission, held a few weeks ago, it was unanimously determined by those present that stops should be made at all unprotected crossings that lay outside cities and towns. The question of whether criminal action should be instituted against motormen or engineers who did not obey this ruling of the commission was decided in the affirmative by the commission. Within cities and towns the commission holds that the City Council or town board is responsible, and that the commission may not order the use of safety devices at crossings in cities and towns without the consent and approval of the local authorities.

## FROM NEW CASTLE, PA., TO CLEVELAND

With the completion of the Akron & Youngstown Air Line Company's road it will be possible to travel from Newcastle, Pa., to Cleveland, Ohio, in about four hours. With the completion of two 14-mile stretches—one between Mahoningtown and Morado Park, and the other between Garretsville and Leavittsburg—there will be thoroughly connected over 325 miles of interurban lines which will reach all the important towns in the vicinity of Pittsburg and Cleveland, besides connecting them with the intermediate towns of the tri-state belt. Roads already under construction, and which will be completed within the next few months, will connect a string of towns from Cleveland to Moundsville, W. Va. The Cleveland, Akron & Canton road operates limited cars between Cleveland and Canton, via Akron. The Stark Electric Company operates a line from Canton through Alliance and Sebring to Salem. The Youngstown & Southern line now connects Salem and Youngstown and will be built through to East Liverpool within a few months; the interurban line from East Liverpool to Steubenville is already established; a change of cars to the Wellsburg line continues the route from Steubenville to Wheeling, where a 12-mile line runs on to Moundsville. A part of the network of Ohio River lines reaches from Conway, Pa., by way of the new line about nearing completion and which is being constructed by the East Liverpool Traction & Lighting Company and Steubenville Railway & Light Company to East Liverpool from the Beaver Valley terminal at Vanport. The Pittsburg Railways Company operates across the Ohio River at Monaca, where a direct line to Pittsburg is secured by way of McKees Rocks and Coraopolis.

## THE SITUATION IN CLEVELAND

At a conference, Wednesday afternoon, Mayor Johnson and President Andrews agreed to one point in the proposition to rearrange the tracks on Superior Avenue in order to relieve congestion, and the local papers have had much to say about the matter. In fact, the mayor made his first real concession—that the devil strip should be thirteen feet wide instead of ten, as an ordinance introduced in Council at the last meeting provides. In return for that he requested that the Cleveland Electric consent to the city's building and owning the tracks on Superior Avenue between the Public Square and East Ninth Street, where it now owns its own tracks. The mayor was frank enough to say he wanted this concession so the company would have no ground for injunction suits and that the city did not want to grant the company any franchise rights whatever on that strip. Mr. Andrews told him that he would bring the matter before the board of directors and they could decide as they think best.

It is probable that the change in the track on this street will not be made before spring, as not much can be done during the cold weather, which will doubtless come soon. An attempt will be made to build one or two of the loops that have been planned, and the others will have to wait for more favorable weather than the winter will bring. General Manager J. J. Stanley announced at this meeting that everything should be decided upon at as early a date as possible so that the special work can be ordered.

Although the statutes contain no provision for municipal ownership of street railway tracks, except on bridges and other places of the kind where the city already owns the property, an ordinance enacted on Monday evening of last week provides that in the rearrangement of the tracks on Superior Avenue the city shall own them and that the existing street railway companies shall be allowed to use them during the existance of their present franchises on the payment of 6 per cent on the amount of money the city has invested in them, this interest to be prorated among the companies according to the use they make of them.

In his letter to the city council, in answer to the resolution of Councilman Koch, President Andrews suggested that all negotiations be carried on between the Cleveland Electric Railway Company and the Municipal Traction Company, if the latter is to be the lessee, and that all differences be submitted to arbitration, the companies to abide by the result and the final agreement ratified or rejected by the City Council. This, the letter says, is the only manner in which an agreement can be made when it comes down to the legal view of the matter. In addition, the letter reiterated the substance of other letters recently sent to the City Council, embodying the views of the board of directors. The company will accept a franchise based upon the valuation of its properties by a fair and impartial board of arbitration, the rate of fare to be such as to yield a reasonable return on the investment, and the additional money that will be required to place the system in first-class condition and build such additions and extensions from time to time as will insure a good and proper service. It is believed, the letter states, that the people of Cleveland want a single fare with universal transfers, good to any part of the city or any point on the system. This point, however, the company is also willing to submit to arbitration.

Mayor Johnson declared the proposition made in this letter is foolish and that the Council should give it no attention. He repeated his former statement that he and the City Council had been appointed arbitrators by the people and that any other board of arbitration is out of the question. His wrath was aroused by the fact that the company named no figures upon which it would be willing to lease its properties to the holding company, which is the Municipal Traction Company, with less than $1,000 paid-up stock, according to the report of the accountants, made some time ago.

Under a suspension of the rules ordinances, approved by the committees in the afternoon, were passed, fixing the compensation for the joint use of the Cleveland Electric tracks on the West Side at $68,706. This sum was fixed on varying estimates made by the city engineering department. Thus the city is not only trying to force the Cleveland Electric to turn over its property to a holding company, but is endeavoring to force it to rent its tracks to other companies at rentals which it fixes. The mayor declared in an open meeting of the City Council that the holding plan is the only method of settling the question and that it will be settled that way with himself and the Council as the arbitrators.

A campaign was started Friday by the low-fare companies to secure consents of property owners on Quincy Street and Central Avenue. The officers of the low-fare companies state that they are willing to build the lines if the people want them. All of these ideas have been worked out without regard to the claims of the Cleveland Electric that it already has the consents of owners of a majority of the front footage on these streets and that power of attorney for six years accompany all consents. On the other hand, the Cleveland Electric seems to be resting secure in the possession of the consents and apparently does not consider the work the low-fare officials are doing of very much account.

Saturday evening President Andrews of the Cleveland Electric sent a communication to Mayor Johnson in which he says that the contracts made between the companies which formerly owned the local lines and the property owners along the streets seem to forbid the relocation of the tracks on Superior Avenue as has been provided by the city administration. A copy of the contracts, signed by the East Cleveland Railroad Company, A. Everett, president; the Woodland Avenue & West Side Street Railroad Company, J. B. Hanna, secretary; the Broadway & Newburg Street Railroad Company, Tom L. Johnson, president, and the Superior Street Railroad Company, Frank DeH. Robinson, president, accompanied the letter. If this change is prohibited in the contracts made by the original companies, as now seems true, the plan will have to be given up by the city. The clause in that contract relating to Superior Street is as follows:

"In consideration of the consent of the property owners to the laying of the fourth track in Superior Street, the street railroad companies named in said contract hereby agree to bind themselves to accept no ordinance or right from the board of improvement under said consent to lay said track that does not contain the following conditions:

"Said four tracks to occupy a space not to exceed thirty-three feet in width in the center of the street, and said thirty-three feet is to be paved by and at the expense of said railroad companies at the time of laying the tracks, with the best quality of dressed block paving, to the satisfaction and approval of the board of improvements; all tracks to be laid with new rail, with less than one inch rise."

Another portion of the contract relates to the operation of cars over the tracks on Superior Street. President Andrews, after mentioning this contract, stated that his company was ready to aid in relieving conditions in the down-town district by building loops or doing other things, so long as such action does not prejudice its rights. If any special work is to be removed or replaced, the directors feel that they should have the same rights and ownership in this property as in the original track.

It was reported on Dec. 4 in New York that the Cleveland Electric Railway Company had that day agreed to the holding plan proposed by Mayor Johnson, the agreement being made in a public meeting of Councilmen, Councilmen-elect, Mayor, city officers, officers of the traction company; and that Fred H. Goff was named by the Cleveland Electric to conduct negotiations. Mr. Goff, it is said, is empowered to accept the terms from Mayor Johnson with no report to the Cleveland Electric, and in his address at the meeting is said to have agreed to the merger of the three-cent and five-cent roads under a holding company, and declared all that remained was the fixing of the figure at which the Cleveland Electric stock shall be taken over. As appraisers, President Andrews of the corporation and President Dupont of the three-cent line, were named, with lawyers and real estate experts to assist, to fix a valuation on the old company's property. These appraisers are to report to another meeting next Tuesday.

Motions for the consolidation of the various foreclosure suits against the Union Traction Company and for the placing of the Chicago Passenger Road (the Adams Street line) in the hands of a receiver, have been made by Colin C. H. Fyffe, representing the eastern trust companies, in the United States Circuit Court. The Equitable Trust Company of Chicago objected to the motion as to the Passenger Railway Company, and the Guarantee Trust Company of New York to the consolidation one. Judge Grosscup said that as the objections did not seem to be insuperable he would postpone the hearings to give the attorneys a chance to get together.

## OFFICIAL STATEMENT REGARDING P. S. C. CHANGES

President Thomas N. McCarter, of the Public Service Corporation, has issued a general statement, in which he sets forth in detail the several changes in the managerial force of the corporation, to become operative Jan. 1, 1908, and various economies contemplated which, it is estimated, will result in a net saving during the next fiscal year of about $500,000, of which mention was made in the STREET RAILWAY JOURNAL for Nov. 30. As previously stated, the principal officers retired are Secretary Frederick Evans, who will be succeeded by Colonel Edwin W. Hine, and Vice-presidents A. B. Carlton and Charles A. Sterling, who were in charge of the electrical and transportation divisions of the company, respectively. The former will be succeeded by George J. Roberts, present chief engineer of the United Gas Improvement Company, of Philadelphia, and the latter by John J. Burleigh, at present a vice-president of the Public Service. Mr. Roberts will be in charge of the operation of practically the entire system, and Mr. Burleigh will have charge of the commercial department. President McCarter also said:

"There has been no change of any moment in the stockholding interest of the Public Service Corporation, nor is any contemplated. The same interests that have controlled the company expect to continue to do so in the same proportions. Nor is any segregation of the different departments of the company's business under the least consideration. The company is following the lead of other large corporations in embarking upon a comprehensive scheme of retrenchment, made necessary by the prevailing financial conditions. Such a course seems dictated by common prudence.

"George J. Roberts, at present engineer in chief of the United Gas Improvement Company, of Philadelphia, will be elected to the office of first vice-president, and John J. Burleigh, at present a vice-president, will become second vice-president.

"Mr. Roberts is an exceptional man for this property. He has a wide knowledge of the property gained after years of familiarity with it, he is unique in possessing a technical knowledge of all three branches of the company's business. I have been trying to get him to come to the property and to obtain the consent of his present employers to his coming for nearly a year, and have only at last succeeded. He will be vice-president in charge of operation. The second vice-president will also be located at the home office. His duties will be connected with the commercial and executive branches of the company's business."

## TRANSIT AFFAIRS IN NEW YORK

Justice Seabury, in the Supreme Court, appointed Paul Fuller, J. Hampden Dougherty and Melvin G. Palliser receivers for the New York City Railway Company in an action by Attorney-General Jackson, Nov. 29. Since Adrian H. Joline and Douglas Robinson, appointed receivers by Judge Lacombe in the United States Circuit Court, already hold possession of the books and properties of both companies, Justice Seabury by his action has precipitated a struggle between state and federal courts for jurisdiction over these companies which will probably go finally to the United States Supreme Court. Justice Seabury in his decision expressly directed his receivers to present the question of jurisdiction in an orderly fashion to the United States Court, and in the mean time not to molest or interfere with the federal receivers in any way other than by due process of law.

Twenty-five special policemen have been placed on duty in the subway at the stations where the crowds are largest in rush hours to stop people who try to board trains already overcrowded and arrest the insistent ones who hold doors open and delay trains. The men were selected by the Interborough Rapid Transit Company, and approved by Police Commissioner Bingham. The same number will soon be put on the elevated lines. The new policemen wear gray uniforms and regular special policemen's badges. To a certain extent they take the place of the platform men, who, though willing enough in most cases, did not have sufficient authority, in the opinion of the company's officials, to handle the subway crowds properly.

A plan has been advanced which contemplates the acquisition of the Belmont tunnel between Manhattan and Long Island City by the city, and what would amount to a partnership in its operation between the city and the interests now owning the tunnel. Briefly stated, the plan is that the city shall buy the tunnel, as it stands, for what it cost to construct it, with interest, to date; shall pay for it with city bonds instead of cash, and shall enter into a contract with the Belmont interests whereby those interests shall operate the line in connection with the Queens County surface lines, the net earnings to be equally divided between the city and the Belmont people, and the city to apply its share of the proceeds to the payment of the interest on the bonds.

At the continuation of the hearing on the affairs of the Brooklyn Rapid Transit Company by the Public Service Commission on Wednesday, Dec. 4, President Winter, of the company explained that the Transit Development Company, a subsidiary, is purely an instrument of economy, and described its purposes.

## REPORT SOON ON MELBOURNE ELECTRIFICATION

In 1903 the conversion of the steam railway between Flinders Street and St. Kilda's, Melbourne, was recommended, and Mr. Tait, the Chief Railway Commissioner of Victoria, urged a thorough investigation as to the feasibility and advisability of using electric traction instead of steam locomotives on all the principal suburban lines within a distance of twelve miles of the central station at Melbourne. He advised that the St. Kilda line should be electrically equipped, having in view the extension of electric traction to the other suburban lines as the condition of each case might warrant, and funds became available for the purpose. As a result, it was decided that the Chief Commissioner should visit England and America and engage a consulting engineer, first to report on and then to superintend this work. This engineer is now in Melbourne engaged in preparing a full report in detail in reference to the subject of electric traction on the suburban lines there. This report is to include his views and recommendations as to the best system and methods to be adopted in connection with electric traction, and his estimates in detail of the financial results which will be obtained therefrom, including the expenditure involved, cost of working and maintenance, and the gross revenue and net revenue after electrification. In the course of an interesting report issued by Mr. Tait, giving an account of his inquiries in Europe and America on this question, he rightly states that great responsibility rests upon the engineer, who is undertaking this work under his agreement with the Commissioners, because the method and designs which are adopted in connection with the first lines to be converted will largely determine the methods and designs to be followed in connection with subsequent conversions.

Without wishing to anticipate the recommendations which the Railway Commissioners may make after the consideration of the report, the Chief Commissioner sets forth some of the special reasons favorable to the electrification of the St. Kilda and Port Melbourne lines, and the need for an early start with the work. Without electrification additional locomotives and rolling stock would have to be built for the Melbourne suburban traffic at an early date. Indeed, owing to shortage of the suburban type of locomotive, engines suitable for country trains have to be employed for the suburban traffic. These engines are unsuited and too costly in construction for the economical working of this service. Carriages built for country traffic are also being used on the suburban lines, but the principal need of additional carriages for the suburban traffic is to replace the obsolete stock still used in that traffic. By converting certain of the suburban lines for electric traction and building new electric rolling stock the steam rolling stock shortage will be relieved. In view of the possibility of the electrification of the busiest suburban lines, it would appear to be unwise to build more suburban locomotives and rolling stock in the meantime. Another reason favorable to the selection of the St. Kilda and Port Melbourne lines for the first step in electrification is that these lines are practically isolated from the rest of the railway system. These tracks are separate from those of the other lines at the principal station in Melbourne, Flinders street, lying, as they do, on the extreme river side of that station, and not being used for through traffic. It is also pointed out that, if the St. Kilda line be electrified, current from the power house supplying it can be used for working the electric tramway which is operated by the Victorian Government Railways, and the obsolete power house at which the current for that tramway is now generated can be abandoned. The financial and other results of the electrification of these lines will be of great assistance in determining the advisability of converting the other suburban lines in Melbourne, and in making detailed comparisons between steam and electric operation.

## THE WESTINGHOUSE BALANCE SHEET

The receivers of the Westinghouse Manufacturing Company have issued a general balance sheet showing the affairs of the corporation on Oct. 23, 1907. The statement shows a profit and loss surplus of $11,610.756. The affairs of the company are apparently in excellent shape, except for its lack of cash. The details of its quick assets show $2,721,839, consisting of $427,262 cash available to receivers, $250,043 available to ancillary receivers, $275,477 in banks which refuse to honor receivers' checks; a special deposit of $1,536,385, which is in dispute, and $232,670 with cashiers and agents. The accounts receivable, $7,849,538, are available. Of this amount $324,661 is due from European Westinghouse companies; $143,430 from the Westinghouse Lamp Company, and $648,450 from the Westinghouse Machine Company. There is in litigation $183,087. The company has on hand raw material and supplies valued at $4,298,143, and work in progress valued at $6,221,129. The company has investments amounting to $29,490,614. A large amount of this consists of bonds of the Lackawanna & Wyoming Valley Rapid Transit Company, and foreign Westinghouse stocks, a large amount of United States Electric Lighting Company stock, representing originally real estate and buildings.

Following is the balance sheet in full:

ASSETS.

| | |
|---|---|
| Property and plant | $12,342,223 |
| Quick assets | 2,721,839 |
| Accounts receivable | 9,210,671 |
| Notes receivable | 3,534,698 |
| Interest accrued, not due | 195,307 |
| Working assets | 17,799,465 |
| Investments | 29,490,614 |
| Other assets | 7,523,106 |
| Total assets | $82,817,923 |

LIABILITIES.

| | |
|---|---|
| Preferred stock | $27,998,700 |
| Assenting stock | 26,237,195 |
| Non-assenting stock | 600 |
| Funded debt | 20,469,000 |
| Collateral notes | 8,702,702 |
| Current liabilities | 13,462,009 |
| Interest accrued, not due | 410,528 |
| Current accounts, special | 13,875 |
| Reserves | 211,956 |
| Profit and loss—surplus | 11,610,756 |
| Total liabilities | $82,817,923 |

The property and plant of the company, consisting largely of real estate, buildings and machinery, is alone worth $12,342,223. The current liabilities are only $13,462,609, almost covered by the real estate held by the corporation alone.

## STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS, ISSUED NOVEMBER 19, 1907.

871,166. Railway Signal and Safety Appliance; George W. Gerlach, Cumberland, Iowa. App. filed March 27, 1907. Consists of a novel semaphore and trip. loated at a point or station, to give warning at a dangerous place.

871,200. Anti-Friction Lateral-Motion Center-Bearing; John C. Barber, Chicago, Ill. App. filed July 26, 1906. A lateral-motion roller-bearing interposed between the truck bolster and the lower plate of the center bearing proper. The bearings have a slightly elongated slot, laterally extending, for the king bolt.

871,220. Controller; Thomas Gilmore, Norwood, Ohio. App. filed Oct. 31, 1906. Designed to reduce the length of the drum and consequently the height of a series parallel controller adapted to heavy current.

871,232. Railway Track Construction; Edwin K. Morse, Pittsburg, Pa. App. filed March 14, 1907. Adapted for subway and elevated roads. A concrete roadbed has channels for the reception of fibrous belting or other sound-deadening material, and rail-supporting plates mounted upon the fibrous belting.

871,277. Pressure Reducing Valve; Andrew T. Johnson, Tonopah, Nev. App. filed March 6, 1907. An automatic pressure-reducing valve to be used in cross-over pipe of air-brake apparatus.

871,294. Vehicle for Recreation or Amusement; Thomas W. Potts, Fulham, London, England. App. filed June 17, 1907. Relates to the construction of vehicles for use on switchback and line pleasure railways.

871,378. Railway Signal; Louis H. Thullen, Edgewood, Pa. App. filed March 18, 1905. Mechanical construction for operating a semaphore arm from an ironclad solenoid magnet disposed within the standard of the semaphore signal.

871,394. Brake Shoe; Joseph D. Gallagher, Glenridge, N. J. App. filed April 3, 1907. Comprises a wearing body having at or adjacent to the back thereof a wire mesh and metal strap.

871,419. Convertible Street Car; George J. Knoll, Cleveland, Ohio. App. filed Oct. 23, 1905. The seats are pivoted so as to be arranged transversely for open or summer use and longitudinally for winter use.

871,424. Surface Electric Railway; Timothy Mahoney, San Francisco, Cal. App. filed July 6, 1906. Provides a system of distribution for alternating current with a third or signal, sectional, surface conductor-rail, which will avoid electrolysis of water and gas pipe mains. Has specially arranged reactance windings or choke coils.

871,442. Trolley-Pole Attachment; Robert P. Rever, Newark, N. J. App. filed Nov. 26, 1906. The trolley harp has a yielding spring connection with the pole, so as to yield in a lateral or in a forward and back direction.

871,455. Automatic Switch-Throwing Device; George R. Stuart, Owensboro, Ky. App. filed March 5, 1907. Automatic means for throwing a switch from a moving train.

871,457. Electrically Propelled Vehicle; Russel Thayer, Philadelphia, Pa. App. filed April 4, 1907. Has adjustable conductor shoes which may be dropped into engagement with the track rails so as to maintain connection therewith notwithstanding deviations of the vehicle therefrom.

871,496. Protection of Railway Trains; Abel R. A. Gerard, Pontgivart, France. App. filed May 1, 1906. A semi-automatic block signal system for railways in which the train itself effects the operation of setting the signals after passing a section and in which the completion of the signals are effected by a local operator.

871,501. Bond for Rails; Charles Y. Haile and George M. Hugus, Uniontown, Pa. App. filed May 17, 1907. The bond passes through the web of the rail and through the fish plates in a zigzag path, so as to prevent such fish plates from being surreptitiously removed.

871,512. Sweeping Machine; Joseph Ledwinka, Philadelphia, Pa. App. filed June 28, 1906. A sweeping machine for trolley roads. Relates to means for raising and lowering the brush and adjustment of the same angularly or laterally with respect to the car.

871,521. Car Fender; George R. Owings, Pittsburg, Pa. App. filed March 7, 1907. Details of construction.

871,538. Apparatus for Insuring Safety of Traffic on Single Lines of Railway; Edward Tyer, Dalston, London, England. App. filed Nov. 15, 1905. A stall system in which a tablet issued from an apparatus which may be electrically controlled, must be received by the engine driver, who can take his train to the next section.

871,616. Trolley-Pole Controller; Clarence Norland, Los Angeles, Cal. App. filed Nov. 19, 1906. The trolley pole is controlled by pneumatic cylinder having a piston therein. When air is introduced on one side of the piston the pole is held in contact with the feed wire, and when air is introduced on the other side of the piston the pole is retrieved. Means for automatically controlling the air.

871,643. Pleasure Railway; Lorenzo D. Shaw, Glen Echo, Md. App. filed Sept. 19, 1907. The car passes down an inclined plane over a body of water, the rails being at the water level. A pipe extends downward through the roof and floor of the car, the lower end of the pipe being adapted to take up water by momentum and spray it over the roof of the car.

871,722. Amusement Device: William J. Millican, New York, N. Y. App. filed April 16, 1907. Embodies features of both a toboggan slide and an ordinary amusement wheel. The wheel has directly opposed loops converging toward a common center, a car carried by the loops and means whereby the car will travel from side by gravity when the wheel is revolved.

871,740. Brake Shoe; Frank R. Spear, Chicago, Ill. App. filed July 3, 1907. A reinforcing and strengthening back for brake shoes, consisting of a malleable iron frame having a plurality of rods or bars connected together and all made in one casting, said rods or bars having beveled sides and ends.

871,744. Amusement Apparatus; Theophilus Van Kannel, New York, N. Y. App. filed March 9, 1907. Means for imparting a wave motion to a pliable floor over which passenger conveyances pass.

12,722. Trolley Retriever; Alfred W. Knutson, Brookfield, Ill. App. filed Aug. 19, 1907. Details of construction of a spring, drum and ratchet for controlling the trolley.

# PERSONAL MENTION

MR. HUGH J. McGOWAN, of Indianapolis, presented an address on the subject of interurban railways at a meeting of the National League, held in Chicago, Nov. 23.

MR. L. W. LESTER has resigned as treasurer of the Worcester Consolidated Street Railway Company, and will be succeeded by Mr. Leverett Candee, who is now associated with New York, New Haven & Hartford Railroad interests, and was formerly treasurer of the Fair Haven & Westville Railroad.

MR. ROBERT T. GUNN has resigned as general manager of the Lexington Railway & Light Company, of Lexington, Ky., to become superintendent of transportation of the Ft. Wayne & Wabash Valley Traction Company. Mr. Gunn formerly was superintendent of the Norfolk Railway & Light Company.

MR. R. P. SHERMAN has not resigned as superintendent of the Los Angeles-Pacific Railway, as was recently reported in this column. It seems that through a grievous misunderstanding the impression gained circulation that Mr. Sherman intended to resign, and on the strength of rumor the announcement of his resignation was made generally in Los Angeles and was published by the STREET RAILWAY JOURNAL.

MR. JOHN I. BEGGS says the election of Mr. W. V. N. Powelson to the presidency of the Union Electric Light & Power Company, of St. Louis, as his successor, does not signify that he will retire from the presidency of the United Railways or the Laclede Gas Light Company. Mr. Beggs states that he resigned the presidency of the Union Electric in order to devote more time to the United Railways and the Laclede Gas companies.

MR. ROBERT MALLEN BABBITT has just been appointed Western business representative of the STREET RAILWAY JOURNAL, with headquarters in Chicago. Mr. Babbitt takes the place of Mr. H. B. Abbott, who has been compelled to resign on account of ill health. Mr. Babbitt is not a newcomer in the electric railway field, as for three years he was connected with the engineering force of Ford, Bacon & Davis, on construction work, and for the last two years has been associated with the operating department of the Chicago & Milwaukee Electric Railway Company.

MR. THEODORE P. SHONTS, president of the Interborough Rapid Transit Company, of New York, was, on Dec. 4, formally elected president of the Chicago & Alton Railroad, control of which recently passed from the Rock Island to the Toledo, St. Louis & Western, of which Mr. Shonts is also president. Mr. George R. Ross, vice-president of the Clover Leaf Railroad, was also elected vice-president of the Alton Company. Mr. Shonts' duties will be of a purely executive nature and in no way will his election to the company affect his connection with the Interborough Company.

MR. FRANK E. ELLIS, who for the past two years has been assistant to Secretary B. V. Swenson, of the American Street & Interurban Railway Association, will retire Jan. 1, 1908, owing to a proposed rearrangement of the work in the office of the association, which will go into effect the first part of the year. Prior to his connection with the association Mr. Ellis was engaged in newspaper work on the New York "Tribune" and other papers. He is planning to return to the Middle West, where he was a resident for a number of years, to act as freight or passenger agent, or both, for some interurban electric railway company.

MR. JOHN B. CRAWFORD, superintendent of transportation of the Fort Wayne & Wabash Valley Traction Company, of Fort Wayne, Ind., has been appointed general manager of the Lexington Railway & Lighting Company, of Lexington, Ky., to succeed Mr. R. T. Gunn, who has become superintendent of transportation of the Fort Wayne & Wabash Valley Company. Mr. Crawford is a very young man, only 31 years of age, but has had an extended experience in construction and operation, both in the East and the West. Twelve years ago he entered the railway field in connection with the work of electrifying the Hartford, Conn., Street Railway. Then, to extend the scope of his work, he took the electrical course in the testing department of the General Electric Company. Having completed this he entered the power field, filling the position of assistant superintendent of the Conductor Power Company, engaged in the construction of transmission lines for power and lighting service on the Pacific Coast. Returning East he accepted the position of general superintendent of the Groton & Stonington Street Railway Company. It was his record with this company that secured for him about a year ago the appointment to the Fort Wayne & Wabash Valley Traction Company, just as his subsequent record with the latter company secured for him the appointment to the Lexington Company. Mr. Crawford is a nephew of Mr. Norman McD. Crawford, vice-president of the Indiana, Columbus & Eastern Traction Company.

MR. WILLIAM WHARTON, JR.—A short notice was published last week of the death in Germantown, on Nov. 26, of Mr. William Wharton, Jr. Mr. Wharton was born in Philadelphia in 1830, and was a son of William Wharton and Deborah Wharton, both of whom belonged to that well-known old Quaker family. He was educated at the Philadelphia Friends' School, being first boy on the list. Of a mechanical turn of mind, Mr. Wharton early in life gave his attention to the construction of track for railroad, and to street railways, which were just then being introduced. His entire life, from the very beginning of street railways in America, was, therefore, given over to this industry. In 1859 he embarked for himself in the manufacture of street railway track material, thus laying the foundation for the business of the company which still bears his name, the Wm. Wharton, Jr., & Company, of Philadelphia. This company he formed in 1881, in conjunction with Edward Samuel and others, for the extension of his former individual business. He became the head of this company and held the office of president until his death. For many years he was also connected with the Wharton Railroad Switch Company, whose business was finally taken over by the Wm. Wharton, Jr., & Company, Incorporated. Among Mr. Wharton's early inventions was the "Wharton switch," which became very extensively used. The use of cold-bent rolled steel grooved guard rails for street railway curves was also originated by him, and he was one of the first to introduce girder rails in street railway track. In 1884 he helped to organize the North Branch Steel Company, of Danville, Pa., which for many years was well known as a manufacturer of girder rails for street railways. The first 9-in. girder rail was rolled at that mill.

In connection with the street railway industry he was a manufacturer, contractor, inventor, experimenter, owner and operator. He built the first street railway tracks in Philadelphia and in New York, and during the Civil War he built considerable railroad track in Virginia, right in the face of the hostile forces. During the Centennial Exposition in Philadelphia he did some remarkable track laying, besides building and operating some roads on his own account specially for the occasion. He built the first tracks on Broadway in New York in 1884, under circumstances recollected by many, and in a manner as to despatch unequaled and unthought of in those times. Wherever there was a difficult piece of track work to be done, requiring knowledge, unusual energy, tact and courage, Wm. Wharton, Jr., was sought. His experiences in this connection, of which he only told once in a while in a circle of intimate friends, would make interesting reading if they could be collected. In the early stages of electric traction he experimented extensively, especially with storage batteries. He built, owned and operated the Lehigh Avenue Railway, in Philadelphia, which for several years was run largely for the purpose of developing electric traction. His versatility and his ability to master and personally to go into the most minute details was most remarkable.

One of his many gifts was the ability to surround himself with men of integrity to carry out his principles. This faculty enabled him in his old age to direct and keep in close touch with all his many interests and to stamp upon them his character, which always stood for straightforwardness and absolutely strict business honesty. His old-time energy and ability as to details asserted themselves with youthful spirit even in late years, when aroused by any special interest in an undertaking. Everybody of the street railway fraternity remembers his able, untiring direction and the consequent success of the exhibition in connection with the convention in Philadelphia in 1905, the first at which this portion of the convention came under the management of the Manufacturers' Association of the American Street & Interurban Railway Association.

For the greater part of the past year Mr. Wharton was in ill health, and was incapacitated from attending to business, but as this was known to but few of his more intimate friends, his death came as a shock to most of them. His widow, for more than 55 years his faithful companion, one son, Mr. W. Redwood Wharton, and one daughter, Mrs. Mendelson, of New York, survive him. His memory will be cherished as a man and as a friend, and he will long be remembered as one of the Nestors of the street railway industry.

# TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

| Company. | Period. | Total Gross Earnings. | Operating Expenses. | Net Earnings. | Deductions From Income. | Net Income, Amount Available for Dividends. |
|---|---|---|---|---|---|---|
| AKRON, O. Northern Ohio Tr. & Light Co. | 1m., Oct. '07 | 155,291 | 92,701 | 62,590 | 43,369 | 19,221 |
| | 1 " " '06 | 134,890 | 80,054 | 54,836 | 39,548 | 15,288 |
| | 10 " " '07 | 1,615,075 | 925,289 | 689,787 | 426,529 | 263,258 |
| | 10 " " '06 | 1,428,244 | 845,227 | 583,017 | 401,147 | 181,870 |
| CHAMPAIGN, ILL., Illinois Traction Co. | 1m., Oct. '07 | 368,838 | *198,852 | 169,986 | ..... | ..... |
| | 1 " " '06 | 280,339 | *141,918 | 138,421 | ..... | ..... |
| | 10 " " '07 | 3,091,321 | *1,732,926 | 1,358,395 | ..... | ..... |
| | 10 " " '06 | 2,443,647 | *1,335,194 | 1,108,453 | ..... | ..... |
| CHARLESTON, S. C. Charleston Con. Ry., Gas & Elec. Co. | 1m., Sept. '07 | 56,731 | 38,516 | 18,215 | 13,517 | 4,699 |
| | 1 " " '06 | 51,732 | 34,275 | 17,458 | 13,017 | 4,441 |
| | 7 " " '07 | 424,110 | 264,583 | 159,527 | 94,617 | 64,910 |
| | 7 " " '06 | 380,237 | 233,130 | 147,107 | 90,967 | 56,140 |
| CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co. | 1m., Oct. '07 | 122,930 | 67,554 | 55,376 | 27,074 | 28,301 |
| | 1 " " '06 | 109,738 | 59,153 | 50,585 | 26,158 | 24,426 |
| | 4 " " '07 | 564,973 | 288,261 | 276,713 | 106,224 | 170,489 |
| | 4 " " '06 | 502,821 | 250,070 | 252,750 | 100,809 | 151,941 |
| Chicago & Milwaukee Elec. R.R. Co. | 1m., Oct. '07 | 99,329 | 42,234 | 57,095 | ..... | ..... |
| | 1 " " '06 | 88,906 | 40,621 | 48,284 | ..... | ..... |
| | 10 " " '07 | 884,730 | 367,671 | 517,059 | ..... | ..... |
| | 10 " " '06 | 722,448 | 293,380 | 429,068 | ..... | ..... |
| CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co. | 1m., Sept. '07 | 29,370 | *17,295 | 12,075 | 6,796 | 5,279 |
| | 1 " " '06 | 29,411 | *14,729 | 14,682 | 7,108 | 7,574 |
| | 9 " " '07 | 222,082 | *118,249 | 103,834 | 63,664 | 40,169 |
| | 9 " " '06 | 207,637 | *110,355 | 97,282 | 62,530 | 34,751 |
| Cleveland, S. W. & Columbus Ry. Co. | 1m., Oct. '07 | 65,793 | 38,296 | 27,497 | ..... | ..... |
| | 1 " " '06 | 56,499 | 31,642 | 24,857 | ..... | ..... |
| | 10 " " '07 | 634,684 | 365,075 | 269,609 | ..... | ..... |
| | 10 " " '06 | 539,133 | 304,430 | 234,703 | ..... | ..... |
| Lake Shore Elec. Ry. Co. | 1m., Sept. '07 | 96,187 | *46,279 | 49,908 | 25,189 | 24,719 |
| | 1 " " '06 | 89,023 | *42,599 | 46,424 | 21,172 | 25,252 |
| | 9 " " '07 | 721,389 | *386,021 | 335,368 | 218,242 | 117,126 |
| | 9 " " '06 | 664,806 | *361,729 | 303,077 | 185,778 | 117,299 |
| COLUMBUS, GA. Columbus Elec. Co. | 1m., Sept. '07 | 28,980 | *15,518 | 13,462 | 10,438 | 3,024 |
| | 1 " " '06 | 26,036 | *14,042 | 11,994 | 8,773 | 3,220 |
| | 12 " " '07 | 326,006 | *177,580 | 148,426 | 117,308 | 31,119 |
| DETROIT, MICH. Detroit, Jackson & Chicago Ry. | 1m., Oct. '07 | 38,724 | *34,276 | 4,448 | 16,575 | †12,127 |
| | 9 " " '07 | 323,467 | *258,956 | 64,511 | 139,800 | †75,289 |
| ‡Detroit United Ry. Co. | 1m., Oct. '07 | 574,525 | *379,419 | 195,106 | 116,857 | 78,249 |
| | 1 " " '06 | 511,240 | *346,823 | 164,417 | 105,857 | 58,560 |
| | 10 " " '07 | 5,686,401 | *3,496,221 | 2,190,180 | 1,145,796 | 1,044,384 |
| | 10 " " '06 | 5,106,926 | *3,061,632 | 2,045,294 | 1,030,434 | 1,014,860 |
| DULUTH, MINN. Duluth St. Ry. Co. | 1m., Oct. '07 | 74,508 | 41,461 | 33,047 | 17,919 | 15,128 |
| | 1 " " '06 | 66,422 | 38,003 | 28,420 | 17,849 | 10,571 |
| | 10 " " '07 | 700,180 | 351,084 | 349,095 | 177,727 | 171,369 |
| | 10 " " '06 | 636,892 | 335,929 | 300,963 | 176,494 | 124,469 |
| E. ST. LOUIS, ILL. East St. Louis & Suburban Co. | 1m., Sept. '07 | 199,211 | 93,704 | 105,507 | ..... | ..... |
| | 1 " " '06 | 177,762 | 84,402 | 93,360 | ..... | ..... |
| | 9 " " '07 | 1,575,973 | 831,236 | 744,737 | ..... | ..... |
| | 9 " " '06 | 1,414,945 | 704,610 | 710,335 | ..... | ..... |
| ELMIRA, N. Y. Elmira, Water, Lt. & R.R. Co. (R.R. Dept.) | 3m., Sept. '07 | 78,132 | 53,213 | 24,919 | 14,945 | 9,974 |
| | 3 " " '06 | 67,731 | 44,352 | 23,379 | 12,118 | 11,261 |
| | 9 " " '07 | 185,430 | 133,763 | 51,667 | 40,572 | 11,095 |
| | 9 " " '06 | 164,743 | 115,680 | 49,063 | 36,632 | 12,431 |
| EL PASO, TEX. El Paso Cos. | 1m., Sept. '07 | 45,556 | *31,906 | 13,650 | 5,222 | 8,428 |
| | 1 " " '06 | 35,905 | *25,144 | 10,761 | 4,356 | 6,405 |
| | 12 " " '07 | 474,875 | *364,530 | 110,345 | 56,434 | 53,911 |
| | 12 " " '06 | 360,128 | *246,752 | 113,376 | 46,472 | 66,904 |
| FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co. | 1m., Sept. '07 | 125,732 | 69,984 | 55,748 | ..... | ..... |
| | 1 " " '06 | 106,276 | 61,258 | 45,018 | ..... | ..... |
| | 9 " " '07 | 937,622 | 557,012 | 380,610 | ..... | ..... |
| | 9 " " '06 | 804,926 | 492,754 | 312,172 | ..... | ..... |
| FT. WORTH, TEX. Northern Texas Tr. Co. | 1m., Sept. '07 | 93,468 | *52,653 | 40,815 | 11,276 | 29,539 |
| | 1 " " '06 | 76,338 | *50,982 | 25,357 | 9,942 | 15,415 |
| | 12 " " '07 | 1,018,274 | *618,061 | 400,213 | 125,803 | 274,411 |
| | 12 " " '06 | 795,807 | *502,226 | 293,580 | 119,288 | 174,293 |
| GALVESTON, TEX. Galveston-Houston Elec. Co. | 1m., Sept. '07 | 97,651 | *56,652 | 40,999 | 13,176 | 27,823 |
| | 1 " " '06 | 84,356 | *51,562 | 32,795 | 11,958 | 20,836 |
| | 12 " " '07 | 1,023,838 | *637,947 | 385,891 | 149,339 | 230,552 |
| | 12 " " '06 | 880,219 | *553,689 | 326,530 | 146,756 | 179,774 |
| HOUGHTON, MICH. Houghton County St. Ry. Co. | 1m., Sept. '07 | 23,878 | *12,873 | 11,006 | 3,948 | 7,057 |
| | 1 " " '06 | 22,689 | *11,781 | 10,908 | 3,896 | 7,012 |
| | 12 " " '07 | 247,581 | *153,265 | 94,316 | 47,347 | 46,969 |
| | 12 " " '06 | 219,981 | *144,506 | 75,475 | 46,486 | 28,989 |
| JACKSONVILLE, FLA., Jacksonville Elec. Co. | 1m., Sept. '07 | 32,651 | *21,830 | 10,821 | 4,852 | 5,970 |
| | 1 " " '06 | 26,968 | *17,480 | 9,488 | 3,333 | 6,155 |
| | 12 " " '07 | 386,478 | *246,508 | 139,970 | 45,452 | 94,518 |
| | 12 " " '06 | 306,112 | *191,656 | 114,456 | 40,445 | 74,011 |
| KANSAS CITY, MO. Kansas City Ry. & Lt. Co. | 1m., Sept. '07 | 534,923 | 262,980 | 271,943 | 156,157 | 115,786 |
| | 1 " " '06 | 476,756 | 224,968 | 251,788 | 144,600 | 107,188 |
| | 4 " " '07 | 2,087,825 | 1,072,997 | 1,014,828 | 619,891 | 394,937 |
| | 4 " " '06 | 1,875,098 | 934,209 | 940,889 | 573,950 | 366,939 |
| LEXINGTON, KY. Lexington & Interurban Rys. Co. | 1m., Sept. '07 | 59,195 | 31,120 | 28,076 | ..... | ..... |
| | 1 " " '06 | 61,634 | 34,370 | 27,264 | ..... | ..... |
| | 9 " " '07 | 420,783 | 266,307 | 154,476 | ..... | ..... |
| | 9 " " '06 | 394,768 | 259,736 | 135,032 | ..... | ..... |
| MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co. | 1m., Oct. '07 | 338,049 | 179,645 | 158,404 | 101,063 | 57,340 |
| | 1 " " '06 | 312,631 | 152,170 | 160,461 | 92,451 | 68,010 |
| | 10 " " '07 | 3,228,886 | 1,628,980 | 1,599,907 | 982,010 | 617,897 |
| | 10 " " '06 | 2,935,470 | 1,432,580 | 1,502,890 | 884,369 | 618,521 |
| Milwaukee Lt., Ht. & Tr. Co. | 1m., Oct. '07 | 67,499 | 31,910 | 35,589 | 36,133 | †544 |
| | 1 " " '06 | 56,607 | 23,747 | 32,861 | 28,257 | 4,604 |
| | 10 " " '07 | 703,259 | 299,357 | 403,902 | 342,921 | 60,981 |
| | 10 " " '06 | 592,271 | 229,029 | 363,242 | 267,501 | 95,741 |
| MINNEAPOLIS, MINN. Twin City R. T. Co. | 1m., Sept. '07 | 561,446 | 251,276 | 310,170 | 115,142 | 195,029 |
| | 1 " " '06 | 534,151 | 236,926 | 297,225 | 114,758 | 182,467 |
| | 9 " " '07 | 4,540,273 | 2,180,437 | 2,359,836 | 1,036,742 | 1,323 095 |
| | 9 " " '06 | 4,217,438 | 1,951,050 | 2,266,388 | 1,004,153 | 1 262,235 |
| MONTREAL, CAN. Montreal St. Ry. | 1m., Oct. '07 | 311 898 | 164,575 | 147,323 | 43,289 | 104,034 |
| | 1 " " '06 | 281,822 | 157,689 | 124,133 | 40,610 | 83,523 |
| | 12m., Sept. '07 | 3,558,744 | 2,104,653 | 1,454,091 | 585,250 | 868,841 |
| | 12 " " '06 | 3,100,487 | 1,850,720 | 1,294,767 | 546,064 | 703,703 |
| NORFOLK, VA. Norfolk & Portsmouth Tr. Co. | 1m., Sept. '07 | 295,611 | 161,921 | 133,690 | ..... | ..... |
| | 1 " " '06 | 155,558 | 94,908 | 60,650 | ..... | ..... |
| | 9 " " '07 | 1,977,297 | 1,200,668 | 776,629 | ..... | ..... |
| | 9 " " '06 | 1,275,754 | 833,831 | 441,923 | ..... | ..... |
| PEEKSKILL, N. Y. Peekskill Lt. & R.R. Co | 1m., Oct. '07 | 16,477 | *8,284 | 8,193 | ..... | ..... |
| | 1 " " '06 | 12,151 | *7,012 | 5,139 | ..... | ..... |
| | 10 " " '07 | 140,221 | *76,495 | 63,726 | ..... | ..... |
| | 10 " " '06 | 120,963 | *63,712 | 57,251 | ..... | ..... |
| PENSACOLA, FLA., Pensacola Elec. Co. | 1m., Sept. '07 | 20,005 | *12,152 | 7,853 | 3,579 | 4,274 |
| | 1 " " '06 | 14,270 | *8,835 | 5,435 | 3,164 | 2,271 |
| | 12 " " '07 | 212,759 | *139,224 | 73,536 | 39,575 | 33,961 |
| PHILADELPHIA, American Rys. Co. | 1m., Oct. '07 | 242,281 | ..... | ..... | ..... | ..... |
| | 1 " " '06 | 230,190 | ..... | ..... | ..... | ..... |
| | 4 " " '07 | 1,108,524 | ..... | ..... | ..... | ..... |
| | 4 " " '06 | 1,038,728 | ..... | ..... | ..... | ..... |
| PITTSBURG, PA. West Penn. Ry. Co | 12m., Oct. '07 | 1,576,492 | 848,408 | 728,084 | 403,650 | 324,434 |
| | 12 " " '06 | 1,409,493 | 773,976 | 635,517 | 378,322 | 257,195 |
| PLYMOUTH, MASS Brockton & Plymouth St. Ry. Co. | 1m., Sept. '07 | 11,620 | *8,927 | 2,693 | 1,745 | 948 |
| | 1 " " '06 | 12,236 | *5,520 | 6,716 | 1,814 | 4,903 |
| | 12 " " '07 | 117,721 | *82,540 | 35,182 | 21,447 | 13,735 |
| | 12 " " '06 | 109,777 | *69,754 | 40,022 | 21,793 | 18,230 |
| ST. LOUIS, MO. United Railways Co. of St. Louis. | 1m., Oct. '07 | 971,322 | *607,450 | 363,872 | 231,483 | 132,389 |
| | 1 " " '06 | 933,613 | *558,915 | 374,698 | 231,984 | 142,714 |
| | 10 " " '07 | 9,087,659 | 5,906,466 | 3.181,193 | 2,315,214 | 865,979 |
| | 10 " " '06 | 8,566,571 | 5,344,588 | 3,221,983 | 2,318,131 | 903,852 |
| SAVANNAH, GA. Savannah Electric Co. | 1m., Sept. '07 | 52,894 | *35,000 | 17,894 | 12,261 | 5,633 |
| | 1 " " '06 | 49,805 | *31,812 | 17,993 | 11,529 | 6,464 |
| | 12 " " '07 | 583,939 | *395,469 | 188,471 | 140,982 | 47,488 |
| | 12 " " '06 | 628,149 | *379,396 | 248,754 | 133,262 | 115,492 |
| SYRACUSE, N. Y. Syracuse R. T. Co. | 1m., Oct. '07 | 108,880 | 65,377 | 43,503 | 27,242 | 16,261 |
| | 1 " " '06 | 95,923 | 55,060 | 40,863 | 24,137 | 16,726 |
| | 10 " " '07 | 1,042,790 | 589,763 | 453,027 | 257,851 | 195,176 |
| | 10 " " '06 | 901,698 | 513,111 | 388,587 | 231,314 | 157,273 |
| UTICA, N. Y. Utica & Mohawk Valley Ry. Co. | 3m., Sept. '07 | 328,918 | 218,722 | 110,196 | 81,443 | 28,753 |
| | 3 " " '06 | 295,882 | 168,834 | 127,048 | 48,614 | 78,434 |
| | 9 " " '07 | 835,607 | 557,605 | 278,002 | 236,586 | 41,416 |
| | 9 " " '06 | 740,833 | 441,853 | 298,980 | 141,664 | 157,316 |