Street Railway Journal

VOL. XXI. NEW YORK, SATURDAY, JANUARY 3, 1903 No. 1

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago Office: Monadnock Block.
Philadelphia Office: 929 Chestnut Street.
Cleveland Office: Cuyahoga Building.
London Office: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States and Canada.....$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico... $6.00 £1-5s M25 31f

Single copies, first issue of each month, 40 cents; other issues 15 cents.

Subscriptions payable always in advance, by check (preferred), money order or postal note, to order of C. E. WHITTLESEY, Treasurer.

Remittances for foreign subscriptions may be made through our European office.

Entered as second-class matter at the New York Post Office.

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

The Street Railway Journal for 1903

With this issue the STREET RAILWAY JOURNAL has made a change not only in the style of type but in the arrangement of the paper, both of which, we believe, will be recognized by our many readers as effecting a great improvement in the typographical appearance and general plan of the paper.

Two years ago the STREET RAILWAY JOURNAL announced a change in its American edition from a monthly to a weekly paper. The reason, as then stated, was that the growth of the street railway field was so rapid and the number of new achievements of the highest technical value was so great that the industry could no longer be properly served by a monthly paper. The experience of the last two years has shown the wisdom of this change, as well as the benefits conferred on our readers by a weekly paper. The volume for 1899, which was the last one in which the paper was a monthly, contained 902 reading pages. In 1900 we published 1228 reading pages, and in 1901 this number increased to 1660. In the year which has just passed the paper has contained 1856 reading pages, showing a growth of more than 100 per cent in three years. We also believe, and feel that in this our readers will agree with us, that the paper has improved in quality to the same extent as it has increased in the number of pages printed each year.

The conditions which existed in 1900 are the same to-day, but are even more pronounced. The electric railway field is constantly broadening, and all engineers and operating managers who wish to keep thoroughly informed of important advances in it need the best and most prompt service which can be given them. In view of this fact we have decided to establish the paper, commencing with this issue, on an out and out weekly basis, and will follow the same general arrangement of articles and style of type in each of the fifty-two issues during the year. The only important distinction in contents between the first issue of the month and the other issues will be the number of reading and advertising pages which they will contain. This difference, moreover, will gradually diminish, due to the constantly increasing size of the smaller issues.

The International Edition of the STREET RAILWAY JOURNAL, which, up to this time, has been continued as a monthly, will also be changed to a weekly publication, and will be uniform, so far as the reading pages are concerned, with the American edition. The digest in German and French of all principal articles, which has proved such a popular feature to our foreign readers, and the special advertisements of European manufacturers and others seeking business abroad, will be continued in the issues published on the first Saturday of each month in the copies circulated abroad. We shall also, for the present, make a point of publishing in the twelve large issues articles which will be of especial interest to street railway engineers and managers in foreign countries.

In spite of the increase in the cost of publishing the STREET RAILWAY JOURNAL, there will be no change in the subscription price to either American or foreign subscribers. We take this occasion to thank the managers, engineers and other officials of street railway companies, who, in the past, have liberally supplied us with valuable technical information for use in these columns, and we hope that in the future we shall be given the same cordial co-operation and will continue to warrant the approbation and esteem of our readers.

Arnold Traction Report

In another column is given a synopsis, by B. J. Arnold, of his forthcoming Chicago report. This is undoubtedly the most thorough engineering report on the street railway problems of a great city that has ever been attempted. Not only is the author an eminent authority on many of the matters contained therein, but he has further demonstrated his ability to handle properly so great an undertaking by calling as assistants a number of the best specialists in various lines of street railway work that were available.

It is, perhaps, in one way unfortunate that, as a matter of expediency, a synopsis of this report on the Chicago transportation problem was given out before the whole volume was available, because fault might be found with some of the conclusions by the over critical before the extended investigations upon which the conclusions were based were known. Indeed, some little hasty criticism of the kind has been indulged in, if reports from Chicago are correct. One of the criticisms has been that it did not contain anything that had not been proposed before. To a level-headed business man or engineer the fact that the report contained nothing radically different from what had been proposed at one time or another previously would recommend the report most strongly. Mr. Arnold was not employed to invent some brand-new plan of local trans-

portation. He was engaged to point out how to make the best use of well-known and tried methods, to present a harmonious scheme of downtown terminals and subways to supplant the present chaos and to furnish reliable estimates on the cost of street railway construction. This he has done to the best of his ability, and the volume will no doubt speak for itself when it appears.

The Brooklyn Hearing

As announced in our last week's issue the complaints of the people of Manhattan and Brooklyn regarding the overcrowding of the transit facilities induced the Board of State Railroad Commissioners to appoint Monday, Dec. 29, for a public hearing in Brooklyn and the following day for a similar hearing in Manhattan. As we go to press the details of the Brooklyn hearing are at hand, and deserve a passing comment. The complaints filed by the several protesting organizations with the Railroad Commissioners concerning the Brooklyn roads were couched in rather general terms. The principal one, however, was that the Brooklyn Rapid Transit Company runs too few cars, thereby compelling people to stand at nearly all hours of the day. The hearing on Monday was called to enable the complainants to submit evidence upon these points.

The several organized public bodies interested in the prevailing agitation were represented by legal talent, and there were probably 100 citizens on hand to witness the proceedings and give evidence. In view of the wide publicity given by the press to the hearing the attendance must have been somewhat disappointing to the promoters of the agitation.

The striking feature of the complaints, as drawn from the evidence submitted, was the unanimity with which the several witnesses detailed the minor inconveniences of travel on the crowded lines to which they and their families had been subjected. As the witnesses omitted in many cases the specific information as to the time of day, the particular car or route, the investigation proceeded upon such general lines as to be of little service either to the Commission, the railroad company or the public interests. Much time was also devoted to such details as the jerking of the cars of the surface lines and the trains of the elevated lines in starting and stopping, to the alleged improper ventilation and heating of cars and trains, the failures of motormen to stop for intending passengers at street intersections, the needs of additional transfer privileges and the failure of cars to wait for one another at connecting transfer points, the slow movement of surface cars through the crowded sections of the city, the inability of conductors to pass through the crowded cars to collect fares, etc. The evidence submitted upon the primary complaint of the overcrowded cars contained nothing that the Railroad Commissioners, the company and the public are not already familiar with, and not one of the complainants had any feasible suggestion to offer for the amelioration or solution of the annoying conditions that are freely admitted by all concerned to exist. In other words, the hearing, which had been heralded for a number of days in the metropolitan press as an uprising of the public to secure better service from an overbearing corporation, practically resolved itself into a sort of clearing house for all the complaints of every character against the operating companies that a lot of querulous individuals could bring together at one time. Were it not a matter of so great importance the failure of the hearing to uncover the real trouble could almost be described as ludicrous.

In behalf of the Brooklyn Rapid Transit Company its representatives submitted that the overcrowded conditions in the rush hours were acknowledged, and could not be avoided until, through the co-operation of the people and their public servants, additional privileges were granted to enable them to expand their transportation facilities. As to the overcrowding in the non-rush hours the position of the company has always consistently been that, barring unavoidable delays on account of street congestion, its service is fairly regular and ample for the traffic offered. An investigation of non-rush hour conditions by the Board of Railroad Commissioners was welcomed by the railway company, with the promise that it would be guided by any reasonable recommendation the Commissioners might see fit to make.

Ethics of Railway Management

Street railway properties may be said to reflect the characteristics of the managing mind, and the results obtained, although affected in a measure by external conditions, may almost invariably be traced directly to this source. Not the least important of these considerations is the financial policy of the owners, which not only affects the operating department, but may be plainly discerned in the engineering, construction and equipment of the system. This is especially true of the methods employed in the upbuilding of new properties, which may, therefore, be classified as promotion projects, investments or accumulative properties.

Promotion methods are felt where a property is seemingly well constructed, but actually lacks stability in the character of its engineering. The factor of safety is often disregarded entirely, track construction and ballasting are not given the attention they merit, and there may be lack of sufficient copper for transmission and poor bonding in the return circuit. But in this class stress is always laid on the finish and lettering of cars and the architectural effect of the power station, while many details are sacrificed in which money should be expended to produce mechanical efficiency. As a result the maintenance, cost and operating expenses will soon be equal to, if not greater than, the gross income. These roads are sometimes made to pay a temporary revenue on the capital invested by the diversion of money which should go towards maintenance of the property. The fallacy of a wrong start in building a railroad on the promoter's lines will always burden the property with a large maintenance cost, and if the maintenance is neglected the property will constantly depreciate.

Investment properties, on the other hand, present a much healthier character. The construction throughout, barring errors in judgment, is on a more substantial basis of uniform excellence; the roadway, rolling stock and power stations are designed to meet the traffic conditions of the locality, and provision is made to meet the increasing demand for transportation facilities. In this respect, particularly, the policy of investment properties differs considerably from the promotion method, which often builds roads in a territory where there is not sufficient traffic to warrant construction. In investment enterprises the weight of the rail, the ballasting of the track, the rolling stock and all the component parts of the system are devised with a sufficient factor of safety to serve fully the purpose intended with only normal wear and depreciation.

Referring briefly to the third class, or accumulative type, it may be said that this generally grows out of the movement of a few local men of means co-operating in building a road for the convenience of the people of the town, and turning the revenue into the expansion of the system as the demand requires. A number of properties have been developed in this way, especially in the East, and are generally well managed.

Having broadly considered the points involved in the general methods of building up these properties, it is interesting to study the effect of the managing spirit on the operation, for in no other industry is the employee brought into such intimate personal relation with the public. Courtesy and civility cannot reasonably be expected of employees where the managing spirit is domineering and unjust. The right kind of discipline will not engender an antagonistic spirit in employees, but will promote manliness and candor, and equity will command their respect. The effect on the public will be to make the road popular and to eliminate the many annoying occurrences which arise between the dissatisfied employer and the exacting public.

Manhattan Railway Distribution

In the equipment of the Manhattan Railway for electrical operation some interesting problems in distribution developed, owing to the peculiar character and conditions of service for which provision had to be made. These had been anticipated by the engineering department, and it is gratifying to learn that the plans which were worked out for this purpose and were described by Mr. Stillwell in the STREET RAILWAY JOURNAL of Jan. 5, 1901, were found in practice to be entirely adequate to meet the situation. The descriptions presented elsewhere in this issue, therefore, of two important branches of the equipment, show that the completed work corresponds very closely with the plans as originally adopted, and that such modifications as were made affected unimportant details only. The sub-stations and the conduit system are particularly interesting, as they are not only on a scale of greater magnitude than any similar service in the country, but because they provide for the successful handling of the large amount of current required for this system at the unusually high potential of 11,000 volts.

The system of underground conduits for this high-tension service is one of the most extensive ever constructed, and may be accepted as embodying the highest standard of modern practice. The conditions under which this work was carried on were unusually severe, owing to the peculiar sub-surface construction throughout the city, particularly in the older parts where the obstructions form a perfect network of gas and water mains, sewer pipes and electrical conduits of all kinds. It was found necessary to provide many original forms of construction for the manholes and conduits, and it is mentioned that the layout was changed in some particular feature on nearly every block of the entire 13 miles of subway which comprise the system. Many examples of this kind are cited by the engineers who had charge of the work, including one in which twenty-two ducts were carried through a space only 15 ins. high, thus necessitating the complete rearrangement of the general plan at that particular point. The crossing of the Harlem River to supply the extension of the elevated lines into the Bronx was another difficult task.

The method of handling the heavy current in the sub-stations and delivering it to the third rail involved several departures from ordinary street railway practice, especially in the switching apparatus, and the constructive details developed in this undertaking mark a distinct advancement in the art. The maximum capacity of each of these stations when fully equipped will approximate 15,000 kw, which is equivalent to the output of many power plants supplying current to fair-sized city systems. But it is in the perfection of details rather than in the magnitude of the enterprise that the operating managers will find the most instructive lesson.

The Manhattan management and the engineering department are to be commended for their splendid achievement, and the community is to be congratulated upon the completion of a system that cannot fail to contribute largely to the comfort and convenience of the people of the city.

The Use and Abuse of Concrete

Within recent years concrete has become a material which is largely used in heavy electric railway structures, and for engine and machinery foundations it is readily moulded into any intricate form, self leveling and exceptionally solid and durable when complete. It is so easy by this simple means to build up a solid structure for any purpose that constructing engineers are beginning to be a little over zealous in their endeavors to invoke its aid in making their work permanent.

Prominent among the instances where this is overdone is the use of concrete in some modern forms of pavements. An instance to which particular reference may be made is the device of excavating a street to the depth of 18 ins. or 20 ins. and laying a deep girder rail on ties spaced at considerable distance apart, and ramming a substantial depth of concrete under the lower flange. So far this is good construction, but when it comes to covering the entire street with a bed of first-class concrete, laid up in Portland cement to a depth of 12 ins. or 14 ins. and allowing this bed to lock over the lower flanges of the rails, up to within about 4 ins. of the upper head thereof, and using for the purpose the best Portland cement that money can buy, it seems as though the matter was being carried a little too far. The situation is still further aggravated by laying on top of this structure hard burnt brick, locking them together with Portland cement and sand mixed half in half. In a few years time the whole structure becomes so dense and solid that it rivals a steel armor plate.

It is a regretable fact that pavements and railway structures of this kind have to be disturbed for other reasons than because parts are worn out. Special work at cross-overs, extra turnouts, double tracks, rebonding and a few other legitimate changes give plenty of reasons why the contractor should avoid making the structure too solid, but when there is added to this the frequent necessity of disturbing the pavement because of burst water mains, leaking gas mains, or even the relaying of an entire line of pipe, it is certainly time to believe that there is such a thing as making a roadbed needlessly good. A concrete structure of the character described is only removable at the expense of a great deal of labor. To remove it by hand means hours of arduous work with picks, drills and chisels, and more often it is best to invoke the aid of powerful concrete breakers of the pile driver type or even explosives.

In view of these facts, the truth of which is being almost daily demonstrated, it does not seem too much to suggest that in many of these cases it will be better to use at least a cheaper grade of cement and less of it, and still produce a structure which is practically just as good. As far as pavement construction is concerned it also does not seem beyond belief that a very satisfactory hard burnt brick pavement could be made on a well rolled, carefully made macadam foundation, and locked in place with a less expensive cement. This would form a pavement almost as durable as the more expensive arrangement, and certainly very much easier to take up and repair. It is bad enough from the street railway companies' point of view to be obliged to spend money for pavements at all, but to spend too much money to gain what, in some respects, appears to be a positive disadvantage, seems to merit reconsideration.

SUB-STATIONS OF MANHATTAN RAILWAY

In the descriptions of the Manhattan Railway Company's electrical equipment, now rapidly nearing completion, little has been said in these columns regarding the structural details of the sub-stations, although the electrical side of the equipment has been very thoroughly treated by L. B. Stillwell in the STREET RAILWAY JOURNAL of Jan. 5, 1901. The system is operated from one central power house, located at Seventy-Fourth Street and East River, where three-phase alternating current is produced and sent out at 11,000 volts, over heavy three-conductor cables, to the seven outside sub-stations, where the current passes through step-down transformers and thence is taken to rotary converters at 390 volts. From these converters direct current, at 625 volts, is delivered to a single-conductor cable, through which it passes to the third rail. The maximum installation for each sub-station is six 1500-kw rotary converters, each with its group of three step-down transformers; a motor-generator set for starting the rotaries from the direct current end; two boosters, for controlling the output of two floors of storage batteries, representing a 3000-kw-hour capacity, and the complete equipment gives a total nominal output for the station of 16,000 hp. Fig. 1 is an interior view of a typical sub-station, in which four rotaries and their auxiliary equipment have been installed.

The ground plan of these buildings is rectangular, and approximately 50 ft. x 100 ft., being as near this dimension as the irregularity of two downtown lots will permit. The buildings are of fireproof construction throughout, and considerable pains have been taken to make the architectural features distinct and attractive. In the case of stations Nos. 2, 3, 6, 7 and 8, the first-story front is of massive pink granite. Above this rise three stories of brown-tinted, fire-flashed brick, mottled by irregular metallic spots. The whole is relieved by moulded brick of the same quality of material, and used in ornamental string courses, and in the cornice. A sill course of pink granite is placed under the fourth-story windows, and the parapet is surmounted by a granite water-table. The total height of these buildings is about 65 ft. above the sidewalk.

In the interior arrangement of stations Nos. 2, 3, 5, 6 and 7 the rotary converters are carried upon concrete foundations, built up to the level of the first floor. They are placed in two parallel rows, with a passageway between them, the space occupied by the converters being approximately 26 ft. x 77 ft.

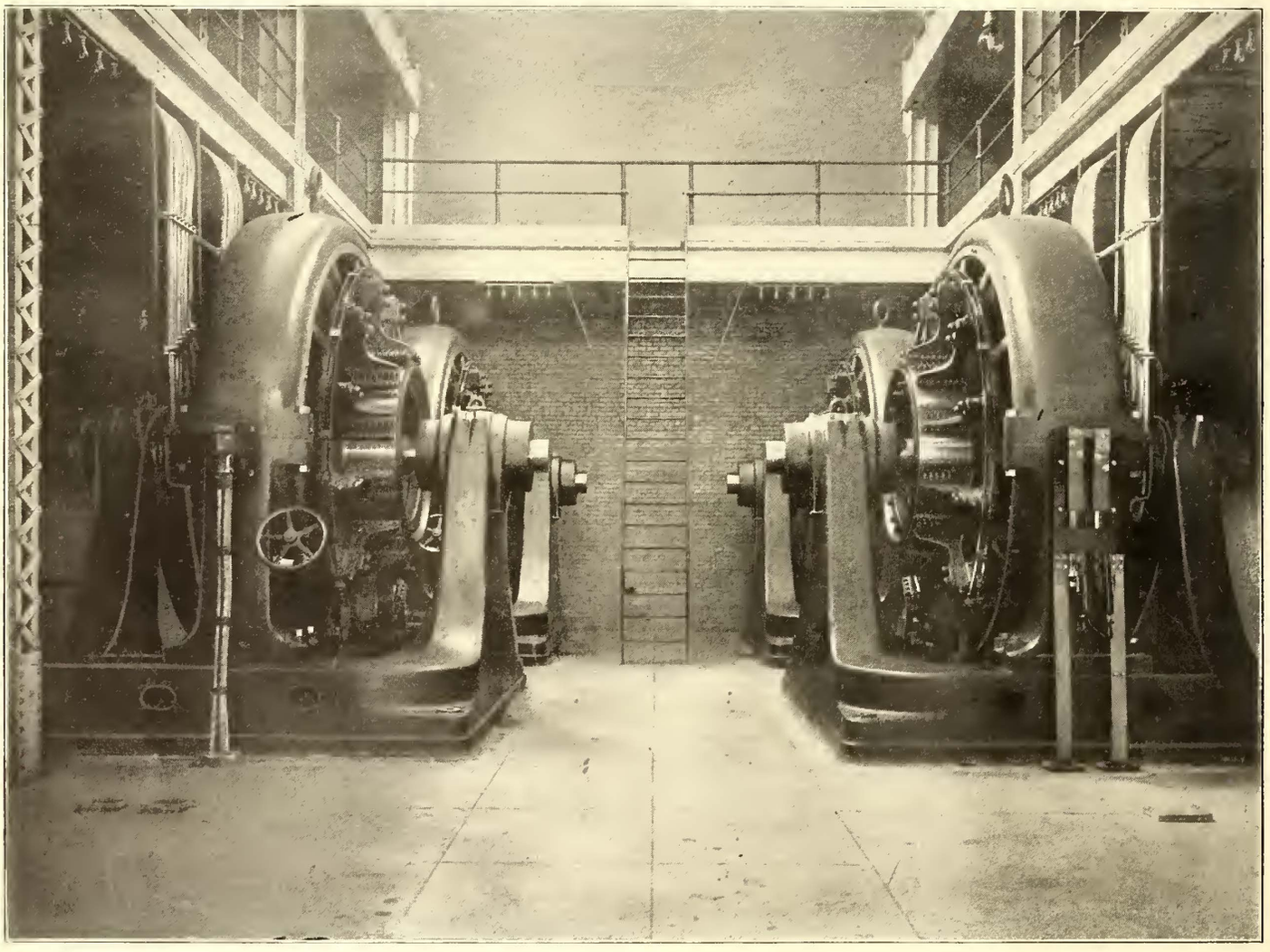


FIG. 1.—TYPICAL INTERIOR VIEW OF MANHATTAN SUB-STATION—ROTARY ROOM OF NO. 8

This bay is spanned by a 25-ton electric crane, traveling on heavy plate girders, which are supported by the interior columns of the building. These columns also form the support for the transformer and switchboard galleries which run around the entire building at a height of 17 ft. 6 in. above the first or rotary floor. In the front of each station this gallery widens to 19 ft. 4 ins., and on it are located the direct-current switchboard, the alternating panel board and the operating bench board.

Directly over the switchboard gallery, and at a height of 15 ft. above it, is located the high-tension or oil-switch gallery. This is of the same dimensions as the switchboard gallery. The transformer galleries are approximately 10 ft. wide, and are spanned by a 5-ton hand crane, which travels the entire length of the gallery on two 10-in. channels, framed respectively to the interior crane columns and to the exterior wall columns. Air is furnished to the transformers, which are of the air-cooled type, from motor-driven blowers located in the base-

ment of each station, and passing through expanded metal and plaster air ducts running underneath the transformer galleries, as shown in the general view of station 4, Fig. 9.

Above the transformer and switchboard galleries in stations 2, 3, 5, 6 and 7 are two floors of storage batteries. These floors occupy only four-fifths of the ground plan of the stations, the buildings being reduced in length at the third or lower storage battery floor by 20 ft., forming an extension over the two lower stories, which is covered by a large skylight, 8 ft. x 32 ft., built entirely of copper and heavy wire glass. This skylight has movable louvres, which admit the maximum quantity of light and air at all times, and aids greatly in ventilating the rotary floor and transformer galleries.

An elevator well, 6 ft. x 6 ft., is built in the front of each station, usually in the left-hand corner. This elevator serves all floors, including the basement. The walls of the elevator shaft are of steel and terra cotta construction, with fireproof doors at all landings.

In the construction of stations Nos. 4 and 8 the concrete foundations for the rotaries have been dispensed with, and the machines are supported directly by the steel girders of the ground floor. Provision was made in the steel design to bolt these machines down, but experience has shown that this is unnecessary, as no movement whatever has been detected during several months operation, the bed-plate being simply grouted to the cement floor. The total weight of each rotary is about 53 tons, and

FIG. 2.—COMBINED PASSENGER AND ROTARY SUB-STATION AT 110TH STREET LOOP, FACING CENTRAL PARK

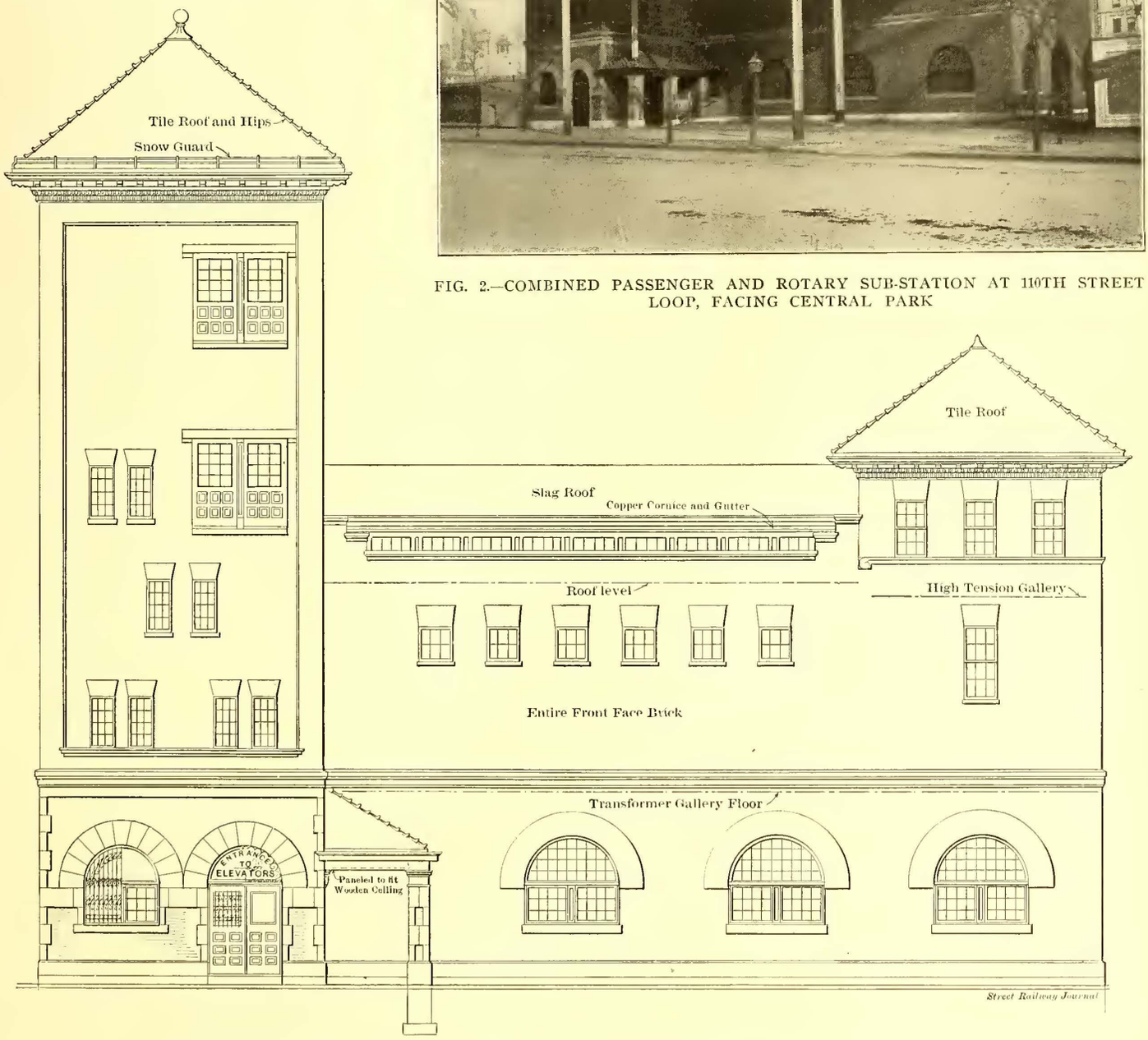


FIG. 3.—SOUTH ELEVATION OF NO. 4 SUB-STATION, AND ELEVATOR TOWER FOR PASSENGER STATION

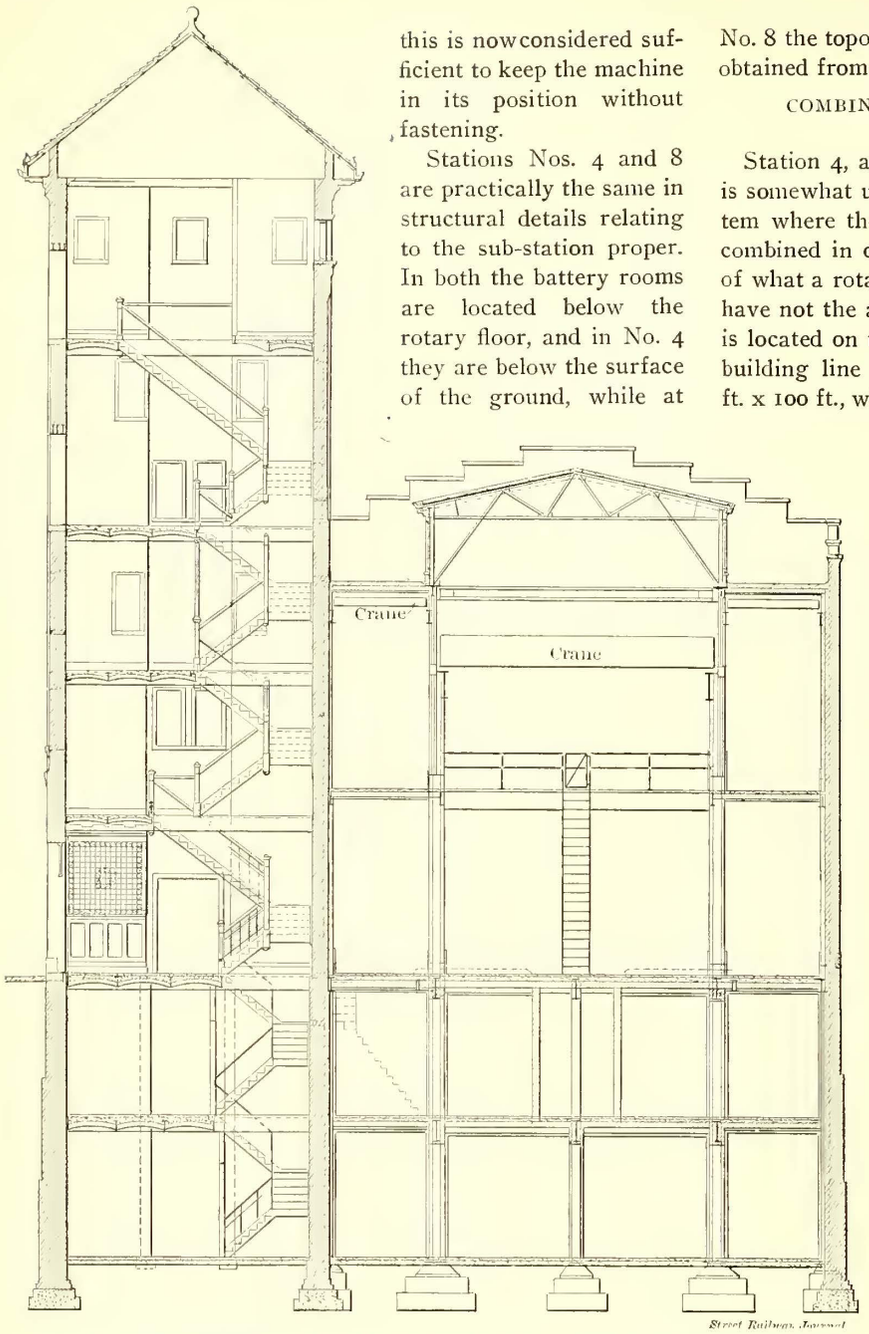


FIG. 5.—CROSS-SECTION OF SUB-STATION NO. 4, AND PASSENGER TOWER

this is now considered sufficient to keep the machine in its position without fastening.

Stations Nos. 4 and 8 are practically the same in structural details relating to the sub-station proper. In both the battery rooms are located below the rotary floor, and in No. 4 they are below the surface of the ground, while at No. 8 the topographical features are such that light and air are obtained from the rear for both basement and sub-basement.

COMBINATION PASSENGER AND SUB-STATION AT 110TH STREET

Station 4, an exterior view of which is presented in Fig. 2, is somewhat unique, inasmuch as it is the only one in the system where the sub-station and a passenger station have been combined in one building. It may well be taken for a model of what a rotary station should be, although the battery rooms have not the advantage of light and air obtained in No. 8. It is located on the north side of 110th Street, 120 ft. east of the building line of Manhattan Avenue, and occupies a plot 50 ft. x 100 ft., with a tower at the southwest corner, 27 ft. x 27 ft., and five stories high, containing the passenger elevators and stairways leading to the passenger platform and track stations. An entrance loggia, one story in height, extends 10 ft. to the east of this tower, the passenger entrance being from the south, with exit to the west. This exit is also protected by a one-story loggia built of wood, copper covered, and containing three large windows, arranged to lower into the wood paneling. The south elevation, Fig. 3, longitudinal section, Fig. 4, and cross section, Fig. 5, show clearly the most important details in the design and construction of this building.

The architectural features of this station differ materially from those of the others. It stands on a city parkway, where no heavy trucks are allowed, and faces the northwesterly entrance to Central Park on the south, with Morningside Heights and St. John's Cathedral on the west. Even now it is a neighborhood of fashionable apartment houses, and consequently an effort has been made to build in keeping with the surroundings. In Fig. 2 is shown the south and easterly sides of the building, with the entrance loggia of the tower. The fourth and fifth floors and roof of the tower, together with passenger bridges leading to the station platforms, are hidden from view by the track structure. The building is constructed of a brownish shade of fire-flashed brick similar in quality to the other stations, with trimmings

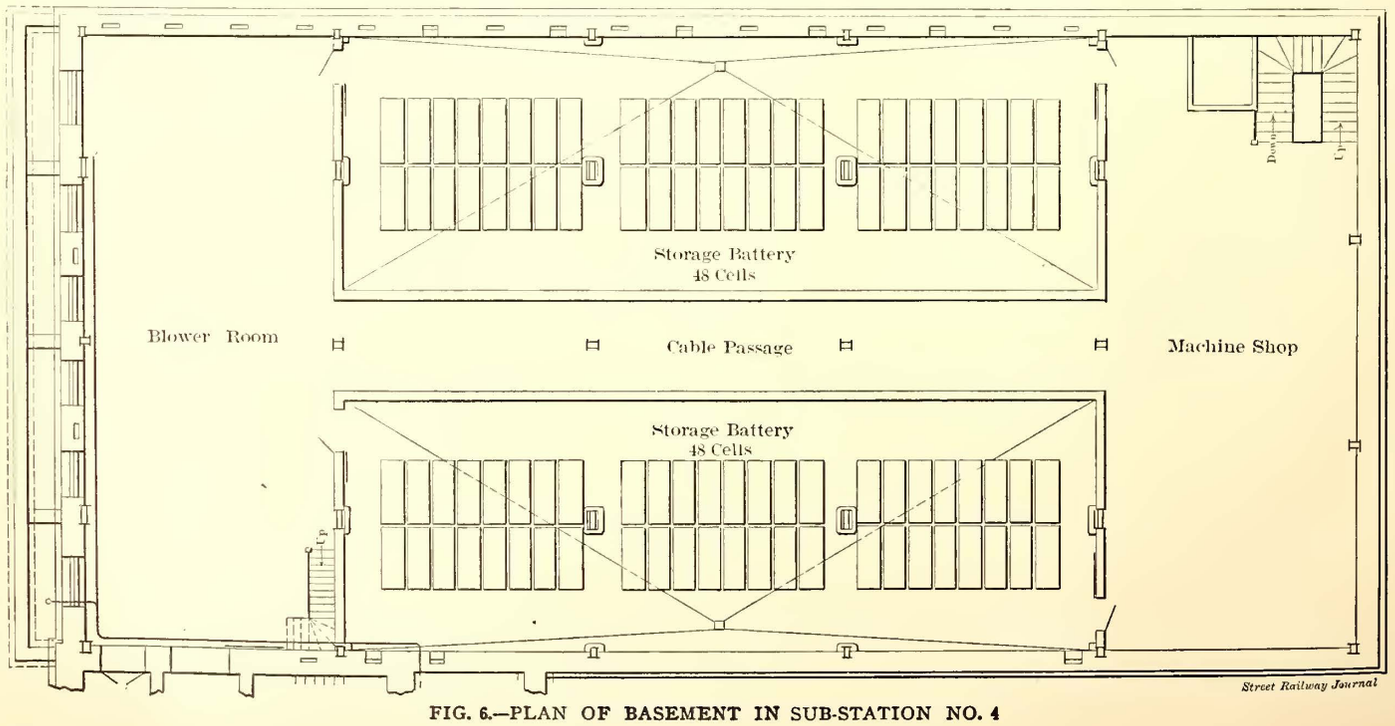


FIG. 6.—PLAN OF BASEMENT IN SUB-STATION NO. 4

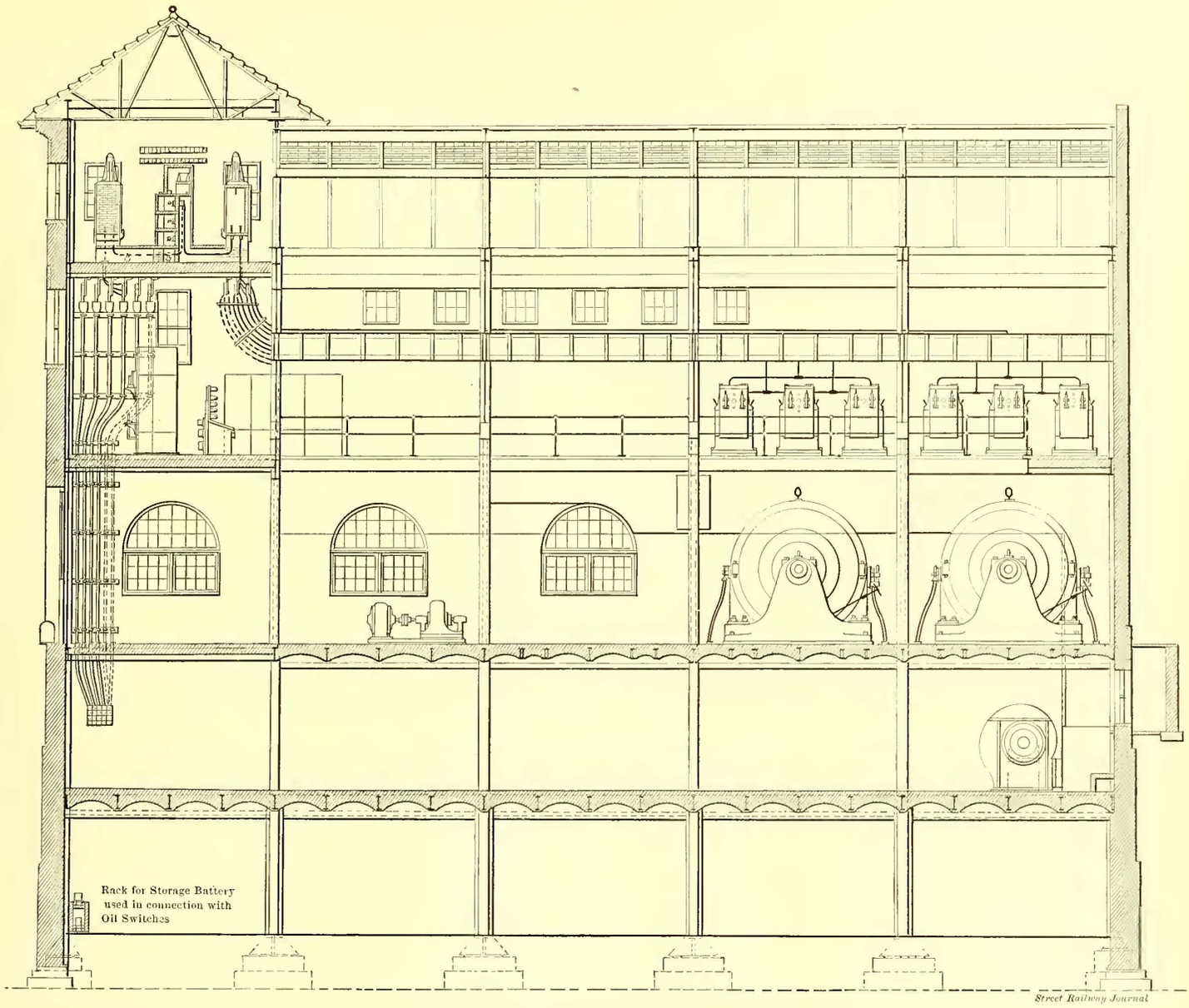


FIG. 4.—LONGITUDINAL SECTION OF SUB-STATION NO. 4

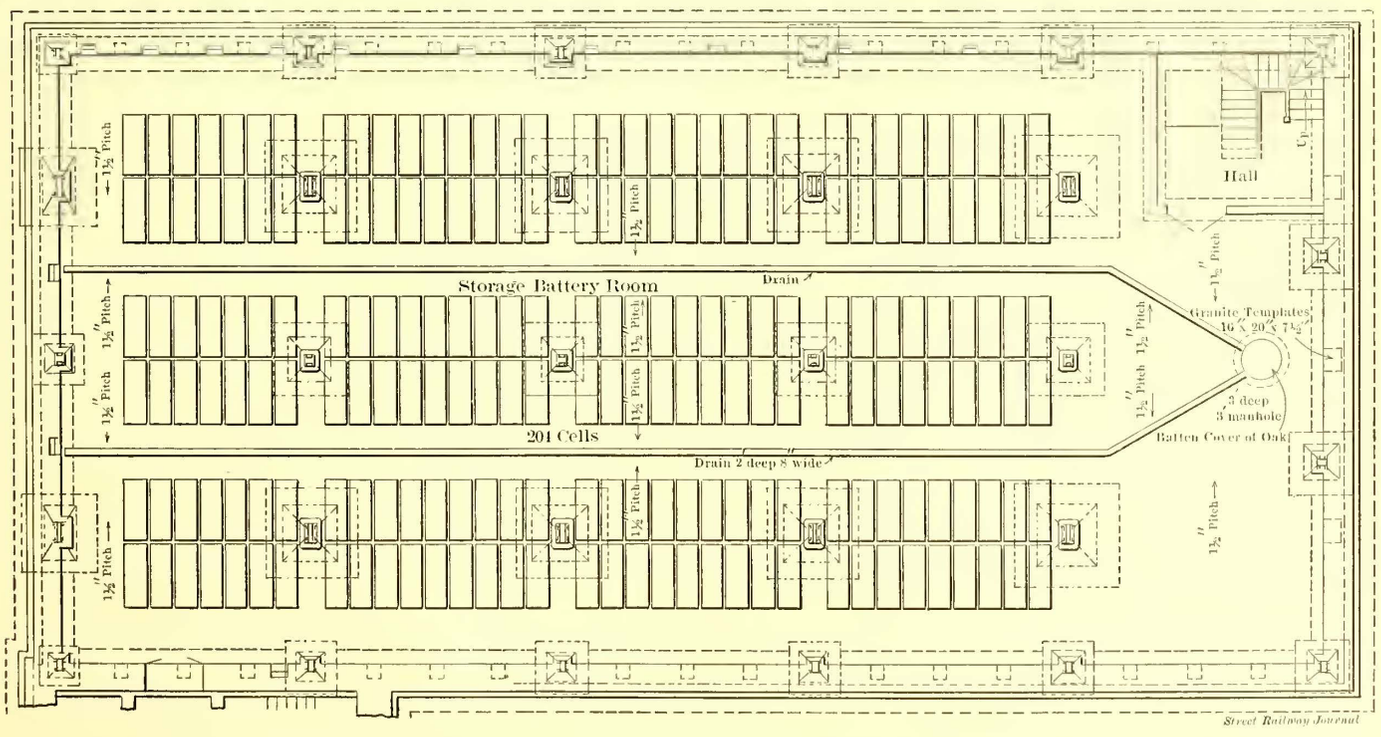


FIG. 7.—PLAN OF SUB-BASEMENT IN SUB-STATION NO. 4, ARRANGED FOR STORAGE BATTERIES

of "Portage Entry," red sandstone, all eight-cut work. The roofs of the high-tension gallery, elevator tower and entrance loggia are of "Conosera" hard-vitrious red roofing tile, while

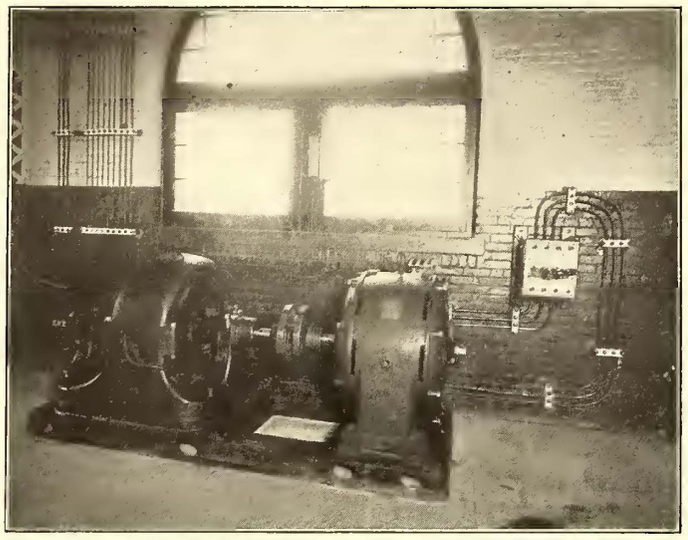


FIG. 11.—STARTING SET IN STATION NO. 4

cornice and gutters are of heavy ornamental copper, 30 ins. wide.

The direct-current cables to the elevated structure have been carried as high as possible in the switchboard tower. They leave the station at a point above the third-story windows and directly below the cornice. The great height of the elevated structure at this point, 59 ft. 4½ ins., makes this possible.

Owing to the peculiarities of the site of station No. 4, which was an old ravine filled in with ashes, it was necessary to excavate to a depth of 32 ft. for the column footings. At this depth a comparatively good foundation was made, on what developed into an old brook bed; in fact, considerable flow of water was encountered near the tower footings, and provision had to be made for allowing this free passage by building 8-in. sewer pipes through the concrete footings at intervals, although to guard against a stoppage of this flow and the possible backing up of water, the entire basement and sub-basement as well as all wall footings were waterproofed. This waterproofing was carried to the surface outside of the brick work. The great depth of excavation was utilized as rooms for storage batteries under the power station proper, and for elevator machinery and heating apparatus in the sub-basement and basement respectively of the tower. Provision is made in this station, as shown in Figs. 6 and 7, for a storage battery of 204 cells in the sub-basement and ninety-six cells in the basement. The west end of the basement floor is used as a blower room, and contains the motors and fans, illustrated in Fig. 8, for supplying air to the transformers. Sturtevant blowers, driven by 30-hp induction motors, are employed for this purpose. There is also in this room a small electric pump for furnishing water to the toilet fixtures on the fifth floor of the tower. At the eastern end of

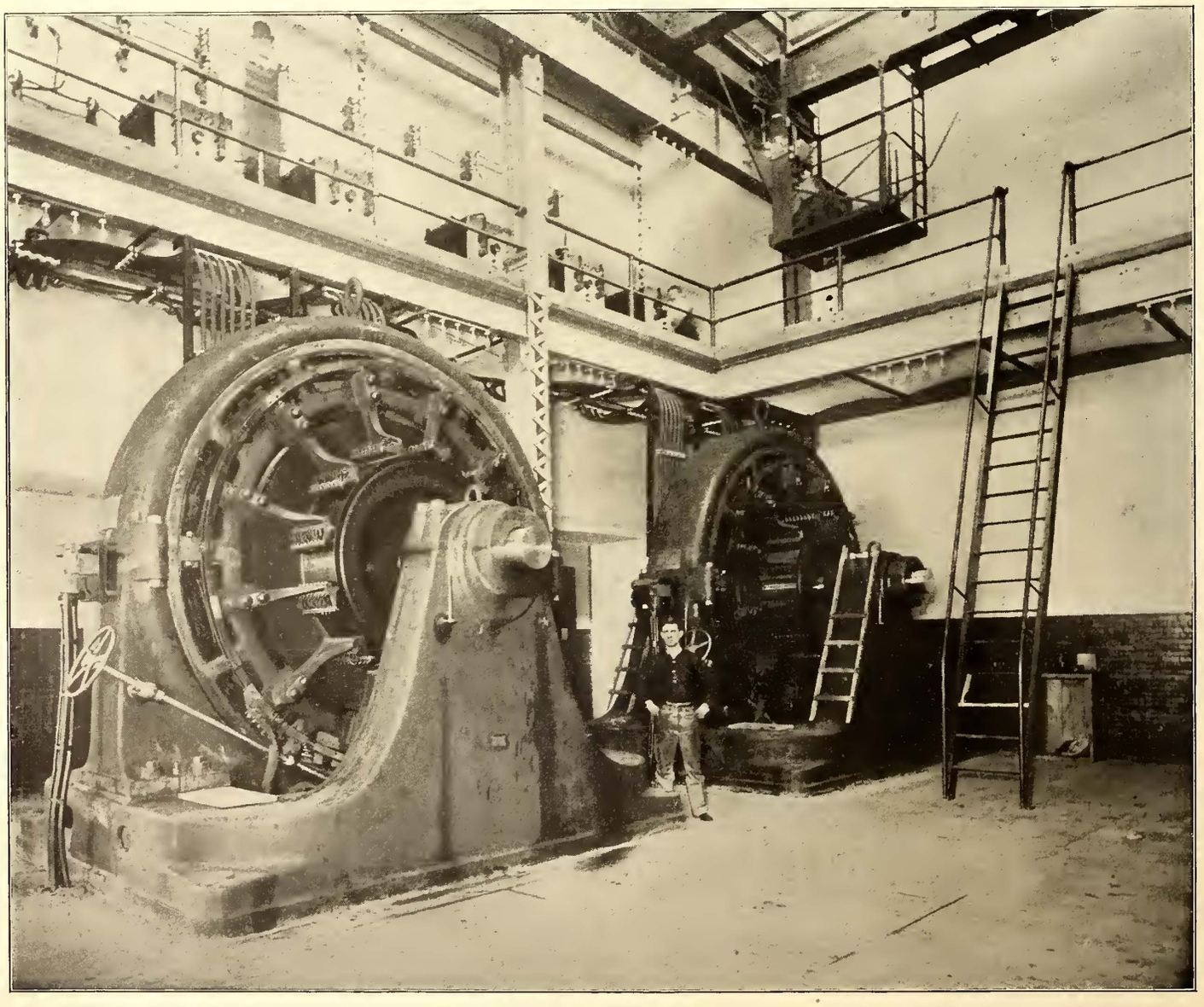


FIG. 9.—ROTARY CONVERTERS, TRANSFORMER GALLERY AND 25-TON ELECTRIC CRANE IN SUB-STATION NO. 4

the basement floor there is a space 19 ft. wide, running the entire width of the building, which is used as a small machine shop. It also contains lockers for the station attendants. The division of this basement floor and allotment of space is shown in Fig. 7. Stairs located diagonally opposite each other in the front and rear of the building lead from the rotary floor to both the blower room and the workshop.

On the rotary floor provision is made for six 1500-kw converters and two boosters. Fig. 9 shows the southwest corner of this station, with rotaries one and three in position, and a section of the transformer gallery and the location of the transformers with respect to the converter. A ladder leads from the center aisle of the rotary floor to the gallery, as well as the spiral stairway at the northeast corner of the building. Fig. 10 shows the transformers and wiring for these machines. In the front of the building, close to the south wall, is located the auxiliary starting set, which is illustrated in Fig. 11. A plan of the first floor is shown in Fig. 12, and a plan showing the transformer gallery and rotary floor is presented in Fig. 13.

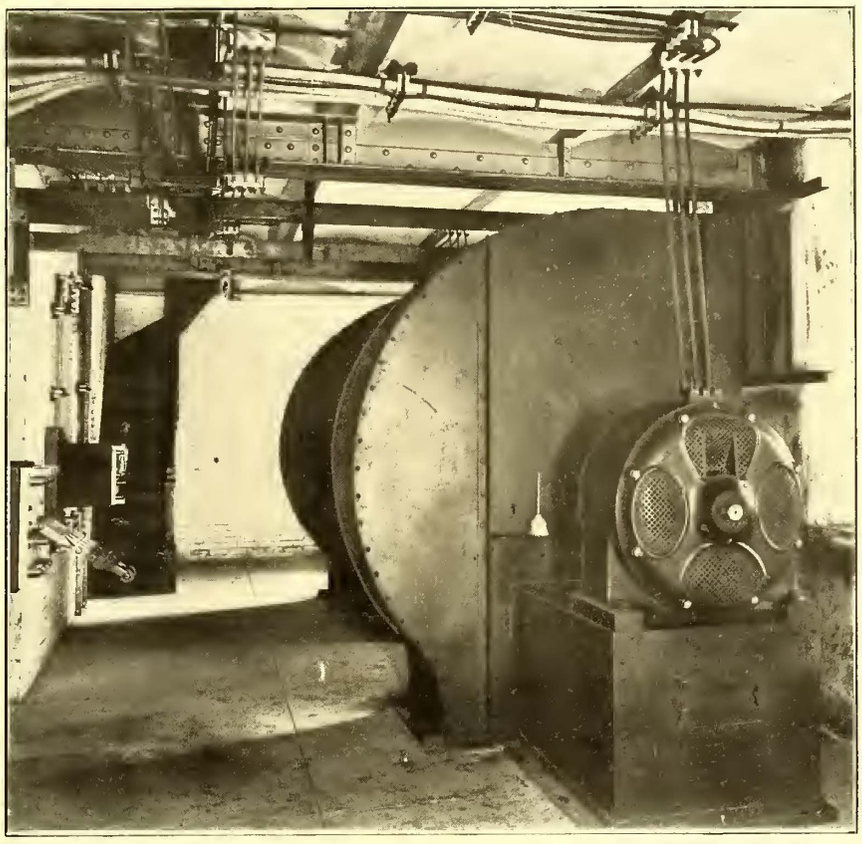


FIG. 8.—MOTOR-DRIVEN BLOWER IN BASEMENT FURNISHING AIR FOR VENTILATING TRANSFORMERS

ROTARIES AND TRANSFORMERS

Each rotary converter is supplied with alternating current from three step-down transformers of 550 kw each, connected in delta. The voltage of the current supplied to the transformers is not uniform throughout the system for obvious reasons, but provision is made for adjusting the ratio of transformation by means of loops brought out from the primary windings so that the potential of the direct current delivered by the rotary converters shall be equal. The transformers are air-cooled, and the necessary air is supplied by motor-driven blowers, which are installed in the basement. A comprehensive system of air ducts serves these transformers with air. The guaranteed efficiencies of the transformers are 97.75 per cent for full load, 97.70 for 25 per cent overload, and 95 per cent for quarter load. The rise in temperature for a 25 per cent overload run for twenty-four hours is guaranteed not to exceed 450 C. In performance the transformers have far exceeded the guarantee, as have also the rotaries, whose efficiency was guaranteed at 95.75 per cent for full load, 96 per cent for 25 per cent overload, and 89 per cent for quarter load.

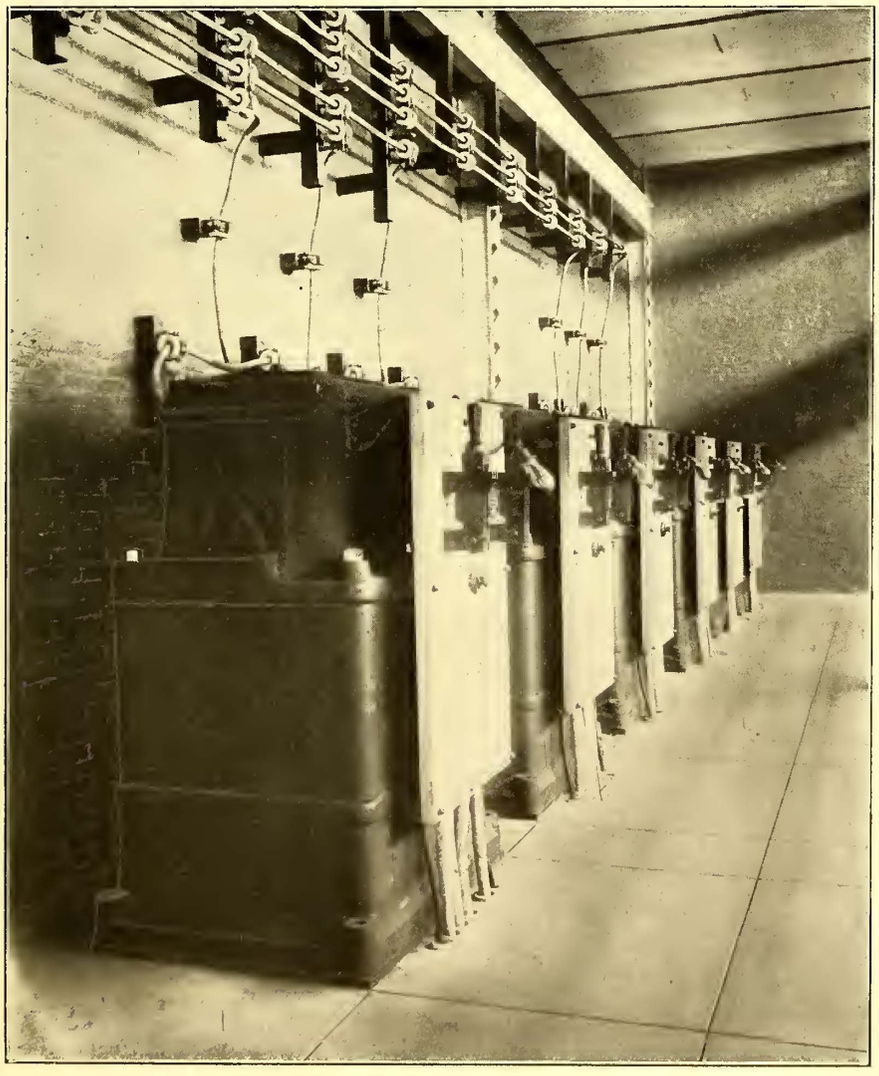


FIG. 10.—SIX 550-KW AIR-COOLED TRANSFORMERS CONNECTED IN DELTA FOR TWO ROTARIES IN SUB-STATION NO. 4

From the switches that are mounted on the marble panel on the front of each transformer, as shown in the cuts, six heavy cables are led directly through the gallery floor from each group of transformers to the alternating-current terminals of its respective converter. The voltage of the current supplied to the rotaries from the transformers is relatively low, and 1,250,000 circ. mil cables are employed for this service.

It has often been remarked that the first impression the visitor gains of the Manhattan equipment is the magnitude of the undertaking, and this applies to the sub-station as well as the main power house. The equip-

ment of the latter is on a larger scale than anything heretofore attempted. This is more noticeable probably in the size of the rotary converters than any other feature of the sub-stations, as these machines, which are on the main floor, confront the visitor immediately upon entering the building. As a matter of fact the rotary converters are larger than any that have heretofore been constructed, having a nominal rating of 1500 kw and maximum capacity of 2250 kw, or 3000 hp. Each converter is a self-contained unit, the two bearings and the lower half of the field frame being mounted on a common base. The field frame is divided in a horizontal plane to permit access to the windings. They are 12-pole machines, and when supplied with an alternating current of 25 cycles per second will operate at a speed of 250 r. p. m. The field is compound wound, the shunt winding being arranged for self-excitation. The output of the converter is delivered at a normal potential of 625 volts. The armature is of the slotted drum type, the core being built up of laminated steel. These laminations are pressed on the cast-iron spider, into which it is dove-tailed, the entire core being held by two end plates. The armature winding consists of strap-wound coils, formed and insulated before being placed in the slots in which they are held by retaining wedges of hard fiber. The winding is of the parallel type, forming twelve circuits, and is cross-connected by balancing rings. The commutators are built of bars of hard copper insulated from each other with mica. With a potential of 625 volts across the direct-current terminals the average difference of potential between two bars will not exceed 12 volts. The brush holders are of the sliding-shunt type, and the collector is of the open type. The field frame is of cast iron, and the pole pieces are of laminated steel. The faces of the latter are beveled at the edges to permit of the use of copper shields, which will prevent hunting of the rotaries. The series field is designed to assist the shunt as the load comes on the rotary converter, and is sufficient to compound the latter from 575 volts at no load to 625 volts full load. The series winding consists of copper, strap-wound on edge. The wave form of these converters is practically the same as that of the alternators. The converters are guaranteed to stand an overload of 100 per cent without "hunting," and may be overloaded to several times the normal full load without falling out of step. In the construction of these converters the fly-wheel effect has been made relatively small, and that of the copper shields is powerful enough to have the controlling effect upon the armatures of the converters. Ample provision has been made for ventilation in designing these machines; the series and shunt coils are separated by air spaces, and large ducts are provided throughout the armature, spider and core. The total weight of each converter, as already mentioned, is about 53 tons; the height is 13½ ft., and the floor space occupied 13 ft. x 10 ft.

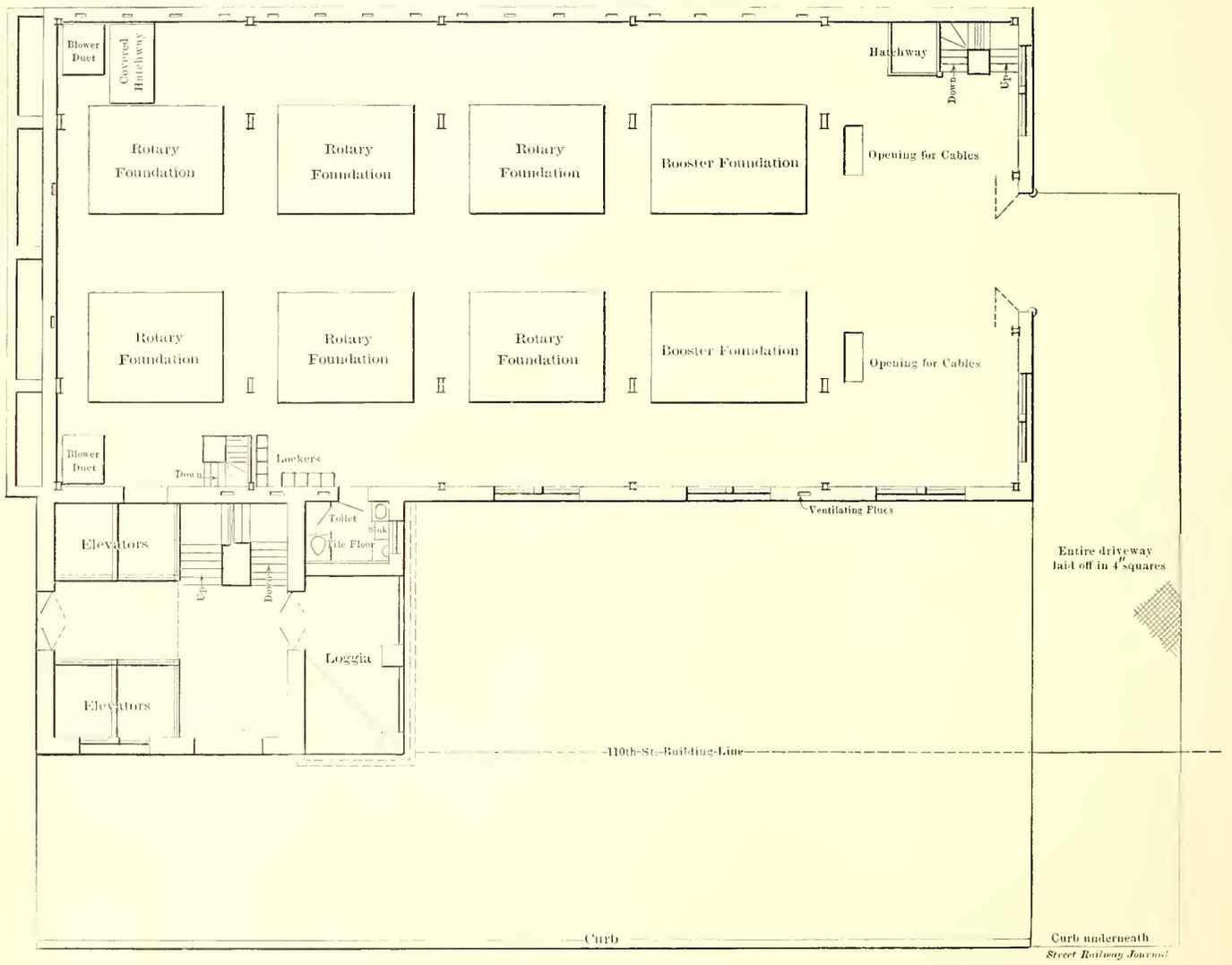


FIG. 12.—PLAN OF FIRST FLOOR OF SUB-STATION NO. 4, SHOWING ROTARY ROOM, AND ELEVATORS FOR PASSENGER TOWER

The converters are started by direct current. A motor-generator set (Fig. 11) is installed in each sub-station for furnishing the current for that purpose. The method of starting by direct current derived from these starting sets, rather than by direct current taken from the main bus-bars of the sub-station, was determined upon to avoid undue magnetic and electrical strains in the converter, such as may easily result from a slight mistake of the operator, for example, in closing

the synchronizing switches when the machines are not exactly in step.

SWITCHBOARD EQUIPMENT

A single set of bus-bars is placed in isolated brick compartments, with incoming feeder switches to one side of the bus-bars, and outgoing rotary converter switches to the other side.

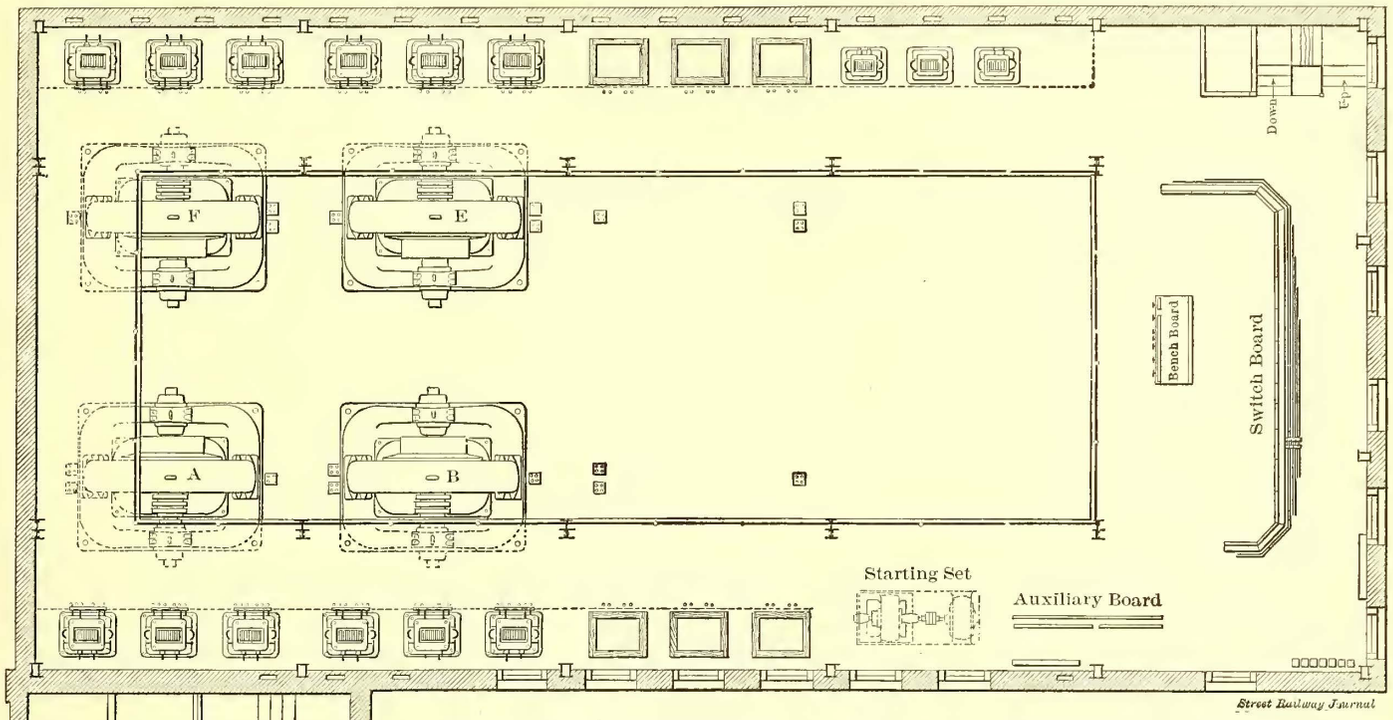


FIG. 13.—PLAN OF SUB-STATION NO. 4, LOOKING DOWN ON TRANSFORMER GALLERY AND MAIN FLOOR

The bus-bars are divided by knife switches into sections, one for each rotary converter, so that any section of the bus-bars may be shut down for repairs.

Each of the three conductor cables carrying high-potential current from the power house to the sub-stations is equipped at the power house end with an oil circuit-breaking switch, with a time limit relay device, and in case of a short circuit in the cable the supply of current from the power house would be interrupted at the end of a predetermined interval. At the sub-station end the cable is connected to the bus-bars through a similar oil circuit-breaking switch, but in this instance the switch will open automatically in case of a reversal of the current, such as would be caused by a short circuit in the cable. Again, in each high-potential alternating-current circuit which connects the bus-bars at sub-stations with a group of step-down transformers and through them with a rotary converter, an automatic circuit-breaking oil switch with time limit relay has been placed, and in the direct-current circuit between the converter and the direct-current bus-bars the circuit breaker has been arranged to open the circuit should power exceeding a certain predetermined small amount flow back through the direct-current bus-bars into the converter. In case of a short circuit in the group of transformers, in the converter itself or in the connecting circuits between the alternating-current circuit breaker and the direct-current circuit breaker, provision is made for these breakers to act automatically and disconnect from the alternating-current bus-bars and from the direct-current bus-bar the converter unit affected.

The switchboard, Fig. 14, is located on the gallery at the eastern end of the station, and consists of a direct-current board of the usual type, with its end panels placed at right angles to the panels forming the central portion of the board, thus inclosing on three sides the operating bench board. The alternating panel board and the operating bench board are illustrated in Fig. 15. Each incoming feeder and each rotary converter has a controlling switch, with visual signals arranged diagrammatically on the face of the bench board. On the panel rising above the back of the bench board are the alternating-current instruments. There are no instruments for the incoming line, but each converter has one indicating wattmeter, with a scale reading up to 3000 kw, one power factor meter and one ammeter. Over the central section of the board a higher panel carries one main voltmeter, one synchronizing voltmeter and two synchronizing lamps.

Switches are provided in the circuits between transformers and converters, and they are mounted upon marble panels carried upon the step-down transformers, as shown in Fig. 10. The panels are equipped with a synchronizer and a synchronizing lamp, and another synchronizing lamp in the same circuit is provided for the switchboard at the end of the sub-station for the convenience of the operator at that point in adjusting the speed of the converter to be synchronized. Induction recording wattmeters and the relays for automatically opening the oil switches in case of accident are mounted on the rear of the operating bench board.

One reverse-current relay for each incoming line, and one time-overload relay for each rotary converter are provided. The direct-current circuits of the rotary converters are run as shown in the diagram, Fig. 16. Each converter is also provided on the switchboard with one Thomson recording wattmeter, an ammeter, reading up to 5000 amps., and a circuit breaker, designed to carry 6000 amps. This circuit breaker is of a new type, without the usual tripping coil, the magnetism for the tripping device being obtained by means of the steel bar surrounding one of the studs, which greatly simplifies the breaker. It is fitted with an easily removable cover over the secondary contacts, and attached to it is a reversal device for tripping the breaker when power exceeding a certain amount tends to flow back over the line into the converter.

Reserve panels, fitted with reserve circuit breakers, one for each of the rotary converters, and outgoing feeders will also

be provided. The reserve panels will be connected to auxiliary bus-bars, as indicated in the diagram of connections, so that in case a circuit breaker gives trouble a reserve panel, with its equipment, may be substituted by throwing the main switch on the converter or feeder panel into another position.

The connections for the motor-generator set for starting up the rotary converters from the direct current end, are so arranged that a converter may be thrown on to the starting bus, and brought up to speed, while other converters are running across the main busses. Suitable switches are provided for connecting the field of a converter to be started outside the starting resistance. The field rheostat of the starting generator is mounted on the alternating-current operating bench board, so that the attendant may accurately adjust the speed of the rotary converter while synchronizing. A switch is also provided on the bench board for tripping the circuit breaker of the starting generator the instant the converter is thrown into the circuit on the alternating-current end.

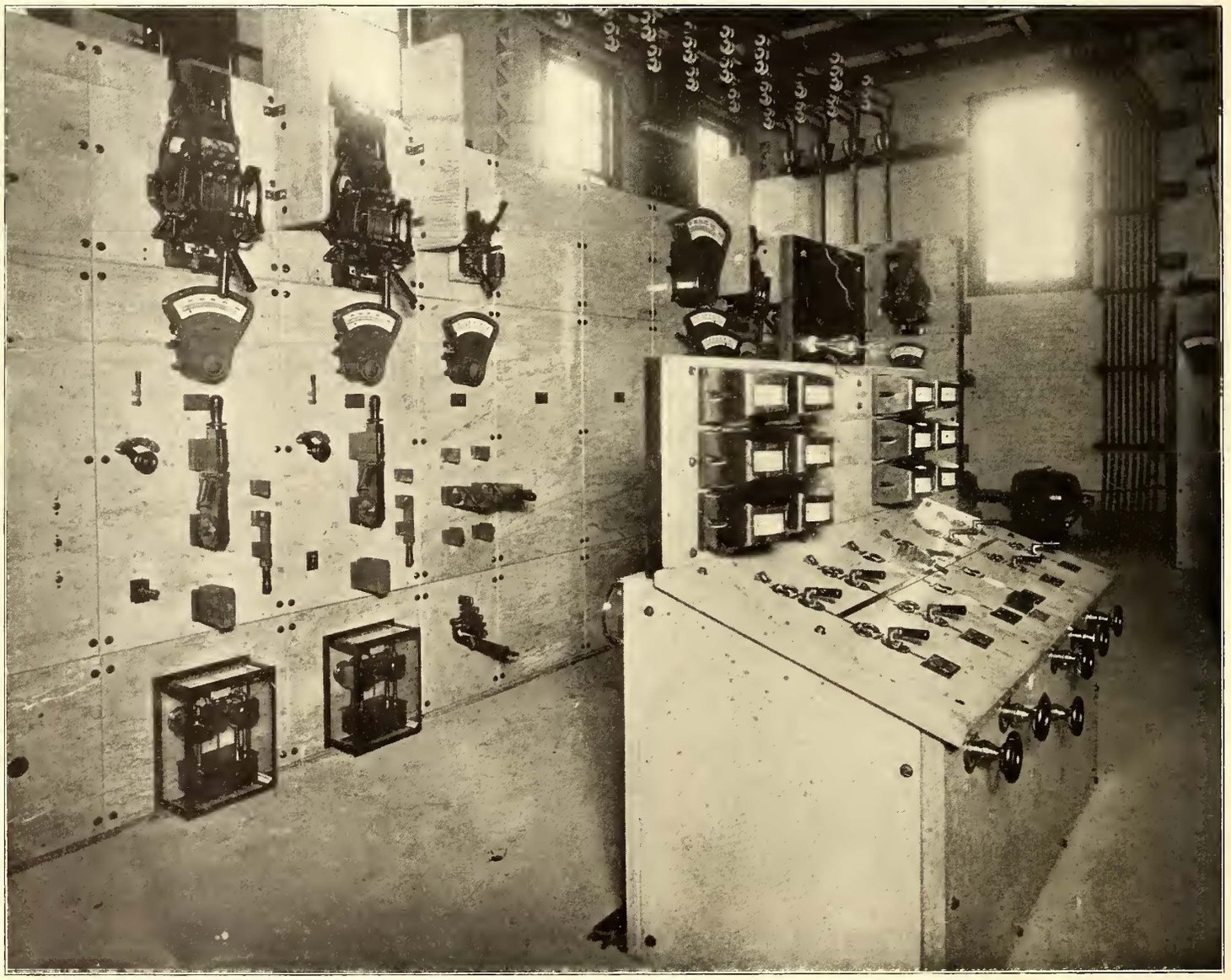


FIG. 14.—SWITCHBOARD GALLERY IN SUB-STATION NO. 4

The rotary converters, static transformers, motor-generating sets, boosters and induction motors for driving the blowers are supplied by the Westinghouse Electric & Manufacturing Company, and the switchboard equipment by the General Electric Company.

LIGHT AND VENTILATION

Light and air are supplied to this station by five large circular head-swinging sash windows on the ground floor, thirteen sliding-sash windows on the gallery floor, and eight sliding-sash windows on the south and east elevations of the high-tension gallery tower, while the entire station to the rear of the high-tension tower is covered by a monitor roof, in the sides of which are thirty-two pivoted windows, 4 ft. x 4 ft. 6 ins. each. The sash and mullions of these windows are entirely of copper, and the windows themselves are of heavy ribbed glass. The roof of this monitor is of tar and gravel construction, laid on 2-in. terra cotta blocks. A copper gutter, 15 ins. wide, runs the entire length, and is connected with the side roof, which is also of gravel, by copper leaders, 3 ins. in diameter.

PASSENGER TOWER

The passenger tower is five stories in height, with interior walls of light buff brick. The entrance loggia, first, fourth and fifth floors, are laid of 3-in. ceramic hexagonal tile, bedded in Portland cement mortar. Stairs of ornamental cast-iron stringers and risers with slate treads lead to the passenger foot bridges on the fourth and fifth floors respectively. Uptown passengers pass under the structure at the elevation of the fourth floor, 42 ft. 6 ins. above the sidewalk, and ascend one flight of stairs to the ticket booths and track platform. Downtown passengers pass directly to the ticket booths and track platforms from the fifth floor, at an elevation of 59 ft. 4½ ins. above the sidewalk. The plan of the platform arrangements is shown in Fig. 17. Provision has been made for six cars, and the platform is consequently much longer than those at other stations, although all platforms are now being lengthened to accommodate the new six-car trains. Four Otis electric

elevators have been installed in this tower for handling the passenger traffic. They run from the first to the fifth floors, a distance of 60 ft., serving the first, fourth and fifth floors. The northeast, or No. 1, elevator, in addition serves the basement and sub-basement, 13½ ft. and 27 ft. respectively, below the first floor, and is provided with a rear door for serving the sub-station building at these lower floor levels. All elevators operate independently, and, with a live load of 3000 lbs., have a speed of 200 ft. per minute. The maximum speed with half this load is 300 ft. per minute. The cars are counterbalanced from the winding drum of the machine as well as from the car. They have six ⅝-in. steel cables, two to the counterweight, two to the drum counterweight and two to the car direct. Car and hatchway gates are designed to give the maximum opening possible, consistent with safe and quick operation. Both cars and grills are of electric bronze finish. The elevator machinery provides that the cars will stop automatically at the upper and first floor landings, and independent safety appliances are provided for each car, to control it when the speed limit is exceeded or trouble develops in the machinery. The motors are of the Otis pattern, and are designed for direct current, taking 60 amps. at 625 volts, with 800 r. p. m. Otis magnetic control is used with independent cut-off switches for each machine located at the switchboard. The switchboard is placed under the lower landing of the sub-basement stairs, and contains the switches for the elevators and for the lighting circuits of the tower.

In lighting the elevator tower ninety-five incandescent lamps of 16-candle power are used, exclusive of the lamps in the elevator cars or on the foot bridges leading to the track stations. These lamps are arranged in clusters of five each; seven of these clusters being placed on the first floor and entrance loggia. The lights for the passenger bridges and ticket booths are placed upon the track circuit, and are independent of the sub-station lighting.

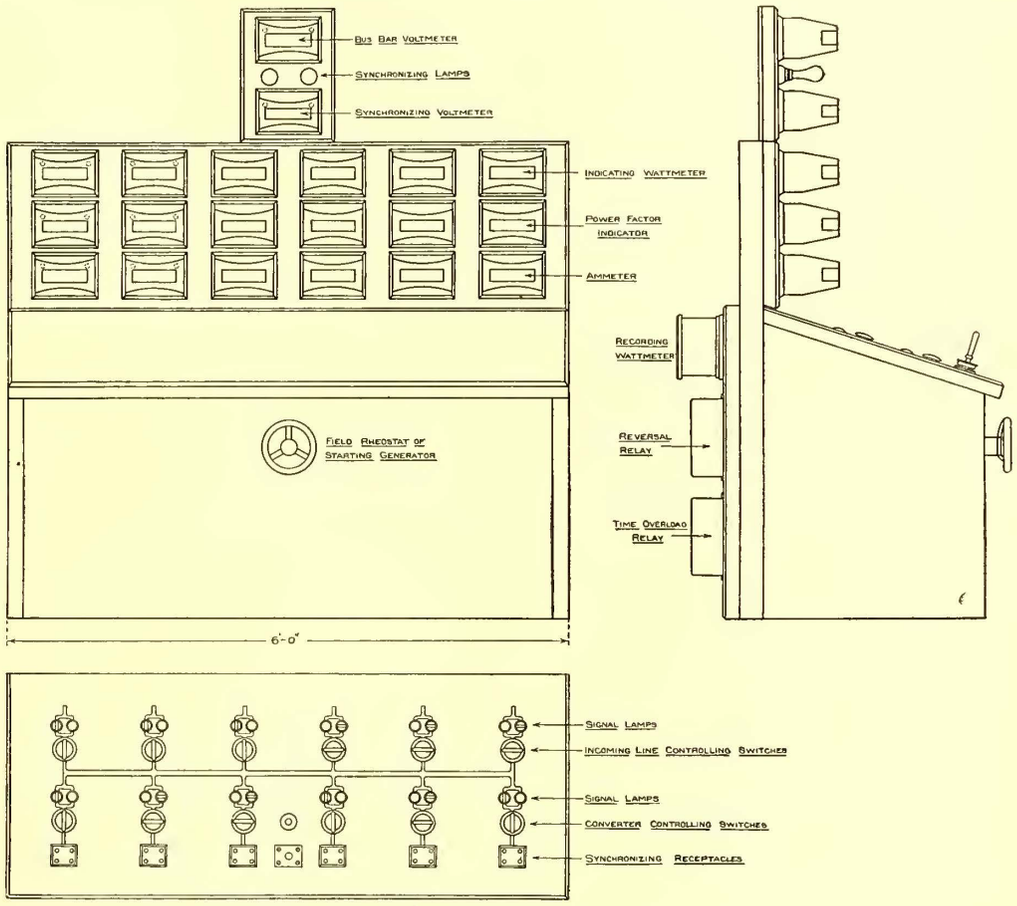


FIG. 15.—OPERATING BENCH-BOARD IN SUB-STATION NO. 4

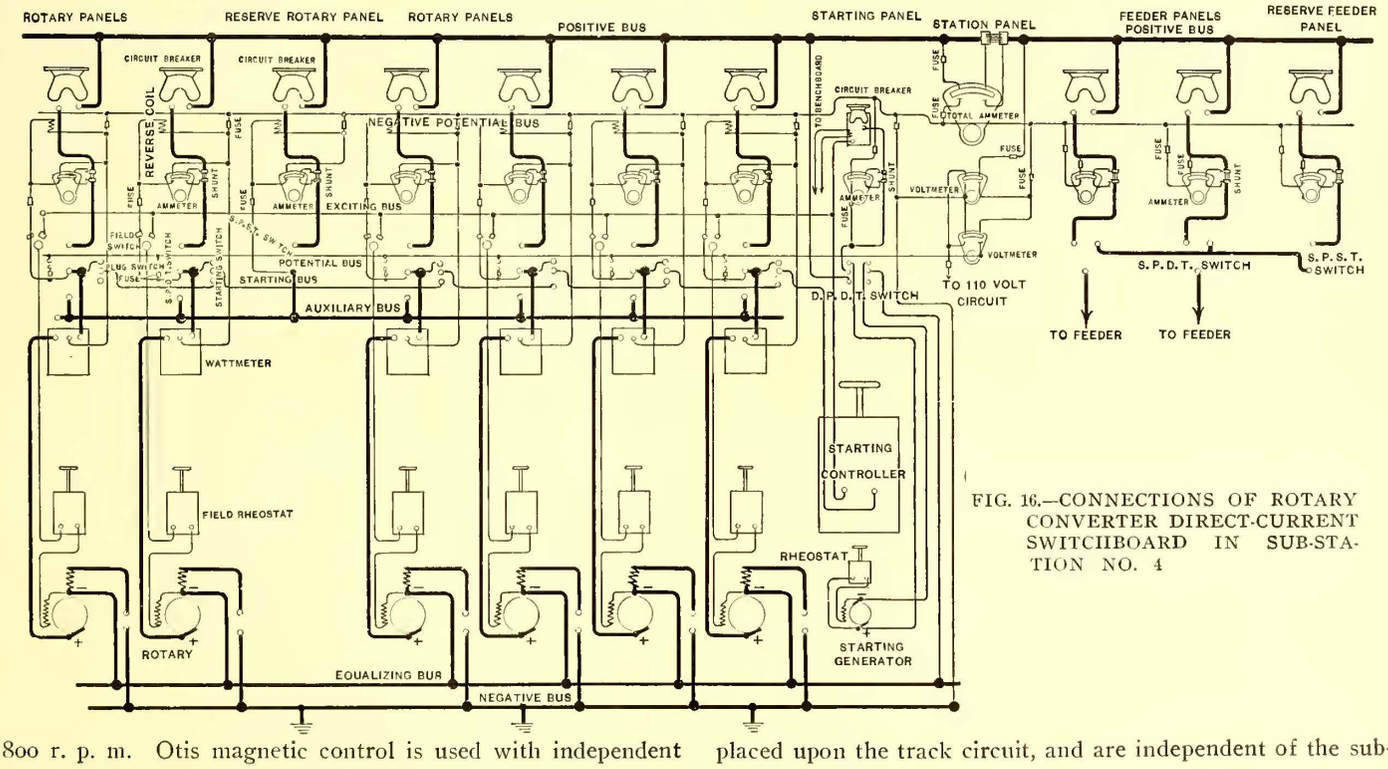


FIG. 16.—CONNECTIONS OF ROTARY CONVERTER DIRECT-CURRENT SWITCHBOARD IN SUB-STATION NO. 4

The tower and passenger waiting rooms on the structure are heated from a low-pressure steam-heating boiler, located in the basement of the elevator tower. This boiler has a

capacity of 1600 sq. ft. of radiating surface, and supplies steam to radiators located on the first, fourth and fifth floors of the tower, and in the north and south-bound passenger stations. Radiators of the Bundy standard type are supplied with steam through a 3-in. riser, and have 2½-in. and 1½-in returns graded to the riser. Where pipes are exposed, as in crossing to the north-bound station, they are covered with a layer of 1-16-in. asbestos paper, 1½ ins. of Russian hair felt, two layers of tar paper and one thickness of 8-oz. canvas. The mains are erected in such a manner as to allow of expansion without throwing the vertical branches out of alignment. On the fifth floor of the tower are station lavatories. These are furnished with white marble fixtures, wainscoting, etc., and have floors of 3-in. white hexagonal tile.

It is estimated that under normal conditions the elevators in this station can carry 1200 passengers an hour from the street to the station platforms, and in addition it is to be assumed that many people will continue to climb the stairs, the same as they now do at 116th Street, where elevator service is furnished. This, of course, will greatly relieve the congestion at 104th Street and 116th Street, at which points the people living near the north end of Central Park now take the elevated trains, and it will undoubtedly encourage the immediate settlement of a very desirable section of Harlem, whose only drawback heretofore has been lack of proper transportation facilities.

George H. Pegram, chief engineer of the Manhattan system, had supervision of this work, and the details of the buildings were worked out in his office. F. G. Cudworth, assistant engineer, has had charge of the construction work of all the sub-stations.

ELEVATED LINES FOR ST. LOUIS

Two proposed elevated railway bills which have been introduced in the City Council of St. Louis are being urged by their promoters and interested business men. One company, known as the St. Louis Elevated Railway Company, makes no allusion to remuneration for the city, while the other, controlled by J. D. Houseman, offers $50,000 cash for the privilege and 5 per cent of its annual profits after fifty years from the time the franchise is granted. The St. Louis Elevated Railway Company is composed of Jordan W. Lambert, Emmet M. Fry, Albert B. Lambert, Marion L. J. Lambert and Judge Henry W. Bond. The company promoted by Mr. Houseman proposes to extend its county lines, now in operation, through the city on an elevated structure. The former company promises to have its main line in operation in eighteen months, and declares it has excellent backing. Each company specifies that the road is to be equipped with pneumatic tube, telegraph and telephone service, and the company promoted by the Houseman interests also asks permission to carry city mail. The matter of bonds, etc., is specified, and in the case of the St. Louis Elevated Railway Company provision is made to enable the city to purchase the franchise twenty years after it is granted. The tracks are to be supported by iron girders resting on a concrete base, and are to be about 16 ft. above ground.

CONDUIT SYSTEM OF THE MANHATTAN RAILWAY

The Manhattan Railway Company, in connection with its electrical equipment, has installed a system of underground conduits for its high-tension service which is undoubtedly the most extensive and modern subway ever constructed. The system includes one main trunk line closely paralleling the Second Avenue elevated structure and extending from sub-station No. 5, at the corner of Allen Street and Division Street, on the lower East Side of Manhattan Island, to sub-station No. 8, at 161st Street and Third Avenue, in the Borough of the Bronx. A feature is the crossing of the Harlem River, where the cables are carried in a specially prepared channel on the bottom the routes followed is given in Fig. 1. The main line is nearly 9 miles long, and consists of from eight to forty-eight ducts. From this main line radiate six branches of various lengths, extending to the main power house and to the sub-stations, three of these branches reaching entirely across town and connecting with the Sixth Avenue and Ninth Avenue elevated lines in sub-stations Nos. 2, 3 and 4, which are located respectively on Spring Street, near West Broadway, Fifty-Third Street between Eighth Avenue and Ninth Avenue, and at 110th Street, near Eighth Avenue. Connection is made with the main power house by a heavy trunk line on East Seventy-Fourth Street, consisting of fifty-six ducts laid in two lines of twenty-eight ducts each. The length of the entire system is very nearly 13 miles; this is equivalent to 345 miles of single conduit, or approximately 2,000,000 duct feet. The conduit used in this construction is of the single-glazed tile type, 18 ins. in length, with inside diameter of 3½ ins., the largest conduit yet used. It is extra heavy, outside measurements being about 5 ins. sq., thus giving a wall of nearly three-fourths of an inch in thickness for each duct, and making a thickness of vitrified material between two parallel cables of very nearly 1½ ins. Great care was taken in laying the conduits so that each individual duct had its ends closely butted together, and a 2¾-in. mandrill, 30 ins. long, and carrying a rubber gasket or disc, 3½ ins. in diameter on the far end, was pulled through as the next succeeding duct was placed in position, thus removing all mortar that may have worked through the joint. No curve greater than 1 in. in 10 ft. was allowed in either horizontal or vertical alignment. The typical section for either eight ducts or forty-eight ducts is illustrated in Fig. 2. This formation is the ideal arrangement of ducts in street manholes for facility and ease of handling cables in the manholes themselves, yet a glance at the cut, with its 7 1-3 ft. of vertical trench, would show to anyone at all familiar with sub-surface construction in New York city its entire impracticability within the bounds of reasonable cost. It is impossible to lay down an ironclad rule for either conduit layout or manhole design in New York city that contemplates the installation of over twenty cables. The obstruction encountered in all sub-surface construction is of so varied a character, and in the older portions of the city so extensive, that little choice is left in the matter of layout. At one

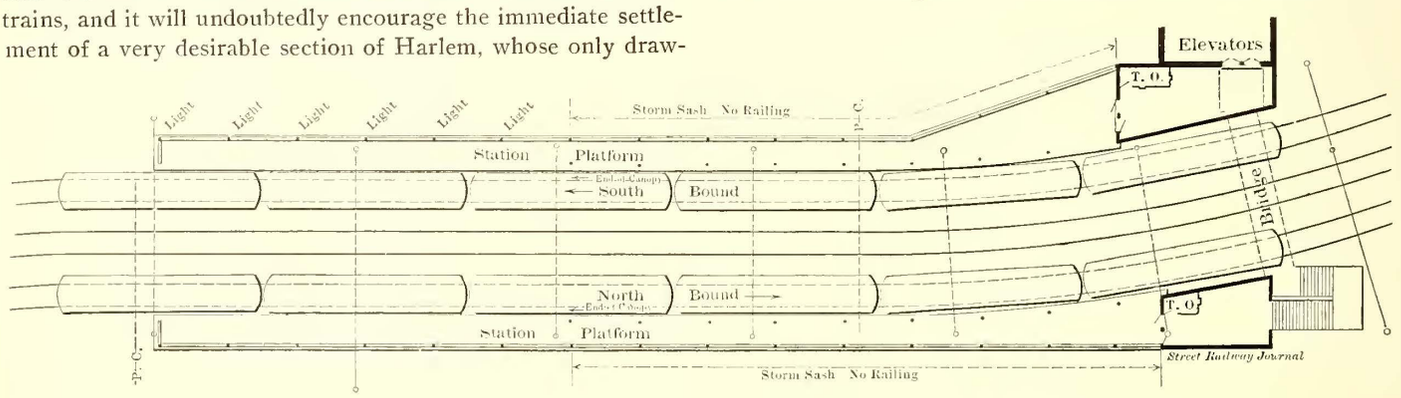


FIG. 17.—SIX-CAR PASSENGER PLATFORM AT 110TH STREET STATION

street crossing it was found necessary to carry a bank of twenty-two ducts under a 48-in. water main and over a street sewer, the only available space being 15 ins. in height. This problem was solved by arranging the ducts two high and eleven wide; this arrangement, however, formed at the manhole one of the most disagreeable situations in cable installation and separation imaginable. As a result of these sub-surface obstructions the layout varies in almost every block, in fact, it was found necessary in many places on the East Side of the town to make the layout as shallow as possible, in order to avoid tide water, and, as it is, rubber-insulated cable has been installed wherever tide water covers the conduit lines.

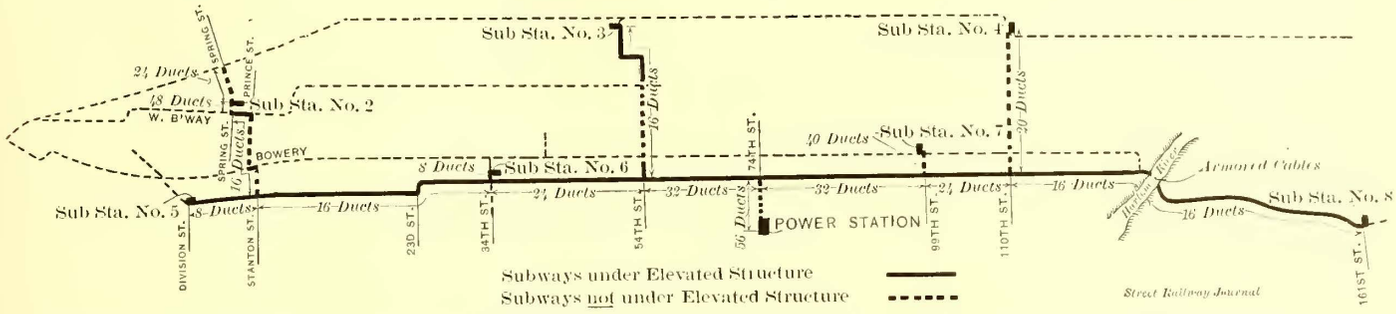


FIG. 1.—MAP OF NEW YORK, SHOWING LOCATION OF SUB-STATIONS AND ROUTE OF ELECTRICAL SUBWAYS

The typical design of the manholes and arrangement for connecting them to sewers is shown in Fig. 3. This sewer arrangement is very simple, and the cost comparatively low. It can be placed in position without employing skilled labor, and if the sump well is properly built and the elbow adjusted correctly there is always a water seal covering the lower end of the pipe, thus preventing sewer gas getting into the manhole. Some cases occur in the system when the bottom of the manholes are below the high-water level of the sewer, and also where the sewers are subject to tide action, and here the manholes have been waterproofed, as it was deemed advisable to keep the tide water out and pump the surface inflow. The waterproofing consisted of the application of from three-ply to seven-ply of roofing felt, each ply being laid in hot Neuchatel asphalt. Again, manholes which were on the same level as sewers that were subject to tide action were waterproofed and also connected with the sewer, and a back-water gate or check valve was placed in the connection, usually about 2 ins. below the level of the floor of the manhole and leading directly out to the sewer, the sump well being dispensed with. The arrangement of ducts, where entering the manholes, is shown in Fig. 3. It will be noticed that these do not enter in the same horizontal plane, but that every other duct is raised or depressed, as the case may be, one-half its diameter above or below its neighbor, with a layout only four ducts wide; this arrangement gives great facility in handling cables in the manholes, and even with wider layouts there is a marked advantage over the old rectangular system where all ducts entered the manhole in parallel rows and the cables had to be separated as best they could. In handling the 2⅞-in. diameter three-conductor cables used by the Manhattan Company, which weigh about 9 lbs. per foot, this arrangement of ducts has proved very satisfactory, and admits of the cables being racked much more readily than with the rectangular layout. Of course this staggering only runs for about 15 ft. along the bank after leaving the manhole, the ducts then returning to a rectangular formation.

Manholes were located, when possible, at distances of 450 ft. apart, as this length was considered the most desirable for cable handling. Although the limit fixed by the cable makers was 550 ft., it was seldom reached, the general average for the system being about 275 ft., and the obstructions met with often compelled the use of two manholes at a single street intersection. In building the manholes slotted channel irons were inserted in the brickwork on the sides adjoining the ducts, and spaced about 2 ft. 6 ins. from the walls, giving a distance of 3 ft. between hangers for splices to be made up in all regular manholes that run parallel with the duct line. These channels were slotted for four, six or eight cable hangers, and hangers were provided to support from one to three cables. The details of channels and hangers are shown in Fig. 4, the channel being anchored to the brickwork by a 9½-in. x ¾-in. hook bolt, having a thread and nut on the inside or manhole end. This passed through the web of the channel and when tightened up brought the flanges of the channel against the brickwork, leaving a clear space equal to the depth of the flange between the web and wall of the manhole and allowing the hanger to be readily inserted and dropped into position. This arrangement of hangers gives a space of 5½ ins. between centers of cables in the same hanger and allows any cable to be removed, spliced or jointed without disturbing its neighbor.

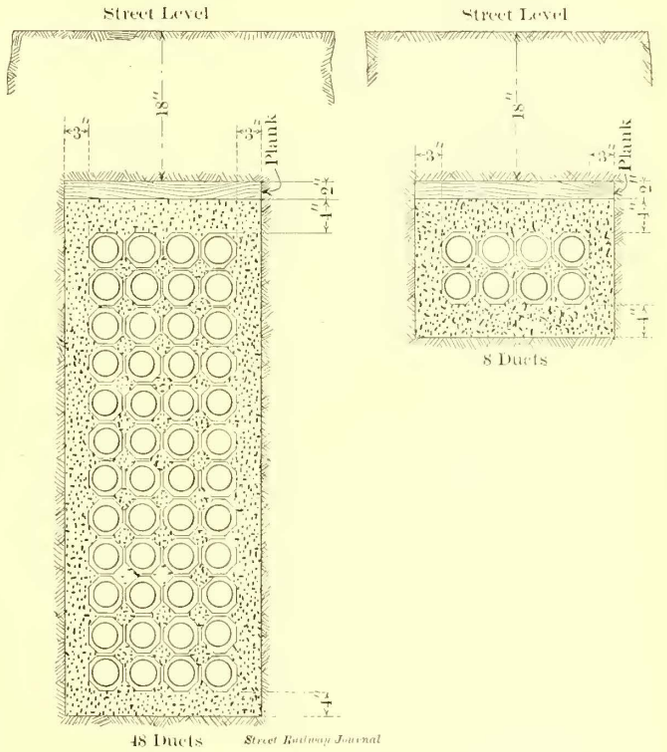


FIG. 2.—SECTIONS OF UNDERGROUND CONDUITS

The hardest and most expensive part of the whole work was the crossing of the Harlem River and the building of the necessary manholes and approaches on each side. It was finally decided to lay armored cable in an open trench, and as the United States Government required a depth of 20 ft. at low water, this necessitated the dredging of the entire river bottom to a depth of 6 ft. The location adopted brought the south approach on property belonging to the company at 129th Street and Second Avenue, while the north approach is in Lincoln Avenue, between 131st Street and 132d Street. Both of

these locations proved to be over old timber cribs filled in with rip-rap and logs, making it impossible to drive piles until these cribs had been cut through and removed, all of which had to be done by divers working under 10 ft. to 20 ft. of water. The approaches, as finally built, consist of a rectangular manhole, 4½ ft. deep, located 35 ft. back from the bulkhead line. Three sides of this manhole are of brick, while the riverside is left

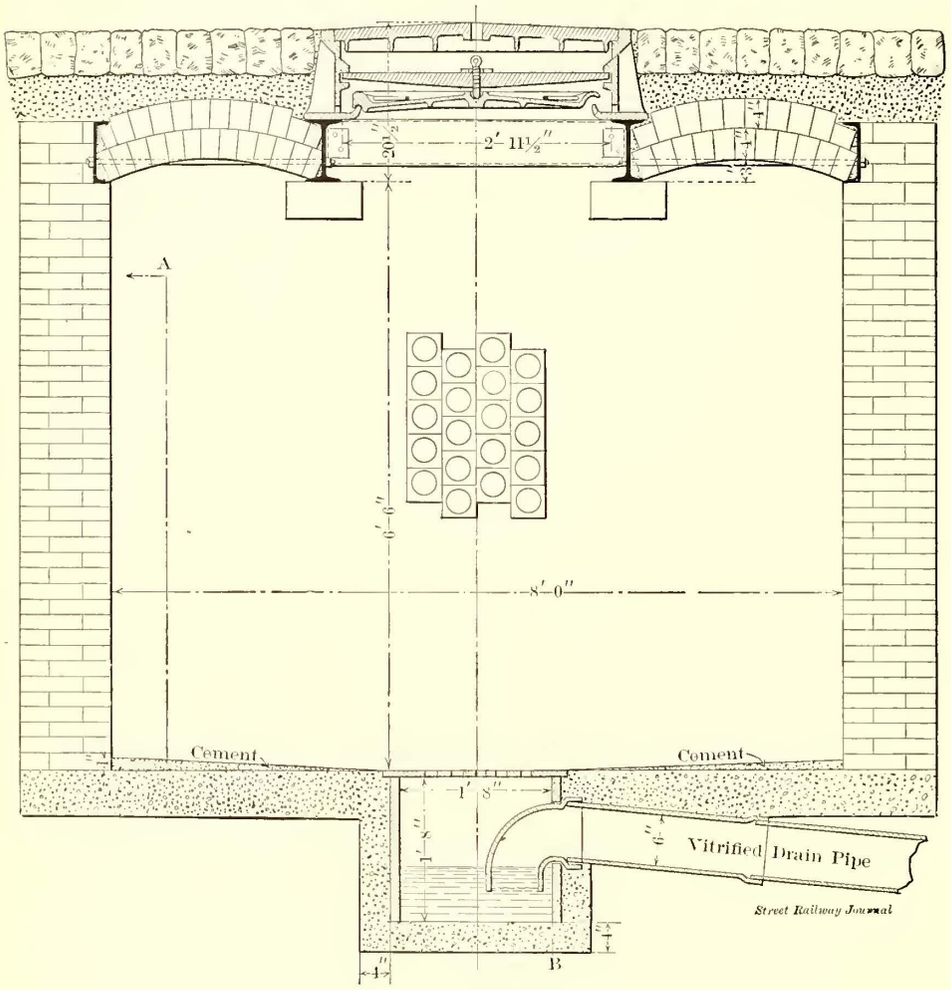


FIG. 3.—STANDARD MANHOLE

open and connected by a timber sluiceway with the river. This sluiceway grades from 4½ ft. at the manhole to a depth of 16 ft. at a distance of 20 ft. From the latter point it slopes off to the maximum depth of 20 ft. below low water at the bulkhead line. Two rows of 12-in. vertical piling were driven 8 ft. apart, 4-in. x 6-in. rangers, 2 ft. centers, were bolted to these, and then heavy 4-in. x 6-in. sheet-piling was driven between the rangers on the outside of the piles, the whole being capped by an 8-in. x 8-in. longitudinal timber. The bottom of the sluiceway is planked for a distance of 20 ft. from the manhole, the whole approach being covered with 4-in. x 6-in. planking. At the bulkhead heavy 12-in. x 12-in. timber breast pieces are built up 6 ft. Just back of this breastwork is a heavy gate, sliding in vertical guides and extending well below low water, this being intended to shut out all intrusion from the river.

The cable installation for all of the East Side stations was carried on jointly with the conduit work, rodding gangs often being at work cleaning and wiring ducts the next day after a section was completed. Specifications covering this part of the work called for the driving through each duct of a steel cutter 3 ins. in diameter, and afterwards drawing through a test block 3 ins. in diameter and 30 ins. long, this to be followed by two or more stiff wire brushes. The operation was repeated until the duct was thoroughly cleaned, after which the contractor placed a No. 8 galvanized wire in each duct. The cables used in the East Side equipment were manufactured by the Standard Underground Cable Company, and are all three-conductor cables, 2⅞ ins. in diameter, very similar to the cables described in the STREET RAILWAY JOURNAL of Jan. 5, 1901, and weighing about 9 lbs. per linear foot. Most of these cables, some of which were 550 ft. in length and weighed nearly 2½ tons, were pulled by hand, an ordinary capstan being set up in the manhole, and a gang of twelve men employed to operate the capstan and to feed cable into the manhole. Some experimenting with a cable-pulling machine was done, which proved very satisfactory, both as to rapidity and cost of operation, but it is greatly to be regretted that no extended investigation could be made in this line owing to existing contracts and the hostility of union labor. The machine is designed to pull new cables or to remove old ones already in conduits, working by either hand or steam power.

In ordering cables for this work the distances given the manufacturers were from face to face of manholes, plus 15 ft., allowed for splices and racking. The location of manholes was also given, with respect to the intersecting streets, the cable reel being numbered to correspond with distances when shipped. The cables, with the exception of those lengths lying in conduits subject to tide water and the armored cables crossing the Harlem River, have paper insulation wrapped in jute with a heavy lead sheath. The three conductors of each cable are built up of nineteen single copper wires each, forming a strand approximately 15-32 in. in diameter, or a 0000-wire B. & S. gage. The waterproof cables have rubber insulation substituted for the paper. The Harlem River cables are covered on the outside of the lead sheath with two windings of steel ribbon wound in opposite directions. This ribbon is 1-16 in. thick and 2 ins. wide, and when applied to the cable forms a complete coat of steel armor averaging nearly ⅛ in. in thickness, and making a cable 3⅝ ins. in diameter, which is nearly twice that

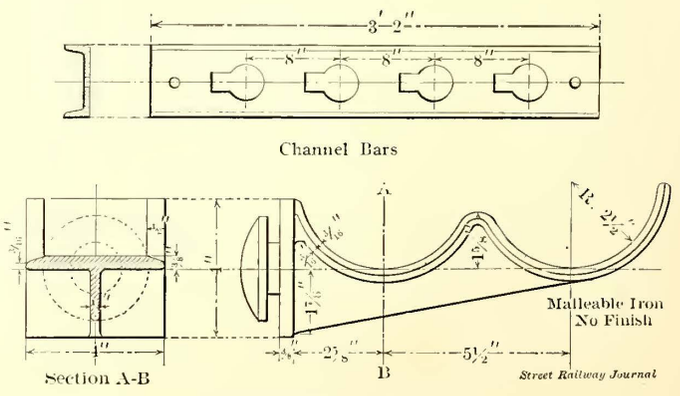


FIG. 4.—DETAILS OF CHANNELS AND HANGERS

of the ordinary cable. The distance between bulkhead lines at the cable crossing was 503 ft., while the contour of the bottom called for a length of 581 ft., and the allowance for splicing, anchorage in manholes, etc., increased this length to 600 ft. To add to the difficulties of pulling the river cables, a city water main was encountered, crossing the cable channel diagonally at a point 60 ft. from the north bulkhead and at a

depth of only 15 ft. below low water. This required that not only the cables themselves but the tow-line as well must be passed under this pipe, and necessitated the anchoring of a float carrying a diver and apparatus over the pipe and having the diver pass the ends of the line and cables under it. The cables were pulled across by means of a tugboat and a small steam winch, used in conjunction with the company's coal hoisting plant on the south side of the river. The tugboat was used to carry the tow-line from bank to bank and to assist in straightening the cables after they were across, the heavy undertow at this point carrying them in some cases several feet outside of the channel. Thirteen cables in all were carried across the river, and were straightened out and placed in position at the rate of three a day. As an additional source of security and insulation the company is now wrapping cables in all manholes with asbestos, the approximate cost of which is $5 per cable per manhole. This may seem like a needless expense owing to the remote possibility of a burn-out crippling all of the cables in one manhole, yet in testing it has been demonstrated that it may occur, and it has been thought advisable to provide as far as possible against such an emergency. The total cost of this improvement in some manholes will be in the neighborhood of $150. Considering the magnitude of the work, combined with the difficulties of construction, where not only pipes but rock was encountered as well, the length of time taken to complete the conduit system and install the cables necessary to operate the system appears remarkably short. The entire line for the East Side was finished in a little less than one year, while the actual time spent on street work was a little over eight months.

THE POSSIBILITIES FOR CAPITAL IN EUROPEAN TRAMWAY ENTERPRISES

It is well known that America leads the world in street railway mileage, as well as in the amount of capital invested in this class of property. Many fortunes have been made in this form of investment, but it is a debatable question with some of our ablest railway financiers whether there are not, just at present, more favorable opportunities for the profitable employment of American capital in tramway enterprises abroad, where the advantages of electric traction are not as fully realized as in this country, and where the choice locations have not been so pre-empted as here.

To give a better idea of the differences in trackage several tables are given below, which shows the population, miles of street railway track and inhabitants per mile of track in a few cities and States in this country and in the United States, as compared with certain countries and cities abroad. Table I gives the gross receipts and miles of track, with receipts per square mile and per capita for four countries in Europe, viz.: England and Wales, Scotland, Ireland and France, together with similar statistics of various groups of American States, which approximate these countries in area. As will be seen, both miles of track and gross receipts average from seven to ten times as much in the United States per capita as in the corresponding European countries selected for comparison. Table II gives somewhat similar figures for Austria and Switzerland, where the gross receipts were not available. Table III gives some interesting comparative figures from different cities in Europe and the United States. In connection with this table it should be said, however, that the practice abroad in reckoning mileage is different from that in this country in that miles of street are usually given instead of miles of track. To make up for this difference in measurement 60 per cent has arbitrarily been added to the mileage in the foreign statements, when reported in this way, to make the basis the same as that for the American cities. The number given under "passengers carried" in the case of a number of foreign cities does not include those riding on commutation tickets, and in the American cities does not include those riding on transfers. The population in the foreign instances is usually that of 1898, while in the American cities the 1900 figures are given. The American cities selected were chosen not because they had an unusual mileage, but generally because they corresponded most nearly

TABLE I.

	Year Ending	Area, Square Miles	Population *b*	Gross Receipts	Miles of Track	Miles of Track per 1,000 Sq. Mile	Miles of Track per 1,000,000 Capita	Gross Receipts per Square Mile	Gross Receipts per Capita
England and Wales	1901	58,309	31,397,078	23,968 875	1,560	27.6	50.3	441.1	.76
New York and New Jersey	1901	54,715	9,151,681	51,205,482	3,759	68.3	417.7	935 8	5.59
Scotland	1901	29,785	4,249,946	3,715,340	205	6.8	51.2	124.7	.87
New Hampshire, Vermont, Massachusetts, Connecticut	1901	31,025	4,468,930	*a* 27,333,714	3,086	99.6	685.8	*a* 881.0	*a* 6.11
Ireland	1901	32,583	4,541,903	2 121,095	225	6.8	50.0	65.1	.46
Pennsylvania	1901	44,985	6,302,115	26,424,396	2,475	55.0	392.9	587 4	4.19
France	1901	204 092	38,517,975	18,373,643	2,462	12.0	63.9	90.0	.48
Ohio, Indiana, Illinois, Michigan	1901	190,100	13,916,539	----------	5,724	30.1	409.0	----	----

a Not including Vermont. *b* British figures, 1898; American, 1900; French, 1896.

in size with the foreign cities taken, because the statistics were easily available, and because they were not terminii of any extended interurban system, so that interurban traffic would not be included in their reports. Suburban traffic, when carried by the company operating in the city, is however, included, as statistics separating the two classes of travel are not obtainable.

PRESENT OBJECTIONS TO FURTHER INVESTMENT IN AMERICA

Many objections are often raised against the investment of American capital in foreign railway enterprises, and they will be fully considered later. It should be recognized, however, that the possibility of a good return on street railway investments in this country is yearly becoming more contracted. This is due not merely to the reason that we are already supporting a very large mileage, as compared with our population, but quite as much to a variety of other causes. In the first place the demands made by the municipal authorities of all public corporations are becoming more exorbitant, and where a city

TABLE II.

	Year Ending	Area, Square Miles	Population	*Miles of Track	Miles of Track per 1,000 Square Miles	Miles of Track 1,000,000 Capita
Austria	1899	115,903	*a* 23,895,413	139	1.2	5.8
Pennsylvania, New York New Jersey, Delaware, Maryland	1300	111,520	*b* 16,828,581	6,738	60.2	396.4
Switzerland	1900	15,976	*c* 3,082,989	55	3.4	18.3
New Hampshire, Rhode Island, Connecticut	1900	14,935	*b* 1,748,509	1,002	67.0	573.2

* 60 per cent. has been added to Austrian and Swiss statistics giving miles of street to obtain miles of track. *a* 1890. *b* 1900. *c* 1897.

is prevented by a company's franchise from making any increase in the direct return required from the company the tendency is toward assessing increased taxes in one form or another against the company's property, which create an indirect though no less certain a drain upon its treasury. Again, if we consider the question of the length of franchise we find the constant demand in all States, and the actual passage in a number, of acts limiting the life of any grant to such a short period that it is extremely doubtful whether a return can be secured in the short time allowed to recoup the necessary investment, to say nothing of obtaining, in the meantime, an adequate annual return. Still a third deterrent to investment in American city enterprises, and one which is probably as serious as either of the other two mentioned, certainly to large companies, is the enormous aggregate of the accident damage claims for which, rightly or wrongly, the courts of this country are making the companies liable. It is not the purpose of this

article to discuss here the merits of this particular phase of street railway operation, but the accident assessments are becoming a very serious question, and attention should be directed to them as one constituting one of the most serious problems which city railway companies have to face.

OBJECTIONS TO INVESTMENT IN EUROPEAN ROADS CONSIDERED

The two principal arguments brought against the desirability of investment in foreign tramway enterprises are, first, the strict regulation in regard to operation which is exercised over the companies by the municipal or other governing authorities; and, second, the low fares which are charged abroad. As regards the first it cannot be denied that the city, and often the national government, interferes in the operation of cars in a way unknown in this country. The type of rail to be used, the plans for car equipment, in fact, in some instances, the proposed schedule must receive the sanction of the proper authorities

TABLE III.

City.	Year Ending	Population	*Miles of Track	Miles of Track per 1,000 Capita	Passengers Carried	aRides per Capita	bGross Receipts per Capita	Gross Receipts
Munich	June 30 1902	407,307	60	.15	645,576,105	111.9	2.96	1,207,375
Baltimore	1901	508,957	353	69	--------	----	9.27	4,718,295
Leeds	1901	416,618	72	.17	39,239,577	94.1	2.19	915,995
Pittsburg and Allegheny	1901	451,512	363	.80	137,259,203	304.1	15.40	6,955,906
Nuremburg and Furth	1901	209,112	51	.24	613,752,740	65.7	1.72	360,541
Providence	1901	175,597	265	1.51	50,101,693	284.7	15.35	2,702,383
Stuttgart	1901	158,321	16	.10	16,208,236	102.6	2.42	381,827
Rochester	1901	162,608	131	.80	21,202,044	130.1	6.56	1,069,163
Basel	1900	89,687	19	.21	8,635,857	96.2	2.27	203,775
Hartford	1901	79,850	87	1.09	17,958,489	224.4	9.31	745,178
Coblenz	1901	32,671	10	.31	2,381,317	72.8	2.33	76,056

*60 per cent. has been added, where statistics give miles of street, to obtain miles of track. *a* Includes suburban traffic when carried by city company. *b* Not including commutation tickets.

before they can be adopted. This is in some cases, as for instance in Switzerland, carried so far that the proposed summer schedules for both steam and street railways have to be submitted to the government officers in Bern for approval three months before the companies intend to put them into effect. The authorities are, however, somewhat more lenient in enforcing this rule in the case of street railway companies than toward steam railroad companies. The number of passengers which can be carried on the car is also usually limited to those who can be seated, plus a certain additional number who are permitted to stand on each platform, and the regulations are particularly strict as to the obligatory adoption of many devices, such as brakes, guard wires, etc., and other precautions which are considered necessary for the safety of the general public.

Without doubt a great many of these regulations are absurd from an American standpoint. Taken as a whole, however, they do not seriously interfere with the operation of a railway. Moreover, they are required in good faith for the benefit of the public, so that if any particular rules can be shown to nullify good transportation, undoubtedly they will be eventually removed, and as the executive officer in charge of the railway operation is usually a government employee of high engineering standing and reputation, many of the most unnecessary regulations will in any case be abrogated as knowledge of the real conditions of tramway enterprise progresses.

On the other hand, when the requirements are fulfilled the railway company is not harrassed by continual exactions. In this statement, of course, only the progressive countries in Central and Western Europe are included. In the Eastern and some of the Southern countries, where the governments are notoriously corrupt, a company has to be either allied with officialdom or have other means of defense against attack. But all evidence goes to show that outside of possibly one or two large cities, where the veniality of a certain class of politicians are well known, the franchise giving powers in the Central and Western countries of Europe are as incorruptible as anywhere in the world. All the conditions required of the company in the operation of its line are absolutely known before it commences operation, and there is nothing uncertain as to the amount of taxes which it will have to pay directly or indirectly for the privilege of running its cars. Furthermore, the courts and juries in the different countries do not have the same exalted idea of the money value of the victims of accidents, so that this item of expense is comparatively small. For instance, all that the combined tramway companies and municipal tramway undertakings of Great Britain and Ireland paid out during the year ending June 30, 1901, for accidents to persons was $255,000. Compare this with the damage claims to which American street railways are subjected. To cite one example from the United States: The Brooklyn Rapid Transit Company alone, in the year which has just passed, paid out for its accident claim department nearly four times this amount or the enormous sum of $1,044,745.

FARES AND FRANCHISES

The prevalent rates of fare for short distances are, to be sure, usually lower than in the United States, but, as has frequently been pointed out in these columns, the rate for any considerable distance is much higher. If the majority of lines abroad at all approximated in size the large companies in this country, the average fare would undoubtedly be higher. Roughly speaking, the average fare on the Continental tramways is 2 cents or 2½ cents for the first ⅝ mile to 1¼ miles (1 km to 2 km), and 1 cent to 1¼ cent for each additional kilometer. The result is that the companies which have suburban extensions get a rate of over 1½ cents per mile, which, it is needless to say, is considerably higher than is charged on most of the interurban electric railways in the United States.

Franchises in the European countries were freely granted up to ten years ago for long periods. This practice is not so prevalent as it was. As a rule franchises are now granted for from forty years to sixty years, after which the provision is usually made that the immovable property of the company, such as its track and buildings, but not its rolling stock, lapses to the city or State. This rule in some countries applies equally to all companies, whether they own their own power station or whether they rent power. As a result, most of the companies in the countries where this rule is in force purchase power from an allied or other corporation, to which, of course, this condition cannot apply.

POSSIBILITIES IN THE DIRECTION OF INCREASED TRAFFIC

The chief possibilities in the creation of a large net business in European tramway enterprises lie, first, in the low wages paid as compared with those in America, and, second, in the greater gross receipts which can be secured on many lines by the introduction of modern methods in railway operation and schedules, and by the construction of interurban and suburban extensions, which are practically unknown in Europe. It is believed by the most careful students of street railway operation that with the low fares charged for short distances, the average rides per capita in many of the larger cities in Europe could be greatly increased by a reform in the matter of schedules. It is, for instance, the practice in many cities to run most of the cars from one central point on shuttle routes, and then have, perhaps, one or two short belt lines, so that, as a rule, a long-distance traveler has to make two or three changes to reach his destination, and he has no guarantee that he may not have to wait a considerable time at each connecting point. Another common practice, where several suburban lines enter the city over the same piece of track, is to despatch a car for each route as well as a local car at practically the same time, so that they follow each other for a mile or two in a sort of train before separating, instead of running them at equi-distant periods and thus giving a better local service with the same number of cars. It should not be understood that these methods are universal,

for many cities, particularly in Germany, have a very fair car service. But the instances quoted are typical of too many systems, and experience has shown a number of instances where a live manager, by the introduction of modern methods in some of the medieval towns in Europe, has increased the traffic from 50 per cent to 70 per cent within a short time, and with no more rolling stock than was required under the former regime.

INTERURBAN RAILWAYS

Another opportunity offered at present in the European railway field, as stated, is in the direction of interurban electric railways. In spite of the immense development of these roads in the United States the number of them now in operation in Europe, that is, as they are understood in America, can be counted on the fingers of one hand. There are, it is true, a great many roads in all the European countries which are called "light railways," and which are usually operated by steam. They are, however, nearly always narrow gage, start from the outskirts of one city and terminate in the suburbs of another city, so that a through passenger has to make at least two changes to or from the tramways at either terminal, and sometimes walk a considerable distance as well. The idea of using the same gage as the tramway system in both terminal cities, of making physical connection with them and of running through cars according to the American method is one which has yet to be learned in Western Europe. Nevertheless, the large cities are comparatively close together, and there is a large population between them. While the same number of rides per capita could not be depended upon, probably, for this interurban population, it should be remembered that nearly all the different governments in Western Europe have in the past shown a great tendency to encourage the European substitute for the interurban railway, i. e., the "light railway." This encouragement has very often gone so far as to include the payment of an actual subsidy for their construction, on the ground that it is a benefit to the agricultural population. There is no reason why a modern electric interurban line should not be even more worthy of government assistance.

WAGES

Reference has been made to the lower rate of wages which is paid in Europe. The wages for the same service will be found to approximate between 40 per cent and 60 per cent those customary in this country. As the platform charge in the United States is usually in the neighborhood of 70 per cent of the total cost of operation, the effect of a reduction of one-half in this item alone should have a marked effect on the operating cost. As an example the following schedule of wages of tramway employees paid in Geneva is given. These, it should be remarked, are not especially low as compared with other European cities, as Geneva is not noted for being a particularly cheap city to live in.

WAGES IN GENEVA

	Number of hours	Pay per hour (cents)	Average per day or month
Motorman	12	7 to 10	$1.00 a day
Conductor	12	7 to 10	1.00 a day
Inspector	12	———	30.00 a month
Laborers	10	7½ to 9	.80 a day
Track foremen	10	9 to 10	.95 a day
Head track foreman*	10	9 to 12	1.15 a day
Lineman	10	8½ to 10	.95 a day
Line foreman	10	9 to 11	1.00 a day
Head line foreman**	10	13 to 15	1.40 a day
Machinist	10	9 to 13	1.00 a day
Blacksmith	10	9 to 12	1.05 a day
Blacksmith's helper	10	8 to 8½	.84 a day
Car painter	10	11 to 13	1.20 a day
Track engineer	—	———	80.00 a month
Overhead engineer	—	———	80.00 a month

Night work is paid 50 per cent extra.
* One in charge of from 300 to 400 men.
** One in charge of 100 men.

AVERAGE SPEED

The low rate of wages is counteracted in some respects by the slow speed to which the cars are held down by municipal enactment in most cities, and which is undoubtedly necessary in many on account of the natural conditions presented by the narrow streets. The usual maximum legal limits are 6 miles to 10 miles an hour within the contracted city streets, and 12½ miles to 16 miles an hour on the country highways. It is doubtful, however, whether the average speed of the cars is very much less than that in the interior of many American cities. This is due to the fact that all of the foreign tramway companies have adopted the very commendable practice of not stopping their cars at every street crossing to take up passengers, but only at certain designated points, which are indicated by a red sign on the corner building or on one of the poles. These stopping points average from ¼ mile to ½ a mile apart, and the police regulations, which are sometimes considered rigorous when applied to the companies, are equally strict as regards the public, and any person who attempts to board a car in motion at a point which is not the regular stopping point is liable to arrest. The result is that not only the average power consumption per car mile is cut down to an average of considerably less than 1 kw-hour, but the effect on the average speed, caused by the municipal regulations on maximum speed, is largely counteracted by this practice. An interesting commentary on the military discipline to which all the male inhabitants of the Continental countries become accustomed through a service of from one to three years, is shown by the ease with which the regulations as to boarding a moving car, as well as that of the crowding of cars and other rules of the company are enforced. The public in this respect offer a striking comparison to the average American passenger when addressed by a conductor or other person in uniform, and are prompt to do as they are told. Moreover, the police and the courts usually act vigorously in cases of infractions of the company's rules, and fines and imprisonment are promptly dealt out to the obstreperous passenger or the one who tries to cheat the company out of a fare and is detected. The effect of a military training is also shown to a large extent in the deportment of the employees themselves to the public and to their superior officers.

METHOD OF OBTAINING A FRANCHISE

To those who are interested in the subject some particulars as to how a street railway franchise is obtained in a foreign country will be of interest. The methods vary, but as that in France is perhaps as typical as that in any other country the procedure in that country will be described.

The first step after incorporation is the preparation of a dosier or complete description of the proposed undertaking. If the route lies entirely within the city, three copies have to be presented to the municipal authorities for their sanction. If the route lies partly within and partly without the city, but in one department, three copies of the dosier have to be submitted to the authorities of the department as well as to those of each municipality through which the route extends, those for the municipality being only such sections as pertain to the plans or route within its jurisdiction. If the road extends through two departments copies must also be filed with the national authorities.

The dosier, as stated, is simply a collection of data descriptive of the plans of the company, and includes the following:

First. An accurately drawn plan of the route to a scale of 1:80,000.

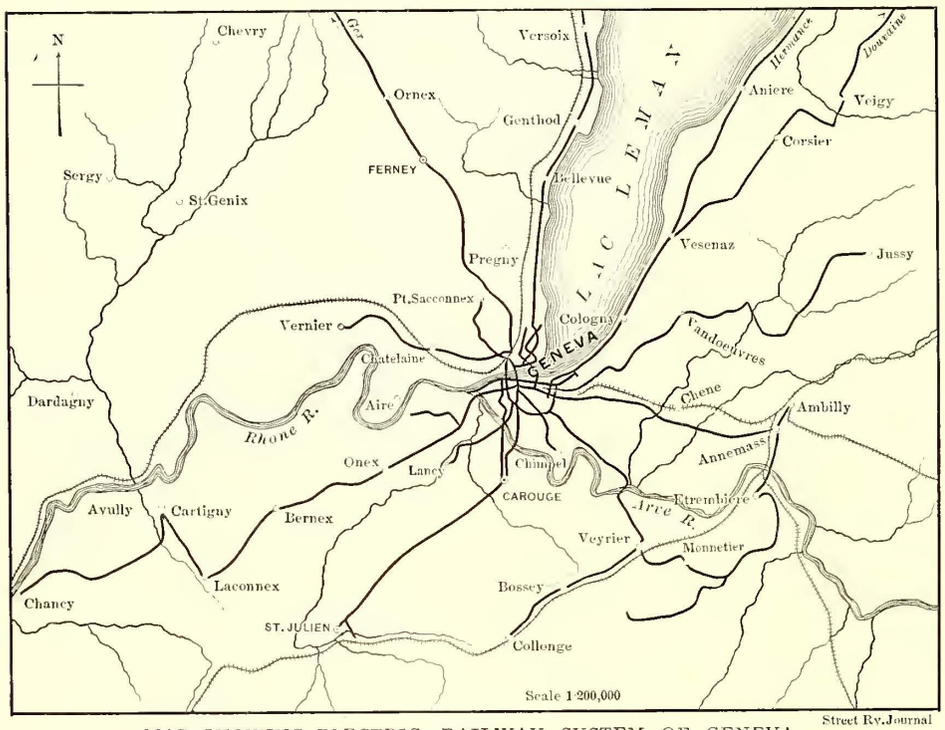
Second. A general plan of the public roads for the use of which permission is asked. On this plan any deviation of the road from the highway must be indicated. The map must be on a scale of 1:10,000, and must give the names of the proprietors of the abutting property.

Third. A profile of the route, drawn to a horizontal scale of 1:4000, and to a vertical scale of 1:1000.

Fifth. A cross section of the proposed track to a scale of 1:50, having indicated on it the profile cross section of the cars to show the clearance on each side.

Sixth. A drawing to a scale of 1:200 of each crossing of the tramway tracks with steam railroads or the tracks of other tramway companies.

These drawings are usually prepared in the form of tracings and are then reproduced by the phototype or zinc process for as many additional copies as may be necessary. As can be imagined this is rather an expensive undertaking, and in a recent undertaking in which an American syndicate is interested the cost of reproducing these drawings alone amounted to $5,000.



MAP SHOWING ELECTRIC RAILWAY SYSTEM OF GENEVA

In another document the company must describe the service which it proposes to conduct, that is, whether passenger, light express or freight, together with particulars as to location of any passenger or freight station which it intends to install. It must also state the minimum curve radius, the maximum grade, the system of track sub-construction to be employed, maximum width of rolling stock, including any projections such as grab-handles or sash rail, any proposed interference with the use of the public roads or the use or access to private roads during process of construction or afterwards, the minimum distance between the tracks and of cars while on the road, also between the cars, and any existing buildings, the maximum length of trains, the maximum speed of trains, the minimum number of trains to be run during the day, etc.

After these plans are prepared and copies of them are filed with the mayors of each of the communes through which the road passes, and are exposed by the latter to public inspection for thirty days, constituting what is called an enquête d'utilité publique. In the case of an interurban road 15 miles or 20 miles long the number of communes involved sometimes amounts to nearly 100, with all of whom plans have to be filed, and each of whom conducts an independent enquête, as do also the department authorities if they are involved.

As a result of this "inquiry" objections to the proposed plans may be made by abutting property owners or others interested. These are considered by the mayors, who, as a result, may suggest certain modifications in the plans to the company. After these plans are discussed and agreed to and the modifications made, a revised set of plans is submitted and a final enquête is held at the mayor's office at which the plans are again exposed to public inspection for thirty days. If there should be a disagreement between the company and the commune authorities, it is submitted for decision to a special committee appointed by the legislative body of the department, which has the final authority in the matter, provided the road is built entirely on the highway. If the road is built partly on its own right of way the plans have to be submitted to the national authorities of Paris, where they must receive the approval of the Minister of Public Works. This usually takes from three months to four months. A deposit must then be made by the company of $320 per mile of conceded route. It must then submit plans of construction and can go immediately to work. If the original plans were in good shape and satisfactory there is practically never any objection to the second plans. Three-fourths of the deposit made by the company as a guarantee of its good faith is returned when the road is started.

A franchise in France is called a cahier des charges, and is signed by the railway company and also by the authorities. It usually includes a clause, to the effect already mentioned, that at the end of the concession all track and immovable construction belonging to the company pass over to the authorities. If not otherwise stated in the franchise the State also reserves the right to lease the property at the end of fifteen years. If it does so the amount of annual payment to be made as rent is obtained by taking the net earnings for the previous seven years, omitting the lowest two years in this list and taking the average of the other five. This average represents the amount which the authorities will pay the company during the duration of the franchise.

STATISTICS FROM GENEVA AND LILLE

Possibly some actual municipal conditions in tramway operation will be of interest. For this purpose two examples will be taken, an existing city property in Geneva and an extensive proposed interurban property in Lille, France, which will be perhaps of more than usual interest from the fact that both of these properties are largely owned by American capital. A map of the Geneva system is presented herewith. It is a consolidation of three existing companies, made two or three years ago, and a concession was granted to the consolidated company on July 10, 1900, for sixty years. The company has 14.75 miles of track in the city and suburbs, and 70 miles of outside lines.

The population of the city of Geneva proper is 58,881, and with its four suburbs 105,000, or 7817 per mile of track. The total population of the towns directly on the suburban lines is 18,930, or 270 per mile of track. The total taxes paid are 5 per cent on the net receipts with a minimum payment of $1,200. Below will be found some statistics of the Geneva lines, in reference to which it should be stated that during most of the eighteen months preceding May 31, 1902, the road was in process of conversion from horse to electric power. H. P. Bradford, the present manager of the company, was appointed in August, 1902, or since the date of the last statistics, and has introduced a number of changes which, it is expected, will increase the earning power of the system.

	1900	1901	Jan. 1 to May 31 1902
Passengers carried	9,713,711	11,360,467	4,718,294
Gross receipts	$315,558	$354,999	$140,900
Gross receipts per car mile...	$0.2613	$0.2104	$0.1607

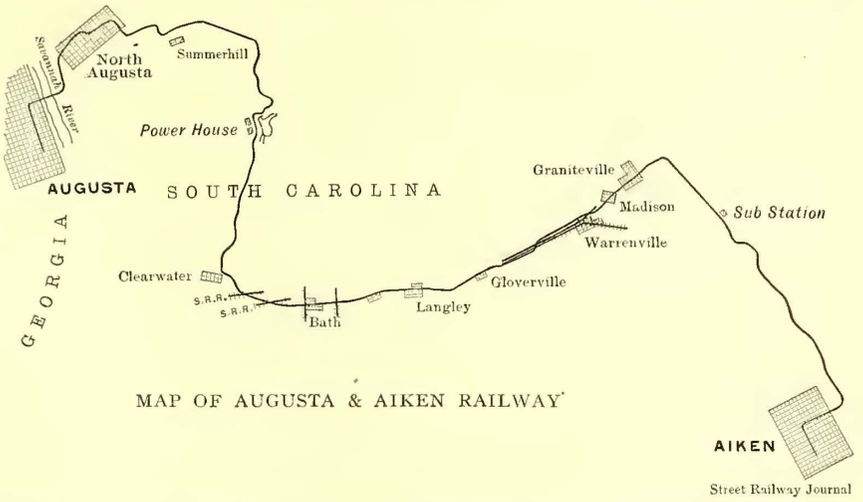
Statistics of summer service, season of 1902:

Total length of lines, 137.77 km or 86.11 miles.
Average number of cars in service, 68.
Average number of hours in car day, 14.4.
Average run per car per day, 150 km or 94 miles.
Total runs per day, 10,224 km or 6390 miles.
Total number of crews in service, 95.
Total number of crew hours, 1054.
Average pay of motormen and conductors per hour, 40 centimes or 8 cents.
Total daily cost of platform labor, 1054 x, 40 centimes or 8 cents, 843 francs or $168.60.
Daily cost of labor, including days of rest, 986 francs or $197.20.
Total cost of platform labor for one motor car, including days of rest, 0.96 franc per car km or 30.72 cents per car mile.
Total cost of platform labor for train of one motor car and one trail car, including days of rest, 1.06 francs per car km or 33.92 cents per car mile.

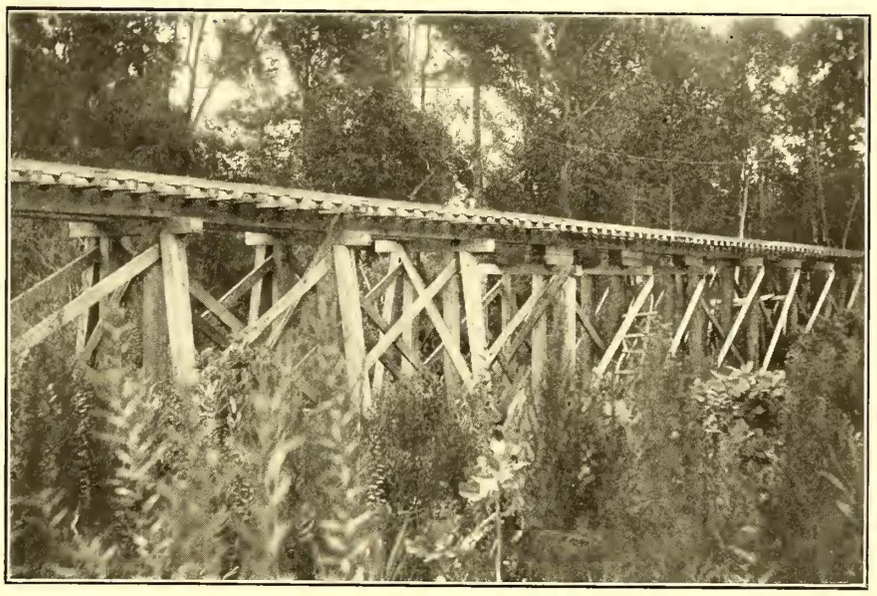
The Lille concession referred to above is a connecting line between Lille, Roubaix and Tourcoing in the coal region of France, and probably the most densely populated part of the country outside of the large cities. The enterprise when complete will include 275 miles (380 km) of track. The cities of Lille and Roubaix are separated only 6 miles to 8 miles apart, and have no convenient means of communication, although they have a combined population of 500,000, while the total population within a radius of 8¼ miles (15 km) of Lille is about 820,000. The fare permitted by the cahier des charges is 2 cents for the first kilometer and 1 cent for each following kilometer. The company is planning to build at once 187 miles (300 km) of track, and will gradually complete the remainder of the system. A large station will be built near the coal mines for supplying power. A broad boulevard has recently been completed between the cities of Lille and Tourcoing at a cost of $2,300,000, and the company has secured the right to build an electric road on this highway. The cost of the construction will be about $7,000,000. Coal costs from 12 francs to 16 francs, or $2.40 to $3.20 per ton, on account of the near proximity of the coal fields. Up to the present time the only means of local transportation, outside of a horse railway system in Lille, has been that provided by the steam trains.

THE AUGUSTA & AIKEN RAILWAY

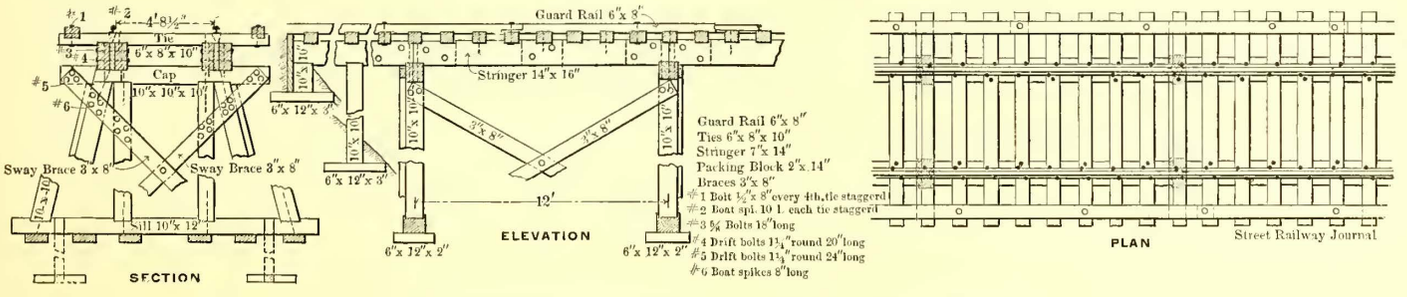
An effective illustration of the influence of the electric railway upon the development of the New South is afforded by the Augusta & Aiken Railway, which has lately been completed, and is even now recognized as an important factor in the commercial and social life of the community. This line penetrates a section that has heretofore enjoyed very little advantage in the way of transportation facilities, and much of the country reached by it has never before had any service whatever. As a result the enterprise has infused a new life into the locality, and has revived the glories of ante-bellum days. Long cherished hopes of making Aiken a favorite winter resort for Northern people are apparently about to be realized, as are also the prospects for developing the great natural resources of the immediate neighborhood.



MAP OF AUGUSTA & AIKEN RAILWAY



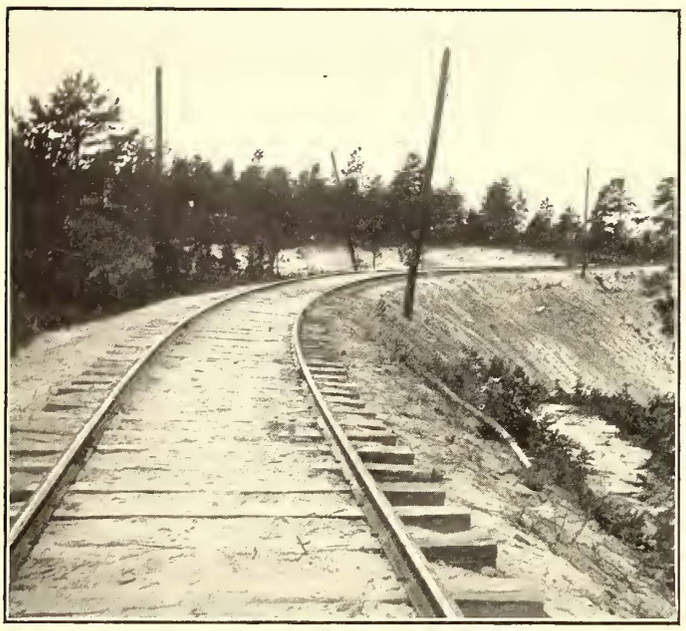
TYPICAL VIEW OF CONSTRUCTION—TRESTLE THROUGH SWAMP LANDS

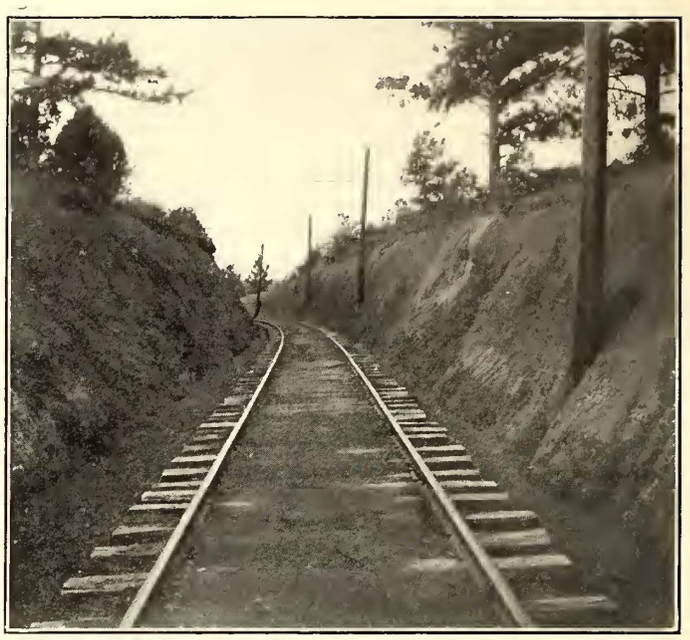


PLAN, SECTION AND ELEVATION OF FRAMED TRESTLE

Taken as a whole the foreign situation is in such a condition that, despite certain and undeniable drawbacks, it is worth the consideration of capitalists seeking investments in tramway enterprises.

A glance at the map of the line, which is presented herewith, shows that the route follows a very irregular course between Augusta and Aiken, and the accompanying views, representing scenes along the railway, convey some idea of the character of the country and the difficulties encountered in laying out and building the road. The project was undertaken by the North Augusta Electric & Improvement Company, a syndicate engaged in the development of the country through which the line passes. This corporation owns 7000 acres of land in South Carolina, just across the Savannah River from Augusta, and it is also interested in many of the industrial enterprises of the vicinity. The natural scenery has attracted many wealthy Northern people to this section, and the presence of beautiful long leaf yellow pines in abundance not only adds to the charm of the place but has secured for it a high standing as a health resort. The old town of Summerhill was the summer home of rich Charleston and Savannah citizens before the war, and Aiken County is now becoming a favorite resort for wealthy Northerners in the winter. W. C. Whitney has his stables at Aiken, and polo and other outdoor sports, for which this locality is well adapted, attracted a large and fashionable throng of pleasure seekers this winter.

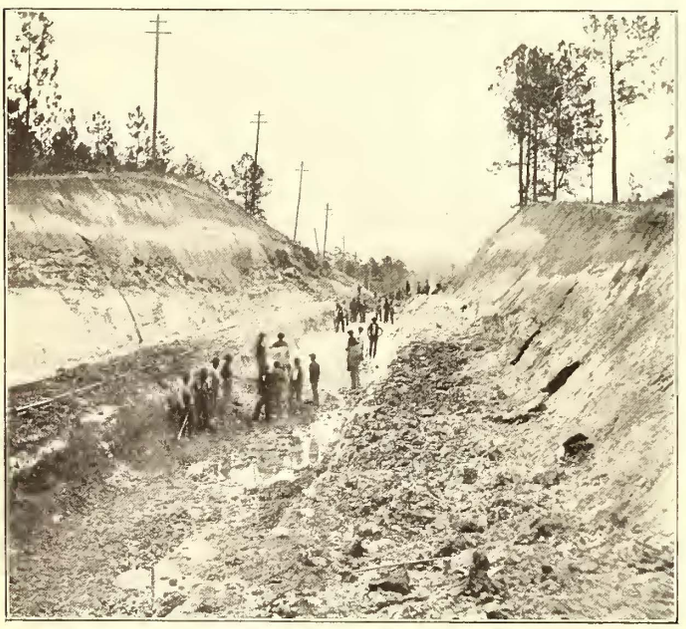




TYPICAL VIEWS OF ROAD CONSTRUCTION

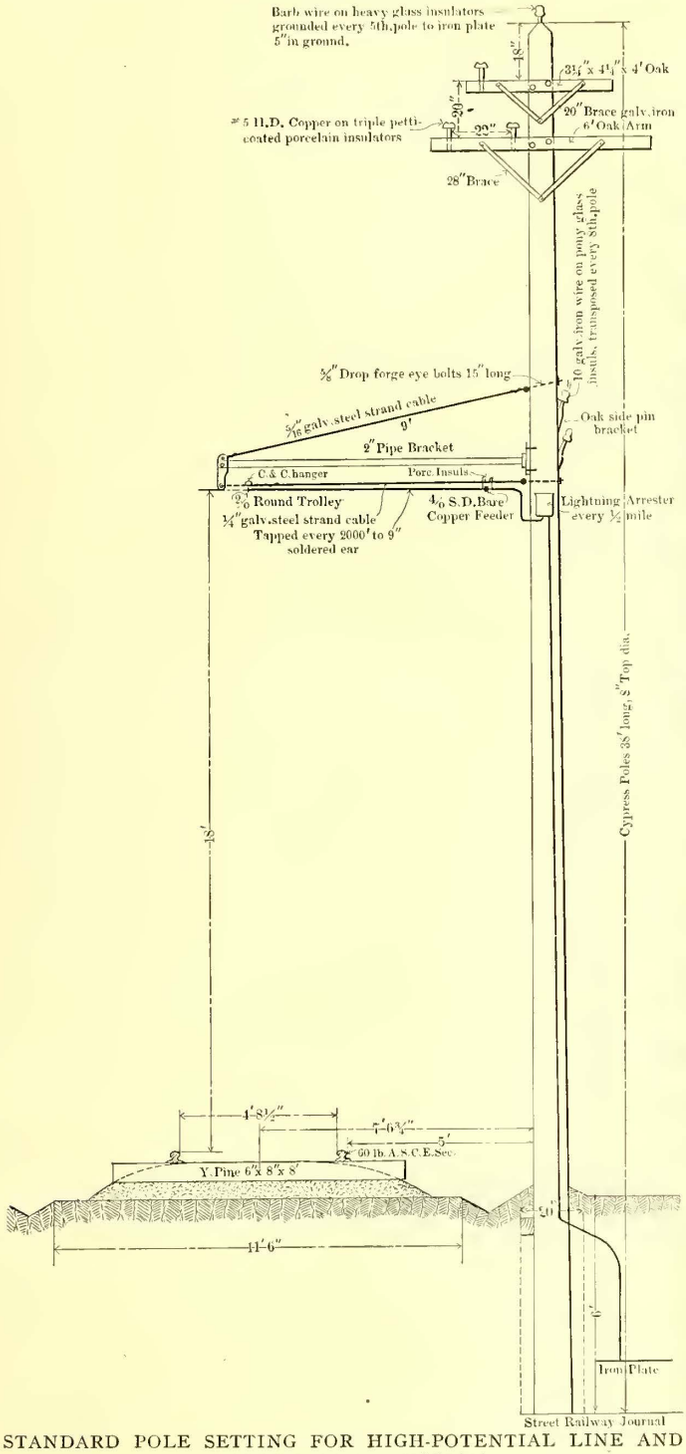
In laying out the route a ridge of hills overlooking the Savannah River valley gave rise to severe engineering problems, but with the idea of developing the company's land the present line was finally adopted after 150 miles of preliminary surveying had been done. For the first 10 miles the road passed through land belonging to the North Augusta Company, which is being rapidly developed. The location follows as closely as possible the contour of the land, and the grades do not exceed 3½ per cent.

As shown by the map the railway starts at the center of Augusta, on Broadway, and utilizes the tracks of the Augusta Railway Company to McKinnie Street, where it branches to the right on its own track, and crosses the new steel bridge over the Savannah River to North Augusta. This bridge was built by the company and deeded to the city of Augusta. From this point the line immediately commences to climb the hills of South Carolina. Reaching an elevation of 400 ft. above the river it follows a fertile plateau through the company land for



PREPARING THE ROADBED

several miles, and finally traverses a ravine towards Clearwater, at which town it enters Horse Creek Valley, which is famous for its cotton mills. Going up this valley it passes



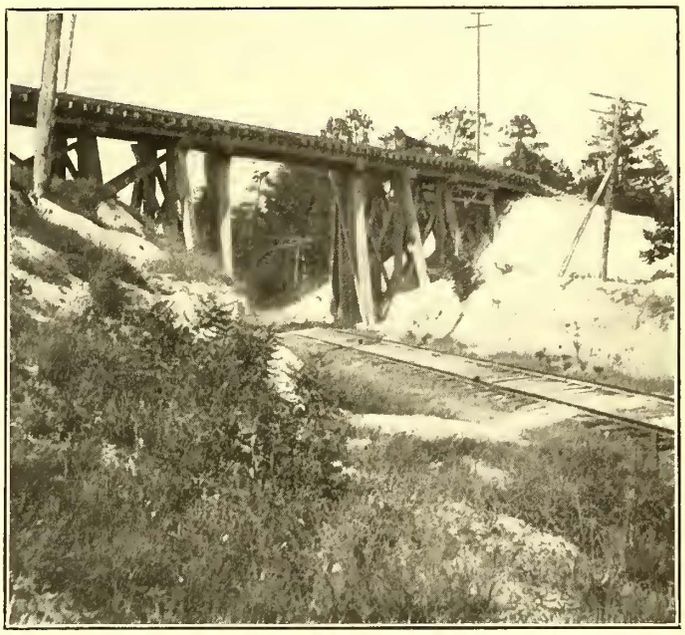
STANDARD POLE SETTING FOR HIGH-POTENTIAL LINE AND TROLLEY CONSTRUCTION

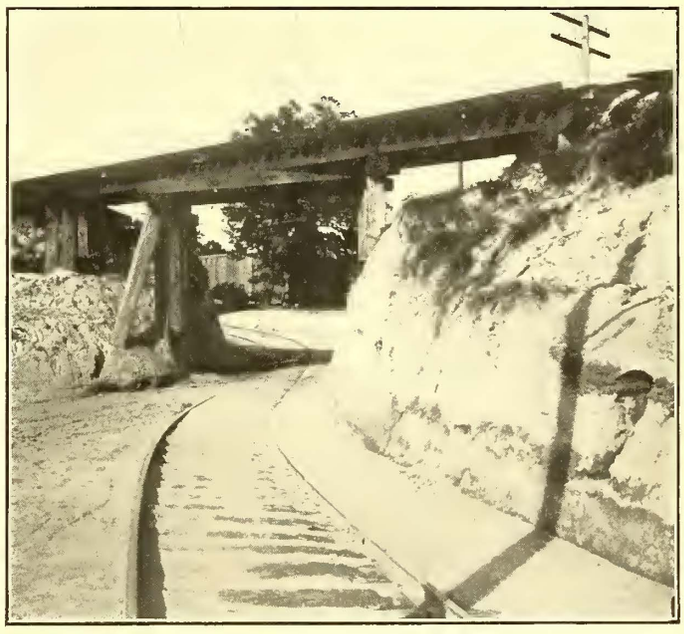
through Clearwater, Bath, Langley, Gloversville, Warrenville, Madison and Graniteville, and thence on to Aiken, a total length of 25 miles.

Bath, Langley, Warrenville and Graniteville have cotton mills containing thousands of spindles and employing an army of operators. These mills were originally operated by water power obtained from Horse Creek, but the demand soon increased beyond the capacity of the power available from this source, and now the total water-power utilized amounts to only one-fifth of the total power consumed. Formerly the output of these mills was shipped North to be bleached, as water sufficiently clear and pure for bleaching purposes is only found in few places in the United States, but of late excellent water has been found at Clearwater, and now a large bleachery has been erected at this point, which takes the combined output of all the mills of this section.

TRACK AND OVERHEAD CONSTRUCTION

The Augusta-Aiken road has been built on standard steam railway specifications, with easy grades and curves of large radius, to permit high-speed in passenger service and enable the company to engage in the hauling of freight. The line passes through some exceedingly marshy ground, which made





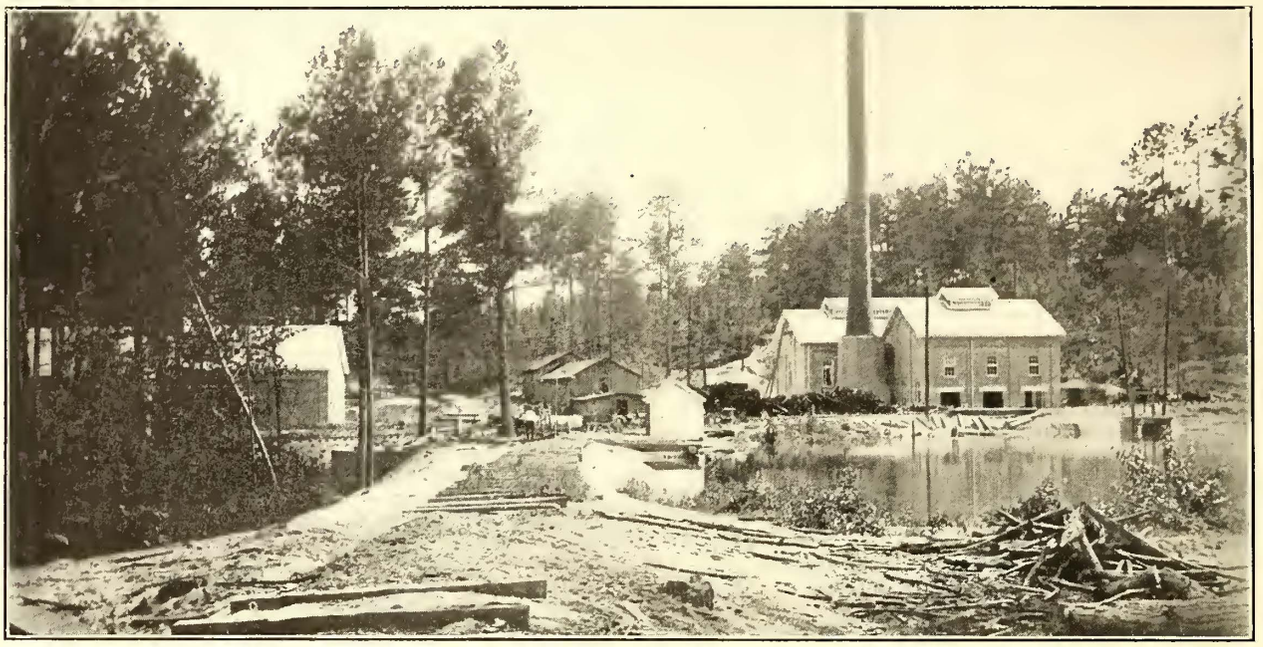
CROSSING SOUTHERN RAILWAY STEAM ROAD ABOVE AND BELOW GRADE

roadbed construction very difficult. Thousands of yards of mud had to be hauled out and replaced with good clay and gravel, and in some places the ground had to be reinforced by driving piles, and planking over the piles after the manner of construction commonly used at New Orleans. At several points along the route fills 40 ft. high and several hundred feet long have been made, and in other places cuts over 50 ft. deep were necessary. The fill at Horse Creek is half a mile long. The curves are all of large radius, permitting of high speed, and there are no broken back curves in the entire route.

It will be noticed by reference to the map that the electric line crosses the Southern Railway at two points. The latter company opposed crossing at grade, and to avoid litigation and delay incident thereto, the Augusta & Aiken Railway Company decided to cross above and underneath these steam lines,

entailing an additional cost of nearly $60,000. To do this heavy bridges and trestles were built, and a fill at one point, 2400 ft. long and 30 ft. high, was made. These features are fully illustrated.

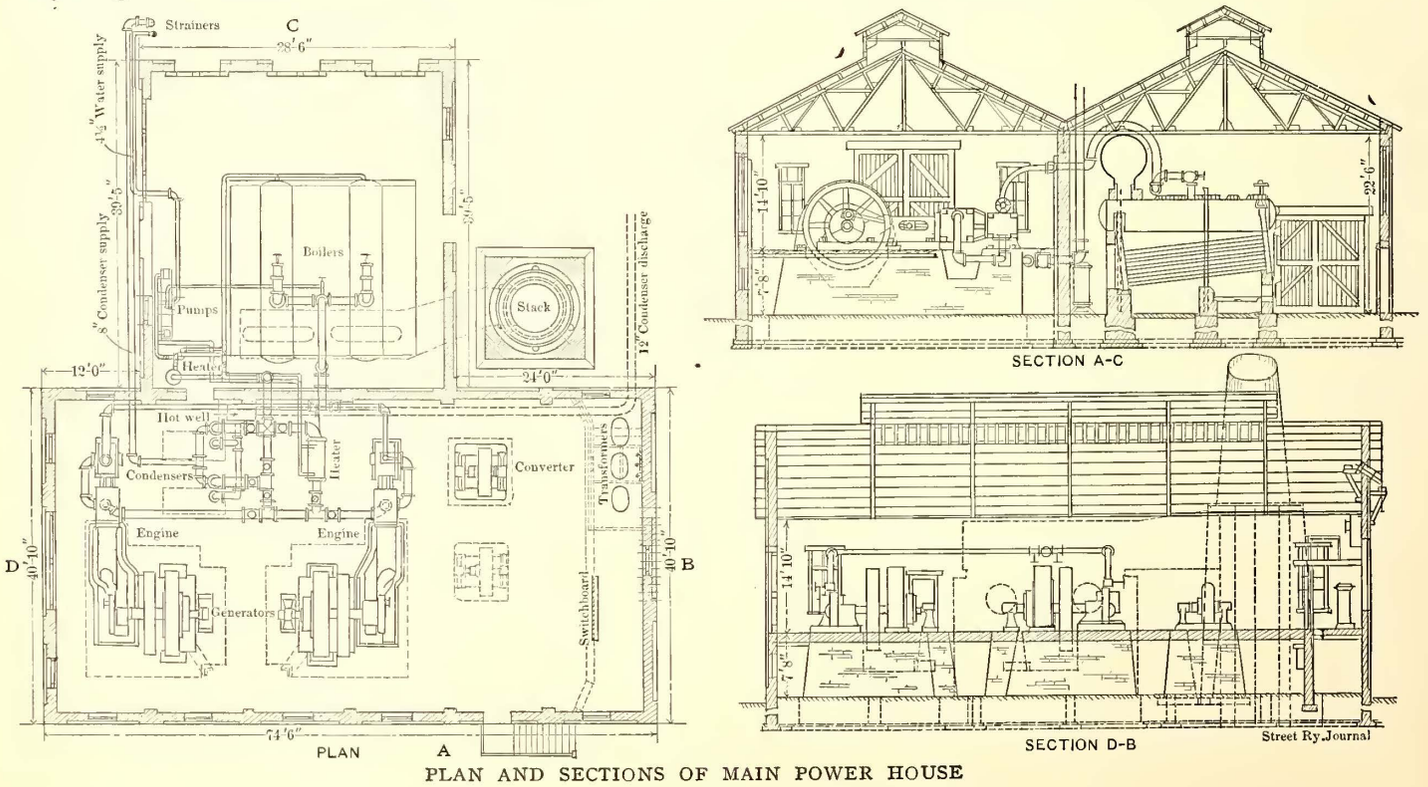
In establishing the permanent way steam railroad construc-



MAIN POWER HOUSE, CAR HOUSE AND SHOPS

tion methods have been followed. The roadbed is ballasted, and yellow pine ties, 8 ft. x 8 ins. x 6 ins., are set at 2-ft. centers. Upon these 60-lb. T-rails, A. S. C. E. section, with standard steam railway frogs and switches, have been laid. The H. P. Brown solid copper bonds have been used throughout. Extra heavy bridges and trestles have been built, with the view of sustaining the most severe service. The character and extent of the trestle work are shown in the views presented, and the details in the plan, section and elevation herewith. Timber used for trestles is all selected long-leaf yellow pine, put up with the greatest care. It is all drift-pin construction, steel pins being used for the purpose.

The method of overhead construction is clearly shown in the diagram and the views of the line. Cyprus poles, 38 ft. long and having an 8-in. top diameter, are used for the pole line. A 0000 feeder is carried continuously from one end of the line to the other, and from the power house and sub-station in either direction, additional feeder is run for about 2 miles, This low-tension feed wire instead of being placed on cross arms or brackets, is suspended upon a porcelain insulator, through which the span-wire is run. It makes a flexible suspension, is easy to string and keeps the bracket arm in the socket. The trolley wire is carried 18 ft. above the rail. The method of suspension is clearly illustrated in the diagram, as are also the details of the transmission line. The high-tension line is not transposed, and is protected by barb wire strung on glass insulators and grounded thoroughly every few hundred feet. Lightning arresters have been placed every half mile along the line. During the construction period and before the sub-

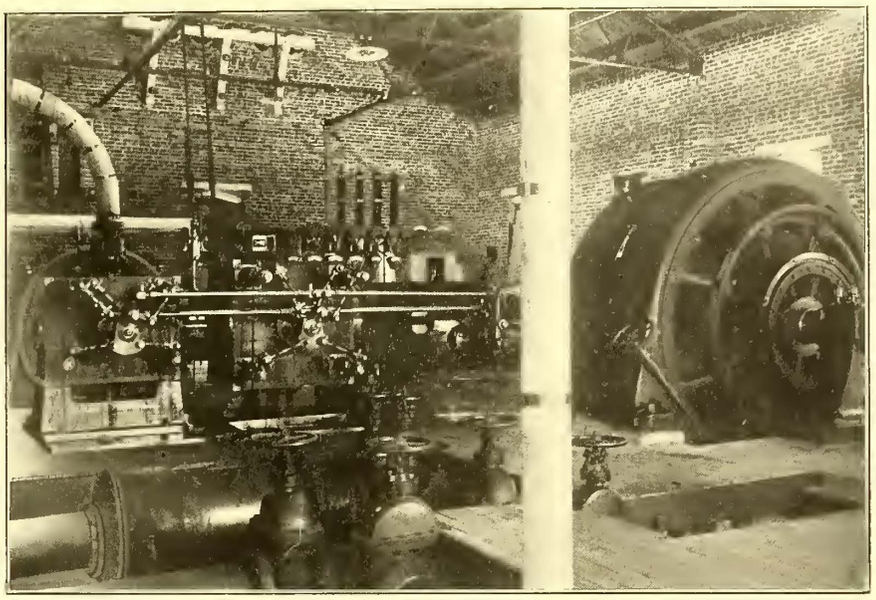


PLAN AND SECTIONS OF MAIN POWER HOUSE

station had been put into operation work cars were run in Aiken, a distance of 18 miles from the main station, which was furnishing direct current into the line, showing how carefully the line was insulated and how well the track was bonded.

MAIN POWER HOUSE

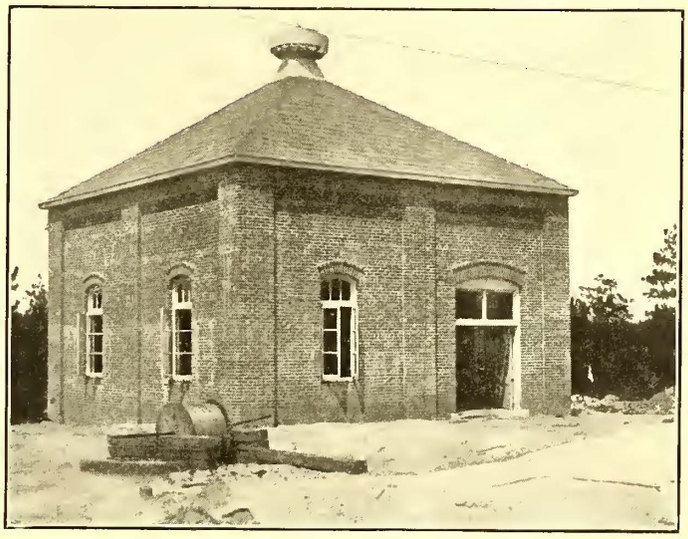
The power house is located about 6½ miles from Augusta, on the stream furnishing the source of supply for the Clearwater bleachery, which is absolutely pure and so cool that the most excellent results are obtained in condensing. The location of the plant is marked on the map, and the character of the locality can best be judged from the exterior view which is also presented. A distinguishing feature of this construction is the self-supporting steel stack, 125 ft. high and 6 ft. in diameter, resting on a cement foundation 15 ft. sq. at the bottom. The plan and sectional view of the power house show the arrangement and location of the machinery. The main building has a frontage of 74 ft. 6 ins., and extends back 80 ft. 3 ins. The engine room, which occupies the entire front of the main building, is 40 ft. 10 ins. deep, and the boiler room 39 ft. 5 ins., but the latter is only 38 ft. 6 ins. wide. The steel stack alluded to is alongside of the boiler room and back of the engine room. In the construction of this plant the foundations were made of concrete and the walls of brick. The machinery foundations are built of brick laid in Portland cement mortar. Steel roof trusses with slate are used, and the buildings are as nearly fireproof as it is possible to make them.



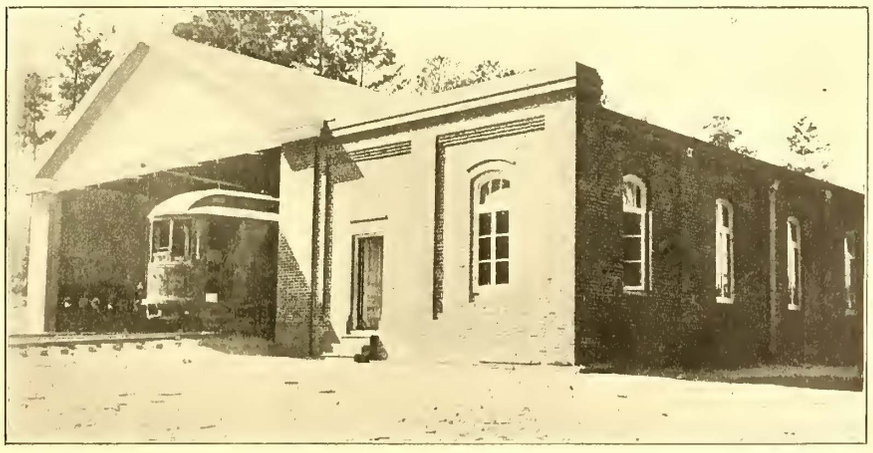
ENGINE ROOM IN MAIN POWER PLANT

BOILER PLANT

The general arrangement of the machinery is clearly indicated in the plans. Two 450-hp compound condensing engines, made by Clark Brothers, Belmont, N. Y., are installed. These are of the bored guide type with Rites governor. The valves are of the usual Corliss type, but without the releasing gear. Directly connected to each engine is a 300-kw General Electric direct-current railway generator, running at 150 r. p. m. These machines furnish power for that end of the line at 575 volts to 600 volts. There is also a 200-kw inverted rotary in the main station, and three 80-kw oil-cooled transformers. Direct cur-

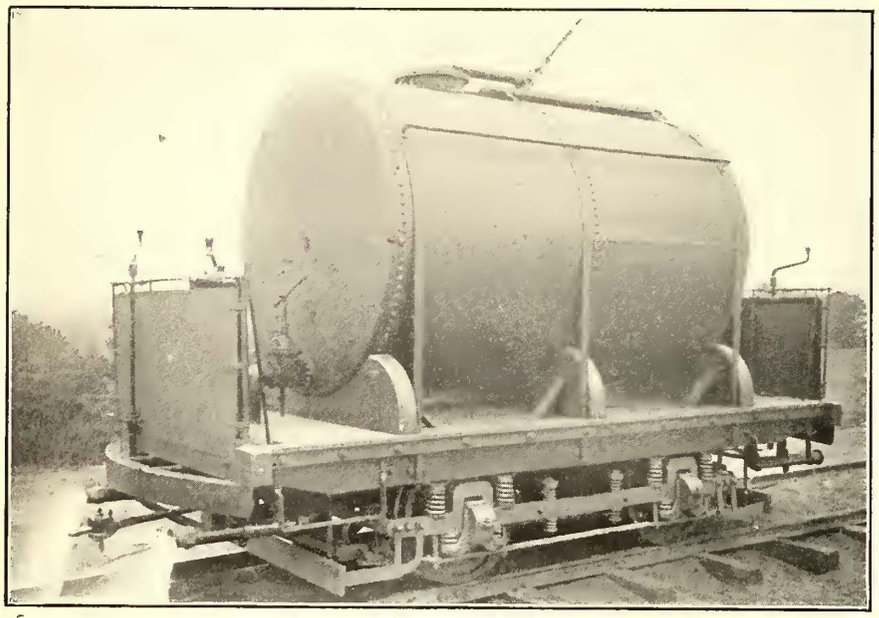


SUB-STATION



CAR HOUSE AND OFFICE

rent at 575 volts is delivered to the inverted rotary and is transformed into alternating current. It is then passed through the step-up transformers and changed into three-phase current at 13,200 volts, at which it is sent out over three No. 5 copper wires, to the sub-station, 12 miles distant, to feed the Aiken end of the system. The site of the sub-station is indicated on the map.



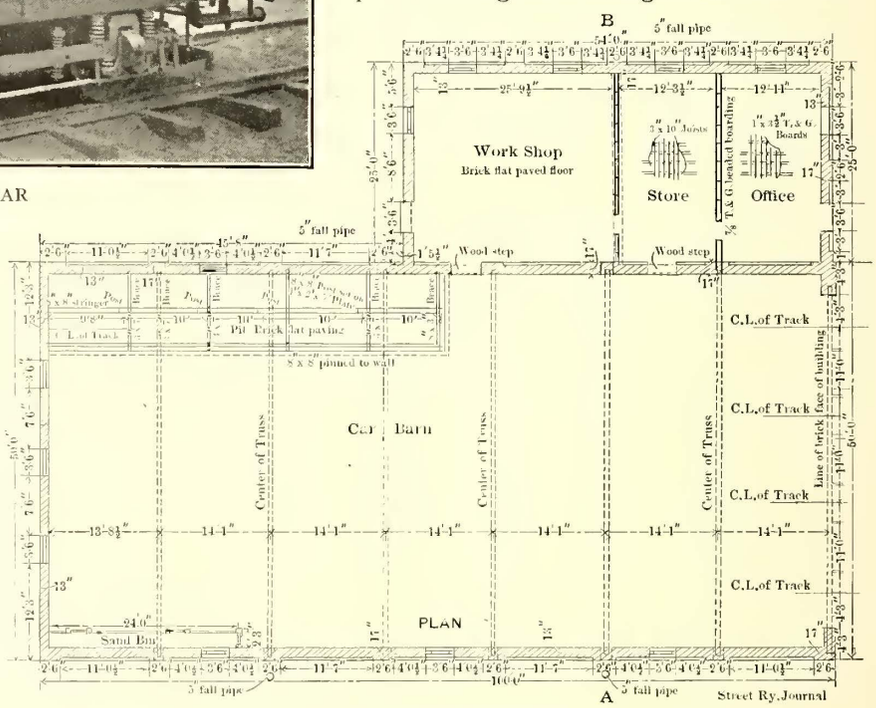
2500-GAL. SPRINKLING CAR

The switchboard for both high and low-tension currents is of the standard pattern, with some modifications in the connections to cover conditions imposed by the engineer. High-tension wires are carried out of the building through 15-in. terra cotta pipe, placed on an angle in the wall over the switchboards. This makes a neat and inexpensive construction, it is claimed, as well as a substantial method of handling the wires safely.

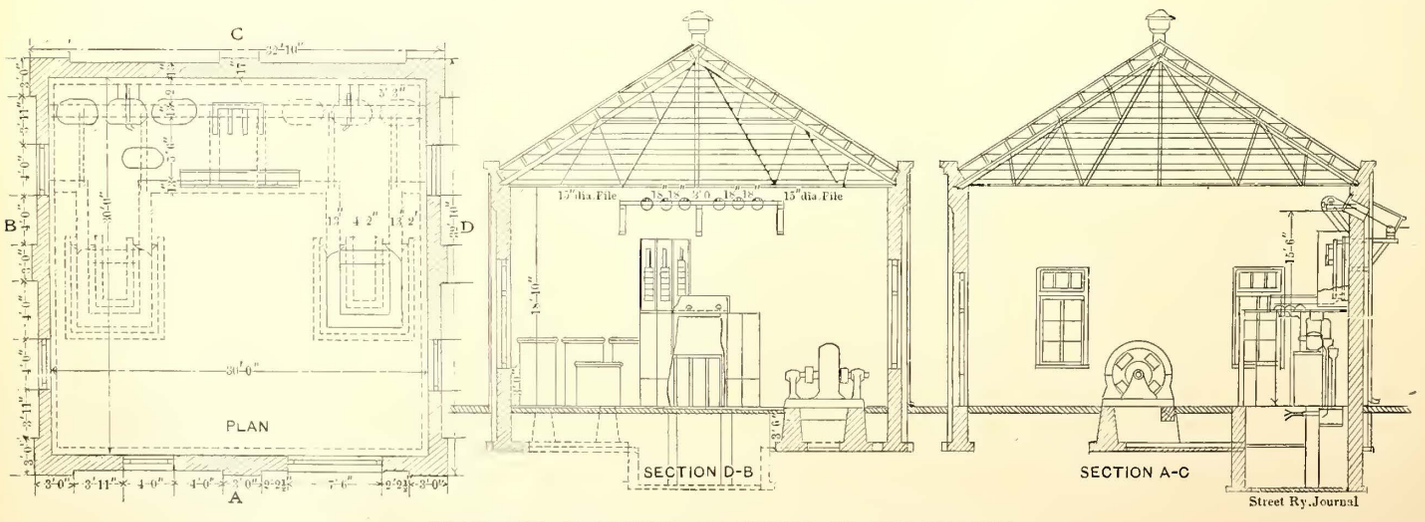
The boiler room is on a level with the engine room basement, and the relative arrangement, as well as the plan of steam piping, are shown in the cuts. Steam is furnished to the engines at 130 lbs. pressure by two 300-hp watertube boilers of the Heine type, furnished by the E. Keeler Company, of Williamsport, Pa. Duplicate feed-water pumps are installed, and the feed-water piping is arranged so as to allow the water to be forced through a main heater, located in the exhaust lines of engines to condensers, and an auxiliary heater, located in the boiler room, taking exhaust steam from pumps and condensing. All pipe work is designed for heavy pressure, and Schutte valves are used on the steam lines. Smith-Vaile jet condensers and a 325-gallon fire pump were furnished by the Baker Engine & Machine Company, of Philadelphia.

CAR HOUSE, OFFICES, STOREROOM AND SHOPS

Near the power house is the general headquarters, including the car house, containing four tracks with a pit the entire length of one track, and another pit extending across all four tracks near the front of the building, so that cars on any track can be examined underneath. It is of the same general design of fireproof construction as the power house. Adjoining this are the offices, store rooms and shops of the company. A view of the front of the car house is presented herewith, and also a plan of the structure showing the division of space and the general arrangement. The combined buildings have a 75-ft. frontage, of which space the car house takes 50 ft. with a depth of 100 ft. The work shop occupies a space 25 ft. x 25 ft. 9½ ins., and the store room 25 ft. x 12 ft. 3½ ins. The offices are 12 ft. 11 ins. deep, and are very conveniently arranged.



PLAN OF CAR HOUSE, SHOPS, STOREROOM AND OFFICES



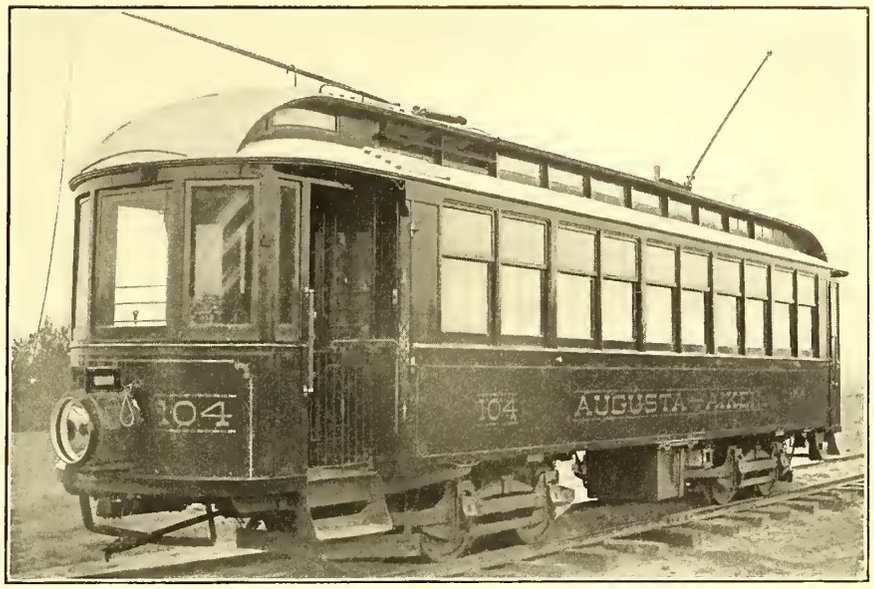
PLAN AND SECTIONAL DRAWINGS OF SUB-STATION

SUB-STATION

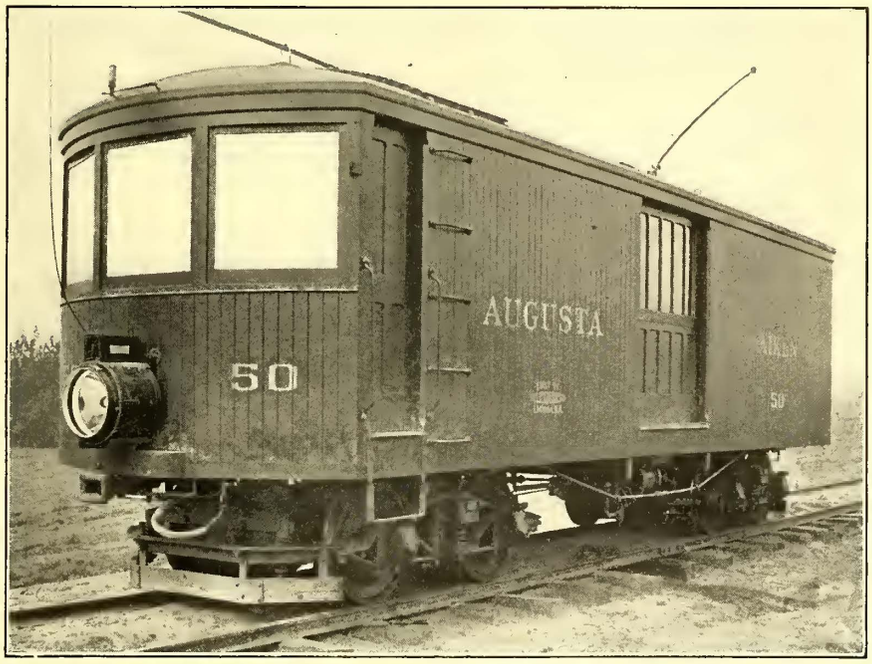
The sub-station is located between Graniteville and Aiken, and contains a 200-kw rotary converter, and a duplicate of the transformer apparatus at the main station reversed, so that the voltage of the current passing through this apparatus is lowered instead of raised, as in the case of the main power house. An exterior view of this station, together with a plan and sectional drawings are presented. The building is 31 ft. sq., and 35 ft. from the floor level to the highest point.

PASSENGER AND FREIGHT CARS

The rolling stock for this road, it is claimed, comprises the handsomest passenger cars in the South. Views of the passenger and freight cars are presented, as well as a 2500-gallon sprinkling tank, which, owing to local conditions, is a very important part of the equipment.



SEMI-CONVERTIBLE CAR



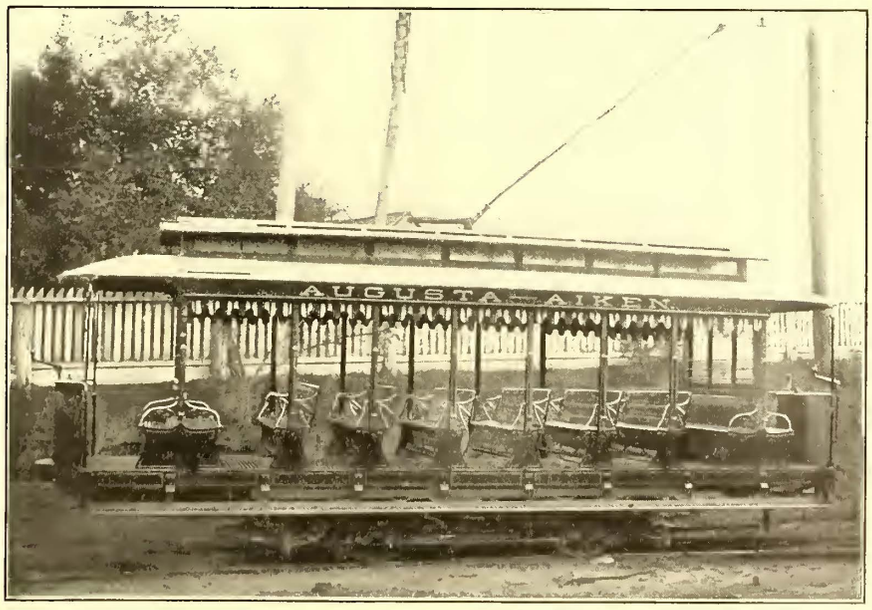
FREIGHT CAR

There are seven 40-ft. semi-convertible cars with center aisles made by the Laconia Car Company. These cars are vestibuled and have Wood's folding gates at each step. They have straight sides and the steam-car type of roof. They are finished in quartered oak, with quartered oak ceilings. Ten Wheeler reversible rattan seats on a side provide a seating capacity for forty people. There are ten double sash windows on each side, both sashes arranged to drop flush with the window stool, which is 28 ins. from the floor, making a very comfortable car for summer use. The curtains are of pantasote for side windows and also for end doors and windows in vestibules. There are double sliding doors at the ends of the car. Each equipment includes Wagenhall arc headlights, consolidated heaters, Christensen air brakes, and two General Electric motors; also the Laconia No. 8-B high-speed double truck with swing bolster, fitted with 4-in. axles and 33-in. double plate wheels. There are also two standard ten-bench open cars with closed ends, built by the same company, finished in white ash, with seats of white maple, ceilings of white birch, curtains of duplex duck running to the floor, grab handles of ash, and all trimmings of solid bronze highly polished. These cars are mounted on Brill E-21 trucks.

One 30-ft. box-freight car of 25 tons capacity, with Laconia "Diamond" double trucks, and four General Electric 67-motors is now in service. This car has Christensen continuous air brakes, and is fitted to operate the brakes on ten freight cars, which it can pull at one time. The company has under consideration the building of a 350-hp electric locomotive, which will be used when the freight service exceeds the capacity of the box car now employed.

2500-GAL. SPRINKLING CAR

An important feature of the equipment is the 2500-gallon sprinkling car furnished by the J. G. Brill Company. The length



SUMMER CAR

of this car over the end sills is 16 ft., and the width over the outside sills 6 ft. 10 ins. It is mounted on a Brill No. 7 truck, equipped with two General Electric 54-motors. This car carries a steel tank 6 ft. 6 ins. in diameter and 10 ft. long. The trolley board is fixed to the top of the tank. The running gear consists of a solid forged frame four-wheel truck. This has double journal springs at each box, which carry the frame of the truck. Upon the truck frame are eight other spiral springs carrying the body of the car. The sprinkling heads have no holes or perforations to clog. This part of the apparatus consists of a cone carefully adjusted in the mouth of the discharge pipe, which forms a spray nozzle, having a small circular opening through which the water is discharged in a thin sheet of film. The 2500-gallon tank carries water enough to sprinkle from 5 miles to 8 miles of road bed. The steel tanks have ¼-in. sides, 5-16-in. heads, and are fitted with swash plates to prevent the surging of the water while on the road, or while stopping or starting.

CONSTRUCTION AND OPERATION

The contractor for the engineering, construction and equipment of the road is John Blair MacAfee, of Philadelphia. Cars on the section of the line between Augusta and Clearwater have been operated regularly since June 26, and over the entire line since Sept. 8. The road is now being operated by the contractor. The chief of Mr. MacAfee's operating staff, Charles L. Furbay, is in charge of operation. The receipts so far have been very gratifying, and the road promises to be a profitable property from the start.

The road was built under the immediate charge of Walter Newbold Walmsley, chief engineer for Mr. MacAfee, who was assisted by G. Edwin Heath and William Harrison MacAfee.

NEW YORK CENTRAL'S TERMINAL PLANS

The city administration and the New York Central & Hudson River Railroad Company have virtually agreed upon terms for the improvement of the terminal facilities at the Grand Central station in New York. The recommendations of the special committee of the Board of Estimate, which has had charge of this matter, propose only one modification of the plans approved by the railroad, and contain the following provisions:

The abandonment of the use of steam as a motive power in the tunnel.

The depression of the Central's tracks so as to make practically grade thoroughfares of the eleven streets intercepting the steam tracks between Forty-Fifth Street and Fifty-Fifth Street.

The continuation of Park Avenue as a single street southward on a viaduct from Forty-Ninth Street, where it now ends, to Forty-Fifth Street, the boundary of the station.

The payment by the Central of $25,000 a year for extra subsurface privileges.

The payment by the city to the company of $600,000 for constructing the new grade bridges across Park Avenue.

Denying the Central's request for vault privileges under Lexington Avenue, because of the city's desire to build an East Side extension of the subway under that avenue.

A connection under Forty-Second Street with the new subway system.

The improvement will entail an investment of $25,000,000 by the railroad company, and will provide for the electrical operation of all trains entering the Grand Central station. Greater safety and comfort for the traveling public and great relief of crowded streets and the transformation of what is now a public nuisance into a substantial public improvement are thus proffered by the railroad management. To accomplish these improvements the railroad companies propose to install electricity as their motive power as far north as Croton on the Hudson River Railroad and White Plains on the Harlem Railroad.

TRAIN UNIT CONTROL SYSTEM USED ON THE BERLIN ELEVATED RAILWAY

The system of motor car control employed on the Berlin Elevated & Underground Railway, of Berlin, and installed by Siemens & Halske, of that city, differs in a number of respects from any of the multiple unit systems employed in the United States. Strictly speaking, it is not a multiple unit system but a one-motor-car-two-motor-car control system, that is, only two motor cars can be used per train, one at each end of the train, and the motorman can use either one or both, as required. A system of this kind developed by the General Electric Company, and known as the Potter system, was tried on an experimental train on the Manhattan Elevated Railway in New York before that company decided to adopt the multiple unit system, and another system, a modification of the Potter system, is now in use on the Metropolitan Underground Railway, of Paris. The system employed in Berlin, however, differs from either of those mentioned, and hence possesses considerable interest. It has been in use for a little over a year and has proved satisfactory. The objections to it, which are common, however, to all one-motor-car-two-motor-car systems, are that it requires a very large controller, there is no automatic throttling of the current, and no more than two motor cars can be used per train. On the other hand, the advantages are that only one train cable is required per train, and only one controller per motor car. In the system of the Berlin Elevated Railway two train cables are used, but one is simply to connect the shoes on the two motor cars, and the system could be arranged to operate without this connection, although it is desirable because of the possibility of bridging over interruptions in the third rail and also for giving

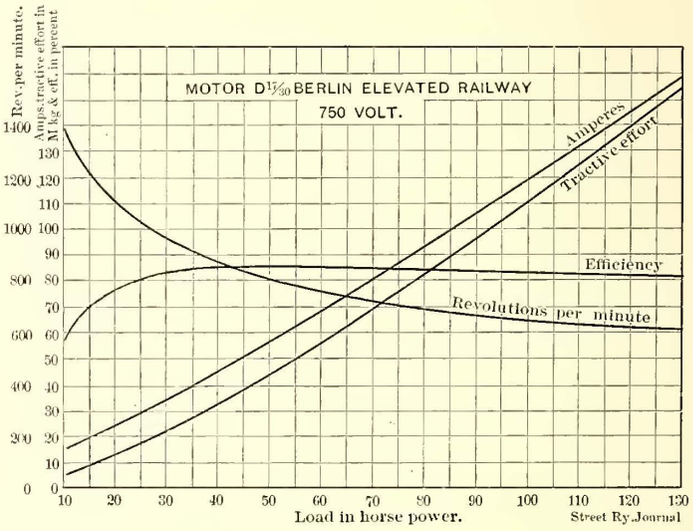
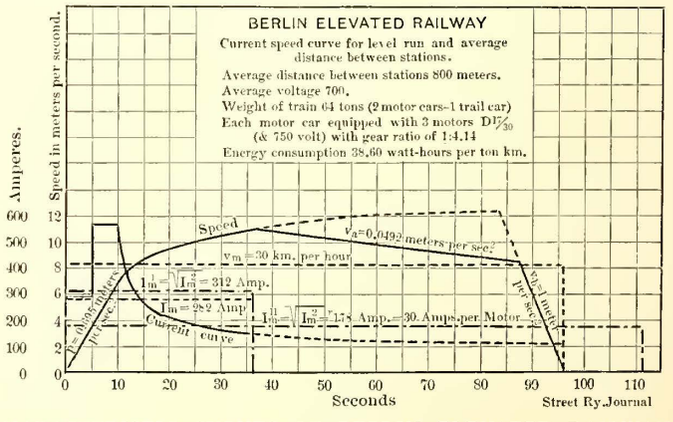
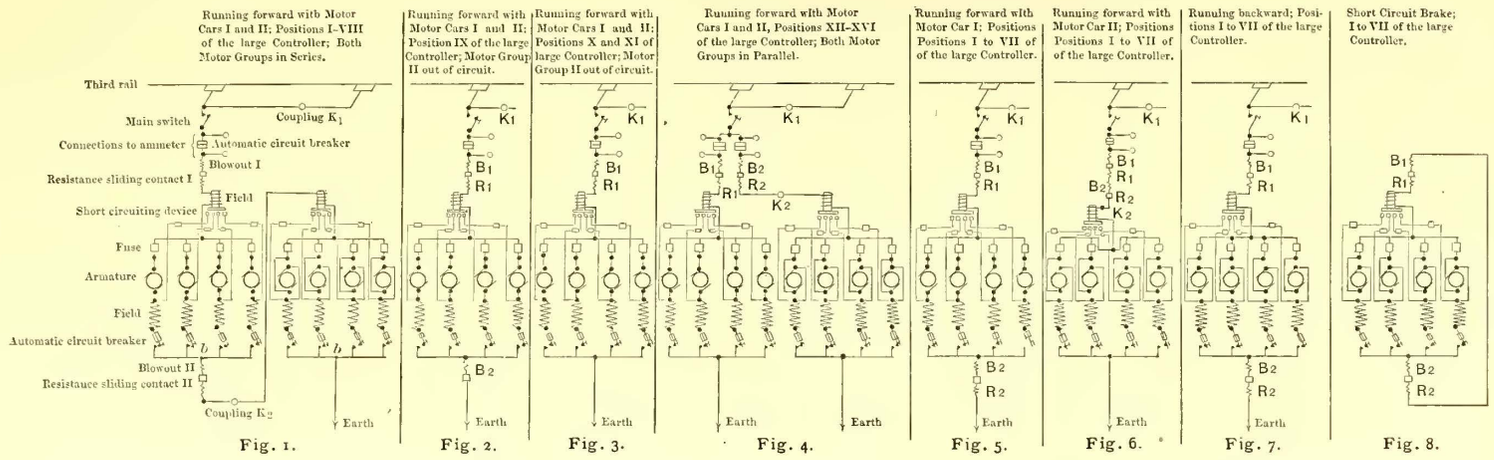


FIG. 9.—SPEED-TIME CURVE FOR AVERAGE RUN, BERLIN ELEVATED



CHARACTERISTIC CURVES OF BERLIN ELEVATED RAILWAY MOTOR



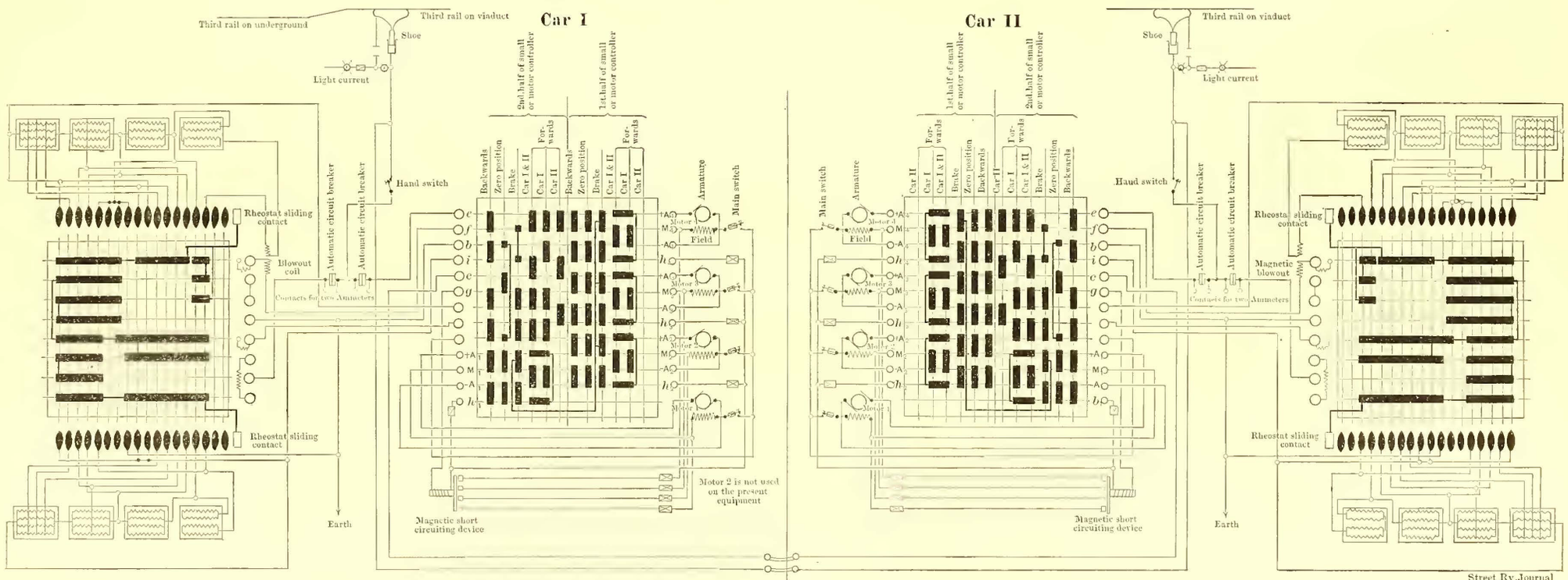


DIAGRAM SHOWING CONNECTIONS OF CONTROLLER, BERLIN ELEVATED RAILWAY

double the contact surface by utilizing the shoes at both ends of the train.

The diagrams on page 29 show the connections employed. As usually made up a train on the Berlin Elevated Railway consists of three cars, 39 ft. long. Of these, two, the first and the last, are for third-class passengers and are motor cars. The intermediate car is for second-class passengers and is a trail car. There is no first-class car. Each motor car is equipped with three motors, but the diagram is made out for the use of four motors, and the fourth motor can be added at any time.

The controlling apparatus consists of two contact cylinders, one for the motor connections and the other for the resistances. The motor cylinder is made up of two halves, each of which is supplied with a separate set of contact fingers. The resistance controller cylinder has a sliding contact of the usual form for throwing in the resistance.

The motors on each car are always connected in multiple, and those on Car I can be connected in series or in parallel with those on Car II by means of the controller.

The operation of the controller is then as follows: The position of the controller on Car II is set so as to connect the negative terminals of all the fields of the motors on the car directly to earth. The motors on Car I are connected in the position "Cars I and II" on the small or motor controller. The connections are then, as shown in Fig. 1, i. e., both motor groups are in series, and resistance of Car I only is used. Points I to VII are resistance points, and at point VIII all resistance is cut out. In positions IX, X and XI, see Figs. 2 and 3, the motors on Car II are first cut out, with resistance, R_2. Blow out, B_2, is then cut out and the motors on Car I are in multiple across the line and in series with R_1. In positions X and XI of the controller, as shown in Fig. 3, R_1 is cut out. Position XII (Fig. 4) puts both cars in multiple with resistance R_1 in the circuit of group I and resistance R_2, which is on Car I, in series with the group on Car II. Both resistances are cut out when position XVI, which is the plain multiple position, is reached.

The next two diagrams, Figs. 5 and 6, show the connections which can be used for operating the train with motor car I only or motor car II only. These correspond to the positions "Car I" and "Car II" on the lower diagram, showing the development of the small or motor controller, all previous connections being made from "Car I and Car II" position of this controller. The resistances R_1 and R_2, shown in Figs. 5 and 6, as will be remembered, are on Car I, and are, of course, worked from the controller on Car I, as shown by the position of coupling K_2 in Fig. 6.

Fig. 7 shows the connections when running backward, and are made from the position "backwards" on the small controller and I to VII on the resistance cylinder. The final upper diagram, Fig. 8, shows the connections for the short circuit brake, in which the motors operate as generators through a resistance, and are secured through position "brake" on the small controller, and, as with the reversing position, with seven resistance points.

A feature of the system is the magnetic short circuit device illustrated in all the diagrams, by which, when the circuit of any group of motors is closed, except in the brake position, the armatures are automatically short circuited. The object of this is to prevent the motors forming a local circuit and braking the train.

Fig. 9 shows an average acceleration diagram for a level run and an average distance between stations, and Fig. 10 the characteristic curves of the motor used on the line.

The East St. Louis & Suburban Electric Street Railway Company, of East St. Louis, Ill., on the day before Christmas, delivered to the men employed on its various lines and also to those who work for the East St. Louis Light Company, Christmas turkeys and cranberries, in appreciation of their services during the year.

SUCCESS OF MUNICIPAL OWNERSHIP IN GREAT BRITAIN

BY ROBERT DONALD

For several years a campaign has been carried on in Great Britain against municipal ownership. The results of municipal management, notwithstanding the restrictions imposed upon it, has caused a reactionary movement, which, in some ways, has influenced the public and in others overshot its mark. A disposition on the part of many local authorities to extend the field of municipal functions and encroach more on trading enterprises has naturally given rise to jealousy among company interests and fears among some other traders. The great movement, however, tending for the ownership of the chief services of public utility has not been arrested and is not likely to be.

The anti-municipal party is continually making comparisons between municipal conditions in England and in the United States. Opponents of municipal progress in England cite the greater advances made in electrical undertakings and electric traction in the United States, and attribute the high development of electrical enterprises generally to the comparative absence of municipal ownership. The conclusions drawn are that municipal ownership in England has checked industrial progress. I submit that the conditions in the two countries do not justify any such conclusion. The growth of American cities has been rapid; the populations are frequently of a cosmopolitan character, a large proportion of them are unaccustomed to democratic institutions, and therefore an easy prey to demoralizing and corrupt influences. The old settled communities in England exhibit a large growth of population during the last half century, but the population has always remained homogenous, and the development of popular institutions has been gradual. It is not more than half a century since English cities emancipated themselves from a species of Tammanyism which controlled the public authorities. It is not fifteen years since the municipal renaissance freed London from demoralizing Vestrydom.

It is purely speculative to say what the state of electric traction would have been in England had there been less municipal ownership. Electric lighting was held back by the natural conservative feeling amongst English manufacturers and by the existence of vested interests in gas works rather than by municipal legislation. In almost all other departments of industry with which municipalities have nothing to do, Great Britain is now far behind America in originality and achievement. Disparaging comparisons could be made between railways in England and the United States, between the engineering industries, printing and in other departments of industrial life, which are not influenced one way or another by municipal ownership.

One of the few things in which Great Britain excels America is in its town government. The way in which the local governing institutions work, the excellence of their staffs, the absence of corrupt political influences on their Councils, are the admiration and envy of American social and political reformers. Much, therefore, can be learned from fair investigation of municipal ownership in England as it affects the main public services. It does not necessarily follow that the system which is now successful in England can be adopted in the United States. The tendency is certainly towards an extension of municipal ownership, but the transition cannot be sudden. Political influences must be subdued, a permanent civil service built up solely on its merits, before city government in America can be reformed. One of the elements retarding progress and making honest government more difficult is the power of the private corporations, which find easy instruments in venal politicians. To municipalize the undertakings now owned by companies under existing conditions, except where reform influences have borne fruit, would be simply to exchange one

evil for another, as corrupt politicians would make up in patronage what they would lose in bribes.

While the existing conditions of city government in England and America differ widely, all interested in municipal work, particularly those who seek to promote civic betterment, can learn much from an impartial survey of municipal ownership in England. But I cannot regard the articles which Mr. Robert P. Porter contributed to two recent numbers of the STREET RAILWAY JOURNAL, entitled "The Failure of Municipal Ownership in England," as presenting anything but a distorted view of the situation. You point out that Mr. Porter is an advocate of private ownership, but say at the same time that "his knowledge of the condition of affairs abroad and at home, and his high reputation as an authority on statistics and all public matters, make his testimony of the greatest value."

In these articles Mr. Porter aims to do two things. He presents a case from testimony which he intends the reader to accept as impartial, and he adds certain sweeping conclusions of his own. I regret to say that Mr. Porter presented evidence of a thoroughly partial, one-sided character, drawn chiefly from interested sources, and that his conclusions are misleading.

Take his so-called authorities, the chief of which are:

(1) The Industrial Freedom League, "an association recently formed in England to free private enterprises from rate-aided competition."

(2) Dixon H. Davies, "a well-known jurist."

(3) A committee of the London Chamber of Commerce.

(4) A report of the Parliamentary committee on municipal trading.

(5) Field's Analysis of Gas Accounts.

(6) Mr. Garcke, Sir Charles Rivers Wilson and Mr. Sydney Morse.

(1) Now, the Industrial Freedom League, from which Mr. Porter quotes largely, was recently formed not to free industry but to fetter municipalities. It was founded by the directors of a large electric combine—the British Electric Traction Company, Ltd.—which is continually trying to capture franchises, and is fighting and harassing municipalities—for the purpose of carrying on local agitations which it could not do itself. Seven directors of the company are on the Council. The managing-director of the company recently described the league as his company's "mouth piece."

(2) Mr. Davies, whom Mr. Porter describes as "a well-known jurist," was the attorney of the first electric power bill which sought to encroach upon the rights of municipalities, and it was practically in that capacity that he gave the address which Mr. Porter describes as a "classic." It was really a brief.

(3) The committee of the London Chamber of Commerce, to which Mr. Porter frequently refers, was formed by the directors of the British Electric Traction Company. It is known as the municipal trading committee, and its chief purpose has been to take part in the anti-municipal trading campaign. The moving spirits on the committee are directors of the combine, and during the municipal elections last autumn it sent a letter to the press inviting electors to vote for candidates who were opposed to municipal trading. It also sent a communication to the Birmingham Chamber of Commerce, in October last, inviting that authority to support the British Electric Traction Company in regard to the city tramways against the municipality.

(4) The report of the Parliamentary committee on municipal trading, which Mr. Porter says he "read with care," is the record of the testimony of many witnesses. Mr. Porter not only read "with care" but also with discrimination, as he cites only a few witnesses who suited his purpose.

(5) Field's Analysis of Gas Accounts is simply an analysis of a few accounts of companies and municipalities (twenty-four companies and eleven municipalities), prepared by an official of the London Gas Light & Coke Company, one of the best hated monopolies in the Metropolis. If Mr. Porter had wanted to give a more complete and impartial result of gas undertakings he could have found material in the official Board of Trade Returns.

(6) Mr. Garcke, whom Mr. Porter mentions, is the managing director of the British Electric Traction Company; Sir Charles Rivers Wilson, from whom he quotes, is the chairman; Mr. Sydney Morse, another of his authorities, is its solicitor.

It is quite impossible for Mr. Porter, having gone to these sources for his information, to draw conclusions which are impartial. Were I to correct in detail all the statements in the articles which I could dispute, I should require to annotate every paragraph.

Mr. Porter makes several sweeping misstatements of fact which I would like to correct before passing to the figures dealing with municipal ownership. He says:

> There can be no doubt that after twenty-five years of experiments in municipal trading, in which the city and town officials have had a free headway with the ratepayers' money, the British public has awakened to the fact that the extension of municipal trading is prejudicial to the interests of the country.

This statement is utterly misleading. The "city and town clerks" have not, and never had, "a free headway with the ratepayers' money," nor have the municipalities. Before new undertakings can be introduced town councillors have to be elected under conditions as democratic as those which exist in the United States. The Council, having arrived at a decision to promote a bill, must again obtain the consent of a public or town's meeting, at which the opposition can demand a poll, which is taken, not under the popular vote, but on an obsolete property qualification, which enables the propertied classes to have plural votes. The bill has then to stand the racket of examiners of bills in the houses of Parliament and the two chairmen of committees, one of the House of Commons, the other for the House of Lords, and their legal advisers, who have power to strike out clauses. The heads of government departments also criticise it. Next, the bill has to pass both houses of Parliament, and is referred in each to a committee, which may spend days and weeks in investigating it, and in hearing all legitimate opposition, and in considering all the interests involved. Yet Mr. Porter says the town officials have had a "free headway." It is only the routine work which can pass without going through this prolonged process, and even small tramway improvements and extensions, which may be sanctioned by means of a provisional order and always come under the purview of government departments have to be confirmed by bills, and may be objected to. The Local Government Board and the Board of Trade exercise strict supervision over the conduct of municipalities in regard to all work involving new expenditure.

Not less inaccurate is Mr. Porter's reference to tramways. He says:

> If a municipality has become possessed for half its capitalized value of a tramway undertaking, that has been worked for twenty-one years by private enterprise, and has been brought to a high state of development and highly organized, it would be strange indeed if it could not make it profitable.

Mr. Porter assumes that companies leave undertakings which can be acquired under the tramways act of 1870, after twenty-one years of operation, in a high state of development. They, on the contrary, leave them in a low state of dilapidation. And not unnaturally so. A company is not going to spend money on an undertaking which has no certain future. Every company, therefore, has adopted the policy of allowing its equipment to run down several years before the time expired, when it could be acquired by the municipalities at its "then value." The tramway companies went into the business after 1870 with their eyes open, and it would be manifestly unjust for a municipality to have to pay them for a good-will which does not exist, or for capitalized value which might be no index to the actual value of the undertakings. The system has undoubtedly de-

layed the introduction of electric traction for a few years, but every limited franchise or lease delays development. There has been no case in England of a company working under a lease and improving its property towards the end of the period of that lease. Even where conditions for improvements are introduced into the lease it is difficult to have them enforced. If, for instance, the tramways in the north of London, which were leased by the London County Council for a large rental in 1897 to the North Metropolitan Tramways Company, had been worked by the Council they would have been electrified by this time. As it is Londoners will have to wait until the lease expires, while the municipal tramways on the south of the river will soon be working on the electric conduit system.

There are many other equally misleading statement. Take the following dogmatic utterance:

> Looked at from whatever point of view we please, whether in gas, electric lighting or tramway service, the vigorous life of private enterprise does not exist in these municipally managed undertakings. They may follow private enterprise; they have never been known to lead. So far in England the municipalities have pounced upon profitable and well-organized and managed enterprises just as the franchise expired, and have carried on the work, excluding absolutely all competition. In many cases they have employed the same manager. With a capital cost for producing gas one-half of that paid by private individuals, and the right to tear up the streets at will, etc.

These are all utterly reckless statements. I will show from every point of view that municipally managed gas, electric lighting and tramways in England compare well with company undertakings. It is impossible for the municipalities to pounce on "profitable and well organized and managed enterprises just as the franchise expired." The statement could only remotely apply to tramways, and I have already disposed of it. Municipalities have only been able to acquire gas and water undertakings when these undertakings were run down and were seeking more capital, as no franchise exists and the municipality has no power to buy. Take the most recently-developed municipal work—tramways. All the enterprise has been on the part of the municipalities. They have been the pioneers. The London County Council is just now laying down the conduit system. No company has thought of doing it. The municipality of Wolverhampton is experimenting with the Lorain surface-contact system. No company has tried that. It is the municipalities that have led the way in introducing the lowest fares and the best cars, freeing them from hideous advertisements, in putting the conductors in neat uniforms and working them reasonable hours, while the companies' conductors are badly clad, badly paid and worked excessive hours. Until the County Council took over the tramways no night cars existed in London. As soon as it proposed to start companies followed. The Council also introduced an extended service of neat, comfortable, halfpenny omnibuses to feed its tramways, and was stopped by the jealousy of the 'bus companies because it had no Parliamentary powers. The following is another of Mr. Porter's statements:

> The fact is, the municipalities once entrenched and able to keep out all newcomers, veto all schemes for cheaper light, whether gas or electricity, and have really no inducement as companies have to supply the public at the cheapest.

Municipalities have no power to keep out newcomers and have no veto to exercise. When they do not own the gas or electric light they try by the pressure of public opinion, the only influence they can use, to get cheaper light from companies. When they supply the light their sole purpose is to do so as cheaply as is consistent with business interests. Here is another amazing criticism:

> The inconvenience to the public is less under company management. The companies, as a rule, are held in strict accountability by the local authorities, whereas the local authorities have no restrictions, and often close whole streets.

It would be charitable to assume that the writer of this statement has never been in London, nor in any other English city where companies prevail. It is one of the notorious grievances which the public have against companies that they open the streets regardless of public convenience. One week it is the telephone company, next a water company, a few days later an electric light company, a gas company or a hydraulic power company—all without regard to each other or to the public. The local authorities have no power over the companies in these matters. A bill has only recently been promoted by the city of London to check the inconvenience caused by companies disturbing streets by getting them to act more harmoniously. Municipal departments, on the other hand, study the public convenience. The city surveyors, in most cases, act for all departments which do any street work.

Having disposed of the more general statements in Mr. Porter's articles I will now deal with his discussions of particular branches of municipal work.

TRAMWAYS

By far the largest municipal development in Great Britain just now is in connection with the tramways. During the last few years enormous progress has been made with electric traction and the mileage has been almost doubled within a few years. We have now had sufficient experience to test the capacity of municipalities to manage and operate street railways, but strangely enough Mr. Porter only gave very meagre information on the subject in his articles. He cited one "authority"—Mr. Murphy, a company advocate—and quoted a table of fares comparing the American and English systems of charging. This part of his articles was altogether inconclusive. On the matter of fares English and American habits are not the same. The uniform fare adopted in American cities is cheap for long-distance traveling, but experience has proved that in British towns what is most needed is a low fare for short distances. For instance, the average fare on the Glasgow tramway system, which serves nearly a million people, is less than 2 cents. As tramways are practically the only means of locomotion in American cities they are largely used for short distances, and uniform fares therefore become dear. One cent per mile for short distances is becoming a popular fare on municipal tramways. When, with electric traction, the economies of transportation are carried further we shall find that in all cities that the average fare will be a trifle over 1 cent. Perhaps a universal 1-cent fare may be possible. A uniform fare of 2 pence or 4 cents has been started on the Central London Underground Railway, running from the Bank of England to Shepherd's Bush. This line has been a great success, as it taps one of the best routes for long-distance traffic. But very little short-distance traffic exists. That low fares for short distances are preferred is shown again by the experience of the Metropolitan Railway, which has 64 miles of line, and although the fares vary from 2 cents to $1.80 the average fare is less than 4 cents. The uniform fare system can evidently only be applied successfully in English cities for long distances, unless the fare is as low as 2 cents.

The last Board of Trade report on tramways, which is for the year ending March, 1901, shows that there were ninety-nine municipal street railways in the country, with a mileage of nearly 700 miles. The capital expenditure upon these was over £14,000,000. The companies had 114 undertakings with a mileage of 616 miles and a capital expenditure of over £12,500,000. The expenditure of private undertakings has been decreasing in recent years, and municipal street railways have doubled during the last four years. During the last eighteen months very large extensions—both municipal and company—have come under operation.

Municipalities start with a great advantage by converting horse traction into electric. Their record of achievements is a splendid testimony to the administrative ability of public cor-

porate bodies. I give in the tables on this and page 34 the results of municipal street railway working for the financial year ending March 31, 1902. These tables are prepared from the duly audited accounts of the various undertakings, which are all electric roads. The population of the towns is not in all cases the entire population served, as the tramways in many cases run into suburbs.

I have given the percentage of receipts and expenses per car mile, although I do not regard that as a fair test, as the cars in some cases may have trailers and the speed is not always the same. However, no standard system of comparison has yet been introduced. From a commercial point of view these figures prove anything but the failure which Mr. Porter suggests. In large cities, as in Glasgow, and in small towns, as in Dover, municipal street railways are proving very successful. Many of the systems are yet incomplete, as in Manchester, for instance, where the process of the transfer to the municipality is just taking place. Such incomplete systems cannot give the best financial result. I regret that it is impossible to make any fair comparison with private companies, as only a few of them have been in existence working electric cars for many years, and all their undertakings are at present on a small scale. For instance, the British Electric Traction Company, which is spreading itself over the country and is operating thirty or more undertakings, does not carry as many passengers as Glasgow municipality does.

The accompanying table demonstrates that municipalities adopt a wise financial policy, and can bear the test of criticism from a commercial standpoint. When one looks into the detailed accounts the results of municipal working are still more exists which could at all approach that result, and, in fact, no company would attempt it.

While I am not able to give a comparison between companies and municipalities which I consider fair to the companies with regard to electric cars, we have an excellent comparison with regard to horse traction. In Sheffield we have the same system as run by a company transferred to the municipality and worked by the same staff. The following are the returns for the last year of the company's operation, when it would be, naturally, anxious to make as much as possible, and the first year of municipal ownership:

Company's Last Year, Ending 30th June, 1896		Corporation's 1st Year, 11th July, '96—30th July, '97
9	Approximate street miles of tramways (double lines)	9
692,855	Number of miles run	733,262
6,566,033	Number of passengers carried	8,453,078
£39,995 2 4	Receipts from passengers	£46,517 2 4
13 85s.	Rec. from passengers per mile run.	15.22s.
£4,443 18 0	Receipts from passengers per street mile of tramway	£5,168 11 4
34.48	Average No. of cars running daily	36.48
3,621	Average No. of passengers per car, per week	4,569
£22 1 1	Average receipts per car per week.	£25 2 10
312	Average No. of horses	340
9s. 0d.	Average cost of forage per horse per week	7s. 9½d.

It will be noticed that while working the same system nearly 2,000,000 more people were carried by the municipality, with

	Population	Year Ending	Total Capital Expended at End of Each Yr.	Total Length of Track	Miles Run	Passengers Carried	Total Receipts	Total Receipts per Car Mile	Total Expenses	Total Expenses per Car Mile	Gross Profit	Interest and Sinking Fund	Depreciation and Renewals	Net Profit
			£	Miles			£	d.	£	d.	£	£	£	£
Aberdeen	153,107	May 31, 1902 * (3d year)	225,027	17¼	794 641	9,099,715	37,931	11.83	26,577	h 9.07 / e 6.14	11,354	7,312	2,334	1,708
Blackburn	137,527	March 25, 1902 (3d year)	288,159	12½	738,557	6,790,091	36,488	11 86	28,439	9.24	8,049	14,740	----	d 6,691
Blackpool	47,348	March 31, 1902 (10th year)	216,059	15	758,363	5,809,190	41,818	----	28,260	----	13,558	i 66,648	----	6,909
Bolton	168,205	March 31, 1902 (2d year)	399,149	31	1,705,580	15,898,933	77,274	10.87	73,879	10.39	27,829	18,197	16,298	3,395
Bradford	279,767	March 31, 1902 (2d year)	581,538	49	1,4 1,8 3	-------	70,214	12.02	48,436	8.29	21,778	17,053	10,015	d 5,290
Dover	41,782	March 31, 1902 (4th year)	38,350	4.5	270,533	2,905,823	11,863	10.53	8,796	7.80	3 067	i 32,075	----	991
Glasgow	760,423	May 31, 1902 (8th year)	2,041,036	103½	h 679,922 / e 11,935,099	8,434,812 / 155,243,378	31,174 / 583,239	11.00 / 11.73	---- / ----	---- / ----	d 1,247 / p 320 019	96,315	111,956	112,395
Halifax	104,937	March, 1902 (3d year)	275,680	27¾	1,063,764	13,173,921	54,969	12.40	55,263	12.47	12,073	12,348	----	d 294
† Huddersfield	95,008	March 31, 1902 (9th year)	384,794	32	1,001,933	7,841,432	49,008	11.72	32,425	----	14,861	25,728	8,334	d 810
Hull	2 0,618	March 31, 1902 (2d year)	310 551	9½	2,218,696	21,065,990	88,502	----	62,869	6.80	40,856	16,017	----	24,839
‡ Leeds	428,953	March 25, 1902 (8th year)	898,454	71¾	4,726,043	48,273,370	224 294	11.10	143,150	8.07	81,144	32,902	12 698	48,241
Liverpool	684 947	Dec. 31, 1901 (§ 4th year)	1,749,428	----	10,970,063	10 ,108,780	474 508	10.38	327,451	7.17	147 057	91,274	35,214	52,822
Manchester	543,969	March 31, 1901 (1st year)	603,322	150	1,831 126	23,590,288	116,356	111.307	78,110	----	33,196	19,433	16 600	20,000
Nottingham	239,753	March 31, 1902 (1st year)	420,073	21	h 412,984 / e 987,939	3,978,503 / 12,188,874	---- / 78 791	----	h 16,440 / e 24,743	9.55 / 6.01	------	19,028	7,000	12,028
Salford	220 956	a March 31, 1902 (1st year)	350,000	32	2,107,808	20,395,386	91,825	10.45	74,902	8.52	16,923	14,469	----	2,454
Sheffield	380,717	March 25, 1902 (6th year)	------	h 4 / e 45	265,994 / 3,525,999	4,0-2,755 / 45,093,876	16,261 / 175,575	---- / ----	---- / ----	---- / ----	d 1,016 / p 69,275	i 36,665	----	32,610
Southampton	104,911	March 31, 1902 (3d year)	150,608	----	855,457	7,668 558	45,168	12.69	----	----	16,432	i 4,271	2,516	10,360
Southport	48,083	March 31, 1902 (1st year)	115,630	10	389,827	3,317,963	16,018	9 863	9,544	5.873	6 568	5,649	360	d 40
Sunderland	146,555	March 31, 1902 (2d year)	135,157	4.18	1,170,207	13,596,508	57,307	11 75	49,565	10.16	26,588	13,387	5,495	7,742

* i. e., complete years of working. † Part steam and part electric traction. ‡ Electric, horse and steam. § 1st year of complete electric traction. *a* 11 months ended. *d* Deficit. *e* Electric. *h* Horse. *i* Interest. *p* Profit

favorable. Take, for instance, the signal achievement of Glasgow, which has never been equalled by any company. The Glasgow Corporation failed to come to terms with the old tramway company which held the lease, and started eight years ago an entirely new organization and equipment, building splendid depots, organizing a new staff, providing and training horses, so that when the company's cars disappeared from the streets at midnight the new municipal cars began running the next morning. There was never such a quick transition or such a splendid object lesson in the superiority of municipal management.

Although obliged to begin with horse traction Glasgow Corporation was alive to the importance of electricity. It has introduced the trolley system, and from its accumulated profits from eight years' operation of horse traction the municipality has been able to wipe out the whole cost of that system, and start its electric cars with a capital account unburdened by any expenditure not exclusively relating to it. No British company increased receipts. These improvements were brought about by the enterprise of the Corporation in improving the service and its action in reducing the hours of the drivers and conductors, in increasing their wages and studying the comfort of passengers. The increase in the wages bill alone amounted to £2,423.

It is true that the development of tramways has until now been somewhat checked in English towns by the operation of the act of 1870. But there are many compensating advantages, and it will be better for the people in the future that no vested interest in street railways was allowed to be created. The towns have maintained absolute control over their streets. In continental cities street railways have obtained long concessions for monopolies. In America franchises have in many cases been given away to powerful and wealthy companies, which can always exercise great influence at election times if they are seeking some concession or advantage. They will look to their own interests first.

The advantages of municipal ownership, even when it does not involve direct working of the tramways, are considerable. The municipality in leasing its lines at a yearly rental imposes terms, it regulates fares, provides for workingmen's cars and fair treatment for employees. This has been admirably illustrated in the case of the London County Council and the North Metropolitan Tramway Company. The Council acquired this company's system under the act of 1870, but gave it a new lease until 1910. Under the old conditions the company paid no franchise and was under no control. It went on comfortably paying itself 10 per cent. or more, but made no effort to improve its system or study the public. Under the new conditions the company pays the Council $225,000 a year, and 12½ per cent of the increase in its receipts. It must set aside $180,000 a year to maintain and reconstruct the lines. Fares must not be raised, and workingmen's trams at low fares must be run up to 8 a. m. The hours and wages of the employees must not fall below the best treatment of the employees on any company's system in London. The company must recognize trade unions, and has been fined because it dismissed some employees on the ground that they were members of a union.

Undoubtedly the County Council made a good bargain financially with the North Metropolitan Company. Compared with the Council's own tramways south of the river the rental of the north lines makes a return on the capital of 4¾ per cent, as against 3½ per cent, taking the reserve into account, obtained from the south system. On the other hand, the average fare on the municipal cars is .88 d., as against 1.12 d. on the company's. One-cent fares are introduced on the Council's tramways, and 50,000,000 of workers are carried annually at this rate, thereby saving them over £100,000 a year. The employees are better treated; there is no friction as has existed on the North Metropolitan system. Moreover, the Council is rapidly electrifying its own tramways, while there is little prospect that the North Metropolitan system will be electrified until the lease expires.

The full fruits of municipalization are only to be obtained, however, when the city councils operate the lines as well as own them. Every example of municipal working has been followed with success. Looking to the future I should say that the object of municipal tramways will not be so much to earn large profits as to carry people at low rates, and that system will be considered the most successful which carried the greatest possible number of people at the lowest possible fares.

Let me cite a few more of the many advantages of municipal ownership and working. To begin with we have lower fares. Every municipality makes it its business to reduce fares to the lowest possible limit consistent with successful operation. As illustrating the great advantages which have resulted from the municipalization of tramways in Glasgow the following comparisons as between the conditions prior to the close of the lease with those now existing were made recently by the Lord Provost:

Length of tramways (double track):

	Company (1894) Miles	Corporation (1902) Miles
Within city	28	46
Outside city	2	22½ (Nearly all completed.)
	Miles	Miles
Fares ½ d., average distance	None	.58
1 d., average distance	1.12	2.29
1½ d., average distance	1.80	3.45
2 d., average distance	2.20	4.60
2½ d., average distance	None	5.74
3 d., average distance	3.25	6.84
3½ d., average distance	None	8.23
Average fare charge per mile	89 d.	47 d.
Passengers carried per annum	54,000,000	170,000,000
Taxes (local and imperial)	£6,653	£19,055

Net annual revenue of common good from tramways:

Company, £2,766 average per annum during twenty-three years' lease. Maximum during last year of lease, £5,660; corporation (1902-3), £15,000.

In addition to the above it may be stated that the Corporation reduced the hours of employees at least 25 per cent, while it also increased the wages practically to the same extent.

In the annual report to May 31, 1902, the committee were in a position to state: "The success which has attended the department during the past eight years has enabled the committee, out of revenue, to renew the whole of the track and to write down the disused horse traction plant to scrap value. The capital account, therefore, contains only expenditure applicable to the electric traction system."

It is remarkable to notice that the extensions of the mileage are a little more than three times as much as under the company, the contributions to the Common Good Fund are in the same proportion, the passengers are between three and four times as many, the average fare per mile has been reduced to almost exactly one-half, while many other benefits have been given to passengers, and the hours of the employees have been reduced 25 per cent., and the wages increased to practically the same extent.

The policy in Glasgow has been, after paying interest and sinking fund charges on capital, to make ample provision for depreciation and renewals, and build up a strong reserve fund. Every municipality, when it comes into possession of tramways, improves the treatment of its staff, on whom largely depends the successful working of the system. The wages of the conductors are increased, they are in every case provided with neat uniforms, they are instructed to be always polite and obliging,

	Leeds		Sheffield		Birmingham		Liverpool	
Purchased by municipality in year	1898		1898		1899		1895	
Capita spent by company	£217,420		£124,472		£219,000		£264,711	
Capital paid by municipality for undertaking	370,580		272,398		420,000		436,474	
Financial Results	Last Year Under Company. Year 1897	Most Recent Under Municipality. Year 1901-2	Last Year Under Company. Year 1897	Most Recent Under Municipality. Year 1900-1	Last Year Under Company. Year 1899	Most Recent Under Municipality. Year 1900-1	Last Year Under Company. Year 1895	Most Recent Under Municipality. Year 1901
Capital outlay	£161,009	£505,029	£123,023	£433,016	£269,366	£543,657	£264,711	£1,187,622
Units produced	833,280	3,055,165	747,063	2,381,708	2,252,692	3,040,822	1,18-,964	20,018,142
Receipts, all sources	£18,405	£45,332	£16,245	£41,939	£43,246	£55,409	£35,414	£168,489
Working expenses	5,212	13,255	4,769	15,110	18,799	28,175	12,041	83,187
Gross profit	13,193	32,077	11,476	26,829	24.447	27,234	23,373	85,302
Percentage to capital	9.90	7.35	10.92	6.94	9.44	5.31	9.04	7.63
Provided for depreciation and sinking fund	£5 439	£10,889	*Nil.*	£6,030	£6,137	£6,597	£7,657	£30,903
Net profit	7,754	21,188	£10,268	20,799	18.310	20,637	15,716	54,399
Working expenses per unit	1 50d.	1.04d.	1.53d.	1.52d.	2.00d.	2.22d.	2.44d.	1.00d.
Average price charged for current per unit	4.68d.	3.56d.	4.60d.	3.83d.	4.38d.	4.20d.	6.86d.	3.60d.

and fares are enormously reduced. Thus, passengers in Liverpool are now carried 2½ miles for 2 cents, while the old charge used to be 5 cents. The drivers were formerly paid in wages 3½ d. to 4¾ d.—7 cents to 8¾ cents per hour—and worked nearly fourteen hours a day; the municipality works them ten hours a day and pays them 6 d. to 6½ d.—12 cents to 12½ cents per hour—provides summer and winter uniforms free, adding a shilling per week merit pay after several years' service, providing mess and entertainment rooms at the depots, and has organized a benefit society, to which the Corporation contributes one-third of the subscription. The position of conductors and other employees has been similarly improved.

Workmen's special cars are in all towns provided in the morning and evening at special fares. In Newcastle the fares for workmen are 2 cents for 5 miles. The needs of the service are in every way promptly responded to. Municipal cars are kept in better condition, and they are not disfigured to the same extent by advertisements.

So much for the alleged "failure" of municipal tramways. And as for Mr. Porter's statement that "none of these municipalities has any comprehension of the potentialities of electric traction, and few of them ever look beyond their own district," it is proof that he has not taken the trouble to enquire into their methods and has found it convenient to be blind to their merits.

There are at present, it is true, difficulties in regard to running powers over very wide areas, owing to the difference in gage, although in Lancashire and many other places a uniform gage is being adopted. As a matter of fact the differences of gage are greater among companies than among municipalities, and no doubt the differences, and also the difficulties, of running powers will be adjusted as they were in the case of British railways. The subject of the other municipal enterprises referred to by Mr. Porter will be discussed later.

(To Be Continued.)

PRESIDENT GREATSINGER ON THE BROOKLYN TRAFFIC SITUATION

President J. L. Greatsinger, of the Brooklyn Rapid Transit Company, in replying to Mayor Low's recent letter to the heads of the various transportation companies of New York, suggesting the advisability of adopting certain changes in practice and offering the co-operation of the city authorities to decrease the present congestion at some points, brings out a number of interesting facts and figures regarding Brooklyn railway conditions. The fundamental difficulty is the lack of sufficient facilities for conveying passengers across the East River. A large part of Brooklyn's population work in Manhattan, and it is on the lines leading to the Brooklyn Bridge, where an average of 300,000 cross daily on the company's cars, that substantially all of the congestion of traffic now occurs. President Greatsinger says in part: "While only a partial relief can be afforded by improvement of facilities for the surface cars, very substantial and immediate relief can be afforded by improvement of the terminal facilities in Manhattan for our elevated lines. Our elevated railroads comprise nearly the same mileage of structure as do the elevated railroads of Manhattan, but they carry less than one-quarter as many passengers as the elevated railroads of Manhattan. Without any additional trackage and solely by reason of better terminal facilities in Manhattan, the Brooklyn elevated lines can be made to carry four times as many people as at present. The inauguration of a one-fare rate through to Park Row has saved the people of Greater New York $2,500,000 annually, and the through trolley transit and partial through elevated transit accompanying the abolition of the bridge fare have been followed by a very marked inerease in the population of Brooklyn.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT, BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON

DISTRIBUTION OF THE DISCOUNT CREDIT

BY W. M. BARNABY

At the annual convention of the Street Railway Accountants' Association of America, held in New York in 1901, some discussion took place as to the proper distribution of the amount obtained by discounting bills. Quite a number of delegates were of the opinion that it was a proper credit under the head of interest, others that the purchasing department or store room should get the credit, and that the unit value of articles purchased should be reduced by the amount of the discount obtained, taking the ground that the cash discount was only an extension of the discounts obtained from list prices. The STREET RAILWAY JOURNAL has thought it worth while to take up the subject, and has asked the writer to give his views on the subject with the hope that others will also give their opinions, either in agreement or dissent of those expressed in this article.

The writer believes and follows the plan that such a discount is a proper credit to interest, and cannot be considered as having anything to do with the cost price of the article. Consequently the supply department should not be credited with the amount saved by the discount obtained. The custom in regard to discounts practically makes this so, because of the fact that while a large purchase affects the price of the article bought, it does not affect the rate of discount, that being fixed.

Another reason why the discount should be considered as a credit to interest is that the ability to take advantage of the discount allowed lies with the treasury department. If the conditions enable it to secure the discount from the manufacturer for prompt payment, it does so; if not, the bills are paid when due.

If, for the sake of argument, we take the view that the discount obtained by prompt payment should be taken from the price at which the article is purchased, would it not be fair to add to the price of the article the interest that would have to be paid in case notes were given in payment of the bills, owing to the fact the treasury was a "little short" of funds.

To take another supposable example: Assume, for instance, the case where the ability of the treasury department to discount the bills presented is due to the fact it has just made a loan of $5,000 or $10,000. Now the interest on the loan will be a sure debit to interest, and consequently any saving made by discounting bills is a proper credit to the same account. If the treasurer of some concern, knowing that quite a large number of bills, say $10,000, would be coming through, on which by paying promptly he could obtain a discount of 2 per cent, it would be a good bit of financing for him to borrow the $10,000, say for sixty days, and take advantage of the discount. The profit would be as follows:

$10,000 at 6 per cent for sixty days	$100
$10,000 at 2 per cent for sixty days	200
Saving	$100

Now, if this were a true case would anyone say the storeroom should get the benefit?

Concerns allowing a cash discount base such discounts on the lines similar to those on which they sell their goods; that is, goods sold on ninety days in all probability would be allowed a higher per cent of discount than those sold for cash, ten days.

In view of this fact it can be seen that the basis of the discount is simply a carrying charge and belongs distinctly in the line of interest, and by no means can the discount be considered as a reduction in the price at which the article is bought.

STANDARD FORM OF REPORT

BY F. E. SMITH

The writer read with interest the able article of H. D. Emerson in the Journal of Dec. 6, on "The Standard Form of Report," but feels called upon to take exception to some of the conclusions reached.

Regarding "the carrying of a net amount into an income account," Mr. Emerson says, "the meaning of the word 'income' is well understood and should not be misused." Webster's definition of "income" is, "that gain which proceeds from labor, business, property or capital of any kind, etc." Would Mr. Emerson say that the gross receipts were necessarily all gain? If we were paying an income tax in this country and if a man owned real estate that yielded in rents $12,000 per annum, and the expense of maintenance, taxes, etc., was $10,000 per annum, would it be proper to list this property as yielding an income of $12,000 or $2,000?

Mr. Emerson further says, "the sums received for sale of power or the rentals of track or terminals, are unquestionably earnings." May there not be exceptions? The Chicago Union Traction Company and the Chicago Consolidated Traction Company, though two distinct corporations, are closely connected through operating agreements. Each company has two electrical power houses. Each of these four power houses supplies the power for the lines nearest to it irrespective of the company which operates the lines, thereby saving the cost of an immense amount of feed wire. This power is sold at cost, based on consumption. Is this anything but a division of the expense and therefore a credit to expenses? Would it be fair to ask those two companies to credit to income the receipts from this sale of power, and, if we had a tax here on gross income as they have in some States, pay a tax on those receipts when there had been no profit? If Mr. Emerson thinks we should, he will, no doubt, agree that this additional tax would then become a part of the expense of producing the power (else it would be sold at a loss) and would add to the amount of the bills, and consequently to our earnings, so called, and we should be paying a tax on a tax.

In numerous cities companies controlling the city lines are required by law to allow suburban lines to reach central points over their lines and furnish power for the same. The charges for the use of tracks and power are based on cost of maintenance and operation, plus, perhaps, a small profit. Is it just to make the city road include in earnings and pay a tax on any more than the profit that accrues to it? It is often a great disadvantage to its own operation to be required to provide these terminal facilities; would it be fair to increase the burden through taxation? One of the companies operating lines in Chicago had a piece of track which it did not require and another company leased it to enable it to make a loop. The lessee pays all the expenses of maintenance in addition to a rental. Is this rental an earning of the lessor company or an income? As an operating company it absolutely does nothing to or with that piece of track, how then does it earn anything from it? Two companies operating lines in this city cross each others' tracks; it is agreed in contracts that one company shall keep the crossings in repair and bill against the other its proportion of the expense. Should the amount of this bill be credited to earnings or expenses? If Mr. Emerson will agree that since it is for a proportion of the expense it should be credited to expense, will he not be willing to agree that that portion of a bill for power which covers the expense of production should be credited to expense also? If not, will he say why?

Just one more question and I am through. Should not dividends be charged against the profit and loss account direct? In other words, would it not be perfectly legitimate to pay a dividend in excess of the net income for the year, provided there was a surplus, after all deductions, that would warrant it? To accomplish this result on a statement without showing any deficit, why not make the income account end like this?

Net income for year		.....
Surplus from last year		.....
Credits		.....
Total		.....
Deductions:	Dividends	.....
	Other	.....
	Total deductions	.....
Present surplus as per balance sheet		.....

ADVANTAGES OF THE CAR HOUR

Milwaukee Electric Railway & Light Company

Editors Street Railway Journal:

Milwaukee, Wis., Dec. 1, 1902.

In the columns of the Nov. 20th issue of your paper there appears an article commenting on the values of the car hour and the car mile as units of comparison, in which the writer (a manager) states that the road with which he is connected has delayed for a year the adoption of the car hour as a basis, in order to learn from the advocates of that unit whether they now have any reason to change their views, etc.

The adoption of this unit by the Street Railway Accountants' Association of America, after a most complete discussion of its merits and demerits, is of itself an indorsement of its superiority, but, inasmuch as the benefits of such discussion are enjoyed only by the members of that association it may not be amiss to give a brief synopsis of the history of the car hour in order to show the careful consideration it received at the hands of the association before receiving its approval. Its investigation and discussion covered a period of three years, first, at Chicago, in 1899, when the writer advocated its use for all general comparisons, in place of the car-mile unit, which had been the standard since the inception of the street railway industry; again, at Kansas City, in 1900, where it received the approval of a select committee, to whom the matter had been referred, resulting in its being recommended for use for a year. The association instructed the committee to report again at the next annual convention, which was held at New York in 1901, where it was adopted without a dissenting voice.

The article before mentioned states that a unit of comparison may be more or less desirable for comparing one line or system or one period with another, but that its principal value to the manager is not as a unit of comparison—that what is most desired is the knowledge of what each particular line is actually doing and what net results it is accomplishing. I am at a loss to understand how the manager is to judge as to what the line is doing, or what its net results are without making use of some unit of comparison, for if he views them in their simplest form, viz., the gross and net earnings, he is comparing the result upon a monetary unit, the United States standard gold dollar, in preference to the weight or bulk of currency received and retained. In other words a unit of comparison is the guide to an intelligent understanding of the results accomplished, and the better the unit the clearer and more accurate will be that understanding.

Again, the question is asked, if the length of run or length of haul per passenger does not have a marked effect on the car-hour unit. I will concede that they may have an effect upon the revenue, but they do not affect the unit. The car hour remains exactly sixty minutes whether the length of run is 1 mile or 100 miles.

We are asked to compare a line requiring but thirty minutes for each half trip, with average earnings of $4 per round trip and 36 cents per car mile, with a longer line, requiring an hour for each half trip and average earnings of $6 per round trip and 20 cents per car mile. In connection with this question, to quote

from the article, "the question is, of what value are the figures for comparison? This would seem to be a fair example of attempting to compare, on a standard basis, two things which are unlike, and shows the difficulty, if not the utter futility, of making a standard unit of comparison." I cannot agree with the writer of the article in this mater, as I believe the lines are very similar (except in their respective earning powers) and are capable of correct comparison by reducing them to a common basis, viz., the car hour. This comparison would show the earnings to be in the ratio of 4 to 3. The figures per car mile I have not considered, as no data was submitted showing speed operated, and that unit has been shown to be unreliable in such comparisons.

Regarding the question as to comparison of lines having different proportions of transfer passengers, a comparison on the basis of the car hour neither raises nor lowers the percentage of cash passengers, but shows the conditions as they actually exist and persistently keeps this information before the management, which, in connection with a traffic statement, furnishes all requisite information for comparison.

To quote from another paragraph of the article, "one road pays its conductors and motormen 17 cents per car hour and another pays 23 cents or 25 cents per car hour, and there is again no equitable basis of comparison without a full knowledge of the details." Again I must disagree, for would not this fact be apparent if the car hour were used as the basis? The conductors' and motormen's wages would be a given amount, which, reduced to the car-hour basis, would show the cost per car hour, and any other period, line or system could be accurately compared with those figures, no matter what the amount expended was, as long as the corresponding account was reduced to the same car-hour basis.

In reference to the car hour as a unit for general comparisons of electric street railways, the undersigned does not claim that it is infallible, but simply that it is the best and most accurate unit yet suggested.

The arguments in favor of the car hour, as compared with the car mile, have been so often presented that I doubt whether a repetition would be of interest to your readers in general, but briefly stated they are as follows:

The absence of the element of speed, which is destructive of correct comparisons on the car-mile basis.

The fact that the principal items of expense, viz., conductors' and motormen's wages, are paid by the car hour and not by the car mile, and the further fact that operating expenses are generally affected more by the length of time operated than by the mileage made.

The company with which the writer is connected, having used the car hour as a basis for more than two years, believes it superior to the car mile, and has seen no reason to change its views since its adoption.

The president and general manager and superintendent of transportation are furnished a daily comparative statement of earnings by lines, per car hour, which keeps the management thoroughly in touch with the service given and its effect upon the earnings.

H. C. MACKAY,
AUDITOR.

ANSWERS TO MR. SMITH'S INQUIRY

CHICAGO CITY RAILWAY COMPANY.
Chicago, Dec. 18, 1902.

EDITORS STREET RAILWAY JOURNAL:

In response to the request of Mr. F. E. Smith, auditor of the Chicago Union Traction Company, to obtain the opinion of the readers of the STREET RAILWAY JOURNAL as to how he shall arrive most accurately at the loss which he states his company will be likely to sustain from increased transfer privileges given passengers over the lines operated by his company, I will offer a suggestion. Assuming there will be a loss, that is to say, a decrease in passenger receipts, the method I would pursue most accurately to determine such a loss would be to compare the average receipts per passenger (fare and transfer passengers) for, say, the month of November, 1902, under the operation of the increased transfer privileges, with those for the month of November, 1901, under the operation of the transfer privileges in force at that time.

The decrease in the average receipts per passenger, for the respective periods mentioned, multiplied by the number of passengers carried in the month of November, 1902, would give the loss sustained.

C. N. DUFFY,
SECRETARY AND AUDITOR,

New York, Dec. 13, 1902.

EDITORS STREET RAILWAY JOURNAL:

In your issue of Dec. 6 Mr. F. E. Smith, auditor Chicago Union Traction Company, asks how he can arrive most accurately at the loss that will be likely to follow from the increased transfer privileges given to the public in compliance with a decision of the Supreme Court. It appears that Mr. Smith is assuming that there will be a loss of some kind without knowing definitely where to look for it, but is it certain that there will be a loss? In a matter of this kind we must not follow the reasoning of the young fisherman who, when asked how many fisn he had caught, replied, "When I catch this one and two more I will have three." Nor should we imitate the logic of the manager who had recently changed from a 10-cent to a 5-cent fare on a considerable portion of his road, and experienced immediately a large increase in passengers, upon which he figured a loss of 5 cents for each additional passenger, although his earnings continued to show the usual normal increase. It will be exceedingly interesting to learn at a later time whether the increased transfer privileges in Chicago have produced a result at variance with the usual course of events.

It would appear desirable first for Mr. Smith to determine whether there is any loss and next to locate it definitely. For this purpose there should be a separation of the lines affected from those not affected. A statement for the six months immediately preceding and the six months immediately following the increased transfer privileges should be made, covering the lines affected, showing (a) the earnings, (b) the timetable cost, (c) the passengers carried, and (d) the car mileage of the car hours. From this statement it will be possible to deduce for comparison the following items, viz.:

1. The earnings per passenger.
2. The timetable cost per passenger.
3. The earnings per car mile or per car hour.
4. The timetable cost per car mile or per car hour.
5. The passengers per car mile or per car hour.
6. The relative porportions of cash and transfer passengers.

If there are any incidental expenses clearly dependent upon the increase in transfers they should, of course, be picked out and shown as separate items on the statement.

Should it happen that the number of passengers has increased it would be well to inquire whether it is the regular normal increase or whether it is due to increased car service or to the new transfer arrangements. If the passengers have increased beyond the normal without a corresponding increase of earnings, and at the expense of increased timetable cost, car mileage or car hours, it will be fair to figure a loss equal to the increased cost, provided, of course, the increased cost contains no extraneous elements such as increased wages, etc. If, however, there should be an increase in the earnings without a proportionate increase in timetable cost, car mileage or car hour it would seem to indicate clearly that there has been a net gain instead of a loss.

The almost universal experience where fares have been re-

duced, or (which amounts to the same thing) where increased transfer privileges have been granted, is that it does not materially increase the rush hour traffic at the start, although it attracts more regular riders gradually. It is quite well understood that the regular riders to and from business, at stated hours, are a pretty constant factor. What it does do almost immediately is to induce more people to ride for pleasure, for shopping, for making calls in the non-rush hours, thus enabling the cars to carry more complete loads without increasing materially the cost of operation. In many cases the gain in passengers may be traced largely to riders who wish to go a short distance over two intersecting lines, and are willing to pay one fare but not two. It will almost certainly follow that any considerable increase in the number of transfer passengers will be reflected in an increase in the cash fares.

It would seem that the figures which Mr. Smith may prepare will show unmistakably the greatly increased accommodation given to the public, but it is extremely problematical whether any loss that might be attributed directly or indirectly to the increased transfers can be clearly shown unless the net earnings are adversely affected. It is difficult to show by figures all the factors entering into a proposition of this character. Many of these factors must be discovered by actual daily observation of the traffic, and may be stated in words but not in figures. This is probably the difficulty Mr. Smith had in mind when he asked for an expression of opinion. One of the usual results where the increase in the transfer privileges is radical is a marked change in the routes of traffic, which naturally seeks the shortest and quickest routes, and, like the electric current, follows the line of least resistance. Where such a process has worked almost a revolution in the volume traffic on certain lines figures for comparing one period with another are not of much value.

An Eastern Manager.

TRANSFORMING AN EGYPTIAN RAILWAY TO ELECTRICITY

Although it was only in March last that the boards of the Alexandria & Ramleh Railway Company and the Alexandria Tramway Company definitely decided on transforming their respective lines into an electric traction system, the progress up to date has been so rapid that the company hopes to have the electric cars running and in service by next May. The service will be at ten minutes' interval on each line, so that at Bulkeley Junction there will be a train service every five minutes. Each train will consist of one first and one second class carriage. Seven of the first-class carriages have double decks with harem compartments. Of the second-class carriages fifteen have double decks to cope with the heavy summer traffic. Both the first-class and second-class double-deck cars have a seating capacity of sixty-four passengers each. These coaches are considered as fine and as commodious as any in the world. The interiors of the carriages in the first-class are upholstered in royal blue, and the seats are of interwoven rattan, which is very cool, and is the proper material for a climate like Egypt. These coaches are supplied by the British Electric Car Company, of Manchester. The second-class cars are the same as those of the first-class in every detail except as regards the upholstering and the roof decorations. The cars are painted outside in royal blue and white, and will form a picturesque addition to the landscape of Ramleh. They will be blazoned with the monogram of the Alexandria & Ramleh Company in the center panel.

The first fifteen coaches are due to arrive at Alexandria on Feb. 1, fifteen on Feb. 7, fifteen on Feb. 21, and the final seven on March 1, making a total of fifty-two cars. The trucks are supplied by the European McGuire Manufacturing Company, of London and Bury. There will be two 1000-hp compound engines supplied by Tosi, of Milan. This same type of engine is to be seen at Cairo driving the Tramway Company's service. The boilers are water-tube, and are of the Belgian type. The electric plant will be supplied by Brown Boveri & Company, of Baden, Switzerland, and will consist of two 600-kw, three-phase, high-tension generators of 6500 volts. The current will be generated at Karmous and taken along an overhead high-tension line, which will follow the banks of the Mahmoudieh Canal at Bulkeley. At Bulkeley there will be a sub-station, which is now under construction, where the current will be reduced to 382 volts, which will in turn be converted to 500 volts direct current. The switchboards are supplied by Brown Boveri & Company, and will consist of highly polished white marble and mounted throughout with Weston instruments. The switches are of the well-known Swiss type, both high and low tensions. All stations will be lighted with arc lamps of 2000 cp. each.

Commencing with Jan. 1 the railway and tramway companies will run in connection with each other. By so doing the operating expenses will be greatly reduced. When the extension of the Ramleh Boulevard is made the terminus of the railway will be in Mohamed Ali Square. During the summer months extra through special cars will run direct from San Stefano to Mex. During any heavy rush of traffic at any one point the two systems will be thrown into conjunction, so that heavy traffic will be readily removed and with as little delay as possible. During the summer months, when traffic is very heavy, there will be a two and a half minutes service between Alexandria and San Stefano.

ANNUAL STATEMENTS OF STREET RAILWAY COMPANIES IN NEW YORK STATE

Through the courtesy of the Board of Railroad Commissioners of the State of New York examination of the annual reports of the New York State street railway companies for the year ending June 30, 1902, and not yet published in report form, has been permitted to a representative of the Street Railway Journal. The principal figures of these companies, showing the capitalization, gross and net earnings, operating expenses, dividends paid in amount and per cent on capital, and surplus and deficit for the year are given in tabular form on the accompanying tables.

These tables show some very interesting results for a year, which has been termed by many a year of prosperity, and which for most manufacturing companies has been so. Thus, of the ninety-two street railway companies in the State only nine have paid dividends, and of these only seven earned the dividends paid by them. The Metropolitan Street Railway Company, included in this list, is not an operating company, as its property has been leased to the Interurban Street Railway Company, so that as it is a dividend payer the list of companies paying dividends should be really reduced by one. The Metropolitan Company has been included in this report simply for the reason that it has for so long been the largest operating company in the State that its figures are a matter of interest.

The rates of dividends paid were as follows: One company paid 16 per cent, one paid 10 per cent, one paid 9 per cent, one paid 8 per cent, one paid 7 per cent, one paid 5 per cent, two paid 4 per cent and one paid 1 per cent on their entire capital stock.

Of the eighty-three companies which did not pay dividends forty-nine companies, or over 53 per cent, of the total number in the State showed a deficit at the end of the year's operation, while on nine of these roads the operating expenses alone were more than the entire gross receipts, without making any allowance for fixed charges. If the Ford Franchise Tax, now under litigation, were in force, the showing would, of course, be much poorer.

FINANCIAL REPORTS OF THE OPERATING STREET RAILWAYS OF NEW YORK STATE FOR THE YEAR ENDING JUNE 30, 1902.

NAME	ON JUNE 30, 1902		YEAR ENDING JUNE 30, 1903					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividend Paid Amount	Dividend Paid Per Cent	Surplus for Year
	$	$	$	$	$	$		$
Albany & Hudson (Hudson)	2,500,000	2,500,000	187,882	120,937	146,520	.....	..	def. 79,575
Amsterdam	1,000,000	1,000,000	60,051	38,978	19,197	.....	..	1,877
Auburn City	300,000	300,000	88,647	68,792	27,398	.....	..	def. 7,543
Auburn-Interurban	250,000	150,000	18,415	11,986	10,173	.....	..	def. 3,744
Babylon	25,000	33,000	200	199	1,719	.....	..	def. 1,718
Ballston Terminal *	300,000	250,000	14,611	10,800	965	.....	..	2,845
Bennington & Hoosick Valley	200,000	182,000	38,216	27,186	11,784	.....	..	def. 755
Binghamton	731,860	1,267,000	207,900	114,631	66,419	.....	..	26,851
Black River Traction (Watertown)	105,000	55,000	54,323	57,465	4,200	.....	..	def. 7,342
Brooklyn Heights	200,000	250,000	11,856,727	7,717,129	4,268,753	.....	..	df. 129,156
Brooklyn, Queens County & Suburban	2,000,000	6,624,000	828,646	429,824	372,420	.....	..	26,402
Buffalo & Depew	350,000	350,000	10,267	20,590	19,125	.....	..	def. 29,448
Buffalo, Gardenville & Ebenezer	39,300	22,000	13,027	10,426	2,490	.....	..	110
Buffalo & Williamsville Electric	75,000	.....	16,357	8,859	870	.....	..	6,628
Catskill	60,000	54,000	8,873	7,674	2,954	.....	..	def. 1,766
Central Crosstown	600,000	250,000	500,260	340,967	106,531	60,000	10	def. 7,235
Citizens Railroad, Light & Power Co	75,000	75,000	37,866	24,631	8,650	.....	..	4,585
City Island	50,000	27,873	4,953	4,038	1,909	.....	..	def. 994
Cohoes	50,000	85,000	25,065	21,616	7,417	.....	..	def. 3,968
Coney Island & Brooklyn	2,000,000	2,000,000	1,507,713	909,591	264,053	320,000	16	14,069
Coney Island & Gravesend	35,400	.....	35,175	32,316	369	.....	..	2,491
Corning & Painted Post	100,000	100,000	33,899	20,826	7,407	.....	..	5,667
Cortland County Traction Co	320,000	180,000	37,617	31,431	8,275	.....	..	def. 2,089
Dry Dock, East Broadway & Battery	1,200,000	2,050,000	585,975	466,993	133,635	.....	..	def. 14,652
Dunkirk & Fredonia	136,410	61,000	43,302	22,018	6,317	12,310	9	2,657
Dunkirk & Gratiot	25,000	55,000	8,974	4,594	2,760	.....	..	1,620
Elmira & Seneca	300,000	300,000	29,903	30,815	17,725	.....	..	def. 18,637
Elmira Water, Light & R.R.	1,000,000	3,200,000	162,232	128,309	41,208	.....	..	def. 7,286
Fonda, Johnstown & Gloversville	600,000	1,100,000	411,944	243,540	115,920	48,000	8	4,483
Forty-Second St., Manhattanville & St. Nich. Ave	2,500,000	2,700,000	839,144	466,525	376,316	.....	..	def. 3,697
Fulton & Oswego Falls	15,000	15,000	2,267	2,688	1,319	.....	..	def. 1,740
Fulton Street (New York)	500,000	500,000	43,694	31,747	21,697	.....	..	def. 9,751
Geneva, Waterloo, Seneca Falls & Cayuga Lake	450,000	436,500	66,955	39,630	20,542	.....	..	6,783
Hamburg	200,000	200,000	29,563	27,123	1,280	.....	..	1,160
Hornellsville & Canisteo	50,000	80,000	17,365	11,695	3,882	.....	..	1,788
Hornellsville Electric	50,000	70,000	15,158	12,828	3,523	.....	..	def. 1,193
Hudson Valley	2,722,400	2,985,500	357,177	226,791	126,924	.....	..	3,463
Huntington	30,000	26,000	12,118	13,622	1,821	.....	..	def. 3,325
International Traction & International Railway	15,000,000	14,715,000	4,566,503	2,256,481	1,174,467	.....	..	1,135,554
Ithaca	325,000	325,000	111,090	95,409	23,135	.....	..	def. 7,455
Jamestown	100,000	300,000	116,117	76,718	32,127	.....	.	7,272
Kingston Consolidated	400,000	700,000	111,683	70,077	32,947	.....	..	8,659
Lewiston & Youngstown Frontier	134,000	134,000	10,457	9,665	10,157	.....	..	def. 9,365
Lima & Honeoye Falls Electric Light & R.R. Co.	125,000	40,000	8,780	13,632	.....	.....	..	def. 4,851
Manhattan Elevated	47,999,700	39,545,000	11,291,711	5,518,585	2,699,671	1,920,000	4	1,153,455
Metropolitan (New York City)	52,000,000	21,750,000	15,866,641	7,385,883	4,815,421	3,640,000	7	25,337
Middletown-Goshen	100,000	275,000	48,113	46,437	2,314	.....	..	def. 638
New Paltz & Poughkeepsie Traction	100,000	100,000	17,133	14,120	6,079	.....	..	def. 3,065
New York & North Shore	600,000	600,000	125,077	86,900	39,373	.....	..	def. 1,196
New York & Queens County	3,100,000	3,000,000	548,464	311,636	181,762	.....	..	55,066
New York & Stamford	500,000	365,000	109,311	72,348	20,540	.....	..	16,424
Niagara Gorge	1,000,000	1,000,000	279,436	54,030	49,792	.....	..	175,615
Ocean Electric (Rockaway, L. I.)	35,000	20,000	5,560	4,951	1,304	.....	..	def. 695
Ogdensburg	150,000	150,000	24,063	21,755	10,036	.....	..	def. 7,728
Olean	300,000	278,500	56,040	29,118	16,493	.....	..	10,429
Oneida Railway Co	15,000	10,000	4,054	3,951	636	.....	..	def. 533
Oneonta, Cooperstown & Richfield Springs	750,000	750,000	41,180	33,165	933	.....	..	7,082
Ontario Light & Traction	30,000	39,785	6,931	5,987	257	.....	..	687
Orange County Traction	325,000	425,000	102,222	62,158	29,201	.....	..	10,864
Oswego Traction	300,000	288,000	41,017	32,623	13,504	.....	..	def. 5,110
Peekskill	350,000	500,000	56,352	24,532	24,543	.....	..	7,277
Pelham Park R.R. Co	50,000	50,000	10,498	9,126	3,390	.....	..	def. 2,018
Penn Yan, Keuka Park & Branchport	94,000	100,000	17,197	14,757	6,767	.....	..	def. 4,328
Plattsburg Traction	100,000	80,000	18,871	15,440	5,986	.....	..	def. 2,555
Port Jervis	450,000	275,000	9,629	7,660	887	.....	..	1,082
Poughkeepsie & Wappinger's Falls	750,000	404,000	93,740	56,037	22,116	.....	..	15,587
Richmond Light & R.R. Co.	1,250,000	2,000,000	219,118	160,508	102,774	.....	..	def. 44,163
Rochester	5,000,000	4,555,950	1,068,222	572,982	313,540	54,110	1	127,589
Rochester, Charlotte & Manitou	97,000	81,250	14,428	13,477	4,642	.....	..	3,693
Rochester & Sodus Bay	1,750,000	.....	107,700	79,658	31,168	.....	..	def. 3,126
Rochester & Suburban	420,000	450,000	48,521	24,112	21,650	.....	..	2,758

* Receiver's report for period from July 1, 1901, to January 25, 1902.

Financial Reports of the Operating Street Railways of New York State for the Year Ending June 30, 1902.—*Continued.*

Name	On June 30, 1902		Year Ending June 30, 1902					
	Capital Stock	Funded Debt	Total Receipts All Sources	Operating Expenses	Charges on Earnings	Dividend Paid		Surplus for Year
						Amount	PerCent	
	$	$	$	$	$	$		$
Rome	150,000	123,500	10,019	20,974	7,363	.....	..	def. 18,318
Schenectady	600,000	1,050,000	350,907	222,235	57,773	.....	..	70,898
Sea Cliff Inclined	9,500	2,000	1,238	803	223	.....	..	212
Southern Boulevard	250,000	250,000	60,505	43,205	18,313	.....	..	def. 1,013
Staten Island Midland	1,000,000	1,000,000	137,914	88,242	63,526	.....	..	def. 13,854
Syracuse, Lakeside & Baldwinsville	500,000	500,000	87,855	74,714	32,153	.....	..	def. 19,011
Syracuse Rapid Transit	4,000,000	3,836,000	693,284	384,265	228,246	.....	..	80,733
Syracuse & Suburban	400,000	427,000	70,106	41,942	27,277	.....	..	888
Tarrytown, White Plains & Mamaroneck	300,000	300,000	65,737	63,231	16,947	.....	..	def. 14,441
Third Avenue (New York)	15,995,800	40,000,000	2,951,202	1,416,429	1,758,309	.....	..	df. 223,536
Thirty-Fourth Crosstown	1,000,000	1,000,000	456,841	278,321	65,004	.....	..	df. 113,516
Troy & New England	180,000	183,800	26,456	16,458	10,165	.....	..	def. 166
Twenty-Eighth & Twenty-Ninth Sts. (New York)	1,500,000	1,500,000	180,927	106,897	85,478	.....	.	def. 11,447
Union (New York City)	2,000,000	2,000,000	1,024,259	697,757	223,652	.....	..	102,851
United Traction (Albany and Troy)	4,999,950	4,241,300	1,479,608	1,004,918	272,090	249,991	5	def. 47,396
Utica & Mohawk Valley	4,850,000	2,150,000	424,844	256,423	99,902	.....	..	68,519
Van Brunt St. & Erie Basin (Brooklyn)	200,000	65,000	50,055	31,708	6,171	8,000	4	4,177
Waverly, Sayre & Athens	200,000	150,000	49,953	35,694	10,218	.....	..	4,041
Westchester Electric	500,000	500,000	222,596	251,137	35,269	.....	..	def. 63,810
Westchester Traction	300,000	138,000	18,101	19,725	6,656	.....	..	def. 8,280
Yonkers	1,000,000	1,000,000	221,781	187,494	61,746	.....	..	def. 27,459

THE PENNSYLVANIA RAILROAD TUNNEL

Although the franchise for the Pennsylvania tunnel has only just received the approval of the Board of Aldermen and been signed by the Mayor, the preliminary plans for this great undertaking and the organization for carrying on the work are well under way. The Pennsylvania Railroad officials, recognizing the magnitude of the enterprise, have very wisely decided not to encumber their own operating departments by attempting to have them perform this work, and, accordingly, they have arranged to treat the entire project as an independent enterprise. While the tunnel and the terminal facilities will be devoted to the use of the Pennsylvania system, the work of construction will be carried on by the Pennsylvania, New York & Long Island Railroad Company, an auxiliary organization formed explicitly to construct, own and operate this property. The actual accomplishment of this project, however, has been subdivided under three heads, and will be entrusted to three separate organizations, which in a measure will be distinct and independent but at the same time will work entirely in harmony. These are the commission, composed of six prominent engineering experts, the engineering department and the architectural department. The commission will consist of the following members: Colonel C. W. Raymond, United States engineer in charge of New York harbor work, who will be chairman; Charles M. Jacobs, chief engineer of the North River section of the tunnel, which extends from west of the Bergen Hill in New Jersey to the terminal station at Ninth Avenue, in New York; Alfred Noble, chief engineer of the East River section, which will extend from Seventh Avenue, New York, to Long Island City; William H. Brown, chief engineer of the Pennsylvania Railroad system, who will be chief engineer of the terminals and track construction; Gustav Lindenthal, the present bridge commissioner of New York, who will act in a general advisory capacity, and George Gibbs, who will have charge of the traction, mechanical and electrical engineering. Mr. Gibbs is also electrical engineer of the Long Island Railroad Company, which is at present engaged in the electrification of its lines in conjunction with the Pennsylvania system, of which it is a part.

The engineering has been entrusted to Westinghouse, Church, Kerr & Co., who will have charge of all engineering problems exclusive of the construction of the tunnel proper, and will act as engineers for the Pennsylvania Railroad Company, the Long Island Railroad Company and the architects in the working out of all problems involving civil, mechanical and electrical engineering. The architectural work has been assigned to McKim, Mead & White, who will have charge of all structural details involving the terminal station and accompanying structures of the New York terminal.

The Pennsylvania Company has naturally given this subject very careful consideration in view of the magnitude of the project and the enormous investment which will be required, as well as the influence which it will exert in developing and improving the service of that corporation. It will be of interest in this connection to mention that in addition to the New York tunnel project, which will involve an expenditure of upwards of $50,000,000, the Pennsylvania Company has at the present time under consideration and in actual progress of completion other improvements in the system, the expense of which, it is reported, will aggregate at least the amount required for this tunnel enterprise. The wisdom of the decision reached by the management to entrust this entire terminal project to a distinct organization will be at once recognized, as it will relieve the company's engineering and operating departments of all direct responsibility for the plans and details of the work, although, of course, the Pennsylvania Company will be financially responsible for the entire project and will approve of all methods employed. This plan for accomplishing this work is original in many respects, and is certainly a very practical and business-like arrangement. It will be noticed that the Pennsylvania commission, which will have general supervisory powers and will pass upon all questions involved in the construction and equipment of the tunnel system, is composed of prominent engineering experts in every line of work included in this enterprise.

It is a significant fact, illustrative of the thoroughness with which the preliminary organization has been perfected, that the engineering department has already completed plans for the power plant in Long Island City, which will be the first one to be installed, and this plant will be utilized in the construction work.

There will be another electrical power plant in New Jersey,

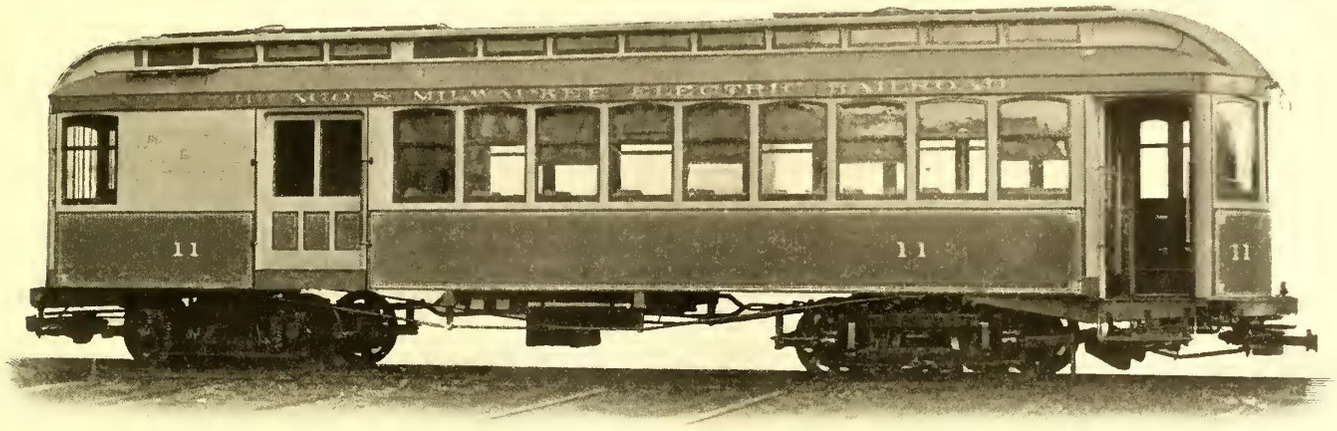
not be undertaken until the work on the tunnel has progressed considerably. For the present efforts will be directed toward completing the Long Island branch of the work, including the transformation of the Atlantic Avenue line of the Long Island Railroad Company into an electric system. This will extend from Flatbush Avenue to Jamaica, and will have a physical connection with the Rapid Transit Subway system, but it has not yet been determined whether the cars of the Long Island Railway will be operated through the subway or not.

The problems involved in the tunnel project and the relations of the Pennsylvania Railroad, the Long Island Railroad and other contributory lines have been very carefully worked out, and it is believed that the completion of the undertaking will mark one of the greatest industrial improvements in the history of the city.

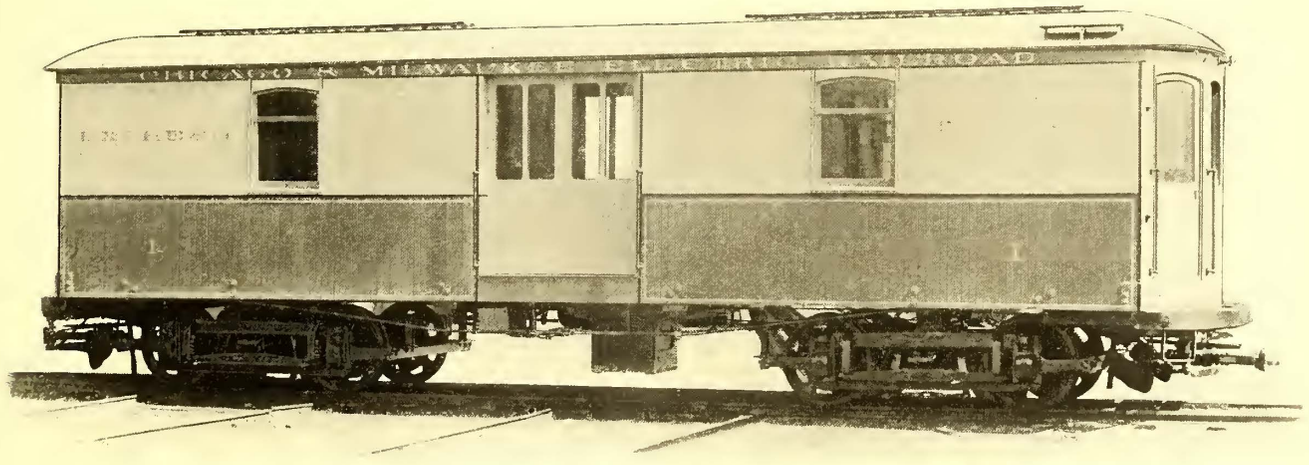
Electric cars and electric lights are to play an important part in the coming carnival of La Fiesta de las Flores, to be held at Los Angeles, Cal., in the spring of 1903. Street railway floats, such as were used in festivals at New Orleans and Kansas City, will be used. As at these cities the car bodies will be removed from the trucks, which will then be covered with a platform of wood. It is probable that each float, in gorgeous incandescent outline, will represent some flower in bloom. Not a few of the floats will be fitted with as many as 300 incandescent lamps and a number of arc lights. John A. Muir, general manager of the Los Angeles Railway Company, has offered the fiesta committee the necessary cars, the car house at Agricultural Park, where the floats can be prepared, power on the four nights of the parade, electricity for illumination, and conductors and motormen.

NEW CARS FOR CHICAGO & MILWAUKEE ELECTRIC RAILROAD

The J. G. Brill Company, of Philadelphia, has lately built a number of combination passenger and baggage and express cars for the Chicago & Milwaukee Electric Railway Company. The combination cars are of the Brill patented semi-convertible type. They are 40 ft. long over end panels and 45 ft. over vestibules. The width over sheathing is 8 ft. 10 ins. The baggage compartments are 15 ft. long, and have sliding doors 4 ft. wide. There are sixteen 39-in. reversible seats and two longitudinal corner seats in the passenger compartment. This compartment is finished in natural cherry with decorated maple ceilings and solid bronze trimmings. The baggage room contains the motorman's cab, and is fitted with folding seats for smokers. The windows in the vestibule and in the end of the baggage compartment are arranged to drop, while those of the passenger compartment are raised into roof pockets, according to the regular methods of the company.



COMBINATION CAR FOR CHICAGO & MILWAUKEE ELECTRIC RAILROAD



EXPRESS CAR FOR CHICAGO & MILWAUKEE ELECTRIC RAILROAD

The express cars are 38 ft. over crown pieces and 8 ft. 10 ins. wide over sheathings. There are wide double doors on each side, and doors at diagonal corners into the motorman's cab, so that he may readily enter or leave without passing through the car. Doors give entrance also from the car into the cabs. The sills are heavily plated and the framing extra strong, for the carrying of heavy loads.

All the cars are equipped with patented angle-iron bumpers, "Dedenda" gongs, improved track scrapers and radial drawbars. The trucks of both passenger and express cars are of the No. 27 high-speed pattern.

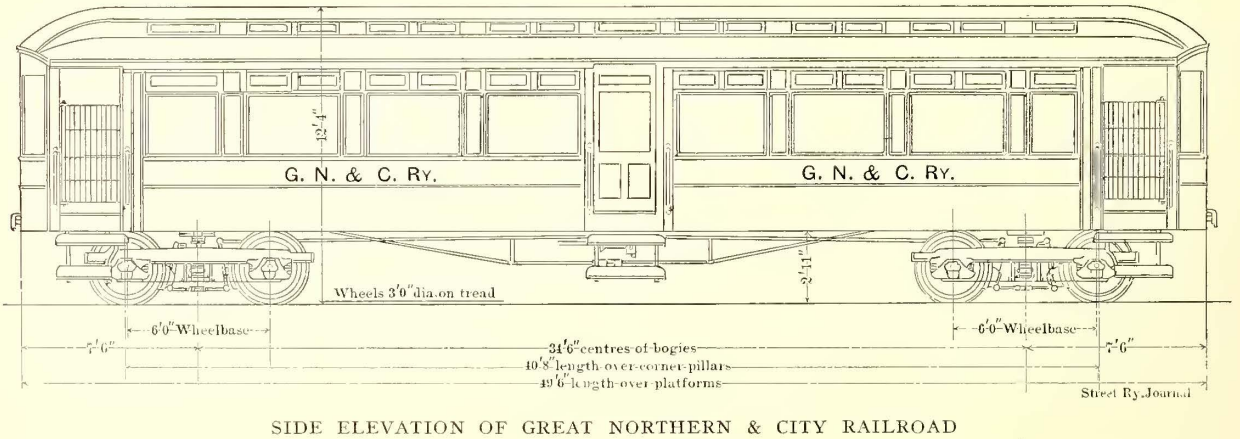
probably near the western terminal of the tunnel, but this will

CARS FOR A NEW LONDON TUBE RAILWAY

In the issue for March 1, 1902, of this paper a description was given of the construction of the underground tube railway of the Great Northern & City Railway. This work has now progressed so far that some of the cars have already been delivered, and views are presented herewith. The cars, which were built by the Brush Electrical Engineering Company, of London, were designed for the contractors, Messrs. Pearson & Son, by Sir Douglas Fox & Partners, engineers. They are to be run in trains of seven cars each, three of which, the two end and middle ones, are motor cars, to be used with the multiple unit system.

TRAIN OF CARS, GREAT NORTHERN & CITY RAILROAD

The motor coaches have the following principal dimensions: Length of body outside, 40 ft. 8 ins.; length over platforms, 49 ft. 6 ins.; width over side pillars, 9 ft. 4 ins.; width inside, clear, 8 ft. 9 ins.; height inside at the center, 8 ft. 4 ins.; height of doorway, clear, 6 ft. 3 ins.; width of doorway, clear, 2 ft. 10 ins.; distance of bogie centers, 34 ft. 6 ins.; wheel base of bogies, 6 ft. 1 in.; gage of track, 4 ft. 8½ ins.; seating capacity, 60 passengers.



SIDE ELEVATION OF GREAT NORTHERN & CITY RAILROAD

The construction of the cars consists of a steel channel-section underframe, the sole-bars of which are filled with a pitch pine timber the whole length of the car, for the reception of the body frame. Two channels run the whole length of the underframe, to which the floor members are securely bolted, the whole being braced diagonally and trussed both transversely and longitudinally. The floor boards are 1-in. red deal, two layers in thickness, running in opposite directions.

The roof is of the clere-story type, with swinging sashes, pivoted for ventilation. It is supported by channel and flat ribs, and strengthened by a number of flat steel carlines, 2 in. x ½ in., carried across the top and down the sides of each cant rail. The roof boards are of red deal, ¾ in. thick, tongued and grooved, and covered with prepared roofing canvas, laid wet on two coats of white lead paint. Sliding doors are provided in panels between the windows are inlaid with sycamore and pressed teak moulding. The other mouldings are of teak, the roof being finished with Lincrusta millboard, painted dull white and divided into eight transverse panels.

The cars are provided with thirteen cross-seats on each side, giving accommodation for two passengers on each; the rest of the seating capacity consists of short longitudinal seats at either end; ample room is allowed per passenger. A combination vertical grab-handle and hat rack of ornamental pattern is fitted to the top of each seat frame. The seats and backs are of best quality spring rattan in mahogany frames. Each door is provided with an automatic spring lock, and these, together with the commode handles and other metal furniture, are of lacquered brass of substantial design.

The electric lighting consists of fifteen 16 cp lamps, fixed to the rails underneath the ventilators on each side and to the end bulkheads. The fittings are arranged to carry a cut-glass pear-shaped globe of an artistic appearance.

A portion of the car, 2 ft. 10 ins. long, at one end is partitioned off for the reception of the electric control apparatus. This compartment is lined with sheet iron and asbestos, which ensure complete protection against fire from any of the electrical gear. An oil lamp is fitted over the inside of each doorway for use when the current is cut off.

The internal woodwork is French polished and finished with a coat of best pale varnish. Outside the cars, which are completely panelled and framed in teak, are got up natural grain

and finished in varnish. The iron work of the underframes is painted with best chocolate oxide. Each coach is lettered "G. N. & City," in 5-in. gold-block shaded letters on the center waist panel, the number being painted in two places on panels between the windows at each end of the coach.

The trailer coaches are of the same general design and construction as the above, except that the platforms are not vestibuled but are fitted with an iron screen 4 ft. 6 ins. in height, carried round the end of each gangway; they are provided with similar wrought iron locking gates.

The Brush "heavy service" trucks, type "E," have been provided. These trucks have cast steel sides, inside brakes and a swing bolster, which ensures very steady running. They are designed for the heaviest service, with speeds as high as 80 miles per hour. The wheel are steel-tired with wrought iron centers.

Both motor and trailer coaches are provided with the Westinghouse quick-acting air brake, the motor coaches being also fitted with an efficient hand-brake, which can be operated from either platform. Air pumps, electrically-driven and automatically controlled, are situated in each contactor compartment. Central radial spring couplers, which also act as buffers, are supplied.

Collapsible iron gates are fitted to the opposite corners of each car, so as to be interchangeable when coupling the cars. These are to rail off the space between the coaches. Hinged cross-over plates are used to provide a gangway between the adjacent platforms, the latter being protected by wrought iron fencing.

INGENIOUS FORM OF SASH LIFT AND ROLLER SHADE

An improved form of spring roller for use both as a sash lift or as a shade roller, has recently been brought out by the O. M. Edwards Company, of Syracuse. This company has done a very large business with both steam and street railway companies in window fixtures, as well as in extension platform trap doors, self-raising sash and other appliances, which have proved very popular. The spring roller of the company, illustrated herewith, possesses a number of special advantages, the principal one being that by means of a worm-gear bracket the roller can be adjusted to any tension desired without removing it from the brackets.

A section with end elevations of the roller is presented in Fig. 1. As will be seen there are four openings or round holes passing through the flange at the spring or spindle end of the roller barrel. In a circular disc, located upon the spring spindle, there is a series of openings or recesses arranged in such a manner that a pin or wire nail inserted through one of the four holes in the roller barrel, can enter one of these notches or openings upon the disc of the spindle, and will lock the roller barrel at any point. Upon the first movement of the roller, by pulling down upon the fabric which is attached to the roller, the pin will drop out of engagement, through gravity, and the continuous spring is obtained.

If it is desired to remove the roller from the bracket for any purpose the roller is readily locked with the spindle by inserting a nail at any position, the tension of the spring holding the nail in engagement. The advantages of this construction are apparent in rollers where a continuous spring is desired, as in the case of car shades which are held by friction shoes sliding in grooves, and in rollers designed for sash balance work, where the design of roller with gravity pawls to catch at intervals is not desired.

After placing the roller in the brackets if the spring is found either too strong or too weak it can be adjusted by means of the worm-gear roller bracket, illustrated in Fig. 2. The interior construction of this bracket is so clearly shown in the engraving that no especial description is necessary. A socket wrench is provided to engage with the end of the worm which projects from the roller bracket.

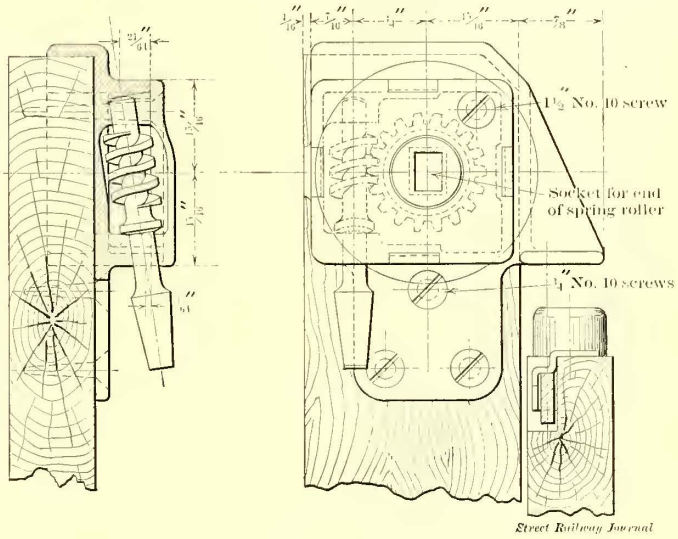


FIG. 2.—ADJUSTABLE SOCKET

This design of roller, together with the worm-gear roller brackets, is especially recommended by the manufacturers for open street car curtains.

This design of spring roller and worm-gear roller brackets has been adopted as standard by the Pennsylvania Railroad upon all its old and new passenger car equipment. At the present time it is being substituted in place of the ordinary type of metal tape sash balances with which the company's cars were formerly equipped, it having been found cheaper to substitute this roller balance than to maintain the sash balance referred to, in service, upon cars which have already been equipped.

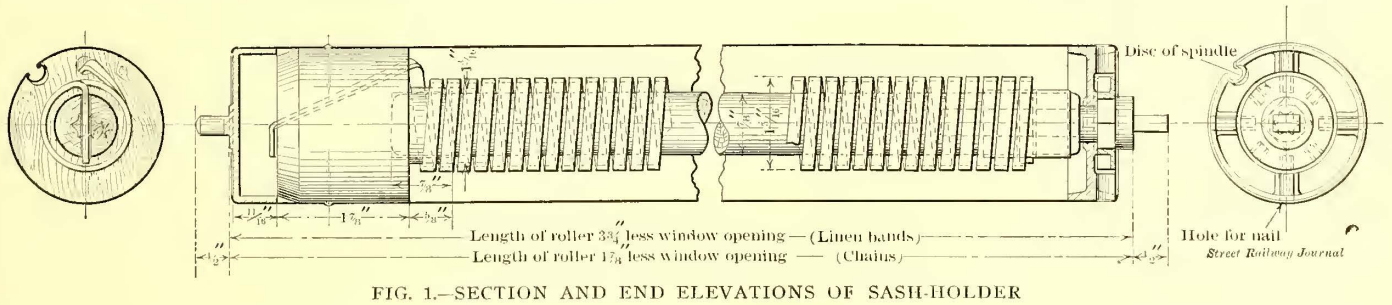
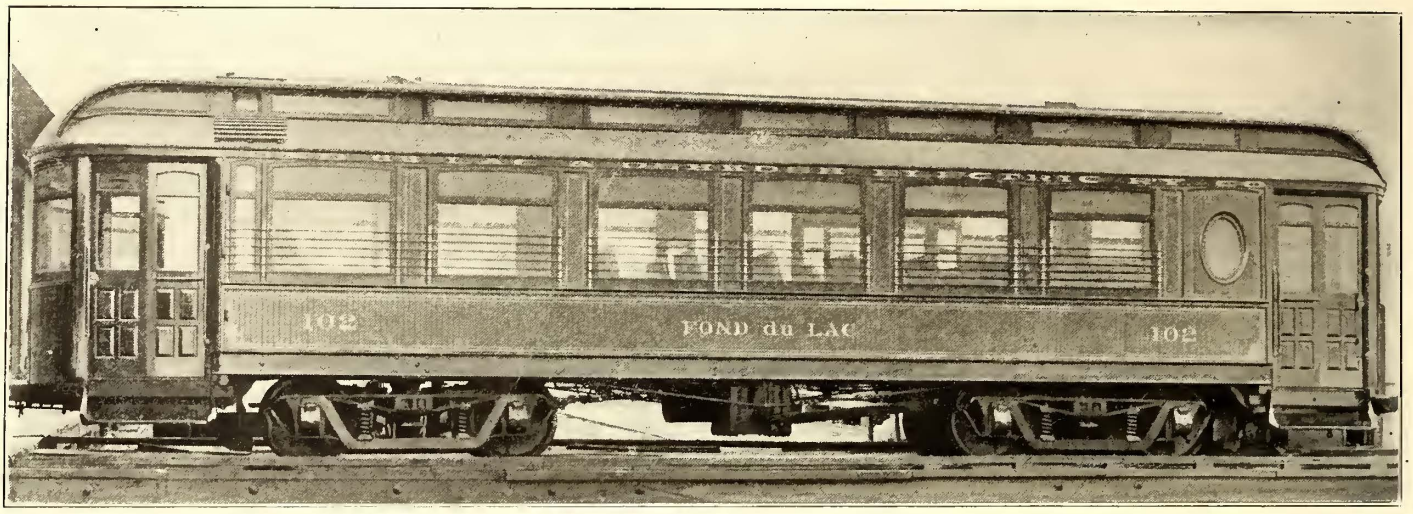


FIG. 1.—SECTION AND END ELEVATIONS OF SASH-HOLDER

Articles of incorporation have been filed in Connecticut by a corporation with a capital stock of $3,500,000, to be known as the Netherlands Tramway Company, of Bridgeport. The capital stock is divided into $1,500,000 of 5 per cent cumulative preferred stock, and the balance is common stock. The incorporators of the company are: Louis B. Grant, of Brooklyn, N. Y.; Richard F. McKinary, Charles T. Lark, of New York. It is understood that the company is to secure tramway and other franchises in the Transvaal and Orange River colonies in South Africa.

NEW CARS FOR FOND DU LAC

The St. Louis Car Company has just finished an order of cars for the Fond du Lac & Oshkosh Electric Railway Company, one of which is illustrated herewith. The general dimensions are as follows: Total length of car body, 34 ft.; total length over bumpers, 45 ft.; total width, 8 ft. 8 ins. They are



NEW DOUBLE-TRUCK CAR FOR FOND DU LAC

of the semi-convertible type, having the Robertson patent channel steel side sill bottom, with double flooring. They are finished with the steam coach roof, and have a double set of windows, the outer window to be removed for summer service, and the inner window arranged in two sections. Both upper and lower sash drop within 24 ins. of the floor line, making practically an open car. These cars are provided with smoking compartment and toilet room, and are heated with the Peter Smith hot water heaters. The interior finish is of mahogany. St. Louis Car Company's patent "walk-over" seats, covered with plush, and pantasote curtains are furnished. The car has vestibules at both ends, with removable folding doors. St. Louis Car Company's ratchet vertical brake wheel, angle-iron bumper, arc headlight, track scraper and fender complete the equipment. The car is mounted on the No. 23-A M. C. B. type truck, fitted with Westinghouse No. 56 motors, and Christensen air brakes.

THE IMPROVED WEINLAND TUBE CLEANER

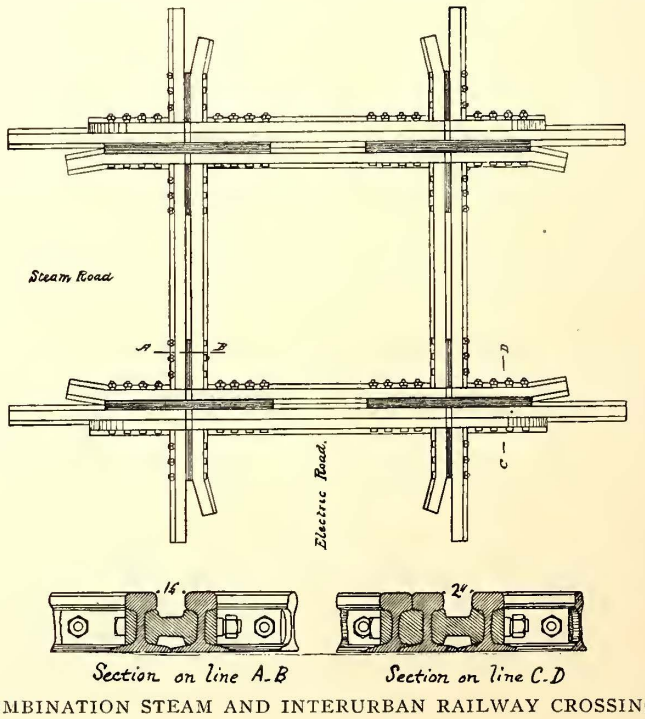
The Lagonda Manufacturing Company, of Springfield, Ohio, has made some changes in the Weinland turbine boiler tube cleaner, which has increased its efficiency. The motive power for driving the star-shaped cutters is a stream of water which flows through a set of turbine buckets. This gives a rotary motion to a spider carrying the cutter arms. The water is brought to the cleaner under pressure through a hose attached to the back end of the cleaner. A patent coupling is used, which makes a perfectly smooth connection without any obstruction to the movement of the machine through the tubes or the water through the hose. The arms carrying the cutters are pivoted in the spider so as to move freely, the centrifugal force, when the cleaner is at work, forcing them against the tube. This spider is screwed fast to the turbine bucket wheel, which revolves on two sets of ball bearings. A considerable water pressure is desirable but not necessary in its operation.

The Toledo Railways & Light Company, of Toledo, Ohio, has placed a contract for the erection of a large paint shop, to be built in connection with the new repair shops which are now about completed. The paint shop will cost about $25,000.

COMBINATION CROSSING FOR STEAM AND ELECTRIC RAILWAY

The Indianapolis Switch & Frog Company, of Springfield, Ohio, has brought out a special crossing for steam and interurban electric railway tracks, which allows a greater flange room for the electric track than the ordinary steam and street railway crossing. As shown in section CD in the engraving herewith, an "easer rail" is used on the outside of the steam railroad rail. This serves to carry the worn or grooved steam railroad tires, and prevents them coming in contact with the abutting rails of the intersecting track. This reduces to a minimum the jar and strain on the corner irons and preserves the alignment of the interurban track, thus adding materially to the life of the crossing. When so desired the easer rails may be extended beyond the end of the steam railroad rail, reinforcing the joints.

The electric track is guarded with a full head-guard rail, as

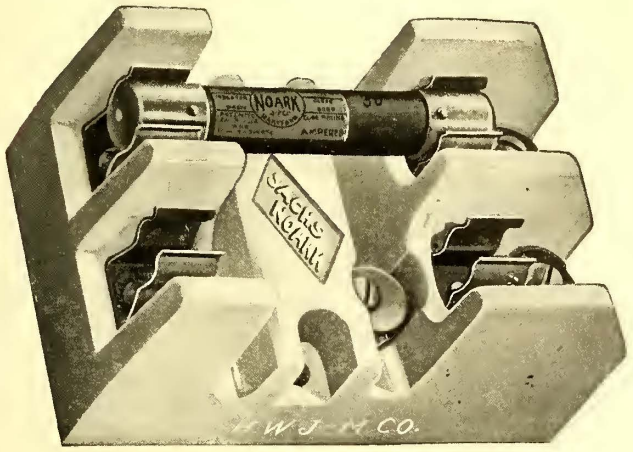


COMBINATION STEAM AND INTERURBAN RAILWAY CROSSING

shown in section AB, which allows a sufficient throat or flangeway to accommodate the flanges of the interurban wheels. The fillers, which are solid rolled steel, as well as the wrought corner irons, which are 1¼-in. thick, are of extra length, admitting of a sufficient number of bolts at each intersection to insure a very rigid construction.

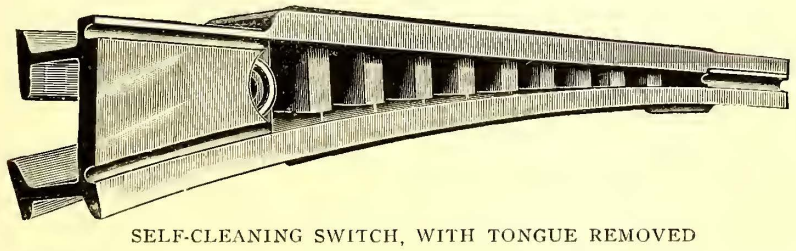
SINGLE BRANCH FUSE BLOCKS

Appreciating the demand for enclosed fuse branch blocks the H. W. Johns-Manville Company has perfected a line of single branch blocks herewith illustrated, which contains features of merit that will unquestionably appeal to the constructing engineer and other users of such devices. The company has departed from the usual arrangement for branch block devices,



SINGLE-BRANCH FUSE BLOCK

in which the fuses for the branch circuits abut at right angles to the outside of the two or three parallel main wires. This construction requires a block of some size, owing to the fact that it is necessary to give space for the main wires and branch fuses separately. In the "Noark" branch blocks the object has been to economize space and at the same time produce a branch block in which the arrangement of the wires and fuses should be absolutely safe, both in the operation and manipulation of the device. To obtain this result the branch fuses are arranged so that each of the terminals in which the branch fuses are received and to which the branch wires are connected are separated from the adjoining terminals by heavy partition walls, high enough above the contacts to prevent anything being laid across from contact to contact and cause short circuiting. This feature is also predominant in this company's main blocks. The main wires to which the branch block is connected instead of passing across the block at the end of the branch fuses are arranged to traverse it in suitable grooves placed in the porcelain block between the terminals of the



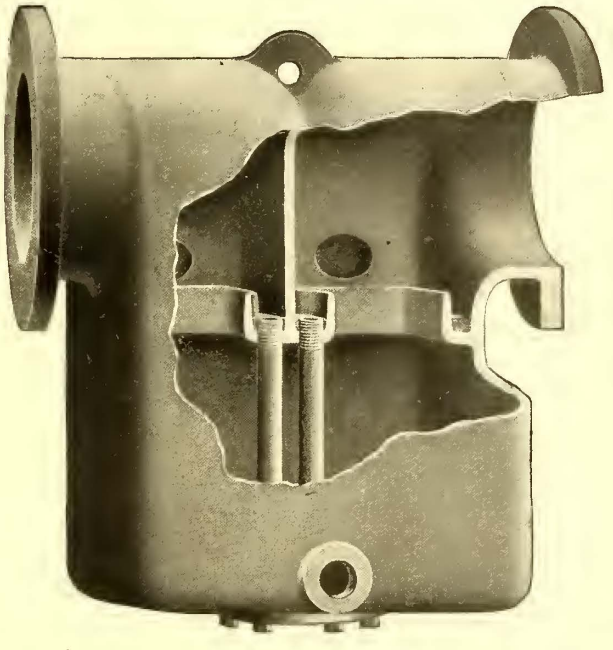
SELF-CLEANING SWITCH, WITH TONGUE REMOVED

branch fuses. In this way a great economy of space is effected, while at the same time the block can be easily and readily installed, and the manipulation of the fuse devices for a removal or insertion is entirely safe.

THE HOPPES OIL ELIMINATOR

Few engineers realize the high velocity at which the steam is compelled to flow from the engine to condenser, and those who do are not inclined to place any device in the steam pipe which will in any way obstruct the flow of steam. The Hoppes Manufacturing Company, of Springfield, Ohio, had this fact in mind when it placed on the market its oil eliminator shown in illustration on this page.

This eliminator or separator is so designed that the inlet and outlet ports are not less than one and one-half times the area of the pipe, while the passage through the body of the separator is much larger. The oil and grease are intercepted by troughs partly filled with water surrounding both inlet and outlet ports, and the oil and excess water is carried from the troughs to the lower part of the steam chamber by means of pipes shown in the



OIL ELIMINATOR

cut. The water of condensation and oil are drawn off from lower chamber by means of drain pipe to trap or receiver in the usual manner.

The machine is cast in one piece to eliminate all danger of leakage, which is a great consideration, especially when the separator is placed between engine and condenser. Pipe flanges are cast on body of machine and made both with and without nozzles to suit the requirements of the case.

AN AUTOMATIC SELF-CLEANING SWITCH

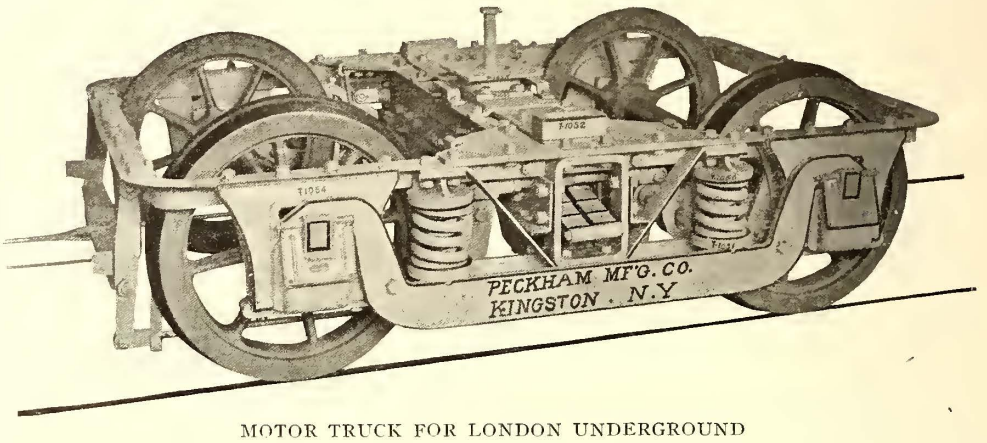
The accompanying illustration shows a self-cleaning switch which has recently been perfected and which is said to be very successful in preventing the accumulation of snow, ice, dirt or water in the track at that point. The construction of the device is simple, and it is very strong and durable. It being a solid casting there is nothing to give out about it, and its life depends only upon the natural wear from the car wheels and street traffic. This switch is made by the Ramion Automatic Self-Cleaning Switch Company, of Syracuse, N. Y. The device is an invention of T. J. Ramion, and has recently been thoroughly tested on the tracks of the Syracuse Rapid Transit Railway Company. An automatic type has been designed where a magnet, placed under a grating in the pavement, is used to operate the switch point, and a signal has also been perfected by the manufacturers by which an approaching motorman can tell immediately the position of the switch point. The switch is operated as follows: At about 30 ft., or any convenient distance in front of the switch, two flat plates, about 2½ ft. long and flush with the roadbed, are placed. These plates are connected by an underground wire with the magnet attached to the switch tongue. Beneath the center of the car a yoke is hung, which, when in its normal position, is some 6 ins. from

the ground. This yoke is connected to a rod running to the motorman, who can by this means depress it so as to make contact with the plates. This contact is made by two brushes, which take current from the main circuit of the car. The signal system consists of a post carrying a signal box placed at the side of the street. A red light and a white light are connected by wires to the switch mechanism so that the motorman can tell by observing which one is lighted how the switch is set. Under the switch is an electric heater, which melts any ice or snow. Each time the magnet is energized by means of the brushes on the surface contact plates the tongue is thrown to a position opposite to that previously held.

The most important feature of the system is, however, the construction of the switches themselves. A recent snowstorm in Syracuse gave the device probably one of the best tests that it could have had, and it is claimed that results showed that the switch could stand up under all conditions of climate in a manner perfectly satisfactory to the railway. Being entirely open below the general level no dirt, stones or other material can collect to obstruct the movement of the tongue, and the heater placed below prevents any accumulation of ice or snow.

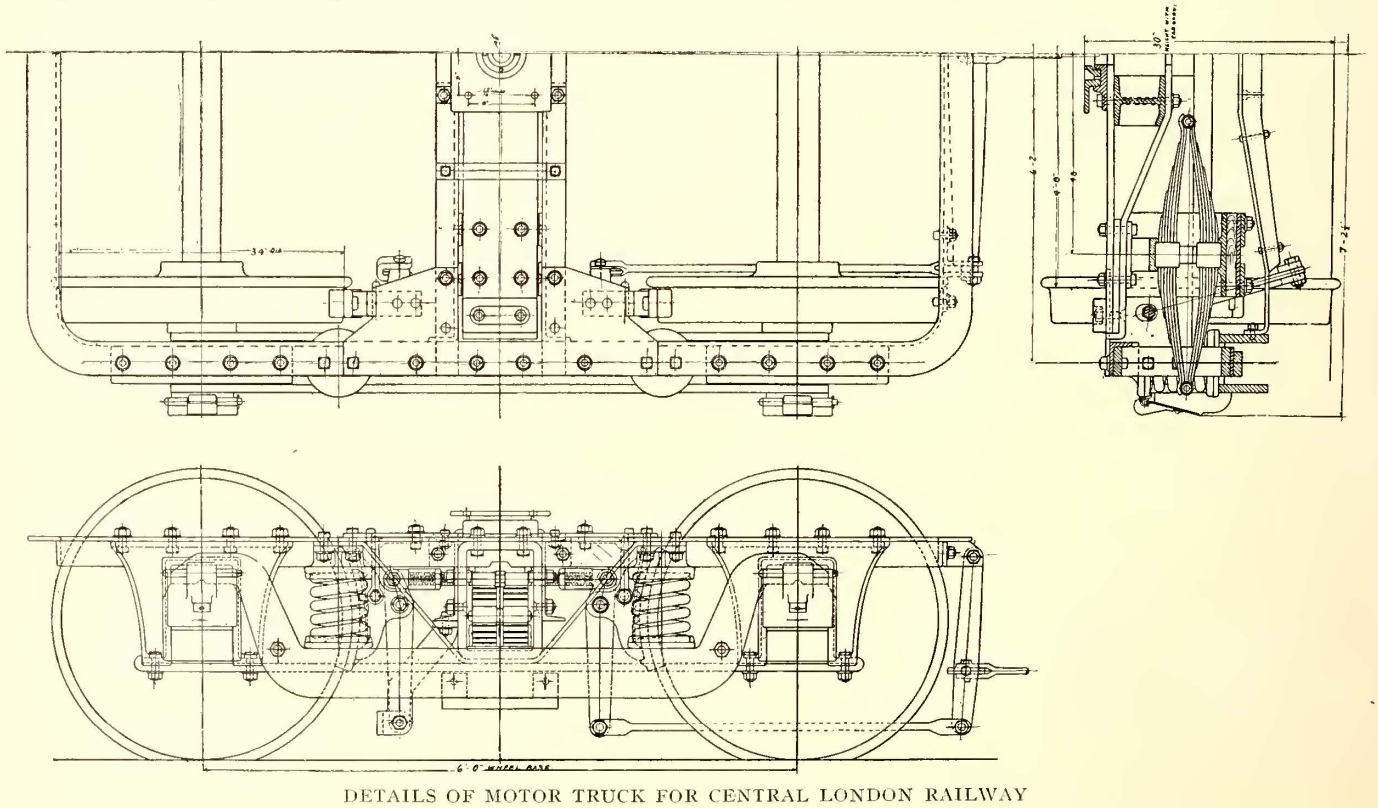
LONDON HIGH-SPEED TRUCK

The accompanying illustrations give drawings and a perspective view of the type of truck selected by the Central London Railway, of London, England. These trucks are made by the Peckham Manufacturing Company, of New York, at its Kingston works. The order comprises the motor-truck equipment of sixty-four cars, and a number have already been completed and shipped.



MOTOR TRUCK FOR LONDON UNDERGROUND

The side frame construction is of the bridge truss type, very strong, and contains many features of interest in its method of building. The spring supports from the equalizing bars to the top frames are placed near the axles and so adjusted that teetering is practically entirely prevented. The transoms are made of channels which extend full size with the side truss frames, to which they are very rigidly secured by bolts fitted tightly in reamed holes. The tops of the top frames and transoms are secured together rigidly by gussets of a rather peculiar shape, as shown in the plan view. The bolsters are of the bridge shape, both top and bottom, and are all steel. The ends of the bolsters are supported by double six-leafed full elliptical springs. Straps secured to the transom and extending over the bolsters prevent its being lifted out and the king pin, which is 2 ins. in diameter, is so secured that it is impossible to lift the car body off the truck. The swivel plates are large



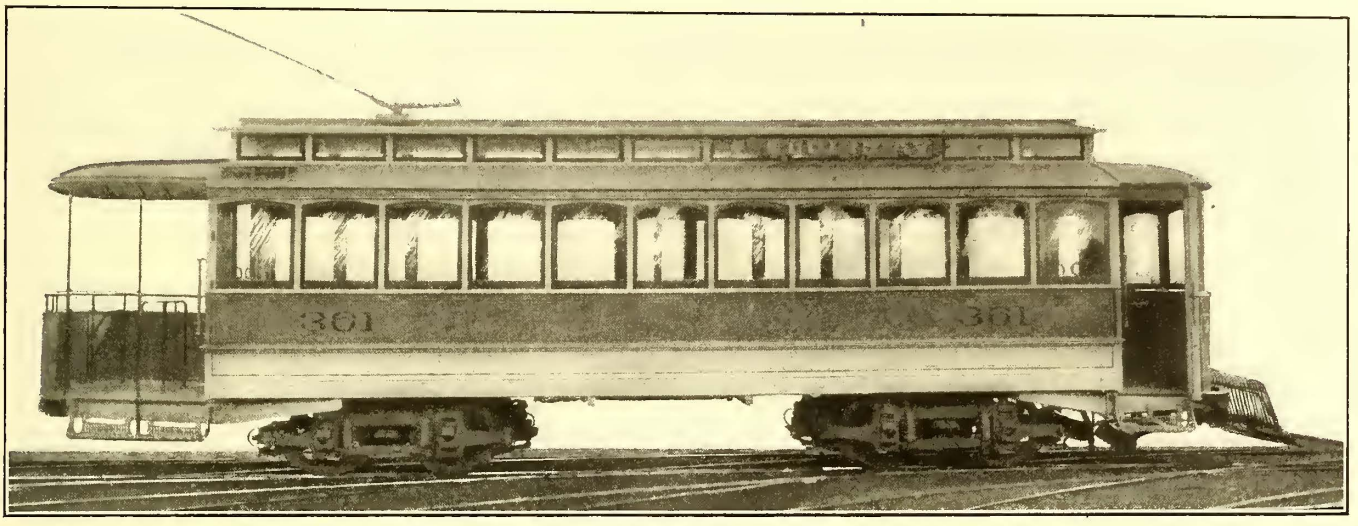
DETAILS OF MOTOR TRUCK FOR CENTRAL LONDON RAILWAY

TROLLEY FUNERAL CARS

The extent to which the use of electric funeral cars are being employed in St. Louis was emphasized during the recent cab drivers' strike in that city. The two funeral cars now owned by the company were unable during the last week or two to fill unprecedented demands upon them. Another car will be put in service as soon as it can be turned out of the shops.

The Fair Haven & Westville Railroad Company, of New Haven, Conn., has decided to issue special half-rate tickets to school children. The tickets will be good on school days only, and between the hours of 7 a. m. and 5:30 p. m.

in diameter, machine fitted, having a boss around the king pin which effectually prevents the escape of the lubricating grease. The pedestals are made of cast steel, machine fitted where they come in contact with the journal box and top frames. The journal boxes are of the regular M. C. B. standard pattern. The bolts are all machined to an exact size and are driven in reamed holes so as to tie the parts of the truck rigidly together, and the entire construction is such that although a great rigidity of the different parts is attained the spring supports give a very smooth riding truck.



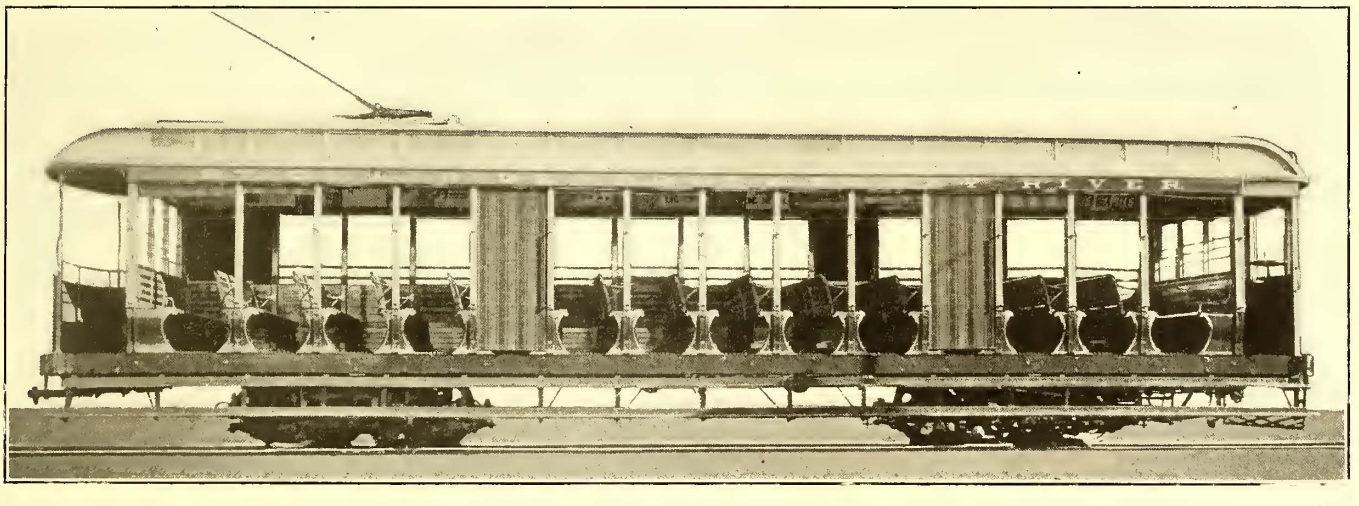
30-FT. CAR FOR CLEVELAND

This truck was designed by Horace Field Parshall, M. I. C. E., and is intended for a motor equipment of two General Electric, 66-motors. It is very similar in construction to the Peckham M. C. B. No. 32 truck, which has been so successfully introduced in high-speed elevated, interurban and trunk line service. The same general lines are also followed in the construction of the 280 car equipments recently ordered from the Peckham Manufacturing Company by the Brooklyn Heights Railroad, of Brooklyn, N, Y.

NEW CARS FOR CLEVELAND, TOLEDO AND DETROIT

The G. C. Kuhlman Car Company has just completed building a lot of closed city cars for the Cleveland Electric Railway and the Toledo Railways & Light Company, which are probably among the finest cars that were ever turned out for city roads. The Cleveland Electric Railway cars have 30-ft. bodies, seating thirty-five people, and the so-called Detroit platform, holding thirty people. The Toledo Railways & Light Company cars are one window shorter. The latter cars have dark green ceiling with gold trimmings, which sets off the dull cherry finish of the car to great advantage. The idea of the Detroit platform is gaining favor with many street railway managers, and it is only a question of time when all large cities will run no cars except with this platform. These platforms are so constructed that they will hold thirty people without dipping an inch.

The second engraving shows one of a number of fifteen-bench open cars just built by the same company for use on the St. Clair, Detroit & Rocky River Railway.



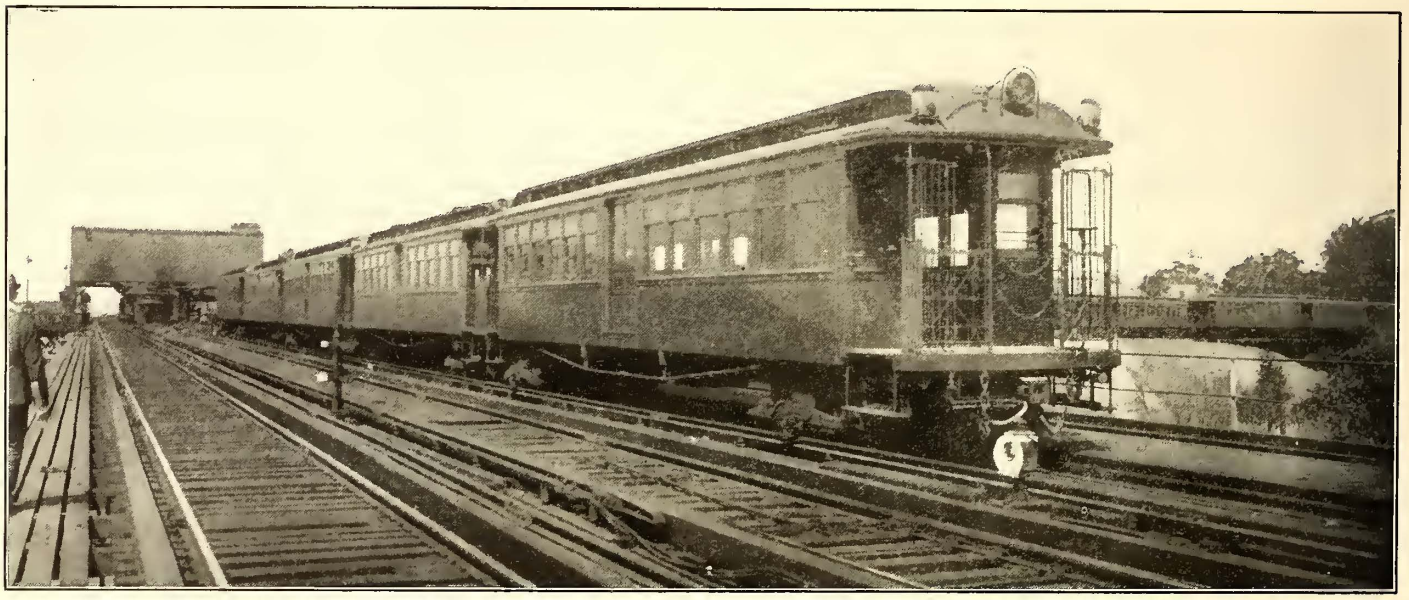
FIFTEEN-BENCH OPEN CAR FOR DETROIT

THE MANHATTAN STEAM LOCOMOTIVES

When the Manhattan Elevated Railway, of New York, commenced the installation of its third-rail electric system it had 324 locomotives. Most of these are now out of service, and the use of the remainder will soon be abandoned. The company is having but little difficulty in disposing of these engines. Most of the purchasers are contractors, and the abandoned locomotives have gone singly or by twos or threes to Canada, Oklahoma, Trenton and elsewhere. Three have been sold to the Utica & Mohawk Valley Railroad, and others will go to the Pacific Slope. A few have been purchased by trolley companies for hauling coal and supply cars.

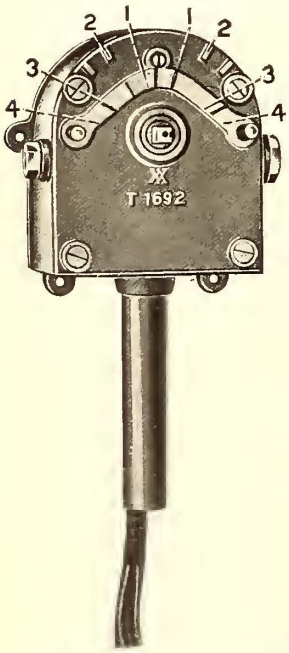
ELECTRO-PNEUMATIC SYSTEM OF TRAIN CONTROL FOR BROOKLYN

The Brooklyn Rapid Transit Company recently gave an order to the Westinghouse Electric & Manufacturing Company, of Pittsburg, for 210 multiple train control equipments. In addition to the order for 210 cars the company has already purchased about 150 equipments of the same type, which have been in satisfactory operation for nearly a year.

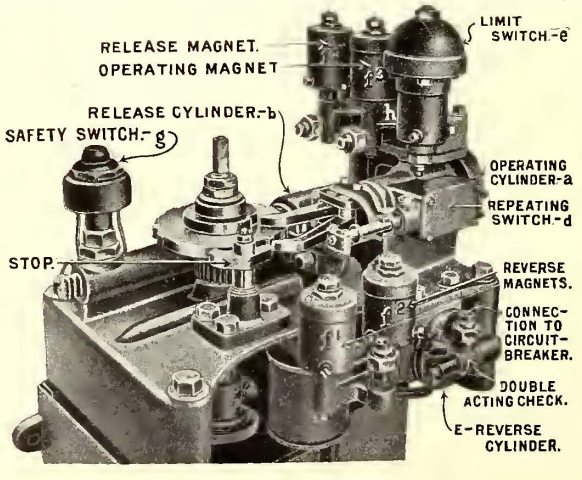


TRAIN EQUIPPED WITH ELECTRO-PNEUMATIC CONTROL SYSTEM

The Westinghouse multiple train control system was described in these columns two years ago, but a number of changes have been made in it, so that the present system is different than that previously described. As will be remembered the Westinghouse system involves the use of compressed air for moving the current-controlling apparatus, electromagnetic valves governing the admission of air to the controlling cylinders and low-voltage electric circuits running from car to car for controlling the action of the magnet valves. The connections for the low-voltage circuits are the only ones which have to be established between the cars of the train, no air connections being required outside of the ordinary brake hose. A complete equipment for each motor car, to be operated in Brooklyn, consists of four electric motors, a controller very similar to the controllers used on ordinary street cars, and two motormen's controlling switches in cabs at each end of the car. The car controller consists essentially of two drums which revolve in bearings, and stationary contact fingers, which make contact with points upon the revolving drums, as in the ordinary hand controller in universal use. The large or main drum opens the main circuit and makes the motor and resistance combinations, the small drum reverses the motors. The multiple control switches, placed at the ends of each motor car, enable the motorman to control the action of the controllers on all of the motor cars in the train, the motorman's position being, of course, on the front of the leading car.

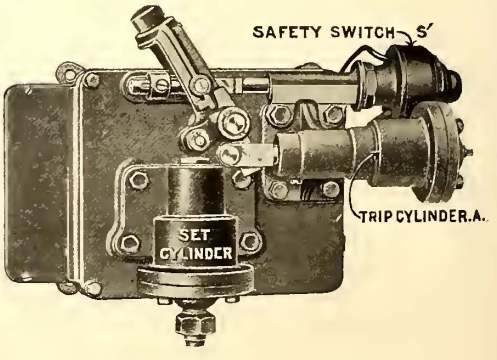


MOTORMAN'S CONTROLLER



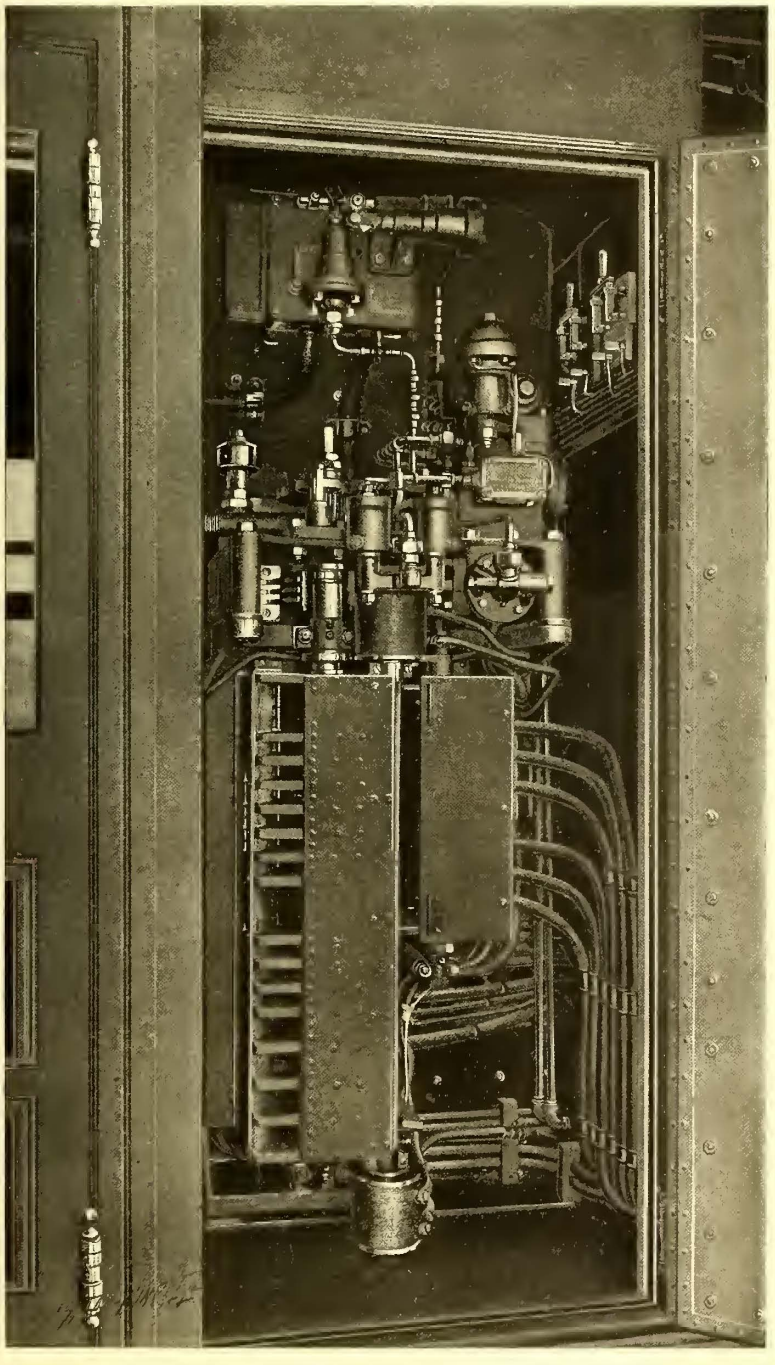
TOP OF CAR CONTROLLER

The accompanying illustrations show some of the details of the system. As installed on the Brooklyn cars the car controller is placed in a closet immediately adjoining the motorman's cab at one end of the car, where all parts are readily accessible, as seen from the view given. The entire inside of this closet is thoroughly fire-proofed. At the top of the closet, above the main controller, is an electromagnetic pneumatic circuit breaker, a separate illustration of which is also shown. The circuit breakers on all the cars are thus directly under the control of the motorman, and can be opened or closed by him as well as serving as a safety device on overloads. The manner of moving the controlling cylinders is well shown in the top view of the controller, where the functions of the various parts are indicated. The squared top of the cylinder shaft enables the motorman, in case of a disconnection or other break down in the control circuits or master controller, to apply a handle and operate the mechanism by hand. The cylinder is turned in one direction by the pawls and ratchets, and in the opposite direction by the rack and pinion, the former being used in starting up. A single stroke of the ratchet air piston turns the controller on one point. The double arrangement of ratchet



CIRCUIT BREAKER

wheels enables different lengths of movement steps to be made and thus insures an extremely even acceleration to the car, a stop being provided to prevent the impulse of the pawl sending the control cylinder more than one step at a time. The action of the long cylinder at the back is independent of the position of the control cylinder, and when air is admitted turns the latter to the off position by means of the rack and pinion. An automatic mechanical interlocking device prevents the motorman from reversing the controller with current on.



VIEW OF CONTROLLER COMPARTMENT—OPEN

The magnets and valves for operating the air mechanism are the result of many years of experience, and combine many novel principles with the well-known standard devices of the Westinghouse air brakes and signals. The magnets are iron-clad, with an iron core, the armature being a disc on the top, normally held away from the core and shell by a spring washer. When the circuit is closed the armature is attracted, and opens the air valve by means of a brass connecting rod. A spring in the valve keeps it closed, except when the magnet is operated. A view is given of the standard multiple control switch placed in the motorman's cabs. The current operated by this switch is obtained from a battery of a few cells, which is sufficient to operate the magnets of the air valves on the various car controllers. Should the motorman release the controller handle the current is turned off on all the cars automatically.

Some of the features of advantage of this system may be stated as follows: It employs compressed air for operating the control apparatus, and thereby uses a powerful and reliable agency. It uses the standard type of controller and standard types of valves and magnets, the latter having been used for years in the operation of the Westinghouse electro-pneumatic system of switches and signals upon the largest railways in the world. The control circuit is isolated from the main power circuit, and is, therefore, not affected by a momentary interruption of current due to ice and sleet on the rails or other causes. With the low-voltage current, grounds and short circuits at the connectors between the cars during stormy weather or fires resulting from high voltage circuits through the train are entirely eliminated. The current for the motors is simply collected from the third rail, led through the local car-controlling apparatus to the motors, and then back to the service rails, and does not pass from car to car. The controlling apparatus is so located that the motorman may have convenient access to all parts.

The motor circuits on any car are automatically opened in case of excess current, and they can all be simultaneously closed at the will of the motorman. All controllers are automatically turned off by the application of the automatic air brakes, which is an important point, since in case of a train breaking in two the brakes are automatically applied and at the same time the power is shut off. Both controllers and circuit breakers are opened by a breaking in two of the train, this action being independent of and in addition to the effects obtained by the application of the air brake. The controller may be operated by hand, thus permitting the train to run to a terminal station in case of any derangement of the controlling apparatus. The operation of both brakes and controllers is effected by a single air hose connection between the cars, the air compressor which furnishes air for the brakes also furnishing air used to operate the controllers.

The Brooklyn Elevated will equip all its new cars with four motors each. The 150 cars now in use equipped with the Westinghouse system have each two motors. The trains on the road are made up of five or six cars, two or three of which are usually motor cars. By the use of this system it is possible to operate cars individually, as on ordinary trolley roads, or to make them up into trains of any length. Furthermore, any proportion of motor cars may be used, making it possible to obtain any desired amount of power for starting the trains quickly, which is necessary in any service involving many stops.

CHRISTMAS ENTERTAINMENT IN BROOKLYN

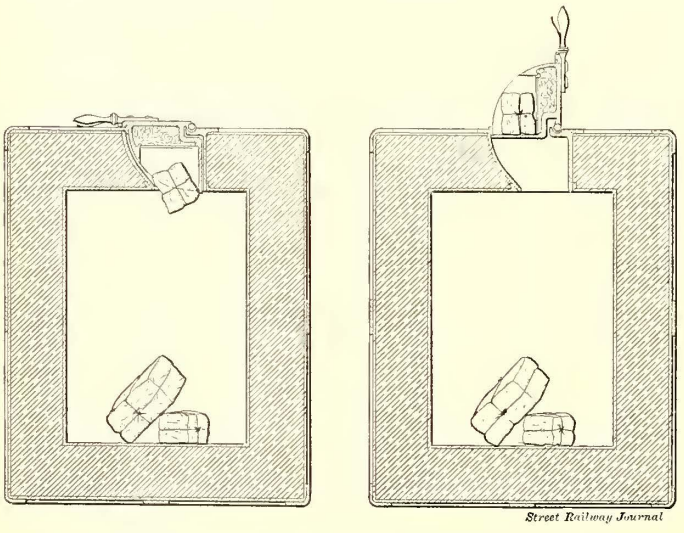
A holiday entertainment was given by the employees of the Eastern Division of the Brooklyn Rapid Transit Company, at the Crosstown Depot club rooms, on the evening of Christmas Day. The performance consisted of a vaudeville show given by local talent, a number of conductors and motormen showing great ability in entertaining their fellow employees and their wives and families. An interesting feature of the evening was the exhibiting at the raising of the curtain of a handsome picture of Division Superintendent N. W. Bolen, which had been painted by Conductor B. Myers, and was formally presented to Mr. Bolen on this occasion. The entertainment consisted of instrumental music, songs, dances and excellent humorous sketches and impersonations. The

performance concluded with the lighting up of a beautifully decorated Christmas tree, containing some 250 red, blue and white 16-cp lamps, and Conductor B. Olmstead, impersonating Santa Claus, distributed candy and fruit to the many children present. Among those who attended the jollification were Superintendent of Transportation Graham and Secretary to the General Manager Valentine. Some 600 were present, and all voted it a fitting end to a very merry Christmas.

IMPROVED CONDUCTORS' SAFES

The accompanying illustrations show cross sections of an improved safe recently perfected by the Morris-Ireland Safe Company, of Boston, Mass. These safes have a device attached to the top which enables the conductors to deposit the money taken during their hours on duty with the company without unlocking the safe or having access to other deposits previously made. The money is put into small bags and tied up in any manner approved by the management of the road, and deposited in the receptacle, as shown in the illustration. When the handle is lifted up to the position shown in the right-hand cut a receptacle is made for receiving the package, but the opening in the safe is closed completely by the bottom of the angle piece attached to the handle. After depositing the package the conductor allows the handle to drop, when the package is deposited, as shown in the left-hand view. It will thus be seen that at no time is the interior of the safe accessible to other employees except those who have the combination of the lock on the main door. The box or receptacle attached to the handle will receive a package 6½ ins. x 5 ins. x 3½ ins., which is naturally much larger than one ordinarily deposited by the conductors.

The Morris-Ireland Safe Company has made a specialty of safes for street railway purposes and has developed the device described above after much experience with the requirements. The safes are made according to the most approved designs, with angle front and back, patent inside bolt work, malleable hinge and everything that makes a first-class safe. This type is made in three sizes, 36 ins., 44 ins. and 50 ins. high, outside measurement, from which a selection can be made to meet the requirements of different

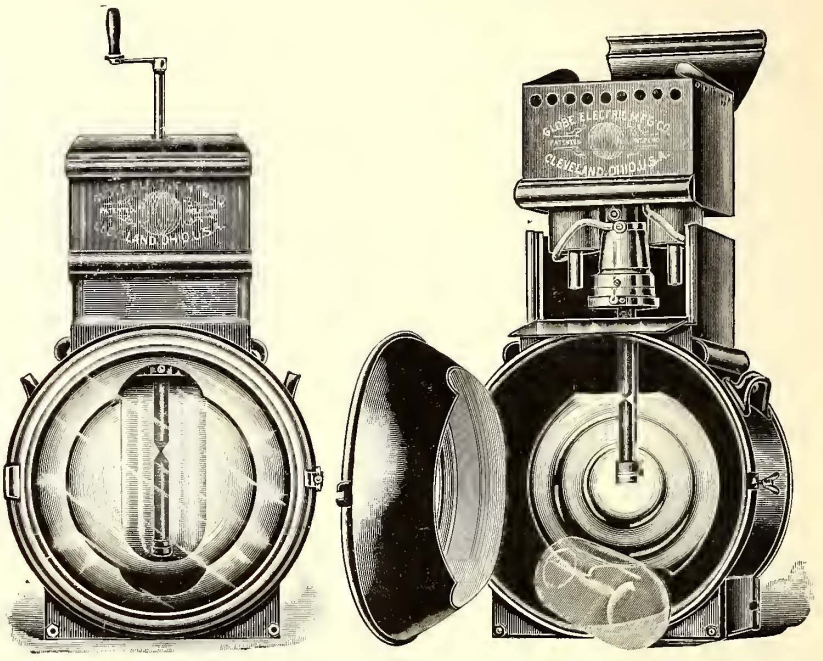


SECTIONAL VIEWS OF CONDUCTOR'S SAFE

roads. It is already used on a large number of street railways, among which may be mentioned the Metropolitan Street Railway, of New York; the Boston Elevated, the Detroit Street Railway, the Hartford & Springfield Street Railway, the Lynn & Boston Railroad, the New Orleans Street Railway, and the Worcester Consolidated Street Railway.

A NEW ARC HEADLIGHT

Improvements are constantly being carried forward in the arc lamp field, and one of the latest additions is the Globe arc headlight, designed especially for suburban and locomotive cars, and manufactured by the Globe Electric Manufacturing Company, of Cleveland, Ohio. Some of the most striking features shown in this lamp is its neat and compact appearance, extreme simplicity of design and dust-proof case. The contact being fitted with ball bearings makes it practically impossible for the carbon to stick. The accompanying illustrations give a good idea of its simplicity and general construction.



IMPROVED ELECTRIC HEADLIGHT

One of the principal advantages of the Globe arc headlight is its automatic regulation on the varying voltage often encountered in railway work. The magnets are two in number, on series wired bobbins, the construction allowing the armature ample play before dropping on variation of the voltage. The working parts are enclosed and thoroughly dust-proof. The positive contact, consisting of ball bearings, can never cause any trouble in burning out. The carbon pressing against the ball bearings, it is claimed, can never stick and make a solid contact. The construction of the clutch is so simple, but at the same time so perfect, that the jarring of the car has no effect on its working.

The Globe arc headlight is constructed to operate under varying voltage, from 100 to 220, the arc varying from ⅜ in. to ¾ in. without going out. The rheostat used with it is connected in series with the headlight, and is built to suit varying voltage at the main circuit. An entirely new feature, and one of great alvantage, in this lamp is shown in one of the cuts. This is the focusing device, which can be operated from the car by the motorman, throwing the arc out of focus and so dimming the light that it is rendered unobjectionable on entering or leaving the city. This company manufactures a complete line of dash and hood headlights of every description. The facilities which it possesses along this line enable it to fill orders promptly, a point that is of considerable importance to intending purchasers.

A party of forty Cincinnati bankers and street railway men made a trip over the Dayton, Springfield & Urbana, Columbus, London & Springfield and Central Market Street Railways, the properties of the Appleyard syndicate, a few days ago. The run of 77½ miles from Dayton to Columbus was made in three hours.

SYNOPSIS OF REPORT ON THE CHICAGO TRANSPORTATION PROBLEM TO BE SUBMITTED BY B. J. ARNOLD

A synopsis of the report to be presented to the local transportation committee of the Chicago City Council by Bion J. Arnold, who was employed as an expert by that committee, was given out last week by Mr. Arnold and Chairman Bennett, of the committee, in advance of the publication of the full report. The synopsis, while correct as far as it goes, having been made by Mr. Arnold himself, necessarily fails to give an adequate idea of the completeness of the report from an engineering standpoint.

As will be seen from the letter of transmittal, Mr. Arnold has employed to assist him some of the best talent in the country. The report is a book on the electric railway engineering and transportation problems in Chicago, that is valuable in proportion to the large amount of talent and money spent upon its preparation.

The reason for the publication of the synopsis in advance of the submission of the full report to the committee was that incorrect and unauthorized statements were being published in one of the Chicago daily newspapers regarding the contents of the report, and it was thought better to give out an authorized correct statement as to its contents than to allow false impressions to get abroad in the public mind, through the publication of incorrect statements.

Following is Mr. Arnold's letter of transmittal to the committee and summary of conclusions and recommendations.

LETTER OF TRANSMITTAL

Nov. 19, 1902.

To the Honorable Chairman and Members of the Committee on Local Transportation of the City Council of the City of Chicago:

Gentlemen—I have the honor to present herewith my report on the several questions relating to the city's local transportation situation submitted to me by your honorable body, as set forth in the agreement between the city of Chicago and myself, bearing date of July 19, 1902, a copy of which is hereto attached.

The situation has been thoroughly canvassed. The operating statistics of the Chicago City Railway Company and the Chicago Union Traction Company have been willingly submitted, and an exhaustive study of them has been made. All facilities have been extended to me by the officials and departmental heads of these companies, and the officials of the several elevated railroad companies, as well as the several companies controlling the underground utilities, all of whom have very kindly, and with considerable trouble to themselves, furnished me with the data required in my investigation. The officials of several railway companies operating roads in other cities have courteously furnished me with valuable statistics.

All recorded information contained in the several bureaus of the city government and the personal knowledge on all subjects pertaining to the transportation matter possessed by the several bureau chiefs has been freely placed at my disposal, for all of which assistance rendered and courtesies extended I desire at this time to express my thanks and appreciation.

I have not assumed it my place to take sides in the report one way or the other on questions of municipal policy concerning which there may be differences of opinion, except where the questions are in their nature clearly engineering or transportation questions. The franchise poliey of the city with reference to these matters I have conceived to be outside of my province. The plans for a comprehensive system of street railways suited to the needs of the community as set forth in the report would be the same whether the system be owned and operated by a private corporation, or owned and operated by the city, or owned by the city and operated by a private corporation under lease. So far as engineering features alone are concerned, it is immaterial whether the subway systems as outlined be owned by the city or by a private corporation.

In connection with my investigation of this problem I have considered many plans, such as movable sidewalks, elevated sidewalks, sub-sidewalk railways, and elevated structures for carrying railways, pedestrians, and the present underground utilities, some of which plans originated with me, and some with others, but ater a careful study of the situation the magnitude of the problem as evidenced by the great number of passengers which must be taken in and out of the business district in very short periods of time, night and morning, has forced me to abandon some of my preconceived ideas, and it is my opinion that a full realization on the part of others of the exact conditions which must govern a comprehensive solution of this problem would show the advocates of the other plans the inadvisability of their adoption. It is possible, however, that some of the suggestions relating to super-surface structures may some day prove advisable to adopt in Chicago, but probably not until the capacities of the systems recommended in this report, or other similar systems, have been reached.

The question of the utilization of the water power of the Sanitary District Canal for generating electricity and transmitting it to Chicago for the operation of its street railways has also been considered, but inasmuch as a decision regarding it need not be made at present, and from the further fact that the question was not involved in my commission, I have not submitted a discussion of it.

I have endeavored to outline not only one plan, but several plans, some of which, if adopted, would give to the citizens of Chicago the best surface railway transportation facilities capable of attainment under the conditions. These facilities cannot be attained at once, and the transition will probably be gradual. In order to make it possible to get immediate relief a plan of surface tracks, which could ultimately become a part of a combined system, has been outlined. This plan provides for ample facilities on the surface for the present needs, permits of through traffic between all divisions with the joint use of tracks, and makes it possible to abandon immediately the river tunnels for street car purposes, thereby permitting the river channel immediately to be deepened for the accommodation of lake traffic, and portions of the tunnels still to be retained for future subway uses.

In closing, I desire to acknowledge the valuable assistance rendered me by Messrs. Charles V. Weston, C. E., Augustine W. Wright, C. E., Oren Root, Jr., and George C. Sikes in the preparation of this report, and to thank the respective office forces of Mr. Weston and myself for faithful and efficient services rendered.

I also wish to acknowledge the consideration shown me by the chairman and each member of your honorable committee for allowing me to perform my duty unhindered by suggestions, and I trust that the information contained in the report will be found sufficiently exhaustive and of sufficient merit to enable your committee to formulate a line of action which will lead to practical results. Respectively submitted,

BION J. ARNOLD,
Consulting Electrical Engineer.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

I. THE ONE-CITY-ONE-FARE IDEA

Chicago, with respect to transportation as well as other things, should be regarded as one city, not three. Divisional lines ought to be obliterated, as far as possible. A street car passenger should be carried over the most direct route between any two points within the city limits for a single fare. Complete unification of ownership and management is the best plan for realizing the one-city-one-fare idea. The same end can be accomplished, however, but in a less satisfactory manner, under divisional ownership, by a plan of through routing of cars, joint use of tracks and interchangeable transfers. To a still less satisfactory degree the same end can be accomplished by the interchange of transfers between companies without joint use of tracks.

II. THE THROUGH-ROUTE PRINCIPLE

Routes through the business district ought to be substituted for downtown terminals, wherever possible. Outside the business district, too, the best results would follow from connecting together the detached lines now found on several streets, and operating cars over such lines from end to end on the through route principle.

III. SUBWAYS

A system of subways should be, and eventually must be, built to accommodate the street car traffic of Chicago and relieve the street surface congestion in the business district. Galleries should be provided in connection with such subways for the accommodation of present and future underground utilities. Two subway plans are outlined in the report. One plan, referred to as Subway Plan No. 1, shown on map No. 11, calls for three north and south subways, from Fourteenth Street on the south to Indiana Street on the north, and two subways entering the business district from the West Side, utilizing the present Van Buren and Washington Street tunnels and looping back at Clark Street. This is a system of high level subways throughout, with no dips. Its estimated cost is $16,000,000. The other subway plan, known as Plan No. 2, shown on map No. 5, calls for practically the same north and south high level subways in combination with three or more low level subways from the West Side, passing under the north and

south subways and reaching Michigan Avenue, and should future developments warrant, under Lake Front Park as far as it may be extended. The low level subways would require the use of elevators. The estimated cost of subways built according to this plan is $20,000,000. Plan No. 2 is recommended as best for the city from an engineering and transportation point of view, but in case this plan is deemed inadvisable for business or other reasons a system of single-decked high level subways, as outlined in Plan No. 1, can be constructed, which will to a large extent accomplish the results. No subways should be built in such a manner as to preclude the operation of cars through them on the through route principle. Under either of the plans as outlined, the whole system of subways need not necessarily be constructed at once. One or more of the subways could be built at a time, and utilized separately, but with a view to their ultimately forming a part of a comprehensive system. The subway plans as submitted do not necessarily call for the removal of all tracks from the street surface in the business district, and Subway Plan No. 1 necessitates some surface loops. Under either plan there could be a street surface system connecting the depots and designed to accommodate short haul traffic in the business district. Under Plan No. 2 there could also be a low level subway system for connecting all depots, and by using it in connection with this subway all tracks could be kept off from the surface of the streets in the business district for some years to come.

IV. THE PRESENT RIVER TUNNELS

It is inadvisable to attempt to lower the present river tunnels and at the same time retain them for surface railway use, for the reason that lowering the tunnels to a sufficient depth to accommodate future river traffic would involve extending the tunnel approaches at least a block further into the business district. In the interest of navigation, therefore, the tops of the tunnels ought to be promptly removed, leaving the lower parts of one or perhaps two of the tunnels for utilization later as parts of a future subway system.

V. PLAN FOR A UNIFIED COMBINED SURFACE AND SUBWAY STREET RAILWAY SYSTEM

A plan is present for a new, reorganized and unified combined surface and subway street railway system, comprising the lines of the City Railway Company, the Union Traction Company, the Chicago General Railway Company and the Chicago Consolidated Traction Company within the city limits, and new lines necessary properly to connect the now disconnected parts of the system. The total single track mileage of this system as outlined would be about 745 miles, and its estimated cost, if constructed new, with everything first-class throughout, but exclusive of subways, would be $70,000,000. Adding $20,000,000, the cost of the subways constructed according to Plan No. 2, would make the total cost of the new system complete $90,000,000. With Subway Plan No. 1, instead of Subway Plan No. 2, the total cost of the new unified system would be $85,800,000.

VI. PLANS FOR IMMEDIATE IMPROVEMENT OF TERMINALS AND SERVICE

Plans are presented for the rerouting of surface terminals in the business district, (1) under the present divisional ownership and operation, (2) under the joint use of tracks in the business district under divisional ownership, and (3) under unified ownership and management. Immediate improvement of Chicago's local transportation facilities may be effected by substituting electric for cable power and routing cars according to any of the plans outlined, all cars from the West and North sides to enter the business district over bridges until such time as subways shall be constructed.

VII. ELECTRIC UNDERGROUND CONDUIT SYSTEM

The operation of cars in Chicago by the electric underground conduit system is practicable and feasible. Overhead trolley construction should be prohibited within the area bounded by Twelfth Street on the south and the river on the north and west. Outside of the district named the objections to the overhead trolley are esthetic in nature, and it is for the city authorities to say—after a balancing of financial against esthetic considerations—how much, if any, underground conduit construction should be required. The cost per mile of single track (track alone, including feeders,) of electric conduit road construction would average $81,300 for a system covering the entire city, including feeder wire, but exclusive of the cost of power, rolling stock and paving of right of way. All conduit construction, however, within the business district would cost about $100,000 per mile, due to the numerous curves, large amount of special work required, and the extra cost of labor, due to the congestion within the district in which the work must be prosecuted. To either of the above figures should be added the cost of paving, as follows: Brick, $12,650; asphalt, $12,880; dressed granite, $18,400. Overhead trolley road construction would cost $20,836 per mile of single track, using the same weight of rail. It would cost nearly as much to convert the Chicago cable roads into electric conduit roads as to build new electric conduit roads.

VIII. GROOVED RAILS

A grooved girder type of rail, of special design, is recommended for well-paved streets upon which cars operate often enough to properly clear the groove of dirt and ice. On outlying streets and on poorly paved and poorly maintained streets the girder type of rail should be maintained as best for team traffic and the railway companies.

IX. ELECTROLYSIS

The destruction of underground utilities from electrolysis is now well in hand by the city, and if the present ordinance governing the subject is enforced no serious difficulties may be anticipated from this source, and when the underground conduit system is adopted there should be no further injury from electrolysis in the area served by the conduit system, because this system use a complete metallic circuit.

X. THE FINANCIAL ASPECT OF THE ONE-CITY-ONE-FARE PLAN

A unified company could afford to conduct the transportation business of Chicago on the basis of a single fare for a continuous ride anywhere within the city limits. The present divisional companies by the interchange of transfers, could afford to do the same thing, provided they were properly protected against the fraudulent use of transfers, but it would be at a somewhat greater cost to themselves, and with greater inconvenience to passengers, than would be the case under unified management.

XI. GROWTH OF POPULATION AND TRAFFIC IN THE PAST AND ESTIMATES AS TO THE FUTURE INCREASE OF STREET CAR TRAFFIC

The population of Chicago has increased since its incorporation in 1837 to 1902 at the rate of 8.6 per cent per year compounded, and is now increasing at the rate of 7.7 per cent per year. For the nine years from 1892 to 1901, inclusive, the number of revenue passengers carried by the Chicago surface and elevated lines combined has increased at the rate of 5 per cent per annum compounded. The increase for the surface lines during the same period has been at the rate of 1.5 per cent per year compounded. The increase for the combined surface and elevated lines from 1894 to 1901, inclusive, a period of seven years, has been at the rate of 6.3 per cent per year compounded. The increase for the surface lines alone during the same period has been at the rate of 3.9 per cent per year compounded, and the increase for the elevated lines alone has been for the same period at the rate of 2.6 per cent per year compounded. The population of Chicago has increased more rapidly than that of any other city in the world, but it is improbable that this rate of increase should continue indefinitely. Figures and curves are presented showing the past growth of Chicago as compared with other cities, also the future results if present rates of increase should be maintained, but as this is improbable curves are shown representing the increase in population and gross receipts that may reasonably be expected for the combined surface and elevated railways during the next fifty years.

XII. ESTIMATED COST OF REPRODUCTION AND PRESENT VALUE OF EXISTING PLANTS

The cost to reproduce the following properties complete with new construction and equipment throughout would be: Chicago City Railway Company, about $17,200,000; Chicago Union Traction Company (not including the Consolidated Traction Company), about $22,200,000. The actual present value of the physical properties for railway purposes of the following companies, taking into consideration the obsolete equipment and construction which must be discarded, but not taking into account any franchise rights or earning capacity of the properties, is estimated as follows: Chicago City Railway Company, about $12,000,000; Chicago Union Traction Company (not including Consolidated Traction Company), about $15,000,000.

XIII. NEED FOR REGULATION OF TEAM TRAFFIC

At the present time team traffic interferes with street cars to an unwarrantable extent. A reasonable regulation of team traffic is essential to the improvement of street car service.

XIV. THE UNION ELEVATED LOOP PROBLEM

The junction points are the ultimate limiting factor of the capacity of the Union Elevated Loop. At the present time, however, the platform stations are the limiting factor. The first and simplest way to increase the capacity of the loop is to lengthen the station platforms so that two trains can load and unload at a station at the

same time. When the capacity of the junction points is reached, added facilities can be provided by building stub-end terminals just outside the loop. The terminal capacity of the loop could be increased by dividing the present loop into four smaller loops, but presumably there would be public objection to such a plan, because it would involve encumbering more downtown streets with elevated structures, and it is, therefore, not recommended. The ideal solution of the elevated loop problem would be to utilize the loop structure as sections of through routes between the different sections of the city.

LONDON LETTER

(From Our Regular Correspondent.)

The Metropolitan Underground Railway has placed its orders for twenty sub-stations, the whole of the electrical apparatus being ordered from the British Westinghouse Electrical & Manufacturing Company. These sub-stations will be distributed in various parts of London, and will furnish current to all of the five railways at present under the control of the Yerkes group, viz., the District Railway, the Charing Cross, Euston & Hampstead Railway, the Baker Street & Waterloo, the Great Northern & Strand, and the Brompton & Piccadilly Circus. These sub-stations will be equipped with 90,000 hp of electrical apparatus, which is 10,000 hp more than the capacity of the large power house which the company is laying out at Chelsea. In the meantime progress is being made with the electrical equipment of the Ealing & South Harrow line, and early in the year there will be two trains equipped, deriving current from a temporary power station. These trains will be turned over to the employees of the company so as to make them familiar with the electrical equipment. They will also be able to experiment with them in every conceivable way, so that slight changes may be made, if necessary, in the final electrical equipment. It is not likely that trains will be running on the District Railway before 1904, although the actual construction has already been begun at the Whitechapel sub-station. The foundation work of the power house at Chelsea is now making fair progress, between 400 and 500 men being now regularly employed on this work. Most of the contracts have already been let, and it is interesting to note that a large dock, capable of containing four of the largest Thames barges, is being arranged for with regular dock gates, so that the barges can be admitted at high tide, and kept afloat on the same level when the gates are shut, even after the tide has receded.

The Pinkston Power House, which furnishes power for the Glasgow Corporation Tramways, has been making such an excellent record as a cheap producer of current, that, as the lighting department of Glasgow has practically reached its capacity in the central stations, it has been decided to get part of the lighting load from the tramways power house. No new machinery has been required, as Glasgow uses a system of 440 volts for lighting, and this is easily arranged from the 550-volt tramway circuits. The Glasgow lighting is costing about ninety-five hundredths of one penny per Board of Trade unit, whereas the Pinkston power house appears to be furnishing current at the low price of twenty-eight hundredths of one penny per Board of Trade unit, and it is expected to be able to do better than that.

The managers of the Yorkshire power scheme, about which a short paragraph appeared in these columns sometime ago, have decided to use steam turbines. Mr. H. F. Parshall is consulting engineer for this work as also for the Glasgow tramways power house mentioned above. The Central London Railway will have five of its new trains running by the middle of January, twenty by April, and the total number of thirty-two motor-car trains will be in service by May. As will be remembered these are to be motor-car trains which are to replace the present trains which are now propelled by electric locomotives. The trains will consist in future of five ordinary carriages which will be taken from the cars now in service, but instead of locomotives, they will have one motor car at each end of the train, making seven carriages for each train, which will be operated on the British Thomson-Houston train control system. The total number of motor cars ordered was sixty-four, forty-four of which are being made by Brown, Marshall & Company, of Birmingham, and twenty by the Metropolitan Amalgamated Railway Carriage and Wagon Company, Limited, of Oldbury. The motor car will be fitted with two different styles of trucks, the trucks which will carry the electric equipment of the British Thomson-Houston Company being of the Peckham type, supplied by Robert W. Blackwell & Co., whereas the other trucks (trailers) on which no motors are mounted, are being manufactured by the Leeds Forge Company, of Leeds. The electric motors to be used are of the G. E.-66 type, and are being furnished by the British Thomson-Houston Company. It is expected that the new trains will give a greater acceleration than the old locomotives, and that the Central London Railway will be able to use a two-minute service instead of a two and one-half minute service, as at present.

Mr. Ernest Thompson, of the firm of Nadler Brothers & Thompson, of London, manufacturers of electrical instruments, has left for a voyage round the world, his health having, unfortunately, been completely broken down, owing to overwork. Mr. Thompson will visit New Zealand, Australia, Japan, Canada and the United States, and will be gone about six months. While not going on business, Mr. Thompson will undoubtedly visit some of the more important electric plants in these countries.

At a meeting of the tramways committee of the Bradford Corporation it was decided to order six car tops of the Liverpool type for experimental use upon the Bradford lines. Plans were also approved for a new shed to be erected at Saltaire to accommodate thirty cars. It has also been decided that ten passengers should be allowed to stand inside the cars. Hitherto the number of inside excess passengers has been left to the discretion of the conductor.

An experiment of interest to numerous municipal authorities and tramway companies is being carried out at Carlisle. A short time ago it was resolved to introduce half-penny fares for certain journeys, and that the result is more than gratifying is shown by the figures for four weeks. The penny fares for that period show a decrease of 2377 as compared with the corresponding four weeks last year. But this is more than compensated for by the addition of 15,761 fares at a half-penny, which increases by £22 18s. 7½d. the yield for the four weeks over the same period last year.

Following the lead of the Lancashire & Yorkshire Railway Company, which has announced its intention of electrifying the line between Liverpool and Southport, the Cheshire lines committee are considering the advisability of going in for the electrification of their lines between Manchester and Liverpool. For this purpose it is proposed to seek Parliamentary powers. The Liverpool line is the joint property of the Great Central, the Cheshire lines committee and other companies. It is also suggested that the new scheme should be connected with the overhead electric railway at Liverpool, so as to provide a new route to Southport. The Cheshire lines route would find a keen competitor in the Behr Mono-Rail Electric Express Railway, the works of which, it is reported, will shortly be commenced.

It is expected that the new electric tramway between Lytham, St. Annes and Blackpool will be completed on May 12. The Corporation of Blackpool is carrying out the doubling of the line to the outskirts of the borough, and it is understood that it will also supply the current for the whole system.

The electrification of the Mersey Tunnel Electric Railway is rapidly nearing completion. The tunnels and platforms will be lighted throughout with electricity, electric arc lamps being employed for the purpose, and in the equipment of the cars everything that will conduce to the comfort of the passengers has been carefully considered. The line has never been a profitable one, but in deciding upon its electrification the directors have without doubt imparted to it a new lease of life, and it is satisfactory to note the rapidity with which the electrification of the Mersey Railway has been carried out—only twelve months having elapsed since the scheme was first projected. This is a fact which reflects great credit on the British Westinghouse Company.

An important decision was given in the House of Lords last month as to the liability of a tramway company so far as the portion of the street devoted to the tramway at 18 ins. on either side of the rails was concerned, to lay sand when the roadway became in a slippery and dangerous condition. The Dublin Tramway Company, against whom damages of £1,000 were awarded for an accident through the falling of a horse, contended that the sanding of slippery streets was the duty of the local authority, and not of the tramway company. The House of Lords, however, has upheld the judgment of the courts below, that the tramway company must keep their portion of the roadway in a condition not dangerous to ordinary traffic.

During the course of the present year the Corporation of Glasgow has been engaged in steadily extending its tramway system. On Jan. 1 last the total length of line in use, measured as single track, was 103½ miles, covering 52 miles of street, and at this date the system extends to 123¼ miles, covering 62 miles of street. The extensions which have been made during the year were authorized by the acts of 1899 and 1901, and comprised lines into the neighboring districts and burghs. On April 2 the line to Rutherglen via Dalmarnock Bridge and Farmeloan Road was opened for traffic. The people of this ancient and royal burgh were extremely anxious to be connected to the city by tramway service, and on the opening day they gave the Glasgow cars a hearty welcome. During the same month, the Shettleston route was opened to the terminus at Barrachnie. In June a short portion of the extension westwards along Dumbarton Road was opened to the Agricultural Show

Ground at Scotstoun, and in July the new Pollokshaws service along Barrhead Road. This last service gives the inhabitants of Pollokshaws and Eastwood a quick service into the city. In August the people of Rutherglen got the benefit of an alternative route into the city via Rutherglen Road. In the same month, the Aitkenhead Road line was opened as far as Messrs. Dubs' works, and the Dennistoun line was extended eastwards as far as Carntyne Road. In September the Cathcart line was opened to the Cemetery Gate, so that people of Cathcart and the rapidly growing suburbs southwards have a very good connection with the city. In October the Dumbarton Road line was carried westwards as far as Yoker, and this line brings the burgh of Clydebank within measurable distance with the center of Glasgow. A short line was also opened at this time to the Battlefield Memorial for the convenience of the Langside people. During the month of November the Paisley Road route was carried on from the Halfway House to Crookston, which is within 1½ miles of Paisley, and another very ancient burgh on the Clyde was brought into closer connection with the city by the Govan route being extended to the Renfrew Town Hall. The chief extensions authorized under the 1899 and 1901 acts still to be completed are Springburn to Bishopsbriggs, Crookston to Paisley, and Union Place to Cambuslang. The first of these three routes is almost finished and will be opened in a few weeks. The work on the other two extensions will possibly be commenced early in the spring of 1903.

In October last an agreement was made between the Corporations of Glasgow and Clydebank, under which the Corporation of Glasgow takes over the Clydebank Provisional Order and constructs and works the tramways in Clydebank as a part of the Glasgow system. No sooner had this agreement been signed than the work of construction was commenced, and a portion of the line to the center of Clydebank will be opened for traffic very shortly. There is no doubt that the Clydebank people will find this connection with Glasgow of very great service. In the Provisional Order for 1903, just being promoted, a few additional extensions are being proposed, the chief ones being in St. George's Road, North Street and Finnieston. These lines are being made in order to form a cross-connection between the northern part of the city and Finnieston Ferry. It is likely that by next summer the total length of line which will be operated by the Glasgow Corporation will extend to 150 miles of single track. It will be remembered that during the summer of 1901 the tramway traffic was abnormally heavy on account of the International Exhibition, but it is gratifying to note that the revenue during the past summer falls very little short of what it was in the exhibition year. The revenue for the last few weeks, as compared with the same weeks of last year, immediately after the close of the exhibition, shows an increase of about £2,000 per week. It is astonishing to note that on the Glasgow system about three and one-half millions of passengers are carried every week, the result undoubtedly of the extremely low fares in operation.

During the past month Mr. Hamilton, who was appointed manager of the Leeds Tramways some months ago, has handed in his report suggesting proper changes to make in the Leeds service. after having most carefully observed the existing arrangements. First, he requests that the service of cars be varied according to the time of day, that during the slack periods of the day the service of cars be not so frequent, while during the rush hours of the morning and evening the service of cars be increased. This has not hitherto been done in Leeds, and has consequently prevented the most economical working of the service. Mr. Hamilton also recommends the introduction of intermediate penny stages, 1½ miles in length, overlapping the existing penny stages, and strongly recommends the abolition of the present system of collecting fares, which is by means of a fare box, and the substitution of a ticket system.

Manchester has now inaugurated its service of electric cars on the southern tramway routes, and incidentally to this inauguration important traffic changes are being made. As most visitors to Manchester will doubtless remember nearly all the tramcars of Manchester have come to the vicinity of Market Street and Deansgate, and have turned at that point, involving loss of time and a great congestion of traffic in Market Street. Mr. McElroy has now arranged a service by which many of the routes previously terminating in the city will be continued through the city and on to the terminus of another route at the further end, so that they will have a complete system of "through routes" in future.

As was intimated in my last London leter, the London United Tramways withdrew its portion of the bill in Parliament which formed a portion of the Morgan group, and entering into negotiations with the Yerkes group have now been absorbed by them. The London United Tramways Company is therefore now controlled by Mr. Yerkes, and the Metropolitan District Railway. It is not necessary here to go into the reasons for this, but the management of the London United Tramways Company seems to have come to complete loggerheads with Mr. Morgan and his associate in London.

In the meantime application has been made in Parliament for a great many underground railways for next year, though the Morgan group has not as yet come forward with a through east and west line from Hammersmith through the city and the northern and eastern suburbs, as proposed last year. The Central London Railway—"The Twopenny Tube"—is bringing forward for next session practically the same project as last year, viz., the formation of a loop in the city by a continuation of the line to Liverpool Street, and the completion of the circle by a continuation of the line from Shepherd's Bush to Hammersmith and back to the city by way of Piccadilly and the Strand. Another important London tube project is the City & North East Suburban Electric Railway, which proposes to build an underground line from a point underneath the present Mansion House Station of the Metropolitan District Railway eastward to Grace Church Street, and thence northward to Bishopsgate Street, Shoreditch, Tottenham and Southgate. The Yerkes group also proposes to extend the District Railway to Earl's Court and Hammersmith, and also proposes another line to complete certain of their lengths in the West End, and for the necessary property on which to build the stations.

The City & South London Railway will again present its bill to continue their line from the present terminus at the Angel, as far as St. Pancras, and there is a bill for a City & Crystal Palace Railway, and one for Paddington, Victoria and Kennington.

The London County Council has decided to adopt the overhead system of electric traction for the tramways to be constructed in the East End of London. The new lines which are to traverse the eastern part of the metropolis are the first of the tramways north of the river to be undertaken. The reason given for the decision is that the extension of the Metropolitan Railway along Mile-End Road does not admit of conduits being constructed, as the girders which, with the jack-arching, form the roof of the tunnel come too close up to the surface to enable the required depth to be obtained.

The first portion of the tramways system which the Salford Corporation is about to provide within the area of the Prestwich District Council, has been formally opened. The corporation has entered into an agreement with the Council to construct and work the lines in Prestwich for a period of twenty-one years. It proposes to undertake a similar task in the district of the Whitefield Council, which lies to the north of Prestwich. These lines will eventually afford through communication between Salford and the Whitefield boundary, and at this latter point a junction will be effected with the electric cars of the Bury Corporation. The portion of track which was opened for traffic yesterday extends from the Salford boundary to the Prestwich railway station.

When the Private Bill Office was closed the other day it was announced that there had been deposited forty-six plans in connection with railways, thirty-eight in relation to tramways, sixty miscellaneous, and 150 provisional orders, including tramways and electric lighting; total 294. The growth in the promotion of tramway enterprises is denoted by an increase of over 50 per cent in this class of bill, the figure in respect of tramway schemes last year being twenty-three.

The tramways in the county of Middlesex forming part of the North Metropolitan tramways system have been taken over by the Metropolitan Electric Tramways Company, in accordance with an arrangement with the Middlesex County Council.

The agreement entered into between the Barrow Corporation and the British Electric Traction Company, provides, among other things, that when a contemplated low road is made from Furness Abbey to Dalton, the Company shall construct a new tramway to continue from the present terminus at Furness on to Dalton-in-Furness, a distance of about 2 miles, providing the necessary powers can be obtained.

The city of Leeds is at present experimenting with the Thermit process of welding tram-rails, and engineers are awaiting the result with great interest. Thermit is a mixture of aluminum and oxide of iron, capable of a temperature so enormous that operations which hitherto have only been possible in the electric furnace now become easy of application. The temperature is so great that Thermit iron running into the joints at once melts into the rails, where it meets them, and a strengthening shoe at the joint may be formed—a shoe not bolted or clamped, but absolutely one with the rails.

Mr. Schenck, the chairman of the Crystal Palace Company, the purchaser of the Manx Electric Tramway between Douglas, Laxey, Ramsey, and Snaefell, has paid into the account of the Liquidator at Parr's Bank, London, the balance of the purchase money. The full purchase price was £250,000, but certain instalments have previously been paid.

The city of Lancaster will have its service of electric cars in service in January. Mr. W. A. Tester, borough electrical engineer, has designed and carried out the scheme, and the preliminary

trials have given every satisfaction. The electricity works have been extended to afford the necessary power, and the car shed in Thurnham Street is a substantial erection. The British Westinghouse Electric Manufacturing Company has had the sole contract for the cars and equipment.

The bodies of the cars were made at the Lancaster works of the Metropolitan Amalgamated Railway Carriage & Wagon Company. The cars are of a very pleasing design, and have a number of innnovations which will add to the comfort of the passengers. One of the most noteworthy features of the cars is that they are provided with the Newell patent magnetic brake, which is in addition to the two other brakes, and especially adapted for hilly districts. The gradients in Lancaster, however, are not abnormal. The corporation has decided to have halfpenny fares, with concessions to working people on workmen's cars.

The promoters of the scheme authorized this year for the construction of a railway partly under ground from a point near the North London hospital at Hampstead to Edgware are preparing a bill for power to extend this line to Watford. The scheme contemplates the working of the railway from Hampstead to Edgware, and from Edgware to Watford as separate undertakings, but under mutual working agreements with each other and with the authorized Charing Cross, Euston and Hampstead Railway Company.

The Bournemouth tramways are rapidly nearing completion. The total length of the permanent way and the conduit system represents about 18 miles of single track, the contractors, Messrs. J. G. White & Co., Limited, of London, having carried out the work as quickly as possible. The permanent way for the overhead trolley system is completed, with the exception of the road from the Cemetery to Winton—a distance of 1¾ miles. During the last few weeks great progress has been made with the construction of the conduit system, and the whole of the conduit construction is now almost completed.

The directors of the Lancashire & Yorkshire have made arrangements for the conversion of the portion of their system running from Liverpool to Southport into an electric railway on the third-rail system, and it is anticipated that the new service will be in operation about eight months hence. For about one-half the length of the section which is to be electrified the line runs through the populous northern suburbs of Liverpool, and at present eighty-five trains run daily each way between the Exchange Station and Crosby. The railway company will themselves generate the power at a central station, for the construction of which arrangements have been made already, and there will be probably several substations for transforming purposes.

The British Electric Traction Company, having been worsted in the attempt to secure the tramway system of Birmingham, is now seeking to force the corporation to yield by securing the control of the tram lines in the district immediately surrounding the borough. The company has, it seems, come to terms with the various local authorities concerned, and will promote a private bill next session to carry these terms into effect.

The first annual convention of the British Electric Traction Associated Companies was recently held at the Loughborough Town Hall, and was attended by a large number of the managers, secretaries and other officials of the various companies. In the morning a conference was held in the lecture room, at which Mr. E. Garcke, managing director of the British Electric Traction Company, presided, and a discussion took place on "The Organization of Traffic." After luncheon, which was provided by the Brush Electric Engineering Company, Limited, Lord Vaux, of Harrowden, chairman of the company, gave "Success to the British Electric Traction Associated Companies," now known so familiarly to them, he remarked, as the "octopus." (Laughter.)

Mr. Garcke, in reply, said the word "octopus" was not new to him. (Laughter.) It had been dinned into his ears a good many times during the past few weeks. It would, perhaps, not surprise them to know that he used the word himself some six or seven years ago when they were going over the prospective schemes they were determined to carry out. For it was their policy and determination to go into every corner of the United Kingdom, and do work which until they came was neglected. Subsequently the visitors went down to the Falcon Works of the Brush Electrical Engineering Company, and made an inspection of that extensive undertaking.

The Hove Town Council has resolved to promote a tramways bill in the next session of Parliament. A. C. S.

It is announced that plans have been submitted to the French Minister of the Interior for the construction of an electric railway to the summit of Mount Blanc from the village of Les Houches, on the Savoy side of the mountain.

OPENING OF THE AUCKLAND ELECTRIC RAILWAY

The completion of the Auckland Electric Railway and the opening of the system were formally celebrated on Nov. 17, the Hon. Alfred Kidd, Mayor of Auckland, presiding at the ceremony. The inauguration of the service consisted of the starting of the machinery at the power house by Mayor Kidd, the setting in motion of the first electric car by Sir John Logan Campbell, a luncheon in the Choral Hall, and a ball at "Rocklands," Epsom, the residence of P. M. Hansen, local director of the Auckland Electric Tramways Company.

Several speeches were made in the course of the ceremonies, and in every instance high appreciation of the work of the contractors was shown. The Mayor said that the enterprise was the greatest public benefit that had ever been accomplished in Auckland, and that it would assist materially in developing the resources of the town and improving the condition of the people.

At the public luncheon W. S. Turner, representative of J. G. White & Company, in responding to the toast, "The Contractors," said his company was an English company, with head offices in College Hill, London. The work which was undertaken included some thirty or more miles of tracks, the necessary overhead wire system, underground conduits and cables, the power station building, the steam and electrical plant for producing electric power, and forty-three cars of all types with the necessary equipments and electric motors. A brief review of the work was then given by the speaker. In company with Mr. Carey, the chief electrical engineer of the Auckland Tramways Company, Mr. Turner arrived in Auckland on June 18, 1901. H. C. Eddy, electrical and mechanical engineer and chief assistant, from New York, and A. H. Witham, chief clerk, from London, arrived the following month. They found practically nothing in the way of plant or materials on the ground. The first shipment of rails, furnished by the Lorain Steel Company, of America, was unloaded on July 19. A sub-contract was made with John McLean & Son for the construction of the first 6 miles of track. Owing to the impossibility of procuring the necessary materials the first rails were not laid until Sept. 3, though the formal breaking of ground took place on Aug. 1. McLean & Son completed the first 6 miles of tracks by Jan. 1, and, in the meantime, took a second sub-contract for 12 miles of additional track work. This had been completed. The lines in Great North Road and New North Road had also been completed. In all about 27 miles of tracks had been completed in a space of about 14 months. The work of track construction had all been done under the direction of J. G. White & Company's civil engineer, John Reed, and supervised by R. A. Wilber, both of whom were brought out from America. The work of constructing the underground conduits, covering 4 miles of streets, was also sub-contracted to John McLean & Son. This work had all been finished and the cables had been placed in the conduits ready for service. These were supplied by the Callender Cable Company, of England, and their installation had been supervised by Mr. C. A. Reeves, who was sent out from England by his company for this purpose. All the overhead line work in the city had been practically completed. The iron poles were furnished by John Spencer & Company, of England. The copper wire was purchased in America, and the insulators and other fittings partly in England and partly in America. This work had been carried out under the supervision of F. N. Smock, who was brought out from America for this purpose. The foundations of the power house were begun in November, 1901. After completing the foundations nothing more could be done until the arrival of the steel framework of the building, which, after most extraordinary delays in manufacture and shipment, was landed in Auckland on July 18 last. The brick work and all other work in the building had been done by J. G. White & Company's own men. The erection of the machinery had gone on with the building. The boilers furnished by the Babcock & Wilcox Company, of England, had been erected by the local agents for the boilers. The engines were purchased from Cole, Marchant & Morley, of England, and their erection had been ably supervised by J. Copley, who came out from his company's factory to direct this work. The generators and switchboard had been furnished by the General Electric Company, of America, and their erection had been in the hands of E. W. Ackland, J. G. White & Company's assistant electrical engineer. The entire building and plant was now practically completed, the whole work having been done within about four months from the date of starting the building. Of the forty-three cars and equipments, thirty-five are now on hand and practically all ready to operate. The remaining seven are expected on the first of next month. They are constructed by the Brush Electrical & Engineering Company, of England, who also furnished the trucks and motors with which the cars are equipped.

NEW ELEVATED FOR CHICAGO

It is understood that New York capitalists are interested in a project to build a new elevated railway in Chicago to tap the stockyards region and relieve the congested traffic in the southwestern part of Chicago. The proposed line is to run under the surface of Clark Street until clear of the downtown district. The plan is to reach the southwest district, which is admittedly seriously in need of better transportation facilities. Starting at the City Hall or thereabout the plan, as thus far outlined, is to build a tunnel under Clark Street to Twelfth Street or a little south of there, then gradually bring the line out and up until it reaches the proper elevation, where it will continue south as an elevated railway. The main branch is to run south along Wentworth Avenue, as at present planned, until it taps the center of the stockyards district. There is to be a branch line to skirt Archer Avenue to the limits. Altogether there will be about 14 miles of road. Ephraim Banning, of the firm of Banning & Banning, attorneys, is said to be interested in the project.

MORE SUBURBAN CARS TO BE OPERATED IN BOSTON

A through car service will shortly be established between Waltham and the Park Street subway station in Boston. Cars of the Newton & Boston line will be run by employees of that road from Waltham to Watertown Square, at which point Boston Elevated employees will take the cars into the subway and back again. The route will be down Western Avenue from Watertown to Cambridge, and thence via Central Square, Harvard Bridge, Massachusetts Avenue and Boylston Street into the subway. During the last few days the Boston Elevated has been operating the cars in different parts of Cambridge and Boston in order to accustom the men to the use of the air brake. It is probable that all the cars operating on the larger lines of the elevated company will ultimately be equipped with air brakes. The through cars from Lowell to Boston, which began running into the Sullivan Square Terminal recently, are equipped with air brakes and have thus far worked very satisfactorily. The operation of foreign cars in the heart of Boston is marking the beginning of an era of broad extension of the city's transportation facilities.

THE NEW COMPANY AT OMAHA—ITS PURPOSES

Articles of incorporation for the Omaha & Council Bluffs Street Railway Company, which is to operate under lease the Omaha Street Railway Company and the Omaha & Council Bluffs Railway & Bridge Company, have been filed at Omaha in the form of an amendment to the articles of incorporation of the Omaha & Florence Street Railway Company, which never constructed any lines. It is provided that the corporation is to be dated from Oct. 5, 1891, and is to continue ninety-nine years, to Oct. 5, 1990. The capital stock of the company is to be $15,000,000, divided into 150,000 shares of the par value of $100 each. Of this stock 100,000 shares are to be common stock and 50,000 are to be preferred. The preferred stock is to be entitled to dividends at the rate of 5 per cent per annum, the dividend to be cumulative after Jan. 1, 1904. It is provided that "in the event of any liquidation or distribution of the capital of the company, no matter by what means, after the payment of the debts of the company, the holders of the preferred stock shall be paid the par value thereof, together with accrued dividends then due and unpaid, before the holders shall be entitled to any payment on account thereof, and the remainder of the assets, after payment as aforesaid, shall be distributed pro rata among the holders of said common stock exclusively." All stock of the company issued prior to Oct. 7, 1902, is to be considered common stock, and the holders, upon surrender of it, are to be entitled to an equivalent amount at par of the common stock of the company. The amended articles of incorporation are signed for the Florence Company by its old officers, Guy C. Barton, president; William S. Cox, secretary, and Guy C. Barton, Frank Murphy, W. A. Smith, W. V. Morse and Luther Drake as directors. It is stated that at the first annual meeting of the new company, to be held Jan. 12, Frank Murphy would be chosen president of the new company and Secretary Leussier retained.

In connection with the lease of the companies the new interests propose to carry out a plan for the construction of important extensions to extend from both Council Bluffs and Omaha. The new lines will be built so that all important points in Eastern Nebraska and Western Iowa will have electric railway connections. A line is to be built from Council Bluffs to Griswold, Cass County, just across the eastern line of Pottawattamie, a distance of 26 miles, and lines are to be built from Omaha to Blair, Fremont, Platsmouth, Wahoo and Lincoln, Neb. The line to Blair will be about 25 miles long, extending through Florence and Calhoun. The line to Fremont will be about 46 miles long, extending through Millard, Elkhorn and Valley. The line to Lincoln will be 56 miles long, extending through Douglass and Sharp Counties to Saunders County, thence through Lancaster County into Lincoln. The line to Platsmouth will be 21 miles long, extending from South Omaha through Cass County.

The plan for additional power development is said to call for carrying out the gigantic water-power scheme first proposed in 1901. This plan provides for the construction of a large dam about 4 miles south of Fremont. This dam will be but 25 ft. wide at its base, but 1260 ft. wide at the top, which will be about 30 ft. from the peak of the bluffs. A waterfall of 157 ft. will be obtained. To secure water to fill the dam, which will create a lake 4 miles long by 1½ miles wide, and 137 ft. in depth at the dam, the Platte River will be tapped several miles west of the site of the dam, and water will thus be conducted into the lake.

INTERURBAN STATION AT CLEVELAND

It is announced that within sixty days work will start on the construction of the proposed interurban freight station, which will be located on Erie Street, Cleveland, on property which has been held by the interurban companies for more than a year. The station will be operated by the Suburban Depot Company, interested in which are the Cleveland Electric Railway Company, the Cleveland City Railway Company, the Eastern Ohio Traction Company, the Northern Ohio Traction Company, the Cleveland, Painesville & Eastern Railway Company, the Lake Shore Electric Railway Company and the Cleveland, Elyria & Western Railway Company. With the exception of the Eastern Ohio Traction Company the business of these roads is operated by the Electric Package Company. At the present time the Eastern Ohio Traction Company has a small temporary station on this site, but when the new building is completed it will probably join with the others. While the station will be devoted almost wholly to freight and express business, there will be waiting-rooms for the accommodation of travelers.

THE INTERSTATE RAILWAY COMPANY

In addition to its purchase of control of the United Power & Transportation Company the Inter-State Railway Company has secured the charters and present capital stock of the following new companies, with the consequent right to build: Reading Power Company, of Reading; West End Electric Street Railway Company, of Reading; The Arch & Green Street Railway Company, of Norristown; East Side Street Railway Company, of Reading; Chester & Rose Valley Street Railway Company, of Delaware County; West Side Street Railway Company, of Norristown; Chester & Middletown Street Railway Company, of Delaware County; Chester & Rockdale Street Railway Company, of Delaware County; the Darby & Fernwood Street Railway Company, of Delaware County; Black Bear Street Railway Company (Pottstown to Reading); Womelsdorf & Myerstown Street Railway Company, of Lebanon County; Twelfth & Thirteenth Street Railway Company, of Reading; South End Street Railway Company, of Reading; Front & Fifth Street Railway Company, of Reading; Hamburg Street Railway Company, of Hamburg, to Reading; Birdsboro Street Railway Company, of Birdsboro, to Reading; the Lima, Gradysville & West Chester Electric Street Railway Company, of Delaware County; Colwyn & Ridley Park Street Railway Company; Clifton & Sharon Street Railway Company, of Sharon Hill; Trenton, Pennington & Hopewell Street Railway Company, of New Jersey.

The official circular to the stockholders of the United Power & Transportation Company says that the majority interest in the company has been sold at $75 per share, payable in forty-year collateral trust gold coupon bonds, to be issued by the Inter-State Railway Company, as of Feb. 1, 1903, and to bear interest at the rate of 3 per cent the first year, 3½ per cent for the second year, and 4 per cent for the third year and thereafter. The bonds, in addition to the obligation of the Interstate Railways Company, will be secured by a deposit with the Real Estate Title Insurance & Trust Company, of Philadelphia, as trustee, of the United Power & Transportation Company stock purchased. The issue will be limited to the amount necessary to take up the present outstanding stock of the United Power & Transportation Company.

Every stockholder of the United Power & Transportation Company is to have the right to sell his stock on the same terms until January 6, 1903, inclusive, and thereupon, on depositing his shares

with the Real Estate Title Insurance & Trust Company, of Philadelphia, trustee, in exchange for negotiable receipt, shall have the right to subscribe for stock of Interstate Railway Company in the proportion of one share for every fourteen shares of United Power & Transportation Company stock sold by such subscriber.

The United Power & Transportation Company held interests in the following companies: Citizens' Electric Light & Power Company, of Delaware County; Delaware County & Philadelphia Electric Railway, Edison Electric Illuminating Company, of Lebanon; Lebanon Valley Street Railway Company, Holmesburg, Tacony & Frankford Railway, Roxborough, Chestnut Hill & Norristown Railway Company, Schuylkill Valley Traction Company, Trenton Street Railway Company, United Traction Company, of Reading; Wilkesbarre & Wyoming Valley Traction Company, of Wilkesbarre; Dallas & Harvey's Lake Railway Company, Wilmington & Chester Traction Company, Wilmington City Electric Company, Southwestern Street Railway Company.

The officers of the new company, as announced, are: Frank O. Briggs, of Trenton, N. J., State Treasurer, president; W. W. Light, of Reading, secretary-treasurer; O. S. Geiger, of Reading; Frank L. Hansell, William F. Eidell and George H. B. Martin, directors.

ELECTRIC RAILWAYS IN CONNECTICUT

From the extent of the plans of the electric railway companies that have already filed applications with the Secretary of State of Connecticut for charters, and from the announcements made by prospective applicants for charter rights, the indications are that there will be witnessed at Hartford a repetition of the struggle between the steam railroads and the electric railways that has been a feature of the Legislature for several years past, and if a majority of the projects are successful and build lines the State, as a center of electric railway operations, will, size considered, outrank any other Eastern State. Among the more important propositions are the construction of a line between Hartford and Norwich, the closing by the Connecticut Railway & Lighting Company of the gaps in a line between Waterbury, Bridgeport and Stamford, the construction of a line between Middletown and New Haven, the construction of a line between Hartford and Middletown, the construction of a line to connect Meriden, Berlin, Newington and Middlefield. These, as has just been stated, are the more important projects; but in addition to them the applications filed by companies less pretentious and the applications filed by existing companies for additional rights, in themselves, make a showing that would be extremely creditable.

The line between Hartford and Norwich, the longest of the new propositions, will extend over practically new ground. It is proposed to reach the Manchester Tramway Company's lines, some 8 miles east of Hartford, via the towns of Bozrah, Lebanon, Columbia, Coventry, Andover and Bolton, taking a southerly route from the line of railroad travel, and for the most part well away from any steam roads. Willimantic, the most important city between Hartford and Norwich, and between which and Norwich an electric railway is now being built, will not be touched by the proposed line. The identity of but few of those behind this project has been made known, and there is considerable speculation as to the interests involved.

The plan of the Connecticut Railway & Lighting Company for closing the gaps in the line between Waterbury, Bridgeport and Stamford provides for an 80-mile line that will parallel the lines of the New York, New Haven & Hartford Railroad for the entire distance. The places through which this line will run are Waterbury, Naugatuck, Union City, Beacon Falls, Seymour, Derby, Shepton, Putney, Stratford, Bridgeport, Fairfield, Southport, Westport, Saugatuck, the Norwalks and Stamford. This line will make electric railway travel between Waterbury and New York a reality.

The plans for building lines between New Haven and Middletown and Middletown and Hartford are being promoted by the same interests. The companies to be organized to build these lines will be known as the New Haven & Middletown Railway Company and the Hartford & Middletown Railway Company. James F. Shaw & Company, of Boston, who are interested in the Boston & Worcester Street Railway, now being built between Boston and Worcester, are understood to be the principal promoters of the scheme to connect New Haven, Middletown and Hartford by trolley, and it is even said that a project is being considered for connecting the Boston & Worcester Railway with the projected lines, so as to complete a line between Boston, Worcester, Hartford, Middletown and New Haven. New York, according to report, is the objective point, the plan being to make traffic arrangements where necessary east of New Haven. Of course this Boston-New York connection is speculation at this time, but the building of the lines to connect New Haven, Middletown and Hartford, with the connections that will be made, furnishing electric railway connections between three of the principal cities of the State, will be a work of great internal improvement. The New Haven & Middletown Railway will be 30 miles long, and will be new, with the exception of a few miles. It will extend from Middletown through Durham and Montowese, where connections will be made with the lines of the Fair Haven & Westville Railroad, of New Haven. It is probable that two power houses will be erected, one in Hartford and one in Middletown. The line of the Hartford & Middletown Railway is to begin in the town of Wethersfield, and will run to Middletown, passing through Rocky Hill and Cromwell, a distance of about 11 miles. Among those interested in these companies are: James F. Shaw and Charles H. Tilson, of Brookline, Mass.; Walter H. Trumbull, of Salem, Mass., and Frederick C. Hinds, of Newton, Mass., besides Charles E. Perkins, Thomas C. Perkins, Arthur Perkins and Harrison B. Freeman, Jr., of Hartford; Frank D. Haines, of Middletown, and Harrison Wagner, of New York.

The Willimantic Traction Company, now building an electric railway from Baltic, through Willimantic to South Coventry, according to report, plans to build from South Coventry to Rockville or Manchester, and then to Hartford. As connections are made at Baltic between the lines of the Willimantic Traction Company and the Norwich Street Railway, Willimantic will thus have electric railway connections on the east with Norwich, and on the west connection will be made to Hartford. Little is heard this year of the project for connecting Willimantic and Southbridge, Mass. It is improbable that anything will be done with this project this year.

The Stamford Street Railway Company announces that it will apply to the Legislature for further important extensions of its lines. Among these projected extensions is a line to Long Ridge. Another branch proposed runs to Darien Station.

The Waterbury & Woodbury Railroad, promoted by Waterbury and New Haven interests, will apply for a charter to build a road to connect Waterbury and Woodbury. This line will extend through Middlebury, Southbury, Pomperang, Oxford and Hotchkissville. Christopher Stroebel, of Waterbury, is the principal promoter of this company.

The Stafford Springs Street Railway Company will apply for permission to increase its capital stock to $1,500,000; to change the name of the Worcester & Hartford Street Railway Company, and to transfer its officers from Stafford Springs to Hartford. The company will also ask for new locations in Stafford Springs, and through Stafford Hollow to the Massachusetts line; also for a new route in Rockville. Interests indentified with this company and the Hartford & Springfield Street Railway Company will apply for a charter for a road from Crystal Lake, Ellington, to connect with the tracks of the Stafford Springs Company; thence to North Somers, East Longmeadow and Hampden, Mass.

It is the intention of the New London Street Railway to extend its tracks to take in East New London, leaving Main Street and going to Riverside Park. The company will ask the Legislature for an amendment to its charter to permit this extension and also to furnish power and illumination for such street railway as may operate in Groton, connecting therewith by a cable across the Thames River. There is no assurance when the Riverside extension will be built, but it undoubtedly will be undertaken within the next year or two.

A charter is to be applied for by the Groton & Stonington Stret Railway Company. Aside from the fact that Cortland E. Colver is the principal promoter of this company, and that Judge Ralph Wheeler, of the Superior Court, has approved the application of the company, little information concerning the project is obtainable.

Application is to be made for a charter for a line between Branford and Westbrook, passing through Guilford, Madison and Clinton. This line will parallel the shore line of the New York, New Haven & Hartford Railroad between the points named. Samuel H. Chittenden, James R. Meigs, Winthrop G. Bushnell and A. William Sperry are the signers of this application.

The Fair Haven & Westville Railroad, of New Haven, will apply for permission to build a number of new lines. Extensive and important lines are to be built within the city, and important suburban extensions are contemplated. The company will ask for the right to build from the terminus of its line, as laid out and partly built in Derby, through Derby Turnpike and New Haven Avenue, to connect with the lines of the Connecticut Railway & Lighting Company. The company also desires to build a line from the terminus of its line in Montowese to North Haven, and thence to Wallingford. The Winchester Avenue Street Railway, which is controlled by the Fair Haven & Westville Railway, will also seek permission to build a number of important extensions.

Charles H. Tredennick, Edmund E. Schmelzer, George P. Smith, Ernest P. Moss, David Higgins and Ellis B. Baker have given

notice of their intention to apply for a charter to construct a line in Meriden, Berlin, Newington and Middlefield, and on certain streets in Hartford.

The Hartford Street Railway Company has given notice of its intention to apply for an amendment to its charter so that it will be permitted to extend its lines from its present terminus in Wethersfield to Rocky Hill and also for permission to connect its lines by a trestle over the East Hartford railroad crossing.

The East Hartford & Glastonbury Horse Railroad Company will ask for permission to change its corporate name, and it will also petition for permission to extend its present terminus in Burnside to Church Street, through Church Street and through Silver Street to connect with its present line on Main Street, East Hartford, and for permission to build a branch in East Hartford through Naubic to connect with its present line in Glastonbury.

Nelson Morgan, of Groton, will seek a charter for the construction of a line to connect Groton and Westerly.

The Meriden, Southington & Compounce Tramway Company will petition for permission to make important extensions. The company wants to extend the line to Cheshire, starting at Milldale and intersecting the old turnpike running between New Haven and Southington. The company also wants to run to Marion, beginning at Milldale, following the Meriden and Waterbury turnpike, or crossing private land, and the tracks of the New York, New Haven & Hartford road, and thence to Wolcott Center. The proposed line will continue to follow the turnpike, passing through Cheshire, Wolcott and Waterbury. At the latter place connection will be made with the line of the Connecticut Railway & Lighting Company. The road also seeks permission to make extensions in the city of Meriden, also to run to Hubbard Park, and the summit of West Peak, which is partly in the towns of Meriden, Berlin and Southington. The company also asks to be allowed to extend its tracks along the road between Kensington and Berlin. The proposed extensions will materially increase the mileage of the company.

COMBINATION OF GERMAN ELECTRICAL MANUFACTURERS

Announcement is made from Berlin that the Allgemeine Elektricitäts-Gesellschaft and the Union Elektricitäts-Gesellschaft have reached an agreement amounting to a practical consolidation, the directors of each company being elected members of the board of the other, so that the management is identical, though the companies nominally remain separate. A movement has been on foot for several months to effect a consolidation of the leading manufacturing interests, and this is the first practical outcome of these negotiations. The Allgemeine took the lead in this effort. The first offer was made to the Schuckert Company, of Nuremberg, which surprised the country last summer by announcing sensational losses through the shrinkage in value of its securities and plant. The negotiations came to nothing through the refusal of the Schuckert directors to accept the terms offered. The Allgemeine then entered into negotiations with the Union, and the announcement of the conclusion of the deal caused a rise in electrical stocks, Allgemeine gaining 6½ and Union 2 1-3 points. The Union owns the Thomson-Houston patents for Germany and neighboring countries.

The Siemens & Halske Company, which is the third large German manufacturing company, has not as yet entered the combination.

PERSONAL MENTION

MR. BENJAMIN F. FILLMORE, who was identified with the building of the first street railway lines of Scranton, Pa., died a few days ago at his home in that city, aged seventy-one years. He was a railroad contractor for many years, and built the Green Ridge, Providence & Dunmore and People's lines.

HON. CHARLES P. GRIFFIN, president of the Toledo & Indiana Railway, and prominently identified with the promotion of electric railways in Northwestern Ohio, died a few days ago at his home in Toledo. The Toledo & Indiana Railway has recently begun operations, and Mr. Griffin had been very active in supervising the work of the company. Mr. Griffin served five terms in the Ohio Legislature. He was sixty years old.

MR. A. FAIVELEY, chief engineer of power stations of the Metropolitan Underground Railway Company, of Paris, who has been making a visit in this country inspecting electrical railway and lighting stations, returned to France Dec. 25. Mr. Faiveley has made, while in America, a very extensive trip, which included a visit to the Pacific coast, and stated in a recent interview that he found much to interest him in the cities which he visited.

MR. W. B. POTTER, chief engineer of the railway department of the General Electric Company, was a visitor in Chicago recently. While in that city he spent some time looking over the electrical equipment of the Aurora, Elgin & Chicago Railway, and expressed himself as very well pleased with its performance. The high-speed tests which he is to conduct in behalf of his company on the Aurora, Elgin & Chicago lines he says will not be undertaken until the completion of the Elgin branch, which will offer track most favorable for tests over 70 miles per hour.

MR. ALBION E. LANG, the retiring president of the Toledo Railway & Light Company, of Toledo, Ohio, was recently presented with a handsome gold watch, watch chain and pencil attachment by the employees of the company as a tribute of love and esteem. The affair was planned very quietly, and was a complete surprise to Mr. Lang. A delegation of fifty employees of the company, representing all the employees, surprised Mr. Lang while he was at work. The presentation was made, and then a presentation dedication, signed by every employee of the company, was read. Mr. Lang, in replying, said that he had not neglected to count the cost of parting with old associates, and that he was not severing his connection with the company entirely, and certainly would not lose his interest either in the men or the company, although he might not be actively engaged in its management. Mr. Lang was born at Huntington, Lorain County, Ohio, in 1849, and entered the street railway business in 1881 as owner of the Monroe & Door Street Railroad, in Toledo. He effected the consolidation of several lines in 1885, and in 1888 became president of the consolidated system. In 1895 a second consolidation, under the name of the Toledo Traction Company, was arranged. At this time Mr. Lang was president of the Toledo Consolidated Electric Company, the two companies controlling the entire street railway and lighting business of the city. Later on the Toledo Railways & Light Company was organized as the successor of the Toledo Traction Company, which on July 1 had obtained control of the Toledo Consolidated Electric Company. Mr. Lang served as president of the American Street Railway Association in 1898. Mr. Lang's plans for the future are not definitely settled, but he will probably spend the coming winter in California. This is the first time for a long number of years that Mr. Lang has not been actively engaged in business, and the relaxation from care will afford a pleasant change. He has acquired considerable property during his business career, and believes under these circumstances it is his duty, as well as privilege, not to undertake other arduous business engagements. This will not, however, mean idleness for a man of Mr. Lang's temperament and mental resources, as his friends well know.

ALBION E. LANG

MR. J. C. M. RÖHL, general manager of the Hamburg Street Railway Company, of Hamburg, Germany, president of the German Street Railway Association, and first vice-president for a number of years of the International Street Railway Association of Europe, died in Hamburg Nov. 8. Mr. Röhl was a gentleman of very charming personality, and was also considered as one of the ablest street railway managers in Europe. He was born in Lubeck in 1850, and in 1864 entered the service of the Lubeck & Kleinen Railroad Company. He became connected with the Hamburg street railway system in 1868, and was gradually promoted until he became, in 1889, general manager of the company. Under his management the system was greatly extended and equipped with electricity. Mr. Röhl was one of the founders of the German Street Railway Association, was a regular attendant at the meetings of that association as well as of the International Street Railway Association, and always took a prominent part in their councils.

J. C. M. ROEHL

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. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Nov. '02	63,362	34,672	28,690	12,850	15,840
	1 " " '01	50,192	27,746	22,446	12,438	10,009
	6 " June '02	318,937	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	136,162	130,004
	12 " " '00	513,725	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	23,866	26,750
	3 " " '02	414,635	251,739	162,897	71,598	91,299
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Nov. '02	15,975	9,135	6,840	------	------
	1 " " '01	15,167	8,304	6.803	-- ---	------
	5 " " '02	98,335	53,810	44,525	------	------
	5 " " '01	95,150	48,621	46,529	------	------
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '02	11,321,030	7,862,571	3,458,458	2,836,560	621,898
	12 " " '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
Massachusetts Elec. Cos	12 m., Sept. '02	6,090,168	3,827,372	2,262,796	1,391,239	871,557
	12 " " '01	5,778,133	3,915,486	1,862,648	937,206	925,442
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., Nov. '02	1,057,666	602,530	455,136	------	------
	1 " " '01	996,851	661,249	335 601	------	------
	5 " " '02	5,760,177	3,129 279	2,630,898	------	------
	5 " " '01	5,475,081	3,397,107	2,077,974	------	------
	12 " June '02	12,789,705	*8952214	3,837,490	------	------
	12 " " '01	12,101,198	*7970635	4,130,563	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., *a* Nov. '02	292,878	160,695	132,183	78,382	53,802
	1 " " '01	283,510	171,195	109,515	93,399	16,116
	5 " " '02	1,613,818	829,697	784,121	394,578	389,543
	5 " " '01	2,701,503	1,203,882	1,557,621	501,533	1,056,088
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., Nov. '02	39,775	26,258	13,516	12,605	911
	1 " " '01	42 961	26,113	16,848	12,673	4,175
	9 " " '02	478,781	283,220	195,561	113,317	82,245
	9 " " '01	367,082	237,984	129,098	115,419	13,680
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Nov. '02	14,112	6,389	7,723	------	------
	1 " " '01	12,041	5,804	6,237	------	------
	11 " " '02	177,251	72,784	104,467	------	------
	11 " " '01	159,453	68,234	91,218	------	------
CLEVELAND, O.						
Eastern Ohio Traction Co.	1 m., Oct. '02	17,365	10,142	7,224	6,033	1,190
	10 " " '02	161,071	89,603	71,468	54,574	16,894
Cleveland, Elyria & Western	1 m., Nov. '02	27,924	16,745	11,180	------	------
	1 " " '01	21,125	12,370	8,756	------	------
	11 " " '02	276,135	154,826	121,309	------	------
	11 " " '01	229,853	125,768	104,085	------	------
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Oct. '02	16,213	9,655	6,558	------	------
	1 " " '01	15,639	8,558	7,081	------	------
	10 " " '02	160,677	86,620	74,057	------	------
	10 " " '01	139,824	71,801	68,022	------	------
	12 " Dec. '01	164,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 89,592	71,520	72,500	† 980
COVINGTON, KY.						
Cincinnati, Newport & Covington Ry. Co.				42,823	22,238	20,585
	1 m., Aug. '02	96,118	* 53,295	28,784	15,807	12,977
	1 " " '01	74,525	* 45,741	252,130	131,230	120,899
	8 " " '02	596,156	* 344,026	208,169	125,328	82,841
	8 " " '01	535,784	* 327,615			
DETROIT, MICH.						
Detroit United Ry.	1 m., Nov. '02	293,671	167,494	126,177	70,140	56,037
	1 " " '01	256,379	148,682	107,696	64,229	43,467
	11 " " '02	3,179,093	1,791,319	1,407,773	743,377	664,396
	11 " " '01	2,789,614	1,531,049	1,258,565	662,515	596,051
	12 " Dec. '01	2,219,171	*1596765	1,322 046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Nov. '02	32,117	*21,187	10,930	------	------
	1 " " '01	27,979	*17,446	10,533	------	------
	5 " " '02	204,644	*117,364	87,280	------	------
	5 " " '01	184,935	*99,350	85,585	------	------
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Nov. '02	46,416	26,426	19,990	9,811	10,179
	1 " " '01	39,217	22,199	17,018	9.195	7,823
	11 " " '02	489,261	259 674	229,587	106,221	123,366
	11 " " '01	413.163	226,273	186 890	160,755	86,135
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Nov. '02	33,542	21,073	12 469	8,333	4,136
	1 " " '01	27,321	17,137	10,184	8,333	1,851
	11 " " '02	375,432	221,238	154,194	91,667	62,527
	11 " " '01	331,465	187,426	144,039	91,667	52,372
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co.	1 m., Nov. '02	24,289	13,173	11,116	1,991	9,126
	1 " " '01	15,833	11,067	4,766	635	4,130
	7 " " '02	142,108	76 228	65,880	28,989	36,890
	7 " " '01	105,329	67,679	37,649	20,752	16,898
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Nov. '02	39,967	20,720	19,247	16,155	3,092
	6 " " '02	266,216	134,574	131,642	97,908	33,734
LONDON, ONT.						
London St. Ry Co.	1 m. Nov. '02	12,356	7,208	5,148	1 850	3,298
	1 " " '01	12,084	6,002	6,082	2,176	3,907
	11 " " '02	139,662	85,428	54,234	24,044	30,189
	11 " " '01	128,898	78,276	50,622	21,976	28,646
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Nov. '02	239,015	105 878	133,137	67,663	65,474
	1 " " '01	206,356	102 286	104,069	63,166	40.903
	11 " " '02	2,493 809	1,167 289	1,326,521	732,288	594,232
	11 " " '01	2,198,416	1,079,875	1,118,541	687,977	430,564
	12 " Dec., '01	2,442,312	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,226,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Nov. '02	309,468	147,168	162,300	60,233	102,067
	1 " " '01	268,517	114,444	154,072	58,350	95,722
	11 " " '02	3,280,880	1,478,713	1,802,166	651,200	1,150,966
	11 " " '01	2,879,634	1,301,345	1,578,289	619,787	958,501
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Nov. '02	172,872	103,628	69,243	16,076	53,167
	1 " " '01	154,912	96,489	58,423	13,967	44,455
	2 " " '02	351,277	200,047	154,230	32 088	122,162
	2 " " '01	320,973	181,700	139,273	29,350	109,922
NEW YORK CITY.						
Manhattan Ry. Co.	12 m., Sept. '02	11,583,546	5,545.395	6,038,151	2,712,089	3,326,062
	12 " " '01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786 030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '02	15,866,641	7,385,883	8,480,758	4,815,421	3,665,337
	12 " " '01	14.720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	3 m ,Sept. '02	18,401	8,135	10,266	4.062	6,203
	3 " " '01	16,372	6,887	9,485	4,200	5,285
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co	1 m., Oct. '02	9,023	5,706	3,317	2,083	1,234
	4 " " '02	37,696	21,586	16,110	8,333	7.777
	12 " June '02	86,795	*56,392	30,402	23.125	7.277
PHILADELPHIA, PA.						
Union Traction Co.	12 m., June '02	14,118,159	6.402,338	7,715,820	*6637781	1,078,038
	12 " " '01	13,431,681	5,836,186	7,595,494	*6734328	861,266
American Railways	1 m., Nov. '02	94,600	------	------	------	------
	1 " " '01	73,815	------	------	------	------
	5 " " '02	544,059	------	------	------	------
	5 " " '01	418.947	------	------	------	------
	12 " June '02	1,009,509	------	------	------	------
	12 " " '01	841,298	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Nov. '02	91,179	43,873	47,306	24,827	22,479
	1 " " '01	85,923	44,962	40,962	25,062	15,900
	11 " " '02	100,458	524,009	480,574	273,024	207,549
	11 " " '01	924,007	539,366	384,641	272,003	112,638
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Nov. '02	60,429	32,395	28,033	19,025	9,008
	1 " " '01	58,626	31,562	27,064	19,025	8,039
	5 " " '02	304,328	166,263	138,065	95,125	42,940
	5 " " '01	283,199	153,913	129,286	95,071	34 216
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Nov. '02	125,936	*55 817	70,119	------	------
	1 " " '01	113,077	*57,273	55,804	------	------
	11 " " '02	1,319,483	*662,889	656,594	------	------
	11 " " '01	1,184,705	*572,775	611,930	------	------
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	------	------
	1 " " '01	39,447	21,837	17,610	------	------
NEW BRIGHTON, S. I.	7 " " '02	237 855	158,911	78,944	------	------
	7 " " '01	187,270	133,283	53,987	------	------
Richmond Light & R. R. Co., formerly Staten Island Elec. Ry.	3 m., Sept. '02	73 687	43,950	29,737	18,950	10,807
	3 " " '01	80,197	42,103	38,094	27,221	10,873
YOUNGSTOWN, O.						
Youngstown - Sharon Ry. & Lt. Co.	1 m., Nov. '02	43,036	*22,911	20,126	------	------
	5 " " '02	198,993	* 109,851	89,141	------	------
	6 " June '02	198,050	* 110,391	87,659	------	------

NEWS OF THE WEEK

CONSTRUCTION NOTES

SAN BERNARDINO, CAL.—The non-arrival of rails from Europe is said to be delaying the completion of the extension of the San Bernardino Valley Traction Company's road to Redlands.

SAN BERNARDINO, CAL.—Kohl Brothers, owners of the San Bernardino & Arrowhead Motor Road, intend to convert the road into an electric railway of standard gage. The widening of the track is under way. A franchise has been granted them over some of the principal streets into the business section of the city.

RIDGEPORT, CONN.—The Connecticut Railway & Lighting Company will petition the coming General Assembly for permission to build a trestle connecting Charles Island with the main land at Milford by a trolley. The distance is about one-half mile. The trestle will be built over the sand bar and an effort will be made to boom the island.

BOISE, IDAHO.—R. L. Costigan, of Minneapolis, president of the Inter-Mountain Electric Railway Company, is in this city to make arrangements for beginning work on the line. He is accompanied by E. S. Stebbins, electrical engineer.

CHICAGO, ILL.—It is expected that the Aurora, Elgin & Chicago Railway will be fully completed and in operation by March 1.

CHICAGO, ILL.—The Oak Park & Northern Railway Company has applied for a franchise on North Sixty-Fourth Avenue, the compensation to the city to be 5 per cent of the gross receipts after the first five years.

TERRE HAUTE, IND.—The Terre Haute Electric Company, preparatory to beginning work in the spring, is preparing final plans for the extension of its lines from Terre Haute to Clinton. The line will be 18 miles long.

INDIANAPOLIS, IND.—The Consolidated Traction Company has filed a map and profile of the route the company's line will follow in Marion, Hendricks, Boone and Montgomery Counties. Agents are procuring deeds for the right of way, and E. H. Hawkins, president of the company, says the work of constructing the line will begin soon. This line will run northwest to Crawfordsville.

MILTON, IND.—The new interurban electric railway between Cambridge City and Milton has been placed in operation.

SOUTH McALESTER, I. T.—The Purcell & Lexington Street Railway Company, with $100,000 capital, has been incorporated to build an electric railway between Purcell, I. T., and Lexington, Okla. The incorporators of the company are: William T. James, Thomas C. Woods and J. F. Sharp.

SOUTH McALESTER, IND. TER.—The Indian Territory Traction Company has just commenced grading on its line in this city and connecting the towns of McAlester, Krebs, Alderson, Bache, Dow, Halieyville and Hartshorne. The road will be 25 miles long.

CRESTON, IA.—President Barker and Secretary Dobbs, of the Creston Electric Railway, Light & Power Company, who returned from Chicago recently, announce that the company will certainly construct the interurban railway from Creston to Winterset this coming year. They state that they completed a deal for floating $600,000 in bonds by the Collins Construction Company, which has the contract for building the line. The floating of the bonds removes every obstacle, and the work of construction is to be pushed as soon as the weather permits.

WORCESTER, MASS.—The Board of Aldermen is to give a hearing on a petition of the Worcester Consolidated Street Railway Company for permission to lay tracks in Summer Street for the purpose of doing a freight business. There may be some opposition from the Boston and Maine Railway, whose line the proposed location parallels.

BOSTON, MASS.—The Railroad Commissioners gave a continued hearing Dec. 22 on street car fenders in accordance with a resolution introduced at the last Legislature. A number of inventors were present and submitted models or drawings. Among them was Louis Pfingst, of Boston, whose fenders are largely used in the city. He submitted a model of a new fender and wheel guard. Others present were: Wm. B. Collins, of North Dartmouth; O. Cullison, of York, Pa.; T. H. Sherman, C. B. Forward, of Cleveland; J. M. Galvin, of Boston; E. L. Hem, representing the Hipwood-Barrett fender; F. B. Dorey, of Cincinnati, representing the Hunter automatic fender, and F. A. Osborn, Jr., for the J. H. Thayer platform fender. Mr. Dorey was given this week in which to file records and submit his model of a fender which is in use in St. Louis and Cincinnati. The hearing then closed.

NEWTON, MASS.—The Selectmen of Weston have given the Newton Street Railway Company the right to operate cars over North Avenue from the Waltham line to the Lincoln line. According to the terms of the grant of location, the Newton Company will construct a boulevard 81 ft. wide throughout the entire length of the line. The cars must be in operation within eighteen months from the approval of the location by the Railroad Commissioners, a 5-cent fare must be established between any point in Weston and Watertown Square, and tickets must be sold to children at reduced rates. The company will accept the location and begin construction as soon as possible. The company will also petition for a location in Lincoln in the near future.

BOSTON, MASS.—The Boston Transit Commission has awarded to Harry P. Nawn a contract for building a roof in State Street on a section of the East Boston Tunnel, extending from India Street to Congress Street. The work will cost $33,420, and is to be finished by April 15, 1903. A bonus of $50 per day is provided for having it completed before that time, and the contractor will forfeit a similar sum for exceeding the contract time.

NORTH ADAMS, MASS.—The Hoosac Valley Street Railway Company will petition the North Adams City Council for locations leading toward Adams, where a petition for locations has been filed already. The proposed line will be the second between North Adams and Adams.

GREAT BARRINGTON, MASS.—The New York & Berkshire Street Railway Company, which is to build a line through the western part of Massachusetts, has been granted a location in the town of Otis. A hearing has been given in Sandisfield.

WORCESTER, MASS.—A conference has been arranged by the Railroad Commission between the Boston & Worcester Street Railway Company and the officials of the town of Southboro, in order to bring about a settlement of the differences as to locations in Southboro. The matter has been gone over at length before the Commission. The conference is set for Jan. 6.

SOUTH HAVEN, MICH.—A company has been organized here, with $75,000 capital, to build an electric railway in South Haven for local service, and also an interurban to Paw Paw Lake. Weston Brothers, of Chicago, have been retained as consulting engineers, and have done some preliminary work. It is the intention to have the South Haven city lines in operation by May 1, 1903. Some of the stockholders interested in the company are: S. S. Dunkley and W. S. Dewing, of Kalamazoo, Mich.; George Bardeen, of Otsego, Mich.; G. J. Monroe, M. Hale, C. H. Williams, of South Haven. Messrs. Dunkley and Williams are of the Dunkley-Williams Company, which operates the line of steamers between Chicago and South Haven, Mich.

ST. PAUL, MINN.—According to report, an elevated electric railway connecting St. Paul and Minneapolis and eventually a complete elevated rapid transit system in both cities is the project of a syndicate which will ask the Legislature at the coming session for a thirty-year franchise. Sherman S. Smith, former member of the Legislature, represents the syndicate, and will engineer its application for a franchise, it is said.

PLAINFIELD, N. J.—Local interests have organized the Watchung Electric Railway Company to build an electric railway along the Watchung Mountains from North Plainfield to Chimney Rock, 5 miles.

TRENTON, N. J.—The Monterey Electric Railway Company, capital $1,500,000, has been incorporated under the laws of New Jersey, to operate street railways in the city of Monterey, Mexico. The incorporators of the company are: Leroy W. Sperry, Edward F. Mass, Simon K. Black, of Baltimore.

ATLANTIC CITY, N. J.—The Atlantic City & Suburban Traction Company has succeeded in securing a majority of consents of property owners in Pleasantville for the construction of an electric railway there. The company has secured a franchise from the Council of Absecom. The company is reported to have placed contracts for equipment.

TRENTON, N. J.—The New Jersey & Pennsylvania Traction Company has been granted a franchise for a line on Calhoun and West Hanover Streets, extending from the Trenton City Bridge to the center of the city, a distance of about three-fourths of a mile. The conditions are much the same as those entailed in the granting of the franchise for the extension of the Trenton, Lawrenceville & Princeton Railroad. The company is required to keep the pavement in repair, pay a percentage of its gross receipts to the city, give 3-cent fares and free transfers, pay its motormen and conductors at least 20 cents per hour, and last, but not least, to widen Calhoun Street a distance of 15 ft. for two blocks. The company also secures the city against damage to the water mains (passing through Calhoun Street) from electrolysis. The city is given the right to purchase the Delaware River Bridge at any time The company paid $200,000 for this structure, and it affords the only outlet for a trolley line from this city into Pennsylvania, unless the Pennsylvania Railroad Company should choose to let a line be built across the lower Delaware River Bridge, which is very unlikely. The extension of the New Jersey & Pennsylvania Traction Company's line into the center of the city will afford direct communication with Morrisville (1 mile) and Yardley, Pa. (6 miles) for a single fare of 5 cents, and doubtless afford an entrance for the Philadelphia, Bristol & Trenton Railway.

TRENTON, N. J.—The Camden & Trenton Railway, which recently won in the suit brought against it to prevent it from building under franchises granted by the City Council, has done some work, although handicapped by the cold weather. Curves have been placed at Liberty and Adeline and Liberty and Grand Streets, and some track has been laid. A number of specially cast curves, frogs and switches are on the ground, and will he placed by the company as soon as the weather will permit.

CLEVELAND, OHIO.—It is announced that the construction of the Lorain & Eastern Railway will be begun by Jan. 1. The road will run from Rocky River, 7 miles from Cleveland, to Lorain and Elyria. It is claimed right of way has all been secured. How passengers are to get into Cleveland is not stated.

LIMA, OHIO.—The County Commissioners have granted a franchise to the Western Ohio Railway for a short strip on the Spencerville Pike. The company is seeking an independent entrance into Lima. At present it operates over the tracks of the city company.

DAYTON, OHIO.—Dayton is to have another interurban line, to be known as the Dayton & Camden Railway. The proposed route is over the Dayton Pike to Bowsertown, Germantown, Mudlick, Winchester and Camden. J. Borris and Peter Grubbs, of Dayton, are the promoters.

PIQUA, OHIO.—The Dayton, Covington & Piqua Traction Company has completed one of the largest interurban bridges in Ohio. It has three spans 120 ft., 140 ft. and 100 ft. in length, the whole resting on two 28-ft. granite piers.