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Hoisting Facilities in Shops

The speed and economy with which ordinary repair and renewal work can be carried on in an electric railway shop depends more on the hoisting facilities than on any other mechanical feature in the shops. When it is remembered that no small part of the repair work of a shop consists of hoisting and lowering car bodies, wheels, armatures and other heavy parts, it is no wonder that the best master mechanics are giving their most earnest attention to these matters. The investment in proper hoisting apparatus sometimes looks large to the directors, but it must be remembered that if considerable money is to be spent in this kind of apparatus it is well to spend enough to have it operate with sufficient rapidity to justify the investment, and not stop just short of that mark. To illustrate, it is poor economy to put in expensive traveling cranes or any other kind of overhead hoisting apparatus and equip them with slow hand-operated tackle.

On the other hand, it is useless to install expensive apparatus of this kind when the remainder of the shop equipment is of such a character as to waste the time saved by the crane. The entire equipment depends for its speed on the slowest part, so that if the cranes are not operated electrically, pneumatically, or by hydraulic means, it is often better to use some of the most efficient hand jacks, which call for little investment and can be used anywhere. Not that we advocate hand jacks where something better is justified, but there is no use in spending money unless enough is spent to make some real gain. We have seen hoisting apparatus, cranes and the like put up at considerable expense only to be handicapped by some antiquated method of actually doing the heavy mechanical work. For example, a traveling crane which can only be moved by several men, who must have the way cleared before them as they drag the crane through the shop, is hardly what one would call a good investment.

The Importance of Reporting Car Service

The description of the new system which the Brooklyn Rapid Transit Company has recently installed for the systematic reporting of its car service, with reference to the tracing of irregularities of headway, which is presented in this issue, calls attention to the importance of street railway systems having adequate means of this kind for examining and keeping track of the quality of service which they are rendering to the public. Few lines have given this matter sufficient attention, and the majority have no system whatever for tracing their car service. If a complaint is received that a serious delay has occurred on a certain line, it is usually impossible for the company to ascertain definitely what the service happened to be on that line at the particular time referred to. The advantage and real importance of a knowledge of these features of the car service of a large system can be readily appreciated by those particularly who have to face the complaints of the public.

We are pleased to be able to place on record a description of so complete a system as has been installed in Brooklyn. A most complete report is made of the regularity and condition of the service on each one of the various lines in operation, so that if a delay is complained of wrongfully or is exaggerated, the company has complete and accurate records with which to face the complainants in a most positive manner. Complainants are apt to abuse the privileges afforded them in making charges of this nature against the service, and the trouble that can be saved for a company, in this way alone, will often warrant the adoption of such a system. But of greater importance is the possibility opened up to the company of observing the actual results of improvements which it has made to the service by this record system. In no other way is it possible to ascertain so cheaply the effect of increased car service upon the number of passengers carried. The effects of delays are shown equally as well, and the causes can easily be traced in this way. A system of this nature serves as the "bookkeeping system" of the car service for the operating department, and should be pro-

vided for and maintained with as much care as the bookkeeping required in the financial department.

In confirmation of the benefits claimed for the use of this system the improvements that have recently been made by the Brooklyn Rapid Transit Company in its service on most all of its lines may be recalled. Before this system was installed complaints from the public as to irregularity and inefficiency of service were the rule rather than the exception, and the company had no means of proving its attempts to better the service. Since the installation of this system, however, weak points needing attention were revealed and were quickly remedied, and in other particulars where the service indicated a need of improvement additional car service was provided and attempts were made to improve the regularity of headways. While this new record system has only been in use during the past few months the results upon the service have been remarkable. So satisfactory has been the service to the public that not a single complaint has been received of irregularities of headway since the first of the year. There is no doubt, also, that the moral effect of this record system upon the employees has had a great deal to do with the improvement of the service, but of the greatest importance is the fact that has enabled the officials in charge to know exactly what is happening on every line, and upon whom to call for explanations as to bad service.

This again calls to mind the fact that the great desideratum in street railway operation in large cities is not so much a large number of cars in operation, or high-speed movements, but rather regularity of headway. The most disagreeable thing to a passenger is that of having to wait unnecessarily long for a car. If the headway is kept regular and the cars properly spaced apart the public will be satisfied in spite of other important shortcomings upon the part of the operating company.

The Coming Park Season

Scarcely does the street railway manager of Northern latitudes lay down the snowplow and the shovel before the question of park business for the coming summer demands attention. The effect of these resorts in stimulating traffic is now so well realized by operating officials that at this time there would seem to be little need of dwelling upon this phase of the subject. In the light of past experience, however, it is worth while at the beginning of a new season to consider what some of the essentials of success may be.

One of the first things to realize in carrying on a street railway park or planning such an enterprise is the great variation of taste and capacity for enjoyment which characterizes the general public. In just so far as everyone's personal enjoyment can be appealed to successfully will the traffic grow in magnitude. Of course, one must realize at the outset that it is next to impossible to suit everybody at one and the same time, but this is the mark to aim at. Many who go to these parks are unhappy unless a constant whirl of excitement and interest surrounds them; others desire to escape the brass band and flying horses, preferring to paddle silently up secluded river or pond channels where animal, insect and vegetable life are supreme. The manager who can provide within the limits of a single park system these two extremes; who can separate by invisible boundaries the lands of forest and hurdy-gurdies, and who can retain the attractiveness of each, bids fair to reap a harvest at the end of the season.

The choice of a park location profoundly influences the future of the enterprise, and it is not a matter to be settled in a three-minute consideration of the problem. A winter examination may fail to uncover many natural advantages, even as it may also overlook malarial and unsanitary surroundings. If it is possible to do so, the site of a proposed park should be visited in both winter and summer, and as any such resort is fundamentally supposed to be healthful as well as recreative, it is emphatically worth while to obtain the disinterested judgment of one or more reputable physicians upon the former qualification before definitely deciding to develop the place for public uses.

It is a mistake to suppose that heavy expenditures are essential to make every park attractive. A very little money will do a great deal toward putting a park on its feet if the location is attractive and not too far from the centers of population. Rustic seats may be thrown together with small expense and placed here and there among the trees and in the open; swings, hammocks and poles for climbing do not involve serious outlays, while the construction of a neat and tasteful bandstand, or a simple out-of-door theater is not an expense to cause recalcitrant directors to balk. If the theater plan is inadvisable it is generally possible in cities large enough to require an outside breathing space to give band concerts two or three times a week throughout the summer. Then, too, the purchase of a few good boats is nearly always an excellent investment, for a park without a pond or river and light water draft is deprived of no small source of pleasure and profit.

While it is true that a well-conducted and attractive park is its own best advertisement, it is none the less advisable for the operating company to make effective the advantages of the place known at home and abroad, by judicious use of suggestive newspaper hints, announcements of attractions in the card racks of its cars, and the distribution of pithy pamphlets artistically illustrated by photographs of the park scenery. There is little doubt that the possibilities of this kind of advertising are a long way from being exhausted. Whatever else such pamphlets tell, the running time of cars, fares and distance of the park from important points in the vicinity, should not be left out. Often the profit on advertisements in these publications easily pays the cost of the descriptive work, although there is a difference of opinion as to the policy of admitting advertisements to this class of pamphlet.

There is also room for divergent views in considering who shall superintend the detailed operation of parks. If the theatrical features are very prominent the problems of successful management call for special knowledge and time which an active railway man usually cannot give up. It would seem to be the part of wisdom either to lease this part of the park to an outside person or else to turn such details over to an official whose experience and duties will enable him to get the most out of the property in large systems, which would otherwise be embarrassed by park and amusement management. Small parks, chiefly attractive through natural location and surroundings, are generally best managed by the street railway company itself. Care should be taken by the railway company to retain general oversight in all cases where the superintendence and operation of a park is sub-let to parties outside the direct influence of the transportation system.

Finally, every effort should be made to throw open the great public reservations and park systems near the large cities to every man, woman and child who can be drawn out of the crowded districts into the beneficent regions of woods and fields. Attempts to prevent the running of trolley cars to the entrances of these reserved tracts of forest and meadow block the pro-

gress of suffering humanity toward the relief which fresh air and sunshine alone can give to the much elbowed dweller in flats and tenements. The purpose of the State in setting aside these regions for public use is thwarted if the only transportation available is that given by horses and automobiles. Even temporary relief from the wearing strain of twentieth century city life is helpful in the cure of social evils common to congested population. The automobilist often complains that he is shut out of these park reservation roads by unjust laws, but he has only himself to blame, through his dangerous and reckless speeding. Certainly if an automobile is allowed to scorch through these counrty roads like an avenging Juggernaut, the electric car should be permitted to operate at moderate speeds over a fixed pathway in the same region, for the purpose of carrying weary thousands to rest and recreation. In many cases it is probably best that the park reservations themselves should be free from both automobiles and cars, but the extension of transportation facilities to the entrances is demanded by every consideration which has the welfare of humanity at heart. In the furtherance of this work the street railway has the opportunity of doing great public good.

The Steam Piping System

Probably no feature of the power plant equipment has received so much careful attention and thought in its arrangement and design, and has yet proved so generally unsatisfactory, as has the high-pressure steam piping system. It has, as is so well known, too often been considered a matter of minor importance, and almost any arrangement that would get steam to the engine has been made use of, with the usual unsatisfactory results. On the other hand, even with the greatest possible care and forethought exercised in the design and installation of piping systems, successful results have not always been obtained, and it devolves upon the power plant engineers to give even greater consideration than ever before to this important detail of power plant work, particularly in view of the increasing pressures used and the use of superheated steam. An unfortunate feature of the design of a steam piping system is that an application of theoretical laws gives no clue to the practical solution of the problem; experience is absolutely the only guide in this work, and it has, indeed, proven to be a very expensive teacher.

As a result of protracted and troublesome experiences the fact has become settled and well accepted that simplicity of arrangement and detail is one of the most important factors to be sought for in the design of a steam piping system. Everything that contributes to complication in high-pressure steam piping seems to entail very detrimental results. The more sections, fittings, parts, connections, etc., that are used, the more joints and weak places are introduced which can and will get out of order and give trouble in the form of wasteful leaking; practice shows that they do invariably get out of order, and that the resulting trouble increases in proportion to the number of joints and connections used. This has proven a very serious matter in large systems, and has in most cases increased the expense of maintenance of the piping system to the real burden. The use of all ring or other duplicate systems of piping wherein complication is involved is thus discouraged, and it is to be noted that in recent new plants longer lengths of pipe are coming to be used and the number of extra fittings is being reduced to the lowest possible, consistent with flexibility of arrangement.

The trend of recent power plant practice is to make use of the general steam piping plan, involving the simple steam header placed crosswise between the engine arrangement on one side and the boilers on the other; this is being generally made possible by the tendency toward the parallel arrangement of boiler and engine rooms in power plant construction, so that the header may be conveniently located longitudinally along the separating wall between the two rooms, and the boiler and engine connections made direct and as short as possible therefrom. This arrangement in conjunction with the proper use of stop valves, evolves the multiple-unit idea of a grouping of individual power plants, each with its boiler and engine equipment arranged side by side, thus allowing each adjoining group of boilers and engine to operate independently of the others, if desired. Such an arrangement has been found most conducive to reliability of operation on account of the possibility of separating different parts of the plant apparatus off into units in case of necessity of repairs, thus making the duplicate system unnecessary. It also results in the most simple and direct arrangement of the steam connections possible between engines and boilers which will provide interconnections. It is also very favorable to the use of long-radius pipe bends for all branch connections, by which expansion is freely provided for with no extra joints.

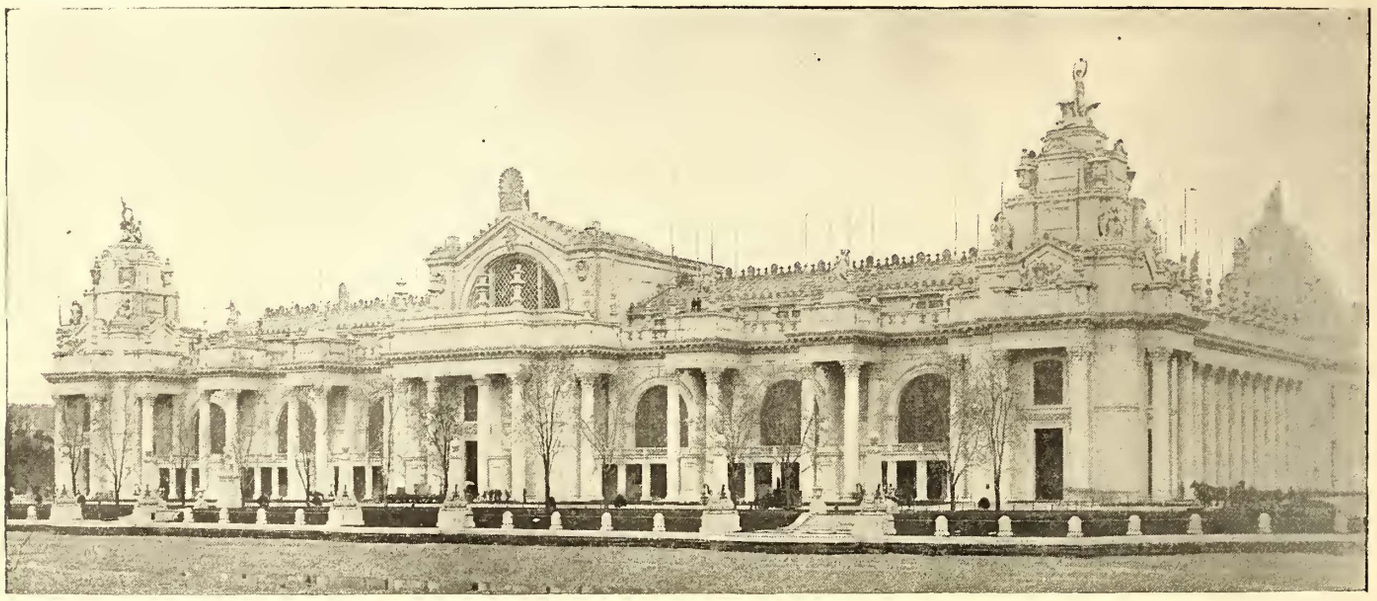
In recent practice the use of the receiver in the piping between boilers and the engines is becoming very marked, and particularly in plants where the service is variable is the value of such a storage reservoir felt for meeting quick demands due to fluctuations. In some cases the main steam header is made to serve as one large continuous receiver, from which the engines take their steam supply directly, while in other installations the use of individual receivers in the connection to each engine is to be seen. Notable among the former class may be mentioned the power plant of the Elizabeth, Plainfield & Central New Jersey Railway Company, at Cranford, N. J., which was recently described in these columns. In this plant a single 14-in. header, 81 ft. long, without a break in it, is in use; this provides a receiver capacity which is ample, and which cannot be lessened, as there are no stop-valves in it, so that it cannot be divided. Each pipe branching away from it is, of course, provided with one or more valves, but a constant receiver capacity is ensured. The suggestion has arisen that in case of accident to this header the plant will be entirely shut down, as no provision has been made for cutting out any section of the same in case of trouble; but the extreme simplicity of design which was worked out in this case has placed the installation in the best possible shape to avoid trouble, and almost none is to be ordinarily expected. By the use of carefully installed metallic gaskets and frequent inspections, the header connections may be kept very tight, and in any event the very small number of joints will reduce the trouble from leakage to a minimum.

In another large installation, in which a similar arrangement of longitudinal steam header is used, a separate large receiver is connected into each engine branch, so as to provide a large steam storage capacity for the engine. In this particular case the steam receiver was found in the earlier experience of the engineers in charge to be of great advantage in connection with street railway power plant work. The rapidly fluctuating loads which were formerly found to present serious difficulties are now much more easily handled by the engines, on account of the much more even steam pressure supplied when most needed, as shown by indicator tests at the steam pipe connections to the engines.

SOME OF THE ELECTRIC RAILWAY FEATURES AT THE WORLD'S FAIR, ST. LOUIS

BY WINDER ELWELL GOLDSBOROUGH

Of all the departments of electrical work there is no one which commands the attention of the engineering world more emphatically than does that of electric railway engineering.



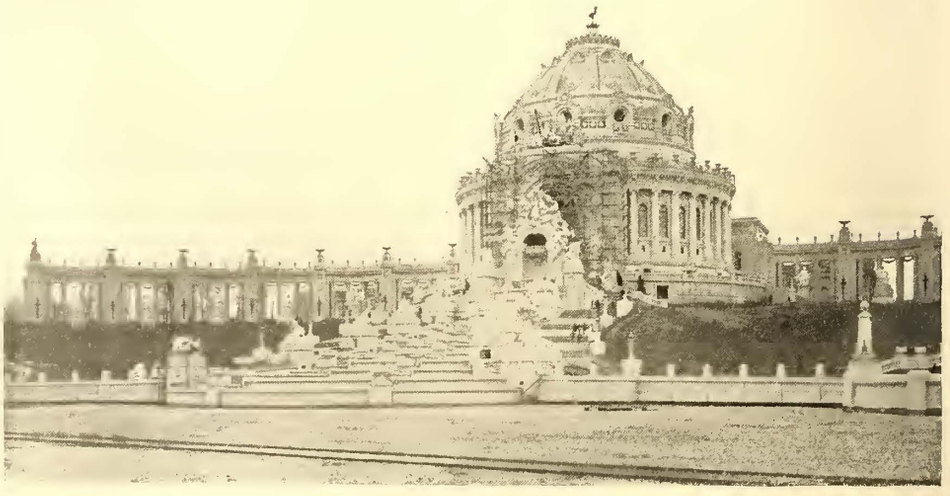
FRONT FACADE OF PALACE OF ELECTRICITY AT ST. LOUIS

The interests centered in this field represent, in money value, far more than do those of any other branch of electrical activity, and the number of employees connected with electric railway properties outnumber those connected with other electric properties in about the same measure. Unfortunately, it cannot be said that the average of engineering ability possessed by the employees in the rank and file of electric railway undertaking measures up to that which is common in central station light and power plants, in telephony, or even in telegraphy, and any venture which will tend to stimulate interest in the technical side of electric railroading among the younger generation of engineers should be welcomed by the older men in the profession, and by the financiers connected with electric railway undertakings as well.

One of the movements which is developing with rapidity and assuming a very important aspect has been brought about by the active efforts of the Electric Railway Test Commission of the St. Louis Exposition. This commission was appointed by President Francis on Nov. 13, 1903, and consists of J. G. White, president J. G. White & Company, New York, chairman; H. H. Vreeland, president New York City Railway Company, New York; George F. McCulloch, president Indiana Union Traction Company, Anderson, Ind.; James H. McGraw, president McGraw Publishing Company, New York, and W. J. Wilgus, vice-president New York Central & Hudson River Railroad Company. Soon after the organization of the commission very active work was begun to devise ways and means for carrying out investigations on all available types of electric railway apparatus now in use or that is being placed on the market.

In a matter of this kind a great deal that "is not" has to be created. When entering upon an investigation of engineering appliances which have so many ramifications as do electric railway apparatus, large resources are required properly to meet unusual requirements, and it is no small undertaking to provide these. However, through co-operation, which is so marked a characteristic of the American people, much can be accomplished; and it has been through the united interest of those associated in the manufacture, the construction, the operation and the study of electric railways that the arrangements are now assuming so gratifying scope.

The Exposition has come to the assistance of the commission, and set apart for its use terminals and tracks sufficient to accommodate twenty-four standard cars, and provide for the tests of these cars under all ordinary conditions likely to be met with in city or local interurban traffic. To take care of the more extended tests, recourse has been had to the very generous offer of the Indiana Union Traction Company, which has provided complete facilities for carrying on the high-speed tests in so far as a heavily ballasted, heavily railed, high-power line, level and straight for a distance of 8 miles, can meet such requirements.



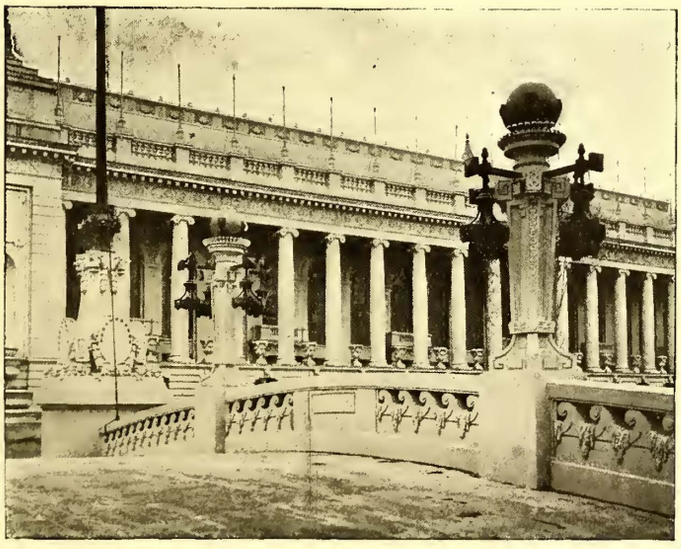
CASCADES AND THE ELECTRIC FOUNTAIN.

The electric railway test tracks and test-track terminals at St. Louis are entirely on the Exposition grounds. The test

tracks parallel the Transportation Building, running east and west along its north side. The test track terminals are to the west of the Transportation Building, and just north of the section of the grounds which is devoted to the foreign buildings. Everything is very conveniently arranged, as the tracks are quite near the power plant in the west end of Machinery Hall, as well as being within easy reach of the Electricity Building, wherein the standardization laboratory of the National Bureau of Standards and headquarters of the Electric Railway Test Commission are located. Probably, at this time, the importance of the laboratory, fully equipped and thoroughly organized, which has been made a feature of the exhibits in the Palace of Electricity, is not thoroughly appreciated by the electrical fraternity. When the installation of this laboratory is completed, it will undoubtedly be the finest electrical engineering standardization establishment in the world. It is fully equipped in all of its departments to take care of any demand that can reasonably be made upon it between the ponderous generators of Machinery Hall on the one hand and wireless telegraphy on the other. A complete cold storage plant eliminates all complications which ordinarily arise from temperature variations, and a corps of twenty trained assistants makes it possible to carry on a large amount of work, and do it well, in a short time.

MAIN ENTRANCE TO PALACE OF ELECTRICITY.

It is to this laboratory of the National Bureau of Standards that the Electric Railway Test Commission will turn for the calibration of all instruments used in its tests, and, if the expectations of the commission are realized, the work demanded of the laboratory by the commission will represent no small part of the large work which the laboratory will be called upon to do in connection with the many electrical devices which are subject to test and inspection at the Exposition.



ONE OF THE MANY BRIDGES ON THE GROUNDS, SHOWING ARTISTIC METHOD OF ILLUMINATION

There are other things, however, demanded besides a place to make the tests and instruments with which to test. A skilled corps of expert electric railway men must be at hand, and the commission has not been negligent in seeking out the best which the electric railway field in America affords in obtaining advice as to what is most to be desired in connection with work of this class.

One of the first steps taken by the commission was to invite the co-operation of electric railway engineers in mapping out a definite scheme for the organization of the tests in the several divisions of electric railroading. Four committees were appointed, and they immediately responded to the call of the commission:

(1) Committee on city and suburban electric railway equipments.

(2) Committee on interurban electric railway equipments.

(3) Committee on heavy traction equipments.

(4) Committee on new electric railway systems.

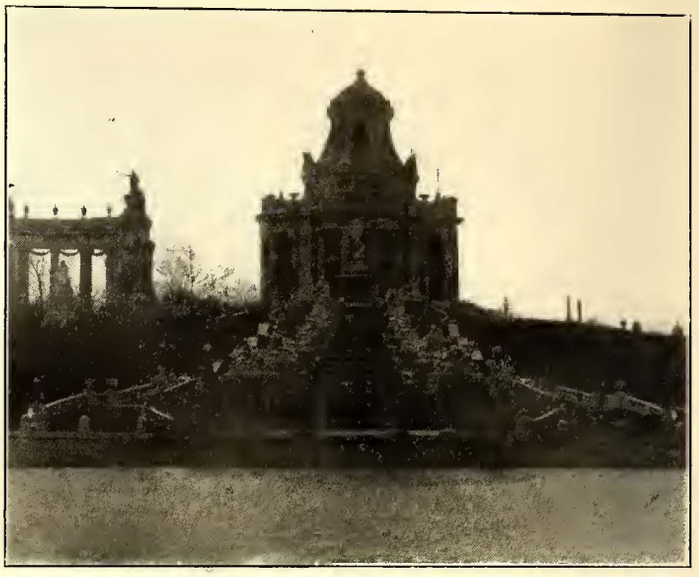
These committees diligently set about the preparation of their special reports (a digest of these has appeared in the STREET RAILWAY JOURNAL), and, taken collectively, these reports represent, in themselves, a very valuable addition to electric railway literature. They embrace the best thought of the best men on special and specific subjects. What more can be asked when much is desired? These reports are now in the hands of a committee of experts, employed by the commission to actively supervise the tests.

The commission has appointed Profesor Henry H. Norris, of Cornell University, superintendent of electric railway tests, and Professor B. V. Swenson, of the University of Wisconsin, and Professor J. W. Esterline, of Purdue University, assistant superintendents of electric railway tests. These gentlemen are now engaged in preparing a final report upon the specific work which is to be done, having at hand all of the information available concerning the facilities for carrying out this work, supplemented by special reports of the committees above referred to.

The Electric Railway Commission has also appointed an

advisory committee, consisting of A. H. Armstrong, of the General Electric Company; Clarence Renshaw, of the Westinghouse Company, and Ward S. Arnold, of the Bullock Electric Company, to act in conjunction with the other experts in an advisory capacity, and especially in matters related to the special features of the various equipments. The committee of superintendents and the advisory committee, together with the chief of the Department of Electricity, form a general committee, reporting to the Electric Railway Test Commission.

THE PALACE OF ELECTRICITY FROM THE JAPANESE GARDENS, DURING THE RECENT SNOWSTORM



WEST RESTAURANT BUILDING AT END OF COLONNADE OF STATES

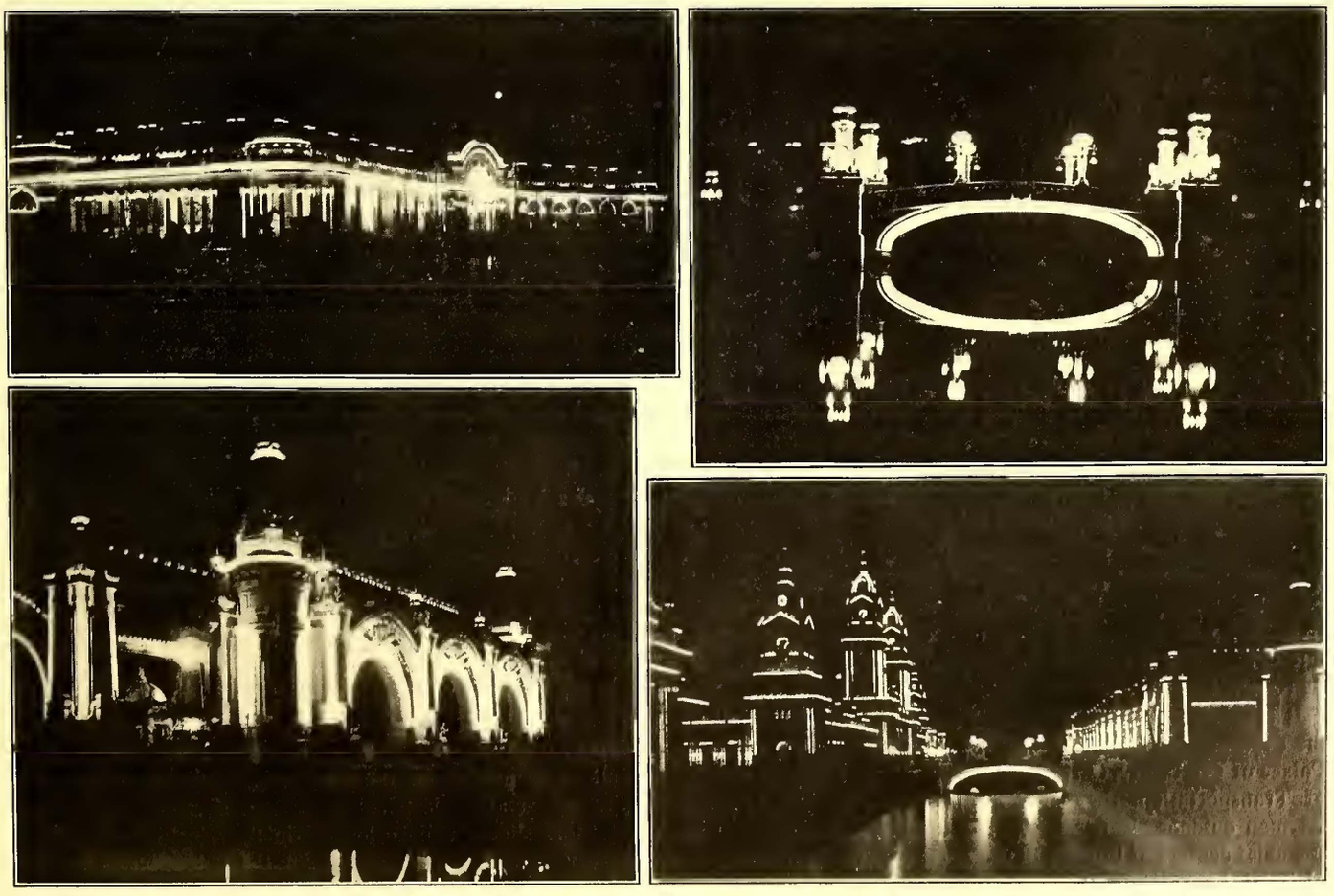
FESTIVAL HALL, IN WHICH THE STREET RAILWAY CONVENTION IS TO BE HELD, COLONNADE OF STATES IN REAR

MACHINERY HALL, THE TRANSPORTATION BUILDING AND THE PALACE OF ELECTRICITY FROM FESTIVAL HALL

Necessarily, in a scheme so broad in its scope as that which has grown out of a small beginning, through the diligent efforts of the Electric Railway Commission, a great many observers and computers will be required to make the work a thorough success. To this end, about thirty young engineers will be on duty during the summer and fall assisting in making records, and in keeping the derived results constantly abreast of what may be termed the "field work." In all, therefore, the undertaking is sufficiently broad and sufficiently well safeguarded to meet the ideas of the most exacting.

The scope of the tests, as related to the equipments to be tested, is as broad as is the scheme gaged from other aspects. All types of electrical apparatus used in the operation and

MAIN ENTRANCE TO MACHINERY HALL



TYPICAL VIEWS OF BUILDINGS TAKEN AT NIGHT

control of electric cars and railway systems come under the plan and scope of the tests, consequently a large variety of apparatus must be investigated, whether it relates to general operation, individual control, multiple control, train despatching, or other matters. All standard systems coming under the head of direct-current equipments and systems coming under the head of alternating-current equipments are at present being arranged for exhibit at the Exposition. The field will be covered very broadly, and the electric railway fraternity at large will have cause for congratulation in reviewing the very broad presentation which is given to this department of engineering work. Probably, no more general classification of electric railway items, ranging from light to very heavy equipments, has been brought together.

Thirteen different systems of electric railway apparatus are displayed for operation and test in the Palace of Electricity, and, at the present writing, nine additional systems are submitted for outdoor operation on the electric railway test tracks; and all this has been arranged and provided by the voluntary action of the parties interested, each working largely without the knowledge of the plans of the others.

Now that a more definite statement can be made it is to be expected that the manufacturers of electrical apparatus will supplement their voluntary offerings with a more comprehensive display of their apparatus, in order that city, suburban, interurban, heavy traction and special systems may be fully represented.

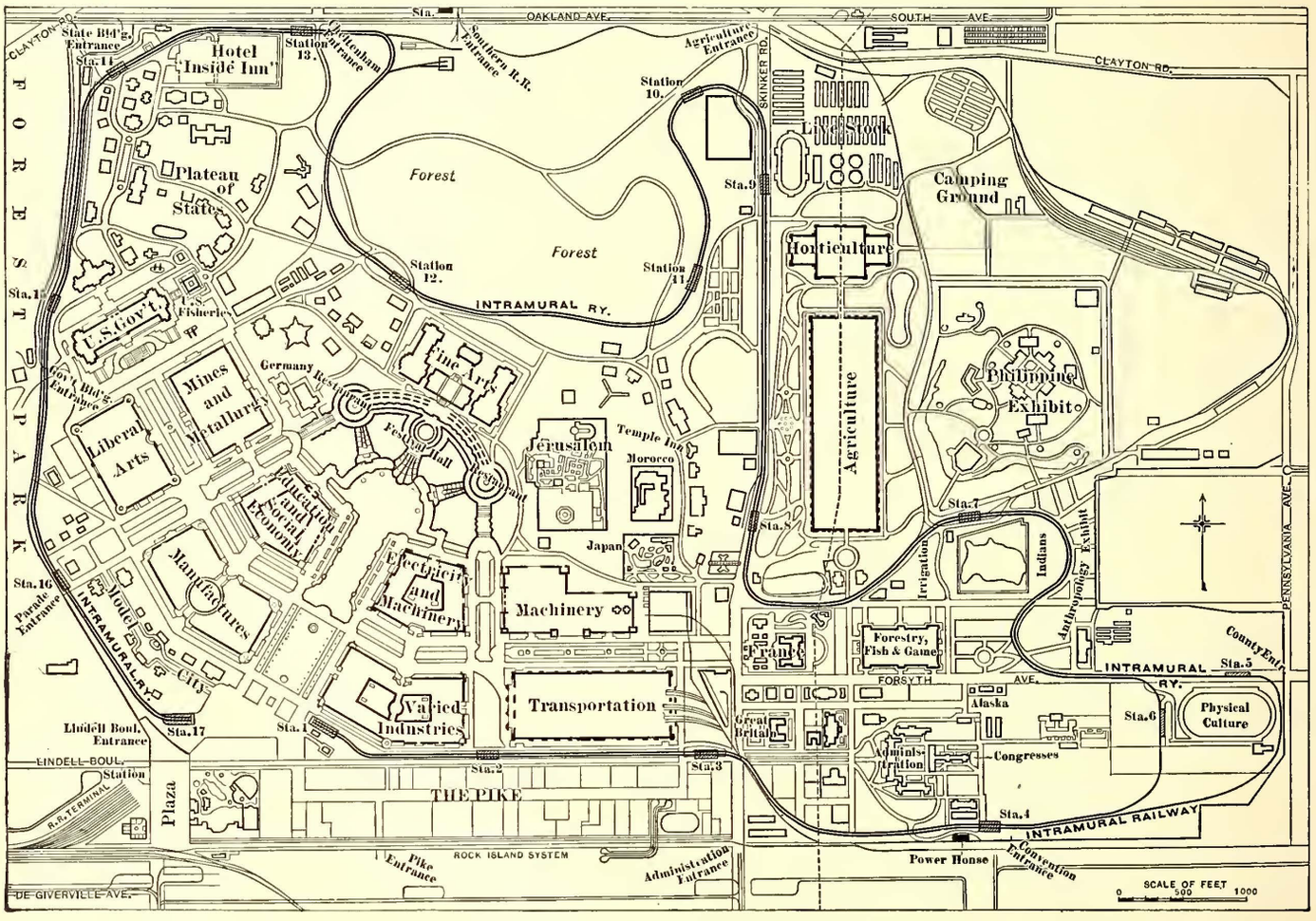
It is unnecessary here to catalogue, in itemized form, all of the apparatus which will be shown. Suffice it to say that the Palace of Electricity, the electric railway test tracks, the Palace of Transportation, the outdoor mining installation, and the German outdoor electric railway train control exhibit, will be the chief centers of interest to the electric railway public which visits St. Louis this year.

STREET RAILWAY INTERESTS AT THE FAIR

The great Exposition formally opened at St. Louis last Saturday will probably, before the season closes on Dec. 1, be visited by no small proportion of the electric railway men of the country. The decision to hold the next convention of the American Street Railway Association at St. Louis next October, and the holding of the electrical congresses in September, all serve to add to the general interest that electric railway men must feel in the great international show at St. Louis.

It would be useless to attempt here to review all the features of popular interest at this Exposition, and these remarks must, of necessity, be confined to an outline of the things of interest to the electric railway man in his profession.

First of all, to give a general idea of the arrangement of the



MAP OF THE EXPOSITION GROUNDS

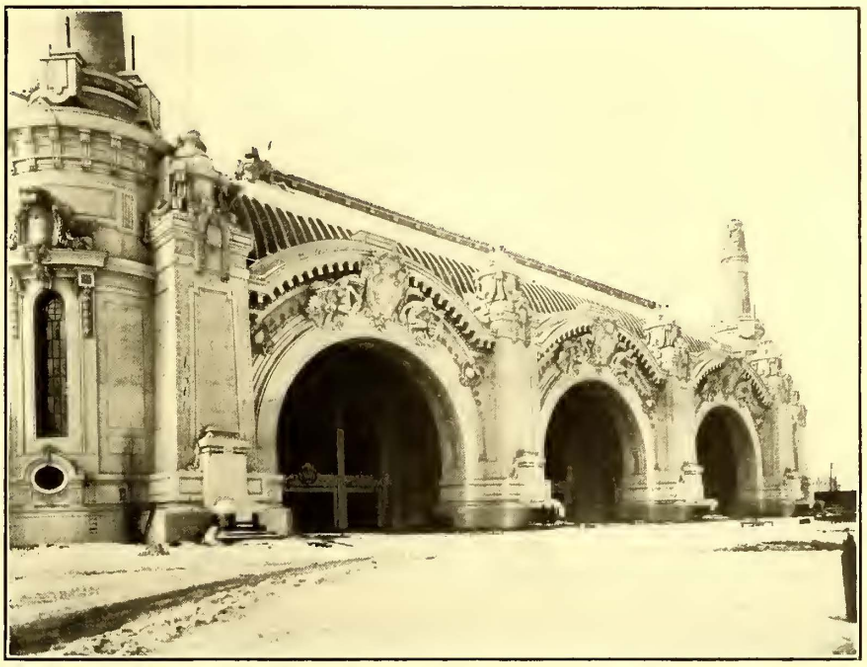
Exposition the accompanying map can be studied. The main courts and buildings radiate like a fan from Festival Hall and the Cascades, which form the central features of the main panorama. Most of the main buildings, which are on these three radiating courts, are on low, level ground, while Festival Hall is on high ground on the edge of a bluff. The Cascades, which are a series of artificial waterfalls in front of Festival Hall, start at the foot of Festival Hall, and the water falls, step by step, to a lagoon in front of the Cascades. Three large courts radiate from the Terrace of States, of which Festival Hall is the center.

On the west court are located the Electricity and Machinery Buildings and the Transportation Building, which will be the points of most interest from the electrical railway man's standpoint. The exhibit in the Electricity Building will consist mainly of smaller electrical apparatus, as most of the large generators shown will be located in the Machinery Building, where they will furnish power for the operation of the Exposition. The Machinery Building is the power house of the

Exposition. Here is located a service plant of 8000 kw, and also an exhibitor's power plant, consisting of engines and generators furnished by the different exhibitors, and all arranged to supply power for exposition purposes. All the steam for engines in the Machinery Building is furnished from a boiler house, known as the Steam and Fuels Building, just west of Machinery Building. This arrangement, which is shown on the map, has necessitated some excessively long steam pipe lines, amounting in some cases to several hundred feet, for units of considerable size. Adjoining Machinery Building on the north is the Transportation Building. This building is devoted mainly to track space for exhibits of rolling stock; in it electric railway trucks and car bodies will be shown, and also some electrical apparatus. The electrical apparatus, however, comes under charge of the Department of Electricity. Just north of the Transportation Building are two test tracks, to be used in electric railway testing. One of these test tracks is 1400 ft. long, and the other 2000 ft. The shorter one will be used for testing slower speed apparatus on short distance runs, and the longer track for testing high-speed apparatus. This is the first Exposition at which the actual testing of electric railway apparatus offered for exhibit has been attempted on a large scale. The plans of the electric railway test commission are discussed elsewhere in this issue by Prof. W. E. Goldsborough, chief of the Department of Electricity, and were also described in the issues of March 26 and April 23, 1904.

THE INTRAMURAL RAILWAY

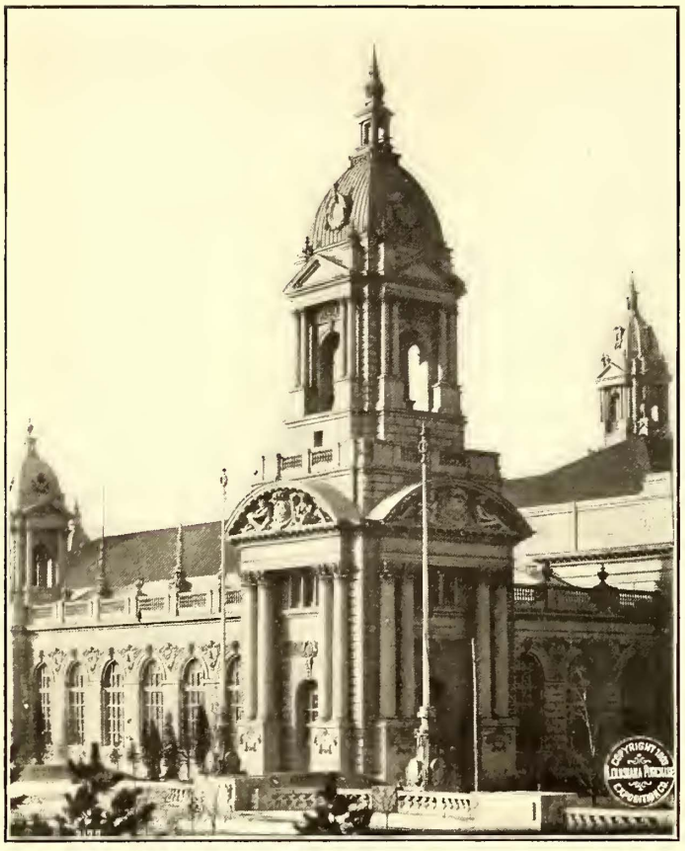
The Intramural Railway, which will furnish local transportation in the Exposition grounds, is located so as to form a kind of outer belt line around the principal portion of the Exposition. The necessity for an intramural railway at the Exposition will be apparent when it is stated that the Exposition grounds cover about 1240 acres, as against 633 for the



ENTRANCES TO TRANSPORTATION BUILDING

Copyright 1904, Louisiana Purchase Exposition Co. A CORNER OF THE PALACE OF ELECTRICITY

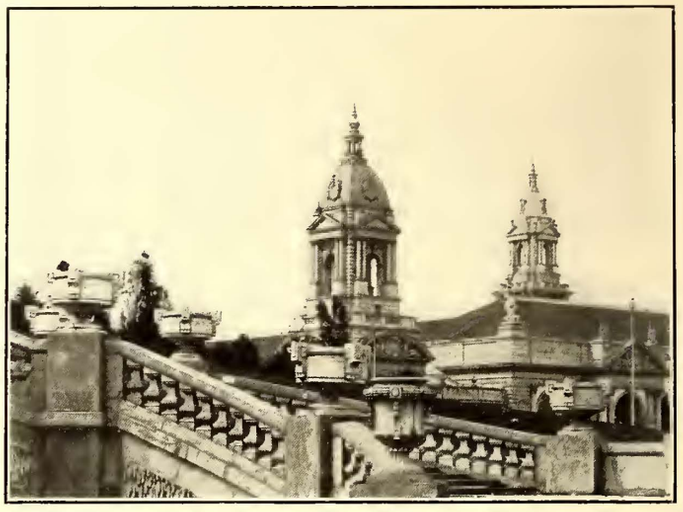
World's Columbian Exposition at Chicago, and everyone who visited Chicago became fully aware of the great distances within that Exposition, and the necessity for intramural transportation. The original plans for this intramural railway were drawn up by C. V. Weston, C. E., of Chicago. They have been altered somewhat by cutting down the amount of elevated structure at first planned and in the general adoption of a construction that calls for less investment.



A CORNER OF MACHINERY HALL

GENERAL VIEW IN MACHINERY HALL

The route of the road has been planned so that a great amount of elevated structure is not necessary. It is approximately 10 miles around the grounds by this line, and there are sixteen stations at the various entrances and spaced conveniently along the track. Starting near the main entrance, whence a view of the Grand Basin and Festival Hall may be had, the cars pass between "The Pike" and the Varied Industries and Transportation Buildings. Then they wind about through the buildings at the western end of the grounds, turning the corner of the Great Agriculture Building and coming out upon the wooded sections beyond. After a stop at the Fine Arts Building, the cars make their way to the extreme northeastern corner of the grounds, skirt the Government, Liberal Arts and Manufactures Buildings, and finally return to within a short distance of the starting point.



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TOWERS OF MACHINERY HALL FROM THE APPROACH TO THE CASCADES

This railway is owned and operated by the Exposition Company, which expects to carry hundreds of thousands of people on it during the spring and summer. Besides being a convenience and an object of interest for the general public, it serves also as an important industrial exhibit, because it will show an electric railway of the most advanced type, its carrying capacity and efficiency taxed to the utmost. In spite of the fact that the road passes all of the important buildings on the grounds it does not obtrude itself on any of the important vistas of the Exposition. This, to a certain extent, puts the road in out-of-the-way places, but the location of any intramural railway in any Exposition must always be a matter of compromise between sightliness and utility. The road will be operated like an elevated railroad, with fifty-two semi-convertible cars running in trains.

Starting at the station at the left of this entrance, the road runs a private right of way for a short distance on the surface, but soon mounts an elevated structure which brings it to the level of the bluff, where it operates on the surface or in cuts among the wooded portion of the grounds, remaining on the high ground until reaching the west end of the belt, where it again descends to the lower ground, finally terminating on a slightly elevated embankment back of the Transportation and Varied Industries Buildings.

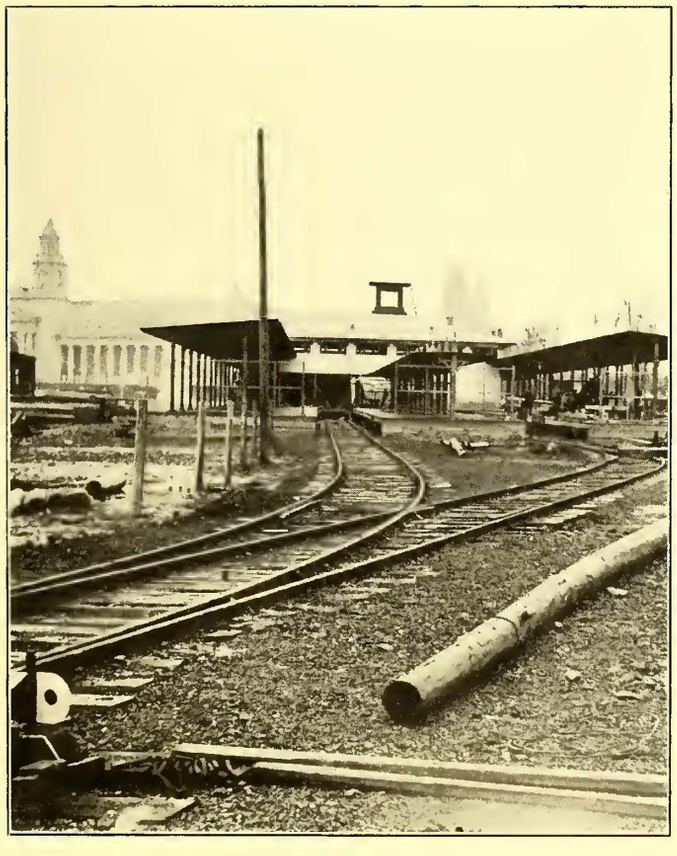
The cars are being built by the St. Louis Car Company, and are very similar to those which this company has built for the Chicago City Railway Company and for the St. Louis & Suburban Railway Company. They are a type which is becoming quite common, and of which a large number have been built. The length of body is 34 ft., and the platforms are 5 ft. long, making the car 44 ft. over all. These intramural cars, however, are not equipped with steps, as they will be loaded and unloaded at station platforms only. The motor equipment is four G. E.-70 motors, and the type-M train control will be used. Cars will be run in trains of three. There are no vestibule doors, platform gates being used in their place. The Christensen multiple-unit air-brake system and Van Dorn's couplers are used. The wheels are the Shoen solid forged and rolled steel wheels. The cars being a standard type for street railway use, can be sold to best advantage after the Fair is over, as it will only be necessary to add steps to adapt them to regular street railway service.

The roadbed is for the greater part on the surface, is cinder ballasted, of standard steam railway construction, 65-lb. rails and standard gage.

The power plant for the intramural occupies a space of about 10,000 sq. ft. in the Machinery Building. It is seen on approaching the main entrance of the building, and is one of the most striking electrical exhibits on the grounds. This will be described below. The equipment for furnishing power for the intramural line was supplied by the Crocker-Wheeler Company, and consists of seven units, having a combined generating capacity of 3500 kw. Each unit is a standard Crocker-Wheeler railway type generator, direct-connected to the prime mover.

There is one unit of 900-kw capacity, running at 100 r. p. m., and driven by a Buckeye cross-compound steam engine. A 600-kw generator, running at 85 r. p. m., is driven by a Lane & Bodley horizontal cross-compound 20-in. x 40-in. x 54-in. engine. Three units are of 500-kw capacity each, one with a speed of 100 r. p. m., and driven by a 26-in. x 48-in. single-cylinder rolling-mill type of Corliss engine, manufactured by the Murray Iron Works, the other two being driven by Brown-Corliss vertical cross-compound engines, at a speed of 135 r. p. m. The sixth unit is of 400-kw capacity, at 150 r. p. m., and uses a Harrisburg horizontal tandem compound 15-in. x 40½-in. x 26-in. engine. The last generating unit in the series is driven by a Doble water-wheel, made by the Abner Doble Company, of San Francisco, the water pressure being furnished by a Jeansville Iron Works pump. The unit is of 100-kw capacity, and runs at 700 r. p. m.

BOILER HOUSE



ONE OF THE TERMINAL STATIONS OF THE INTRAMURAL RAILWAY

POWER PLANT IN MACHINERY BUILDING

The power plant in Machinery Building will undoubtedly be one of the most interesting collections of large prime movers ever assembled under one roof. Here the latest things in steam turbines and gas engines will be shown, as well as some of the largest types of reciprocating engines.

The sources of electrical energy for the operation of the Exposition may be divided into three classes. The service plant of the Exposition, installed by the Westinghouse interests, contains four units of 2000 kw each. The engines are vertical, compounding, condensing. Two of them drive 25-cycle, three-phase 6600-volt Westinghouse generators, and the other two drive similar General Electric generators.

A DOUBLE-TRACK TRESTLE ON THE INTERURBAN RAILWAY

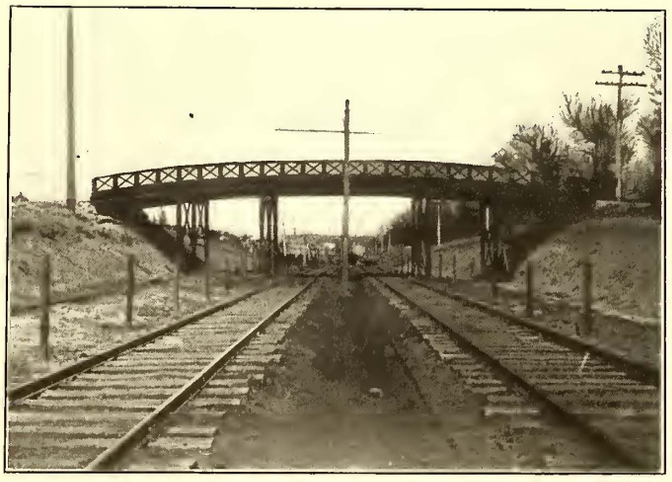
The Louisiana Purchase Exposition Company has also a contract with the Union Light & Power Company, of St. Louis, to supply 7500 kw in 25-cycle, three phase 6600-volt current.

The capacity of the exhibitors' power plant, which consists of the miscellaneous engines and generating units supplied by

various exhibitors, will probably total in the neighborhood of 8000 kw, in 6600-volt, 25-cycle, three-phase current; besides this, there is 3400 kw in 500-volt, direct-current machinery, part of which will be used to drive the intramural railway.

Most of the power for the Exposition will be transmitted about the grounds at 6600 volts, three-phase, and transformed at sub-stations in the larger buildings into the character of current needed for different purposes.

All of the larger engines in Machinery Building are designed to be operated condensing. The condensers in the Westinghouse service plant are supplied with cooling water by a set of cooling towers, placed along the east wall of the boiler house. The centrifugal circulating pumps and the fans for these cooling towers are driven by high-speed engines, located in the boiler house. The balance of the condensing water for the engines in Machinery Building is taken from the lagoons. The discharge water from the condensers passes into a conduit 1100 ft. long, which runs under the lagoons, and terminates at the suction of the pumps which supply the cascades. There



CROSS ROAD IN PARK OVER INTRAMURAL RAILWAY

are three centrifugal pumps for Cascades. Each pump is driven by a 2000-hp induction motor. The hot water from the condensers being taken by these centrifugal pumps and raised to the top of the Cascades is cooled by falling down the Cascades, and thus the Cascades serve as a cooling tower for the condensing water as well as an important part of the Exposition landscape.

The switchboard at the west end of Machinery Building, where the distributing feeders of all the 6600-volt, three-phase, 25-cycle current are controlled, is an interesting piece of switchboard construction. It occupies two floors of a gallery, the lower floor being given up to brick bus-bar compartments, and the upper floor having the oil switches and control board.

ENGINEERING AND ORGANIZATION

The construction and operation of the Exposition is under the charge of Isaac S. Taylor, director of works. Henry Rustin, mechanical and electrical engineer, made the plans for the electrical service features and decorative lighting, but illness compelled him to retire from all active work, and his position was assumed later by E. B. Ellicott, city electrician of Chicago, who has been in active charge since last December.

The Department of Exhibits is under the direction of F. J. V. Skiff. The exhibits in the Machinery Building and in the boiler house come under Thomas M. Moore, chief of machinery. The electrical exhibits in Electricity Building and the electric railway apparatus, such as motors and controllers that may be exhibited in Transportation Building, are in charge of Professor W. E. Goldsborough. The Transportation exhibits, with the exceptions noted, are under Willard Smith.

EXECUTIVE COMMITTEE MEETING OF THE ACCOUNTANTS ASSOCIATION

The executive committee of the Street Railway Accountants' Association of America met at the offices of Auditor F. E. Smith, of the Chicago Union Traction Company, on April 30, and made plans for the convention in St. Louis next October. Those present were: President F. E. Smith, of Chicago; Secretary W. B. Brockway, of Yonkers, N. Y.; C. O. Simpson, of Birmingham, Ala.; J. J. Magilton, of Schenectady, N. Y.; H. J. Davies, of Cleveland; S. C. Rogers, of Youngstown, Ohio, and H. M. Pease, of Buffalo.

Thirteen new members were voted into the association, viz., Youngstown & Southern Railway Company; Cleveland, Painesville & Eastern Railroad Company; Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company; Northern Texas Traction Company; Cleveland, Painesville & Ashtabula Railway Company; Pennsylvania & Mahoning Valley Railway Company; Lima Electric Railway & Light Company; Indiana Northern Traction Company; Knoxville Traction Company; Niagara, St. Catherines & Toronto Railway Company; New Jersey & Hudson River Railway & Ferry Company; Boise Traction Company; Norfolk Railway & Light Company.

The accountants' convention will be held Thursday, Friday and Saturday, the last three days of street railway convention week at St. Louis, Oct. 13, 14 and 15, following the American Street Railway Association convention. One session will be held each day. The first day's session will be held at the Inside Inn. Those of the following two days probably at Festival Hall.

On the first day, a report, prepared by a joint committee of the accountants' and master mechanics, will be taken up. This report will be on shop records and accounts. H. M. Pease, of Buffalo, and W. G. McDole, of Cleveland, will represent the accountants in preparing this report, while the master mechanics will be represented by H. H. Adams, of Baltimore, and H. E. Farrington, of Chelsea, Mass. It was decided to make a question box a feature of this convention, and the secretary will invite members to file questions they may wish answered with him before July 1. The identity of the questioners will be kept confidential. The questions will be sent to members for reply, and the answers presented in pamphlet form and discussed at convention.

The report of the committee on collection of blanks by Elmer M. White, of Hartford, will be a feature of the meeting.

The matter of a headquarters hotel was left to a committee, consisting of President F. E. Smith and F. R. Henry, of St. Louis.

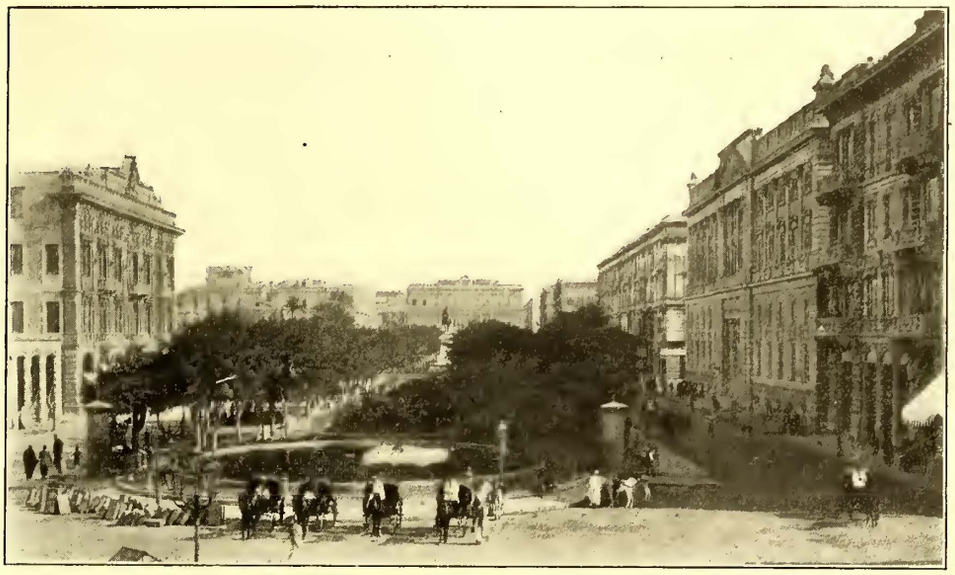
The inauguration of a question box this year adds still more to the practical value of membership in the association. Secretary Brockway has recently sent out a very neat little book, calling attention to the advantages of membership in the association, and it has been instrumental in adding a number of names to the membership.

The long standing action of the city of Montreal against the Montreal Street Railway Company, involving percentages on the company's earnings, has been decided by the Supreme Court in favor of the city. The immediate amount covered by the decision is only about $15,000, but the judgment will affect the earnings during the twenty years of the unexpired franchise. By the agreement under which it secured a franchise in 1892, the company contracted to pay the city a percentage of the net earnings of its system, at the rate of 4 per cent for the first million dollars, and increasing to 15 per cent on all profits over $3,000,000. In 1893, however, the company refused to recognize this agreement as including lines outside the city limits, and withheld the percentages thereon from that date forward. The suit by the city followed this action.

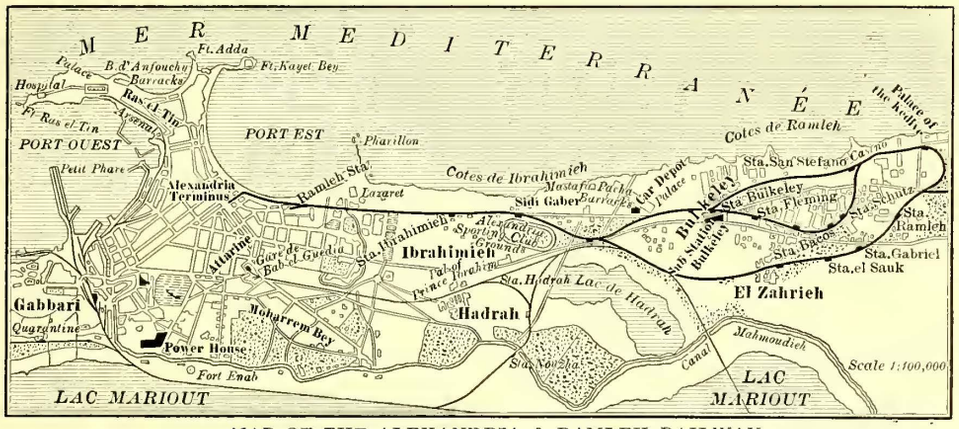
A NEW ELECTRIC RAILWAY IN ALEXANDRIA, EGYPT

Approval of the electrical method of railway operation in the Far East is again made evident by the recent electrification of the Alexandria & Ramleh Railway, an old steam-operated road running out of Alexandria, Egypt, and in connection with this the installation of electric traction upon the lines of the Alexandria Tramway Company. An equipment which is strictly modern in every particular has been installed upon the combined system, partaking of the salient features of the most recent electric railway practice; notable among many interesting features may be mentioned a high-voltage alternating-current transmission system with rotary converter sub-stations and the use of compound condensing engines of a highly efficient pattern in the power plant.

The Alexandria & Ramleh Railway is one of the oldest roads in Egypt, some of the original equipment of locomotives and cars, which were built in 1866, being still in service on other lines; it also has the distinction of being the second railway in Egypt to be changed over to electric traction. It has long been one of the important roads of this country, operating mainly for passenger traffic between Alexandria and the points of Ramleh and Boukir on the coast of the Mediterranean Sea. The change to electric traction was begun by the company in March, 1903, and was completed in December last. The results of the electrification of this road have already proven more than satisfactory, the earnings of the system having increased by 33 per cent in the first month, and the outlook is very favorable for a heavy and profitable traffic.



VIEW OF THE ALEXANDRIA TERMINAL OF THE LINE



MAP OF THE ALEXANDRIA & RAMLEH RAILWAY

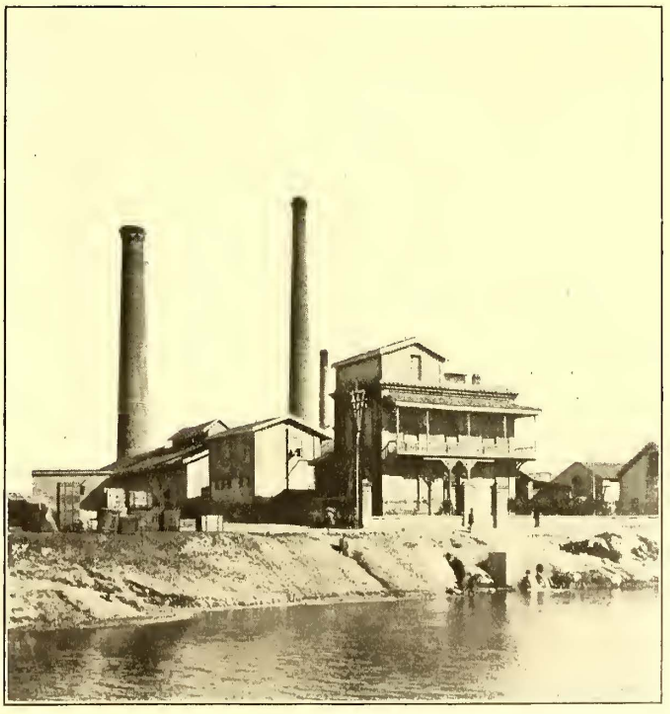
The route of the system is shown in the accompanying detail map of the city of Alexandria and its environs. The main line from Alexandria to Ramleh is a straight double-track line, while in Ramleh the line makes two loops through different portions of the city. The main line from Alexandria to Ramleh is double track with center-pole overhead-line construction. Eighty-six-pound rails are used in the track onstruction, being laid to standard gage (4 ft. 8½ ins.), with ties spaced 36 ins. apart. This provides an unusually heavy track system for electric railway work. The rail-joints are bonded for the return circuit with the Crown bonds, and every third pair of rails are interconnected by cross bonding.

THE POWER PLANT

As may be seen from the view of the power plant it is conveniently located for access to an abundant supply of water for condensing purposes, being located at Karmous upon a canal leading from the sea inland. The plant is situated some distance from the points of power consumption, which made necessary a high-voltage transmission system; this is provided for by a high-tension three-phase alternating-current distribution system, from which rotary converters are operated at sub-stations to deliver the direct-current supply to the trolley wires.

The steam generating equipment of the plant consists of ten boilers of the elephant type, arranged as illustrated in the accompanying illustration of the boiler room. They are designed to operate at a steam pressure of 135 lbs. per square inch. They are hand-fired, using bituminous coal, and are equipped with Green economizers for the heating of feed water. The boiler feed and other pumps used in the plant are Worthington pumps.

The engine equipment consists of



VIEW OF THE POWER PLANT AT KARMOUS

Two horizontal tandem-compound condensing engines, each of which operating at 107 r. p. m., with a steam pressure of 135 lbs., develops 800 hp. These engines were designed particularly for use with alternating-current generators, being guaranteed not to vary in angular velocity more than one-fourth of 1 per cent per revolution under constant load; the governor is of the Porter high-speed type, and is arranged so that the speed of the engine may be changed by sliding a weight upon the governor lever. The engines were built by Franco Tosi, Legano, Italy.

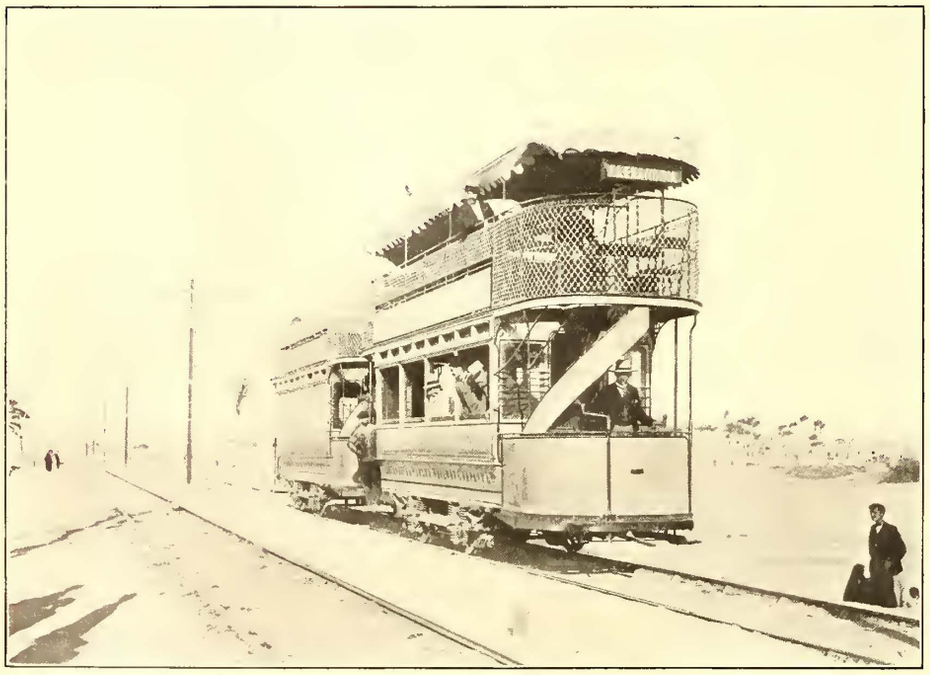
The engines each have cylinders of 600 mm (23.6 ins.) and 975 mm (38.4 ins.) in diameter, with common stroke of 1200 mm (47.3 ins.). They are designed for operation with superheated steam, and have special features of jacketing; all the cylinders and heads are jacketed, through which jackets the steam entering the low-pressure cylinder is carried. Each cylinder has four separate valves of the poppet type for the steam distribution; the high-pressure inlet valves are two-seated, and all of the others four-seated, to shorten the travel and permit quick closure without throttling the steam. A feature of these engines is that the low-pressure piston is easily accessible for inspection or repairs from between the two cylinders. Effective lubrication is provided for journals, guides, etc., by means of a gravity system, with elevated oil tanks in the engine room for gravity flow.

The condensers, which are located beneath in the basement, are mechanically operated from the main engines by means of beams and connecting rods to the main crank pins. The air pumps are arranged vertically in a single body for each engine, and are of the duplex single-acting type. Suction valves are omitted, whereby the resistance to the entering water is reduced and the pumps tend toward noiseless operation.

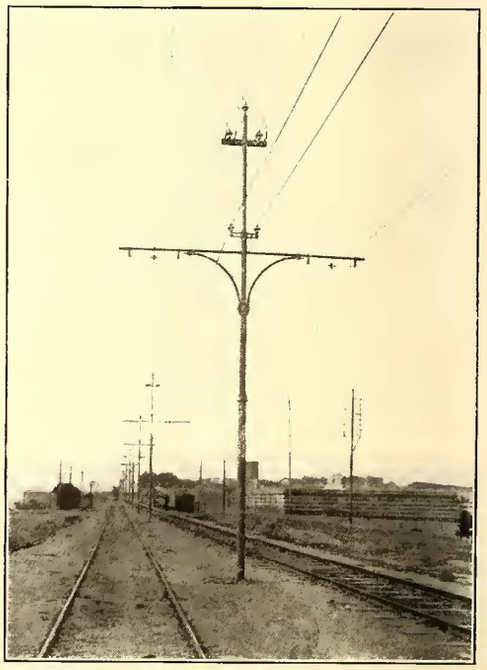
Each engine is direct-connected to a 600-kw Brown, Boveri & Company three-phase alternating-current generator, operating at slow speed for 25 cycles. They are of the high-tension revolving field type, delivering current at 6500 volts. The generator circuits, as well as the feeder and exciter circuits, are controlled from a convenient black marble switchboard, which is equipped with Weston measuring instruments and Brown, Boveri oil switches.

ANCIENT METHOD OF TRANSPORTATION IN EGYPT. "LADIES ONLY"

VIEW OF THE HOTEL AND CASINO OF THE COMPANY AT RAMLEH



VIEW OF THE MAIN LINE AND TYPE OF DOUBLE-DECK CARS USED, SHOWING FIRST-CLASS MOTOR CAR AND SECOND-CLASS TRAILER

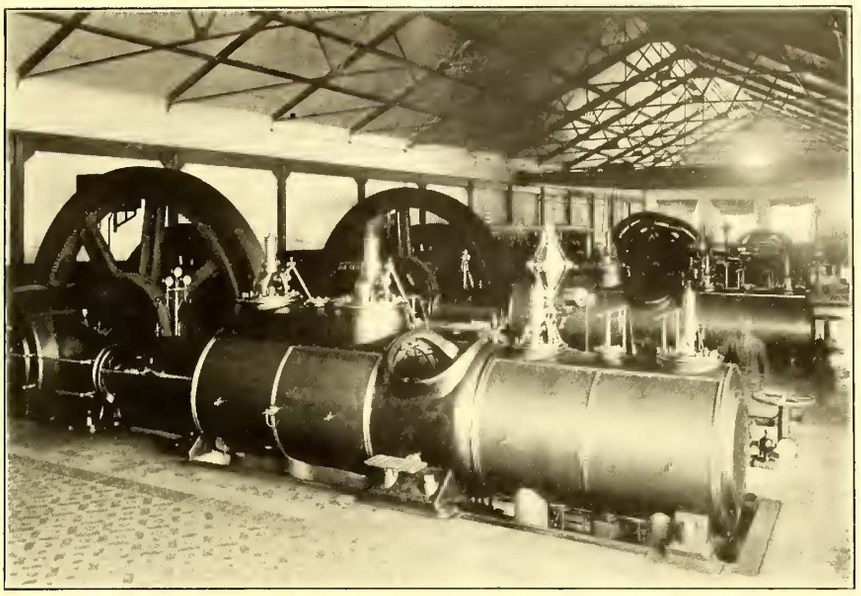


VIEW OF LINE CONSTRUCTION, SHOWING ALSO HIGH-TENSION TRANSMISSION LINE

SUB-STATIONS

There are two sub-station equipments for supplying direct

current to the trolley wires at the line voltage of 500 volts, the main station being located at Bulkeley and the other in the main power power station at Karmous, as auxiliary to the main generators. The Bulkeley sub-station is located at the center of Ramleh, about 8 miles from the power plant, and contains three rotary converters, each of 300-kw capacity, and the necessary nine static transformers of 125-kw capacity, all of which were furnished by Brown, Boveri & Company. The sub-station equipment in the power plant at Karmous consists of one 600-kw rotary converter, which is so connected up that if an accident should occur to both of the main power generating units can be operated from the direct-current side with current from the direct-current generators of the Alexandria Tramway Company, located nearby, and thus deliver alternating current to the Bulkeley sub-station—this is a very convenient and desirable arrangement of apparatus under the existing circumstances.



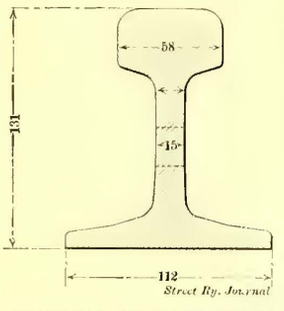
GENERAL VIEW OF ENGINE ROOM OF THE KARMOUS POWER PLANT

THE SUB-STATION AT BULKELEY

The Bulkeley sub-station has a neat, white marble switchboard, furnished with a complete equipment of Weston measuring instruments; Brown, Boveri & Company oil switches and Thomson-Houston circuit breakers are used upon the board.

OVERHEAD CONSTRUCTION

Current is led out from the power plant to the sub-station by two three-core cables with conductors each 50 mm (1.97 ins.) in diameter. These cables are of the paper-insulated type, designed for high voltage, and were supplied by the British Insulated Cable Company. They are metallic sheathed and are laid underground, on the slot system, at a depth of 70 cm (2.76 ins.) below the surface, as far toward Ramleh as the Sporting Club, where connection is made with an aerial line. From this point the high-tension feeders are carried to the Bulkeley sub-station upon the center poles of the system which are used to carry the trolley brackets; they are mounted upon porcelain insulators, upon cross-arms and pole tops, as shown in the view of the line and double-deck cars. A notable feature of this high-tension line is the provision of automatic grounding forks, under each line wire upon both sides of each insulator; in this way if a high-voltage wire breaks it drops into the fork, and is immediately grounded and rendered harmless.

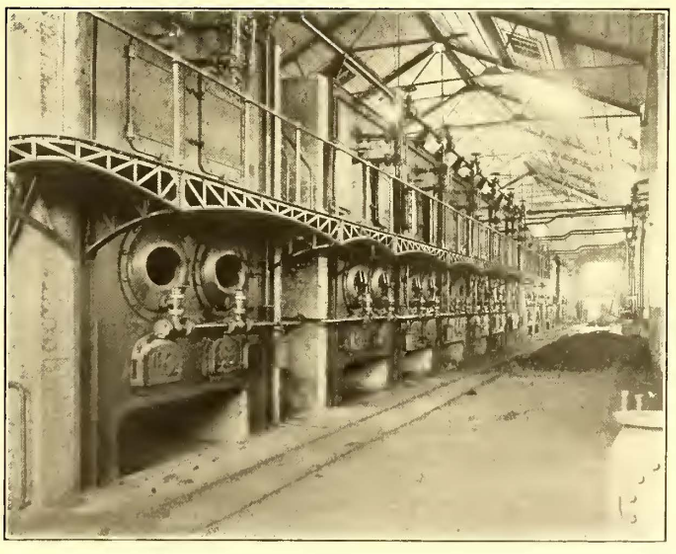


SECTION OF RAIL USED

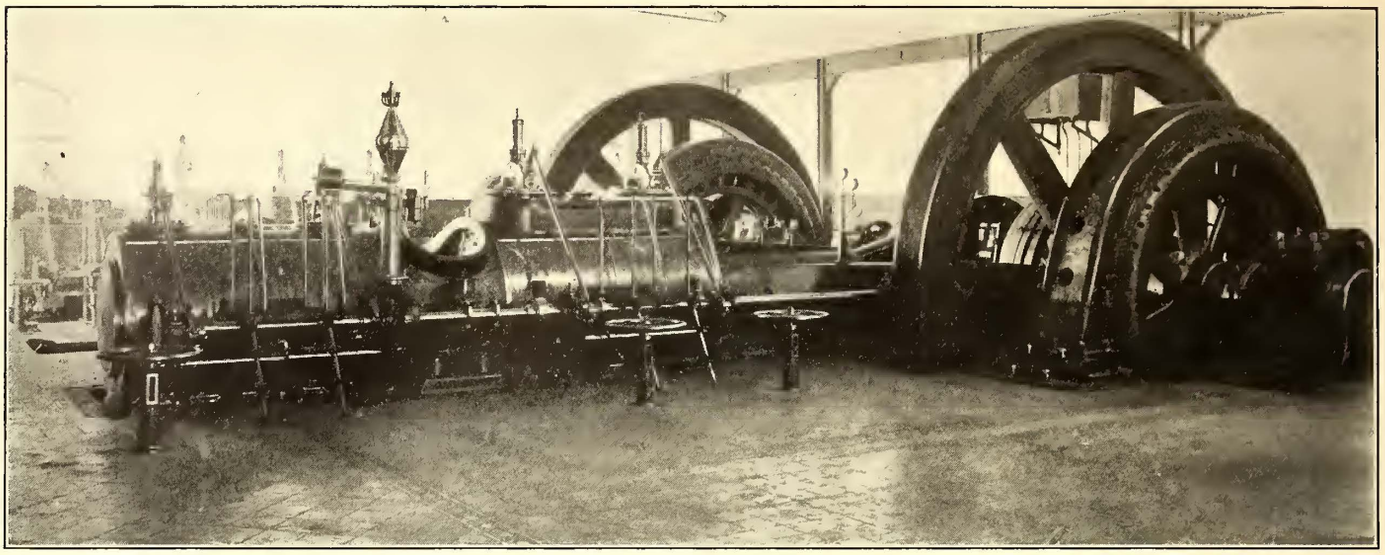
The important features of the trolley-line overhead construction may be seen from the accompanying line views. The center poles are of steel, supplied with particularly heavy bracket construction; the method of erecting is well shown in one of the detail photographs. The size of trolley wire used is No. 000, and the feed wires are No. 0000; all the trolley and feed wire was supplied by Roebling's Sons Company. The line material throughout, including line insulators, trolley frogs, breakers, etc., was supplied by the Ohio Brass Company, of Mansfield, Ohio.

CAR EQUIPMENT

The car equipment consists of fifty first-class and fifty second-class cars, all of which are of the double-deck type, corresponding with modern European practice. This is of particular interest at present to American street railway interests in view of the present



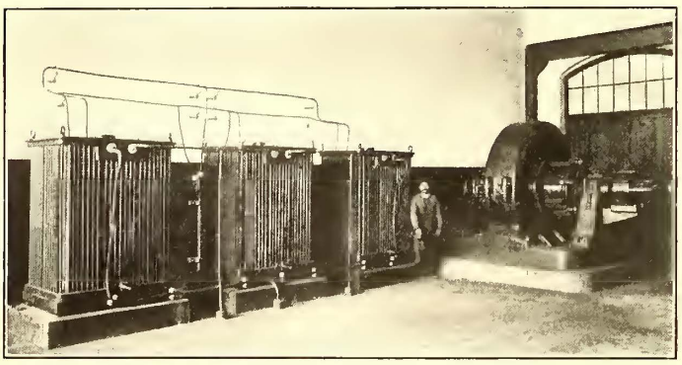
THE BOILER ROOM OF THE KARMOUS POWER PLANT



THE 600-KW GENERATING UNITS AT THE KARMOUS POWER PLANT

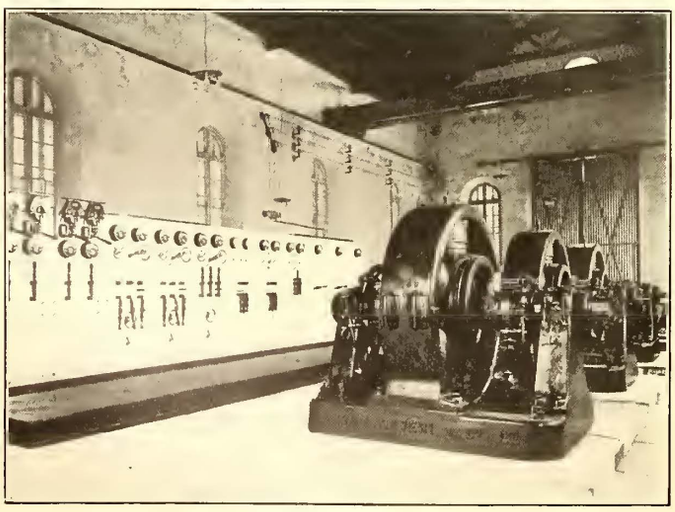
agitation that is being raised with reference to the use of double-deck cars.

The first-class cars are beautifully upholstered in royal blue and rattan cushions; they are finished with roller blinds and veneer roofing of Canadian maple, all highly polished. The second-class cars differ from the first-class ones only in the



THE SUB-STATION EQUIPMENT IN THE MAIN POWER PLANT

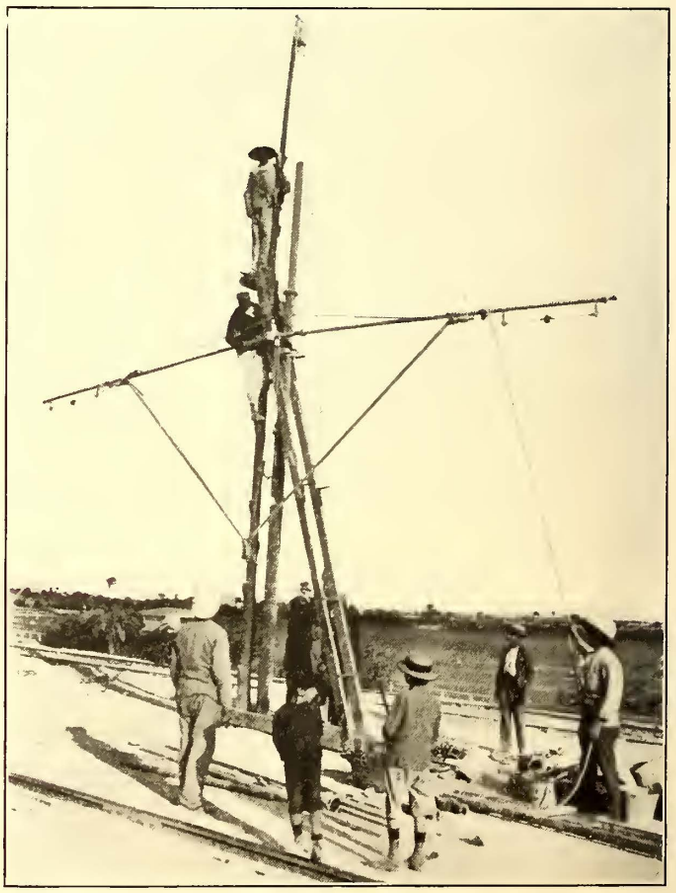
matter of finish, being furnished with plain seats instead of upholstered. The length of body of the cars is 18 ft. inside of posts, while the length of platform is 4½ ft. The seating capacity of each car is twenty-four inside and thirty-four upon the second deck, making a total of fifty-eight. The cars were built



SWITCHBOARD AND ROTARY CONVERTERS AT THE BULKELEY SUB-STATION

by the British Electric Car Company, of Manchester, and are equipped with McGuire trucks.

The first-class cars only are equipped with motors, the second-class cars being used as trailers, as shown in the view of the line and cars. The electrical equipment of each first-class car consists of two 35-hp motors, which is designed to give them a speed capacity of 30 m. p. h. These motors are the



LINE CONSTRUCTION DURING STEAM TRAIN SERVICE UNDER CLOSE HEADWAY

standard 3A-4 motors, built by Dick, Kerr & Company, Preston, England, and are of the usual heavy tramway pattern, with four-pole fields and slot-wound armatures, having four turns per coil and forty-one coils per armature. These motors are capable of developing 35 hp under a one hour's rating. They are mounted in the usual manner and drive through single re-

duction gearing. A general repair shop and car house is provided for at Karmous, adjacent to the power plant, where all heavy repairing, such as wheel work and renewals and general overhauling of cars, including painting and finishing, will be done. This installation includes a foundry, a machine shop, a carpenter and pattern shop, and a paint shop, and is very fully equipped for prompt and efficient work.

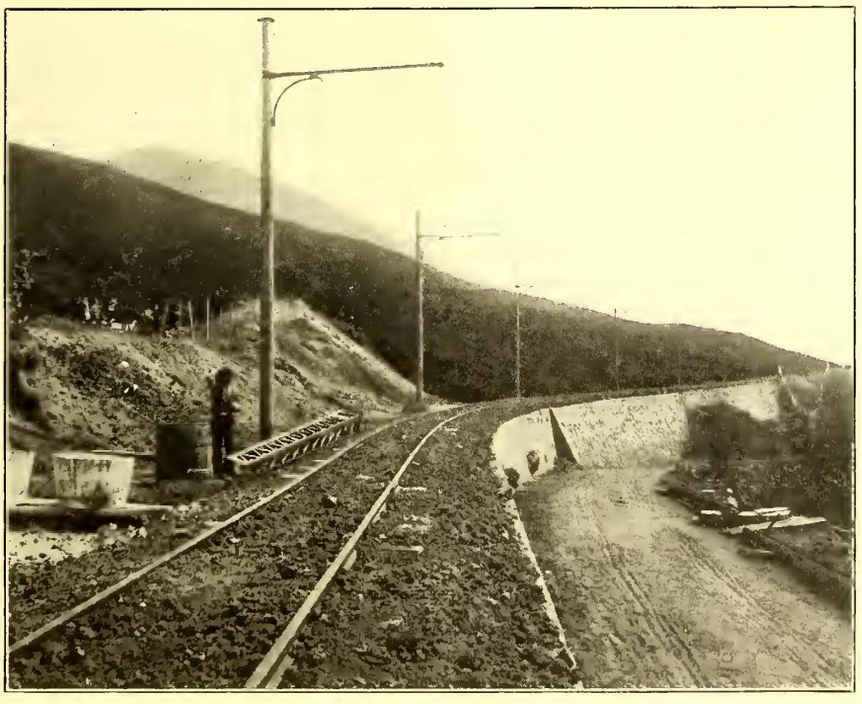
The main car storage house is located at Mustafa, near the Bulkeley sub-station, and has a capacity for storing seventy cars. This building is constructed of cut stone, with spacious and conveniently arranged interior and a substantial steel roof construction. It contains six tracks, each of which is built with a pit, and is equipped with Taylor pit jacks for the removal of motors.

This paper is greatly indebted for this information to Nelson Graburn, general manager of the road, through whose energetic efforts the entire installation was completed in nine months. The success of the new work was largely contributed to by the able and thorough co-operation of the chairman of the Alexandria & Ramleh Railway, H. E. Boghos Pacha Nubar, and of the chairman of the Alexandria Tram Company, J. Lumbroso.

THE NEW MT. VESUVIUS ELECTRIC RAILWAY

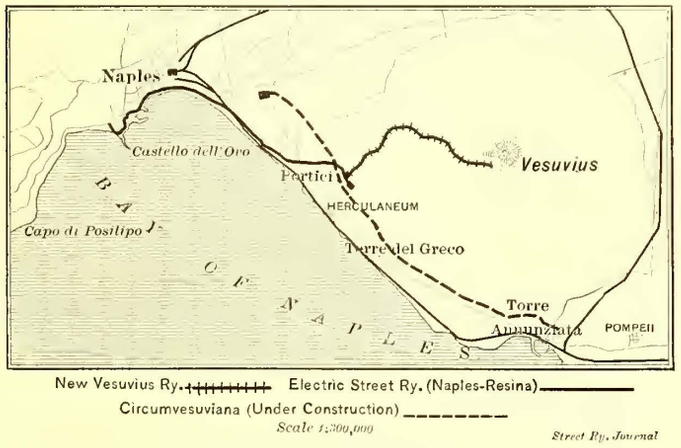
The problem of building a railway up Mt. Vesuvius is one that has had a peculiar fascination for the engineer. Its solution involves certain conditions that are not likely to occur again in Europe, for while that continent possesses several other active volcanoes, none of them is of such commanding importance and interest as Mt. Vesuvius. Its situation in one of Italy's most fruitful districts, and its nearness to a great city which for 3000 years it has never ceased to threaten with destruction, have helped to make Vesuvius a subject of perennial interest to the scientist and nature-lover alike.

The original Vesuvius line is a cable railway, which was built in 1880 by a Roman banking house, but which for some time has been owned by Thomas Cook & Sons, the well-known



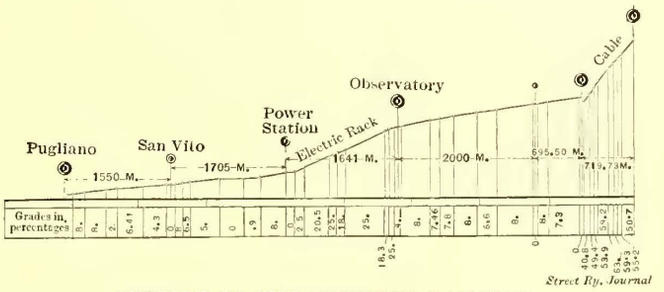
VIEW ALONG ELECTRIC RAILWAY, SHOWING RETAINING WALL

tourist agents. The line begins at the base of the lava cone, about 2450 ft. (749 m) above the sea, runs in an almost straight line up the steep, smooth sides of the cone and ends at a height of 3700 ft. (1182 m), in the vicinity of the old crater, and about 360 ft. (110 m) below the present crater. The grades on this line, which is practically a cable incline



MAP SHOWING PRESENT AND PROPOSED LINES IN THE VICINITY OF MOUNT VESUVIUS

road, range from 39 per cent to 63 per cent, measured on the tangent method, and average 54 per cent, a figure which is not



PROFILE OF THE VESUVIUS RAILWAY

reached by any cable railway in Switzerland. The construction difficulties on this line were due principally to the lack of good supporting soil, as the lava banks were seldom packed solid. It is worthy of note that while the line was under construction red-hot lava sometimes flowed down the mountain within 500 ft (150 m) of the workmen.

Owing to the heavy tourist traffic it was long recognized by Messrs. Cook that some better means for reaching the base of the cable railway from Naples should be provided than the long and expensive carriage trip which, from the time the cable road was started until recently, was the only method available. With this end in view they considered a number of plans for the construction of an electric railway, and finally adopted the suggestions of E. Strub, the well-known engineer of Zurich, Switzerland. Mr. Strub's plans embraced the employment of ordinary and rack sections, to be operated by electricity, at an approximate cost, including right of way and power station, of $237,500 (1,250,000 Fr.).

The length of the completed line from Resina to the base of the cable railway is 4.5 miles (7.5 km), and the distance can be covered in 48 minutes, including stops at the intermediate stations. It will be seen, therefore, that cars can be started from each end of the line at intervals of 35 minutes, which give twenty trains in each direction every 12 hours. Counting thirty passengers per car the daily capacity of the line would be 600 persons.

OBSERVATORY ON MOUNT VESUVIUS

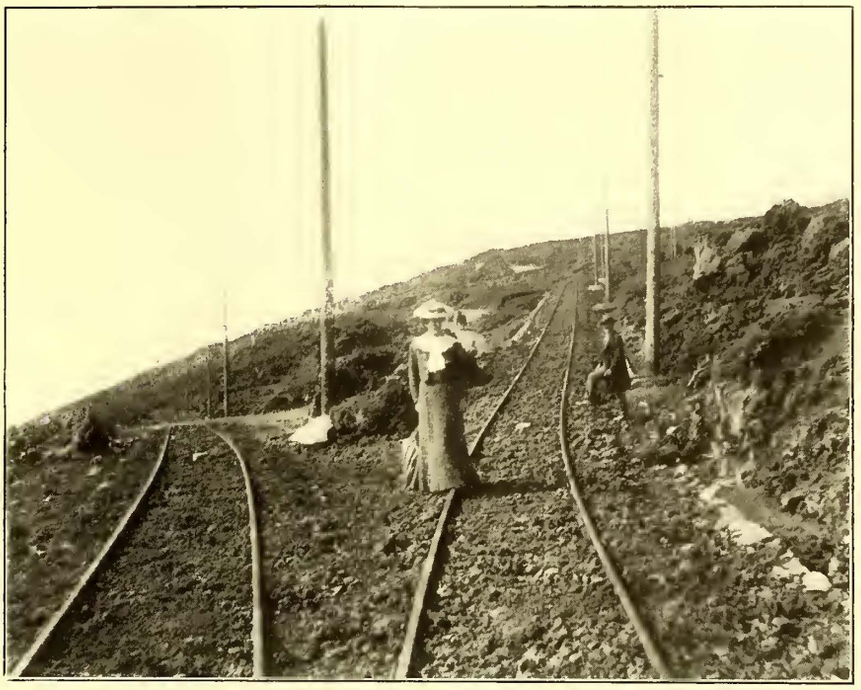
RESERVOIRS FOR RAIN WATER

APPROACH TO THE LOWER STATION OF THE CABLE RAILWAY

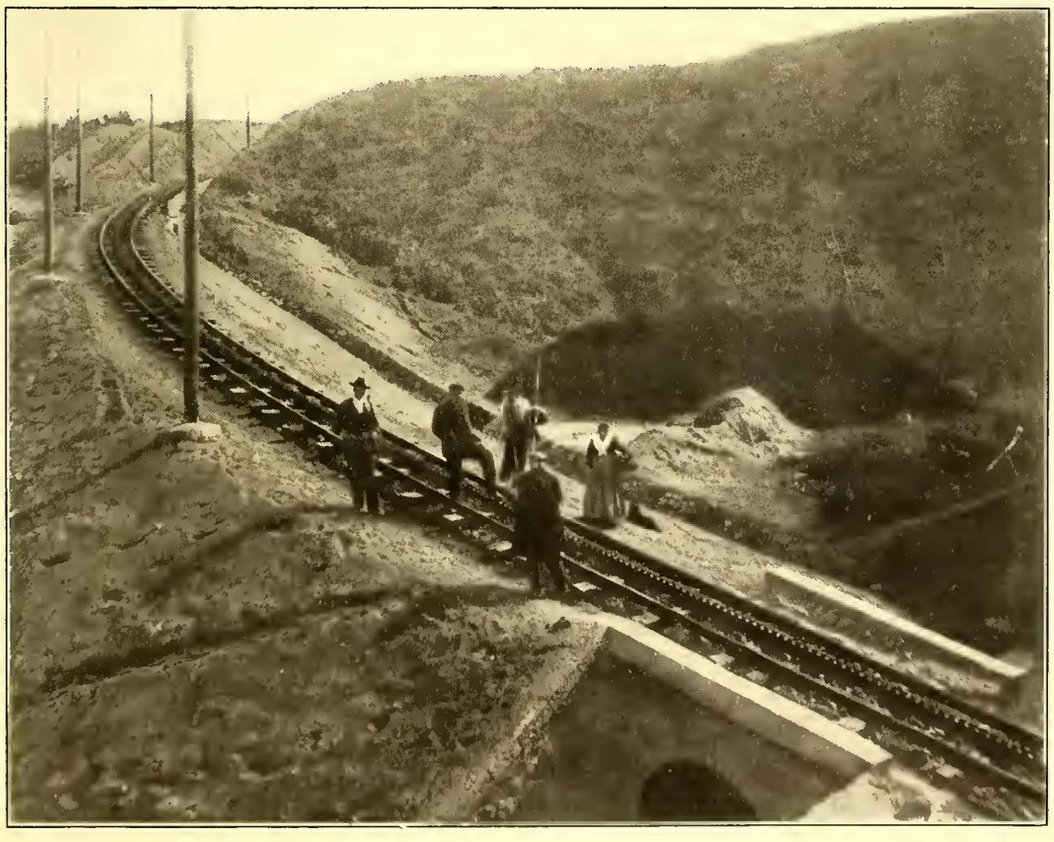
However, as in the past the cable railway has never been obliged to carry more than 300 people daily, the capacity of the new line should be ample for a long time to come. In this connection it should be noted that the top of Mt. Vesuvius is too small in area to permit the accommodation of a large number of people at one time, and, besides, the fare from Naples to Vesuvius and return is so high ($4), the line is not likely to be overcrowded. Of course, this high fare is due to the fact that the railway may be utterly destroyed at any time. If necessary, the capacity of the line could easily be doubled without using much more power by building turnouts and arranging the schedule so that when a train is going up the mountain another is traveling down toward the valley over the rack road.

ROUTE

As shown in the accompanying profile of the complete line, the grades between Resina and San Vito do not exceed 8 per cent. About the same grades are found between the Government Observatory and the cable railway. It was determined, therefore, to operate both of these divisions by the usual methods. For the section between the power station and the observatory a rack road was chosen, as that division includes grades as high as 25 per cent. On this division the motor car of the electric railway is hauled by an electrically-driven rack locomotive. The Vesuvius Railway, as now completed, has a gage of 39.37 ins. (1 m), and is divided into three sections, having a total length of 4.5 miles (7.5 km). The first section is an electric railway starting at Pugliano (the upper part of Resina), and extending 1.9 miles (3.15 km) to the power house and car house. The minimum curve radius is 164 ft. (50 m). The second section, as stated, is a rack road, and runs from the power house to the observatory. Its length is about 1 mile (1650 m), and its highest point nearly 1950 ft. (594 m) above the sea. The third section is an ordinary electric railway, similar to the first, and is 1.62 miles (2700 m) long. The roadbed in general is built in accordance with the practice adopted on the later Swiss mountain railways, with due consideration, however, to the fact that in autumn and winter there are very severe rain storms, which make it necessary to make liberal allowance for quick drainage. Careful surveys made it possible to avoid artificial construction to a great extent. The supporting walls are constructed of lava stones and a mortar made of lime and puzolla earth, a combination which, in time, becomes as hard as stone and possesses certain hydraulic properties—in fact, the same material has been used in building a large dry-dock in the harbor of Naples.



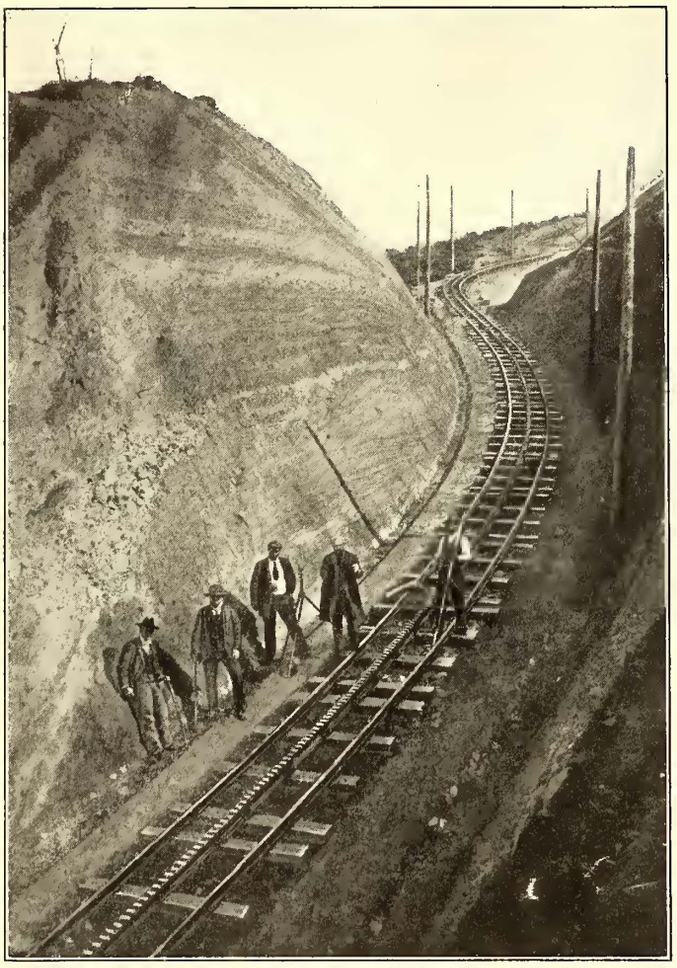
SCENE ALONG THE ELECTRIC RAILWAY



VIEW ALONG THE RACK RAIL DIVISION

The Pugliano station at the beginning of the line has not yet been definitely completed, owing to the fact that some arrangement is to be made for connection with the proposed Naples-Resina line. A connection is also proposed with the Circumvesuviana line, which is now under construction. From Pugliano the line traverses a very fertile agricultural district, and just before reaching the rack road passes through a number of petrified lava streams. The first station, San Vito, is in the middle of the garden district, about .87 mile (1.45 km) from the beginning of the line. From this point the railway runs for 1.02 miles (1.7 km) in an almost straight line to the rack road.

The lower portion of the latter road passes through inhabited territory, but soon enters a large forest, from which it does not emerge until it reaches the observatory. This section is cut

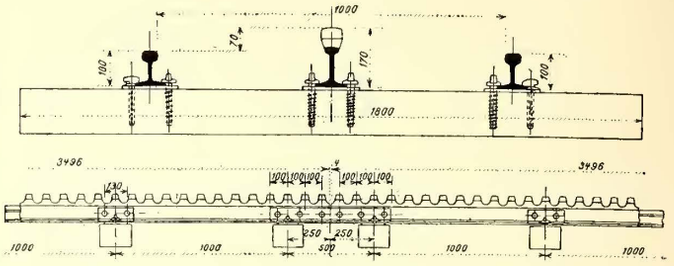


BUILDING THE RACK RAIL DIVISION

through by a large number of so-called "burroni," which are simply deep narrow cuts made through the light puzolla earth by torrents during the rainy season. Many of these cuts are 30 ft. to 60 ft. in depth. During the dry season they serve for paths, as the shelter they afford is very convenient. Where the railway is obliged to cross these "burroni" vegetation has been planted to strengthen the sides against future inundations. The observatory railway station lies very near the large hotel which has been built at this point by Messrs. Cook. There is also close to the station a little chapel and park. From this station the line is again of the ordinary electric railway construction, and traverses a distance of approximately 1.62 miles (2695 m) before reaching the lower station of the old cable railway.

TRACK CONSTRUCTION

The track construction of the electric line consists of rails, 3.94 in. (10 cm) high, weighing about 40 lbs. per yard (20 kg per meter). The rack rails are laid in 11-ft. 3-in. (3.5 m) sections, while the outside rails are 33 ft. 9 ins. (10.5 m) long. The rails on the rack road and the curves on the other divisions are anchored by means of iron tie-plates. On straight track of the electric railway divisions the joints are furnished with the usual base plates as well as angle-plates. Oak ties are used throughout rather than metal ones, as they can be replaced more quickly in case of lava overflows and because the Strub rack system operates equally well with metal or wooden ties. These ties are 6 ft. long, 6.3 ins. to 7 ins. wide, and 4.73 ins. to

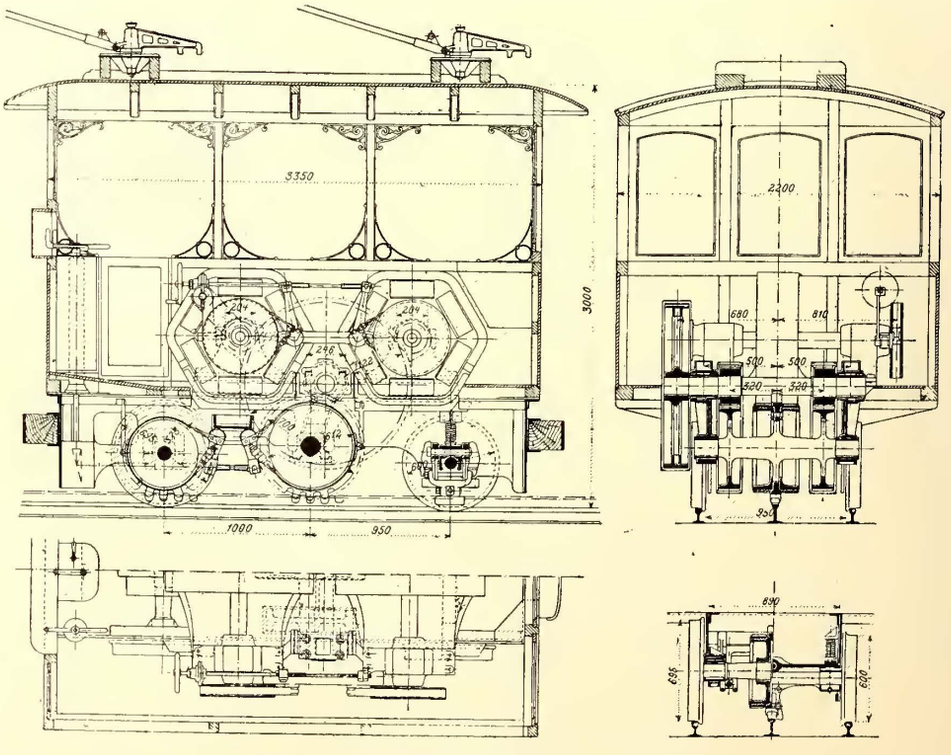


CROSS-SECTION AND SIDE ELEVATION OF RACK

5.52 ins. high. Plastic bonds are used for bonding in the rail return except at special work, where wire bonds are used.

ROLLING STOCK

The same cars are used on both the electric and rack divisions, but on the rack division, as stated, the cars are hauled by a special rack locomotive. To make possible a 35-minute headway turnouts have been built at each end of the rack division. Only three motor cars and one rack locomotive are required to carry out this schedule. The present equipment consists of three motor cars and two locomotives. The cars have single trucks, of 6.2 ft. (2.1 m) wheel base, and weigh 16,800 lbs. (8400 kg) each, without motors. The motors are of the direct-current series type, and are built somewhat larger than would otherwise be required, on account of heavy grades and warm climate. All cars are built in three sections, each of which has a separate side door. The seating capacity is eight passengers per section, with additional room for six passengers on the platform. The sides of the car are cut off halfway to the roof, but in stormy weather the openings may be



ELECTRICALLY DRIVEN RACK LOCOMOTIVE

closed by waterproof curtains. To provide for baggage, one of the three divisions is furnished with seats which may be turned up when necessary. The side walls of this compart-

ment are removable. The cars are equipped with bow trolleys.

Owing to the severe grades each car is furnished with two independent sets of braking apparatus. The first consists of a powerful spindle brake, furnished with eight brake-shoes, which can be operated from either platform. The second consists of an electric short-circuiting brake combined with an electromagnetic track brake. To overcome slippery rails two sanders are supplied at each end of the car. When the motor cars are used on the rack division they are pushed by the electric locomotive so that no brakes are required; the rack locomotive is equipped with four independent brakes, each of which is capable of controlling both locomotive and car.

The rack locomotive weighs about 20,800 lbs. (10,400 kg), and is capable of running at about 5 m. p. h. when propelling a load of 22,000 lbs. (11,000 kg) on a 25 per cent grade. It is equipped with two 80-hp shunt-wound motors, which run at 650 r. p. m. to 700 r. p. m., and operate the rack-driving wheels through gearing. The rack wheels are made of crucible steel and weigh about 160 lbs. (80 kg) each. As the motors are shunt wound, current is returned to the line when the locomotive is running down grade.

CABLE RAILWAY

The old cable railway which will be kept in operation, but reconstructed as described below, is a monorailroad, with the supporting wheels in the center of the car. The supporting stringers, which are two in number, one for each track, rest on cross ties placed about 5 ft. (1.5 m) apart. These ties are stiffened by diagonal braces, and the entire construction is supported at intervals of 200 ft. to 400 ft. by masonry pillars. The top of each stringer carries a T-rail for the center wheels of the cable car. Each car is operated by two endless cables, one being placed on each side of the car. To each cable is attached a forked gripping device, held in position by springs, and connected with an automatic brake, which consists of two cogged eccentrics embracing the wooden stringer, and designed to hold the car in position in case the cable breaks or loses its tension. The cables are operated through gearing by a 40-hp steam engine, which is located at the lower end of the line, cable line. The new cable line is to be built about 10 ft. (3 m) above the grade of the present line. It will be of meter gage, and the rails will have conical heads to allow the use of special emergency brakes. The roadbed will be of dried mortar construction and the tiles laid in cement. Massive mortar pillars,

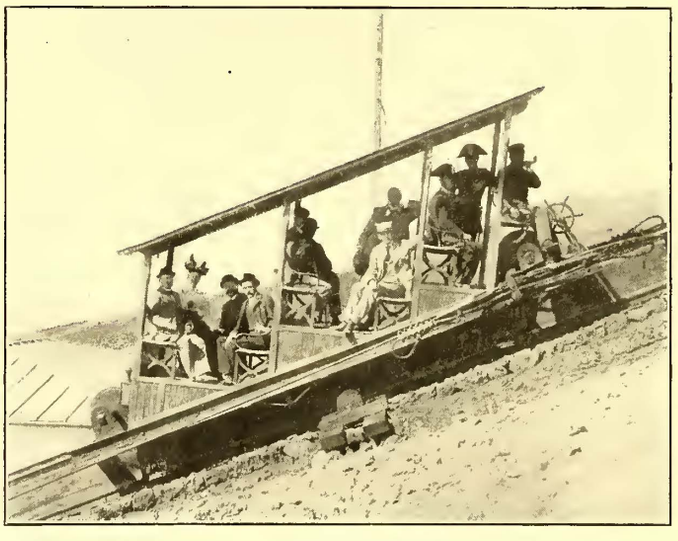
GROUP OF OFFICIALS AND ENGINEERS ON AN INSPECTION TOUR

several meters wide, will be erected at intervals of about 65 ft. (20 m). The new cars will seat twenty passengers, twice as many as the old ones. The cable will be driven by a 550-volt, 600-r. p. m. direct-current motor, which will be completely inclosed to protect it from injurious gases and lava dust.

POWER GENERATION AND TRANSMISSION.

The power station is furnished with two 67.5-kw, 550-volt direct-current generators, running at 700 r. p. m., and operated

BUILDING THE SUPPORTING WALL BENEATH THE TERRACE OF THE OBSERVATORY



PASSENGER CAR ON OLD CABLE RAILWAY

to minimize the danger from eruptions. The trip on this line takes about 8 minutes. This line has been in use since 1879, and during that time the roadbed has gradually sunk, so that whenever there is a severe wind storm loose ashes accumulate to such an extent that it often takes 100 men or more several days to remove the debris, and thereby allow the service to be resumed. This has caused the maintenance charges to be very high, and plans have been made for the building of another

by belting from the fly-wheel of two 100-hp, 160-r. p. m. gas engines, using Dowson producer gas. The generators may be connected in parallel to a Tudor storage battery having 300 elements and a capacity of 256 amp-hours. These generators are wired according to the C. E. L. Brown system, which enables them to deliver current to the storage battery without the use of a booster. The full-load efficiency of each generator is 92 per cent and the half-load efficiency 89 per cent. There

are two gas producers, and as each is of 200-hp capacity only one is used at a time. There are also two boilers for these producers, one of which may also be held in reserve. The gas engines are started by compressed air, but can also be started by supplying the generators with battery current and momentarily operating the latter as motors.

The switchboard is furnished with nve panels, one spare panel for a future generator and one battery panel. The switchboard is so arranged that one generator can be used to give current to the line while the other is feeding the storage battery. The feeder panel is connected to three outgoing circuits.

The power transmission line is divided into two sections by a section insulator, these divisions being respectively that from the power station to Pugliano, and from the power station to the cable railway. The third circuit leaving the switchboard was intended originally to be a feeder for the power house-cable railway division or to furnish current for the electric motor which is to operate the new cable railway. It has been found, however, that this feeder is unnecessary at present.

A circuit breaker has been placed at the upper end of the rack railway near the observatory, dividing the power house cable railway section into two parts. In case of an eruption it will be possible, therefore, to cut off all current from the electric railway division between the observatory and the cable railway. The power circuits are protected by Wurts lightning arresters, which are mounted on poles along the line at intervals of about .6 mile (1 km). The lightning arresters are grounded through the rails.

In addition to the power wires there are two telephone wires and one telegraph wire, used for despatching and other purposes. These wires are mounted on porcelain insulators but the power wires have insulators of hard rubber.

All of the electrical apparatus throughout the system was furnished by Brown, Boveri & Company, of Baden.

DEPRECIATION FUNDS IN EUROPE

One of the subjects to be discussed at the biennial meeting of the International Street Railway Association at Vienna, on September 11 to 15, is that of depreciation funds. In accordance with the practice of the Association, the different member companies of the organization have filed with the secretary of the Association a statement of their practice on the different topics to be discussed, and a digest of that relating to the subject of depreciation and sinking funds follows:

In Aachen the maintenance of a fund of this kind is required by law. This fund is credited with the sale of old apparatus, and annual payments are made to it as follows: 1½ per cent of the cost price of the track construction; 1 per cent of that of the overhead equipment; 4 per cent. of that of the power stations; 2½ per cent of the cost of the motor cars and 1¼ per cent of that of the other cars.

In Berlin the by-laws of the Grosse Berliner Strassenbahn require a payment to a fund of proportionate cost of the replacement of the material, depending on the wear. This amounted during 1902 to 2,850,430 marks or 4.23 pfs. per car km. (1.7 cents per car mile). The company does not own its power stations, but hires power.

The Berlin-Hohenschonhausen Strassenbahn charges off 1½ per cent. of the cost of the equipment, which amounted during last year to an average of 5.6 pfs. per car-kilometer (2.24 cents per car mile).

In Brussels the life of the track is estimated at twenty-five years, that of conduit lines at fifteen years and splice-bars at twelve years. The life of the cars is figured at twenty-five years and the power station for the same length of time. The overhead construction is figured at 25 years except trolley wire which is put at ten years. The company therefore charges off a proportion of its receipts to a sinking fund; this is independent of the maintenance which is paid out of operating expenses.

The municipal tramways of Cologne have not yet been in operation long enough to determine the amount to be charged off. The management at present is charging off 8 per cent of the cost of the rolling stock and 1 per cent of the cost of the buildings, and is investigating the subject of track wear.

The Crefelder Strassenbahn has a franchise which requires the payment of 6 per cent of its gross receipts to a fund of this kind.

The Czernowitz Railway charges 1½ per cent of the track construction, 3 per cent of the rolling stock, ¼ per cent of the buildings, 2½ per cent of the power station equipment, which amounts to 2.1 heller per kilowatt-hour; 1½ per cent of the feeder construction, and 2 per cent of the rest of the equipment.

The Dessauer Strassenbahn pays for power station depreciation 1.5 pfs. per kilowatt-hour, a total of 3¾ pfs. per car-kilometer (1.5 cents per car mile).

The municipal road in Frankfort charges 5 per cent of the track, 5 per cent of the overhead equipment and 6 per cent of the mechanical and electrical equipment, which amount to 3 pfs. per car-kilometer (1.2 cents per car mile). The company hires its power.

In Geneva the creation of a depreciation fund is required by law, and the company pays annually 1000 francs per kilometer ($320 per mile) of track.

The Glasgow municipal tramways charges off £450 per mile of single track per year, 7 1-3 per cent of the cost of the rolling stock; 2½ per cent of the buildings, 5 per cent of the power station equipment, 3 per cent of the underground cables, 7½ per cent of the bonds, 3 per cent of the poles and overhead construction, and 5 per cent of the section boxes, miscellaneous equipment 7½ per cent. For the year ending May 31, 1902, the total amount charged off was £127,555.

The Hamburg Street Railway Company charges off 1.4 pfs. per car-kilometer (0.56 cents per car mile) per year, that at Hamm 3.5 pfs. per car-kilometer (1.4 cents per car mile), and the Konigsberg municipal road charges off 1½ per cent of the capital.

The Leipziger Strassenbahn charges off 2 per cent of the track, 4 per cent of the overhead equipment, 8 per cent of the rolling stock, 1½ per cent of the buildings, and 8 per cent of the power station equipment. This amounted during the last year to 4.68 pfs. per car-kilometer (1.87 cents per car mile).

On the Leipziger Elektrische Strassenbahn the amount charged off was 3 pfs. per car-kilometer (1.2 cents per car mile).

The Linz-Urfahr Tramway Company charges off 5 per cent, and the Lyons Tramway Company 0.0386 francs per car-kilometer (1.24 cents per car mile).

In Mannheim the practice is to charge off for the track construction 5 per cent, motor cars 7 per cent, trail cars 5 per cent, buildings 1 per cent, feeders 1 per cent, pole line 3½ per cent, rest of the overhead equipment 8 per cent, amounting in all to 5.4 pf. per car-kilometer (2.16 cents per car mile).

In Munich 6 per cent of the receipts is charged off, and in Nordhausen 4 pfs. per car-kilometer (1.6 cents per car mile).

In Remscheid the proportion is track construction 2 per cent, rolling stock 10 per cent, power station equipment 6 per cent, conductor lines 3 per cent, other electrical apparatus 8 per cent. In Solingen the city system charged off 4.9 pfs. (1.96 cents), and the suburban system 4.3 pfs. per car-kilometer (1.72 cents per car mile).

In Würzburg the company provides for a charge of 1.6 per cent of the capital invested, which amounted during the last year to 2.5 pfs. per car-kilometer (1 cent per car mile). In Zurich the municipal system charges off 4.14 centimes per car-kilometer, or 1.32 cents per car mile.

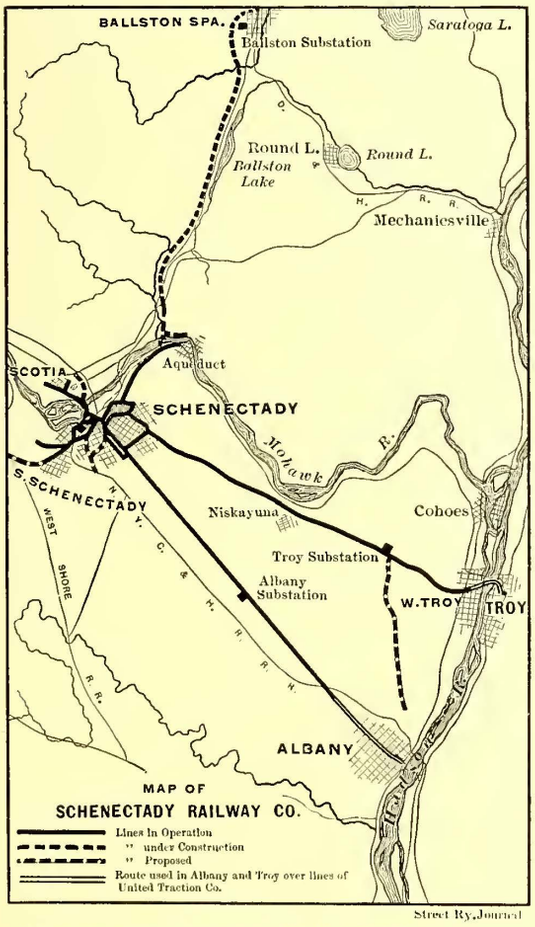
EXTENSION OF THE SCHENECTADY RAILWAY SYSTEM

BY ALTON D. ADAMS

Schenectady, N. Y., which is already connected with Albany and Troy, each about 15 miles distant, by fast electric lines, is soon to enjoy similar service to Ballston Spa. Connection with this last named place is now being completed by an extension of the tracks of the Schenectady Railway Company, which will unite the four cities. The extension from Schenectady to Ballston Spa is a double-track line, largely on private right of way, and 15.3 miles long. On this line the sharpest curve is 5 degs., with a radius of 146.3 ft., and the steepest grade is 1⅛ per cent. The private right of way on which the road is mostly located is 60 ft. wide. At the center of each track the gravel ballast has a maximum depth of 18 ins., and the estimated quantity is 5724 cu. yds. per mile.

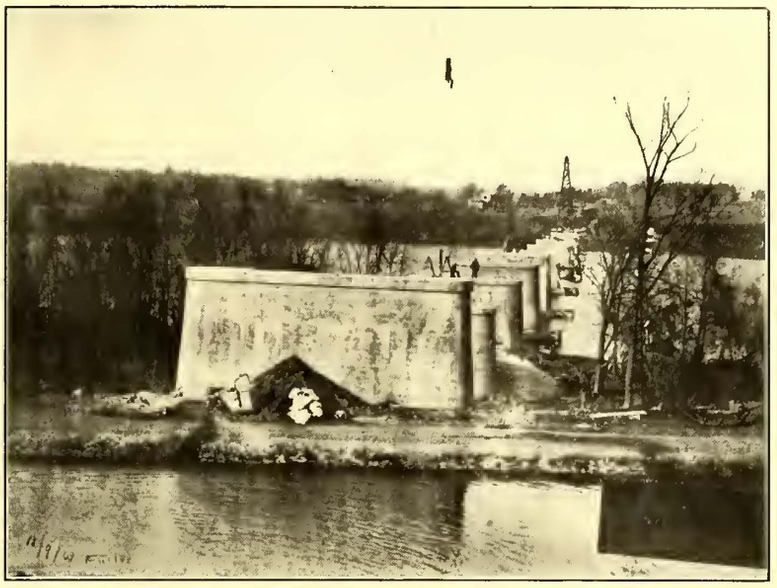
The tracks are laid with T-rails weighing 85 lbs. per yard, and mounted on 6-in. x 8-in. x 8-ft. ties. Between the centers of the double tracks the distance is 13 ft. In entering the city of Schenectady the Ballston division crosses the Mohawk River over a new steel bridge 1765.5 ft. long, built for the purpose. This bridge also crosses the Erie Canal, which runs close to the river at that point. This bridge is mounted on ten concrete piers. About a mile north of the bridge the electric line passes underneath the tracks of the Fitchburg Railroad through concrete masonry arches.

The trolley and feed wire poles are spaced 100 ft. apart, and are set in concrete to a depth of 8.25 ft. Each pole is octagonal in section, of yellow pine, conical at the top, 34 ft. long, 14 ins. in diameter at the butt and 7½ ins. in diameter below the cone at the top. A feature of the pole line is that iron steps are used, being 2 ft. apart, and the lowest step 7 ft. above the tops of rails.



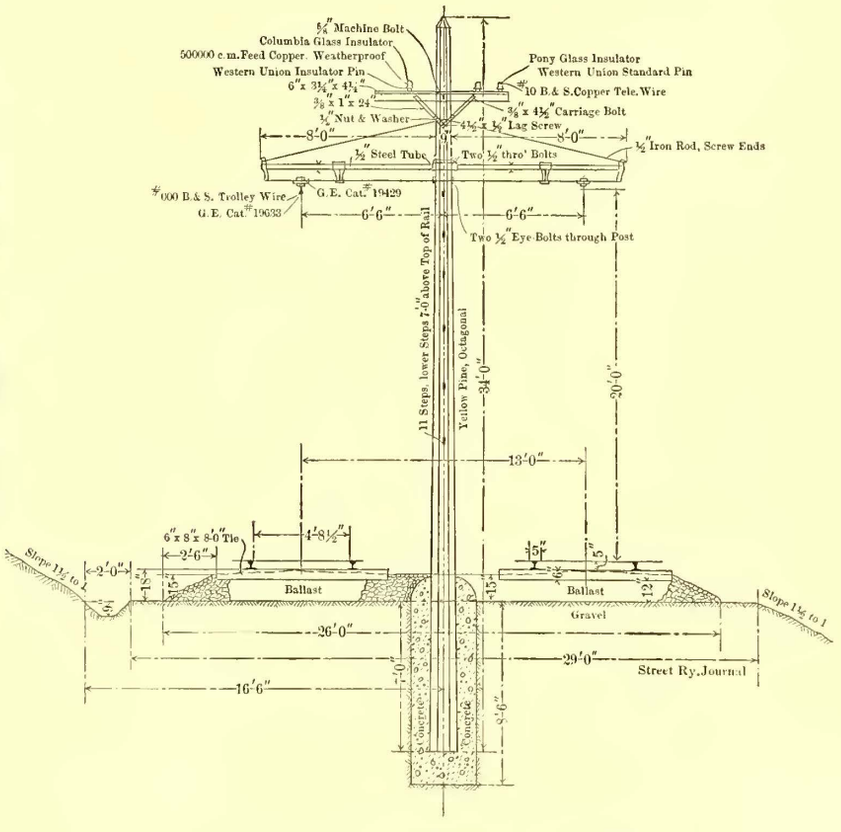
MAP OF THE SCHENECTADY RAILWAY COMPANY'S SYSTEM

The 500,000 circ. mil copper feeder runs the entire length of the Ballston line and is connected to the trolley wires once every 700 ft. for a distance of 3800 ft. from the Dock Street Station. while passing through the city of Schenectady the feeder for the Ballston line is laid underground in Camptile conduit. From the end of the underground cable a second copper feeder of 500,000 cm runs out onto the railway line to a distance of 30,000 feet and is then connected to the feeder that runs the entire length of the line.



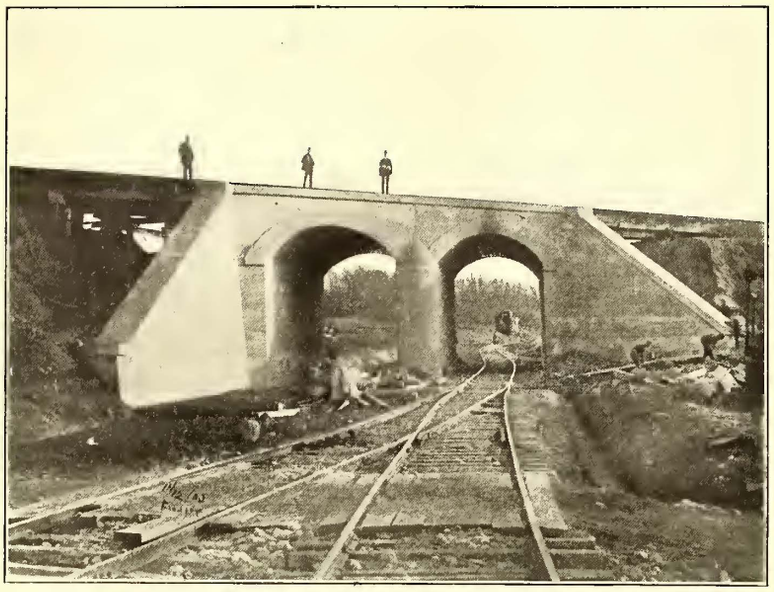
BUILDING CONCRETE PIERS FOR STEEL BRIDGE NEAR SCHENECTADY

At the Dock Street sub-station, which furnishes current for the railway in Schenectady and parts of the Troy and Albany branches, as well as for the Ballston line, the capacity in rotary converters is 1800 kw, made up of two machines rated at 600 kw and two rated at 300 kw each. At the Ballston sub-station the capacity of the rotary converters to be installed at



DETAILS OF POLE SETTING AND FITTINGS

present is 900 kw in three machines of 300 kw rating each. The rotary converters at both of the sub-stations named are 40-cycle machines and operate at 600 volts on the direct-current side. On the Ballston line the new cars will weigh 40 tons each when loaded and are to have a maximum speed of 50 miles



CROSSING STEAM RAILROAD BELOW GRADE

per hour. Each of these cars will be equipped with 125 hp motors, with type M control.

An other moderate extension of about 5 miles would carry the new Ballston line on up to Saratoga Springs, and this would afford rapid electric transit between that city and Schenectady, Albany and Troy.

NEW SYSTEM OF CHECKING CAR SERVICE FOR DELAYS—BROOKLYN RAPID TRANSIT COMPANY

The operating department of the Brooklyn Rapid Transit Company has recently placed in commission a very complete and effective system of reporting car service, with special reference to the tracing of irregularities of headway. This system is the outgrowth of a series of experiments that have for some time been under way with the view of perfecting the service on all lines. In a recent issue of the Street Railway Journal reference was made to the first step in this direction, in the adoption of a novel method of systematically reporting the service on the various lines by registering the times of passage by certain points of all cars of the system; this has been instrumental in leading up to the efficient system which is here described. The complete success of this system, as well as its simplicity and cheapness of operation, makes it worthy of the consideration of all street railway managers.

The method of registering the headways of the cars by recording the times of passage by certain points of the system, was described in the article on page 175 of the Jan. 30 issue. This was arranged to be accomplished by special clock registers, which were installed at two points of the system past which the two greater portions of the traffic of the city are directed. Each clock operates by rotating a large graduated circular record sheet of paper, upon which the records are made by means of electromagnetically-operated perforating needles. This circular sheet is divided off radially into 144 sectors, corresponding to every 5 minutes for a period of 12 hours, and is divided concentrically into twenty-four circles, to represent the various car lines; in operating, as a car on any particular line passes the clock station, a push button is touched to operate the perforating magnet, which makes the record by quickly pricking the sheet in one of the concentric circles which corresponds to this particular car line. The distances between indentations thus indicates the time that has elapsed between passages of cars.

In this way it may be seen that each car line is carefully traced, the intervals between cars being denoted by the distance between perforations in the circle representing the line; any irregularity of headway is at once shown graphically, and with very little trouble the amount of delay can be located. Two of these clocks are maintained in the city at points covering the greater density of traffic, the complete time of a man being required to operate either register. In addition to the duties of registering of the clock man he is thus enabled to make reports of the irregularity of headway upon each line separately, which he does whenever he notices an interval longer than usual between passages of cars on any particular line. If this interval is more than 5 minutes he is instructed to record the same upon the blank form, illustrated herewith as No. 435. This report is sent to the superintendent of surface lines, who may then make inquiry as to the delay if other explanation has not been given for the same, as will hereafter be referred to. This sample report, No. 435, which is shown, was made out by the clock man at the City Hall clock station, and shows the irregularities of headway on the Gates Avenue line for Saturady, April 16—a busy day.

Similar records showing irregularity of service are also kept upon the lines which do not pass the clock registers; these are easily taken care of by the starters, who, in such cases, have sufficient time to do so without serious addition to their other duties. The starter at each end of every line, from his knowledge of the time-table of his line, keeps careful record of this kind upon the same blank form as shown under No. 435, so that

THE B. H. R. R. CO. STARTERS' DAILY REPORT

April 16th, 1904.

SUPT OF TRANSPORTATION

I give you below irregular headways on up rail at City Hall on above date

Gates																	
FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY	FROM	TO	HDY
A. M.						M.			M.			M.			M.		
9:19	9:28	9															
10:35	10:44	9															
10:56	11:05	9															
11:05	11:13	8															
12:31	12:38	7															
3:03	3:13	10															
3:32	3:39	7															
P. M.																	
7:12	7:22	10															
7:27	7:35	8															
9:48	9:56	8															
10:01	10:10	9															
10:27	10:36	9															
11:07	11:15	8															
12:00	12:10	10															

Day C. H. Burton Tour 7:00 A. M to 7:00 P. M

Night G. A. Perinchief Tour 7:00 P. M to 1:00 A. M

Starters

FORM NO. 435.

the records turned in by the starters at both terminals, and in many cases those furnished by the clock registers are checked up against each other for accuracy. In this way, at the end of each day, duplicate, and sometimes triplicate, records from different points, are turned into headquarters of the service upon a single line. Careful provision is made so that no line, whether running to ferry stations or across the Brooklyn Bridge, is without at least a double checking system of this nature.

In this way it may be seen that the clock records serve as a

valuable check upon the important records of irregularities of headway which are kept by the starters at all terminal points of lines. The intrinsic value of the clock register is that of presenting a graphical record of the headway of the various lines past an important center of the system, from which records the irregularities may be calculated; on account of the large number of cars passing City Hall Square it would be otherwise impossible to keep accurate records of the headway without employing a large force of men. The clock register enables this to be done with comparative ease by one man, which man can also make out from this recording system the required statement of irregularities.

In addition to the above-mentioned reports which are kept by the starters, another blank form is provided, upon which they are required to make statements of the reasons of all delays and irregularities which are known, or can be ascertained, by them. This form is shown as No. 434, one of which reports is made out to cover the service of every line from that terminal and is turned into headquarters daily. On it is recorded the reasons for each delay and irregularity upon that line which can be accounted for at that terminal.

With these reports of irregular headways and additional reports giving explanations at hand, the superintendent is enabled to locate at a glance the location of trouble if any, and can thus easily make inquiries to remedy the same, or if satisfactory explanation is not given he will know exactly where to make inquiry. For instance, if the more serious delays noticed upon the Gates Avenue line (see form No. 435), are not satisfactorily explained in the starter's daily reports, No. 434, inquiry is made of the division superintendent in charge of that

N. S. 434. O—42100

The B. H. R. R. Co. Starters' Daily Report

April 16th, 1904. 190

SUPT. OF SURFACE LINES:

I give you below irregular headways on Gates Avenue line, direction Park Row taken at New York Terminal on above date.

FROM	TO	HDY.	EXPLANATION
P. M.			
8:20	8:28	8	Car No. 3306, run 27, Motorman 1665. Sent to Fulton Perry account being blocked by wagon at Gates and Nostrand.

Day J. B. Coffin Tour 12:00 M. to 12:00 M.

Night " M.

Starters.

NOTE—This report is exclusively for irregular headways and same must be fully explained and not cover more than one line.

FORM NO. 434

line, who can readily trace the trouble and make report of the same to headquarters, so that steps may be taken to remedy the difficulty. The valuable feature of this portion of the system is the provision for reports to show reasons for delays, which supplement the records of delays—this is of great assistance to the operating department and is of the greatest importance in providing for improvements to the service.

Another interesting report is now required by the operating department, which is of still further assistance in obtaining information as to the condition of the service. This is provided for upon the blank shown herewith as No. 312, the records for which are kept by the inspectors, being made out for a single line and turned in after every day's work. A glance at this report will indicate its usefulness. The questions to be answered with reference to the maintenance of the headway, to the sufficiency of the service at any hour, and to the general sanitary condition of the cars are valuable, while even more so, perhaps, is the statement as to whether the cars are running to proper terminals to accommodate the public.

A general monthly summing up of the condition of the service upon each line is to be had from the passenger record, which is made up in the form shown upon the large blank, No. 313. This record covers a month of operation, being made out in full for the four most important days of the week, namely, Sundays, Mondays, Wednesdays and Saturdays. These days represent the most important periods of traffic during the average week, as the records of the intervening days show up much lighter and are thus of less importance. As may be seen, a record is made of the condition of service for each half-hour

N. S. 312 O—41662

Inspectors Daily Car Service Report

DATE April 16th, 1904. 190

Tour from 5:00 P.M. to 6:00 A.M.

Gates Avenue Line

Is headway well maintained? Yes - outside of one gap (see below)

Are cars running to proper terminals to accommodate the public? Yes.

General condition of cars Good

Is there insufficient, or too much, service at any hour? The service was O.K. during my time.

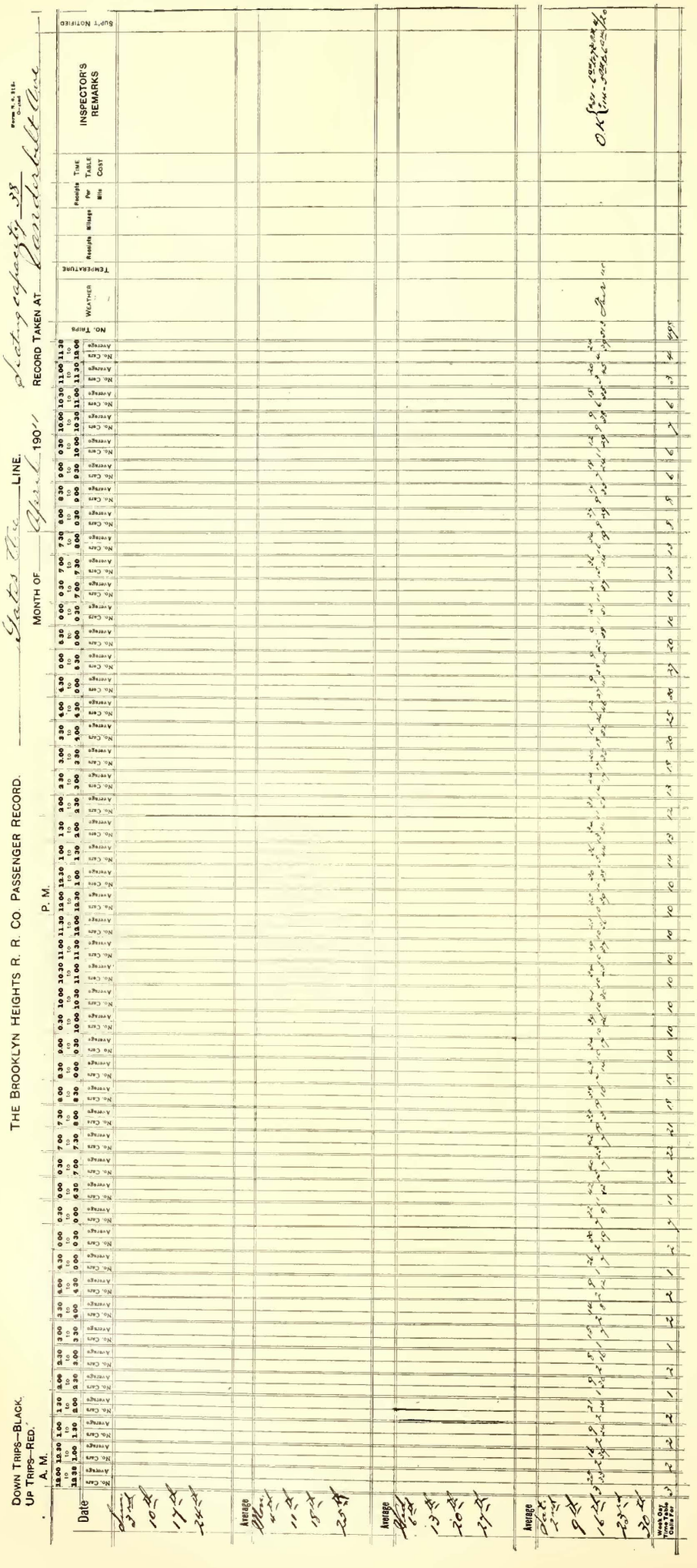
Delays, Cause? Gap of 10 minutes on up rail at Nostrand from 10:21 to 10:31 P.M. account being blocked by car which would not take switch at Fulton and Dekalb.

Sign - J. H. Cordes No. 114

NOTICE—This report must be made up accurately and turned in after days work, and must not cover more than one line.

FORM NO. 312

throughout the entire twenty-four hours of each of those days for the entire month. Under the heading, Number of Cars, is recorded the entire number of cars in operation upon the line during that half-hour; opposite this under the heading, Average, is recorded the average number of passengers upon a single car as counted at one of the busiest points of the line by the conductor, for both the up and down trips. In the actual keeping of this record the average numbers of passengers for both down and up trips are inserted in pairs opposite the number indicating the cars in service, in black ink for the down trips and in red ink for the up trips (the red ink numbers appear in black in the accompanying sample sheet, but may be distinguished readily from being the lower of the two average numbers). The average number of passengers riding upon a single car of the line during any half-hour is calculated from



the reports turned in from all the cars upon the line during that half-hour.

The obtaining of these counted numbers of passengers in each car, from which to calculate the averages, presented at first a serious problem, but was solved in an interesting manner. At first slips were given the conductors in addition to their day cards upon which to record at some designated busy point of the line the actual number of passengers in the car at that time, the number of passengers being obtained by counting and not by reference to the register, as it is desired to provide for the maximum number of passengers riding on a car at the busiest point of the line, which cannot be obtained by reference to the register. The trouble encountered was that the conductors were continually losing their passenger report slips, and the records turned in were thus made indefinite. It was also an easy matter for a conductor not to receive the blank passenger slip, and, furthermore, it was an easy matter for him to purposely lose the slip if he had neglected to make out the report properly.

This was overcome in an effective manner by a rearrangement of the conductor's day card so that the passenger report blank is attached to its lower end, with perforations permitting it to be torn off and turned in separately at the end of the day's work. The form that was finally adopted is shown herewith as No. 137. This method effectively solved the difficulty, inasmuch as a conductor cannot now take out a car without receiving his day card, and with this arrangement the day card carries with it the passenger report blank.

The process of recording the average numbers of passengers is clearly indicated upon the passenger report blank which is attached to the day card as shown. Columns are provided for the car number, trip number, times of leaving, destination, average numbers of passengers of both down and up trips, and, finally, the busy point on the line at which the record was made. As shown in the accompanying sample report, the busy point on the Gates Avenue line is taken at Vanderbilt Avenue, and the number of passengers which the conductor counts at that point is recorded as shown. The real value of this report is that it shows whether the car service is made to provide carrying capacity for these average numbers of passengers and thus give adequate service.

Form No. 313 is of sufficient size to allow the records to be neatly and con-

STATEMENT OF CASH AND TICKETS TURNED IN

Date _____ 190

_____ Line

Run No. _____

_____ Conductor

	Cents	Dollars	Bills	Dollars (silver)	Halves (silver)	Quarters (silver)	Dimes (silver)	Nickels	Cents	Tickets at 5 cents each	Total

A This Cash and Ticket Statement to remain attached to day sheet and turned in with cash in bag.

CONDUCTOR'S DAILY PASSENGER REPORT

Date April 16th 1904

Gates Avenue Line

Run No. 26

Car No.	Trip No.	Left A.M.	DESTINATION From	DESTINATION To	PASSENGERS Down	PASSENGERS Up	TAKEN AT
950	1	6.03	Ridge	N.Y.	59		Vanderbilt Ave
	2	8.10	"	"	48	23	"
	3	10.26	"	"	35	16	"
		P.M.					
	4	1.20	"	"	37	20	"
	5	3.40	"	City Hall	15	33	"
	6	5.50	"	"	12	46	"
						58	"

SIGNED: Conductor John Jones No. 4206

Motorman P. Murphy No. 5907

NOTICE—When at point designated count passengers on car and show same on this report

DETACH AT PERFORATED LINE A AND TURN IN TO STARTER AT END OF DAY'S WORK

FORM NO. 137, USED AT FOOT OF DAY CARD

veniently made, and space is left at the right-hand end for further records which are of value in considering the service, namely, the total number of trips, the weather, the temperature, the total daily receipts of service upon the line, the mileage, the receipts per mile, and the time-table cost, or cost of labor, in operating the cars in service. This latter is important as, when taken in connection with the fourth column, it gives a basis upon which to figure directly the gross profit of operating the line. The inspector's remarks are recorded in the next to the last column, by making reference to his reports, while in the last column is indicated whether the superintendent has been notified of troubles, if any have occurred.

Another important feature of this record sheet is to be seen in the horizontal column at the bottom of the page, which shows what service the week-day time-table calls for. In this column is recorded the number of cars which ought to be in service upon the line during each half-hour of the day, and thus it may be seen, at a glance, by comparison of the recorded number of cars in service with this time-table number, whether the service is being maintained or not. It is important to note that in very many cases the service actually called for is considerably exceeded. Reference to the service record will show that at "rush-hour" periods of the mornings and evenings, and also at the theater hours of the evenings, the service called for is greatly exceeded, showing the attempt of the company to supply adequate service for all demands. The actual amount of extra service ordinarily to be required can in no other way be ascertained than by frequent study of the records obtained from this system.

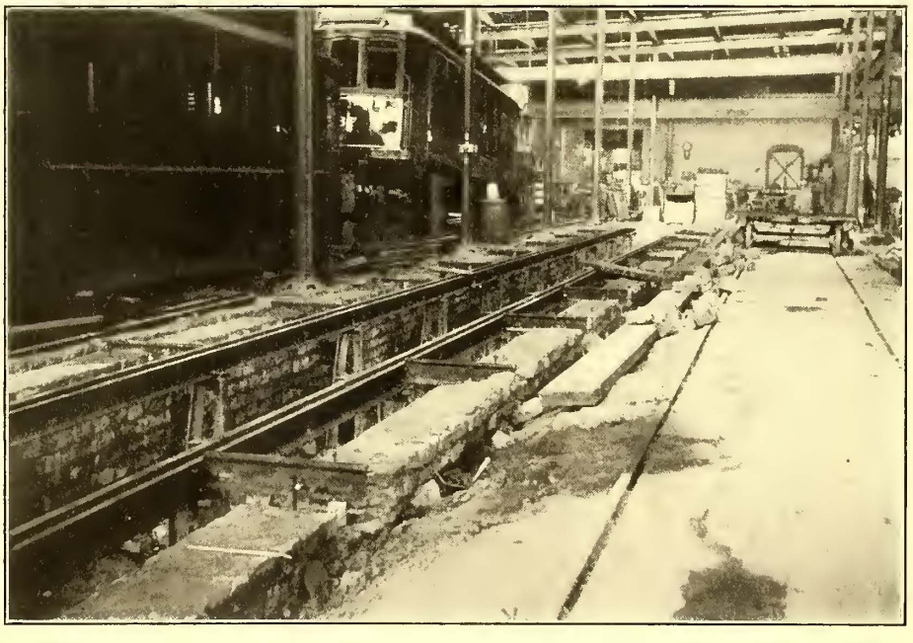
This reporting system has been worked out under the direction of Mr. Graham, superintendent of surface lines of the Brooklyn Rapid Transit Company, who has devoted a great deal of work to its development.

STORAGE AIR BRAKE SYSTEM IN CHARLEROI

The electric railway system in Charleroi, Belgium, owned by the Société Nationale des Chemins de fer Vicinaux, has recently been equipped with the Westinghouse storage air brake system. The line is about 16 miles in length and is equipped with thirty-nine motor cars and the same number of trail cars. The power station is about the center of the system and the air compressors are located at that point. They are two in number and driven by a 17-hp motor. The company has one auxiliary compressing station, which is also equipped with two electric compressors. The motor cars are fitted with two compressed air reservoirs, with a total capacity of 750 liters. The trail cars are equipped with brake cylinders and rigging, but not with reservoirs.

REPAIR TRACK PITS AT KANSAS CITY

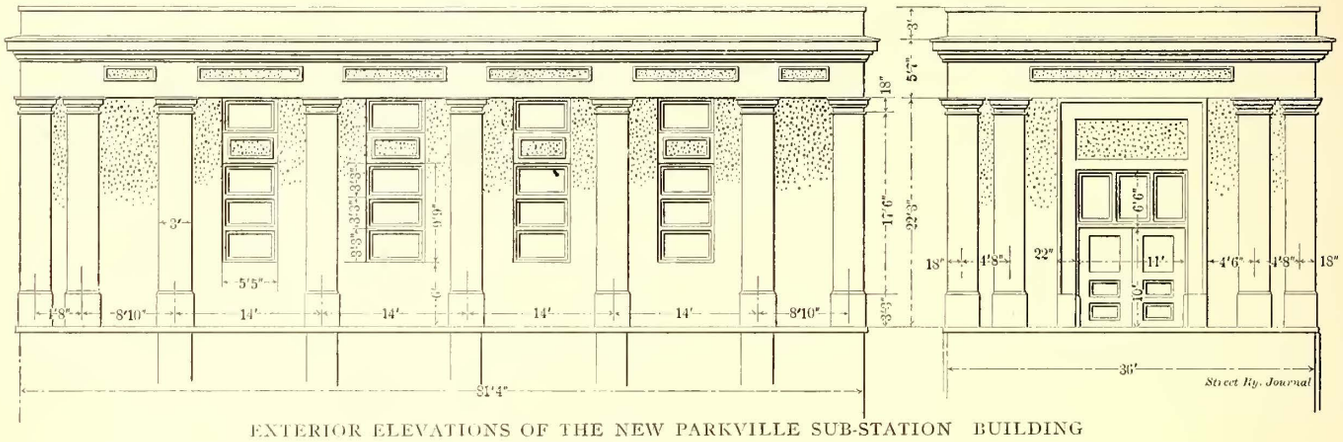
The accompanying engraving is from a photograph taken during the construction of some new repair pit tracks in the shops of the Metropolitan Street Railway Company, of Kansas City, of which G. J. Smith is master mechanic. It will be noticed that these pits differ from the ordinary, being wider than the tracks under which they are located. The tracks are supported on cast-iron columns, and these columns are braced laterally by T-rails, which are tied into the masonry wall. The photograph was taken just before these tie-rails were embedded in the masonry. The material used in walling up these pits was granite block, as the company happened to have a large stock of these on hand, recently taken from streets where the track had been relaid in asphalt paving. The object of the pit is, of course, to enable repair work to be done on the journal boxes and other parts by a man in the pit or seated on the edge of the pit. The man in the pit can easily get at either the inside or the outside of the truck without going to the end of the truck and crawling out of the pit onto the floor. The pits being wider than usual are more convenient for the repair men. This pit construction combines some of the advantages of ordinary pit construction with some of the advantages found in repair shops where certain repair tracks are elevated in place of having pits under them.



WIDE REPAIR PITS IN KANSAS CITY, WITH TRACKS SUPPORTED ON CAST-IRON COLUMNS

THE NEW PARKVILLE CONCRETE SUB-STATION OF THE BROOKLYN RAPID TRANSIT COMPANY

In line with their general policy of improvement of service, the Brooklyn Rapid Transit Company is now adding another link to its very extensive power distribution system by the installation of the Parkville sub-station, which was sometime ago proposed for use in connection with the new Third Avenue power station, now being completed. This sub-station is located upon the Brighton Beach line, near the intersection of East Fifteenth Street and Avenue H, and close to the crossing of that line with the Long Island Railroad. It is intended to furnish power to the district now supplied by the Thirty-Ninth Street power station of the system, which includes many of the important lines leading to the ocean resorts.



EXTERIOR ELEVATIONS OF THE NEW PARKVILLE SUB-STATION BUILDING

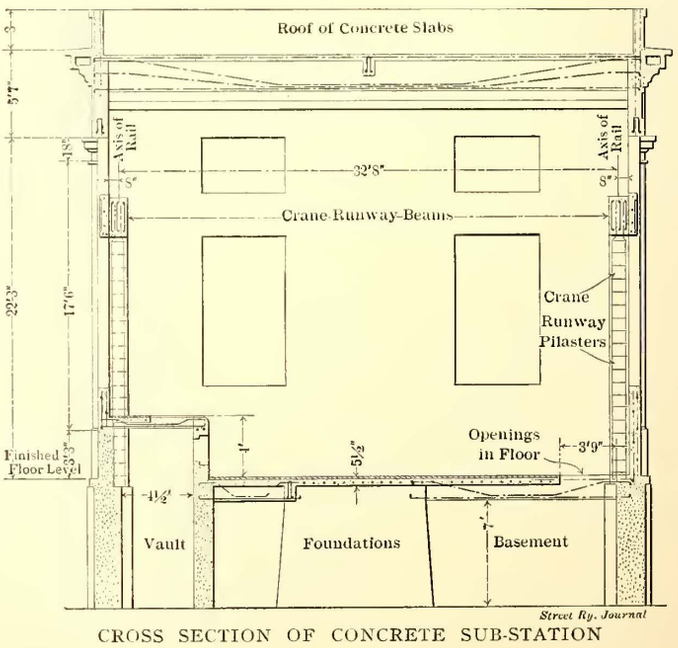
This sub-station is of unusual interest, as it involves a departure from usual methods of construction for such purposes. Work is progressing rapidly upon the construction, although the side-wall foundations and those for the rotary converters only are as yet in place. It has been so badly delayed during the late winter by bad weather that it is proposed to temporarily erect two of the machines for assisting in the service of carrying the heavy traffic on the ocean lines in the coming summer, although the structure will not be entirely completed until fall. The machines installed will be protected by a temporary shed covering, which will permit of their operation, yet not interfere with the construction of the remainder of the sub-station building. This step is being taken in order to relieve the present power stations which have been carrying heavy overloads during the past summer seasons in handling the enormous summer traffic of the system, and particularly as the company intends this coming summer to increase the service considerably beyond anything previously attempted. This sub-station will greatly facilitate the operation of these lines and will permit the desired additional improvement over the greatly improved service of last summer.

This station is designed to provide for five rotary converters of 1000-kw capacity each, although at present only two machines will be installed. The equipment of the sub-station is to conform with the standards that are in use at the other sub-stations of the city distribution system for interchangeability. The three-phase current from the main Third Avenue power plant is received at 6600 volts, but is transformed in static "step-down" transformers to a convenient working potential for the rotary converters; these machines will operate in synchronism, at the frequency of 25 cycles, to deliver the direct-current supply to the line feeders at 550 volts potential.

The static transformers are of the air-cooled type, and are to be delta-connected to the leading-in feeders through the necessary equipment of motor-operated oil switches. They are to be mounted in groups of three upon the raised platform at one side of the sub-station floor, as shown in the accompanying cross-section drawing; this arrangement makes convenient the necessary air-blast connections from beneath, as well as also facilitates the wiring connections which will be made from the basement. The oil switches to be used will be the standard type-C switches of the Westinghouse Electric Company, who is furnishing the complete electrical equipment of this plant, including the rotaries, statie transformers and switchboard apparatus. The station is fed by two separate feeders from the main power plant, which are carried underground part of the way, and on overhead lines the remainder of the distance.

The interesting and important feature of this sub-station is that it is constructed throughout exclusively of reinforced concrete, including all the necessary beams and girders. This is something of a departure for sub-station construction, and the success of the system will be watched with interest by those having to do with power distribution problems. Many novel features are involved in this installation, including that of a concrete slab roof, concrete roof beams of 34-ft. span, conerete crane running girders to carry a hand traveling crane of 20 tons capacity, and reinforced floor construetion of a eapacity of 400 lbs. per square foot.

The accompanying drawings well illustrate the details of con-



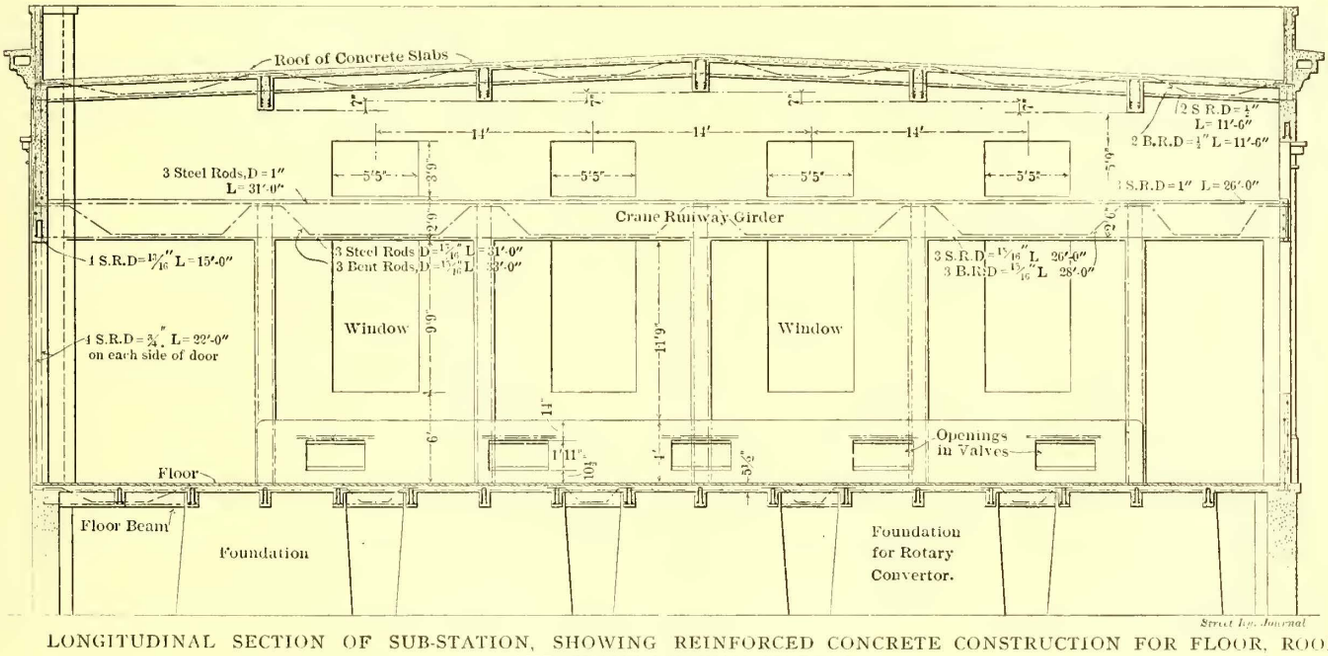
CROSS SECTION OF CONCRETE SUB-STATION

struction of this structure. The exterior is designed for an artistie effect, with rows of pilasters placed externally to represent columns, thus enhancing the otherwise plain effect of the concrete construction. Two rows of windows are provided for, and a large double door in the south end, as shown, will permit of easy handling of parts of maehinery into the building.

A spacious basement is provided for carrying the wiring connections.

The longitudinal and cross sections illustrate the arrangement of the wall and rotary converter foundations, and also of the transformer platform at one side of the building. Five foundations are provided for the rotaries, surrounding which are open spaces in the basement, which has a clear height underneath floor beams of 6 ft. A spacious vault is formed under the transformer platform, occupying the west side of the basement, which provides easy access to the air blast pipes for cooling the transformers. The concrete crane girders are supported by pilaster columns rising between windows, upon which the runway is built up as a solid member. The roof is constructed similarly, being supported by five cross beams and stiffened by one longitudinal beam, all of which are of a construction similar to that used in the floor beams. The roof covering consist of sections of concrete slabs, which are reinforced by double rows of ⅜-in. steel rods, as indicated.

The details of this beam construction are made clear in the



LONGITUDINAL SECTION OF SUB-STATION, SHOWING REINFORCED CONCRETE CONSTRUCTION FOR FLOOR, ROOF AND CRANE RUNWAY GIRDERS

engravings. Each beam, whether for floor, roof, or crane-runway support, is built up with two or more rows of round steel rods extending longitudinally through the lower side of the beam and with corresponding bent rods extending downward from the upper sides of the ends, as shown; this effectual location of the steel reinforcing rods in the lower part of the beam enables the tension at the middle point under load to be fully taken care of by them. The shearing effect of the load upon the beam is taken care of by a carefully designed arrangement of stirrups of round steel rods, of smaller diameters, which are woven between the main longitudinal reinforcing rods, as shown, being necessarily closer together at the ends of the beams where the shear is greatest.

The cross section view shows some of the beams in detail and well illustrates this construction. In the floor beams reinforcing rods are placed in the lower side only, while in the crane girders and in some of the roof beams additional stiffening is provided by reinforcing rods in the upper sides also. In most of the beams two rows of straight and bent longitudinal rods are used, but in the crane girders three rows were used for obvious reasons.

The important feature of this system of concrete construction lies in the fact that all the steel members and even the section, location and spacing of the stirrup members, are carefully calculated for the loads which are to be imposed upon them. By actual destructive tests it has been found that with this system definite results can be provided for with the exactness which enters into steel-beam construction. It is believed by the contractors that this is the only system wherein shearing stresses in the beams are calculated for and suitably taken care of by the actual distribution of the reinforcing steel members. The main object of the contractors in the use of this system is to establish a system of concrete steel construction, which, while taking into consideration all theoretical principles, will also provide for the practical features of the work necessary for definite results; the theoretical requirements are well known, and have been much discussed, but they assert that sufficient consideration has not been given to the practical features, as required to make an exact application of the theory to the practice.

One of the defects of a good many systems of concrete steel construction, it is claimed by them, lies in the difficulty in the placing of the so-called stirrups in their proper positions in relation to the main reinforcing rods; while their theoretically proper locations are carefully indicated upon drawings, their practical placing in the beam is left to the ability of laborers or of foremen to space them after the longitudinal reinforcing rods are located in the moulds, thus creating a fruitful source of error. In this system this difficulty is obviated by the building up of the longitudinal reinforcing members and the vertical stirrups together into a framework, by tying with thin wire, before inserting into the moulds. It is then an easy matter to lower these frames, or trusses, into the moulds and locate them rigidly at the proper distances from the centering in order that the steel may be entirely embedded in the concrete, which is the condition required in order that the construction may be absolutely fireproof. The contractors believe that this will be the first concrete structure in which the reinforcing steel work is located definitely and exactly as called for by the plans.

Considerable care is used in the selection of material. In regard to the reinforcing steel, which is one of the most important features, nothing but steel rods of round section are used. The use of flat steel bars was found to offer the disadvantage that when the concrete is poured around it, air bubbles are formed upon its lower face, thus rendering a good part of its surface useless for adhesion; the patent twisted or corrugated rods which are used in many systems for the purpose of increasing the adhesion of the concrete to the steel, are thought to be absolutely unnecessary, inasmuch as the adhesion of con-

crete to a steel surface is equal to the shearing resistance of concrete. In some tests recently made on concrete beams it was noticed that in those merely reinforced with a patented type of reinforcing rods, the concrete almost in every case sheared off longitudinally along the rods near the stirrups where the shear is maximum, thus leaving the rods entirely exposed; in destructive tests of some beams of the system used for this sub-station, it was found that they failed in a manner similar to that in which steel or wooden beams usually break, that is, by breaking at the middle; this goes to show that the plain round rods, as here used, have many advantages for this work.

The other materials used are of the best quality. The broken stone is carefully screened to run in sizes of from ¼ in. to ¾ in., and is carefully washed. The sand is also screened and washed. The concrete is mixed wet in proportion of one part of cement to two of sand and four of broken stone, Atlas Portland cement being used for this structure. Wet concrete is used on account of having been found best for this work, owing to its property of more thoroughly covering and adhering to the steel frame work than the more dry rammed concrete. Some of the features of this system, as carried out, would seem to make the work rather expensive, but with the numerous labor-saving appliances that have been introduced for the construction, are said to render it a very economical system.

A building constructed in accordance with this system, the entire design and construction of which was supervised by R. L. Bertin, is in use in Long Island City for a large paper mill, and has been for some time subjected to the extreme test of daily service under heavy machinery-opearting conditions. The complete success of that building induced the Brooklyn Rapid Transit Company to investigate this system for the sub-station building, and, no doubt, its unquestionable success will do much to influence future work of this kind. The saving in first cost over that of former methods of construction is sufficient to warrant its being given careful attention by street railway managers.

The estimated cost of this structure, as erected by the Bertin system of reinforced concrete, will be $10,000—a material saving over what it would have cost with ordinary methods of construction. The materials and labor for its erection are being furnished by the Brooklyn Rapid Transit Company, the Bertin Engineering & Contracting Company, of Brooklyn, having contracted the engineering and supervision of the erection upon a percentage basis, with a bonus agreement for any reduction of cost below that estimated, and rebate for increased cost. The calculation and design of this structure was carried out by R. L. Bertin, of the Bertin Company, who was ably assisted in the designing work by its consulting engineer, E. P. Goodrich, formerly connected with the United States Navy.

The first electric railway in Peru was formally opened to the public at Lima, Feb. 17, with ample ceremony and great rejoicing by the populace. The road connects Miraflores, Barranco and Chorillos, summer resorts, with Lima, and is 8 miles long. It really was built in record time. The company applied to the Government for a charter to build the road Dec. 9, 1902; the concession was granted Jan. 20, 1903; work began June 11, of that year; the road was completed Jan. 18, 1904, and inaugurated Feb. 17. President Manuel Candamo of the Peruvian Republic, who is the formal sponsor of the road, replied to the address delivered by its president, Jose Payan, and Archbishop of Lima, Manuel Tovar, invoked divine aid and pronounced the benediction upon the new enterprise. Manuel T. Marca, chief engineer of the city railroads of Lima, is engineer for the new road. W. McLimont is electrical engineer, and Emilio Godoy, manager. All cars are of American manufacture, and are equipped with Christensen straight air brakes.

FINANCIAL RESULTS OF ELECTRIC RAILWAY OPERATIONS IN GERMANY

BY A GERMAN ENGINEER

Although the street railways in Germany were electrified at a later date than those in America, practically all the lines have now been equipped for electric traction for a sufficient length of time to demonstrate the results of the transformation from animal to electric power. The returns show that while most of the privately owned railways have continued to pay the customary dividends, the results obtained by the adoption of modern traction methods have been much less favorable than was anticipated. It is true that some of the railways operating in cities exceeding 125,000 inhabitants are paying over 6 per cent dividends, but they are few in number. In general the companies are satisfied if they can pay 4 per cent or 5 per cent on their stock. This is not a very encouraging fact. If an industrial undertaking, which is subject to ruinous competition at any time should return only 4 per cent on the cash investment, it would be considered a failure. The difference between the estimated and the actual net receipts of the electric railway enterprises lies in the operating expenses. In fact, so great has this difference proved that had not other unlooked for, but favorable, factors appeared, the larger part of the capital invested in electric railway enterprises in Germany might as well have been considered lost. If the reader asks what items in the original estimates were erroneous, the reply must be, "almost all."

Consider first the cost of power from the standpoints of both generation and use. Although two or three of the largest central stations produce power for about 1.25 cents (5 pfs.) actual cost (including station repairs) per kilowatt-hour, in the greater number the cost is at least 2.25 cents to 2.5 cents (9 pfs. to 10 pfs.); medium sized installations, 3 cents to 3.75 cents (12 pfs. to 15 pfs.), and smaller stations up to 10 cents (40 pfs.) per kilowatt-hour. To this must be added the cost of cables and other material, provision always made for sinking and renewal funds, etc. In the early days, tests made under most favorable conditions showed that the power consumption per car averaged 350 watt-hours per car-kilometer, but in practical operation the power consumption has risen to from 450 watt-hours to 600 watt-hours per kilometer, while on many city railways operating on good level streets the power consumption sometimes reaches 700 watt-hours per kilometer (1170 watt-hours per mile). These figures are based on the standard common in Germany, namely, a single truck car carrying two motors of about the same capacity as the G. E. 800 or G. E. 52 motor, and weighing from 7 tons to 8 tons.

Naturally, the deterioration of the equipment and track has increased in the same ratio. To-day it is considered remarkable if a gear runs 40,000 car-kilometers (24,000 car miles). The life of track in cities of 150,000 to 200,000 population was formerly assumed to be fifteen to twenty years. Now it is known, even if not always admitted, that expensive special track work, such as is used at points of heavy traffic, becomes so worn within three years that the wheel flanges run on the bottom of the grooves, and that in general railways in cities with heavy vehicular traffic must renew their entire track every ten years.

The cost for paving has proved enormously higher than was expected, as the companies are subjected to the most exacting requirements. The increasing use of asphalt is responsible for a great part of this expense, as asphalt pavements constantly need repairs. It can be safely asserted that wherever a company is obliged to maintain an asphalt pavement the maintenance charges will swallow all operating profits unless the passenger business is very dense.

The labor cost is in some cases more than double the amount

paid under horse-car conditions. The motormen, or rather the labor unions, suddenly discovered that there is a great difference between a motorman and a horse-car driver, although the former is not obliged to handle heavy reins and a whip while driving one or more horses and keeping a sharp lookout. This discovery resulted in wage increases and reductions in working hours from 12 or 13 hours to 8 or 9 hours. Of course, the conductors had to be treated likewise, but in their case the working time was reduced until they themselves protested. This anomaly is due to the fact that it is customary in many cities in Germany for the conductors to receive tips from passengers in return for information. As these tips sometimes equal if not exceed the wages paid by their employers, conductors on crowded lines are not likely to be short-hour enthusiasts.

The greater number of the employees have been accorded the benefits mentioned, as the companies were obliged to treat the other employees likewise, so that to-day the wages cost per car-kilometer is about one and a half times as much as it was eight or nine years ago.

Accident insurance is another item whose cost has proved to be far greater than was originally estimated, because the insurance companies grew tired of paying heavy damages out of their own pockets. Where formerly a company could secure personal injury insurance by paying 3 per cent or 4 per cent of its gross earnings, now as much as 20 per cent is demanded, and even then the railway company runs the risk of having its policy canceled by the insurance company at any moment.

Besides the old hand brakes power brakes have long been installed on most of the railways, not only in compliance with the demands made by municipal authorities and accident insurance companies, but also because of the desire of the railway companies themselves to secure safety in operation. The maintenance of this additional equipment, of course, involves still another heavy charge.

The one favorable condition that has tended to offset all of the additional charges named is the entirely unexpected increase in traffic. It can hardly be claimed that this increase has been caused by any one prominent characteristic of electric traction. It cannot be attributed to the change in speed alone, for in many cases this has increased on an average from only 9.5 km to 10 km (5.7 miles to 6 miles) an hour, or in some cases to 12 km (7.2 miles) an hour, possibly reaching 13 km (7.8 miles) an hour in suburban towns. Nor is this additional traffic due entirely to either more attractive cars or to lower fares, but more probably in principal measure to quicker and more regular headway and the introduction of transfers. Only all of these factors combined could cause an increase in traffic large enough to overbalance on a large number of lines the additional expenses brought on by the change to electric traction. Nevertheless, the very small city lines and the interurbans operating in thinly populated districts will be saddled with deficits for some time to come, or at best earn trifling dividends.

The profits of the municipal railways compare very poorly with the dividends paid by the companies under private ownership. This probably explains why the ardor for municipal ownership of tramways in Germany has cooled recently. It is true that in 1902 eight lines were added to the thirty-four municipal roads in operation at the end of 1901, but 1902 appears to have witnessed the maximum increase, for in 1903 only two were added. Not more than twelve of these roads can show earnings reaching or exceeding 4 per cent. To be sure, some of them are very profitable, for instance, Frankfurt-on-Main, which operates only 40 km (24 miles) of track for a population of 300,000, and Cologne, where high fares are charged. The other systems either pay very small dividends or show deficits.

The German street railways at the end of 1902 covered a total street length of 3176 km (1906 miles), an increase of 5.7 per cent over the preceding year. Of this amount, 576 km (346 miles), or 18 per cent, are under public ownership. It must be noted, however, that of this number only 470 km (282 miles) are operated directly by the municipalities, the balance being leased to individuals. This method is employed in Berlin, Halle, Münster, Elberfelde, Solingen, Aachen and Freiberg. On the other hand, there is only one privately owned railway operated by a municipality, namely, Bad Pyrmont, a 3-km (1.8 mile) horse-car line. The largest four municipal lines are Cologne (67 km, or 40.2 miles) München (48 km, or 28.8 miles), Frankfurt (44 km, or 26.4 miles), and Düsseldorf (42 km, or 25.2 miles).

Another symptom of the decline of the municipal ownership idea is the fact that several municipalities, Barmen, for example, are considering the advisability of leasing their lines to individual companies.

Of the 3176 km (1906 miles) above mentioned 80 km (48 miles), or 3 per cent, are horse railways. There are twenty-two in all of the latter, Mainz, Brandenburg, Rostock and Potsdam having the most important systems. Steam lines comprise 175 km (105 miles). The principal installations are at Strassburg, Mülhausen (Alsatia), Bonn and Gera. There is also one gasoline line, 7 km (4.2 miles) long at Nördsee-Bad Juist.

The few horse-car lines have remained in existence because the traffic did not justify their electrification, or in consequence of the excessive demands made by municipalities to permit such change. The remaining steam lines have held their own owing to their connection with the steam trunk lines, which enables them to deliver freight to factories in town. While there is little profit in this business it appears to be better suited for steam power than for the electric lines. A few of the electric roads are doing a little freight business, but with small success. In all, there were in 1902 twenty-eight street railways, operating 665 km (400 miles), handling freight, but the length of line fell to 540 km (324 miles) in 1903—a certain sign of poor business. Hanover, with 160 km (96 miles) and thirty electric locomotives, stands at the head of the electric lines handling freight. The number of freight-car kilometers run in Hanover last year was 1,475,000 (885,000 car miles), and the tonnage carried 176,000, giving only 1100 metric tonnes per kilometer (1936 tons per mile) of track.

The largest street railway system is the Grosse Berliner Strassenbahn (including the Western and Southern Berliner Vorortbahn & Charlottenburger Strassenbahn), covering 332 km (200 miles). The annual income of this company for 240 km (144 miles), exclusive of controlled lines, is 28,100,000 marks ($7,025,000), the number of passengers carried 295,000,000, and car-kilometers run 67,400,000 (40,440,000 car miles). The Hanover system, with 160 km (96 miles), is next in length, but the Hamburg lines, though 6 km (3.6 miles) shorter, have an annual income of 10,900,000 marks ($2,725,000), which is second only to Berlin.

The most profitable line is that owned by the Hamburg-Altonaer Centralbahn. It is 9 km (5.4 miles) long, and consists of a single straight line, joining the business and amusement centers of Hamburg and Altona. It is distinguished from all other German lines in selling no commutation tickets. A uniform fare is charged, viz., 10 pfs. (2½ cents). It holds the record with about 150,000 marks per kilometer ($62,500 per mile), followed by Frankfurt with 115,000 marks per kilometer ($47,916 per mile), and Berlin with 112,000 marks per kilometer ($46,666 per mile). The Hamburger Strassenbahn receives 75,000 marks per kilometer ($31,250 per mile), while the gross income of the Hanover company is barely 17,000 marks per kilometer ($7,083 per mile). At first the Hamburg-Altonaer Centralbahn paid 30 per cent, but is now paying 19 per cent on its capital of 2,000,000 marks ($500,000).

A review of the fares charged throughout the country may be of interest. Up to 1902 the cost of transportation was

lowered either by reducing the fares or giving a longer ride for the same charge. Most of the railways, in compliance with the urgent demands of the public, introduced a unit of 10 pfs. (2½ cents), and even lower commutation rates which often amounted to less than one-half of the usual fares, and this for distances up to 15 km.

Of course, low fares are conducive to heavier traffic, and every railway company should endeavor to reduce its transportation charges as much as is possible, but only within reason. Many of the railways found that they had gone too far and began to seek means for relief. This, however, could be obtained only by the municipal lines, because the private companies were bound by contracts with their respective municipalities, who, of course, would not be likely to abrogate agreements which would make their citizens pay higher fares. So, while the private companies were obliged to stand by the low rates, nearly all of the municipal lines abolished the 10 pfg. (2½ cents) uniform fare. It is a fact that in most of the large cities having municipal lines the fares are appreciably higher than in cities of corresponding size having privately owned railways—another sign of the times which has done much to dampen the ardor for public ownership. A good example of this is Nürnberg, where the private railway charged 10 pfs. (2½ cents) for many years. In May, 1903, the city acquired this line, and two months later a zone system was inaugurated which increased the average fare. The city explained this action by stating that additional income was necessary to build extensions.

The following table shows the average fare per passenger in some of the large cities:

	1902		1901	
	Pfg.	Cents	Pfg.	Cents
Breslau	8.3	2.075	8.3	2.075
Frankfurt	8.9	2.225	8.8	2.2
Deutsche Strassenbahn Dresden	9.0	2.25	9.0	2.25
München	9.1	2.275	9.2	2.3
Berlin	9.2	2.3	9.4	2.35
Leipzig	9.4	2.35	9.2	2.3
Magdeburg	9.5	2.375	9.1	2.275
Düsseldorf	10.2	2.55	9.1	2.275
Cöln	10.3	2.575	10.3	2.575
Hamburg	10.5	2.625	10.9	2.725
Hanover	10.8	2.7	10.8	2.7

Most of the lines showing an increased average accomplished this result by increasing the commutation rates, and in one case by raising the regular fare. Where a decrease is shown in the average fare the cause is due chiefly to reductions in commutation rates; but not a single company reduced its regular fares in 1902. The serious losses suffered in 1902 by many suburban lines operating in industrial districts were in most cases recovered the following year, when the industrial depression began to disappear, and up to the present time this betterment has continued. It is significant, however, that there is a general tendency to pay lower dividends than heretofore, and use the difference for the benefit of depreciation and maintenance funds and for contingencies.

In 1903 several of the railways began paying to the municipalities the percentages of net earnings stipulated in their charters, thus adding another item to the many exactions already required. Clauses regarding net earnings are worded somewhat like the following:

> Besides the payments hereinbefore mentioned, the railway is to pay, beginning with the year ....., a portion of the surplus remaining after disbursing a 5 per cent or 6 per cent dividend, this part to equal 35 per cent of the surplus remaining after a 6½ per cent dividend has been paid and rising to 50 per cent of the surplus remaining after the payment of an 8 per cent or 9 per cent dividend.

The only good feature about this method of taxation is that it tends to make a municipality cautious about granting concessions to a competing company, because with two companies in the field there would be far less likelihood of its receiving such additional payments.

In conclusion, it may be interesting to note the capital invested in street railways in Germany. The total amount invested is 745,000,000 marks ($186,250,000), of which 395,000,000 marks ($98,750,000) is invested in standard gage lines, and the balance in other gages (mostly meter gage). The average cost per kilometer is 240,000 marks ($96,000 per mile). The total income for passengers in 1902 was 123,800,000 marks ($30,950,000), against 118,300,000 marks ($29,575,000) in 1901. The freight and mail business amounted to 1,140,000 marks ($285,000). The actual operating expenses in all Germany were 72,000,000 marks ($18,000,000) in 1902, against 71,200,000 marks ($17,800,000) in 1901.

The cost to the companies for the workmen's insurance required by law was 2,270,000 marks ($567,000), and for taxes and special payments 7,300,000 marks ($1,825,000). It must be remembered that the latter amount, although very large, represents only a small part of the total sum paid to the municipalities by the companies, particularly in paving costs, the obligation in many cases to purchase current at high prices from municipal power stations and other heavy expenses. The total amount paid in dividends was only 15,800,000 marks ($3,950,000), or hardly more than twice the amount paid for taxes and special payments.

Great interest has been created by the question whether municipalities have the right to grant franchises to new companies on streets already given to another company. In all the cases which have been tried hitherto the highest court has decided that where one surface railway occupies a street a second franchise cannot be given to another surface railway for the same street. However, all of these cases were based upon specific agreements, and no general ruling has yet been rendered.

The present case concerns the city of Berlin and the Grosse Berliner Strassenbahn. The railway company seeking a franchise is not a street railway, but an underground railway, nor is it a new line but a continuation of an old one. The Grosse Berliner Strassenbahn has informed the city that it objects to having the other company receive a franchise, and the city has, therefore, appealed to the courts to make the railway company acknowledge its right to grant the franchise. The local court has placed the value of the concession at 37,000,000 marks ($9,250,000), and before the case is finally decided the legal expenses will probably amount to 1,500,000 marks ($375,000).

Naturally, the public is far from pleased to have the development of traffic facilities thus interfered with, but the Grosse Berliner Srassenbahn is simply defending its rights in objecting to the granting of franchises that will injure its best lines. Without question, this company has done much for the rapid development of Berlin, often building and operating lines which remained unprofitable for a long time. Now, when it is in position to gather the fruit of many years' work, another steps forward to enjoy the privilege without even being obliged to make the many payments under which the old company has labored for years.

RACE SEPARATION IN SAN ANTONIO, TEX.

The San Antonio Street Car Company, of San Antonio, Tex., has proposed a new plan for race separation on its cars which promises a solution of the problem. As the ordinance which governs the separation of the races now stands, certain seats are arbitrarily set apart for blacks, and the whites are not permitted to occupy them. Under the plan proposed, the conductors of the cars will seat the whites in the upper ends of the cars, and the blacks in the lower end, the two races gradually filling up the space between without any mixing. When only the center seats are not occupied, the first passenger aboard to take one of them will determine the color which is to prevail for that seat.

CONSTRUCTION DETAILS OF TORONTO CONVERTIBLE CAR

The general features of the convertible cars built by the Convertible Car Company, of Toronto, Ont., were described in the STREET RAILWAY JOURNAL of March 12, but as the construction details present many interesting points, further data regarding these cars will, no doubt, prove interesting. As mentioned in the first article, they have been thoroughly and successfully tried out on the lines of the Toronto Railway Company, where many are in service.

The four platform sills of this car are faced with strongly bolted steel plates, which are of the same length as the sills. The bumper is also faced with sheet-steel, giving adequate strength for all ordinary usage.

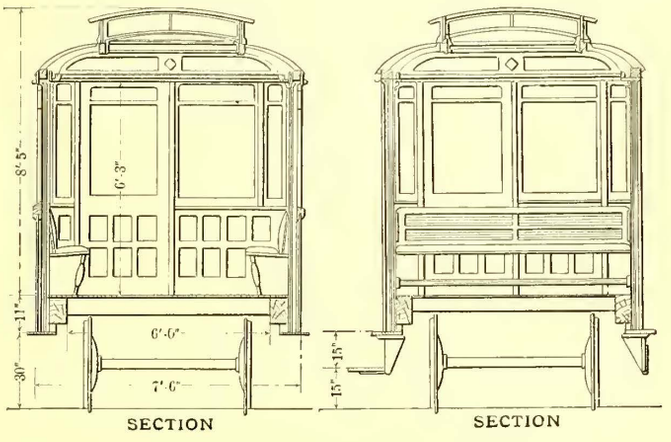
The platform is 4 ft. 7 ins. long, and 6 ft. 4½ ins. wide; height from platform to roof inside, 8 ft. 1½ ins.; height from platform to roof doorway, 7 ft. 1 in.; doorway to vestibule, 2 ft. 7 ins. wide; doorway sill entrance to car from platform, 7 ft. ¼ in. high.

The vestibule is sufficiently large to enable the motorman to have free access to all appliances, but is not large enough to permit passengers to remain in it to interfere with the motorman's work. It is of pleasing design, and has shown itself capable of standing great hardship from collisions and other contact. It is circular in form, all mouldings and belt rails being bent before ironing off. This type has been adopted as standard by several railways after thorough test. The top step or running board, when the car is closed, acts as a guard to prevent the car sides from being damaged by coming in contact with other vehicles. It forms also a permanent rest for the removable sections. The side posts are securely bolted from below this running board by a steel plate, which acts as a washer as well as a support underneath the running board. A steel plate is also bolted at the outside end to this step and bolted to the sill underneath.

This top step is 8¼ ins. wide, and is 1 ft. from the flooring. It is rounded off by a malleable iron stripping, which protects it against wear and contacts. The projection of this running board when the car is closed is 4¼ ins. from the car body. A moulding is screwed on to the step when the panels are on for closed car conversion, thus preventing the panels from becoming loose or rattling. At the same time this moulding gives a finished appearance to the closed car.

a very stiff and rigid car body, prevents all racking, and may be utilized either as a brace or seat support whether the car is open or closed. The posts are constructed so as to permit the curtain to rise or lower inside the hand rails, whether the car is closed or open.

On top of the car posts are steel plates of unusual depth halved into the car posts and forming the top or outside panel, thus making a very stiff construction. Steel plates are used on the face of the car sills, on which are securely fitted malleable

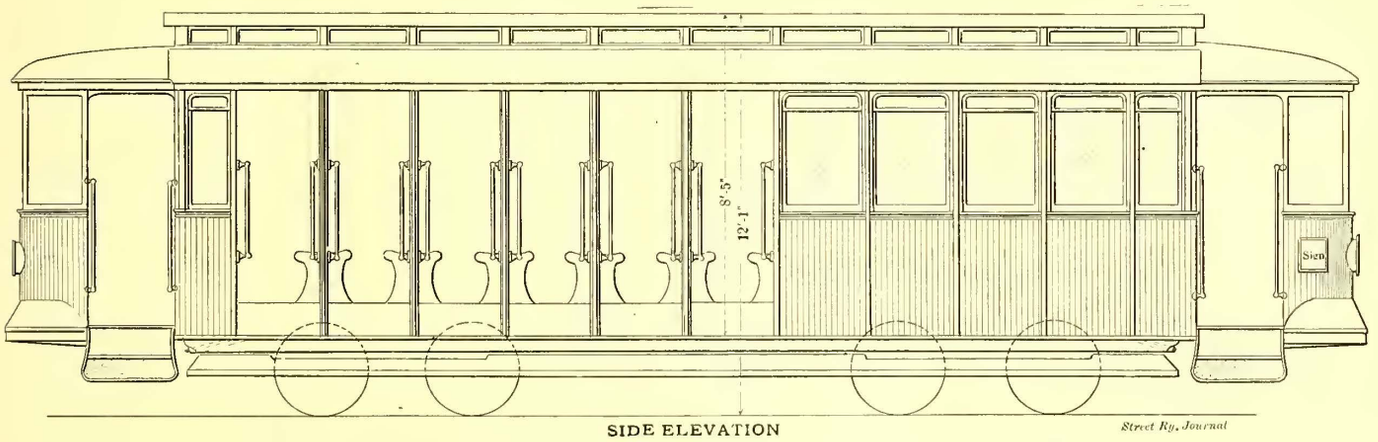


SECTIONS OF CONVERTIBLE CAR

cast-iron panels, bolted through the car sills. On the face of these panels is a rim which forms a slot into which the car posts pass. These being bolted to the upright panel, pass down to the bottom of the car sill and are securely bolted through the face of the same. They are also notched into the running board or top step, making the base extremely rigid.

The outlet of the eave trough runs through a specially devised flow through the corner post of the car body by means of a galvanized iron pipe passing inside or sunk in the same.

The following are the principal dimensions of the standard type of this car: Car body, 30 ft. from end sill to end sill; length over all, 40 ft.; car body, 8 ft. 4¼ ins. wide over all; top step or running board, 8¼ ins. x 1⅜ ins.; top step or running board, 3 5-16 ins. drop from sill inner side; stripping on closed side, 2 ft. 8 ins.; stripping on convertible side, 3 ft.;



SIDE ELEVATION, SHOWING CAR WITH SOME OF THE PANELS IN POSITION

The posts which sustain the panels may be of any well-seasoned wood, preferably white ash. The panels, or removable sections, are simply and strongly constructed of any good, solid, well-seasoned wood as may be selected. Where the posts meet the first step or running board they are bolted from below as well as being notched into the running board. The upright panel which sustains the transverse seats when the car is open is bolted to the car post and at the sill. This construction makes

width of removable section or panel, 2 ft. 6 ins.; top step or running board, when car is closed, 4¼ ins. wide; door entrance, 6 ft. 1 in. high, 2 ft. 7 ins. wide; corner posts, 5 ins. x 5 ins. x 7 ft. x 4½ ins.; side of car, running board from roof sill, 7 ft.

The weight of the car body equipped complete without trucks, motors and other material, is 5 tons. The weight of car equipment and trucks, motors and overhead material complete, ready for commission, is 15 tons.

AN INTERESTING SEMI-CONVERTIBLE CAR

Among the cars built by the J. G. Brill Company for exhibiting at the Louisiana Purchase Exposition is a particularly interesting suburban type of semi-convertible, with body 30 ft. ½ in. in length. It may be considered that this car is the fullest expression of the builder's idea of what a car for suburban service should be. The roof storage window system is too familiar to require description. It may be stated, however, that

INTERIOR OF EXPOSITION CAR

the top of the window sill is 25 ins. from the floor. This height has been adopted lately as the standard practice in this type. It necessitates the use of an arm rest, as the window sill is too low for that purpose. An arm rest has been devised, therefore, which is bracketed to the side lining, and is an addition to the comfort and appearance of the seats without interfering with the window lifts. The seats are 36 ins. long, have step-over backs, tilting cushions and are upholstered in figured plush. They are of a new design, and arranged so that the levers extend but seven-eighths of an inch beyond the cushion at either end. They are placed so that they do not come in contact with seated passengers, whose bodies may extend over them, and thus maximum seating space is obtained without encroaching upon the aisle.

Single sliding doors of the semi-accelerator type are used in the ends. These are set at the side close to the platform entrance, and, therefore, room is obtained for a seat for three passengers at either end of the car with the back against the end. The platforms are of the vestibuled "Detroit" type with entrance at one side, so that in whatever direction the car is running passengers must enter and leave at the rear. The platforms, which are 5 ft. 4 ins. from the end panels over the vestibules, are divided by brass railings, with room for passengers to move around the ends. The folding doors at the entrances are controlled in their movement by an ingenious device for which application for patent has been made. It consists of a vertically placed metal roller on top and at the end of the outer leaf of the door, and moves behind a rail or track extending across the inside of the lintel.

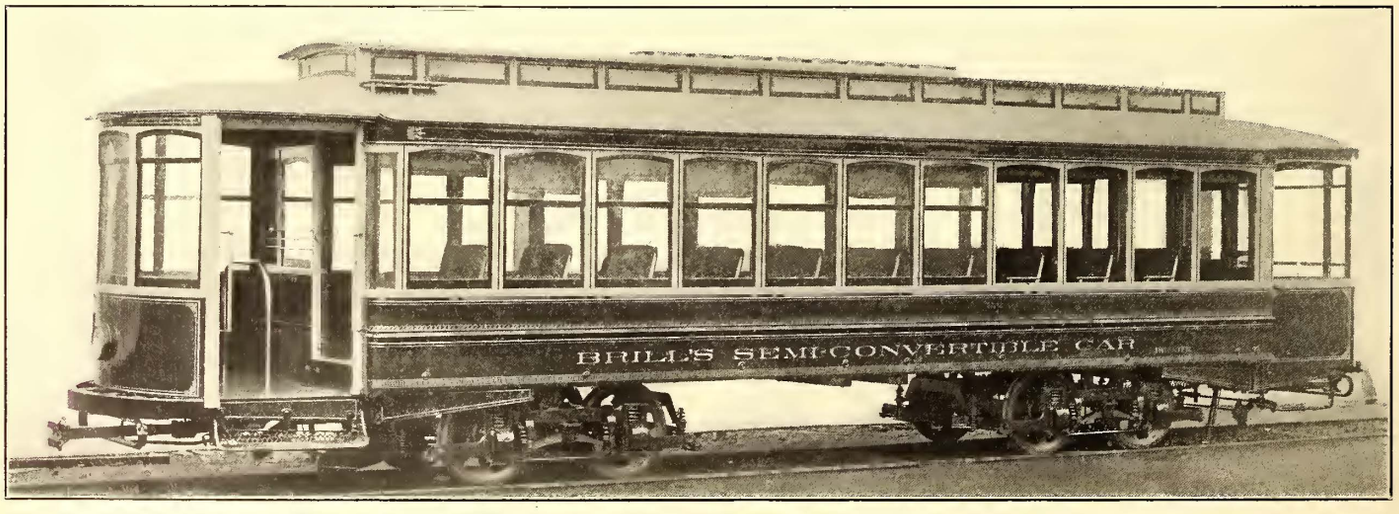
In the side of the vestibule opposite the door is a large window, arranged to drop into a pocket in a new and interesting manner. It is composed of two sashes, the lower of which on being raised engages the upper, then both are "walked over," and by means of trunions at the sash corners are guided down a second runway into the pocket. A patent on this device has also been applied for. The windows at the front of the vestibules have pockets in the wainscoting, the central has steps for holding it at any desired point.

The interior of the car and the platforms is finished in vermilion, richly ornamented with parquetry, and the ceilings are of painted veneer handsomely decorated with gold. Brake handles, sand-boxes, draw-bars, angle-iron bumpers, track scrapers, platform and conductors' gongs are some of the builder's specialties with which the car is equipped. The trucks are Brill 27-G-E-1.

BLOCK SIGNAL SYSTEM

An automatic block signal system, which possesses a number of novel features, has been brought out recently by the Bradley Railway Signal & Supply Company, of Providence, R. I. In this system a block consists of two signal boxes and two contact boxes. The contact boxes serve to operate the signal boxes, and are secured in position on the trolley wire near the intersection of the turn-out and single track, while the signal boxes are placed on poles, one at each end of a stretch of single track at a distance of about 100 ft. from the contact boxes. The system is connected by three insulated galvanized iron wires.

The signal boxes contain two openings, one of 8 ins. and another of 4 ins., protected by heavy transparent glass discs, which are placed on the side toward the turn-out and facing the entering car. Within each box is a large transparent red semaphore, which is held away from the larger opening and thus concealed from view by a continuous current on a closed circuit. Within each opening there are also incandescent lamps which are for illumination only, as the operation of the system is not dependent upon them. When there is no car in the block the signal boxes at each end will show two clear openings.



SEMI-CONVERTIBLE CAR FOR LOUISIANA PURCHASE EXPOSITION

The operation of the system is as follows:

When a south bound car leaves the first turn-out and enters the single track with the intention of meeting and passing a north bound car on the second turn-out, its trolley wheel in passing the first contact box breaks the circuit, thus allowing the red transparent semaphore in the signal box at the other end to fall by gravity to danger position, covering the larger opening in the box. This danger signal will thus be set in front of the waiting north bound car at the second turn-out and prevent it from coming into the block.

As the red danger semaphore falls by gravity in this signal box, it sets a green signal in the signal box near the south bound car. This green signal is absolutely dependent upon the danger signal being set in the other box, for if from any cause the danger signal fails to be set, no green signal will appear in the signal box near the south bound car. The green signal is a permissive signal, for it tells the entering car at the first turn-out that the danger signal is set at the second turn-out, and thus gives the car setting the signal the right to proceed.

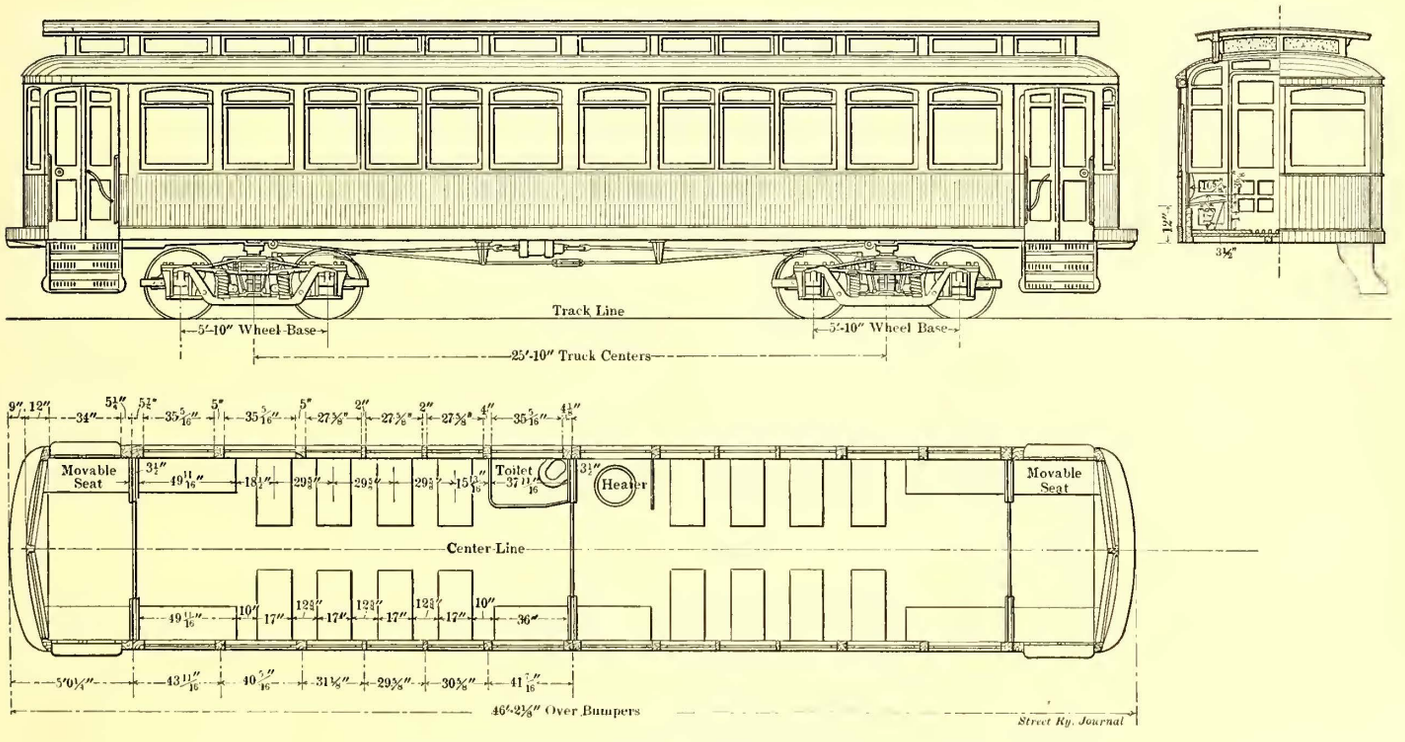
When the south bound car reaches the second turn-out and is about to leave the block, the trolley wheel passing the second contact re-establishes the circuit, thus raising the danger semaphore in the signal box at that end to safety, which in turn clears the green signal in the signal box in the rear at the first turn-out. There is now no car in the block, the single track is clear and the signals at both ends of the block are at safety and show a clear light. The car upon the second turn-out going north now has the right to proceed, and it repeats the operation, reversed, of the south bound car.

If there is one car on the second turn-out going north and three cars on the first turn-out going south, with orders to meet and pass the north bound car at the second turn-out, the first car to leave the first turn-out going south will set the danger signal at the second turn-out and get a green permissive signal. When the second south bound car following is about to enter the block it will see the green permissive signal, showing that there is a car in the block ahead going in the same direction. The passing of the trolley of the second following car at the first contact box will lock again the danger signal in the signal box at the other end of the block. This will be indicated to the car by a second operation of the green signal in the signal box at its end. The third following car will lock the danger signal a third time, which will be indicated as before by another green permissive signal. The north bound car waiting at the second turn-out will see nothing but a danger signal and will have no means of knowing how many cars are approaching, but as the first southbound car passes out of the block and is about to enter the second turn-out, the trolley wheel in passing the second contact box will simply unlock the signal once in the second signal box, which will stay at danger, as the two following cars must unlock it each in turn before it can go to safety. When the third or last south bound car passes out of the block, the danger signal will return to safety and the green permissive signal in the box at the other end will go to clear, and the north bound car on the second turn-out will be at liberty to proceed. The operation will be the same of course for any desired number of cars going in either direction.

It is plain from the foregoing description that no two cars can enter a block from opposite directions and meet on a single track, whether the system is in working order or not, unless the crew should go blindly against a danger signal.

INTERURBAN TRAILER CARS FOR MILWAUKEE

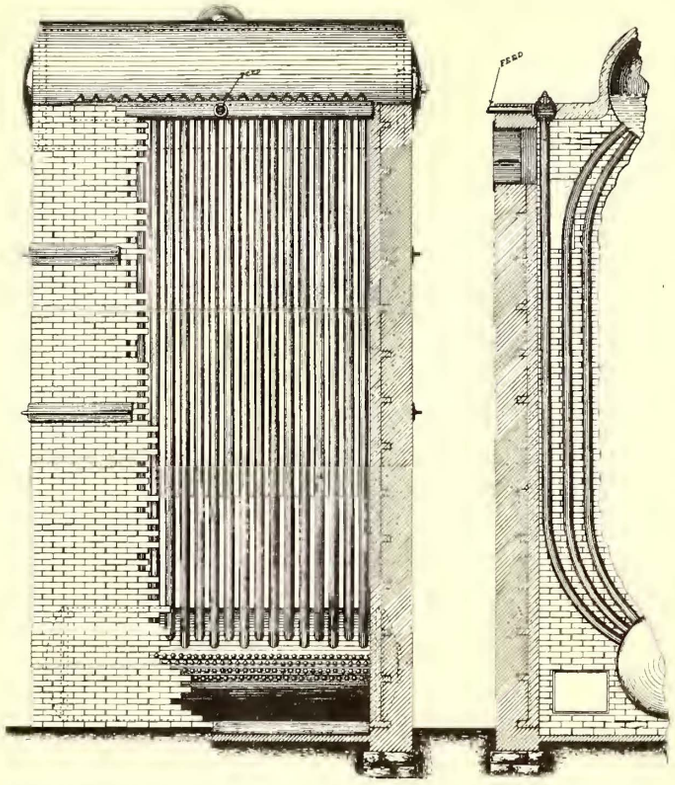
In the STREET RAILWAY JOURNAL of Sept. 5, 1903, the new interurban motor cars of the Milwaukee Electric Railway & Light Company, of a radically new design, were described. For attachment to these motor cars as trailer cars during times of unusually heavy traffic, the Milwaukee Electric Railway & Light Company is now having built at the St. Louis Car Company's shops a car, the design of which is shown by the accompanying drawings. This car, as can be seen, has the vestibule platforms with a movable seat over the steps, so that the front vestibule can be used for seating purposes when the car is in the country and as an entrance when in the city. In this respect it is similar to the motor cars previously described. The arrangement of windows makes the rear of the car about as near an observation car as can be obtained. The car is divided in the center for a smoking compartment.



PLAN AND ELEVATIONS OF MILWAUKEE TRAILER CAR

WATER TUBE BOILER AND SUPERHEATER

The accompanying cuts present two views of the Milne water-tube boiler, designed and built by the Milne Boiler Company, of New York. This boiler is a simple combination of



REAR VIEW OF WATER-TUBE BOILER, SHOWING FEED-WATER SECTION

four parts, namely, an upper and lower drum, a number of sections of staggered 4-in. seamless drawn steel tubes connecting them, and an independent feed-water section composed of a single staggered row of tubes coupled to the drums. Not an ounce of superfluous material, nor any of the numerous parts and complications so prevalent in steam boiler practice are to be found in this type, the whole having been designed to generate steam at the highest efficiency with the most perfect fuel economy.

The drums are set one above the other and connected by a number of rows of 4-in. tubes, all joints being expanded. The tubes are all curved to a 5-ft. radius. There are but five different bends in a complete set of tubes, the front and back rows being interchangeable. The tubes are spaced and arranged so that any of them can be removed and replaced without disturbing the brick work or the tubes adjoining.

The feed-water section is composed of a single staggered row of 4-in. tubes extending completely across the back of the boiler. The upper ends of the tubes are expanded into an independent header (not connected with the upper drum) which receives the feed water. Feed water is not admitted to the upper steam and water drum. This feed-water section takes up considerable heat heretofore wasted, as it presents a cool surface to the escaping gases, and adds another element of safety in protecting the drum plates from the influence of the feed water, particularly in case of low water. Much drier steam is produced, as fluctuations in temperature, due to variable feed supply, are very unlikely.

The furnace design and heating surface situation will, with intelligent firing, produce the most perfect combustion, because the fire-brick arch covering the furnace maintains the high temperature required to ignite and burn the fuel gases. As the heating surface is situated at the back of the furnace and bridge wall, the highest furnace temperature is maintained, and the temperature of the fuel gases not reduced until combustion is completed.

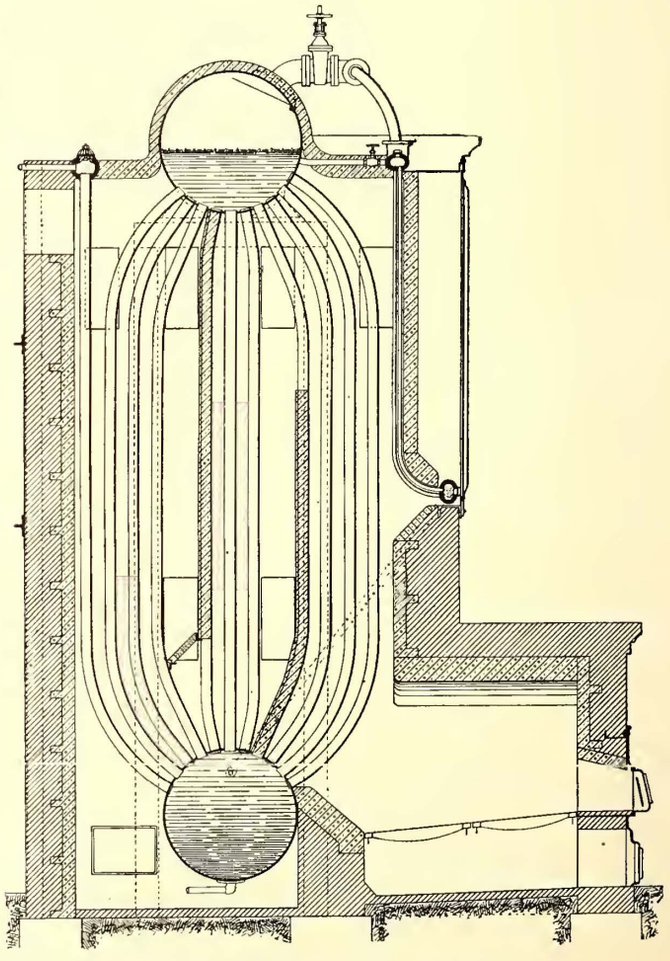
The boiler is constructed of wrought steel material throughout. It contains no flat, stayed or inaccessible surfaces. All surfaces are cylindrical, of moderate diameters, and accessible in the most direct manner for every purpose.

The vertical position of the tubes prevents the collection of dust and ashes, thereby insuring a rapid and uniform transmission of heat, and as the gases of combustion travel about 70 ft. over the heating surface, and finally over the feed-water section before escaping, higher fuel economies are insured than heretofore possible in steam boiler practice.

The tubes can be cleaned with greater ease and less expense than straight tubes; scaffolding or other structures are not needed, and there are no hand-hole plates to remove and replace. One manhole gives access to every tube in the boiler, and any of the mechanical rotary cleaners, now so extensively used, will clean them in the most direct manner.

The Milne steam superheater is of the most simple form, being composed of an upper and lower steel header, having each end of the superheating tubes expanded therein, the flexibility of this form amply providing for expansion and contraction. Being situated in the front of the boiler it is directly accessible for any purpose, and in case of serious derangement can be removed entirely while the boiler is under pressure.

The simple nature of the connections permits instantaneous flooding, accompanied by a perfect circulation of the water in



SECTION OF WATER-TUBE BOILER

the boiler, and, what is equally important, the degree of superheat can be varied to suit all practical working conditions.

The simplicity of the complete boiler and superheater guarantees the greatest ease and efficiency in operation and the lowest cost for maintenance. They are constructed in sizes up to 1000 hp, and for any steam pressure, the design permitting ample grate area for capacities far in excess of the rating.

1500-KW ALTERNATOR FOR ST. LOUIS

The following is a description of the large alternating-current generator to be installed by the National Electric Company at the central power station of the Louisiana Purchase Exposition at St. Louis. This alternator will be direct connected to a 2250-hp Hamilton-Corliss vertical cross-compound engine. The rated output is 1500 kw, 25 cycles, 6600 volts, running at 83 r. p. m.

Like all of the standard alternators built by the National Electric Company, it is of the revolving field type, leaving the armature stationary and easily accessible. The difficulty of properly insulating the armature coils is eliminated, as the windings are not subject to any mechanical strains whatever. The revolving field is of large diameter, giving additional fly-wheel effect to the engine. The construction of the field coils is such as to make them practically indestructible. All parts are accessible, and the method of ventilation insures low temperatures.

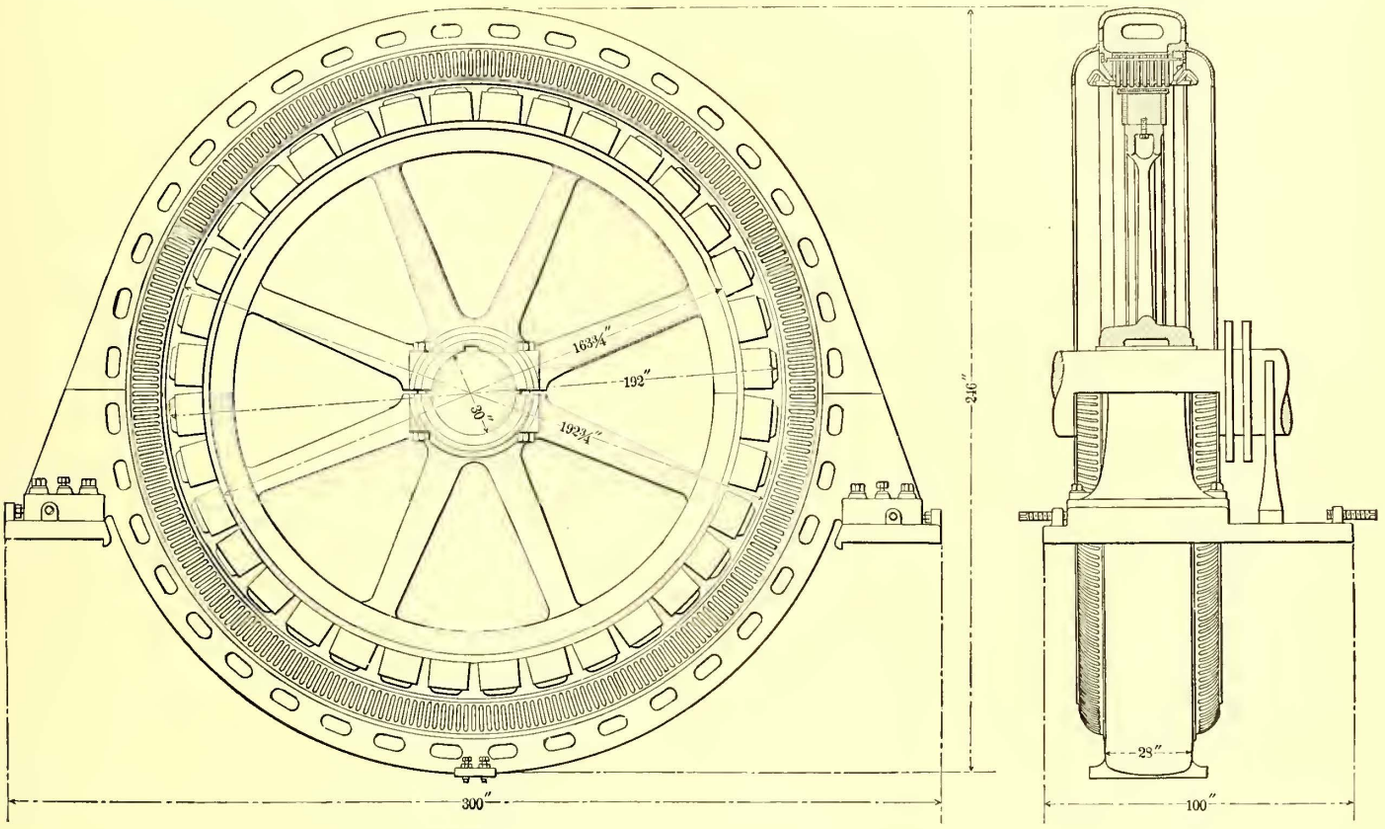
The revolving field is made of cast-steel in halves, which are bolted and secured together by shrunk links. The rim of the wheel is in channel cross-section, to which the cast-steel pole pieces are bolted. The field coils comprise sixty-five turns of 1½-in. x ⅛-in. copper strap, wound on edge and thoroughly insulated, the outer edge of the coil being exposed to the atmosphere for cooling. Laminated pole shoes are secured to the ends of the pole pieces, and serve to hold the field coils in position. These shoes cover a large polar arc, distributing the magnetic flux evenly.

The field coils are insulated from the pole pieces by fullerboards, and from the pole shoes and spider ring by heavy fiber. The revolving field is 16 ft. in diameter, and weighs approximately 50,000 lbs.

The frame is a circular cast-iron housing into which laminated punchings with inwardly projecting teeth are assembled for the reception of the armature windings. The frame is extremely heavy and stiff, not requiring any external support. It is divided horizontally, the halves being bolted and keyed together. Bolts and keys are contained entirely within the cross-section, obviating the use of side lugs. Large open spaces are provided in the sides of the frames, allowing a free passage of air from the ventilating ducts in the core.

The armature core is built up of laminated soft steel punchings, annealed and japanned before assembling. Ventilating space blocks are inserted at suitable intervals, providing openings extending around the circumference and allowing free passage for the heat generated in the windings. There are six slots per hole, 2½ ins. deep by 1½ ins. wide, each being wound with fourteen conductors of .37-in. x .28-in. compressed copper strand. The internal diameter of the armature is 16 ft. ¾ in., and the width of the core 16 ins.

Cast-iron collector rings and carbon brushes are used, enabling the machine to be operated with a minimum amount of attention, and at the same time providing a collector gear which will carry a heavy temporary overload.



SIDE AND END ELEVATIONS OF 1500-KW ALTERNATOR

The net weight of this alternator is 135,000 lbs. The efficiency guarantees are as follows: One and one-quarter load, 95.5 per cent; full load, 95.5 per cent; one-half load, 94.75 per cent. The regulation is 5.5 per cent on power-factor unity, and 22 per cent on power-factor zero.

The temperature will not exceed 30 degs. C. on armature and magnets on a continuous run at full load, and 40 degs. C. on the armature and magnets on a continuous run at 25 per cent overload.

The announcement was recently made in the STREET RAILWAY JOURNAL that the Western Ohio Railway and the Dayton & Troy Electric Railway had completed arrangements for operating limited cars between Lima and Dayton, charging $1.40, as compared with $2.20, the fare over the same route made by the parallel steam road. Now the Cincinnati, Hamilton & Dayton Railway (steam) announces that it will meet the rate of the electric lines and inaugurate additional train service should the competition become active. It is stated also that the present conditions will continue if the electric roads abandon their plan of limited service.

SECOND MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

The second meeting of the Ohio Interurban Railway Association was held at the Hollenden Hotel, Cleveland, April 28. About sixty operating railway men and supply men were present, including representatives from a number of roads in Northern Ohio that were not represented at the previous meeting. Practically the entire session was given up to the discussion of a plan for handling the form of coupon book adopted at the previous meeting, and for adjusting settlements between the various companies using the coupon book. This matter has been left to the transportation committee of the association with power to act. As stated in the last issue of this paper the transportation committee met at Fostoria, Ohio, April 16, and formulated a plan of agreement. However, the committee decided that this agreement was quite an important matter, and declined to take final action, and, instead, recommended its plan to the association for adoption.

In the meantime, H. C. Lang, of the Western Ohio Railway Company, had formulated a plan of agreement between the companies, patterned after the contract existing between the companies in the Central Traffic Association of steam roads. Mr. Lang presented his plan before the meeting, and the discussion which followed took up the greater part of the time set apart for the session. Many of those present favored Mr. Lang's plan, while others thought it too cumbersome. It was finally decided to send typewritten copies of both plans to the various roads in the association, together with a return postal card giving an opinion on the subject. One of the plans will then be adopted at the next meeting.

The plan proposed by the transportation committee was, in brief, as follows:

Coupon books to be issued by the various companies and to be purchased in bulk through the secretary of the association, who would have them printed, thus insuring uniformity. Books to be numbered in consecutive order and charged to a company as sent out. Settlements to be made between the various auditors not later than the tenth of the month, in which coupons were collected. Settlements to be made on a basis of 83 1-3 per cent of the face value of the coupons and settlements to be made by payment of balances. Each road to keep a daily record of serial numbers collected, to be made basis of settlement in case of loss or surrender of book and to indemnify issuing railway against lost coupons being presented for payment. Unused coupons to be redeemed at option of issuing company within eighteen months, full face value to be computed for all coupons used and remainder to be redeemed in cash. New companies to be bulletined by secretary. The agreement to be for one year from May 1, 1904, any company to be permitted to withdraw from the agreement upon sixty days' notice, providing all adjustments with other companies have been made. But companies withdrawing from the agreement must continue to honor books of other roads that were issued prior to the date of withdrawal from the agreement. Violation of rules to be brought before the association for action. Rules to be amended by two-thirds vote of companies in the agreement; thirty days' notice to be given to all companies of such changes. The decision of the transportation committee to be final in all disputes.

The plan proposed by Mr. Lang contemplates the formation of a bureau, to be composed of all roads parties to the coupon book agreement. This would take the matter of coupon books out of the hands of the association, and all matters pertaining to same would be controlled only by those who are parties to the agreement. It is proposed to have an executive committee composed of three members, selected by the various roads, the action of this executive committee to be final in all discussions arising between the various roads parties to the agreement. It is proposed to change the form of the book somewhat, and attach the contract with the purchaser to the auditor's check, to be retained by the selling agent and forwarded to his company. Coupons to have a perforated line through the center, each section of each coupon to have the initial of the issuing road and the number of the contract. One section of each strip is to be retained by the company collecting and the other to be mailed to the road that issued the book.

The secretary of the association to be the secretary of the bureau. All books to be ordered through the secretary, who will order them from the official printer, bill to be rendered to the company ordering. New roads desiring to become parties to arrangement must be approved by the executive committee of the bureau. Each company party to the agreement to give a bond of $10,000. Expenses of bureau to be provided for by an assessment, based on 25 cents per single track mileage. Settlements on coupons to be made monthly by balances between the various auditors. Redemption of coupons to be on a basis of cash fare for the portion used. Meetings of the bureau to be called by executive committee. Members of bureau may be fined $1 for failure to have representatives present at meetings. Members may be represented by proxy. Instructions to agents and conductors to be uniform, as prescribed.

These rules provide among other things that the signature of purchaser must be made in presence of agent. Baggage to be checked in accordance with the rule of the road over which book is being used. In case a loss of book is reported to agent, the agent must send a written notice to his auditor, who will notify other roads to take up the book. Owner of the book must agree that in case he finds the book he will not attempt to use it until he has notified the company from whom he purchased it. Expired books will not be redeemed. A joint agent must ascertain over which road a passenger desires to travel first and sell a book for that road. Coupons will be accepted for local fares outside of corporations. On the back of each coupon strip the conductor must write the name of the station at which the passenger boarded the train, his destination and the train number.

F. J. J. Sloat, general manager of the Cincinnati, Dayton & Toledo Traction Company, brought up for discussion the subject of uniform rates for interurban cars operating over the tracks of other interurban roads. Mr. Sloat stated that during the past year or two all of the seven interurban roads radiating from Dayton had sent special cars over the Cincinnati, Dayton & Toledo, and that his road has sent cars over all the other roads. This interchange of traffic has been considered complimentary, and no attempt had been made at an equitable adjustment. He stated that he believed that this interchange of business was bound to grow, and that particularly in view of the agitation on the subject of operating through limited cars over several roads, he thought that some equitable basis should be arrived at for the division of receipts. He stated that a scale of prices for such interchange of business would be difficult to arrive at, because of the great difference in the equipments and weights of cars, the capacity, gear ratio, etc., the idea being that a heavy car with large seating capacity, heavy motors and high gear, costs more to handle than a lighter car having smaller motors and lower speed. Mr. Sloat presented a tabulated statement of the various sizes of motors used in the operation of interurban cars, ranging from 125 hp to 500 hp, the gear ratio, the maximum and minimum weights of cars, and the operating charge per car mile, based upon the kilowatt-hour consumption, including bond interest charge. These figures ranged from 15 cents to 28 cents per car mile. Mr. Sloat proposed that a committee be appointed to prepare a tabulated statement of the cost of operating various types of cars, and that the matter of adopting such a schedule be discussed at the next meeting.

Taking as a concrete case, Mr. Sloat spoke of a special party

going from Piqua to Cincinnati, over the Dayton & Troy and the Cincinnati, Dayton & Toledo. In the division of receipts both companies should consider the dead mileage as well as the live mileage. The special car on the Dayton & Troy would run from the car house at Troy to Piqua, then down to Dayton and back to Troy on the return trip, a total of 60 miles over the Dayton & Troy. On the Cincinnati, Dayton & Toledo the round trip from Dayton to Cincinnati and return would be 110 miles. At 50 cents, the Dayton & Troy fare, and 95 cents, the Cincinnati, Dayton & Toledo fare, the single trip rate would be $1.45, or $58 for forty passengers. The Dayton & Troy cars are 200-hp cars, with proportionately heavy equipment, which, according to Mr. Sloat's schedule, should be charged at the rate of 23 cents per mile. The operating charge on the 110 miles would thus be $25.30. The Dayton & Troy regular fare would be $20, and deducting this together with Mr. Sloat's cost charge from the $58, would leave a balance of $12.70, which Mr. Sloat stated would be his profit for handling the car over his track.

Some one took exceptions to this last item on the ground that as the Dayton & Troy would furnish the crew while the Cincinnati, Dayton & Toledo would simply furnish the pilot, the Dayton & Troy should enjoy part of the profit while the car was on the Cincinnati, Dayton & Toledo tracks. One manager remarked that he would not permit a foreign crew to operate over his tracks, even though the car was in charge of a pilot, while another manager was equally positive that he would not care to have strange crews handling his cars. The question of liability to cars and passengers while on foreign roads entered into the discussion, and it was obvious that a wide range of ideas would have to be thrashed out before a schedule of charges, such as proposed by Mr. Sloat, could become operative but at the same time it was recognized as a subject which is of considerable importance in a district where interurban lines are being connected up as they are in Ohio.

Warren Bicknell, chairman of the committee on legislation, presented a report of the work accomplished by his committee before the recent State Legislature. As outlined in the last issue of the STREET RAILWAY JOURNAL, the committee put through several measures of considerable moment to electric railways, and killed several others that were considered detrimental to the best interests of the properties.

Walter H. Abbott, of the Roberts-Abbott Company, gave a "chalk talk" on steam turbines. In a very entertaining manner he described the principles, make up, advantages and disadvantages of the three leading forms of turbines used in this country, and presented figures showing the economies claimed for the various types as compared with reciprocating engines. Mr. Abbott referred particularly to the De Laval turbine installed at the power station of the Ohio Central Traction Company, and the Parsons turbines now in operation at the Cleveland & Southwestern Traction Company's station, both of which were installed under Mr. Abbott's direction. He stated that both of these installations were proving out most satisfactorily.

Thursday evening the delegates took a special car over the Cleveland & Southwestern line to Elyria, where they had an opportunity of inspecting the Parsons turbines described by Mr. Abbott. The return was by way of Lorain, and the party took a special car on the Lake Shore Electric Railway to the Beach Park power station, in which has just been installed a 1500-kw, 16,500-volt A. C. generating set. The run to Cleveland was made in one of the "limited" type of cars at a speed which was commented upon.

Invitations to inspect the plants of the Sherwin-Williams Paint Company, the Kuhlman Car Company and the National Carbon Company were read at the meeting, and some of the delegates availed themselves of the invitations.

The Dayton contingent made an "all trolley" trip from Dayton to Cleveland by way of Toledo. They left Dayton at 9 a. m. and reached Cleveland at 10:30 p. m., covering nearly 300 miles.

The next meeing of the Ohio Interurban Railway Association will be at the Chittenden Hotel, Columbus, the last week in May.

Seventeen companies have promised to become parties to the coupon book agreement as soon as the plan is formulated.

NEW MEMBERS ADMITTED AT THE CLEVELAND MEETING

Thos. F. Clohesey, Stanley Electric & Mfg. Co., Cincinnati, Ohio.
J. A. Rutherford, Tuscarawas Traction Co., New Philadelphia, O.
J. O. Wilson, Cleveland & Southwestern Trac. Co., Cleveland, O.
A. J. Reynolds, The National Ticket Company, Cleveland, Ohio.
Geo. S. Davis, STREET RAILWAY JOURNAL, Cleveland, Ohio.
Daniel Royse, Street Railway Review, Chicago, Ill.
E. R. Larter, Dayton & Troy Traction Co., Tippecanoe City, O.
F. W. Stewart, Climax Stock Guard Co., Chicago, Ill.
A. R. Dittrick, Dittrick & Jordan Elec. Co., Cleveland, Ohio.
Wm. H. Stafford, Central Union Tel. Co., Indianapolis, Ind.
W. R. McKown, Indianapolis & Eastern Ry. Co., Greenfield, Ind.
Milton C. Stern, Egry Autographic Register Co., Dayton, Ohio.
James F. Mahoney, H. W. Johns-Manville Co., Cleveland, Ohio.
E. F. Schneider, Cleve. & Southwestern Trac. Co., Cleveland, O.
A. E. Akins, Cleve. & Southwestern Traction Co., Cleveland, O.
Frank Hoffman, Jas. V. Howell & Co., Cincinnati, Cleveland, O.
L. M. Wolf, Ohio Central Traction Co., Cleveland, Ohio.
Valentine Winters, Dayton & Troy Traction Co., Dayton & Troy Electric Railway Co., Dayton, Ohio.
Ambrose Petry, Ambrose Petry Co., Dayton, Ohio.
Clinton E. Palmer, Cincinnati, Dayton & Toledo Traction Co., Middletown, Ohio.
William Akins, Ohio Central Traction Co., Galion, Ohio.
J. A. Bendure, Lima Electric Railway & Light Co., Lima, Ohio.
Frederick V. Green, Westinghouse Traction Brake Co., Cleveland, Ohio.
John McGeorge, McGeorge & Sons, Cleveland, Ohio.
Francis B. Morgan, Eastern Construction Co., Cleveland, Ohio.
Geo. H. Pomeroy, Cleve. & Sharon Traction Co., Cleveland, O.
O. M. Carter, Western Electrician, Cleveland, Ohio.
L. C. Thompson, Taylor Manufacturing Co., Cleveland, Ohio.
F. W. Coen, Lake Shore Electric, Cleveland, Ohio.
S. T. Dodd, Stanley Electric Mfg. Co., Pittsfield, Mass.
Edward M. Williams, Sherwin-Williams Co., Cleveland, Ohio.
Geo. B. Dusinberre, Westinghouse Electric & Manufacturing Co, Cleveland, Ohio.
Warren Bicknell, Lake Shore Electric Ry. Co., Cleveland, O.
F. W. Bliss, Buckeye Electric Co., Cleveland, Ohio.
W. E. Ludlow, Ludlow Supply Co., Cleveland, Ohio.
R. H. Mickey, National Carbon Co., Cleveland, Ohio.
W. S. Hammond, Jr., Consolidated Car Heating Co., Chicago, Ill.
Robert K. Fast, Trolley Supply Co., Canton, Ohio.

BROOKLYN RAPID TRANSIT COMPANY MAKES CONTRACT FOR REMOVAL OF SOIL FROM SUBWAY

The endeavor on the part of the Brooklyn Rapid Transit Company to develop new phases of business as auxiliaries to its purely street railway field is evidenced again in the execution of a contract with Messrs. Cranford & McNamee, contractors for one of the sections of the Rapid Transit Subway to be built in Brooklyn. The company proposes to dispose of the excavation. The section of the subway in question extends along Flatbush Avenue from Fulton Street, where there are elevated railways, and the work of constructing the subway will require supporting both the surface tracks and the elevated structure without interfering with the regular traffic operation of the roads. The contractors will be allowed to close off one side of the street, and the Brooklyn Rapid Transit Company is now at work laying a third surface track as a siding, long enough for perhaps five cars. At a point between the siding and the adjacent main track, will be located a hoisting derrick which will lift the excavated material in buckets from the subway and dump into gondola cars.

PROMINENT EXHIBITS AT THE ST. LOUIS EXPOSITION

The opening of the Louisiana Purchase Exposition at St. Louis on April 30 makes a review of the exhibits in the transportation line to be shown there of interest. Owing to the condition of the grounds and buildings, as described elsewhere in this issue, it is impossible to present yet any satisfactory views of the street railway exhibits, which are divided between Electricity Building and Transportation Building. Through the courtesy of different manufacturers, however, it has been possible to present a brief statement of certain of the exhibits to be made at the Fair. Further information, with views, will be published in early issues of this paper.

EXHIBITS AT THE ST. LOUIS FAIR

The exhibit of the J. G. Brill Company occupies 300 linear feet on aisle D of the Transportation Building, and consists in the main of a suburban type of the patented semi-convertible car, a double-truck convertible, and a thirteen-bench "Narragansett" car; three sizes of the high-speed truck No. 27-E, one size each of the single-truck No. 21-E, the "Eureka" maximum traction, and the suburban truck No. 27-G. An exceedingly attractive office is in a section of a car with windows of the semi-convertible style, and finished in solid mahogany rich in parquetry. The cars are handsomely finished in rich woods inlaid, and include details which make them singularly complete, and are equipped with the well-known Brill patented specialties.

William Wharton, Jr. & Co., Inc., of Philadelphia, will have an exhibit at the St. Louis Exposition in the Transportation Building, aisle C, posts 8, 9 and 10. It will comprise parts of special track work, such as switches, frogs, crossings, etc., both for steam railroad use and for street railway use. Particular stress is laid by this company, as is well known, on the introduction of manganese steel into track work in general, and the great value of this is to be illustrated by some samples giving evidence of the long life imparted to track work by the use of manganese steel. Some specialties are also to be shown, like the Wharton improved unbroken main line switch, for steam railroads, and the Wharton unbroken main line switch for street railways, the Wharton manganese steel frog for steam railroads, the guard rail with manganese steel reinforcement for steam railroads, and the manganese steel hard center work for street railway girder rail track, also solid manganese steel work for T-rail track. The entire exhibit will present the most modern and advanced constructions and all parts of special track work as supplied by the company. It will be in charge of Arthur S. Partridge, of St. Louis.

The Standard Steel Works, of Philadelphia, Pa., will have an exhibit in the Transportation Building. The articles to be shown are steel tired wheels of various types, solid rolled steel wheels, steel tires for locomotive and car wheels, steel castings for locomotives and steel springs for locomotives, coaches and freight cars. The company will make a special feature of wheels mounted on axles for electric railway equipment.

The Alberger Condenser Company, of New York, will have two large exhibits at St. Louis. There will be an Alberger barometric condenser equipment in connection with the 5000-hp Allis-Chalmers engine in the first space at main entrance of Machinery Hall, and also an Alberger surface condenser equipment, in the adjoining space, used in connection with several engines furnishing power for the intramural railway system. The barometric condenser equipment consists of an Alberger barometric condenser, air cooler and tail pipe, with a vertical Corliss combination engine and vacuum pump, operating in connection with a rotary circulating pump. The surface condenser equipment consists of a 5000 sq. ft. Alberger surface condenser, horizontal Corliss dry vacuum pump and a centrifugal circulating pump and engine.

The American Locomotive Sander Company, of Philadelphia, will have examples of its style "A" and style "E" sanders in actual operation at St. Louis, together, of course, with various details of its sanding devices shown in section, and in fact everything possible to show the construction and operation of the company's sanding devices. This exhibit will be located in the Transportation Building.

The United States Electric Signal Company, of West Newton, Mass., will occupy space No. 167 in the Electricity Building at the St. Louis Exposition. It will show its latest block signal system for electric railway service. C. V. Turner, of the company's works, will install the plant and probably remain at St. Louis during the month of May, and may be followed by J. H. Nickerson, treasurer, in June.

The exhibit of the Wyckoff Pipe & Creosoting Company, Inc., of Stamford, Conn., will be in the Electricity Building, under the Court Colonnade. It will consist of Wyckoff creosoted conduits for underground wires, showing method of laying; creosoted cross-arms, poles, cross-ties and paving blocks; two sections of piling, one creosoted and one uncreosoted, the one creosoted showing the penetration of the oil into the very heart of the pile, and the uncreosoted section showing the effects of the teredo in a very short time. The company will also have on exhibition several pieces of creosoted Wyckoff conduit, laid in Philadelphia fifteen years ago, and removed by the Bell Telephone Company of Philadelphia last fall on account of the building of a subway in that city. These pieces show no signs of decay whatever, and are just as good as the day they were laid.

The Leonhardt Wagon Manufacturing Company, of Baltimore, will have one of its tower wagons on exhibition at St. Louis in the Transportation Building, Department of Electricity, in connection with the Electric Railway Equipment Company, of Cincinnati, Ohio, which will exhibit its tools, etc., in connection with the Leonhardt wagon.

E. Imhauser & Company, of New York, have arranged to have a working exhibit of their improved watchman's time detectors in the Fish, Game and Forestry Buildings at the St. Louis Exposition, and will also probably have them in some twenty to thirty other concessions where they can be seen in operation.

The Locke Insulator Manufacturing Company, of Victor, N. Y., will have an exhibit of porcelain and glass insulators, both high and low tension, in the Electricity Building at St. Louis.

The Richardson Scale Company, of New York, will exhibit at the St. Louis Exposition an automatic coal scale, working in conjunction with the Robins conveyor, referred to elsewhere, also two or three automatic grain scales of its usual type. This coal scale is operated entirely by gravity and is of the beam type. The coal to be weighed is delivered from the conveyor to the weighing hopper of the scale, which is suspended on one end of the beam and balanced on the other by a weight box in which ordinary dead weights are deposited. The material is admitted into the weighing hopper by means of a double swinging gate, or cut-off, which at the beginning of the weighing operation is open. When the charge is nearly completed the first cut-off, or gate, actuated by the increased weight of the weighing hopper, closes and thus reduces the stream of material to a mere dribble—the second cut-off or gate being only partially open. When the exact weight has been passed into the hopper the cut-off completely closes and the exact balance is reached. A lever, connected with the cut-off mentioned, acting upon the lever attached to the hopper, sets in motion the mechanism which opens the bottom of the hopper, and, as soon as the charge has been dumped, closes it and locks it. In closing the bottom of the hopper the dumping mechanism in turn strikes the lever connected with the cut-off, or gates, thereby causing the same to open and allowing a new charge to flow into the weighing hopper. The whole action is entirely automatic—the only power required being the momentum of the falling material, except where bituminous coal is used, when some slight power is needed to drive the feeding apparatus fitted above the scale. The drip, or column of material, which is in the air at the time the feed is automatically cut off, is compensated for by a novel contrivance which works automatically and without manipulation of any of the working parts. The machine is fitted with a self-registering device which records and totalizes the weighing. The exhibit will be at stand No. 1 in the Machinery Hall.

The Harrison Safety Boiler Works, of Philadelphia, will be well represented at St. Louis by a large number of their specialties. These will be described later in connection with a more complete article on the steam specialties. A number of these are now in service in the pre-Exposition power plant and will later be transferred to exhibitors' power plant. They consist of one No. 118 Sorge-Cochrane system and three 6-in. horizontal receivers. In addition, the Westinghouse, Church, Kerr Company is using at the Fair one No. 14 1½ heater, and the company has installed in the Intramural power plant one 10-in. vertical receiver, one 8-in. vertical receiver, one 8-in. horizontal receiver, one 40-in. vacuum oil separator, one No. 11 ½-heater, one No. 110 Sorge-Cochrane system, one 14-in. horizontal receiver, two 6-in. horizontal oil ammonia receivers, one No. 7½-heater and one No. 9 heater.

The Wheel Truing Brake Shoe Company, of Detroit, Mich., will show shoes of various sizes and designs adapted for different uses. Some are designed for removing flats from chilled iron wheels of electric cars, some are for dressing down flattened wheels of locomotive driver wheels, and still others are especially designed for dressing down tread-worn or grooved tires of locomotive drivers.

The Winton Motor Carriage Company, of Cleveland, Ohio, will have on exhibition one chassis, one Winton touring car in Winton red and one Winton touring car in Brewster green.

The Buckeye Engine Company, of Salem, Ohio, will exhibit one of its standard cross-compound engines, with the following cylin-

der dimensions: High pressure is 26½ ins.; low pressure, 50 ins.; both 48-in. stroke. The wheel is 15 ft. in diameter and weighs 40,000 lbs. The total shipping weight of the engine was a little over 300,000 lbs. The engine has governors upon both the high and low pressure sides, connected together in such a manner that both move an equal distance under any given change in load. The engine is well equipped with oil guards and with a self-contained central oiling system, piped to all the principal bearings and regulated by needle valves. There is a pump for returning the waste oil to the filter. The engine is of the company's heavy-duty or rolling mill bed-plate type, and there are no extras of any description furnished, it being the company's intention to exhibit such an engine as is ordinarily supplied in filling orders.

The Standard Underground Cable Company, of Pittsburg, Pa., and the McRoy Clay Works have installed a joint exhibit in Section 3, immediately adjoining the northwest entrance of the Electricity Building. The exhibit shows a cross section of an actual conduit consisting of 72 ducts with a manhole at either end, one manhole being complete with a cover, the other being open. A trench 7 ft. deep and 5 ft. wide extends the entire length of this conduit, enabling close inspection of the method of laying conduits, including the wrapping, concrete base and top, and the general construction of the manholes, showing hangers, pipes to holes, etc. At one end in the manhole is a capstan rigged up for drawing in cables and connected to a cable which is mounted on a reel at the other manhole; the cable is thus shown being drawn through the ducts and part of the ducts are split so as to show the method of fastening cables to rope, etc. From the various manholes, cables go to distributing poles to illustrate the method of distribution to aerial cables for telephone, electric light and street railway work, with various terminals used to protect the ends of the cable in such work. The McRoy Clay Works show piles of clay as it is dug from the ground and the various processes through which the material goes to produce the finished duct. The Standard Underground Cable Company will also exhibit samples in handsome cases of all the various cables and appliances made by the company. An examination of this system will present in very complete detail the method of installing conduits and drawing cables into completed conduits.

The International Steam Pump Company will be represented in a large number of departments and in various capacities at the St. Louis Exposition. The central compressing power plant will be equipped largely with this company's apparatus, including a cross-compound, two-stage Cincinnati-gear compressor, and a cross-compound, two-stage Meyer-gear compressor. The first machine is to supply the general exhibits of the Exposition and the second is to supply the transportation exhibits. The Grand Cascade, which will probably be the largest artificial waterfall ever exhibited, will be equipped with two 3500-gal. Worthington 36-in. single-stage turbines, each operating against a head of 159 ft. and driven by a direct-connected 2000-hp Westinghouse induction motor. The fire protection of the Exposition will be furnished by twelve 1000-gal. Worthington underwriter fire pumps, and the sewage pumps will also be supplied by the company. Elsewhere the company will be represented in the C. H. Bradley & Company exhibit, with Westinghouse, Church, Kerr & Company and with with the General Electric Company.

The Lunkenheimer Company, of Cincinnati, will have an exhibit in Machinery Hall, location 5-G Block 26. The company will show a comprehensive display of the high-grade specialties which it manufactures.

The Peter Smith Heater Company, of Detroit, Mich., will exhibit at the St. Louis Exposition one of its No. 2 heaters, nickeled in the most improved style, and placed on the private car of John I. Beggs, general manager of the Milwaukee Electric Railway & Light Company, which is being built by the St. Louis Car Company.

The Electric Storage Battery Company, of Philadelphia, has at the St. Louis Exposition the most extensive and comprehensive exhibit that has ever been made of storage batteries and auxiliaries. It is located in Block 20, Electricity Building. A conspicuous feature is a map about 30 ft. in height by 45 ft. in length which, by an ingenious arrangement, shows the distribution of "Chloride Accumulator" installations throughout the United States. Illuminated glass jewels designate the locations and characters of the installations, whether for railway, central station, isolated lighting and power service, yacht plants, telephone installations, etc. There is set up in a model battery house a complete operating installation of chloride accumulators for railway service. Specimens of chloride accumulators ranging in size from a 61-H type of cell to the smallest laboratory cells, are also shown, together with a complete exhibit of the Exide battery, used for electric automobile work. In another section of the exhibit there are five types of storage battery switchboards, together with end-cell switches, storage battery recording instruments, etc.

The apparatus of the Hartman Circuit Breaker Company, of Mansfield, Ohio, will be exhibited by its Western selling agent, The Wesco Supply Company, of St. Louis, and will be found in the Electricity Building. The exhibit will consist of high-tension oil switches and circuit breakers, and also oil circuit breakers for direct current. The apparatus will be mounted on a switchboard and it will all be shown under actual operating conditions. The company will also have an exhibit in connection with that of the Bullock Electric Manufacturing Company, consisting of a three-pole, 6600-volt oil switch, which will be used in controlling current for the large rotary converter which the Bullock Electric Manufacturing Company will have on exhibition.

The Harrisburg Foundry & Machine Works will show at the St. Louis Exposition one Fleming 4-valve tandem compound self-oiling automatic engine, of 600-hp capacity, directly connected to and driving a 400-kw Crocker-Wheeler generator, furnishing power for the electric railway system within the Exposition grounds. In addition to this, there is a small engine of 8-hp direct connected to 4½-kw Crocker-Wheeler generator for lighting the exhibit, speed 450 r. p. m. This exhibit is located in Machinery Hall.

The Brown Hoisting Machinery Company, of Cleveland, Ohio, will make an exhibit of hoisting machinery, etc., jointly with the Yale & Towne Manufacturing Company, sales agent for the Brown Company for trolleys, tramrail equipment, and crabs and winches. The exhibit will be in the Machinery Building, and will comprise one of the Brown standard 10-ton and 15-ton locomotive cranes, a complete line of safety crabs and winches, a full line of tram rail equipment and trolleys up to 10 tons capacity, plain, geared and electric, a stationary hand bridge crane, a small overhead traveler, and a very complete line of Yale & Towne triplex chain blocks.

The International Register Company, of Chicago, expects to have a large display, including a full line of International and New Haven registers, mounted on mahogany boards. One of the boards will be the one the company has shown at street railway conventions, and which has attracted wide attention there. Some of the New Haven registers, however, will be mounted on posts. There will be polished oak boards containing a full line of the various pulleys, brackets, etc., manufactured by this company, a mahogany case with plate glass doors, in which will be shown punches, Heeren badges, and articles of that type, coils of pulley rope, bell cord, etc. Some of the registers will be shown with their dials removed so that the working parts will be exposed. The company is located in the Transportation Building, aisle C, near post 30, right opposite the exhibit of the St. Louis Car Company, and will be represented at the convention constantly by A. N. Loper, for many years connected with the New Haven Car Register Company.

Stombaugh guy anchors will be shown at St. Louis in the Electrical Building with the display of the Wesco Supply Company, which is in Section 8. The exhibit will also include wrenches of all sizes.

The Egry Automatic Register Company, of Dayton, Ohio, will have an exhibit in the Varied Industries Building, the exact location being Block B-4, which is close to the British Exposition. Here the company has fitted up a handsome booth occupying a space 15 ft. x 15 ft., where will be shown the many styles and sizes of the Egry registers. Particular attention will be paid, however, to the company's train dispatching system, which has been described in this paper, and the company will show a system in operation, through the connection of telephones located at opposite corners of the booth. A No. 101 dispatching register in the pole box, accompanied by a telephone, will represent a turn-out station, while the opposite corner will be fitted up like a chief distpatcher's station, with a telephone, dispatching register, etc.

The Burt Manufacturing Company, of Akron, Ohio, will have no regular exhibit at the St. Louis Exposition, but will be represented by a No. 3 oil filter in the 30,000-hp station which is used by the Exposition authorities in their pre-power plant. A No. 3 oil filter will also be used by C. H. Bradley, Jr. Company, of Pittsburg, a No. 3 American filter by the Buckeye Engine Company, of Salem, Ohio, and a No. 3 American filter by the De Laval Steam Turbine Company.

N. A. Christensen, of Milwaukee, Wis., will have no individual exhibit of his apparatus at the St. Louis Exposition, but has made arrangements with a number of concerns who will require compressed air to install one of his compressors with their exhibit. Thus the Standard Railway Equipment Company will use his compressor in connection with its pneumatic tools, the Pneumatic Signal Company will employ one in demonstrating the operation of its signal system, and the Weber Gas & Gasoline Engine Company one for use in starting up gas engines.

The W. T. Van Dorn Company, of Chicago, will not have any regular exhibit at the St. Louis Exposition, but will be repre-

sented by the couplings in use on all the intramural cars that run through the Fair grounds. These cars will probably bear a placard stating that they are equipped with the Van Dorn automatic couplings No. 11.

The exhibit of the American Brake Shoe & Foundry Company, of Mahwah, N. J., will be in the Transportation Building, and will present an illustration of the development of the railway brake-shoe for car and engine service from the time the plain cast iron shoe was adopted up to the present date. This will include samples of the various patented brake-shoes which have come into successful use as standards on the various railroads during this period, and will show not only the development of the wearing face of the brake-shoe to secure durability and beneficial action on the wheel tread, but will also emphasize the various improvements which have taken place in the way of reinforcing the brake-shoe in order to continue it in service when the body metal cracks. The company will also be represented by the brake-shoes on many of the engines, cars and coaches on exhibition throughout the grounds. In the Baltimore & Ohio Railroad industrial exhibit the company will also have full-sized illustrations showing the development of the railway brake-shoe as indicated in its own exhibit with reference to both the wearing qualities and staying qualities of the brake-shoe. The company will also illustrate various small steel castings made by its Tropenas process, covering tools, oil cups, motor and gear castings, and representing its product as supplied by the Chicago Heights steel plant.

B. E. Tilden Company, of Chicago, manufacturers of car and locomotive replacing frogs and motor car replacers, will have several pairs of its steam railway replacing frogs on exhibition. These steam railway replacing frogs are, of course, also adapted to the replacing of motor cars on interurban roads, but not for replacing cars on paved streets. This exhibit will be in the Transportation Building. The company will probably not exhibit at the St. Louis Exposition motor frogs for replacing street railway rolling stock on paved streets.

The Crane Company, of Chicago, will have two exhibits, one in Machinery Hall, Block 26, aisle H-4, the other in Transportation Building, west end aisle H, near aisle 4. The company's exhibit in Machinery Hall will consist of a full line of steam, gas, water and engine supplies, including pop safety valve, electrically operated gate valves, pipe bends and special flanged connections. That in the Transportation Building will comprise a full line of valves and fittings for locomotive and marine use, including all types of brass and iron pop safety valves for locomotive and marine use.

W. W. Lindsay & Company, engineers and contractors, of Philadelphia, will be represented at the St. Louis Exposition by a model electric storage battery house, 20 ft. long, 12 ft. 9 ins. wide, and 12 ft. 6 ins. high, which they constructed for the Electric Storage Battery Company, of Philadelphia, as part of the exhibit of that company in the Palace of Electricity. The building is of steel and concrete throughout, and is an exact reproduction of a design for a large modern storage battery house. The columns and trusses are built of structural steel. The chief feature of the building is the roof and walls, which are built of ferro-inclave. This is a somewhat new building material and is manufactured by the Brown Hoisting Machinery Company, of Cleveland, Ohio, for whom W. W. Lindsay & Company are agents, and whose shops in Cleveland are constructed entirely of it. The ferro-inclave is covered on the inside as well as the outside with cement plaster, forming an interior finish and completely incasing all the structural steel, thus protecting the columns and trusses from the battery fumes. Ferro-inclave, it might be added, is fireproof, waterproof, practically indestructible and light in weight, making it particularly adapted to storage battery houses, power houses, car houses, etc.

The Joseph Lay Company, of Ridgeville, Ind., has arranged for an exhibit in the Manufacturers' Building at the St. Louis Exposition, and will there present a full line of its brooms, including those manufactured especially for street railway service. The different samples of brooms for this work will be arranged on a large board tastefully designed, and descriptive circulars will be prepared fully explaining the advantages of these brooms over the old-style broom.

The Baldwin Locomotive Works, of Philadelphia, will have an exhibit at the Louisiana Purchase Exposition consisting of thirteen steam locomotives in the Palace of Transportation, two of which will be placed on pedestals at the entrance and the others in aisles G and H, west of the center of the building. The company will also have three electric locomotives and four electric trucks in the Palace of Electricity, Block 3, aisles A, B and S. One of the electric locomotives is designed for surface haulage, the other two for mine haulage. The electric trucks are designed to illustrate: (1) The heavy construction shown by the type built for the Interborough Rapid Transit Company, of New York. This truck weighs 12,500 lbs., without motors, and is designed to carry a weight on the center pin of 25,000 lbs. (2) The medium-heavy construction is shown by the type built for the Central Illinois Construction Company. This truck weighs 11,000 lbs., without motors, and is designed to carry a weight on the center pin of 26,500 lbs. (3) The light construction for interurban service shown by the type recently supplied by the company to the Twin City Rapid Transit Company. This truck weighs 6300 lbs., and is designed to carry a weight of 18,000 lbs. (4) The light construction for street railway service. The weight of this truck is 5300 lbs., and it carries a weight of 14,000 lbs.

The Elliot Frog & Switch Company, of East St. Louis, Ill., will have an exhibit in the Transportation Building devoted entirely to new designs of frogs, switches and switch stands.

The Heine Safety Boiler Company, of St. Louis, Mo., has erected in the main power station eight boilers of its single shell type, rated at 400 hp each, set in four batteries of two boilers each. Each boiler consists of a single drum 48 ins. diameter, with 176 18-ft. tubes and is designed for a safe working pressure of 175 lbs. per sq. in. They are connected by means of an overhead horizontal breeching to an induced draft apparatus. Each boiler is provided with a Green traveling chain grate, the fuel for which is fed from overhead coal bunkers which are kept filled from a central distributing bunker by means of overhead conveyors. The ashes are discharged into an ash pit which opens into a tunnel in the space in front of the boilers, thus permitting the removal of the ashes without inconvenience. Besides the eight boilers in this main power house there are three Heine 250-hp boilers of the double shell type in the power plant of Ferris wheel and also 210-hp boilers of the single shell type in the fuel testing plant of the Outside Mining Exhibit. These latter two plants will be equipped with ordinary flat grates and the usual high stack. The Heine Safety Boiler Company will also have an exhibit space in the extreme northwest corner of Machinery Building, in which will be exhibited portions of Heine boilers, illustrating methods of construction, and also samples illustrating the quality of material used in construction of the boilers. A portion of this space will be utilized as an office and resting place for visiting engineers.

The Walter A. Zelnicker Supply Company, of St. Louis, has secured a large space in the Transportation Building, where it will exhibit a few of its specialties, among them being the Zelnicker "double-clutch" car mover, which has been of great assistance to the railroad companies at the Fair grounds in placing their large and heavy dead locomotives in position. The exhibit will also include the company's new 60-ton hydraulic wheel press, which represents several years of experiments, and is designed so that a maximum result is obtained on a minimum of weight. The company is also expecting to show its well known rail bender and a large variety of track tools and other machinery.

The Robins Conveying Belt Company, of New York, will be located at St. Louis in Block 1, Section 1, Machinery Hall. Its exhibit will consist of three 16-inch belt conveyors, with the company's patent automatic distributing tripper and a Richardson automatic scale to weigh the material as it passes from one conveyor to another.

The Duff Manufacturing Company, of Allegheny, Pa., will have two or three exhibits at the World's Fair, including a complete exhibit of all jacks in the Transportation Building, and also one in the Machinery Building. The company is further exhibiting the Barrett pipe forcing jack, in the Liberal Arts Building, in connection with the Western Gas Association exhibit. In all the company will show between forty and fifty different sizes of Barrett lifting jacks of various capacities, among them the new No. 30 Barrett geared ratchet-lever jack of 30 tons lifting capacity, which will be on exhibition for the first time; the Barrett motor armature lift, which will be shown in the Transportation Building, a full line of Barrett differential screw jacks, the Barrett automobile jack, which will be shown in connection with the general automobile supply exhibit and also in the company's regular exhibit; also a complete line of track jacks, car jacks, car house jacks, journal jacks, bridge jacks and screw jacks.

The Atlas Railway Supply Company, of Chicago, Ill., will have an exhibit containing a full line of samples of its straight, compromise, insulated, raised and standard joints for T and girder rails, also braces and tie plates, and the Atlas primer and surfacer for priming and surfacing cars of street and steam railways. This exhibit will be located in the Transportation Building, aisle C, post 28.

The Weston Electrical Instrument Company, of Waverly Park, Newark, N. J., will have a particularly attractive booth in Electricity Building, space No. 25, immediately opposite the entrance.

It will contain a full line of the electrical measuring instruments for which this company is famous.

The space which has been allotted to the Western Electric Company in the Louisiana Purchase Exposition, St. Louis, is Block No. 17, located near the southwestern corner of the Electricity Building. Immediately adjoining on the south is the space which has been allotted to the American Telephone & Telegraph Company. In the center of the Western Electric Company's space a motor generator equipment will be installed, consisting of two L-5, 100-kw frames, the motor side taking current at 500 volts and the generator side delivering current at 220 volts. This unit will operate in conjunction with a 15-kw compensator, thus permitting the use of 110, 220 and 500-volt current. This same space will also contain two switchboards, one for controlling the operation of the apparatus receiving current from the motor generator, and upon this board will be mounted all the necessary switches, circuit-breakers, ammeters, etc. The other board will be for display purposes only, and will contain a line of knife switches, circuit-breakers, voltmeter switches and kindred apparatus. In the extreme northeast corner of the space a small machine shop will be installed where the company will exhibit in actual operation some of the modern machine tools driven by Western Electric motors on the three-wire multi-voltage system. The company will also show in this space a line of new emery grinding machines manufactured by it. West of the machine shop will be exhibited a few of type "L" direct-connected and belt-driven generators, also a number of Cornish cycle engines direct connected to Western Electric generators, these sets being for marine use especially. In the northwestern corner of the space will be shown a line of power motors arranged in the form of a pyramid, the smallest ones at the top. In the southwest corner of the space will be shown a series alternating arc light equipment, consisting of a full line of transformers, regulators and switchboards. Opposite this, in the extreme southeast corner, will be exhibited ornamental arc lamp stands, from which will be suspended the various types of arc lamps which the company manufacture, also a number of sewing machine motors in actual operation. Fan motors and ceiling fans will be distributed throughout the space, suspended from overhead, and a number of boards containing supplies manufactured by the leading companies throughout the country.

The Continuous Rail Joint Company of America, of Newark, N. J., is located on aisle C, between posts 9 and 10 in the Transportation Building. The company will show samples of its type of T and girder rail joints and step joints, also insulated and special electric bonding joints, with numerous photographs and pictures of its works at Troy, N. Y. The exhibit will be a very attractive one, and will be in charge of E. A. Condit, Jr.

The Brown Corliss Engine Company, of Corliss, Wis., is erecting at the World's Fair two of its vertical cross compound Corliss engines. They are built for high speed, running 135 r. p. m., and each unit will at that speed develop 750 hp at its most economical rating, with 150 lbs. steam at throttle. The cylinders, which are 18 ins. and 36 ins. x 36 ins., are made double ported so as to give quick opening for steam and at the same time give less throw to valve gear parts and reduce momentum of moving parts on gear. All wearing parts are made large, and the oiling system is most modern and complete. These engines are located at the right-hand entrance of the Machinery Hall, Block 45.

The Eureka Tempered Copper Works, of North East, Pa., are located in space 19, Electricity Building. The exhibit will consist of a very attractive display of commutators, trolley wheels, commutator bars, copper, bronze and brass castings, together with other articles which the company manufactures and which are too numerous to mention here.

The Maltby Lumber Company, of Bay City, Mich., will have no booth of its own at the Exposition, but will be represented by a number of excellent photographs of trainloads of ties and poles, and of the company's tie and pole concentrating yards, in the Michigan Building, under the head of Forest Products from the Southern Peninsula.

The American Car & Foundry Company, of St. Louis, Mo., will have a very extensive exhibit of passenger and freight cars. The street railway portion of the exhibit will include a vestibuled electric motor coach with smoking compartment, one of a lot built at the Wilmington plant for the Scioto Valley Traction Company, as part of a contract with W. E. Baker & Co., engineers, of New York. As the car is intended for interurban service, with an attainable speed of possibly 75 miles per hour, it is very strongly and substantially built, with composite steel and wood bottom longitudinals running through to platform end sills, and is equipped with four General Electric 150-hp motors and Westinghouse Traction Brake Company's latest standard electric brake, both installed by these respective companies. The car is of the American Car & Foundry Company's design and the trucks are its high-speed standard, with all contact parts machined. The painting is Pullman color. The decoration is in gold and lettered "S. V. T. Co., Valley Route," and numbered "111." It will be exhibited on the electric test track. The main dimensions of this car are as follows: Length over buffers, 60 ft.; length over vestibules, 58 ft. 2½ ins.; length of car body, 49 ft. 2½ ins.; length of ladies' compartment, inside, 37 ft. 6 ins.; length of smoking compartment, inside, 10 ft. 10 ins.; width over sheathing, 8 ft. 4 ins.; distance between center of trucks, 37 ft. 4 ins.; wheel base, each truck, 6 ft. 6 ins.; seating capacity, ladies' compartment, 54; seating capacity, smoking compartment, 16; windows, 18 each side, arranged in pairs with upper and lower sash; roof, monitor; hood, steam type; weight in running order, 86,900 lbs.; vestibule finish, not like street cars, but in quartered oak and similar to steam car practice, with both compartments in mahogany or Prima Vera, with marqueterie and inlay lines; ceiling, 3-ply poplar veneer, decorated in gold; seats, Hale & Kilburn special high-back walkover, upholstered in green pluch in the ladies' compartment, and in leather in the smoking compartment; trimmings, such as basket racks, door locks, etc., in scratch brass; window guards, bronze; curtains, silk-faced pantasote; glass, crystal plate; saloons, one; tool box with the usual tools; fire extinguishers; lighting, General Electric; heating, Consolidated Car Company's system; headlights, movable arc; center plates, basic steel; signal whistles and gongs. The car was moved to St. Louis on its own wheels, which are Standard Company's steel tired 36-in. diameter M. C. B. flange, 3¾-in. tread, on steel axles. For movement to the Exposition it was equipped with Smilie couplers, but these will be eventually removed and Van Dorn No. 3 automatic couplers will be substituted.

The Crocker-Wheeler Company, of Ampere, N. J., will have two exhibits at the Fair, one being the power plant for the Intramural Railway and the other a number of motor driven machine tools operating under the multiple-voltage system of speed control. The intramural plant is described elsewhere in this issue. The motor exhibit will consist in the drive of a number of machine tools, some of which are located on the company's own exhibit, and others in the official machine shop, which is located in Block 21 of Machinery Hall. All these tools will exhibit the latest progress in the application of electric drive to lathes, drill presses, etc.

The Consolidated Car Heating Company's exhibit at the St. Louis Exposition is located in aisle E of the Transportation Building, and is arranged in a space representing an interurban railway car, but somewhat larger. A most interesting feature is the McElroy electric lighting system for railroad cars, employing an axle-driven dynamo, an automatic rheostat and one storage battery. This system is shown in operation. The various types of Consolidated standard electric heaters, including new types of cross-seat heaters, and special sizes of panel heaters, are shown on a panel, and on a second panel are shown several types of regulating switches and one of the switchboards the company is now building for the new elevated cars of the Brooklyn Heights Railroad. A row of electric heaters of the truss plank type is shown at one side of the exhibit, the cases of these heaters being finished in copper bronze. At one end of the exhibit is a new hot-water system for electric railway cars, with which special fittings are used similar to those furnished with Consolidated equipments for railroad cars. The following equipments for railroad cars are also shown: two-pipe and three-pipe direct steam heating equipments, with thermostatic traps, special train pipe and valves, and steam valves on turnstiles; hot water drum equipment complete, with special parts in section; coupler rack showing twenty-four different styles and sizes of steam couplers, many of them fitted with a new automatic locking device, and couplers so arranged that any two may be coupled together; a turnstile showing four different styles of thermostatic traps, all in section. There is also shown a locomotive equipment in section; a panel with pipe fittings, and a panel with photographs of the company's various plants and offices, and of a few special cars and locomotives recently equipped with its apparatus.

The booth of the Photoscope Company, of New York, is located in Liberal Arts Building, where the company has secured a space 10 ft. x 16 ft. The front of the booth is constructed of staff, with two very artistic female figures representing the pillars, holding up a cross-piece of attractive design, which bears the letters "Photoscope" standing out in old gold. The company will have two photoscopes in operation, also a model in a glass case, so that the complete mechanism is exposed to view, showing the simplicity of the machinery. Around the Exposition grounds the company will have 200 machines in operation. The company will also have an assorted lot of brooch pins and lockets, souvenirs of World's Fair, St. Louis, which will hold small photo-

graphs, making a valuable token to take home or give friends.

The Ingersoll Construction Company, of Pittsburg, Pa., expects to exhibit at the Fair at St. Louis its figure 8 roller coaster, which will have a number of improvements; the Ingersoll laughing gallery, and a new feature called "Wonder World." It is not possible at the present time to give a full description of this new feature, but it will be published in a later issue. It is said, however, to be entirely new and promises to be one of the leading park amusements.

The Miniature Railway Company, of New York, is to operate thirty miniature railway equipments for 15 ins. and 22 ins. gage, to be used as feeders for the intramural railway. Each outfit will consist of locomotive, tender and five canopy-top cars, giving a total seating capacity of 100 adults or 150 children. Each locomotive weighs 3500 lbs., and is trimmed in brass.

The Western Wheeled Scraper Company, of Aurora, Ill., is exhibiting in the Transportation Building a line of dump cars consisting of ten side dump cars of capacities ranging from 1¼ to 10 yards, and four rotary and end dump cars of from 1¼ to 3 yards, also two styles of bottom dump cars for use in ballasting electric and steam railways, with a capacity of from 5 to 10 yards. The company will also show a number of novel devices particularly adapted to the work of constructing and repairing railways. This company is also exhibiting in the Liberal Arts Building, dump cars, also scrapers, plows, road machines and elevating graders for grading public roads as well as railroads. In that exhibit the miniature machines will be shown in the grading operations.

The Bellamy Vestlette Manufacturing Company, of Cleveland, Ohio, will have an exhibit of its conductors, collectors, milkmen and drivers' vestlettes. It will probably be in the Ohio Building.

The American Blower Company, of Detroit, Mich., is not making an exhibit at St. Louis, but will be represented at the Fair by apparatus furnished in connection with a number of exhibits. Among them are two 60-in. full housed top vertical discharge steel plate fans, and a 30-in. exhaust fan supplied the Westinghouse Electric & Manufacturing Company, and which will be attached to suitable motors; also a 60-in. full housed top horizontal discharge steel plate fan with a Westinghouse motor direct-connected for the Bureau of Standards, Department of Commerce and Labor exhibit. The American Blower Company also furnished to the Northern Electrical Manufacturing Company, of Madison, Wis., a disc ventilating fan, to which that company will attach one of its motors.

The Magnetic Equipment Company, of Chicago, will have an exhibit at St. Louis, which will be nearly the same as that shown last fall at the Street Railway Convention at Saratoga. It will consist of a small model electric car equipped with the company's device, and will probably be in the transportation department of the Electrical Building. The company also proposes taking its large 200-hp double-truck car to the Fair and at some time during the season placing it before the Electric Railway Test Commission for their expert opinion upon it.

The exhibit of the Buda Foundry & Manufacturing Company and Paige Iron Works will be found in the Transportation Building of the Louisiana Purchase Exposition. It will occupy a space of about 35 ft. in length, and will contain a number of articles of interest, both in goods of standard manufacture and in new devices. Among them is the Buda oscillating cattle guard, which is constructed of slats fastened on to a hanger, which in turn is supported by a number of iron plates from one tie to the next. The motion is free, so that when an animal approaches and places its foot on the guard it slides and swings so easily that it is impossible for the animal to obtain a foothold, and, as is well-known, animals will not step where there is an unsecure surface beneath their feet. The company will also show the Buda derailing device, designed to prevent cars or engines from passing to side or main track, except when the main track switch is properly set. The derail is located on the side track and placed approximately 125 ft. from the main track switch stand and operated from that switch stand by pipe line connection. Other devices to be shown are a switch stand with tower and semaphore attachment, the Ramapo automatic switch stand, a large variety of track levels and gages, Jim Crow and roller rail benders of various sizes, a new line of ratchet and friction jacks for track and other work, a Buda standard hand-car with pressed steel wheels, as well as a variety of sizes of wheels. These wheels have the reinforced flange with the straight web, carrying the load of the car direct through the web to the top of the rail. Paulus, Buda and Wilson track drills will also be shown as applied to the track for bonding and signal purposes, as well as some of the products of the company's frog and switch department, such as points and mates, spring frogs, forged work, etc.

The Bullock Electric Manufacturing Company, of Cincinnati, Ohio, will be located in the Electricity Building, Block 15, and will occupy a space 104 ft. x 54 ft. In the center of this space will be an ornamental pavilion, the interior of which will be decorated and the walls hung with interesting photographs of Bullock installations and apparatus. Visitors may sit here and refresh themselves. Among the most interesting part of this exhibit will be a complete multiple-voltage outfit, including a three-wire balancer and motors driving a number of machine tools, and controllers. This outfit will show the practical operation of the Bullock (patented) multiple-voltage system. The company will also show four street car motors mounted on trucks, which will be turning over. They will be furnished current from a 500-kw rotary, which in turn receives its current from three 150-kw transformers which are reducing a voltage of 6600 down to 500 volts. There will also be a number of alternators ranging from 50 to 350 kw. Some of these machines will be partly finished to show their construction, and there will also be a complete line of type "N" motors, which are particularly adapted for driving machine tools, and also a line of "B" motors, which have been successfully applied for driving nearly every kind of machinery. The entire Bullock exhibit will represent a modern testing floor with its accessories of instruments, testing tables, etc., and the company will have in constant attendance a number of engineers from the factory who will look after the operation of all the machinery and will explain in detail to all interested the claims made for Bullock apparatus.

The Fairbanks-Morse exhibit in the Transportation Building will show the various articles which this company manufactures, among them its latest type of motor car. This car is of the No. 10 size, has a seating capacity of about six passengers, and is fitted out with an independent engine and special transmission gear of novel design and construction. It is arranged with three speeds, making it adaptable to almost any system of road. On the slow speeds, of course, very steep grades can be mounted. The company will also have in position within the next few days one of its extra large motor cars, constructed very much on the same line as that above, but large enough to carry a gang of men with tools useful for construction work. Their exhibit will also include the usual run of track tools, such as shovels, picks, bars, gages, levels, a complete line of track jacks, and a number of styles of automatic lowering-jacks and trip jacks. A new feature in jacks which will probably attract attention is a special gear jack, which is constructed for lifting large loads with the least possible effort or power. This jack works about seven times quicker than the old-style screw jack, and has the advantage of the pump motion, instead of that necessary with the old-style screw jack. Several sizes of these jacks will be exhibited. Several types of platform as well as hand-cars will be shown, also a complete line of gas engines, which are manufactured by the company.

The St. Louis Car Wheel Company, of St. Louis, Mo., will have a large exhibit of wheels, showing wheels loose on stands, holding them in upright position and wheels on axles, which will embrace all styles of chilled cast-iron wheels used for steam railroad service, as well as the St. Louis Car Wheel Company's improved spoke Twentieth Century street car design of pattern. None of the wheels will be polished nor painted in any manner, the intention being to show them in their original state after coming from the foundry. Each wheel being perpendicular and supported in a manner to afford easy access for careful examination, will give opportunity for those most interested to examine the chill and quality of the metal, as well as the mechanical form of the designs. The street car wheels on axles are shown in two forms of equipment. Those for interurban electric railroading weigh 550 lbs. each and were designed especially for such service on the lines of the Milwaukee Electric Railway & Light Company. The lighter weight wheels are such as are furnished for city street car service. A double-plate car wheel will also be shown with a section cut out to show the depth and quality of the chill, and to give means of making a minute inspection of the quality of the iron. The display is to be a joint exhibit of the St. Louis Car Wheel Company, St. Louis; the Decatur Car Wheel and Manufacturing Company, Birmingham, Ala., and the Atlanta Car Wheel & Manufacturing Company, Atlanta, Ga.

The Mica Insulator Company, of New York City, has incorporated the exhibit of its well-known specialty, Micanite, with that of the State of North Carolina, in the Mines and Metallurgy Building. The exhibit is an interesting object lesson, showing to what utility and extent mica can be put in the ever-expanding field of electrical insulation. Micanite in all kinds of shapes and forms is shown. Flat sheets of various thicknesses, generator and motor commutator segments, and rings, of many of the standard types. Micanite tubes from ⅛-in. in diameter to the immense tubes entering into the construction of X-ray induction coils.

LONDON LETTER.

[*From Our Regular Correspondent.*]

Since the publication of the items contained in the STREET RAILWAY JOURNAL of April 2 and April 9, further details have come to hand of the tender of Bruce Peebles & Company, of Edinburgh, amounting to £42,250, which has been accepted by the Canadian Electric Traction Company, London, St. Thomas & Port Stanley Railway. This order comprises a 1000-hp power station equipment, three-phase transformers, ten 250-hp three-phase motor cars, etc. This is probably the first electric railway to run in Canada with plant entirely of British manufacture. The railway passes through an agricultural district, the first portion of which—30 miles—runs from London, Ont., through the city of St. Thomas to Port Stanley, on Lake Erie. As soon as this line is energized the remaining portion, from London to Hamilton, will be electrified on the same system, making a total distance of 160 miles. The Ganz system has been adopted as the guaranteed figures in comparing continuous current, single-phase and three-phase estimates show a saving of 30 per cent both in first cost and in running costs in the Ganz three-phase system. The power will be transmitted at 10,000 volts, 25 cycles, and will be transformed to 1000 volts for the motor cars, each of which is designed to run at 30 m. p. h. on the level and 15 m. p. h. up to grades of 1 in 25. Each car holds fifty passengers, and is capable of hauling either freight or passenger trailer in addition. The line is built partly across private right of way and partly across public roads, as is the case with interurban railways in Canada and the United States, and considerable interest will await results in practice. The line is under contract to be completed in six months from date. The whole of the electrical portion of the plant will be built at Bruce Peebles & Company's works in Edinburgh.

The London County Council is now proceeding rapidly with the electrification of the old cable tramways between Kennington and Streatham, J. G. White & Company, Ltd., have secured the contract. In doing this work it has been decided best to stop completely the service of the cable cars, and this being so, special efforts will be made to complete the whole installation in about ten weeks, which will probably be a record for carrying out work of this kind. Some disappointment has been felt by J. G. White & Company's engineers, as the first plan projected was to use both cable cars and electric cars, and a special gripping device and junction box had been designed for this work. Electric cars, in fact, were run for some time up Brixton Hill, the electric car being attached to the cable by this special device, and being pulled up the hill by the cable in the same manner as the ordinary cable cars. The London County Council, however, found out afterwards that while the cable was amply large enough for pulling up its ordinary small cable cars it soon gave signs of failure when pulling up the much heavier electric cars equipped with electric motors, gearing, etc. At present there are about 2000 men engaged on the work, and whatever night work is possible is being done. The whole road will have to be lowered about a foot under the Brixton Railway bridge, and from Streatham Hill the whole of the roadway is to be widened.

The electrification of the Metropolitan Railway and the Metropolitan District Railway is proceeding apace, and some of the outlying branches entirely outside of the inner circle are practically ready for work. The Baker Street to Harrow and Uxbridge branch of the Metropolitan Railway is ready to be put in service, and is only waiting now for completion of the large generating station at Neasden, which will be capable of supplying from 14,000 hp to 17,000 hp. Under the guidance of A. C. Ellis, general manager of the company, a party of experts, journalists and others recently inspected a portion of the line, and a trial trip was made on a section which has been electrified, with the new type of first and second-class corridor cars. They are large, commodious and handsome vehicles of the open corridor class, each 52½ ft. long and 8 ft. 9 ins. wide, tastefully upholstered, well ventilated, and, when necessary, both lighted and warmed by electricity. It is intended to run trains wholly composed of these corridor carriages, with motor cars at each end, on the multiple-unit system. All of the carriages have been built in this country by the Metropolitan Amalgamated Carriage & Wagon Company, Ltd., of Birmingham, and the electrical equipment by the British Westinghouse Electric & Manufacturing Company. The Metropolitan Railway Company is itself undertaking the fitting of the line for electric traction, with T. Parker, of Wolverhampton, as consulting engineer, and C. Jones, formerly of the Liverpool Overhead Railway Company, as chief electrical engineer.

A parliamentary committee recently commenced its sittings in the High Court of Justiciary, Edinburgh, for the purpose of inquiring into the merits of a number of Scottish provisional orders sought to be passed. The first case heard was that in connection with an order promoted by the Town Council of Leith for power to purchase, electrify and work the tramways undertaking within the burgh of Leith. The cost of the work is estimated at £225,000. The passing of the order is objected to by the Edinburgh Town Council, and the question resolves itself into a fight between the cable and the electrical systems of traction.

Municipal tramway managers throughout the country have received a decided shock at the decision of a House of Lords' committee to grant to a company compulsory running powers over a municipal system. The Tyneside Tramways Company, working a small undertaking between Newcastle and Tynemouth, has obtained powers from the lords' committee to take its passengers over the extensive system of the Newcastle Corporation. This is the first time a parliamentary committee has granted such powers, and the municipalities throughout the country see in the decision a serious menace to the efficient development of their tramway enterprises. The chairmen of the Manchester and Glasgow committees have invited representatives of various public bodies to attend a conference in London, with the object of promoting united and strenuous opposition to the company's bill when it reaches the House of Commons. The position that the municipalities will take up in the matter will not be one of opposition to inter-communication. They contend that the arrangements made should be voluntary, after full consideration has been given to the local requirements, and not compulsory.

The annual dinner of the Tramways & Light Railways Association was held last month at Prince's Restaurant, under the presidency of Alfred Baker. Responding to the toast of the association, Mr. Atherley-Jones, K. C., M. P., said that they were to be congratulated on the accession of Mr. Baker to the presidency. The object of the association was to develop as far as possible the interests of the public by the promotion of cheap and facile locomotion. If they had not done much to obtain this result, it was not through want of effort, but through the innate conservatism which was one of the principal characteristics of the English people. Tramways formerly regarded railroads as competing bodies, but he did not agree with this, for tramways were the feeders of the railroads. In the same way he believed that the omnibus proprietors might be induced to regard the passage of tramways over Westminster Bridge as not destructive to the British constitution. (Laughter.) He was sure that the association would in the future increase the locomotive communication between the various centers of population and between the suburbs and the centers of cities. After the speeches, which were not of a particularly important character, an excellent musical programme, provided by Mr. Benedict, the secretary, to whom a special vote of thanks was accorded, was enjoyed by all who cared to linger.

The first electrical train of the Newcastle and Benton line of the North-Eastern Railway Company was started recently by Viscount Ridley (chairman of the company), in the presence of a large gathering, which included most of the other directors and chief officials of the railway. The run to Benton and back was performed easily within the scheduled time, and the public service commenced soon afterwards, over 200 passengers traveling by the train. A luncheon followed the opening ceremony, at which the authorities of the company, Mr. Merz, the consulting engineer, and the British Thomson-Houston Company, the contractors, were heartily congratulated on the complete success of the proceedings. Sir David Dale, who presided at the luncheon, said that it was expected that the whole of the electric service would be working on June 30.

In the description of the Great Northern & City Railway, published in the STREET RAILWAY JOURNAL of March 5, a list was given of the gentlemen who had charge of the electrical engineering work. Reference should have been made at the time to the fact that all of the electrical apparatus used throughout the system was furnished by the British Thomson-Houston Company.

The Crewe Town Council some time ago decided to promote an electric tramway scheme of its own and withdrew its support from a private company. It had been arranged that the application should be made in May for an order, but on account of trade depression in the borough, the railway workmen being on short time, the committee has decided to abandon the scheme for the present.

Some alarmist reports have lately appeared in the daily papers about the discontinuation of the electric train service on the newly-opened electrified branch of the Lancashire & Yorkshire Railway from Liverpool to Southport. Doubtless nothing serious has happened, and probably by the time this appears in print the service will have been resumed. It is possible that too keen a zeal to be able to claim the first electrified main railway in England has led to a little trouble, as certainly the power house was hardly in condition to do itself justice when the railway was opened. A gradual commencement would probably have been better.

A. C. S.

PARIS LETTER.

(From Our Regular Correspondent.)

The much-talked-of city loan has at last been issued by the municipal authorities. The amount is 170 millions of francs, and it is said that the issue was oversubscribed scores of times.

The authorities made a special feature in the loan and have thus made it popular with all classes. The nominal amount of the bond is 500 francs and the price was 440 francs. Interest at the rate of 2½ per cent is paid on 500 francs. The payment is to be made in instalments, running over three years, payable every six months. From an early hour on the eve of the issue the streets were thronged in the neighborhood of the banks and brokers' offices, and the subscribers in many cases waited all night in order to sign early for their bonds. The amount of the loan will be utilized for the new construction work of the Paris-Metropolitan Railway, especially for the No. 4 line, which runs north to south, and is considered as the backbone of the whole system as regards anticipated results in traffic. It serves the populous district of Les Halles, or Central Markets.

The last word regarding the great accident of Aug. 10 last has not yet been said. The motorman who drove the doomed train, the station master at whose station the 100 lives were lost and two other officials connected with the operation of the line are all to be charged early in May with manslaughter. It is thought that the trial will be somewhat of a farce. The traffic manager, considered by many to be as responsible as any for the accident, has not been indicted.

The traffic receipts on the two Metropolitan lines continue to increase in a most satisfactory manner. For the period between Jan. 1 and April 15, the returns give 35,000,000 passengers carried, an increase of over 20 per cent compared with the same period of 1903.

Some months ago it was stated in this monthly letter that an action had been started by the Compagnie Generale des Omnibus against the city authorities for breach of faith in respect to the monopoly granted them some fifty years ago for street conveyance. The action has dragged out before the courts, and it is anticipated that the final decision will not be favorable to the city. The new Municipal Council will, at its meeting in June, take up the question of the means of transport within the city, with the view of putting the affairs of the Cie Generale on a better basis. The monopoly of the company runs out in six years' time, but matters are being hastened to a conclusion owing to the impossibility of the Omnibus company competing successfully with the Metropolitan lines. The Compagnie Generale reports a decrease in receipts for 1903 of 1,353,420 francs, which, however, is converted into a net increase by reason of economies in management, running expenses, etc. The net products for 1903 were 2,162,600 francs, against a total of 469,981 francs less for the year 1902. The company was obliged to pay off some 13,800 debentures (3 per cent) amounting to 6,900,000 francs, leaving a deficiency of 4,737,399 francs, which sum was met by the issue of new debentures at 4½ per cent. Thus, the company's affairs are drifting from bad to worse every year.

The Cie des Tramways de Nice has just been mulcted in the sum of 95,000 francs damages given to the University of Paris, which body possesses an observatory at Mont Gras. The Nice Tramway Company extended its system of lines close to the observatory, with the result of interfering with the magnetic apparatus installed in the observatory. Hence, the damages to the Paris University, which received daily reports from the observatory before operations were stopped by the tramway company.

Algiers has a very efficient tramway system which is soon to be increased by the addition of several units. The new rolling stock includes G.E.-53 motors, and Type-B controllers, and the material will mostly come from the United States.

The year 1903 was a pretty favorable one for tramways in France. The larger companies are paying about 5 per cent, among which may be mentioned the Cie Generale Francaise de Tramways, owning a large system at Marseilles, the Havre Tramway Company, and the Thomson-Houston concern.

It will be remembered that about a year ago the Est-Parisi Tramways were granted a license to run their cars in the rue du 4 Septembre by means of overhead trolley, instead of the surface contact system in use. The reason for this was that the Est-Parisien made out that the new Metropolitan line (No. 3), which runs under the rue du 4 Septembre, interfered with the surface contact system. The No. 3 line is finished as regards construction work and the city authorities have called upon the Est-Parisien Company to remove the so-called unsightly trolley from the streets. The time granted expired at the end of last March, but the company has made no effort to comply with the request. The city will undoubtedly take immediate action, and the consequences are not difficult to foresee, in view of the parlous state of the finances of the Est-Parisien, which has never recovered from the disastrous strike which terminated about two months ago. The Est-Parisien system includes about 50 km of track, mostly outside the city boundaries.

The State Railway announce the putting into service of a new steam motor car, composed of motor (two small compound engines) baggage car and seating accommodation for forty passengers. The Northern Railway Company has already a number of these in service and the P.-L.-M. Railway is also experimenting in this direction. Coke is the fuel in general use on French railways, together with a certain proportion of briquette, or patent mixture, and this will be used on the new automobile car. The fuel feed is automatic as well as the water feed. The engine will only need one attendant. In appearance the trolley cars used for interurban service in America are very similar to the steam automobiles in use on French and British railways.

TWELFTH ANNUAL REPORT OF THE GENERAL ELECTRIC COMPANY

The annual report of the General Electric Company for the year ending Jan. 31, 1904, was made public last week, and shows that the profits of the company for the past year, including a profit of $138,644.06 upon securities sold, and $750,796.69 royalties, dividends, sundry profits, etc., after deducting all general and miscellaneous expenses, and allowances for depreciation, losses and writing off $553,773.01 from patent account, and from factory plants and machinery were..... $2,027,841.52 $7,865,376.89
Less interest on debentures..... 76,007.15

$7,789,369.74

Less net debit to profit and loss in writing off the patents, etc., of the Stanley Electric Manufacturing Company, and other acquired interests, and balance due on all turbine patents acquired by the company, and in revaluing stocks and bonds owned 1,470,098.98

$6,319,270.76

The amount of surplus at the end of the last fiscal year was 4,482,701.99

$10,801,972.75
Paid in dividends during the year..... 3,508,284.00
Surplus Jan. 31, 1904..... $7,293,688.75

The report states that disturbed financial and other unsatisfactory conditions of the past year have considerably affected the business, and the percentage of profit upon business done is smaller than for the previous year; the increased price of copper, higher priced and less effective labor, large expenses in developing steam turbines, and lower selling prices have also contributed to this result.

The total sales (amount billed to customers) during the past year were $41,699,617.

The orders received during the past year include: Generators, rotary converters and steam turbines, aggregate capacity about 900,000 hp; railway motors, more than 7000, aggregating over 300,000 hp capacity; transformers, over 650,000 hp capacity; stationary motors, more than 15,000, aggregating over 200,000 hp capacity; arc lamps, more than 75,000; meters, more than 110,000.

The equipment of the Manhattan Elevated Road in New York City has been completed, and has continued to operate with complete success, frequently carrying more than one million passengers per day. This road has now been operated electrically for about one year, and despite the early unfamiliarity of the operating men with electrical apparatus, and the enormous increase in traffic, not a single passenger in the elevated trains has met with a fatal accident that in any way, directly or indirectly, could be attributed to the electrical apparatus. This record is not only one of which the operating department may well be proud, but is also a strong testimonial to the reliability of the electrical apparatus. It is worthy of note that the popular apprehension of the "deadly third rail" is without foundation as regards danger to the public. There is not a recorded instance of a passenger being killed by the third rail.

Most of the equipment for the Interborough Rapid Transit Company, New York City, has been delivered, and many of its cars have been operated for months on the lines of the Manhattan division.

STEAM RAILROAD EQUIPMENTS

Considerable progress has been made during the year in the steam railroad branch of the business. The New York Central

Railroad has placed large orders with this company for electrical apparatus to operate its trains south of Croton (a distance of 34 miles from the Grand Central Station). The officers and engineers of many of the great railway systems are watching closely the progress of electric traction, and express themselves as ready to adopt electricity as soon as its economical operation has been demonstrated by the installations now in progress. The South Side and Lake Street Elevated Railways of Chicago, and the Manhattan Elevated Railway of New York City, are three roads which originally operated by steam and have since adopted electric traction. The South Side Elevated and Manhattan are equipped respectively with the Sprague and Sprague-General Electric multiple-unit control system, and all are equipped with General Electric Company's apparatus. A comparison of results obtained with steam and electricity is given below:

Year.	Gross Receipts.	Operating Expenses.	Net Earnings.	% Operating Exp. to Gross Receipts.
SOUTH SIDE ELEVATED, CHICAGO.				
Steam, 1895	$744,167	$573,704	$230,463	69.1
Elec., 1899	1,170,381	516,206	654,175	44.1
LAKE STREET, ELEVATED, CHICAGO.				
Steam, 1895	517,305	290,000	227,298	56.1
Elec., 1899	697,513	331,553	365,960	47.5
MANHATTAN ELEVATED, NEW YORK.				
Steam, 1901	9,416,888	5,253,230	4,163,658	55.8
Elec., 1903	12,208,337	5,460,793	6,747,544	44.7

The figures in the case of the Manhattan road are made more interesting by the fact that the number of passengers carried in 1903 was 246,587,022, as against 190,045,741 in 1901, while it will be noted that the operating expenses were only $207,564 more in 1903 than in 1901. The 1903 figures given above are for the year ending June 30, 1903. The results since that date are even more favorable to electric traction.

MULTIPLE UNIT CONTROL.

The Sprague General Electric control equipments on the Manhattan Elevated have continued to give satisfaction to its officials and engineers and by prolonged test have proved their strength, reliability and durability. The same is true of the Interborough equipments during the time that they have been in operation. During the past year the company secured the order for the complete equipment of the elevated road in Boston with the Sprague-General Electric system and orders for the same type of multiple unit control have been given by the Yerkes system of underground roads in London to the British Thomson-Houston Company, and by the Metropolitan Underground in Paris to the French Thomson-Houston Company. The Central Underground Railway of London has also equipped its entire system with the Sprague-General Electric control. The list of roads and number of cars equipped, or under contract, given in the last report aggregates now 53 roads and 2595 cars.

RAILWAY MOTORS

Since the organization of the company in 1892, it has sold 92,557 railway motors, having a total capacity of 3,420,537 hp. These motors are in operation in all parts of the world.

POWER TRANSMISSION PLANTS

One of the important enterprises completed during the year is a power transmission plant at Guanajuato, Mex. The power is transmitted at a continuous pressure of 60,000 volts. The transmission line is 101 miles long and the wires are carried on iron towers 48 ft. high and 440 ft. apart, instead of by the usual system of poles spaced at intervals of 100 ft. or 125 feet.

Including steam and water power plants, the company has installed and under contract to-day: 1,230,270 hp capacity in polyphase generators. Of this number, 514,919 hp capacity are being operated by water power. The company has now five large plants under construction employing 60,000 volts. The average size of the transformer used in such installations has increased from 100 kw to 1000 kw, and the maximum size from about 300 to 2500 kw.

The various installations mentioned in previous reports, in which electricity is transmitted long distances, have continued to be commercially successful, and many have been increased; for example, 5000 hp capacity in generators with the necessary transformers have been ordered by the government of Mysore for the Cauvery-Kolar plant. This nearly doubles its original capacity. The remaining 5000 hp generators for power station No. 2, at Niagara Falls, have been completed and there are now in operation at this station eleven machines of General Electric manufacture, making a total of 55,000 hp. The company has also shipped the first of the 10,000 hp generators intended for the Canadian development of Niagara Falls power, and the second and third machines of this same size are nearly completed. These generators are the largest in capacity that have yet been constructed.

The company's engineers have been engaged for several years in developing and perfecting a line of single-phase alternating-current motors suitable for use on railroads and tramways. While this motor and its control are both new, they are now based upon patents already owned by this company.

STEAM TURBINES

The past year has been marked by the successful introduction of the Curtis steam turbine. A large line of turbo-generators, varying in size from 1½ hp to 7500 hp, has been developed. The company has sold about 350,000 hp, of which 35,000 hp have been installed and are in successful operation.

BALANCE SHEET

The balance sheet follows:

ASSETS.		
Cash		$3,289,445 18
Stocks and bonds	$14,665,346 27	
Real estate (other than factory plants)	424,082 74	
Notes and accounts receivable	15,207,480 74	
Work in progress	2,046,488 43	
	32,343,398 18	
MERCHANDISE INVENTORIES:		
At factories	$10,488,464 63	
At general and local offices	1,247,754 37	
Consignments	69,899 38	
	11,806,118 38	
		44,149,516 56
Factory plants	6,500,000 00	
Patents, franchises and good-will	2,000,000 00	
		8,500,000 00
		$55,938,961 74
LIABILITIES.		
3½ per cent gold coupon debentures	$2,049,400 00	
5 per cent gold coupon debentures	82,000 00	
Accrued interest on debentures	683 33	
Accounts payable	1,810,664 54	
Unclaimed dividends	1,825 12	
		$3,944,572 99
Deferred liability on account of purchase of Curtis Turbine Patents, payable in installments to Feb. 1, 1906		834,000 00
Capital stock		43,866,700 00
Surplus		7,293,688 75
		$55,938,961 74

ACCIDENTS IN CHICAGO

The Civic Federation, of Chicago, Ill., has classified the cases of death or injury in Chicago from accidental causes which were reported by the Chicago police for the year 1903. The tabulation of the street railway accidents, giving their nature and number of victims, is given here:

STREET RAILWAY ACCIDENTS.

Alighting from car	331
Boarding car	217
Collisions	123
Arm or head out of window	9
Car jumping track	61
Car striking wagon	442
Falling or thrown off	198
Thrown off by conductor	18
Jerking of car	15
Run over	457
Hit by passing wagon	99
Knocked off by bridge	28
Crushed in tunnel	8
Slipping from car	16
Hitching on car	13
Total	2,035

UNION ENGINEERING BUILDING IN NEW YORK

The programme of competition for designs for the Union Engineering Building will be placed this week in the hands of the architects who are to compete for the design to be selected, and all drawings are to be in the hands of Prof. Hutton, secretary of the committee, by June 15. The building will occupy a space of 10,500 ft. on Thirty-Ninth Street, exclusive of the 15 ft. required by city ordinances, and will contain offices for the different societies, reception rooms, a library, audience halls, the largest of which will seat 1500 people, etc. The Engineers' Club, which will connect with the Engineering Building, will front on Fortieth Street and will be eleven and a half stories in height.

STATISTICS OF VIRGINIA COMPANIES

It is possible to give here only a summary of the statistical tables compiled by the State Corporation Commission of Virginia concerning the details of the capital stock, funded debt, cost of road and equipment, income account, earnings from operation, operating expenses, balance sheets, traffic and mileage statistics, mileage, equipment and average wages of and number and class of employees of the electric railways of the State. The total of outstanding common stock of the twenty-two companies reporting is $19,456,950, while the total of outstanding preferred stock is $5,925,000, making the total of stock issued per mile of road $32,748 for the companies able to report the amount of capital stock per mile. The total of bonds authorized is $37,949,000, of which $31,760,500 has been issued. The figure of $47,969, given in the table as the amount of bonded indebtedness per mile, represents the average of those companies which are able to report the amount of their funded debt. The total cost of road and equipment, as given in the report, is placed at $48,991,717. The figure of $86,991 given as the cost per mile of road represents only such companies as operate railway lines, it being impossible to ascertain the cost where lighting and other properties are included. The income account is shown in the following table:

INCOME ACCOUNT

Name of Company	Income from Operation	Deficit from Operation	*a* Income from Other Sources	Total Income	Total Deficit.	*b* Deductions from Income	Net Surplus	Net Deficit.
	$	$	$	$	$	$	$	$
Bay Shore Terminal Co	-------	7,568.23	-------	-------	7,568.23	9,938.89	-------	17,507.12
Berkley Street Railway Co	2,303 80	-------	510.23	2,814.03	-------	28,875.77	-------	26,061.74
Charlottesville City & Suburban Railway Co	4,467.80	-------	-------	4,467.80	-------	7,000.07	-------	2,532.27
Chesapeake Transit Co	-------	5,318.60	754.09	-------	4,564.51	17,395.84	-------	21,960.35
Citizens' Railway, Light and Power Co	15,261.92	-------	42,142.39	57,404.31	-------	51,005.84	6,398.47	-------
Danville Railway and Electric Co	12,642.85	-------	6,206.46	18,849.31	-------	13,301.66	5,547.65	-------
Hampton Roads Railway & Electric Co *c*	-------	-------	-------	-------	-------	-------	-------	-------
Lynchburg Traction and Light Co	36,452.42	-------	44,597.51	81,049.93	-------	53,578.54	27,471.39	-------
Newport News and Old Point Railway and Electric Co	63,944.55	-------	87,753.59	151,698.14	-------	158,781.10	-------	7,083.02
Norfolk and Atlantic Terminal Co	3,415.96	-------	-------	3,415.96	-------	47 272.97	-------	43,857.01
Norfolk, Portsmouth and Newport News Co	9,542.16	-------	322.82	9,864.98	-------	10,509.21	-------	644.23
Norfolk Railway and Light Co	90,692.18	-------	119,448.48	210,140.66	-------	206,073.91	4,066.75	-------
Old Dominion Railway Co	5,688.48	-------	188.35	5,876.83	-------	30,897.48	-------	25,020.65
Radford Water Power Co	-------	3,613.02	13,003.34	9,390.32	-------	7,144.73	2,245.50	-------
Richmond Passenger and Power Co	121,546.30	-------	12,859.21	134,405.51	-------	226,856.89	-------	92,451.38
Richmond and Petersburg Electric Railway Co	19,614.32	-------	-------	19,614.32	-------	14,090.47	5,523.85	-------
Richmond Traction Co	53,039.06	-------	3,584.05	56,623.11	-------	57,437.60	-------	814.49
Roanoke Railway and Electric Co	32,395.18	-------	16,637.34	49,032.52	-------	26,695.39	22,337.13	-------
Tazewell Street Railway Co	505.10	-------	-------	505.10	-------	-------	505.10	-------
Virginia Passenger and Power Co	66,754.46	-------	258,946.88	325,701.34	-------	440,015.02	-------	114,313.68
Washington, Arlington & Mt. Vernon Railway Co	73,812.79	-------	4,234.60	78,047.39	-------	44,061 89	33,985.50	-------
Washington, Arlington and Falls Church Railway Co	2,974.83	-------	-------	2,974.83	-------	10,688.31	-------	7,713.48
Total	615,054.15	16,499.85	611,189.34	1,221,876.39	12,132.74	1,461,621.64	108,081.43	359,959.42

a Advertising, light, power and ice plants, leases, hotels, ferries, amusements, interest and dividends on securities owned, etc. Total net deficit, $251,877.99. *b* Interest, dividends, rentals of leased lines, taxes, etc. *c* In hands of United States Circuit Court—no report made.

The earnings from operation are shown as passenger earnings, freight earnings, mail earnings, miscellaneous earnings, and total at $2,307,082, making earnings per mile of $8,134. The operating expenses are detailed as maintenance of way, maintenance of equipment, operation of power plant, operation of cars, and general expenses. The total of operating expenses is given as $1,708,527, making expenses per mile of $6,024. The total balance sheet shows the total of assets to be $71,406,710, while the total of liabilities is given as $71,406,710. The total number of passengers carried is given as 56,038,428, while the number of transfers is given as 8,819,870. The passenger car milcage is 13,385,688 and the rate of fare per passenger $.0392. The passenger earnings per mile of road are $7,858, while the passenger earnings per car-mile are $16.61. The total mileage, including main line, branches and side tracks, is given as 374.42. The total number of cars is 675, made up of 358 closed cars, 267 open cars, 1 express car, 31 freight cars, 13 service cars, 1 snow plow, 1 sprinkler, 3 sweepers. The wages of employees are given for general officers, general office clerks, conductors, motormen, drivers, starters, watchmen, etc. The general average for conductors is placed at $1.49 per day. The highest wage paid for this class of service is by the Chesapeake Transit Company, which pays $2.19, while the lowest rate is paid by the Tazewell Street Railway Company, which pays $1 a day. The average of wages of the motormen is $1.55 per day. The highest rate paid for this service is by the Washington, Arlington & Mount Vernon Railway Company, which pays $2.25, while the lowest wage is paid by the Charlottesville City & Suburban Railway Company, which pays $1.15. The total wages for all service averages $1.42 per day.

The Roberts & Abbott Company, of Cleveland, writes that the long double-truck cars recently purchased by the Northern Texas Traction Company are equipped with four 75-hp motors, and not four 50-hp motors, as stated in the description published April 23. The cars were built by the American Car Company, according to the specifications and under the inspection of, the Roberts & Abbott Company.

ANNUAL REPORT OF THE PITTSBURG RAILWAYS COMPANY

The annual report of the Pittsburg Railways Company, for the year ended March 31, 1904, was submitted to the stockholders on May 2. It was as follows:

During the year the following lines have been added to the system: the Pitcairn & Wilmerding Street Railway, extending from Wilmerding through Pitcairn to Trafford City, and the Wilkinsburg & Verona Street Railway, extending from Wilkinsburg to Verona and Oakmont. The East McKeesport Street Railway completed a connection in Wilmerding by a long viaduct over the tracks of the Pennsylvania Railroad Company to Airbrake Avenue in Wilmerding, thus affording a connection through the Turtle Creek Valley to McKeesport. The Pittsburg & Charleroi Street Railway completed the connection between Castle Shannon and Monongahela City. Through cars are now operated from the head of Pittsburg Incline in Pittsburg to Allenport, a distance of 31.89 miles. The results from the operation of this line during the fall and winter months indicate that this railway will eventually be profitable, and especially so when cars can be operated direct from Pittsburg through Mount Washington tunnel and by private right of way to Castle Shannon. On this line are ten double-truck closed cars, equipped with motors, controllers, etc., adopted for high speed interurban traffic. The tracks of the McKeesport & Reynoldton Street Railway have been extended to the southern limits of Glassport. The Howard & East Street Railway was constructed to the city limits of Allegheny and the tracks of the Bellevue & Perrysville Street Railway to West View. The results from the operation of these railways during the summer and fall were satisfactory.

The company during the year has constructed 34.53 miles of new track, and the total track now operated by the company is 445.56 miles.

The company purchased 200 cars during the past year, 100 being closed vestibule motor cars, and 100 closed trail cars.

The company during the year has maintained its tracks in good repair. Several of the heavy traffic lines of the system were thoroughly overhauled, cast-welded joints being used, rails straightened and new ties placed at joints. It is believed that the repairs, while involving a large expenditure, will add three or four years' service to these tracks.

The company has maintained its power plants, cars, buildings and equipment in thorough repair. The progress of construction of the power plant on Brunot's Island has been slow. Since April 1, 1904, however, the contractors have been pushing their work rapidly, and from present indications current will be supplied from this plant early in July.

During the year the Pennsylvania Company has completed the work of elevating its tracks on the main line in Allegheny, which practically removes all the grade crossings of the company in that city.

The gross receipts from the operations of the company up to January 1, 1904, show a satisfactory increase. The depression in general business and the closing down of many of the mills in this district has caused a slight decrease in receipts between Jan. 1, 1904, and March 31, 1904. The increase in gross receipts for the year is .0481 per cent, and a slight increase in net earnings.

The extremely severe weather during the winter has also affected

the receipts as well as increased the operating expenses. The principal item in the increase of expense is shown in the transportation department, and is owing to the increase in wages to all classes of workmen—especially to motormen and conductors—and to the advanced cost of coal, which was about 40 per cent over the preceding year, but owing to competition the company will be able to purchase its supply of coal at reduced prices for the coming year. The item of maintenance of way and structures also shows an increase, which was caused by the extensive repairs made upon the system.

Attached hereto will be found a statement of the operations of the company for the year ended March 31, 1904:

INCOME AND PROFIT AND LOSS ACCOUNT YEAR ENDED MARCH 31, 1904

Gross receipts from operations		$8,661,394.48
Operating expenses—		
General expense	$607,735.04	
Conducting transportation	2,922,431.99	
Maintenance of way and structures	405,393.48	
Maintenance of equipment	650,166.18	
Parks and Duquesne Garden expenses	60,612.35	
Total operating expenses	4,646,339.04	
Bridge tolls	118,217.73	
Taxes	422,325.11	
Total operating expenses and taxes		$5,186,881.88
Net earnings		$3,474,512.60
Other income—		
Advertising in cars	$37,711.91	
Dividends on stocks owned	62.50	
Rent of buildings and real estate	65,310.60	
Interest and discount	17,437.76	
Miscellaneous	17,133.67	
Total other income		137,656.44
Total income		$3,612,169.04
DEDUCTIONS FROM INCOME		
Rentals of leased companies—		
United Traction Co. of Pittsburg	$370,785.04	
Consolidated Traction Co	757,098.00	
Interest on current liabilities	150,996.76	
Tenement expenses	14,924.89	
Total deductions from income		$1,293,804.69
Net income		$2,318,364.35
FIXED CHARGES		
Interest on funded debt	$1,464,440.84	
Dividends on preferred stock—		
United Traction Co. of Pittsburg $150,000.00		
Consolidated Traction Co 720,000.00	870,000.00	2,334,440.84
Deficit for year		$16,076.49
Surplus March 31, 1903		206,961.79
		$190,885.30
Bad accounts collected	$224.50	
Premium on bonds sold	8,353.63	8,578.13
Surplus March 31, 1904		$199,463.43

NOTE.—During the fiscal year ended March 31, 1904 the gross receipts from operation increased $384,829.40 over the same period for the preceding year.

Passengers carried	174,400,055
Car mileage	34,748,836 Miles
Earnings per car mile	$.2532
Expenses per car mile (including taxes)	.1492
Net earnings per car mile	.1040

IMPROVEMENTS AT CINCINNATI

The Cincinnati Traction Company is planning to make a number of improvements to its system during the summer. W. Kesley Schoepf, president of the company, is at present in the East discussing with his asociates the expenditure of about $500,000 in betterments for the property. At the Depot Street generating station there will be installed 2250 hp of additional boilers and engines and a 1500-kw generator. Plans are under way for the erection of a large fireproof car house on Walnut Hill to replace the one burned some time ago. Considerable new special work will be laid at crossings in the down-town district, and additional curves will be put in at a number of points which will enable both the city company and the Cincinnati, Newport & Covington Traction Company to operate additional cars over loop routes during rush hours.

SUBWAY EXTENSION REPORTED IN NEW YORK

The Plan and Scope Committee of the Rapid Transit Commission, of New York, on Thursday, April 28, reported favorably upon the subway plan, of which mention was made in the STREET RAILWAY JOURNAL of April 30. This, in general, is the plan proposed by the New York City Railway interests a few weeks ago, but differs from that plan in advocating the use of Seventh Avenue instead of Eighth Avenue up to Forty-Second Street. In brief, the line is to run down Lexington Avenue to Irving Place and Fourteenth Street, thence to Broadway and Chambers to William, through the financial district and around the Battery, through West and Houston Streets, up Seventh Avenue to Thirty-Fourth Street and thence east to Lexington Avenue. It would afford the loop system for the lower part of the city and connect with the Grand Central Station and the new Pennsylvania Station at Thirty-Seventh Street and Seventh Avenue. A public meeting will be held May 12, to consider the project.

As an incentive to competition in building the new subway, the committee suggests that the work be divided into sections in such a manner as to make it adaptable in practice to the plans of both the New York City Railway Company and the Interborough Rapid Transit Company. Notwithstanding this provision, the contract, offered wholly or in sections, will go to whichever bidder can offer the most attractive proposal in the matter of transfers. The Interborough Company has suggested the building of a lower west side route by extending the present subway from Forty-Second Street and Broadway to the Battery, and an upper east side route by an extension from Forty-Second Street and Fourth Avenue up Lexington Avenue into the Bronx. The Metropolitan interests recommend building an independent system running from the Bronx down the east side, thence around the Battery and continuing up the west side of the city to Thirty-Fourth Street, and thence across to the east side tunnel. This is the committee's recommendation:

The routes in Manhattan and the Bronx now proposed by your committee follow generally the line suggested by the Metropolitan interests on the east side, except that the terminus in the Bronx is moved northerly so as to connect with the present subway at One Hundred and Ninety-Fourth Street and Third Avenue. On the east side, instead of going up Hudson Street and Eighth Avenue, it is proposed to continue up West Broadway to Washington Square, thence under Washington Square and private property to Greenwich Avenue, thence under Greenwich and Seventh Avenues to Thirty-Fourth Street, and thence under Thirty-Fourth Street to a junction with the east side line at Lexington Avenue.

Three additions to the route thus outlined are proposed by your committee:

First—A short line to connect the Lexington Avenue line with the present subway at a point near Fortieth Street and Park Avenue.

Second—A line up Seventh Avenue from Thirty-Fourth Street, to connect with the present subway at Forty-Third Street.

Third—The line from Fort Hamilton, Brooklyn, already referred to, running under Fourth Avenue and Flatbush Avenue, as extended, and over the Manhattan Bridge to a point in Canal Street near Centre.

This large scheme of building, if approved, should not be offered to bidders as an entirety. On the contrary, it is the judgment of your committee that it would be essential to invite bids upon it in separate sections. One section would embrace the Brooklyn line, one section might embrace the east side line from One Hundred and Thirty-Eighth Street to Forty-Fifth Street, another the east side line south of Forty-Fifth Street, and another the west side line as far north as Thirty-Fourth Street. The four connecting links from One Hundred and Thirty-Eighth Street and Third Avenue to One Hundred and Forty-Ninth Street and Third Avenue, from Park Avenue and Fortieth Street to Lexington Avenue and Forty-Fifth Street, along Thirty-Fourth Street from Seventh to Lexington Avenue, and along Seventh Avenue from Thirty-Fourth to Forty-Third Street, would also each constitute a separate section. Bidders might be allowed to bid for one or more of the sections.

The board should reserve the right to award contracts for one or more sections, or suspend the construction of any section until such time as the increase of traffic might establish the necessity for an additional route. The invitation to contractors should also require them (as was done in the case of the Brooklyn-Manhattan Rapid Transit Railroad) to specify the maximum fare, not exceeding 5 cents, which would be charged, and also specify what transportation facilities over railways connecting or to connect with the new line each bidder would be able to assure the city. The transfers offered might be with or without change of cars, as the several bidders might be able to offer.

Bidders might also be called upon to specify what rental they would be willing to offer above the minimum provided by law. In this way the competition might be invited, not merely as to the expense of construction, but also as to the accommodations offered to the public and the rental to be paid to the city for the use of its streets.

CHICAGO TO ASK COMPANIES FOR TERMS

Mayor Harrison, of Chicago, has been authorized by the City Council to invite the companies to enter into negotiations with the city officials for franchises. The resolution began by making the observation that the street railway question is still open and unsettled and the general pubic is still submitting to deplorable transportation facilities. The resolution then proceeds to authorize the Mayor to extend an invitation to all street railways of the city whose franchises expired July 30, 1903, and since that date, to negotiate with the proper officers of the city of Chicago as to what character of franchise they or any of them contemplate requesting from the city.

FERROSTEEL FLANGED FITTINGS

The practice of superheating high-pressure steam is becoming so general that the Crane Company has brought out a material called ferrosteel, for use in piping systems subject to the higher temperatures and increased expansion strains which the improved practice involves. This metal has an average tensile strength of 32,500 lbs. per sq. in. The weakest test bar in 31 heats was 30,135 lbs. per sq. in., and the majority of the bars were within 5 per cent of the average, showing a remarkable uniformity. Ferrosteel is more than 50 per cent stronger than the ordinary run of cast iron, which rarely exceeds 19,000 lbs. tensile strength, and quite frequently runs 14,000 lbs. to 16,000 lbs.

A property of this metal which makes it very desirable in heavy fittings, is that of maintaining the close character of the grain in large sections better than cast iron. The result of this is, that while a ferrosteel test bar 1 inch square is 50 per cent stronger than a cast iron test bar of the same size, a heavy ferrosteel fitting will probably be 60 per cent stronger than a cast iron fitting made from the same pattern. The company's extra heavy ferrosteel fittings for working pressures of 250 lbs. are made from the same patterns as the cast iron, so that the full benefit of the difference in strength is obtained.

Ferrosteel fittings of 12 ins. and smaller will be tested under 1500 lbs. hydraulic pressure per sq. in., and those of 14 ins. and larger under 1000 lbs. pressure. All fittings will have cast on them: "Crane F. S.," and when tested, will have stamped on them: "tested 1500 lbs.," or "tested 1000 lbs.," according to size. The difference in price between cast iron and ferrosteel is small.

THE PERSONNEL OF THE MEXICO ELECTRIC TRAMWAYS

W. W. Wheatley, formerly manager of the railway department of the Public Service Corporation of New Jersey, who, as previously announced in the Street Railway Journal, is now general manager of the Federal District Railway Company, which operates the extensive electric traction system in Mexico City, has issued the following circular:

In order that there may be a clear understanding among all employees, concerning the responsibility and jurisdiction of the heads of the respective departments, the following order will become effective immediately:

A. J. McDonald, with the title of traffic superintendent, will have charge of the operation of all the lines of the company, with such assistants as he may appoint.

J. L. McCreary, with the title of superintendent of maintenance of way and equipment, will have charge of the various shops and of the maintenance of track, rolling stock, roadway and buildings.

H. S. Bolton, with the title of electrical engineer, will have charge of the company's power plant, and of the transmission lines and overhead work. He will be consulted by the superintendent of maintenance of way and equipment in all matters relating to bonding of track.

C. A. Malau, with the title of consulting engineer, will perform such duties as may be assigned to him.

J. C. Jackson, with the title of storekeeper, will have charge of the company's stores.

It will be understood that the above departments cover all lines of the company, irrespective of the system of traction.

The heads of each of the above-mentioned departments will report directly to the general manager.

SINGLE-PHASE EQUIPMENT FOR A PACIFIC COAST LINE

The Vallejo, Napa & Benicia Electric Railway Company, of California, has closed a contract with the Westinghouse Electric & Manufacturing Company for the electrical equipment for a single-phase electric railway. The grading is progressing between Vallejo & Napa, and the road is expected to be finished in about six months.

NEW FACTORY OF CHASE-SHAWMUT COMPANY

The new factory which the Chase-Shawmut Company has recently equipped at Newburyport, Mass., is one of the most complete of its kind in the country. The plant covers about an acre and is located on the Merrimac River, far enough out of the city proper to give plenty of air and light to the 220-odd employees. Coal for the steam plant and all raw material used in the manufacture of the company's specialties can be taken from barges within 100 ft. from the main factory building. The steam plant consists of three Hodge boilers, having an aggregate capacity of about 300-hp. The power is supplied from one 150-hp horizontal Rollins engine. The lighting plant consists of two 30-kw direct current machines, also a 30-kw alternating-current machine, used for testing purposes.

The main factory building is a four-story structure separated by fire walls, and having a depth of 350 ft. On the ground floor is the switchboard, assembly room and the motor and generator repair department, together with the heavy stock room. The second floor is devoted largely to the manufacture of switchboard parts. On this floor are also the polishing, plating and dipping rooms. The third floor is used for the manufacture of the well-known "Shawmut" soldered rail bonds and "Shawmut" indicating enclosed fuses, the output of which has been increased more than 100 per cent since the advent of the company into its new quarters. The fourth floor is employed for the storage of finished product, kept ready for shipment in standard packages. In a separate part of the building on this floor is located the wire-drawing machinery used in the manufacture of the company's tested fuse wire, which is drawn through a series of sapphire dies. In the rear of the main building and on the water front, is located the foundry, where the company makes all its castings. There are also a number of other buildings adjoining the main building, including the pattern and cabinet shop, drafting rooms, photographing and blue print rooms, laboratory, and a storehouse for raw material.

The office buildings are pleasantly located, and were constructed to enable the work to be done in the simplest and best manner. The past experience of the company in its crowded quarters in Boston led it in selecting new quarters to secure as far as possible a plant where it would be possible to manufacture complete the different specialties which it puts on the market, and with the facilities at the new factory it is apparent that the company can carry a complete line of raw material, manufacture and assemble it without the necessity of buying a piece here and there to fill in on the details.

The company is now manufacturing all kinds of open and enclosed fuses and fuse metals, switches and switchboards, flexible soldered rail bonds, conduit boxes and fittings, and is constantly adding to its lines. In addition to this material, the "Boston" cable clip is manufactured by this company.

TWO-CENT FARE ORDINANCE IN CLEVELAND

An ordinance has been introduced in the City Council of Cleveland, which will, upon its passage, grant franchises for the construction of four 2-cent fare street railway lines. It will be remembered that some months ago the city advertised for bids for the construction of street railway lines over the following routes:

Dennison Avenue, from Rhodes Avenue to the city limits; Summit Street, between Erie and Seneca; Edgewater Boulevard, between Taylor and Lake Avenue; Doan Street, between Wade Park and Ansel Avenue. The city officials and railway people in general were mystified upon the bids made by Will Christy, of Akron, Ohio, to construct street railway lines over these routes and give a 2-cent fare. Mayor Johnson declared that it was only a straw bid, but despite this claim Mr. Christy deposited with the city the required $20,000. The city holds consents for the majority of frontage over three of the routes, and the city would be bound under its policy of securing low fare roads, to turn these consents over to Mr. Christy. Mayor Johnson declares that the introduction of the present ordinance is a ruse to recover the $20,000. The ordinance

says nothing about the city having the right to buy the property at the expiration of the franchise, which is one of Mayor Johnson's pet hobbies. A change in the ordinance to embody this point would give Mr. Christy an opportunity to recover the forfeit money. A precedent on this point was made recently when the city returned a forfeit of $5,000 deposited by another promotor of a low fare line who claimed he was unable to secure consents of property owners. Mr. Christy continues to maintain a sphinx-like silence on the subject of his plans or how he expects to make one on a city line giving a 2-cent fare.

IMPORTANT FRANCHISE BILL IN NEW YORK

One of the latest bills passed by the New York State Legislature at its last session and signed by Governor Odell practically abolishes in second class cities the necessity of having auction sales of street railway franchises. When this bill was passed it was believed by its advocates that it would benefit the cities by securing for any franchise the maximum amount of return for any new franchise. It has been found, however, that there are many other considerations to the public than the money paid for a franchise, and the bill required in some cases the award of franchises to companies under conditions detrimental to the public interests, as well as to the interests of the railway companies themselves. For this reason several street railway managers, including representatives of the State Association, spoke at the hearing in favor of the change.

In this connection it is interesting to note that the State Association is increasing in membership. Among recent new members are the United Traction Company, of Albany, and the Kingston Consolidated Traction Company. Others have applied for membership.

NO STRIKE IN SAN FRANCISCO

Information to hand as the STREET RAILWAY JOURNAL goes to press says the threatened strike of the employees of the United Railroad, of San Francisco, has been averted by the acceptance by the union of the terms of the company submitted through Mayor Schmitz. The basis of the settlement, however, is not even intimated.

PERSONAL MENTION

MR. M. O'BRIEN has resigned as master mechanic of the Chicago City Railway to take a similar position with the St. Louis Transit Company.

MR. CLINTON B. KIDDER has resigned as manager of the Savannah Electric Company, of Savannah, Ga. He will engage in mining at Bonanza, Yukon Territory.

RICHARD H. PIERCE, of Pierce, Richardson & Neiler, engineers of Chicago, has been appointed chief engineer to take complete charge of the power plant at the Louisiana Purchase Exposition. He was consulting engineer of the Columbian Exposition and later was consulting engineer for the Chicago City Railway Company. Mr. Pierce will be assisted by Mr. Charles S. Foster, of Chicago.

MR. R. L. CHILES, of New York, has been appointed superintendent of the street railway lines of the Norfolk, Portsmouth & Newport News Company, of Portsmouth, Va. He succeeds Mr. Randolph Peyton, who resigned from the company April 1 to accept another position. Mr. Chiles is a railway man of experience, and was formerly associated with Mr. E. C. Hathaway, general manager of the local company at Portsmouth.

THE ENGAGEMENT is announced of Mr. T. E. Mitten, general manager of the International Traction Company, of Buffalo, N. Y., and Miss Ruth Bissell, of Lockport, N. Y. Mr. Mitten is very well known in street railway circles. Before his connection with the International Company he was general superintendent of the Milwaukee Electric Railway & Light Company. Miss Bissell is a talented young woman, very pretty, and with excellent musical accomplishments, acquired by study in Paris. The date of the wedding is not yet announced.

MR. BION J. ARNOLD has been appointed consulting electrical and mechanical engineer for the Illinois Tunnel Company. This company has already completed some 21 miles of subway tunnels underneath the streets of the business district of Chicago, and has installed an extensive automatic telephone service in the same district, carrying its telephone wires in the tunnels. The problem which confronts Mr. Arnold is that of planning and installing a narrow gage electric freight railway in these tunnels and arranging connections to the business buildings, freight depots, river docks, etc. It is proposed to perform a general freight collecting and distributing business, thus obviating a large portion of the teaming now greatly congesting the streets above. The necessary power stations, type of equipment, signalling and switching system, and method of conducting this transportation are all interesting factors in the problem. Mr. Arnold, it will be remembered, as municipal traction expert, recently made an extended study of the transportation problem in the downtown district of Chicago, and his report to the City Council upon that question is being followed out as the basis of a general scheme for relieving the surface congestion.

MR. JOHN I. BEGGS, president of the Milwaukee Electric Railway & Light Company, of Milwaukee, Wis., was recently presented with a beautiful silver service by officers and directors of the company, assembled at a banquet at Hotel Pfister, Milwaukee. Sixteen guests were present at the dinner, which was an informal affair tendered to Mr. Beggs. The gift was presented by Dr. Charles H. Lemon. He paid a high tribute to Mr. Beggs' ability as a manager and to the success of his work with the company. The silver service is intended as part of the equipment of a private car for Mr. Beggs. This car is being built by the St. Louis Car Company after plans and designs by Mr. Beggs, and is to be part of the St. Louis Company's exhibit at the Louisiana Purchase Exposition. The car is for use on the Milwaukee Electric Railway & Light Company's system in Milwaukee and Wisconsin, and is designed so that it may be used for touring, being provided with sleeping compartments, dining-room, kitchen, etc., at the same time having large observation compartments at each end. In general design it is as fine a specimen of the art of car building as is to be found on any steam railroad.

THE ELECTRIFICATION of the Alexandria & Ramleh Railway, described in this issue, was successfully accomplished through the efforts of three gentlemen who, although of widely differing nationalities, worked together most harmoniously in carrying out this project. His Excellency Boghos Pacha Nubar, who is chairman of the Alexandria & Ramleh Railway, was for many years on the Council of Direction of the Egyptian State Railways Administration, where he gained considerable experience in railway work. He is the son of the late Nubar Pacha Nubar, who was for many years Premier of Egypt. Mr. J. Lumbroso, who had charge of much of the routine work of the executive portion of the undertaking, proved himself eminently capable of coping with the many intricate problems which he was compelled to solve. Mr. Lumbroso is well known in Europe as a large cotton merchant and financier. The general manager and chief engineer of the Alexandria & Ramleh Railway Company and the Alexandria Tramway Company is Mr. Nelson Graburn, M. I. E. E. He is the son of the late Captain Marmaduke Graburn, R. N., of Melton Hall, Barnaby, Lincolnshire, England. He was appointed to his present position in November, 1901, to carry out the transformation of the Alexandria & Ramleh Railway and to reorganize the Tramway Company. Mr. Graburn served an apprenticeship with the Canadian Pacific Railway as a mechanical engineer from 1881 to 1887, when he joined the Edison Illuminating Company, of Brooklyn, where he secured a practical training in electric lighting. He remained with that company until 1889, when he went to the Thomson-Houston works at Lynn, Mass., to take a student's course in electric railway work. After completing this course he was sent to Canada in the spring by the General Electric Company to look after contracts. Mr. Graburn resigned this position to join the Montreal Street Railway Company as assistant electrical engineer. In 1894 he was promoted to the position of electrical engineer and assistant superintendent. He resigned from this company in 1899 to accept a position as consulting engineer of the Compagnie Générale de Traction, of Paris.

Boghos Pacha Nubar

Nelson Graburn

J. Lumbroso

PROMINENT EGYPTIAN ELECTRIC RAILWAY OFFICIALS

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.

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	1 m., Mar. '04	62,110	36,617	25,493	22,467	3,026
	1 " " '03	61,699	35,361	26,248	21,083	5,164
	3 " " '04	178,601	107,869	70,732	67,601	3,131
	3 " " '03	175,097	102,618	72,479	64,275	8,204
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co.	1 m., Mar. '04	34,544	23,239	11,304	9,133	2,171
	1 " " '03	32,824	19,973	12,850	9,216	3,635
	9 " " '04	344,630	207,578	137,052	82,641	54,411
	9 " " '03	319,978	185,903	134,076	81,946	52,129
BINGHAMTON, N. Y.						
Binghamton Ry. Co.	1 m., Mar. '04	17,031	10,610	6,421	------	------
	1 " " '03	16,975	9,794	7,181	------	------
	9 " " '04	165,381	95,333	70,048	48,245	21,802
	9 " " '03	177,846	96,595	81 251	57,366	23,885
BUFFALO, N. Y.						
International Trac. Co.	1 m., Mar. '04	315,021	215,265	99,757	137,633	† 37,876
	1 " " '03	295,916	170,294	125,622	130,862	† 5,239
	9 " " '04	3 071,106	1,781,092	1,290,014	1,197,272	92,742
	9 " " '03	2,783,163	1,494,562	1,288,601	1,152,858	135,743
CHICAGO, ILL.						
Aurora, Elgin & Chicago Ry. Co	1 m., Mar. '04	24,381	* 18,691	5,690	------	------
	10 " " '04	352,149	186,081	166,068	------	------
Chicago & Milwaukee Elec. Ry. Co.	1 m., Mar. '04	22,839	10,093	12,746	------	------
	1 " " '03	13,355	6,317	7,038	------	------
	3 " " '04	59,873	31,489	28,384	------	------
	3 " " '03	36,035	18,705	17,330	------	------
Metropolitan West Side Elevated R. R. Co	1 m., Mar. '04	189,886	------	------	------	------
	1 " " '03	180,911	------	------	------	------
	3 " " '04	536,782	------	------	------	------
	3 " " '03	524,537	------	------	------	------
Northwestern Elevated R. R. Co	1 m., Mar. '04	115,233	------	------	------	------
	1 " " '03	108,609	------	------	------	------
	3 " " '04	330,179	------	------	------	------
	3 " " '03	315,754	------	------	------	------
South Side Elevated R. R. Co.	1 m., Mar. '04	143,448	------	------	------	------
	1 " " '03	136,383	------	------	------	------
	3 " " '04	410,207	------	------	------	------
	3 " " '03	399,018	------	------	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co.	1 m., Feb. '04	94,477	* 56,361	38,116	20,954	17,161
	1 " " '03	86,264	* 51,243	35,020	20,995	14,024
	2 " " '04	193,797	* 116,260	77,537	42,366	35,171
	2 " " '03	180,475	* 109,180	71,294	41,982	29,313
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., Mar. '04	33,860	24,471	9,389	------	------
	1 " " '03	31,547	18,624	12,922	------	------
	3 " " '04	89,168	69,527	19,640	------	------
	3 " " '03	83,730	55,698	28,032	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m. Mar. '04	14,958	9,392	5.566	------	------
	1 " " '03	14,359	8,950	5,409	------	------
	3 " " '04	38,383	27,324	11,059	------	------
	3 " " '03	38,039	24,803	13,236	------	------
COLUMBUS, O.						
Columbus, Buckeye Lake & Newark Traction Co	1 m., Feb. '04	9,455	8,886	569	------	------
	1 " " '03	8,717	7,490	1,227	------	------
	2 " " '04	18,862	17,206	1,656	------	------
	2 " " '03	16,046	14,521	1,525	------	------
DETROIT, MICH.						
Detroit United Ry.	1 m., Mar. '04	334,206	* 224,396	109,810	90,315	19,495
	1 " " '03	330,668	* 795,326	135,342	82 534	52,808
	3 " " '04	933,993	* 656,428	277,565	267,669	9,896
	3 " " '03	937,495	* 568,369	369,126	244,738	124,388
DULUTH, MINN.						
Duluth Street Ry. Co.	1 m., Mar. '04	48,036	31,381	16,655	16,505	150
	1 " " '03	47,889	28,615	19,275	15,204	4,071
	3 " " '04	135,462	87,929	47,533	49 325	† 1,792
	3 " " '03	131,324	84,452	46,872	45,544	1,328
EAST ST. LOUIS, ILL.						
East St. Louis & Suburban	1 m., Mar. '04	97,033	46,902	50,131	------	------
	1 " " '03	78,015	41,046	36,969	------	------
FORT WORTH, TEX.						
Northern Texas Traction Co.	1 m., Mar. '04	44,251	25,300	18,951	9,908	9,043
	1 " " '03	34,644	16,602	18,042	9,018	9,023
	3 " " '04	117,215	73,576	43,639	28,575	15,064
	3 " " '03	90,391	47,932	42,459	26,970	15,489
HAZLETON, PA.						
Lehigh Traction Co.	1 m., Mar. '04	10,574	6,101	4,472	------	------
	3 " " '04	30,160	23,697	6,464	------	------
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Mar. '04	256,589	142,283	114 307	74,050	40,256
	1 " " '03	237,364	125 614	111,751	70,714	41,036
	3 " " '04	756,727	417,399	339,328	220,504	118,824
	3 " " '03	700,740	370,368	330,372	209,900	120,472
MINNEAPOLIS, MINN						
Twin City Rapid Transit Co	1 m., Mar. '04	343,302	164,408	178,895	90,275	88,620
	1 " " '03	319,556	*153,304	166,252	78,400	87,852
	3 " " '04	988,073	480,661	507,412	267,493	239,919
	3 " " '03	913,995	442,329	471,666	235,200	236,466
MONTREAL, QUE.						
Montreal St. Ry. Co	1 m., Mar. '04	184,857	148,075	36,782	19,809	16,973
	1 " " '03	171,902	118,677	53,225	18,432	34,793
	6 " " '04	1,122,680	766 334	356,346	105,598	250,748
	6 " " '03	1,017,491	652,056	365,435	100,139	265,296
MUNCIE, IND.						
The Muncie, Hartford & Fort Wayne Ry.	1 m., Mar. '04	12,654	* 6.797	5,857	------	------
	3 " " '04	35,501	* 20,639	14,861	------	------
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., Mar. '04	7,365	4,337	3,029	2,452	576
	1 " " '03	6,370	3,439	2,931	2,040	891
	9 " " '04	76,031	37,110	38,920	22 069	16,852
	9 " " '03	53,626	28,581	25,045	14,129	10,917
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co.	3 m., Mar. '04	24,192	16,292	7,900	------	------
	3 " " '03	22,888	15,750	7,138	------	------
	12 " " '04	106,757	63,605	43,152	27,215	15,937
	12 " " '03	86,795	56,392	30,403	23,125	7,277
PHILADELPHIA, PA.						
American Railways	1 m., Mar. '04	103,622	------	------	------	------
	1 " " '03	97,566	------	------	------	------
	9 " " '04	1,048,837	------	------	------	------
	9 " " '03	909,183	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry. Co.	1 m., Mar. '04	117,639	66,743	50,896	26,240	24,656
	1 " " '03	100,792	53,853	46,939	25,450	21,489
	3 " " '04	340,845	206,417	134,428	78,585	55,843
	3 " " '03	299,168	157,902	141,266	76,407	64,859
SAN FRANCISCO, CAL.						
United Railroads of San Francisco	1 m., Mar. '04	534,044	------	------	------	------
	1 " " '03	497 947	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Mar. '04	127,000	45,000	82,000	------	------
	1 " " '03	110,817	33,003	77,814	------	------
	3 " " '04	368,354	122,512	245,842	------	------
	3 " " '03	312,723	95,035	217,688	------	------
SAVANNAH, GA.						
Savannah Electric Co.	1 m., Feb. '04	38,607	23,393	15,214	10,187	5,027
	1 " " '03	35,298	23,228	12,070	9,583	2,487
	12 " " '04	524,296	307,280	217,016	120,909	96,107
	12 " " '03	490,216	276,112	214,104	115,359	98,745
SEATTLE, WASH.						
Seattle Electric Co.	1 m., Feb. '04	171,744	120,747	50,997	23,488	27,509
	1 " " '03	155,164	111,871	43,293	23,672	19,621
	12 " " '04	2,129,053	1,506,157	622,896	279,935	342 961
	12 " " '03	1,941,769	1,379,063	562,706	268,098	294,608
SYRACUSE, N. Y.						
Syracuse Rapid Transit Co.	1 m., Feb. '04	63,927	40,161	23,766	20,249	3,517
	8 " " '04	556,032	322,148	233,884	162,250	71,634
	8 " " '03	495,085	273 878	221,207	152,200	69,007
TAMPA, FLORIDA.						
Tampa Electric Co.	1 m., Feb. '04	26,613	14,820	11,793	2,122	9,671
	1 " " '03	22,473	11,686	10,787	1,976	8,811
	12 " " '04	310,999	182,172	128,827	24,702	104,125
	12 " " '03	248,777	142,628	106,149	22,684	83,465
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., Feb. '04	40,308	30,390	9,918	9,408	510
	1 " " '03	31,620	24,467	7,153	6,469	684
	12 " " '04	490,591	382,316	168,275	93,304	74,971
	12 " " '03	352,558	269,052	83,506	76,776	6,730
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Mar. '04	138,665	* 77,858	60,807	41,971	18,836
	1 " " '03	127,012	* 65,452	61,560	40,715	20,845
	3 " " '04	400,320	* 223,767	176,553	124,874	51,679
	3 " " '03	367,654	* 188,964	178,690	119,738	58,952
YOUNGSTOWN, O.						
Youngstown-Sharon Ry. & Light Co.	1 m., Mar. '04	37,619	* 23,230	14,389	------	------
	3 " " '04	110,631	* 69,386	41,245	------	------