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CONTENTS.

Co-operation Between Departments

A commendable desire to avoid the odious name of fault finder may often prove a hindrance to the effective co-operation which should exist between all departments of an organization. The truth of this was vividly brought to mind by a recent accident at a new carhouse where a car was badly damaged through its inability to clear a wall when passing over a certain wye. The fact was that the engineering department had foreseen every clearance condition except the case where the forward truck of a car was on one branch of the wye while the rear truck was on the other branch. The investigation of the accident showed that the platform men who operated at this location were fully aware that some cars were liable to foul this wall under the condition noted, but no one had thought that the oversight could be remedied by reporting the matter to his superior. This incident clearly indicates how necessary it is that the employees should feel that they are working for the interests of the company at large no matter what their own daily routine may be.

Protection of Linemen Against Shocks

The Central Electric Railway Association at its meeting last week decided to appoint a committee to draft a code of rules for the protection of linemen working on high-tension circuits with the end in view of having such a code adopted as standard by all member companies. The wide diversity of practice in this hazardous work is shown by the reports of twelve railway companies published in the ELECTRIC RAILWAY JOURNAL of June 18, 1910, page 1068. Many companies rely for the safety of their linemen largely on the use of grounding wires or chains thrown over the wires after the lines to be repaired have been killed at the power house or substation on telephone instructions from the linemen or dispatcher. Other companies have an elaborate system of transmitting and confirming line dispatching orders which resembles the system of double-order dispatching of trains in that the line dispatcher is notified after his orders have been carried out. Unless the utmost precautions are taken accidents occasionally will happen either through the carelessness of the linemen or as the result of a mistake or disobedience of a substation operator. The old adage that familiarity breeds contempt applies to nearly all men who are employed in dangerous occupations, especially to linemen. Left to their own devices they often will take chances. But if the substation and power house operators as well are specifically instructed as to the proper steps to take to protect linemen working on the wires a simultaneous combination of mistakes by two or more men is necessary to cause an accident. A carefully prepared code of rules covering the acts

of everyone concerned in making high-tension repairs will no doubt be welcomed by all engineers in charge of line maintenance.

Increase of Fare on Hudson & Manhattan Railroad

The action of the Hudson & Manhattan Railroad in increasing its rate of fare 40 per cent between points in uptown New York and New Jersey follows an experiment with the usual 5-cent unit which was found to be unprofitable. That the service rendered by this company is of a superior nature there can be no question. It not only affords greater convenience but also a material saving of time when compared with the old combined route of ferry and surface railway between these points. The fact that the company needs more money to meet its fixed charges and taxes is a sufficient excuse, after the experimental period has passed, for a new start with a higher rate of fare. Allied with the natural inquiry as to whether the company will retain at the higher rate the full amount of business which it has at the lower rate is the question of the means that will now be taken to demonstrate the unusual value of this highly specialized form of service. This may prove to be a greater problem than the one of adopting satisfactory ways for the collection of revenue under the arrangement by which classes of passengers paying different rates of fare will be carried in one train. The latter problem is an operating question, but the former question is the greater and requires a broad policy that will have the effect not only of retaining most of the present business but of stimulating the greater traffic that is needed for the future.

THE PROPER BASES FOR RATES AND FARES

The full report of the committee of the American Electric Railway Association appointed to consider the "Determination of the Proper Bases for Rates and Fares" covers many aspects of this serious question. It includes, in addition to the brief summary of conclusions made public at the last Atlantic City convention, written personal contributions by most of the members of the committee. The study is, as it needs to be if it is to receive public support, an argument for higher average fares through reasonable and justifiable changes in methods, and a statement of the reasons why greater revenue is required to encourage continued investment in the properties so as to enable them to keep pace with the growth of the communities served.

Although, as stated, the brief report of the full committee was published during the week of the Atlantic City convention, this part is republished in this issue for the convenience of readers, together with a full abstract of the rest of the report. The lowest rate recognized in the list of suggested methods of securing increased average rates is the retention of the present 5-cent flat fare and the elimination of free transfers. This rate alone, if attainable by the railways throughout the country, would solve some problems, but unfortunately many companies are confronted by requirements of franchise ordinances governing transfers which were accepted when costs were lower and prospects brighter. Such contracts provide, in many instances, not only for free transfers, but also for the sale of tickets in lots at an average of less than 5 cents. Railways bound by such requirements, however, might secure supplemental contracts with cities authorizing a charge based more nearly on the cost of service if the companies should make other concessions that might meet general public convenience. We have called attention previously to the plan generally recommended by the committee as the most feasible of the methods that it offers. This is the establishment of a zone system with a 5-cent fare for a large central zone and 3 cents extra fare, making a total rate of 8 cents, for a trip to the outlying zone, and the issue of transfers either free or with some charge.

A modification of this suggestion is advanced by Mr. Sergeant in his memorandum. He mentions the possibility of having a central and outer zone with the condition that a passenger might ride without extra payment from one into the next. If, however, the passenger rode from the outlying zone through the central zone and continued his journey to another point in the outer zone, a second fare should be asked. This practice would tend to restrict the average lengths of rides and possibly bring them within the scope of a single 5-cent fare. Such a method might be available by an amendment of the franchise where there is a plain need of increased revenue as well as of additions and betterments.

Inasmuch as the memoranda presented by members of the committee constitute the new part of the report, it is in these that the principal interest centers. The memorandum by Mr. Ford, the chairman, is written on the assumption that necessity exists for general increase in rates of fare if the continued growth of American electric railways is to be assured. Mr. Ford presents a statement of the factors which govern transportation rates. These factors apply not only to the city street railway, but also to the interurban line, steam railway, taxicab, steamship, etc. This memorandum may be supplemented by a reference to factors in transportation conditions which are most apparent in the larger cities of the country. On Manhattan Island two extremes of public utility transportation service are found in the surface and subway lines. The surface lines provide the maximum convenience for very short journeys. Their cars can be taken or left at every street intersection, or, in the case of long blocks, at midway stopping points. On the principal lines the headway is very close. In the subway the average person, instead of finding stations at every street crossing, is obliged ordinarily to allow for a walk of several blocks at the starting point or destination. But the subway service, notwithstanding the crowded cars, the lack of surface air and the noise of operation, redeems itself in the opinion of the busy individual by the amount of time which its wonderful operation saves. These differences in character of service exist in one city. When we compare two or more cities similar differences as to rapidity of travel, lack of overcrowding and general convenience to the public are found, and these differences are so definite that they should be taken into account in any consideration of remedies which appear to be of general application.

In referring to the longer ride, increasing cost, increasing use of transfers and greater requirements as to service and facilities imposed, Mr. Ford states that in consequence of the insufficiency of margin resulting from these condi-

tions the development of the electric railway is at a standstill. Even now these conditions are becoming more serious in many cities. The desired increase of short-haul business in sufficient volume to overcome the increasing density of long-haul traffic is not always realized. Any curtailment in transfers is difficult to effect without the accompaniment of a public outcry by those who have been enjoying privileges to which they are not legally entitled. Improvement in these matters, however, is facilitated by support from public authorities which can be given in a number of localities by state commissions if the members of those bodies are so inclined.

Mr. Sergeant, in his suggestive memorandum, states that if the general public is to be convinced of the necessity for an increase of rates it must be shown the factors of expenditure, capitalization and other elements which enter into the problem. This is a fundamental requirement, and companies with insufficient revenues should prepare themselves and their properties to demonstrate the losses or the insufficient margins returned by analysis of the operations. All conditions of investment and costs of operation as well as of traffic differ in each city. Some systems are reasonably compact and are fairly well protected against excessive waste of mileage. Cities, however, do not develop in expected ways, and investments of companies, reasonable when made, are not always as remunerative as they promised to be. In such cases either the investments are part of the fair costs of the property or the earnings should be sufficient to enable the companies to retire them by sinking fund payments.

The contribution made by Mr. Bradlee, of Stone & Webster, is important not only because of the large number of companies operated by the interests which he represents, but also because of the study which shows definite calculations of the maximum length of haul permissible for profitable operation with average stated numbers of 5-cent fare passengers. In his summary of London conditions, Mr. Clark mentions the fact, which has relieved the companies in that city, that little objection appears to have been raised to the increase in fares.

A growing interest in the well-known European zone system or some modification thereof is evident by references in the various memoranda to the possibilities of some plan of this nature. Mr. Foster, for instance, in emphasizing the necessity of stopping the decline in net earning power, suggests this as one of the possible means. Of course the companies have bound themselves, unwisely in many cases, to extend the 5-cent fares whenever the limits of cities in which they are located are enlarged. In these days of cost analysis and careful consideration of possibilities for economy blanket conditions that involve unlimited and unforeseen responsibilities appear to be suicidal. It is fortunate for the industry that members of the association who have had long experience have paved the way through this report for a thorough consideration of the entire subject. The discussion planned for the mid-year meeting will be a helpful one. It is to be hoped that the consideration of this subject by the association will not be ended until each company in serious straits can make public proof of its need for relief without having unjust use made of its figures by others.

A. C. VERSUS D. C. AT MILWAUKEE

A contribution of exceptional value has been made to the study of the choice of electric systems for railway operation by Messrs. Rau and Mullett in their article in this issue on the results with single-phase and high-tension direct-current operation on a part of the interurban system of the Milwaukee Light, Heat & Traction Company. As so much has been said and written about the merits of these two systems for railway service, it is fortunate that full particulars are available of the performance of equipments of each type on the same road and for the same traffic. To the management of the company are due the thanks of the industry for the information thus freely made public. A somewhat similar analytical article which described the reasons for the change from alternating current to high-tension direct current on the Washington, Baltimore & Annapolis Railway was published in the ELECTRIC RAILWAY JOURNAL for May 27, 1911, and the attention which that article attracted is evinced by the extent of a discussion on that change at the recent Turin International Electrical Congress.

The experience on the Washington, Baltimore & Annapolis Railway, as well as on the Milwaukee road, shows simply that the high-tension direct-current equipment which was installed later was better adapted than was the original equipment to the special conditions on each property. The conclusion should by no means be drawn from these examples that the single-phase system *per se* might not, under other conditions, have been equally superior to any form of direct-current system now developed. The fact is that one of the most important services which can now be rendered to the railway industry by electrical engineers is to outline still more closely than in the past the respective fields of the high-tension direct-current system, the single-phase system and the three-phase system. This cannot be done by exaggerated claims for any one system or equally exaggerated condemnation of another. It can best be accomplished by the development of a clearer knowledge of what have happily been termed the peremptory factors in the choice of an electric railway system. According to this theory each electrical system has undeniable advantages over all others under certain conditions, and a careful consideration of all the surroundings of each particular case should disclose certain factors which make the choice of one system in many cases so much more desirable than any other as practically to decide the question.

The article of Messrs. Rau and Mullett on the Milwaukee situation presents service and cost statistics which are easy of comparison. Those relating to repair work on the two classes of motors are based on twelve months' service with fifty-two a.c. motors and an equal length of service with sixty 1200-volt d.c. motors. During this time 130 repairs were made to the a.c. motors and only five to the d.c. motors. This comparison has an important bearing on the first reason (frequent road failures) given for the change in Milwaukee. However, it should be noted that the a.c. motors were of 75-hp capacity while the d.c. motors are of 100-hp capacity, and there is a possibility that the requirements of traffic brought about by the rapidly increasing load due to new extensions, and also by

more frequent passenger stops, may have put upon the 75-hp a.c. motors heavier loads than those for which they were designed. The a.c. car complete with four 75-hp motors weighed the same as the 1200-volt d.c. car complete with four 100-hp motors. The car bodies were of the same general proportions, but the seating capacity of the a.c. car exceeded that of the d.c. car by two passengers. The total weight of equipment per horse-power of the a.c. motors per car was 266 lb., while the corresponding weight for the d.c. car is 200 lb. per motor horse-power. Thus, considering running conditions identical and without load, each rated horse-power capacity of the a.c. motor was called upon to propel 66 lb., or 33 per cent, more dead weight than the d.c. motor equipment. This difference in motive power rating, when considered in proportion to the weight of equipment, would have an important bearing on the number of motor repairs and probably accounts largely for the inability of the a.c. equipments to fulfil the service requirements as well as for the way in which the 1200-volt equipments are now doing the work.

With regard to road failures of the two types of equipment, no definite statement is made, but the comparison of motor repairs already mentioned indicates a lower road reliability for the a.c. cars, thus substantiating the reason given at the time the change was announced; namely, a lack of reliability of the a.c. cars. But the authors point out in connection with the 1200-volt cars that the dynamotor which supplies 600-volt current for lighting and control purposes when running on the 1200-volt trolley is a frequent source of road trouble. The air-compressor motor is designed for 1200-volt operation and runs at half-speed on 600 volts.

The authors greatly increase the value of their article by presentation of energy consumption statistics which are to be found in Table XI in the article. These statistics are particularly interesting because they show the energy consumption, stops, running time and other operating factors for both a.c. and d.c. types of equipment of like weight when operating over the same tracks on 600 volts d.c. and on the higher voltages (3300 volts a.c. and 1200 volts d.c.) for which they were particularly designed. It will also be noted that the power consumption per train-mile for an a.c. car while running on the 600-volt sections, with motor car alone, with one trailer, and with two trailers, averages 3.5 kw-hours, 4.42 kw-hours and 5.48 kw-hours respectively.

The single-phase car equipment of the Milwaukee system was at the same disadvantage as that of other roads on which terminal operating arrangements required that a.c. cars be routed for portions of their runs over 600-volt d.c. trolley sections. On the Watertown interurban division the total one-way run is 50.56 miles, and 23.49 miles of this distance was and is operated at 600 volts. This 600-volt section includes nearly 9 miles of city tracks, on which stops are very frequent, and about 14 miles of double-track private right-of-way interurban line on which the stops are less than a mile apart. The a.c. cars thus had to be designed for combination service and when in that service had to make frequent stops. The high-voltage sections admit of fast running, and the traffic between Milwaukee and the many attractive lake resorts near Waukesha and Oconomowoc call for heavy train service. As many as four trailers are attached to one motor car, since it is the practice of the transportation department of this road to handle all possible extra business by adding trailers to regular trains. This plan avoids a disturbance of regular schedules and keeps the number of train orders at a minimum. But in the case of the single-phase equipment this practice could not be satisfactorily followed because the a.c. motor cars did not have sufficient motor capacity to handle as heavy train loads as the transportation department demanded.

ELECTRIC RAILROADING AT THE TURIN CONGRESS

We publish elsewhere a résumé of a very interesting discussion on electric railways which took place at the International Electrical Congress at Turin. It is very pertinent evidence of the intense interest in heavy electric traction on the Continent and the activity of engineers in working out the various problems connected with it. In fact, if one went through the discussion and substituted "direct current" for "three-phase" wherever found, it would read very much like the polemics which have often been delivered at a meeting of the American Institute of Electrical Engineers or the New York Railroad Club at New York. For at the Turin conference direct-current traction received very scant consideration, the comparisons made being almost wholly between single-phase and three-phase equipments. Much interesting information was brought out regarding the alternating-current systems of various kinds in use on the Continent.

One striking fact mentioned was that the regenerative control with single-phase motors is being tried out on the Midi line in France. Another was the testimony of Mr. de Kando as to the practical usefulness of the very successful recuperation to be accomplished with three-phase motors. According to his figures, on the Giovi line there was an actual saving of 16 per cent of fuel consumption due to the adoption of recuperation on the system. Thanks to its effect on braking, it has become feasible to run the electric trains down grade on this line at a speed 50 per cent higher than is thought desirable with steam trains controlled by ordinary brakes. Moreover, Mr. de Kando stated that the constant-speed properties of the three-phase motors were practically very useful, and it was found that on the Valtellina line the electric locomotives generally held their schedule admirably under traffic conditions that caused the steam locomotives to be frequently late. As to the complication of the contact system, he thought practical experience had shown that to be greatly exaggerated.

Mr. Vallauri vigorously defended the single-phase system, stating that the only serious defect originally feared in it—that is, the difficulty of commutation—had been found to be much less serious than was at first supposed and that in fact the commutator was as reliable as any other part of the machine. As for the admitted greater weight of the single-phase motor, it was actually useful to traction, and recuperation, from tests already made, was shown to be possible with this system. Another speaker, taking the opposite view, defended the three-phase system against the charge of over-complication in the overhead

system, mentioning a single yard with 5 miles of electrified tracks on the three-phase system which was regularly in operation without any difficulty in construction or maintenance.

Only toward the end of the discussion did the direct-current system come into consideration. It was brought vigorously into evidence by the distinguished president, Mr. Mailloux, and warmly defended by some of the German, Austrian and Russian delegates, one of whom in particular expressed the opinion that with high voltage on direct-current lines the total economy was quite comparable with that of single-phase operation.

The papers and discussion deserve careful reading from all electric railway engineers, particularly on account of their presenting a totally different viewpoint from that which we Americans are wont to take—a viewpoint the more interesting since it is based on considerable experience with conditions and systems not common here.

Aside from this discussion as to methods, the most interesting result of the congress was the decision to define acceleration in terms of miles (or kilometers) per hour per second, instead of using the smaller linear units and writing feet (or meters) per second per second. This resolution, which was put through the congress unanimously, is an important and logical one, the point being that the acceleration is thus expressed in terms of the same linear unit used to define the speed instead of a submultiple of that unit, a change which considerably simplifies the numerical part of the problems of acceleration. This decision was very largely due to the influence and the clear setting forth of the situation by President Mailloux, who has consistently advocated the simpler method. Altogether the proceedings at Turin were rich in their record of comparative experience, and the results of the meeting are certainly most valuable and instructive.

IMPROVING DRAWINGS OF PIPING INSTALLATIONS

Throughout the entire field of power plant design it is doubtful if there is a more difficult problem from the drafting point of view than the clear and accurate presentation of piping layouts. Even in drawings of large stations it is hard to present plans and elevations of pipe runs which are easily interpreted when examined by persons reasonably familiar with the use of blue prints. There is relatively more space available for piping and auxiliaries in plants of high capacity, but the frequent changes of level encountered produce overlapping on drawings of assembled equipment, and the requirements of drawing to scale leave little opportunity for making complicated details clear on general plans and elevations. These conditions are the cause of no little lost time, mental friction and general inconvenience whenever important piping installations are projected or are under construction, and in the interests of the busy operating man something ought to be done to improve the situation.

There is no good reason why the use of diagrams and sketches of important pipe details should not come into vogue on the mechanical side of the station, just as the application of skeleton diagrams of electric wiring has done so much to simplify the arrangement of equipment on the switchboard end of the establishment. Contractors must have detailed plans in any event; but it is scarcely less important to provide those who are to operate the plant with drawings showing the principles of the arrangement adopted, even if scales and the exact locations of all fittings are omitted. Some excellent work has been done along this line in the preparation of drawings showing the connections of valves in automatic sprinkler systems for car-house and shop service, and if similar diagrammatic sketches could be brought into general use in the power house field, the results would be of real value. Best of all, the preparation of such sketches, by the use, say, of a single line for each pipe instead of the double line, and the employment of convenient symbols such as X, T and U at valves and fittings, with appropriate numbers, takes very little time and trouble if done by the man who designs the piping. It is entirely needless in the majority of cases to attempt to show numerous piping systems on a single drawing. The better plan is to confine the diagram of each system to a separate sheet which can be posted behind glass or filed in a loose-leaf book easily accessible by the power station engineer.

Designers of electrical power stations have too often failed to realize that when the operating engineer, the construction man or the superintendent is running down trouble in the system of compressed-air piping he cares very little about the valves in other systems of auxiliaries, but needs a clear record of manipulating possibilities on a highly specialized assembly of apparatus. The station operator soon finds himself so familiar with the installation that he rarely refers to the diagram, but it is none the less a valuable adjunct to the plant's resources. In too few cases as yet are copies of the final approved drawings of a plant maintained in the office of the chief operating engineer as well as in the files of the consulting or designing engineer. Nothing less than a full set of blue prints should be supplied to every station in cases where drawings are provided for its efficient construction and extension.

There is also room for improvement in the preparation of detailed drawings of piping, notably in the labeling of every run and piece of apparatus shown, the specifying of diameter and material, and the tabulation of lists of fittings and special parts, with space for the index number, number required, size and description. It would be a great help if piping plans showing the termination of a given run, as at the end of a given contract section, were always provided with letters, figures or other identification by which the continuation of the pipe could be picked up and followed on another drawing. This method has been followed of late with great success to show the course of wiring runs in connection with the installation of switchboard panels and apparatus for remote control, and there is no reason why it should not be utilized equally well in piping work. Still another improvement which has lately come into use is the lettering of all piping and auxiliary equipment in the station with the function of each important piece, a plan which extends the benefits of the pipe-coloring schemes, which are so deservedly popular, and promises further application when its conveniences have become fully appreciated.

Alternating and Direct-Current Interurban Lines of the Milwaukee System

Comparative Construction Data and Car Energy Consumption Figures Are Presented for the Interurban Lines of the Milwaukee System Formerly Operated by 3300-Volt Alternating Current and Now by 1200-Volt Direct Current

BY. O. M. RAU, CHIEF ELECTRICIAN OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY, AND H. A. MULLETT, SUPERINTENDENT OF ROLLING STOCK

Three divisions of the Milwaukee Light, Heat & Traction Company afford a most excellent basis for comparing the cost and performance of 3300-volt a.c. and 1200-volt d.c. trolley systems. These divisions, or rather the parts of them located away from Milwaukee, terminate at Watertown, East Troy and Burlington, Wis. About 75 miles of track on these divisions was first equipped for 3300-volt single-phase operation, and then after about two years' service the same mileage was re-equipped for 1200-volt d.c. operation. Thus direct comparisons of important features of the installation may be made on one basis, and these, therefore, are more valuable than comparisons of dissimilar operating systems on different roads.

The single-phase equipment was described in the Street Railway Journal for Aug. 3, page 156, and Aug. 10, 1907, page 218. The 1200-volt equipment was described in the Electric Railway Journal for July 16, 1910, page 102.

The interurban cars which run to the Public Service Terminal in Milwaukee had to be designed for 600-volt operation as well as for 3300-volt a.c. or 1200-volt d.c. operation. It may be said that the combination 3300-volt a.c.-600-volt d.c. equipments did not fully meet the requirements so far as continuity of service and trailer-hauling capacity were concerned and that the change to 1200 volts d.c. was made largely for this reason.

The three lines for which data are available have the same 600-volt terminal route for 8.64 miles between the Public Service Building in Milwaukee and West Allis. This is over city track. From West Allis one route extends westward to Waukesha Beach and Watertown and another southward to St. Martins, where it in turn divides, one extension leading to East Troy and the other to Burlington. The total run between the Milwaukee Terminal and Watertown is 50.56 miles, of which 27.07 miles from Waukesha Beach to Watertown formerly was operated at 3300 volts a.c. and now is operated at 1200 volts d.c. On the south branches the routes are the same between Milwaukee and West Allis and between West Allis, and St. Martins, 6.17 miles. The route from West Allis, through St. Martins to East Troy, is 27.42 miles, and to Burlington it is 28.13 miles. These routes, with the exception of the West Allis-St. Martins section, also were operated with single-phase current and now are operated with 1200-volt direct curent.

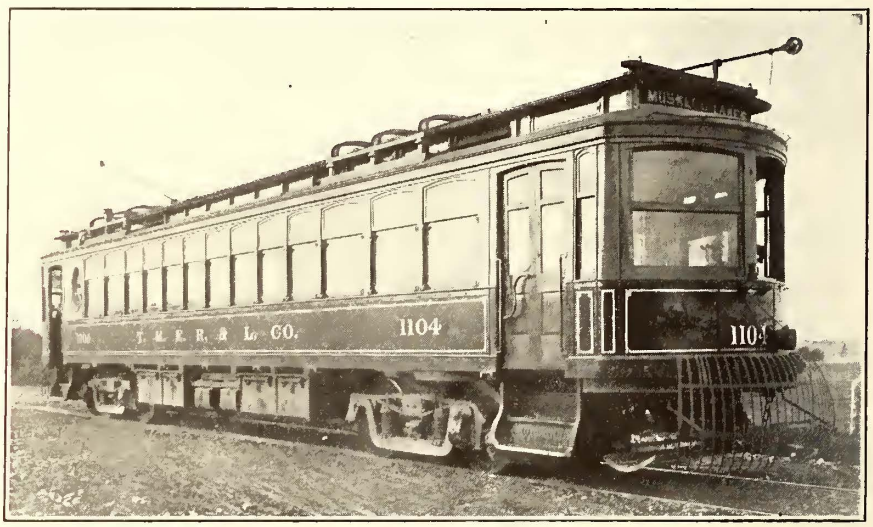
Table I.—Mileage of 1200-Volt Lines.

Waukesha Beach to Watertown	27.07
West Allis to St. Martins	6.17
St. Martins to East Troy	21.25
St. Martins to Burlington	21.96
Total	76.45

A summary of the mileage, including sidings, of the 1200-volt lines of the Milwaukee Light, Heat & Traction Company is published in Table I.

The service requirements on these lines are heavy during four summer months. The average daily revenue car miles run during the four summer months of the year approximate 2100 and during the other eight months are approximately 1400. Ordinarily single cars are run on the East Troy and Burlington divisions on two-hour headway, but on Saturdays and Sundays as many as four trailers are added to each motor car to meet the demands of the traffic to and from the numerous resorts served by these interurban divisions. The service on the Watertown line has an hourly schedule during the four summer months. The daily motor-car mileage and the Saturday and Sunday trailer-car mileage for summer and winter months are as shown in Table II.

The schedule speeds on the high-voltage portions of the routes average about 24.5 m.p.h. with maximum speeds of 55 m.p.h. The average distance between regular stops is 0.75 mile on the Watertown divisions and 0.83 mile on the other two divisions. These data and those which follow refer only to service on the high-voltage sections of the interurban lines.



Milwaukee Interurban Lines—Interurban Car with Single- Phase Equipment

Table II.—Average Daily Car Mileage on 1200-Volt Line.

	Watertown.	East Troy.	Burlington.
Summer, four months.			
Motor cars	976	377	364
Saturday trailers	90	84	32
Sunday trailers	117	168	40
Fall, winter, spring, eight months.			
Motor cars	448	377	364
Saturday trailers	...	42	24
Sunday trailers	...	84	32

As earlier stated, the high-voltage lines operate to and from the Milwaukee terminal over 600-volt city and connecting lines. Thus the service requires more high-voltage cars than would be necessary to operate only the high-voltage sections. Considering only the high-voltage sections ten motor cars and eighteen trailers would be sufficient to handle the traffic. The disposition of cars on the three lines then would be as shown in Table III.

TABLE III.—DISPOSITION OF CARS ON THE THREE LINES.

	Watertown.	East Troy.	Burlington.
Motors	4	4	2
Trailers	6	8	4
Motor cars operating eight months, Sundays	3	1.5	1.5
Trailers operating four months, Sundays	5	3	3

Milwaukee Interurban Lines—Waukesha Beach 1200-Volt Substation Building

Milwaukee Interurban Lines—Grade Separation on Waukesha Line

SINGLE-PHASE CARS

The original single-phase motor cars, ten in number, had the characteristics given in Table IV.

TABLE IV.—DATA OF SINGLE-PHASE CARS.

Length over all	53 ft. 5 in.
Length over corner posts	40 ft. 0 in.
Width over belt rail	8 ft. 4 in.
Height from rail over roof board	11 ft. 11¾ in.
Truck-center distance	29 ft. 0 in.
Wheel base	6 ft. 1 in.
Wheel diameter	3 ft. 0 in.
Trucks, M. C. B. type, company design.	
Seating capacity	66
Motors, four a. c.-d. c. GE-605	75 hp
Total weight with a. c. motors	80,000 lb.

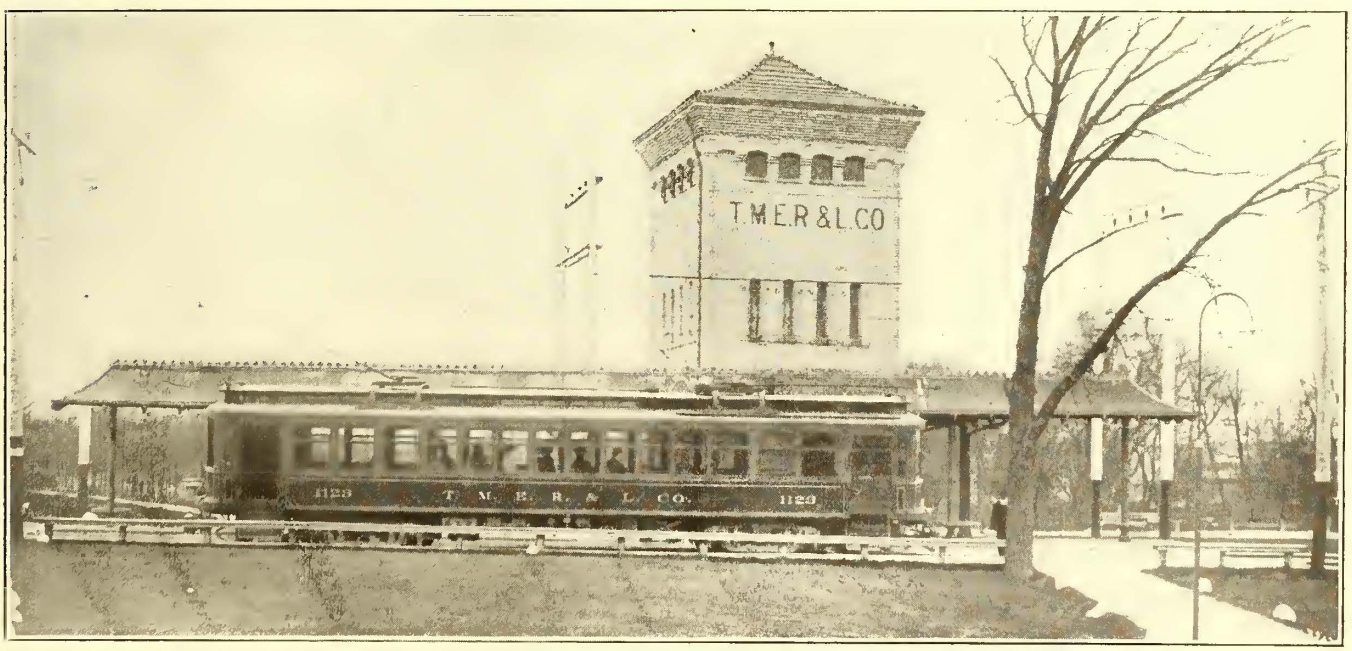
1200-VOLT CARS

The present 1200-volt passenger rolling stock consists of the ten cars designed for single-phase use, fifteen new passenger cars and five utility cars. The fifteen new steel passenger cars are equipped with GE-207 100-hp motors. The ten older cars and the utility cars were re-equipped with GE-205 75-hp motors. The motor cars equipped with GE-205 motors weigh 72,000 lb. complete with d.c. apparatus, whereas formerly, with the single-phase apparatus, they weighed approximately 80,000 lb. Both types of motors have commutating poles and are designed for operation on both 600 volts and 1200 volts. The gear ratio of the 205 motors is 2.525 and that of the 207 motors is 3.05.

The standard interurban trailer cars of the Milwaukee interurban system seat fifty-four passengers and weigh 36,500 lb. The latest type of interurban motor car, that operated by the GE-207 motors, is built largely of steel. These cars were described in the ELECTRIC RAILWAY JOURNAL for July 16, 1910, page 102. The more important data concerning these cars appear in Table V.

TABLE V.—DATA OF 1200-VOLT CARS.

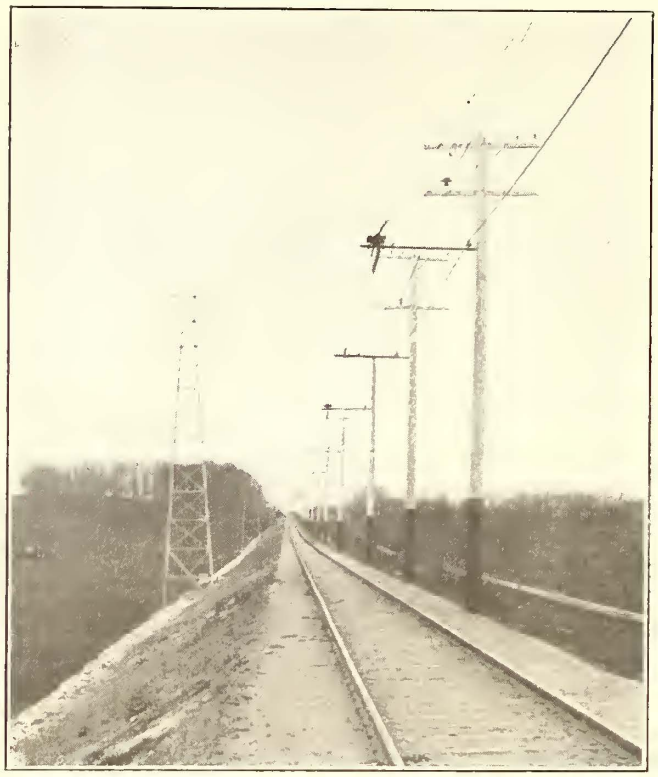
Length over all	53 ft. 5 in.
Length over corner posts	40 ft. 0 in.
Extreme width	8 ft. 7 in.
Height from rail over roof boards	11 ft. 6 in.
Truck-center distance	28 ft. 4 in.
Trucks, Brill M. C. B. type.	
Wheel base	6 ft. 1 in.
Wheel diameter	36 in.
Motors, four GE-207	100 hp.
Weight of car body and trucks	48,000 lb.
Total weight	80,000 lb.
Seating capacity	64



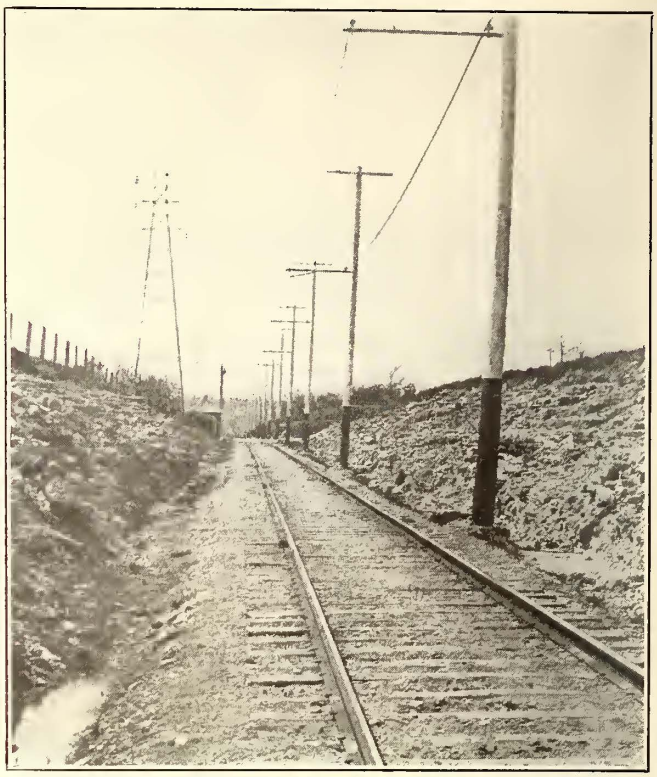
Milwaukee Interurban Lines—Single-Phase Transformer Substation at Waukesha Beach

The new motor cars have the type M non-automatic control with two motors connected in series when running

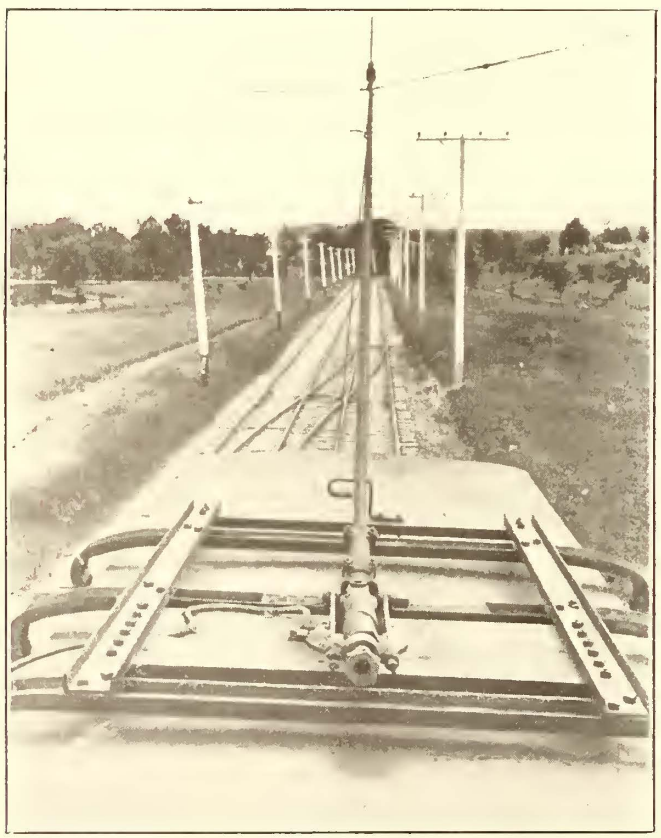
on 1200 volts. A dynamotor supplies current for the control and lighting circuits when the car is on the 1200-volt trolley. The air-compressor motors are insulated for 1200 volts and run at half-speed on the 600-volt trolley section. A commutating switch for changing the motor connections from series to series-parallel during 1200-volt operation and from series-parallel to parallel during 600-volt operation, thereby giving full speed at both voltages, is placed under the car and operated from either end by a lever in the motorman's cab. This switch also transfers the auxiliary circuits, except that for the compressor, from the trolley to the 600-volt tap of the dynamotor when the 1200-volt section is entered. The other parts of the electrical equipment are practically standard 600-volt apparatus with



Milwaukee Interurban Lines—Dead Section Between High and Low Voltage Lines



Milwaukee Interurban Lines—Typical Roadway and Transmission Line Construction on Waukesha Line



Milwaukee Interurban Lines—Method of Supporting Trolley Base on High-Voltage Cars

Milwaukee Interurban Lines—Crossroad Waiting Station and Car Signal

additional insulation designed to provide for 1200-volt conditions.

The dynamotor is the most frequent source of trouble on the 1200-volt equipment. When operating on 1200 volts on the interurban sections it is subject to trouble from lightning and with the dynamotor out of service an individual car is helpless because no 600-volt current is available for the control and light systems. To provide against undue delays and for continuous operation of trains, even though one dynamotor may be inoperative, the light jumpers are made of sufficient capacity so that the control circuit on a car having a damaged dynamotor may obtain 600-volt current through the light jumper from the dynamotor of the next car.

The mechanical department has prepared the following instructions to trainmen for their assistance in preventing or locating and remedying troubles on 1200-volt cars:

NAMES AND LOCATION OF APPARATUS—[600-1200-VOLT D.C. CARS—1111-1125]

"1. Main Switch.—Large knife blade switch in wooden box located under the car between reverser and circuit breaker.

"2. Circuit Breaker.—Automatic overload or safety switch located between commutating switch and main switch.

"3. Commutating or Change-Over Switch.—Iron case located under car between circuit breaker and contactor case.

"4. Contactor Box.—Large iron case under car containing eighteen contactors numbered from 1 to 18, reading from left to right.

"5. Motor Cut-Out Switch.—Iron case located at side of car between triple valve and fuse boxes with handle and dial marked with arrows 1 and 3 out; 2 and 4 out.

"6. Fuse Boxes.—(Four used.) Located under side of car; two placed one above the other and two side by side.

"7. Reverser.—(Two used.) Iron cases located under car next to truck at No. 1 end.

"8. Kicking Coil.—Coil of wire wound on wooden spool, located by No. 1 trolley base on roof.

"9. Lightning Arresters.—(Two used.) Located in wooden box, by No. 1 trolley base on roof.

"10. Dynamotor.—Located underneath car adjacent to No. 2 truck cab side.

"11. Dynamotor Resistance.—Resistance placed in iron box located near the dynamotor.

"12. Controller Switch.—Located overhead in cab.

"13. Controller.—Located in left-hand corner of cab.

"14. Circuit-Breaker Trip and Reset Switch.—Located overhead in cab.

"15. Auxiliary Fuses and Switch.—Located in fuse cabinet, as follows:

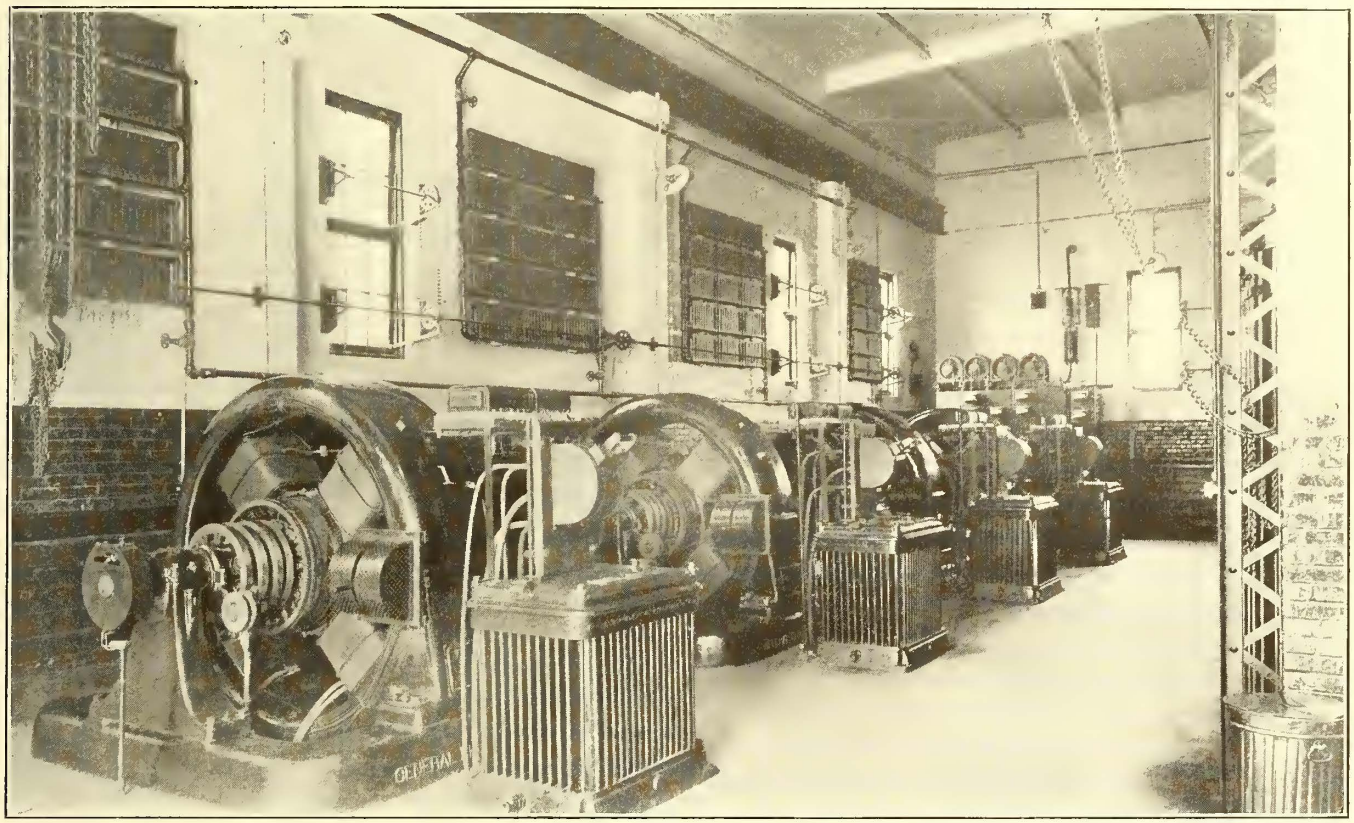
"600-1200-volt switch in small asbestos-lined compartment.

"600-1200-volt dynamotor fuse in small asbestos-lined compartment.

"600-1200-volt air-compressor fuse in small asbestos-lined compartment.

"600-volt headlight fuse.

"600-volt control-circuit fuse.



Milwaukee Interurban Lines—Interior of Burlington 1200-Volt Substation

"16. Resistance Grids.—Located under center of car directly back of contactor box.

"17. Headlight Resistance.—Inclosed in wire casing, directly back of fuse boxes under car.

"18. Air Compressor.—Adjacent to truck, No. 1 end.

"19. Governor for Aair Compressor.—Inclosed in square wooden box under car, located between compressor and fuse boxes.

RULES FOR THE PREVENTION OF TROUBLE ON 600-1200-VOLT D.C. CARS (1111-1125)

"1. As the major portion of the car wiring, control, etc., is at the same voltage as the trolley wire, it is absolutely necessary to have both trolleys off the wire and securely held by the retaining hooks at each end of the car before any of the equipment on the roof, within the car or below the car is inspected or repaired.

"2. When replacing main fuses which are located under car be sure to pull the main switch, and as a second precaution for your safety trip circuit breaker. Do not trust

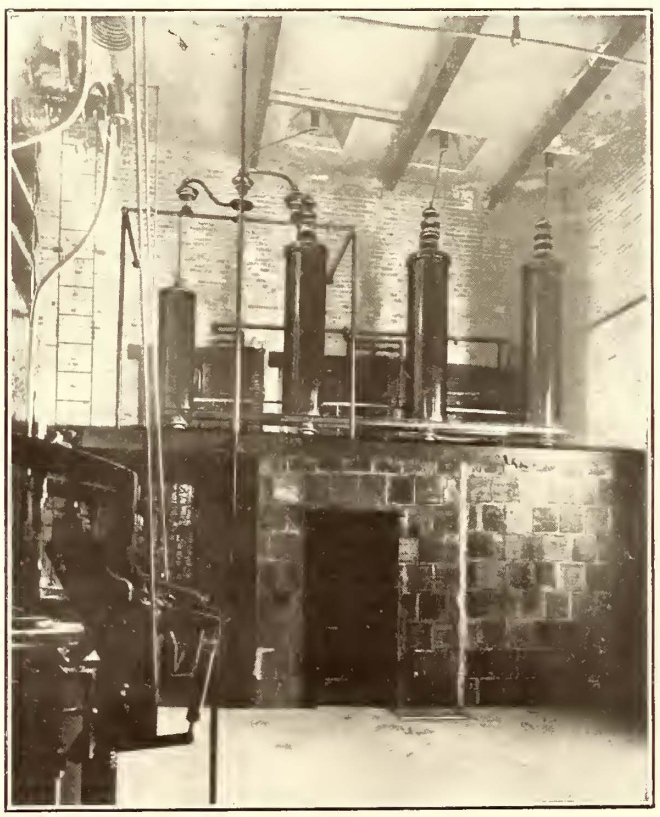
to others to arrange these precautions. Do so yourself.

"3. In case the trolley rope breaks near the wheel use the wooden pole provided to pull the trolley down.

Milwaukee Interurban Lines—Watertown Substation and Dam

"4. Don't throw the handle of the controller backward before releasing the trip button.

"5. Don't run over sectional insulators on any portion of the line with power on. To do so will burn up the insulators.



Milwaukee Interurban Lines—Electrolytic Lightning Arresters at Waukesha 1200-Volt Substation

"6. Don't cross over the dead portion of the line between 600-1200 volts at a greater speed than will allow you time enough to throw change-over switch to proper position.

"7. If for any reason the switch cannot be readily thrown bring the car to a stop before the dead section has been overrun; place the switch in the proper position. This can be done by reaching in at the side of the car, if the throwing arrangement has become inoperative, then pull off the dead section, if necessary, by the forward trolley. Under no conditions should this switch be thrown when the trolley is on the wire.

"8. In cases where the reverse handle is thrown to stop the car wait until the car stops before throwing it to forward position again. Not to do so will cause the burning of the reverse fingers.

"9. Always bring the controller handle up slowly, notch by notch, even though the car is going at full speed. The contactors need time to work properly.

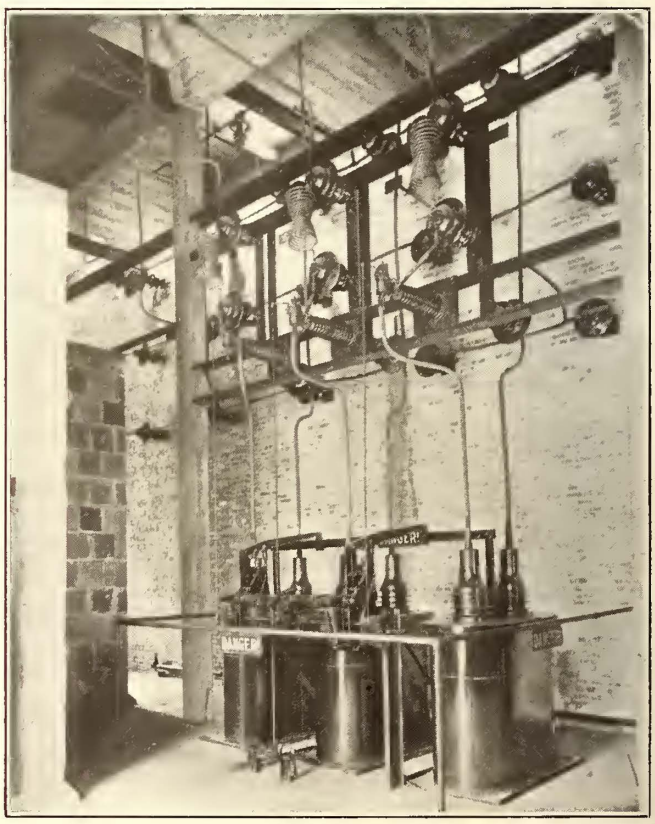
"10. The sixth and tenth points only are running points. Great care should be taken that the intermediate positions are used but momentarily while passing to a running point. This is extremely important and should be closely followed, particularly when trailers are being handled.

"11. If the automatic circuit breaker fails to trip or come up instantly when the trip and reset switch handle is swung to the proper position do not hold it there, but try the switch handle at the other end of the car. If this gives a like result it shows that the trouble is under the car. Provided that nothing can be found out of order, the circuit breaker may be closed by hand.

"12. Motormen must never leave handle of change-over switch from 600 volts to 1200 volts upon rear end of car, but must always see that handle is upon their end in order that passengers cannot meddle with same.

Troubles, Probable Causes and Remedies on 600-1200-Volt D.C. Cars (1111-1125)

"If the car has been operating satisfactorily on 600 volts and is dead when entering 1200 volts, but the air compressor works satisfactorily, this is evidence of control trouble. If



Milwaukee Interurban Lines—High-Tension Switching Equipment in Burlington 1200-Volt Substation

the lights do not burn examine the light fuse and then the dynamotor fuse (be careful to follow precaution given on fuse box cover) or ascertain if dynamotor is running. If so, pull main switch and try contactors; if they do come

up correctly, close main switch and circuit breaker and try contactor slowly up to the third point on the controller, and if car does not move then cut out motor No. 1 and No. 3 and notch up carefully to sixth point, and should car not move then as a second test cut out motor No. 2 and No. 4 and try car.

"If car starts on some point between the first and the sixth it is evidence of a broken grid or poor contact on commutating switch fingers. If, having made these tests, the car does not start, inspect equipment thoroughly for defects, especially main fuses, grids, motor leads, reverse fingers, cut-out fingers, change-over fingers and contactor tips.

"If dynamotor fuse is O. K. and machine refuses to operate move the commutating switch handle back and forth several times to be sure of good contact. (The trolley must be locked down while this is being done.) Provided that this does not clear the trouble examine brushes and lead connections; also small fingers on the commutating switch.

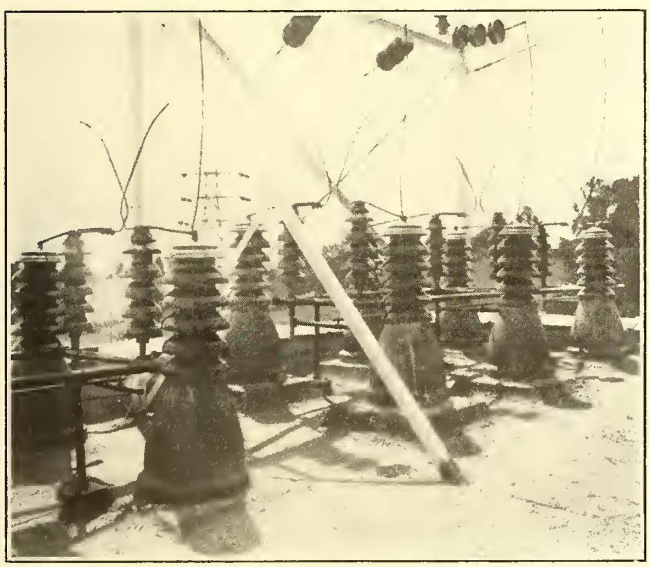
"It is impossible to operate the car on 1200 volts unless the dynamotor is running properly. However, if another motor car is available, the two cars may be coupled together and by plugging in a trailer light connection the disabled car may be operated in the usual manner or the two can be operated simultaneously. It is absolutely necessary, before this is done, to disconnect the dynamotor leads outside of the casing and securely tape the bare ends.

"To replace fuse, open cover of fuse box outward, turn hand screws at end of box and loosen burned fuse and remove same. Insert new fuse and be positively sure that it is properly installed and secured in jaws of clamp, for if not the next time it blows the jaws will be damaged by the arc.

"Should the air governor fail to work properly the only available course to pursue would be to see that the governor is making contact (by the use of wrapping wire, if necessary) and allow the compressor to pump up to normal pressure. Then pull down the trolley pole, open 600-1200-volt switch (following directions on cover) and remove air compressor fuse until pressure has dropped to a point too low for safety, then replace and pump reservoir to pressure again."

TABLE IX.—SUMMARY OF TESTS ON A. C. CARS IN 1908 AND ON D. C. CARS IN 1911.

Run between—	Milwaukee-Waukesha Beach.	Milwaukee-Waukesha Beach.	Ratio D.C. Car. to A.C. Car.	Waukesha-Oconomowoc Wye.	Waukesha-Oconomowoc Beach.	Ratio D.C. Car. to A.C. Car.
Trolley voltage at substation	600 volts d.c.	600 volts d.c.	...	1200 v. d.c.	3300 v. a.c.	...
Type of motor equipment	100 hp 600/1200	75 hp 600/3300		100 hp 600/1200	75 hp 600/3300	
Weight of car complete	80,000 lb.	80,000 lb.	1.	80,000	80,000	1.
Length of run	24. mi	24. mi	1.	13.7	13.35	1.02
Seat miles	1536.	1584.	.97	876.8	881.1	.99
Ton miles	960.	960.	1.	548.	534.	1.02
Running time, total hours	1.262	1.280	.98	.569	.515	1.10
Stop and delay time, hours	.124	.086	1.45	.042	.011	3.90
Running time, net hours	1.138	1.194	.95	.527	.504	1.045
Number of stops	12.5	16.5	.76	7.16	3.	2.38
Average distance between stops, miles	1.92	1.45	1.32	1.93	4.45	.44
Average number passengers	42.	23.	1.83	21.6	10.	2.16
M.p.h., including stop time	19.0	18.75	1.01	24.04	25.95	.93
M.p.h. while running	21.1	20.8	1.01	26.00	26.48	.98
Kw-hours for run	93.15	84.09	1.11	50.8	48.75	1.43
Average kilowatts, including stop time	73.9	65.6	1.13	89.3	94.6	.94
Average kilowatts while running	82.0	70.4	1.16	96.4	96.9	.98
Average horse-power per motor while running	27.5	23.6	1.16	32.3	32.5	.99
Kw-hours per car mile	3.875	3.504	1.11	3.71	3.66	1.02
Watt-hours per ton mile	97.0	87.6	1.11	92.7	91.3	1.04
Kw-hours per seat mile	.061	.053	1.14	.058	.055	1.05



Milwaukee Interurban Lines—Roof Insulators and Discharge Horns at Watertown Substation

COMPARATIVE FIRST COST AND MAINTENANCE OF A.C. AND D.C. CAR EQUIPMENT

The first cost of the cars compares as 100 for a.c., 91.7 for d.c. and 21.5 for trailers.

That the a.c.-d.c. equipment required considerably more maintenance work than does the 1200-600-volt equipment is shown by Table VI, which contains a record of the repair work done on the fifty-two GE-605 single-phase motors from June 1, 1908, to June 1, 1909, and on the sixty GE-207 motors from Jan. 1, 1910, to Jan. 1, 1911. During the latter period only one of the forty GE-205 motors was repaired and that had to be rewound.

TABLE VI.—REPAIR WORK ON A. C. AND D. C. MOTORS.

	A. C. Motors.	D. C. Motors.
Turned commutators	1	1
Burned heads	43	..
New head	..	1
Slotted commutator	7	..
New segments	8	1*
Coils (armature) damaged and replaced	8	..
New bands	13	..
New collars	12	..
Repaired leads	7	1
Hot boxes	2	..
Low bearing	6	..
Turned shafts	10	1
Bent shafts	4	..
Loose pinions	1	..
Neeessary to replace field coils	6	..
Damaged field coils	2	..

*Commutator damaged by foreign body.

OVERHEAD CONSTRUCTION

The catenary trolley construction erected for the single-phase operation is now used for 1200-volt operation with trolley wheels. Part of the trolley wire is No. 00 and part No. 0000. At the time of conversion from 3300-volt a.c. to 1200-volt d.c. aluminum and copper feeders of 250,000-circ. mil and 500,000-circ. mil section were installed to supplement the trolley wire. These feeders tie the substations together electrically. The additional feeder capacity required by the 1200-volt distribution system increased the cost of the overhead system, it is estimated by about 65 per cent.

POWER SUPPLY

The Milwaukee system has a very extensive high-tension network, which is fed from a large steam generating station in Milwaukee and from a hydroelectric station at Kilbourn, 120 miles west from Milwaukee. The steel-tower transmission line from Kilbourn station is on the right-of-way of the Watertown interurban division and supplies the substations of this division.

SUBSTATIONS

The present 1200-volt trolley lines are fed by five rotary-converter substations spaced approximately 25 miles apart, which receive electrical energy at 38,000 volts, three-phase, 25 cycles, and deliver it to the trolley at 1200 volts d.c. All high-tension apparatus is designed for 66,000 volts, to be obtained by changing from star to delta connection. To obtain 1200 volts, two 600-volt rotary converters are operated in series, both being fed by three single-phase transformers. The average load factor for twelve months on these substations is approximately 10 per cent, based on a nineteen-hour operating day, and about 8 per cent based on a twenty-four-hour day, during five hours of which the substations are not operating.

On the different lines the distance between substations averages: Watertown, 26 miles; Burlington, 21 miles, and East Troy, 20.2 miles. The 1200-volt substations have rotary converters as follows: Watertown, four 300-kw; Waukesha Beach, three 500-kw; Burlington, four 300-kw; West Allis, two 500-kw; East Troy, four 300-kw. Thus the total rating of all rotary converters is 6100 kw, which is approximately 33⅓ per cent above the present maximum demand. The third rotary converter at Waukesha Beach substation is used for feeding the adjacent 600-volt line and serves as a spare unit for the 1200-volt set.

The five transformer stations for 3300-volt a.c. operation were equipped each with three 300-kw transformers, except the Waukesha Beach station, which had four 300-kw transformers. The total capacity of the single-phase transformer substations was thus 4800 kw. These stations had a total capacity of approximately 20 per cent more than the average maximum demand.

The single-phase system had considerable advantage over the 1200-volt d.c. system in the cost for substation buildings and equipment. The cost of operating the 1200-volt rotary-converter substations, including labor, supplies and expenses,

Table VII.—Input and Output of Five 1200-Volt Substations, July to December, 1910.

Substation.	Kw-Hour Inpct	Kw-Hour Output.	Efficiency, per Cent.
Watertown	369,352	291,091	78.8
Waukesha Beach	332,452	261,673	78.6
West Allis	402,988	311,606	77.4
East Troy	404,219	238,444	59.0
Burlington	431,254	254,163	59.0

maintenance and equipment and sundries was more than twelve times as much per year as the cost for operating single-phase transformer stations.

Table VII shows the input and output of the five 1200-volt substations during the six months from July, 1910, to December, 1910, inclusive. The figures for input include the line losses.

ENERGY CONSUMPTION OF SINGLE-PHASE CARS WITH TRAILERS

Tests made with the combination a.c.-d.c. cars when operating on 600-volt lines showed the following average results with the 80,000-lb. motor cars and 36,500-lb. trailers earlier described. The results are given in Table VIII.

While operating on the 3300-volt power the a.c.-d.c. type of car and equipment used 3.6 kw-hours per car mile at an average speed of 26 m.p.h. and when hauling one trailer the same motor car consumed 4.8 kw-hours per car mile and ran at an average speed of 21.8 m.p.h. The average energy demand of an a.c. motor car alone was 97 kw and with one trailer the demand was 108 kw. The maximum demand without trailer was 225 kw and with trailer, 257 kw.

Table IX on page 1143 summarizes tests made on a.c. cars in 1908 and on d.c. cars in 1911. The performance of each type of car is shown for the run from the Public Service terminal in Milwaukee to Waukesha Beach on 600-volt d.c. trolley and from Waukesha Beach to Oconomowoc on 3300-volt trolley for the single-phase cars in 1908 and on 1200 volts for the d.c. cars in 1911. This comparison is particularly interesting because the cars were of the same

Table VIII.—Power Consumption and Other Statistics of A. C. Cars on D. C. Circuits.

	Motor Car.	One Motor and One Trailer.	One Motor and Two Trailers
Schedule speed, m. p. h.	18.80	15.86	17.10
Average speed while running	20.00	17.20	18.70
Kw-hours per train mile	3.5	4.42	5.48
Maximum kilowatt	357	362	470
Average kilowatt	66.3	69.8	98.2
Maximum amperes	700	830	820
Average amperes	123	161	216
Minimum volts	175	197	263
Average volts	475	500	492

total weight and operated over the same route. This largely eliminated the effect of grades and curves which might unbalance a comparison made between cars operating on routes with different roadway characteristics. The quantities shown for the 1200-volt d.c. trip between Waukesha Beach and the Oconomowoc wye are the averages of three eastbound and three westbound trips. The other data presented are averages of one eastbound and one westbound trip.

PROPOSED ORDER ON POLES IN NEW YORK

A hearing on the form of a proposed order prepared by the New York Public Service Commission, Second District, requiring all electrical, municipal, telephone, telegraph, railroad and street railroad corporations to stencil and number their poles and structures for carrying overhead wires was held at Albany on Nov. 23. Statements in reference to the proposed order were made by a number of representatives of the various companies. The commission asked those who were present to file suggestions regarding the form of the order by Jan. 1, 1912.

NEW DETROIT ORDINANCE COMPLETED

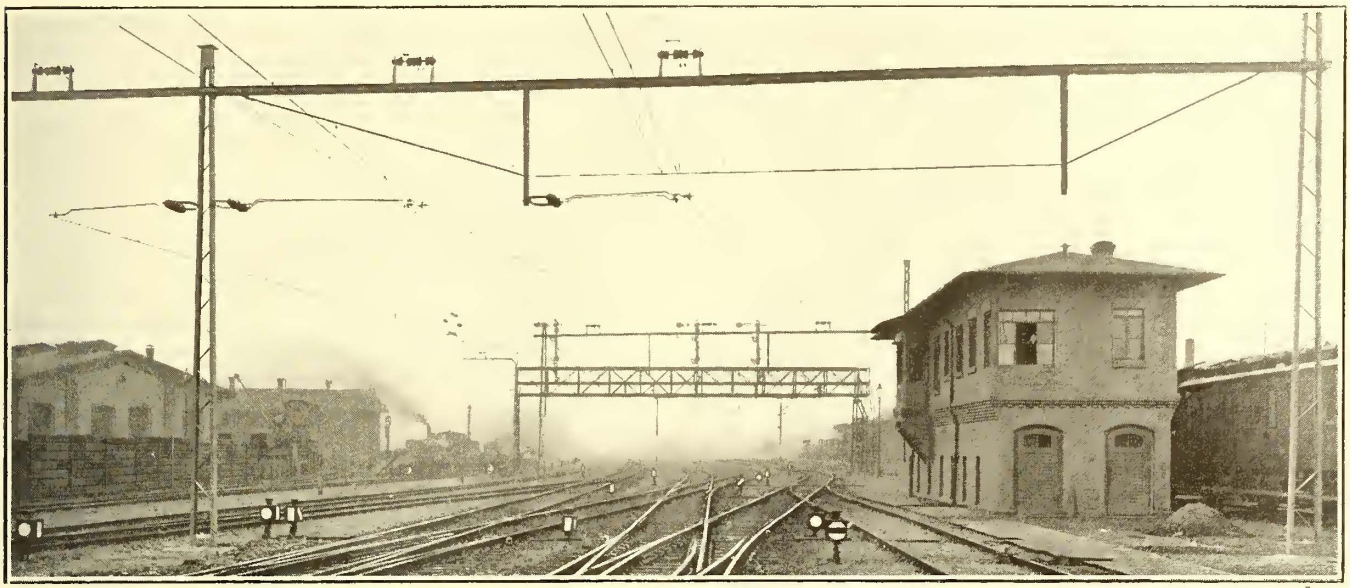
The ordinance based on the preliminary agreement made between officials of the Detroit United Railway and officials of the city of Detroit was presented to the Detroit City Council on the evening of Nov. 28. The ordinance was drafted by Corporation Counsel Hally and places in the form of a franchise contract the features of the agreement described in the issue of the Electric Railway Journal of Oct. 28, 1911, page 950, when the first public announcement of the tentative agreement was made. The ordinance, after action by the City Council, is subject to approval by the voters.

ELECTRIC RAILWAYS IN SWITZERLAND

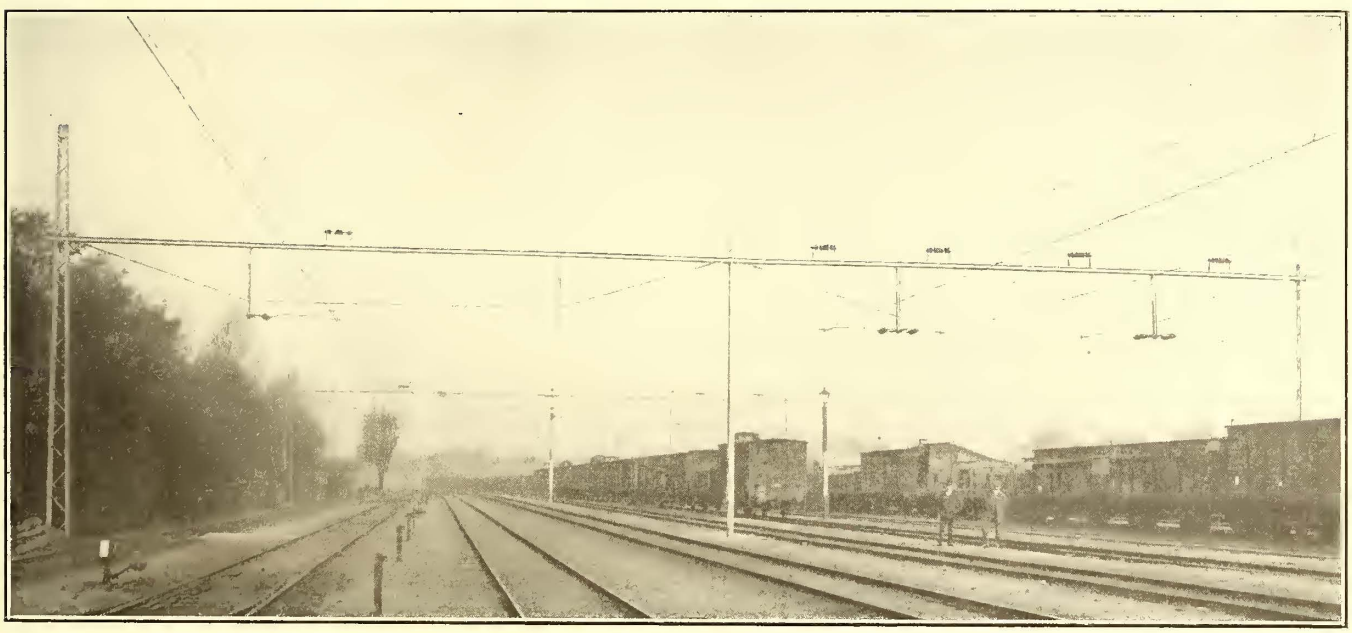
The following figures have recently been issued by the government of Switzerland showing the number, class and mileage of electric railways in that country, exclusive of electrified trunk lines, for the year ended Dec. 31, 1909. There were thirty 1-meter (39.37-in.) gage, interurban electric lines totaling 330 miles, in addition to a 2-mile line which was operated by steam and electricity. The thirty-two city electric railways were all of 1-meter gage and possessed 241 miles of track, an increase of about 15 miles over the preceding year. Only 1.4 miles were operated by gasoline or horse traction. The city railways carried 111,163,266 passengers and operated 15,695,349 train-miles. Their total earnings, including $27,987 for freight, were $2,736,159 and their total expenses $2,096,541. Electricity was also used to operate six rack railways with 18 miles of track and twenty-four cable railways with 14.26 miles of track.

MULTIPLE CATENARY OF BITTERFELD LINE

In the article on "Power and Transmission Methods of the Prussian-Hessian State Railways," published in the ELECTRIC RAILWAY JOURNAL of Nov. 4, a description was presented of the catenary line installed by the Allgemeine company between Bitterfeld and Raguhn. The accompanying illustrations and following description refer to the multiple catenary construction installed by the Siemens-Schuckert company for the rest of the line, namely, between Raguhn and Dessau. This section is slightly over 9 miles long. The types of the catenary bridges are practically the same as those used for like conditions on the rest of the line, the principal difference being in the design of the brackets or outriggers for the trolley and the auxiliary catenary. The suspension installed comprises a hard-drawn copper trolley wire, a steel auxiliary catenary wire, a main catenary consisting of a seven-strand steel cable and various auxiliary fittings, including means for maintaining constant the tension of the trolley, auxiliary catenary and catenary lines. The auxiliary catenary is attached to the main catenary at intervals of not more than 41 ft. by means of hanger wires which have clamps at each end to permit considerable angular movement. The hangers between the auxiliary catenary and the trolley wire are spaced at distances which do not exceed 20 ft. 6 in. The clamps of these trolley hangers are designed to slide along the auxiliary catenary. The main catenary spans on open track are 246 ft. long, but different spacing is used in the yards according to the conditions. While the several wires of the overhead line are not insulated from each other, the whole system is doubly insulated against ground by carrying the main catenary cable over a spool insulator which is set on a rod having vertically supported insulators at each end. On long bridges this structure for the catenary is carried on the top of the cross girders, but on open track it is carried from the underside of the cross girders. The side sway of the trolley and auxiliary catenary is prevented by outriggers or steady brackets of 1½ insulated tubing, which are attached by yokes to short vertical beams of the catenary bridge. These beams, in turn, are steadied by guy rods. On double track the yokes of these steady brackets are attached back to back below the center of the catenary bridge as illustrated. The trolley wire is

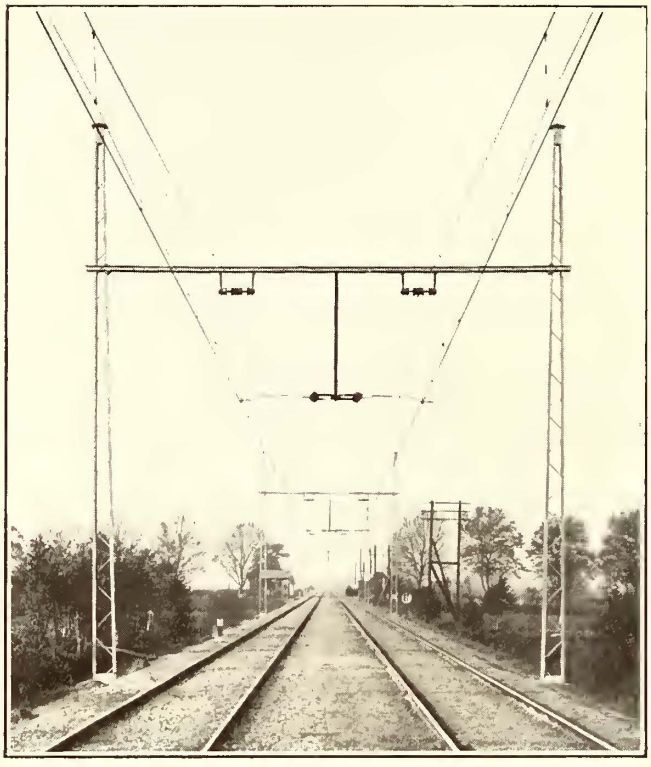


Dessau-Bitterfeld Electric Railway—Catenary Bridge Over a Curve, with Signal Bridge in the Background



Dessau-Bitterfeld Railway—Light Catenary Bridge for Yard Service

staggered throughout. It was necessary to use an extremely wide current collector because at one location the low trolley clearance of 15 ft. above the height of the rails required the trolley wire to be placed 3 ft. 1 in. from the center line of the track. The trolley wire on the other track was also placed offside to the same degree for an equal distance in order to equalize the wear on the collector.



Dessau-Bitterfeld Railway—Two-Track Construction.

The tension take-up devices consist of weights attached to chains which run over sheaves installed on poles or towers about 4600 ft. apart. In addition, the tension of the auxiliary catenary and the main catenary can be separately adjusted at places 984 ft. to 1312 ft. apart. At one place between two tension take-up devices the trolley wire has been rigidly connected to the auxiliary catenary to minimize the tendency of the former to creep in the direction of running. Every track is furnished with horn switches and oil resistances as safety precautions against high-tension and lightning discharges. The main line is divided by section insulators. The siding tracks are dead except when it is necessary to run cars over them, but even then the line is not energized until warning signals have been given to those who are working on the cars and tracks.

ELECTRIC RAILWAY IMPROVEMENTS IN SYDNEY

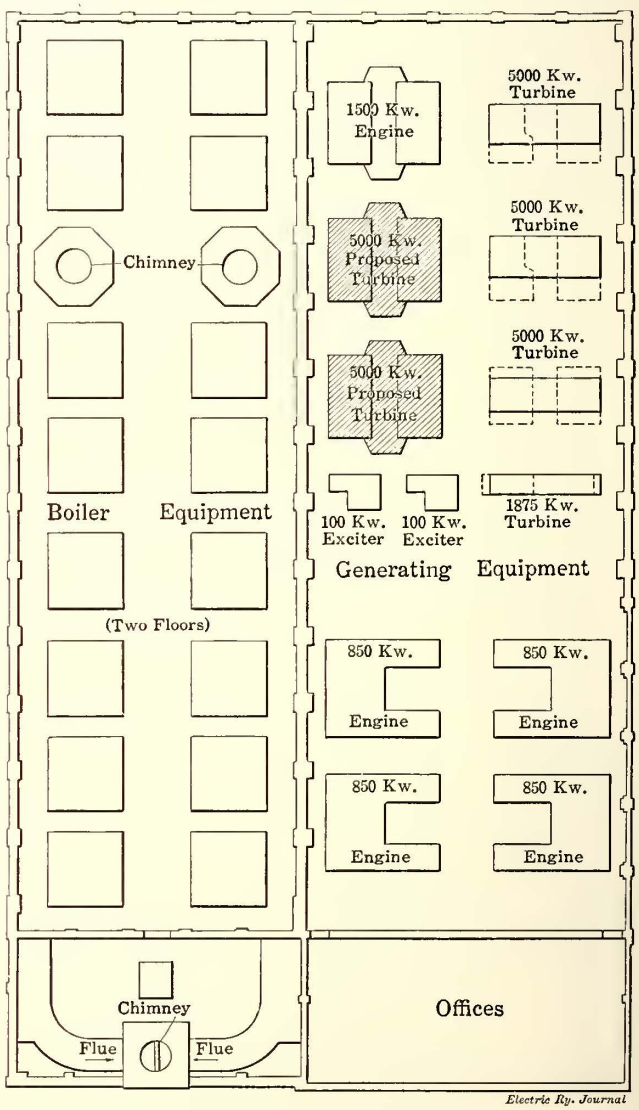
The New South Wales Government Railways and Tramways have recently received bids for the erection of two 5000-kw turbo-alternators to be added to the Ultimo power house at Sydney and three 5000-kw units for the new White Bay power house, also at Sydney, which eventually will contain ten sets of the same size.

The arrangement of the present generating plant at the Ultimo power house is shown in the accompanying drawing. The existing equipment consists of four horizontal condensing engines, direct-connected to generators, having an output of 850 kw each, at 600 volts d.c.; two vertical condensing engines, direct-connected to a 1500-kw alternator; one 1875-kw turbo-alternator; and three 5000-kw turbo-alternators. The a.c. plant furnishes three-phase current at 6600 volts, 25 cycles. There are also two horizontal compound engines, each direct-connected to an exciter, having an output of 100 kw at 125 volts. The boiler house contains forty-eight B. & W. water-tube boilers, of 2842 sq. ft. heating surface each. Twenty-eight of these boilers are fitted with superheaters capable of giving 120 deg. Fahr. superheat. There are also twelve B. & W. boilers, with a heating surface of 3140 sq. ft. each, which are also fitted with superheaters.

The new turbines are intended to operate either at 150-lb. or 200-lb. pressure above atmosphere with 110-deg. superheat. The alternators will be wound for 6600-volt, 25-cycle, three-phase operation. The generating sets will be guaranteed to carry an overload of 25 per cent continuously and an overload of 50 per cent for two hours. The specifications for these turbines were prepared by O. W. Brain, electrical engineer, New South Wales Government Railways and Tramways.

OTHER IMPROVEMENTS

The healthy growth of the tramway system is also indicated by improvements in other departments during the fiscal year ending June 30, 1911. There were added forty-nine eighty-passenger motor cars of the type described in the Electric Railway Journal of July 1, 1911, and two



Ultimo Power Station of the New South Wales Tramways.

ballast trail cars. The track department relaid 9 miles, double-tracked 5 miles and built several loops. The Manly steam tramway was converted to electric traction and work has been commenced on the conversion of another steam line. Two substations, two battery rooms, nineteen waiting rooms and an employees' recreation room have also been provided, besides two new carhouses and enlarged shops.

Proceedings of the Railway Section of the International Electrical Congress at Turin

Among the Subjects Discussed in the Three Days' Session at Turin Were the Relative Merits of Single-Phase, Three-Phase and Direct-Current Traction, Methods of Current Collection and Distribution and a Standard Unit for the Measurement of Acceleration

The International Electrical Congress, held in Turin, Italy, Sept. 10-17 in connection with the international exposition in that city, was divided into eight technical sections as follows: (1) electrical machinery and transformers; (2) construction, central stations, switchboards, distribution; (3) instruments and methods of measurement; (4) electric light and heat; (5) electric traction; (6) telegraphy and telephony; (7) storage batteries, electrochemistry and electro-metallurgy; (8) rates, taxation and legislation.

The United States sent official delegates and this country was well represented at the congress. Dr. Elihu Thomson was president of the International Electrotechnical Commission, which held its meetings the week before the congress. Gano Dunn was one of the honorary vice-presidents of the congress; C. O. Mailloux was president of Section 5; Prof. A. E. Kennelly was president of Section 3, and Dr. C. H. Sharp was vice-president of Section 4. These and other American electrical engineers presented papers either in person or by proxy.

The sessions of the railway section were held on Sept. 12, 13 and 15. The officers of the section, besides the president, C. O. Mailloux, of New York, were: Vice-presidents, L. M. Barnet-Lyon, of The Hague, Holland, and Giuseppe Sartori, of Trieste, Austria; secretaries, Fenzo Fenzi, electrical engineer, Milan, and G. Ponti, Turin.

PROCEEDINGS ON SEPT. 12

The first paper presented was that by Giorgio Calzolari, who is connected with the Italian State Railways. It was entitled "The Application of Single-Phase Traction and Three-Phase Traction on Lines of Heavy Traffic." An abstract follows:

SINGLE-PHASE TRACTION AND THREE-PHASE TRACTION FOR HEAVY ELECTRIC RAILWAYS

By way of introduction Mr. Calzolari summarized expert opinion on this subject, briefly reviewing the conclusions reached by the various commissions that had been appointed to investigate and study it. The preference of the various countries for one system or another, as reflected in their present activities, was then taken up in a brief description of the electric traction systems under construction in different parts of the world. This review placed Germany, Sweden and Austria on one side as favoring single-phase traction for general adoption in heavy railroad work, while Russia, France and Italy were opposed to the standardization of any electric system at the present time, but seemed, if anything, to favor the three-phase system.

In studying the characteristics of the two systems the author divided the problem into two parts, which he stated as follows:

(1) The requirements of railway operation, viz.: (a) Sufficient starting and running torque, (b) ability to maintain schedule time, (c) multiple operation of motor cars or locomotives.

(2) Economy of operation in the following respects: (a) First cost of motive power plant, (b) simplicity and durability of the distribution system, (c) simplicity and durability of the electric equipment, (d) ratio of weight of motor equipment to torque and power, (e) energy consumption at locomotive and at power plant per ton-kilometer, (f) instantaneous power demands, (g) maintenance expense.

Continuing, Mr. Calzolari said that both single-phase and three-phase motors were able to develop sufficient torque and power for heavy railroad work. In regard to schedule speed he looked upon the constant-speed characteristic of the three-phase motor as an advantage, and in comparing the induction motor equipped for either cascade or variable pole operation with the single-phase commutator motor he was of the opinion that because of the variation of power-factor with speed the single-phase motor was more limited in its running speed than was the three-phase motor.

Multiple operation, he said, offered no difficulties with three-phase motors. It had been the general belief that because of their constant speed induction motors could not be operated in multiple on the same train without serious disturbances. However, actual experience had shown that no serious difficulty was experienced when two locomotives were attached to the same train even though one had new and the other worn tires.

The question of first cost depended so extensively upon local conditions that it was difficult to show where either one of the systems had an advantage over the other in this respect. The single-phase distribution system was clearly the simplest, and yet, because of the extremely high tension in the working conductor, the three-phase system with a much lower working emf had a greater factor of safety.

As regards the motor equipment, the induction motor was simpler and more robust than the commutator motor, but both had a very short air gap. Furthermore, the single-phase motor equipment weighed about 40 per cent more than a three-phase equipment for the same service, and because of this difference in weight the energy consumption per ton-kilometer was slightly in favor of the three-phase equipment, and if the three-phase system was operated with regenerative control the energy consumption at the power house was still further reduced. Regenerative control with single-phase motors was now being tried out on the Midi line in the French Pyrenees Mountains.

The three-phase system had an important advantage over the single-phase system in that it permitted the running trains to feed energy back to a starting train, thus relieving the power house of excessive demands. The author estimated that by suitable adjustment of the speed regulators the momentary demands in the power house of a three-phase system could be reduced by more than 30 per cent. On the score of general maintenance, the two systems were considered to be about equal. Summing up, the author thought that the 10,000-volt, 15-cycle to 25-cycle, single-phase system was best adapted to long lines of moderate traffic, especially in cases where hydroelectric energy was developed exclusively for traction purposes, while the 3000-volt, 15-cycle, three-phase system was best adapted to lines carrying heavy traffic, especially where there were heavy grades and long runs.

At the end of the paper the author gave a detailed description of the electrification of the Giovi lines with three-phase equipment.

DISCUSSION ON MR. CALZOLARI'S PAPER

President Mailloux, after expressing his pleasure at seeing so many distinguished specialists and experts in electric

traction present at the meeting, requested Mr. de Kando to give, in French, a brief résumé of the paper, and then to open the discussion. He had selected Mr. de Kando for this purpose on account of his linguistic attainments, and, above all, on account of his high reputation as an authority on the subject, especially as regards three-phase traction, where no one could deny him first place.

Mr. de Kando (Italian Westinghouse Company) referred to the subject of recuperation, which was one of the most important points brought out by Mr. Calzolari in his description of the Giovi line. He had said that there was a saving of 16 per cent secured in fuel consumption by the use of recuperation. This amount was worth saving, especially as the figures showed that the weight of trains ascending the line was about 50 per cent greater than that of the trains descending the line and that a considerable part of the energy recuperated was allowed to be wasted in the safety rheostat at the power station. This latter condition, however, was temporary. Actually, the losses during a run were sufficient to consume the energy recuperated from a standard train (500 metric tons) with two locomotives descending at slow speed. The safety rheostat was necessary only when the train was descending at high speed, that is, at 45 km or 28 miles per hour. The great success of the system of recuperation on the Giovi line had induced the Italian State Railways to permit an increase of speed on trains descending grades, so that now the speed of descending electric trains is about 50 per cent higher than that of steam trains controlled by ordinary braking apparatus. This decision, it should be remembered, was reached by an extremely conservative management.

Another important point, in Mr. de Kando's opinion, was the question of constant speed. Railroad timetables were based on the average maximum speed possible after allowing a sufficient margin between the time of run actually required and the minimum time possible for a given run. Where motors of constant speed were used this margin was always available, independent of the conditions of the track, of the weight of the trains, and of other circumstances which had an effect on a variable speed motor. The result was that steam trains on the Valtellina line operating between Milan and Lecco were frequently late, while the three-phase electric locomotives under equally difficult operating conditions would not only maintain their schedule time but often gain time.

Another point to consider was that of the contact line. He thought that the opponents of the three-phase system exaggerated the objections to a double overhead trolley line system. That on the Giovi Railway had been built by the Italian State Railway Department, whereas those on some other lines, such as the Burgdorf-Thun line, the Valtellina line and the Simplon line, had been built by contractors, and it was obvious that when the overhead line was built by contractors certain desirable features in it might be sacrificed to gain advantages in other parts of the system. On the other hand, the governmental Railway Department had undertaken a class of work which was not at all in its line. Nevertheless, he thought the work had been very well done.

Finally, he spoke about another point mentioned in the report of Mr. Calzolari which he considered important; that was the question of motor capacity in its relation to weight. He thought that Mr. Calzolari, in his report, had unduly favored the single-phase system, because he had compared the most powerful single-phase locomotive with the Giovi three-phase locomotives, which ought not to be considered as a finality as regards weight per horse-power capacity. If the Giovi motors had been supplied with forced ventilation it would have been possible to have increased their capacity considerably. If the weight of an electric locomotive was greater than that absolutely necessary to secure traction it would increase the energy consumption. Thus, if the Giovi locomotives had been only 20 tons heavier the corresponding increased consumption of fuel would have amounted to 1600 tons per year with a ten-minute train service.

Riccardo Vallauri, the next speaker, defended the single-phase system. He said that in those European countries in which railway electrification had actually begun, such as Sweden, Switzerland, Prussia, Austria and on the Midi Railway of France, the decision had been in favor of the single-phase system. The only notable exception was the Italian State Railways, which had commenced electrification at a time when the single-phase system had not been developed, and the Italian State Railways were showing a conservatism toward a change from three-phase which was perhaps only natural in a governmental organization. He thought that the more complicated overhead construction required by the three-phase system was sufficient to condemn it. The motor itself was also less desirable, possessing as it did the characteristics of a shunt machine. It could be used only at three economical speeds, and then only by the use of complicated connections. It had a low power factor and was sensitive to fluctuations in the voltage. It was difficult to connect two locomotives in multiple-unit service. On the other hand, the only objection originally feared in the single-phase system, its use of a commutator, had been found not to be as serious as was at one time thought. Motors of 1000 hp had been in use on the Dessau-Bitterfeld line for some months and had operated at speeds of 120 km (75 miles) per hour without sparking at the commutator. This proved that the commutator was as reliable as any other part of the machine. The single-phase motor was somewhat more expensive to build than the three-phase motor, but this higher cost was more than counterbalanced by the lower cost of distribution in the single-phase system. The greater weight of the single-phase motor was not commercially objectionable because such weight was useful for traction. As regards recuperation, some tests made on the Dessau-Bitterfeld line had shown that single-phase locomotives were capable of recuperation if it should be considered economically desirable. He thought that the conditions on the Giovi line were especially favorable as regards recuperation. Finally, he referred to the plan to equip the Gotthard line with the single-phase system as evidence that it was now accepted by the Swiss commission as more desirable than the three-phase system.

Alfredo Donati, delegate from the Italian State Railways, referred to the fact that Italy had been the pioneer in the use of high voltage. The selection of the three-phase system for the Giovi line was made in 1905, when little had been done with the single-phase system. Moreover, the line seemed particularly adapted for the three-phase system on account of its heavy grades, dense traffic and heavy trains. The government Railway Department was not committed to any one system, and on the Verese line had direct-current locomotives of 1200 kw hauling heavy trains at speeds of 90 km (56 miles) per hour. On the other hand, on the Parma suburban lines it had recommended the single-phase system. He thought that each system had its field. He did not consider the difficulties with two overhead wires, crossings, etc., mentioned by the previous speaker, as a serious objection to the three-phase system when there was sufficient space between the tracks for the erection of supporting structures. As an example of the possibilities of equipping large stations with the three-phase system, he referred to the station at Busalla, which he claimed was the largest electrified station in the world and which had 8 km of electrified tracks. In these yards there were thirty-seven overhead frogs. The station at Pontedecimo was second in size, and also had a great many frogs and crossings on curves and on grade. No difficulties had been experienced in its construction or in its maintenance. It had been installed by the regular rail-

road force within about a month. Many of the seeming difficulties could be eliminated by the use of two collectors on each locomotive. No trouble had been experienced on the Giovi lines with the system of current collection. Whether span construction was used, as on the Valtellina and Giovi lines, or a catenary was employed, as on the Lecco-Calolzio Railway, where a speed is attained with trolleys of 106 km (66 miles) per hour, the service was satisfactory. Unfortunately there was at present no single-phase railroad system that had as difficult a traffic situation as the Giovi Railway, so that it was impossible to establish comparisons or deduce conclusions therefrom.

The traffic on the Giovi line, the speaker said, was practically 500,000 ton-kilometers (340,000 ton-miles) per day and the grades were as high as 3.1 per cent; while the locomotives were as powerful as those on the Lötschberg line, which weighed 27 tons more. With such traffic, the fuel consumption per ton-kilometer, with steam, was 65 grams, whereas with electric traction it was only 29.5 watt-hours measured at the power station. With these figures it was possible to calculate the saving. Mr. Donati did not accept the conclusions of Mr. Vallauri that a wide range of speed for the locomotives was desirable for trunk-line service. He thought that two or three operating speeds were all that were needed to utilize as much as possible the capacity of the line. Neither did the speaker think that a standard electrical system was necessary, as in railway service locomotives would have to be changed at the end of each locomotive run, and it would be desirable to use on each section the type of locomotive best adapted for the special conditions of that section. The demand for a standard electrical system was based upon theoretical rather than upon practical considerations. On the other hand, ability to recuperate power produced a saving not only in the investment and operating expenses of the power station, but also in the wear of rails, tires, brakeshoes, etc. He thought that on the Giovi line the ability to recuperate ought to more than double the life of the rails which, although weighing 50 kg per meter (100 lb. per yard), had not lasted more than three years when steam traction had been used. The saving in brakeshoes and brakes on the locomotives and trains ought to amount to 7000 francs ($1,400) per locomotive per year on the Pontedecimo-Busalla line. In conclusion, the long experience with electric traction of the Italian State Railways had shown the desirability of selecting the electric system for the work to be done rather than blindly to adopt one standard system.

As Mr. Donati had been interrupted a number of times in his talk by advocates of other electrical systems, the president suggested at this point that it would be much better if the discussion should be conducted "in series" and not "in parallel." By this means a better power factor and a higher efficiency would be obtained. He announced that every delegate desiring to speak would have the opportunity, but he should take his turn in doing so. In this connection he urged all speakers to use the French language, if possible, as that language was understood by more of the delegates present than any other language.

Frédéric Koramzay, delegate from Hungary, said that he would like to correct an erroneous statement by Mr. Vallauri, that all of the state railroad managements in the different European countries, with the exception of Italy, had adopted the single-phase system. Hungary has not yet adopted any special system. Personally, he had a very high opinion of the three-phase system for lines of heavy traffic, and in many installations this system would be less expensive in first cost and more economical in operation. In Hungary the first single-phase line at 10,000 volts had recently been put into operation, but he believed that the three-phase system would also be extensively used in that country.

Henry Graftio (Russian State Railways) thought that the section should by no means conclude from the papers which had been read that the single-phase system was the only one to be used for trunk-line service and that the three-phase system and other systems were out of the running. The Western State Railways of France were about to equip all their suburban lines with direct current, and the Russian State Railways intended to select the direct-current, single-phase or three-phase system, according to the conditions, whichever would give the best results. The hope of establishing a single standard electrical system for all of the railways in one country was a mirage. The subject had been discussed at the Berne Congress, and the conclusion had been reached there that electricity could advantageously be substituted for steam traction under two conditions only, viz., first, when the cost of generating current was low (the discussion related principally to the conditions in Bavaria and Austria), and second, when the traffic exceeded a certain density in ton-kilometers per year. These conclusions showed that the installation should be made for reasons of economy, and the claim for a standard system fell to the ground. As a matter of fact, the two instances quoted by the Berne Congress as those in which electric power should be used were those which favored respectively the employment of the three-phase system and of the direct-current system. For these reasons the Berne Congress did not decide in favor of a standard system, nor was such action taken at London at the 1910 meeting of the Institution of Mechanical Engineers, nor in 1911 at the Chicago meeting of the American Institute of Electrical Engineers.

One example of a line in which electric equipment was not justified by economic reasons was the Seebach-Wettingen line in Switzerland, where the electrical equipment had been removed and had been replaced by steam. There were certain conditions in Russia where the introduction of electric traction would be advisable, but there were many other places where the steam locomotive would remain for a long time as the best and most economical form of motive power. With two exceptions, namely, the electric locomotives built for the Kiruna-Richsgreuse Railway by the Siemens Company and for the Lötschberg line by the Oerlikon Company, the ratio of power capacity per ton of weight would be about as follows: Three-phase locomotives from 30 to 33; direct-current locomotives from 20 to 24; single-phase locomotives from 13 to 15. The speaker made the two exceptions mentioned above because figures published in certain technical papers indicated higher values than those given above, amounting to about 20 hp at the periphery of the wheels.

President Mailloux said that the discussion of the relative values of different electrical systems which had taken place at the meeting had interested him greatly and had astonished him a little. In a sense the same sort of discussion had occurred in America, where electrical engineers had carried their arguments along the narrow right-of-way of advocating the superiority of this electrical system or condemning the inferiority of that electrical system rather than keeping to the broad and more advantageous field of discussing the advantages of electricity over steam. He had always believed that these controversies over the relative merits of the different electrical systems had done much to delay the entry of electric traction into its own domain, which still belonged to its one real rival and adversary—steam traction. The battle between systems, it seemed to him, ought to be postponed, and all electrical engineers should unite to convince the advocates and partisans, and often fanatic partisans, of steam power that electric traction was desirable, at least in principle and at least in certain cases. At present the very idea of the introduction of electric traction was scorned by many steam railroads. It was true, as Mr. Graftio had said, that there were many places where the introduction of any system of electric traction could not be justified. On the other hand,

there were a great many places where electric traction would be advantageous and practicable, but unfortunately the fact that specialists in electric traction could not agree as to the system to be used had the effect of discouraging those who were already somewhat incredulous and of making them still more so. The spirit of rivalry had retarded the progress of trunk-line electrification. When the electrical engineers did not agree between themselves railway managers often reached the conclusion that it would be better to wait and not adopt any system.

In Europe the battle of the systems seemed to be between the single-phase system and the three-phase system. Direct-current received scanty if any attention. It seemed practically out of the running. In America, however, the battle of the systems was between the alternating-current and the direct-current system. In fact, the three-phase system and the single-phase system were, so to say, put in the same boat. It ought to be said, however, that the three-phase system was not as well understood in America as in Europe, since there had been but one three-phase installation, that in the Cascade Tunnel of the Great Northern Railroad. When alternating current was mentioned in America in connection with electric traction the words were generally understood to refer to the single-phase system. The speaker did not believe that the direct-current system could be ignored. He himself had recently seen the technical data of the study of a railway system on which high-tension direct current from 1500 volts to 2000 volts was probably to be installed. The line was 1200 km (750 miles) in length, with grades steeper and longer than those of the Giovi line. It had an intense traffic, and conditions which rendered the problem of electrfication extremely difficult. The high-tension direct-current system was far from being dead in America. It had been defended by such distinguished engineers as Potter, Armstrong, Hobart and others, and had an especially valiant champion in Frank J. Sprague, whose name occupied so distinguished a place in the annals of electric traction. More than any other person, perhaps, he deserved the title of the father of the electric railway, and the speaker regretted that Mr. Sprague was not in attendance at the meeting to present the paper which he had been scheduled to read. No one would have been better able than he to discuss the advantages of high-tension direct current. As far as alternating-current traction was concerned, the largest system in America, of course, was that of the New York, New Haven & Hartford Railroad. This line had undeniably been a success and the company was now planning important extensions. The differences in points of view by which the system which had been adopted most extensively and perhaps was held in the highest esteem on one side of the Atlantic—that is, direct-current in America and three-phase in Europe—was the least appreciated on the other side of the Atlantic was undoubtedly to be explained by technical, economical and industrial conditions. For this reason, he believed that the choice of an electric system on any particular line was determined absolutely, in a great many cases, by factors which he calls "peremptory factors," and that in very few cases was there really a choice between two or more systems. He stated that he would discuss this subject more in detail in the paper which he was to present on electrification.

Eugene Eichel, editor *Elektrische Kraftbetriebe und Bahnen*, Berlin, then gave some of the results obtained on German single-phase systems, particularly the Dessau-Bitterfeld line.

Gustave l'Hoest, Belgium Railway Department, said that that country had not adopted any standard system of traction. It was to employ direct current on a suburban section of its line now being equipped on account of the large density of traffic. He asked for information in regard to the indirect economies such as in the wear of brake-shoes, tires, etc., due to recuperation, on the Giovi line.

Dr. Beckmann, Tudor Accumulator Works, Berlin, referred to the system of the Piedmont Traction Company in America, soon to be equipped with the 1500-volt direct-current system. He also said that other lines in America which had originally been equipped with the single-phase system had been changed to the direct-current system, among them the Washington, Baltimore & Annapolis Railway, the Watertown branch of the Milwaukee Electric Railway & Light Company and the Warren & Jamestown Street Railway. He quoted some comparative figures which had been published as to the cost of maintenance and operation of the Washington, Baltimore & Annapolis Railroad before and after the change. These figures were favorable to direct-current traction. He also quoted some comparative figures of cost of operation on the Hamburg-Ohlsdorf Railway, equipped with alternating current, and the Berlin-Grosse-Lichterfelde, equipped with direct current. These figures were also favorable to direct-current traction.

Dr. Behn-Eschenburg, manager of the Oerlikon Company, Switzerland, explained the reason for the discontinuance of electric traction on the Seebach-Wettingen line. It was purely an experimental line and the purpose of its equipment was to determine the merits of the different systems, so that a proper selection could be made for the much longer Berne-Lötschberg-Simplon Railway, and the line had been selected for this test simply because it was near the works of the Oerlikon Company. The purpose of its equipment having passed, the electrical equipment was removed.

Mr. Eichel, Berlin, called attention to the fact that the same plan had been followed in Prussia, where the Spindlersfeld line had been equipped temporarily so that proper decision could be reached for the Altona-Ohlsdorf line. Continuing, the speaker said that local conditions had largely dictated the conversion of the Washington, Baltimore & Annapolis Railroad from alternating current to direct current. At the Washington terminal the cars had to use a 500-volt double-trolley system and also run over an underground conduit system. At the Baltimore terminal the cars had to use a single-trolley system. Moreover, the cars were very heavy for the conduit line in Washington. These were the controlling factors, and the best interests of the section of the line between the termini had to be subordinated to the controlling factors at the termini. The writer then quoted some statistics of the Spokane & Inland Empire single-phase railway and a statement which appeared in the Electric Railway Journal for July 15 from the management of the Chicago, Lake Shore & South Bend Railway favorable to single-phase traction. He also thought that from the announced plans for extension of the New York, New Haven & Hartford Railroad it was well satisfied with its single-phase equipment.

Mr. de Kando said that the successful single-phase roads of America which Mr. Eichel had mentioned had all been constructed by one company, the Westinghouse company, but that this company frankly recognized in its publications that each of the three systems under discussion had its field. It recommended among others the three-phase system for lines with steep grades, and, although the Westinghouse company had done a larger amount of single-phase work than any other manufacturing company, it was not a fanatic in regard to the single-phase system.

In concluding the session the president referred to the importance in the industrial world of railway transportation and said that he did not believe that any sections of the congress were considering more important subjects than the railway section. Railroad transportation had played a large part in the industrial and financial revolution which has taken place in the nineteenth century. The twentieth century had the mission to be better than its predecessor, and electric traction would be to it without doubt as useful in this purpose as steam traction was to the nineteenth century. Therefore, in contributing to the progress of

electric traction members of the congress might feel that they were contributing to the progress of civilization itself. It was for that reason that the president attached such great importance to the work of the railroad section of the Turin congress.

SESSION OF SEPT. 13

At the opening of the session on Sept. 13 the president announced that there would be no meeting on Sept. 14, as that day had been reserved for a visit to Genoa to enable the delegates in attendance at the congress to inspect the Giovi three-phase railway. He urged all to participate in this visit. He then announced that G. l'Hoest, manager electrical department of Railways, Posts & Telegraphs of Belgium, would present a paper on working conductors for electric railways. The president added that the paper would be especially interesting because of the studies which the Belgian govenment had recently been making on the subject of electric traction. An abstract of Mr. l'Hoest's paper follows:

WORKING CONDUCTORS FOR ELECTRIC RAILROADS

The author first described the different types of third-rail construction and said that the under-running third-rail was superior to the over-running third-rail as regards safety and was less susceptible to difficulties from snow and sleet, but it was more objectionable from the standpoint of car clearances and hence could not be used on many of the lines in England. He then described the various types of catenary overhead construction in general use and the double-trolley systems employed by various three-phase lines.

In conclusion the author stated that the third-rail could be advantageously employed for direct-current traction where there were not too many switches and crossings. Its use was especially desirable in and around cities where the unsightliness of the overhead construction was objectionable, and also on account of its non-interference with the clear view of the signals. On the other hand, high-tension systems were limited entirely to overhead distribution. With present-day methods no especial difficulty was encountered in handling emfs as high as could be utilized in the motors, and this with little or no fear of danger due to mechanical failure of any part of the line. However, the author noted a tendency on the part of some constructors to relax and take chances by employing a lower factor of safety.

COMMITTEE ON UNIT OF ACCELERATION

Before proceeding with the discussion on Mr. l'Hoest's paper, the president, with the authority of the delegates, appointed a committee to consider the subject of the proper unit to be used for measuring acceleration, a topic which was on the program of the section. This subject had been referred to the Turin congress from the Marseilles congress in 1908. The committee appointed was Messrs. Barnet-Lyon, chairman; Sartori-Leguez, l'Hoest and de Kando.

The paper on single-phase traction motors by Dr. W. Kummer was then read by Mr. Barnet-Lyon. An abstract of this paper follows:

SINGLE-PHASE TRACTION MOTORS

Beginning with a statement that practically all electrical manufacturers who had earnestly studied the subject had adopted the single-phase system for heavy railroad work, Dr. Kummer said that the motors now in use could be divided into three classes, namely, series, repulsion, and repulsion with armature excitation. He then proceeded to give some of the mechanical characteristics of these motors.

Experience with steam traction had taught railroad engineers to require a driving motor that could develop a variety of torques at a given speed, so as to be able to maintain the operating schedule; also one that could develop large torques at low speeds and low torques at high speeds, so as to secure good economy of energy in starting and in operation over a road having grades. These characteristics were fulfilled to a marked degree by all the single-phase motors. The speaker also said that single-phase motors could be arranged for regenerative control and that an actual installation of this kind was under construction now on one of the lines of the Chemins de fer du Midi, France. However, although regenerative control introduced certain complications in the equipment, it was quite feasible to utilize the motors for transforming the energy of retardation into electric energy which could be dissipated in a rheostat. This system was in use on the Valle-Maggia road.

Following these general characteristics, the author took up in detail the relation between the motor torque and some of the principal dimensions. Using the following symbols, he gave formulas for the interrelations of the various quantities as represented by modern practice:

Normal motor torque in meter-kilograms	$= D$
Rotor diameter	$= D_a$
Gear ratio	$= U$
Drawbar pull per driving axle in kilograms	$= Z$
Diameter of the driving wheel	$= D_r$
Speed in kilometers per hour	$= V$

$D_a = 2.42 \times \sqrt{D}$, for gearless motors

$D_a = 3.30 \times \sqrt{D}$, for geared motors.

Assuming one motor for each driving axle:

$$\left.\begin{aligned} Z &= 82.4 \frac{D_a}{D_r} \sqrt{D} \\ V &= 67.9 \frac{D_r}{D_a} \end{aligned}\right\} \text{for gearless motors.}$$

$$\left.\begin{aligned} Z &= 30.3\, U \sqrt{D} \\ V &= 135.8 \frac{1}{U} \end{aligned}\right\} \text{for geared motors.}$$

$\frac{D_a}{D_r}$ being assumed as 0.5 for geared motors.

With reference to weights and torque, denoting:

Car weight in kilogram	$= G$
Car torque in motor-kilograms	$= D_f$
Adhesion weight in kilograms	$= G_a$
Adhesion coefficient	$= \mu$
Diameter of drives	$= D_r$

Thus

$$\frac{G}{D_f} = \frac{G}{G_a} \times \frac{1}{\mu} \times \frac{2}{D_r}$$

which for single-phase motors was about

$$\frac{G}{D_f} = 11 \text{ to } 13$$

DISCUSSION ON PAPERS OF MESSRS. L'HOEST AND KUMMER

Mr. Eichel, Berlin, pointed out that there was a difference in the method of supporting the lower working conductor on the overhead line of the New York, New Haven & Hartford Railroad and in the Siemens system. In the latter the working conductor was attached to the supporting wire by loops so that it might move vertically and longitudinally, and it was held in tension by weights located at convenient points from 1 km to 2 km apart. It was thus very flexible and no difficulty had been experienced in taking current from it by trains at speeds of 130 km (81 miles) per hour on the Dessau-Bitterfeld line. On the New York, New Haven & Hartford Railroad construction the contact wire was of steel and was attached rigidly to the former contact wire by clamps spaced midway between the points of suspension of the old contact wire. The German railway authorities had adopted as standard trolley-wire voltage 15,000 volts at 15 cycles.

In the Cascade Tunnel 6000-volt line trolley wheels were used, as the speed was low, but for high-speed lines the writer thought the bow or pantograph collector more desirable.

President Mailloux then gave a short sketch of the characteristic features of the overhead catenary line of the London, Brighton & South Coast Railway, which he had recently inspected in company with Mr. Dawson, the engineer of that line. He was struck with the flexibility of the construction and the simple and extremely ingenious manner with which Mr. Dawson had secured this result. The double V type of hangers was employed, and the working conductor was supported under an upper parallel conductor by droppers which allowed a flexible movement. These droppers were in two links with an opening between the links of 25 mm (1 in.) so as to permit a vertical movement of 50 mm (2 in.). Such an arrangement also allowed considerable lateral movement in the device. It could be seen to rise and fall with the passage of the pantograph.

C. Palestrino (Italy) believed that better results could be obtained by the induction type of single-phase railway motor like the Winter-Eichberg, Latour, etc., or by a repulsion motor like the Déri, than with the ordinary series type. It had been generally admitted that the single-phase system was more desirable than either the three-phase or the continuous current so far as distribution was concerned, and the critical point in the single-phase series system was the commutator of the motor. Such a motor as he advocated largely overcame commutator troubles. Tests had been made of the Déri type of repulsion motor with rotating brush holders on the Stanstadt-Engelberg line by Brown, Boveri & Company, and also on the Waldegg-Lucerne line of the Seethalbahn, in which a trolley voltage of 5000 was applied directly to the motors. During the past year this motor had also been used on the Martigny-Orsières line and on the city tramways of Parma.

F. Fenzi, consulting engineer, Milan, compared the results on the direct-current Milan-Verese line and on the three-phase Valtellina Railway, both of which had been in operation for about ten years. The power consumption on the former, which was a direct-current line, was 45 watt-hours per ton mile and on the latter, which was a three-phase line, was 40 watt-hours per ton mile, although the grades and speeds on the latter line are much greater. He then entered into a comparison of the relative merits of the different systems and concluded by expressing his opinion that the selection of direct current, with a third-rail at 700 volts, would have been justified for the Simplon and Giovi lines, and that for longer railways he believed that there was a great future for the high-tension direct current. At a voltage of, say, 2500 the substations could be located from 40 km to 50 km (25 to 30 miles) apart.

President Mailloux then, according to the program for that day, presented a paper in French on "The Industrial Definition and Measurement of Train Acceleration." This paper was a résumé of a more extended paper presented under the same name by him at the Marseilles congress in 1908. A condensed and paraphrased English translation of the Marseilles paper was published in the Electric Railway Journal of Feb. 13, 1909, pages 277-279, with an editorial comment on page 270 of the same issue. The Turin paper recapitulates briefly the arguments and the mathematical reasoning and demonstrations which had been previously set forth more fully in the Marseilles paper in favor and in defense of the American practice of measuring and expressing train acceleration in miles per hour per second, and in advocacy of the general adoption of the kilometer (or mile, or verst) per hour per second as an industrial unit of acceleration. The paper shows that such a unit is more rational, logical and scientific, in theory, and especially more intelligible and more convenient, for practical use, than the units used hitherto in Europe, i. e., meters (or feet) per second per second.

This communication and the question of the adoption of the proposed new unit was referred to the special committee already mentioned as appointed for that purpose.

SESSION OF SEPT. 15.

The first order of business on Sept. 15 was the report of the committee on the adoption of an "industrial" unit for train acceleration, as proposed by Mr. Mailloux. The special committee made a unanimous report in favor of the proposed unit, and reported resolutions which were unanimously adopted by the section as a body. The committee was also instructed to submit its report and the resolutions to the entire congress for formal adoption. (This was done at the plenary meeting of the congress, on the following day, when the report and the resolutions were unanimously adopted by the congress as a body.) The resolutions were as follows:

"Whereas it is the universal practice on railways to express the speed of trains in kilometers per hour (or in miles or versts per hour); and

"Whereas it is logical to use this measure of speed in expressing the acceleration per second; and

"Whereas this definition of acceleration of trains is the one employed in America and its use is spreading in other countries; and

"Whereas this proposition has already received favorable action at the International Congress of Electricity held at Marseilles in 1908; now, therefore, be it

"Resolved, (1) That the acceleration of trains ought to be expressed in kilometers per hour per second (or in miles or in versts per hour per second); and,

"Resolved, (2) That the International Electrotechnical Commission be informed of this formal action."

APPLICATION OF ELECTRICITY TO SUBMARINE BOATS

A paper by A. Bezzi on the application of electricity to submarine boats was then presented. In the absence of Mr. Bezzi this paper was read by proxy. As the paper did not relate to railway work, an abstract of the paper and discussion will not be published in this journal.

A paper on the subject of high-voltage direct-current electric traction was then presented by Guglielmo Gyáros. An abstract follows:

HIGH-TENSION DIRECT-CURRENT TRACTION

In this paper Mr. Gyáros claimed that, thanks to the commutating-pole motor, the direct-current system had taken a new lease of life and would in all probability become the standard system for interurban and suburban lines. He said that the commutating pole had greatly increased the possibilities of commutation and experience had shown that high-tension motor brushes had an average life of between 200,000 and 1,500,000 motor kilometers (125,000 and 812,500 miles) and that the motors would stand a momentary overload of 100 per cent without flashing over. He said that the ordinary motor would flash over with an overload of 50 per cent. As an example of the comparative cost of maintenance of single-phase and high-tension direct-current systems the author gave figures taken from the results of the Washington-Baltimore-Annapolis Railway, as published in a recent issue of this paper.

It was the author's opinion that the single-phase system could compete with the high-tension direct-current system only when very high tensions were used in the working conductor. For example, he considered that on the basis of equal economy a 1000-volt direct-current system was equivalent to a 5000-volt or 6000-volt alternating-current system, and that a 2500-volt or 3000-volt direct-current system was equivalent to a 15,000-volt alternating-current system.

There were now either in operation or under construction in Hungary five important high-tension direct-current lines, and the author gave data regarding each one. These systems used the pantograph trolley with an aluminum con-

tact bow. When employed in catenary construction these bows had an average life of about 20,000 car kilometers, but in ordinary trolley construction their life is much shorter. Three of these five lines are owned by one railway company and aggregate in length about 160 km (100 miles). The rolling stock on these three lines will consist of twelve electric locomotives each with two 150-hp motors, eighty-eight passenger cars and eighty-eight trail cars. The voltage to be used is 1000. Of the other two one is 17.5 km (11 miles) in length and will use 1200 volts; the other is a narrow-gage line 58.3 km (36.4 miles) in length.

PEREMPTORY FACTORS IN TRUNK LINE ELECTRIFICATION

Vice-president Barnet-Lyon then took the chair to allow President Mailloux to read a paper on trunk-line electrification. An abstract of this paper will be published in a later issue.

DISCUSSION ON THE PAPERS OF MESSRS. MAILLOUX AND GYÀROS

Dr. Beckman, Berlin, referred to the discussion which had taken place on Wednesday in regard to the conversion of the Washington, Baltimore & Annapolis Railway from single-phase to direct-current. He pointed out that one reason for the change was the excessive weight of the cars, which it had been impossible materially to reduce. Hobart had calculated the weight of single-phase equipment as 40 kg (88 lb.) per horsepower and of direct current as only 20 kg (44 lb.) per horse-power. It was evident that this greater weight would require a higher maintenance charge not only for the rolling stock but also for the track. He maintained that during the past two years there had been a reaction against the single-phase system in America, and that a much greater mileage had been constructed in that country during these years with direct current than with alternating current.

Mr. Eichel did not think such a conclusion should be drawn from statistics which he had received from America.

E. Scheichl, of Vienna, contributed some facts in regard to the three-wire system of the Krizik Company at Prague. This company in 1903 had built a three-wire (2 x 750-volt) electric railway between Tabor and Bechyn and several years later had conducted some tests in Vienna on a three-wire (2 x 1500-volt) system. Although these experiments did not result in the adoption of this system of current distribution for the Vienna system, the speaker believed that the use of a 2500-volt to 3000-volt direct current was practicable and that in many cases it would be more desirable than a 15,000-volt single-phase system.

FINAL CONCLUSIONS

After some further general discussion, Mr. Donati presented the following resolution to summarize the sense of the section:

"As it is desirable in every case to employ that system of electric traction which is best fitted to the financial and technical conditions of the railway to be equipped, this section does not consider it possible to give preference to any single system of electric traction for all railway lines."

Mr. l'Hoest, in seconding this resolution, remarked that it was in accord with the resolution which had been adopted at the International Railway Congress at Berne in 1910.

The resolution was then adopted unanimously by the section. A vote of thanks was then extended to the president, vice-presidents and secretary for their services to the session.

The meeting then adjourned.

Under a new agreement Prussia accords its consent to Hamburg extending its railway to Farmsen, Volksdorf, Wohldorf and Gross Hansdorf. Hamburg gives its assent to the extension by Prussia of the Blankenese-Ohlsdorf single-phase railway, which will open up communication with the towns in the Alster Valley, and, later, an extension to Segeberg will be made.

REPORT ON ELECTROLYSIS IN CHICAGO

In the annual report of the commissioner of public works of Chicago, just issued, is printed a report by Ray Palmer, consulting engineer, on the electrolytic damage to various underground metallic structures in different parts of the city caused by stray return current from the surface and elevated lines. Surveys made during August and September, 1911, showed excessive stray current in the neighborhood of the Illinois Street and Hill Avenue substations of the Chicago Railways Company, the Forty-second Street substation of the Chicago City Railways and at many points along the elevated railway structures. At one point on the Northwestern elevated structure readings of 30 volts negative to 12 volts positive were taken between the rails and a water pipe under the surface of the street. Near the power house of the Metropolitan West Side elevated road the water pipes were positive to the elevated structure and negative to the street-car rails.

The damage is said to include underground water pipes, lead cable sheaths, the metal in structural-steel buildings and the structural steel in bridges used by street railways in crossing the Chicago River. As a remedy for the conditions existing on the elevated structure the report recommends that large negative return cables should be placed on the structure and should be connected to the track rails at intervals of 300 ft. At the present time no return cables are used on any of the elevated structures in the city.

The existing city ordinance relating to the prevention of electrolysis is as follows:

"Ground return wires must be so arranged that the difference of potential between the grounded dynamo terminal and any point on the return circuit will not exceed 25 volts. The positive pole of the dynamo must be connected to the trolley line, and whenever pipes or other underground metal work are found to be electrically positive to the rails or surrounding earth, they must be connected by conductors arranged so as to prevent a flow of current from the pipes into the ground."

The report recommends that the ordinance be amended to read as follows:

"Ground return wire and rail circuits must be of such current-carrying capacity and so arranged that the difference of potential between any two points on the return will not exceed the limit of 12 volts. The railway companies must so equip their return current systems with insulated pilot wire circuits and voltmeters that an indicating reading may be obtained at any time showing the difference of potential between the negative busbars in each station and the extreme limits of the return circuit in the corresponding feeding district.

"The railway companies must protect all metallic work from electrolysis by the proper installation of a system equal to or better than a pipe and cable sheath drainage system consisting of insulated copper wires, pipe straps, ammeters, etc., which limits the maximum amperes drained from this subsurface metallic work to 10 per cent of the total output of the station."

To operate within the limits required by such an amended ordinance the railway companies would be compelled to make one or more of the following improvements:

(a) Reconstruct all defective track work and install additional return feeders.

(b) Install a negative booster system.

(c) Install a return-current drainage system.

(d) Reduce the size of the power plant and substation feeding districts.

(e) Insulate the railway return circuits.

The report states that the most practical and efficient method of reducing electrolytic damage would be the installation of a pipe-drainage system. It recommends that all track bonds should be repaired and maintained in an efficient condition.

Determination of the Proper Bases for Rates and Fares*

A Consideration of This Important Subject by a Committee of Leading Members of the American Electric Railway Association, Collectively and Individually—Increased Fares Will Afford Encouragement to Capital to Provide for Development

BY FRANK R. FORD, CHAIRMAN; C. S. SERGEANT, WM. J. CLARK, H. G. BRADLEE, JAMES F. SHAW AND E. C. FOSTER

REPORT OF THE FULL COMMITTEE

Your committee appointed last winter has given consideration to the subject of determining the proper basis for rates and fares and would beg to report as follows:

First: We believe that there exists a widespread need of increased fares, if adequate service is to be furnished and capital secured to provide for the continued growth of the industry.

Second: Practicable methods of securing increased rates for city systems may be summarized by the following:

(a) Retain present 5-cent flat rate, but eliminate free transfers.

(b) Retain 5-cent rate, but charge 1 cent, 2 cents or 3 cents extra for transfers.

(c) Increase 5-cent rate with (1) free transfer, or (2) without transfers, or (3) with extra charge for transfers.

(d) Establish straight European zone system without transfers.

(e) Establish zone system where a 5-cent fare is charged from outlying districts to central business district, but require a 10-cent fare from outlying district across business district to opposite outlying district, eliminating such transfers as would defeat this object.

(f) Establish zone system with 5-cent fare for a large central zone and 3 cents extra fare, making 8 cents through fare to smaller outlying zone, either with (1) free transfers or (2) a charge for transfers; the local fare in outlying zone being 5 cents.

From analogy with the past history of the industry and from practical considerations, we would in general recommend method (f) as the most feasible of the above plans. Local conditions, topography and customs are, however, different in each city, and would modify any general conclusions on this subject.

Third: Various members of this committee have prepared memoranda on this problem which are hereto appended.

Fourth: We believe that this subject is deserving of the most careful study by the association and we therefore recommend that this report and accompanying memoranda be printed and circulated among the members of the association, and that a full discussion thereof be had at its next winter's meeting.

MEMORANDUM BY FRANK R. FORD, OF FORD, BACON & DAVIS, NEW YORK

To start with it is assumed that necessity exists for a general increase in rates of fare of American electric railways if their continued growth is to be assured. Some railways are obtaining a reasonable return with present rates of fare, others are near the danger line and soon will not earn a reasonable return if the present tendency of increased expenses of operation be continued, while a third class consists of the roads whose present rates are insufficient to pay the entire cost of operation, taxes and a reasonable return to the owners. It is absolutely certain that with the extension of the city limits, with the present 5-cent fare in force, a point will be reached at which the operation at this rate will not be profitable. A proper basis for determining rates and fares should be obtained, even if rates are to be lowered instead of raised.

FACTORS WHICH GOVERN TRANSPORTATION RATES

Apart from the local conditions there are a number of general factors which have governed the fixing of transportation rates which may be summarized in Table I.

TABLE I.—FACTORS WHICH GOVERN TRANSFORMATION RATES.

	Basis.	Unit.	Example.
1.	Distance	(a) Passenger mile	Steam railroad, interurban electric railway, etc.
		(b) Passenger zone	European street railway.
		(c) Vehicle mile	Taxicab.
2.	Wholesaling	(a) Round trip	Steam railroad, electric railway, ferry, etc.
		(b) 50-trip	Do.
		(c) Strip tickets	Do.
		(d) Commutation	Do.
3.	Age or size of passenger	(a) Half fare	Steam railroad, street railway, etc.
		(b) Free (infants in arms)	Do.
4.	Occupation of passengers	(a) School ticket	Steam railroad, street railway, etc.
		(b) Workmen's ticket	Do.
5.	Class of equipment or accommodation.	(a) 1st class, 2nd class, 3rd class.	European railroad, steamship.
		(b) Parlor car, sleeping car, etc.	Steam railroad, interurban railway, etc.
		(c) Double street car fare.	Auto bus.
6.	Elapsed time	(a) Passenger hour	Cab.
		(b) Chartered car hour	Electric railway.
7.	Time of day	(a) Double fare for owl service.	Street railway.
		(b) Reduced fare for rush hour service.	Do.
8.	Day of week	(a) Reduced rate for holidays, excursions, etc.	Steam railroads, steamboats, etc.
		(b) Double fare for Saturdays, Sundays and holidays.	Street railway (Coney Island fare).
9.	Speed	(a) Limited train (or ship) fare.	Steam railroad, steamship.
		(b) Passenger pool differential.	Do.
10.	Discontinuity of passage	(a) One cent transfer	Street railway.
		(b) Three cent exchange.	Do.
11.	Direction of passage	(a) Reduced rate in light direction.	Street railway (Coney Island fare).
12.	Weight	(a) Ton mile for freight.	Steam railroad.
13.	Space	(a) Cubic foot for freight.	Steamship.
14.	Readiness to serve.	(a) Initial charge	Taxicab.
15.	Expense at service terminals	(a) Present national boundary, weight.	Postal service.
		(b) Message zone	Telephone, telegraph.
		(c) Passenger within present and future city limits.	Street railway.
16.	Free	(a) Transfers	Street railway.
		(b) Dead heads	Steam railroad, street railway, etc.

It will be seen that a large number of factors govern the matter of transportation rates, but practically all of them are disregarded in the standard 5-cent flat rate adopted in most American cities. The simple nature of this standard appealed to the railway managers in the early days of the industry when in many cases, for the short rides involved, the nickel fare apparently represented more than a reasonable return, especially when the cost of maintenance and renewals of the property was overlooked.

If the rate of street railway fares were placed on a measured basis and such measure took into account a number of different factors as above, the rate of fare would become more of the complex problem which it has assumed in the electric lighting industry and would be subject to reasonable analysis for special classes of service.

*An abstract of the report of the committee presented to the American Electric Railway Association, Atlantic City, N. J., Oct. 9 to 13, 1911. The report consists in large part of memoranda furnished by the individual members of the committee, and these constitute the part of the report which has not been available for publication until now. The brief report of the entire committee was published in the issue of the ELECTRIC RAILWAY JOURNAL of Oct. 13, 1911, and is republished here for the convenience of readers.

CHANGES OF RATES SUBJECT TO GOVERNMENTAL APPROVAL

Assuming that a raise of rates is necessary in any given situation, our problem is to determine the most reasonable basis as affecting the riding public, the operations of the company and the general growth of the municipality. Generally, the present rates are the result of charter or franchise agreement, so that consent of state or municipality is required, insuring a treatment of the subject that must be fair to the public; consequently, a broad and just solution is the only one admissible. The fact that in many states the amendment of street railway rates is subject to the approval, or in some cases to the initiative, of a public service commission renders the problem certain of careful treatment and much good should result from impartial consideration by these bodies.

In this connection it is of interest to note that the amended public service commission law of New York State provides that "whenever (the) commission shall be of opinion * * * that the maximum rates, fares or charges chargeable by any * * * street railroad corporation are insufficient to yield reasonable compensation for the service rendered, and are unjust and unreasonable, the commission shall with due regard among other things to a reasonable average return upon capital actually expended and to the necessity of making reservation out of income for surplus and contingencies, determine the just and reasonable rates, fares and charges * * *."

FORMER CHANGES OF RATES

One approach to the problem is from the standpoint of the past history of the business in this country and of the methods employed in this and other countries for changing rates.

The position of the electric railways of this country today is somewhat similar to that of the horse car lines during the latter part of the civil war. Congress had imposed an internal revenue tax of one-eighth of a cent per passenger. The price of supplies and labor had increased considerably when measured by the depreciated value of the 5-cent fare and many companies raised their rates from 5 to 6 cents to cover the increased cost. In order to give legal status to the raising of the rates above the 5-cent fare provided in the charter of many of these companies, Congress in March, 1865, enacted a law permitting them to raise the rates 1 cent.

EARLY RATES IN NEW YORK CITY

An examination of the records of some of the horse railroads at the time shows that in New York City before 1860 5 cents was practically the universal fare in the center of the city, although a 6-cent or higher rate was charged where the lines extended beyond the built-up section. By 1886, however, five of the New York lines were charging 6 cents per passenger (some of these, however, having a 5-cent "way" rate) and three charged 5 cents plus the United States tax of one-eighth cent. In 1870, practically all of the lines were running upon the 6-cent basis. By 1874, however, presumably due to a return to normal conditions, practically all of them had reduced the fare to 5 cents except the Fourth Avenue line, which charged 6 cents "way" and 8 cents "through," and the Second and Third Avenue lines, which charged 5 cents "way" and 6 cents "through." By 1880 all of the lines had reduced to 5 cents except the Fourth Avenue line.

EARLY RATES IN BROOKLYN

The Brooklyn City Railroad began operation in 1854, charging a uniform rate of 5 cents within the city limits, which rate was raised in 1865 to 6 cents and continued until 1870; from 1866 to 1875, however, tickets in bundles of twenty were sold for $1. In 1875 the rate was reduced to 5 cents and as the extensions of the various roads beyond the city limits were made, the through rate was placed at 8 and 10 cents inclusive for distances beyond the old city limits. Shortly after electrification in 1895 the universal rate of 5 cents became effective.

EARLY RATES IN BOSTON

In Boston practically all of the city railroads were incorporated on the basis of a 5-cent fare. About 1866 the rate was increased to 6 cents for reasons already given, which remained until the 5-cent fare was restored in the eighties. For the longer rides there also existed rates of 8, 10, 15, 18 and 20 cents for various distances. After the roads were electrified and consolidated, however, the universal rate was fixed at 5 cents.

EARLY RATES IN PHILADELPHIA

In Philadelphia the situation is well stated by R. W. Speirs in his book "The Street Railway System of Philadelphia":

"The railway companies in Philadelphia began in 1858 with a 5-cent fare. The usual omnibus rate had been 6 cents, and the railways promised a reduction, urging this as one reason for establishing the new system of transportation. At first, exchange tickets were sold for 6 cents, but in 1860 the exchange rate was made 7 cents by the Board of Railway Presidents. Although there were many attempts to change the rate, the single fare remained at 5 cents until 1864, when it was increased to 6 cents. The reason given for the increase was the 'high price of horse feed.'

"Shortly after this the single fare was increased to 7 cents, sixteen tickets being offered for $1, and exchange tickets for nine cents each. These rates were maintained for about twelve years, and then, in January, 1877, the fare was reduced to 6 cents, the price of exchange tickets remaining 9 cents. Four years later, in 1881, the general demand for cheaper transportation induced Councils to attach to a grant of extension privileges, requested by the Lombard and South Streets Company, the condition of a 5-cent fare. As other companies applied for privileges Councils took similar action in many cases, and later the General Assembly made the 5-cent fare rate a condition of using cable traction. Thus by means of the pressure brought to bear by the public a uniform 5-cent rate was attained in 1887."

Another statement regarding the rates prior to the civil war, was that in 1857, due to the financial panic, wages for unskilled labor were 60 cents per day, which enabled street railroad companies to make money at the 5-cent fare. War times, however, made men scarce and material higher, which forced the companies to increase the fare to 6 cents.

An interesting fact in connection with the Philadelphia situation at that time was that the board of presidents of the various independent street car lines met periodically at the exchange, Third and Dock Streets, working in combination to control all of the companies for mutual benefit. It is stated that 6 cents was barely enough to cover expenses and they were compelled to raise the rate to 7 and 9 cents including an exchange ticket.

In securing the above information a number of old horse railroad men were consulted and records of the period examined.

FIXED RATES UNREASONABLE FOR LONG PERIODS

The general result of the above situation was that the original 5-cent fare was raised to 6 cents and kept at that point until economic factors reduced the cost of operation, either by change of the financial standard, by consolidation of the companies, or by use of mechanical or electrical traction, and made possible a reduction again to 5 cents. It is apparent that by the nature of things rates depend upon economic factors the same as charges for any other commodity, and no fixed rate can be a reasonable one over a long period, being either too high or too low at practically all times.

PRESENT AMERICAN STREET RAILWAY RATES

In May, 1908, the American Street & Interurban Railway Association published information concerning city fares collected from 117 different city railway companies. With

one exception all companies reported a 5-cent cash fare for adults, the excepted company having a 6-cent fare. Practically all of the companies carried small children free at ages less than from two to five years; for older children of maximum ages from five to fourteen years, a reduced rate of from 2½ to 3 cents was charged. One hundred of these companies reported the use of tickets for adults, as shown in Table II.

Table II.—Rates of City Ticket Fares.

	Average Rate, Cents.
5 companies sold 8 for 25 cents	3.13
2 sold 7 for 25 cents	3.57
22 sold tickets for 4 cents	4.00
36 sold 6 for 25 cents	4.16
4 sold 23 for $1	4.35
9 sold 22 for $1	4.55
4 sold 21 for $1	4.76
33 sold 5-cent tickets.	

Thirty-nine companies sold school tickets ranging from 2.5 cents to 4 cents; seven sold workmen's tickets ranging from 3 cents to 4.16 cents; nine sold postmen's tickets from 2.5 cents to 5 cents, and fifteen sold miscellaneous commutation and school tickets from 2 cents to 4.33 cents.

The mathematical average of the above reduced rates for all tickets, adult, children and school, is 3.53 cents.

One hundred and eight of these companies issue transfers and six do not, seventy-one companies being obligated to issue free transfers by statutory requirement and thirty-three issuing them voluntarily.

Seventy-nine companies gave information showing that their average rates of fare excluding transfers varied from 5 cents to 3.60 cents, and including transfers from 4.81 cents to 2.86 cents. The mathematical average of the rates for these companies is 4.70 cents excluding transfers and 3.89 cents including transfers.

THE CLEVELAND RATE

At the present time the rate of fare of 3 cents of the Cleveland Railway is probably the lowest of any large American city. An additional 1 cent is collected for a transfer on all lines in the city limits, which is returned to the passenger upon presentation of his transfer ticket upon the car of the second line within the time fixed by the company's regulations. Free transfers are issued to and from crosstown lines. A 5-cent fare is charged to various suburbs directly adjoining the city with the same transfer privileges as within the city, although to two of the suburbs eleven tickets are sold for 50 cents and in some cases free transfers are given on these fares.

It is the contention of many that the receipts from these rates of fare are not sufficient to provide Cleveland with good service, to provide adequate maintenance and to leave a sufficient surplus for accruing depreciation and contingencies, nor is the return and surplus sufficiently large to attract capital which should be spent for the extension and development of the property.

SIX-CENT FARES IN MASSACHUSETTS

A number of street railways in smaller cities surrounding Boston have within the past few years raised their rates of fare with the consent of the Board of Railroad Commissioners from 5 cents to 6 cents, in some cases selling tickets at a lower rate.

THE EFFECT OF INSUFFICIENT RATES UPON THE INDUSTRY

A summary of the American situation regarding rates of fare is that, excepting a few minor companies charging 6 cents and one charging 3 cents, the 5-cent cash fare is universal. Due to the reduced rate tickets and to the large use of transfers, the average rate of fare received per passenger, including transfers, is between 3 and 4 cents. With the longer rides, the increasing cost of labor and material, the increasing use of transfers and the enlarged requirements as to service and facilities imposed by public service authorities and by public opinion, the return in the street railway industry at fixed rates of fare, which have been largely reduced in the average, has in general become insufficient to provide the margin necessary for conservative financing. In consequence of this condition the development of the electric railway is practically at a standstill. This effect is also shown in the unfavorable attitude assumed by the banking world to this class of property resulting in the higher rates of interest required in the sale of these securities.

Table III, quoted from the McGraw Electric Railway Manual of 1911, indicates, notwithstanding some discrepancies in the comparisons, the stoppage of development of this industry during the past three or four years, due to the conditions above enumerated.

Table III.—Reports of American Street Railways.

Year	Total Number of Companies.	Miles of Track.	Total Number of Cars.	Total Capitalization Outstanding.
1910	1,279	40,088	89,601	$4,682,106,217
1909	1,253	40,490	91,153	4,652,735,633
1908	1,252	40,247	89,216	4,557,136,143
1907	1,238	38,812	86,204	4,123,834,598
1906	1,164	36,932	84,732	3,765,317,875
1905	1,081	32,517	79,751	3,368,937,062
1904	993	29,548	75,904	3,217,091,971
1903	1,187	29,212	76,186	3,102,390,946
1902	1,110	25,592	70,006	2,794,338,251
1901	1,062	22,063	68,777	2,410,670,135

So much for the flat rate of fare and the early extravagant development of the street railway industry due to its fancied safeguarded profit.

EUROPEAN STREET RAILWAY RATES

On the other hand, the situation of European street railways, where the zone system is largely in force, forms an interesting comparison. A representative discussion of this subject as relating to the English tramways took place in the recent Edinburgh congress of the Tramways & Light Railways Association, from the reports of which the following extracts are given:

"The further demands which are being made by various sections of the public for cheaper fares are becoming one of the most serious problems in connection with management. Demands for preferential treatment to the working classes during certain hours of the day are continually being pressed forward, and when such concessions are granted to laborers and artisans, various other classes of the community, such as shop assistants, clerks, etc., demand similar treatment, and certainly with some show of reason, because, if it be conceded to another class who are equally well paid for their labor, their requests cannot reasonably be refused. In addition, there are agitations for free traveling for certain sections of the community, with the result that about 60 per cent of the traveling public plead for preferential treatment, or free traveling, on many systems where the general rate of fares is already so exceedingly low that if a close examination were made it would be found that they are not in as sound a position as could be desired. It has now been discovered by certain undertakings which have given preferential treatment on a large scale to various sections of the public that a tremendous loss has resulted on that portion of their business, seriously endangering these undertakings."

The statement was made that " * * * tramways and light railways, apart from the preferential treatment referred to, are carrying the general public at very little more than half the fares charged by railway companies. Those responsible should, therefore, consider very carefully the financial result which a haphazard method of charging fares may bring about, especially having regard to the difficulty of some struggling undertakings which are, unfortunately, operated at a loss, and others whose income merely covers operating and other expenses, or yields but very small returns to the proprietors. Railway companies have found it necessary to fix some general basis of charging, with the result that 1 penny per mile third class appears to have been adopted as their standard. If a similar basis could be adopted by tramways and light railway proprietors—not necessarily 1 penny per mile—there is no doubt that good would result, and the public would not, on the whole, suffer, as it is surely beyond cavil that the passenger

should pay for his ride just as he expects to pay for any other service rendered to him."

A further quotation from these reports follows:

"Making every reasonable allowance for the extraordinary difficulty of obtaining authority to construct, and afterwards for the over-regulation which has much increased both the first cost and the working expenses, it still remains a fact that England should be the most eligible country in the world for electric traction schemes, and that many miles of suitable route have only been left unconstructed because of some commercial weakness in the general position which prevents the earning of an adequate profit even in districts that were the first choice of traction engineers when electrical working was originally introduced.

"Judged by the standard of comparable industrial securities, the average return on the many millions invested by municipalities and companies in urban, suburban and interurban transit is painfully, and even dangerously, insufficient—dangerously because sooner or later the public usefulness of the service must suffer in one way or another if the revenue is insufficient to provide amply for efficient upkeep and interest on the investment. The financial health of electric traction in Great Britain is below par, while in every other country such services are steadily prosperous, and additional capital is readily forthcoming for extensions and new schemes. With, on the average, almost unparalleled density of traffic, the British lines are peculiarly unprofitable, as compared with foreign and colonial systems, and after making adjustments in respect to the varying monetary conditions, cost of labor and so forth it will be found that this department of public service is throughout the United Kingdom inadequately remunerated by the average fares obtained.

FARES TOO LOW

"The simple fact is that the price of traveling is too low, and it is solely because of underpayment by the passenger that practically the whole list of electric traction undertakings in this country consists of insufficiently remunerated systems—from tube railways down to small tramways and light railways. There are exceptions, it is true, but these are to be found in densely populated cities where the exceptionally heavy traffic obscures the inadequate profit per passenger. Apart from the London County Council, which has not been able to obtain satisfactory financial results, tramways in the very largest towns earn a substantial balance over the interest on loan capital. Depreciation is seldom adequately allowed, but it may nevertheless be admitted that these few undertakings are genuinely prosperous for the time being. Unfortunately, such towns, with their volume of traffic so enormous that the chief difficulty is to find accommodation for the swarm of passengers, have been allowed to set up a false and uneconomical standard, both as regards fares and as regards wages. Out of their overwhelming revenues they have made repeated concessions to the passengers and the employees, with results immediately costly to themselves and with threatening future consequences, but with an effect almost at once disastrous to the greater number of less favorably situated undertakings, which have been driven by local agitation or municipal ambition to accept the most prosperous systems as their model in regard to the fares, wages, hours of work, holidays and other like matters. There are thus large numbers of municipal tramways, started in the expectation of relief of rates, which are engaged in a constant struggle against insolvency. The lot of the company systems with no ratepayers to fall back upon is naturally harder still. When joint stock companies have gained a footing in the larger towns, as in Bristol, Dublin, Birmingham, and the metropolitan districts of Middlesex, they have undoubtedly demonstrated that there is no failing in respect of good commercial management to explain the poor results which characterize public service companies in this country. But, for the most part, it is the places with the thinner traffic that have been left to companies; and here, after accepting troublesome and expensive conditions, which might still have been supported without the sacrifice of a moderate dividend, they have been subjected to further pressure from municipal authorities, trade unions and public opinion, so that there has been a general encroachment upon those figures of fares and working expenses which formed the basis of the estimates when the service was undertaken. On the one hand, it has become a popular craze to demand so many miles for a penny; and, on the other hand, tramways' employees are granted privileged conditions, much better than are justified by the nature of the work and by the treatment of similar men employed in other occupations of at least equal responsibility.

CAPITAL DISCOURAGED

"The total effect therefore is that electric traction does not pay, and that no further development is likely to occur. Remedial legislation will not overcome this economic obstacle. Nothing but the establishment of a fair price for the service will unloose the purse-strings of the investor, who sees that so many millions already sunk are left without an adequate dividend by this fatal policy of cost price traction.

"In the period of horse tramways—about 1878—the average receipts per tramway passenger were 1.84 pence; in 1898, when there were numerous steam lines, they were 1.23 pence; in 1910, with almost universal electric working, they were only 1.09 pence. Meanwhile, there has been continuous agitation, largely successful, tending to more expensive labor conditions; and constructional maintenance and renewals are also more costly."

These and other summaries of the situation abroad point out the fact that, with the increasing cost of service, rates for privately operated companies are generally insufficient. In many cases of municipal operation, flat rates of fare have been adopted which, under pressure of public opinion, bid fair to wreck these enterprises.

On the other hand, under the new franchises recently granted to the various tramways in Paris, the former flat fares with transfers have been superseded by a zone system of fares and the abolition of transfers, which are said to have improved the average rate.

RATE BASED ON THE PASSENGER MILE UNIT

Disregarding all except the most important factors bearing upon the problem of transportation rates, street railway rates are dependent primarily upon the length of passenger ride, or the average length of ride of all passengers times the total number of passengers, which equals the number of passenger miles carried. The rate is also dependent largely upon the time of service, whether at rush hours or not, as this most largely affects the amount of investment required for equipment.

TABLE IV.—AMERICAN STEAM RAILROAD PASSENGER STATISTICS.

Year.	Journey per Average Passenger. (Miles).	Revenue per Passenger Mile. (Cents).	Revenue per Passenger (Cents).
1909	32.85	1.928	63.053
1908	32.86	1.937	63.394
1907	31.72	2.014	64.600
1906	31.54	2.003	63.895
1905	32.21	1.962	63.985
1904	30.64	2.006	61.746
1903	30.10	2.006	60.720
1902	30.30	1.986	60.494
1901	28.58	2.013	57.941
1900	27.80	2.003	56.459
1899	27.89	1.978	55.816
1898	26.70	1.973	53.237
1897	25.04	2.022	51.163
1896	25.50	2.019	52.078

The passenger mile unit is one used by the steam railroads of this country and is practically the basis upon which passenger rates are fixed. Table IV, showing the average rate of fare of all the steam railroads of the United States, from the Interstate Commerce Commission reports, indicates that, despite fluctuations, this rate has been kept at practically 2 cents per passenger mile, resulting with the increasing length of ride in increased receipts per passenger.

As to American street railways, it has already been pointed out that, with the diminishing rate of fare and with the increasing length of ride per passenger at the flat rate, the rates per passenger mile, which vary directly as the fare and inversely as the length of ride, are rapidly diminishing.

METHODS OF DETERMINING STREET RAILWAY PASSENGER MILEAGE

On the steam railroad, due to the use of tickets, an accurate count can be kept of the passenger mileage. With street railways, however, no record is kept of the length of ride of each passenger, and, consequently, the average length of ride and number of passenger miles carried can only be approximated.

STREET COUNTS

The first comprehensive approximation of street railway passenger mileage of a large city of which I am aware was made by my firm on the lines of the Chicago City Railway in 1905. At that time, with the use of a large force of observers placed at all important traffic points and generally over the system at points of from one-half to one mile apart, a sufficient record was obtained for twenty-four hours of passengers on all cars to permit, by the use of certain formulas and with a separation of the transfers collected, a close approximation of the average length of ride, number of passenger miles carried, the average rate of fare per passenger mile and the approximate point of origin and destination of each portion of the traffic. A similar count with observers stationed on the street was made on the lines of the Pittsburgh Railways in 1906.

RIDING COUNTS

From the results of these two counts of passengers we determined that a sufficiently accurate result could be obtained at less expense by stationing observers on the cars instead of on the street. By this method one or two checkers were placed on an average of every tenth car, and an exact record was made of the number of passengers on and off at each stop. This gave the exact passenger mileage for the cars counted and by applying the average figures obtained to the total passengers riding for the period a very close approximation could be obtained. Counts of this character were made on certain of the lines of New York City by my firm and a plan devised by which similar results could be periodically obtained for the entire city system. We later in 1908 made such a count of the lines of the Toledo Railways & Light Company. These counts showed average lengths of ride varying from 2.5 to 4 miles per revenue passenger and average receipts of from 1.26 cents to 1.84 cents per passenger mile.

A similar count made upon the lines of the Philadelphia Rapid Transit Company by my firm in 1910 showed that the average length of ride for the surface system was 2.71 miles per revenue passenger with equivalent receipts of 1.75 cents per passenger mile. On the subway-elevated system the ride was 3.96 miles per revenue passenger with receipts of 1.27 cents per passenger mile.

TRAFFIC DATA OBTAINABLE FOR EACH LINE

From observations of passengers on and off at each stop in connection with an analysis of the transfers there may be determined for each line and for the system the following:

(a) Average length of ride per passenger.
(b) Number of passenger miles carried.
(c) Average rate of fare per passenger mile.
(d) Proportion of passengers originating and delivered in each section.
(e) Approximate destination and routes of passengers.
(f) True average of number of passengers per car for a given period. (Indicating density of traffic.)

The results of such a count differentiate sharply the profitable and unprofitable lines of the system. While the receipts per passenger mile on any line may be comparatively small the density of traffic may be such that the operating expenses per passenger mile are correspondingly small and the operation of the line may be profitable even with a large average haul. From the results of these observations it is possible to calculate the distance on any line for which a 5-cent ride may be furnished at a profit, or the distance equivalent to the cost of service per passenger represented by operating expenses and a fair return upon the investment. If the average ride per passenger is within this distance the line can be operated profitably. If the average ride upon such a line is greater than this distance it is possible to calculate from the observations the distance it would be necessary to shorten the fare limit on the line to produce an average ride that would be profitable.

In other words, this method renders it possible to determine the length of profitable 5-cent fare limit on each line within a close approximation. The operating expenses per passenger mile for each line are obtained by dividing the operating expenses per car mile of the system by the true average number of passengers per car of that line, which is one of the results obtained from the count, thus correcting the expenses for density of travel. Such a division of operating expenses, while not strictly accurate as between the lines on account of variation of speed, weight and type of cars, furnishes within limits an accurate comparison, and, if desired, allowance can be made for these factors. A similar calculation can be made for fixed charges or return on investment. Division of the cash receipts per passenger for each line by the summation of the operating expenses per passenger mile plus the fixed charges or return on investment per passenger mile for the same line gives the length of ride for which the cost of service equals the receipts.

Many other instructive results may be obtained from these passenger counts. With the increasing use of platform doors and prepayment of fares, periodical checks of traffic can be made in this manner at a moderate expense, resulting in valuable information for the scientific treatment of the rate question.

TIME OF SERVICE

As an instructive comment on the unreasonableness of reducing fares at rush hours by the sale of workmen's and other reduced tickets, the estimate which we have made of the annual income account of the extra motor car operated only at rush hours on the Philadelphia surface system, shown in Table V, will be of interest:

Table V.—Estimated Annual Income of the Extra Rush-Hour Motor Car.

Receipts	$2,664
Operating expenses	1,884
Net earnings	$780
Interest, taxes and depreciation (10 per cent on cars, power plant, car houses and shops)	1,500
Loss (exclusive of fixed charges on track and line)	$720

It should be noted that in this case the receipts are the result of 5-cent cash fares with 3-cent exchange tickets and a limited number of free transfers. This estimate indicates that the greater the number of passengers carried at the 5-cent fare rate by these extra cars the larger would be the loss of the operating company. A reduced rate during the rush hours would enlarge this loss by the amount of such reduction. While it is probably not possible to improve this condition by increasing the rates during rush hours, the large cost of this extra service should be kept in view in the fixing of rates.

SUMMARY OF RECOMMENDATIONS

From a study of the methods used in the past history of this industry and from observation of traffic conditions and rates upon city electric railways, the following method would seem to be a practical solution of the problem:

1. Determine for each line the distance for which the cost of service per passenger mile on that line (including a reasonable return on investment) equals the receipts per passenger mile at 5 cents per passenger, or the base rate of fare.

2. For each line fix the limit of a central 5-cent fare zone

which will result in an average length of ride equal to this distance.

3. Adjust the limits of this central zone to correspond with a practicable point for each line. In order to work out a practical system some lines will, of course, show a loss in operation which must be balanced by an excess profit on others.

4. For the portions of lines outside of this central zone, construct outlying 3-cent fare zones, calculating the distance on each line for which such additional fare would equal the total cost of service. It is believed that the rate of fare for outlying zones, as a matter of expediency, should be less than 5 cents and also that 1 cent or 2 cents additional fare for such zones would not usually be desirable on account of the inconvenience of the additional payment for the short ride involved. The local ride in such outlying zones would cost 5 cents.

5. With regard to transfers both in the central and outlying zones, either free transfers or transfers at a charge equal to the outlying zone fare could be used, dependent on the area to which it was found desirable to extend the zone limits. In other words, a charge of 3 cents for a transfer would permit of considerably larger zone areas than with free transfers, and in many cases the charge for transfers would eliminate the necessity of establishing the outlying zone. On the other hand, the use of free transfers has tended to stimulate traffic and with a high enough rate of fare has some desirable features. If 3-cent tickets for outlying zone fares and 3-cent transfers were used, the same ticket might be interchangeable.

The comprehensive nature of this problem and the difficulties in the way of working out a schedule of rates for any electric railway system will be appreciated when it is considered that there are required the following determinations:

1. The amount of investment or value of the property upon which a return must be earned unless the amount of outstanding securities be used.

2. The reasonable rate of return on this capital value unless the interest and dividend rates of outstanding securities be used.

3. Division between lines on the passenger mile basis of operating expenses and return on investment, with corrections where desirable for speed and weight of cars and for segregation of physical property.

4. For each line the length of average ride which will yield a reasonable profit at 5 cents or other base rate of fare, fixing zone limits for each line corresponding with the maximum ride allowable for these fares.

MEMORANDUM BY C. S. SERGEANT, VICE-PRESIDENT BOSTON ELEVATED RAILWAY

In reply to your favors of Aug. 5 and Sept. 18 upon the subject of rates and fares for transportation of passengers, it seems to me that your schedule of the factors which govern transportation rates, or should govern them, is a very complete outline of the elements which should be taken into account. I can only give a few general views on the subject.

I am quite sure that street railway managers in general do not need to be convinced that existing rates for transportation of passengers, both in this country and abroad, are much too low to give a revenue sufficient to perform a suitable service, properly to maintain the property and provide for depreciation and for reasonable rates of interest upon the investment.

The practical question seems to be whether or not existing charter limitations or public opinion will prevent, and will continue to prevent, raising the fares to meet this situation. No general answer can be given because in some instances it may be possible to raise fares and in others not.

Again, it is by no means certain that an increase in the rates would in all cases yield more gross or net revenue. If the general public is to be convinced of the necessity for an increase of rates it must be shown the factors of expenditure, capitalization and other elements which enter into the problem. To do this would be difficult, perhaps not always feasible. But in view of the tendency to publicity accounting as required by laws governing public service corporations, increasingly prevalent, may we not expect that it will be more easy in the future than it has been in the past to demonstrate that a business is being done at a loss or a margin too small adequately to provide for depreciation and maintenance?

RESULTS OF THE COMPANY CONCERNED

Assuming an instance in which this is possible, will it not then depend upon the particular case and the showing of net income and maintenance which can be made by the company concerned rather than on the general principles which ought to govern the transportation rates, irrespective of the ultimate net results to the company?

It is frequently stated that in city passenger business, even in a dense population, a rate of at least 1½ cents per passenger mile should be received to provide proper compensation. Steam railroads, which make suburban season tickets or commutation rates frequently not exceeding 7½ mills to 9 mills per passenger mile, are prone to state that there is no profit in the business, and there is little doubt that this statement can be substantiated. They do, however, often make lower season ticket rates for the longer distances, which is precisely contrary to the principle we would seek to establish of obtaining additions to our rates for the longer rides. In their case the theory underlying this rate is presumably that of inducing, by a special rate to the bread-winner of the family, a family to settle at a point where they will contribute materially in the course of a year by the local fares which the family other than bread-winner pay to the revenue of the railroad.

OVERLAPPING ZONES

This principle is not capable of application to street railway fares, and changes, it would seem, ought to be made rather in the direction of providing overlapping zones than by disturbing the unit of fare.

Obviously the first and simplest method of increasing fares would be to secure the abandonment of free transfers, which, where the fare is universal, have no logical basis for existence. Straight zone limits, however, always create a feeling of hardship in persons living near the boundary line of the zone who may have to pay two fares for a very short ride.

It has occurred to me that in many cities, if there could be a central zone surrounded by an outer zone, so far as riding across the central zone is concerned, two fares might be properly demanded; that is to say, the suburban rider by such an increase would pay no more than he now does for his daily ride, but if he wished to ride from one outer zone across the central zone into another outer zone he would have to pay another fare. Such a system would tend to restrict the length of the rides and perhaps to bring them within the scope of a 5-cent fare.

MEMORANDUM BY WM. J. CLARK, MANAGER OF TRACTION DEPARTMENT, GENERAL ELECTRIC COMPANY

So far as I can ascertain, no successful application has ever been made to Parliament by a tramway or local transportation company in the United Kingdom to increase its passenger rates above those fixed in its charter.

During recent years there have been some changes in passenger fares on certain of the London Underground or similar railways, which, in a few cases, have resulted in obtaining increased rates on certain classes of traffic, but these have all been within the maximum prescribed by the charters of these companies.

If I recollect aright, the District Underground—so called—whose Parliamentary grants provided for three classes of passenger traffic with fares charged according to distance,

has, since its electrification, succeeded in securing a slight advance in fares for certain classes of its traffic. At any rate, this was done by the Metropolitan Railway Company in 1907, I think dating from July 1 of that year. The Metropolitan is the system which operates the Inner Circle —so called—in conjunction with the District Underground. The chairman of this company, at its annual meeting held about Feb. 1, 1908, remarked thereon as follows:

"The effect of the small advance in fares made in co-operation with the other London companies has increased the average receipts per passenger from 1.377 pence to 1.407 pence; that is, for the total number carried."

The Central London Railway commenced its operations in 1900 with a flat fare for ordinary passengers of 2 pence. Dating from July 1, 1907, this rate was increased on long-haul passengers to 3 pence. It should perhaps be explained that the average rate received per passenger on this system is affected by the issuing of workmen's tickets, etc. In the semi-annual report of the Board of the Central London Company of June 30, 1907, the following statement appears:

"After careful observation and inquiry the directors decided, though with much regret, to abandon the system of charging a uniform fare and to adopt the increased charge of 3 pence for passengers traveling beyond seven or eight stations, adhering to the fare of 2 pence for all lesser distances."

The chairman of the company, at the shareholders' meeting when this report was presented, remarked "that in the face of the new competition (electric buses) they (the board) saw that it was impossible to charge 2 pence for short distances as well as for longer routes, and therefore they had found it necessary to alter the fares. As a result of the extra charge of 1 penny, there was a difference of £60 to £70 a day in the receipts, which they (the board) considered satisfactory."

At the next semi-annual meeting of the company, held Feb. 5, 1908, no particular reference was made to the results secured from the increase in fare, but a long discussion occurred over the fact that there had been a large decrease in passenger traffic. Strange to say, however, a goodly portion of this decrease had occurred in workmen's travel upon which no increase in fare had been made, this being only 1 penny over the entire length of the line—approximately six miles. This rate is also equivalent to that charged for the shortest ride on the competing buses.

The remainder of the decrease was plainly attributable to the competition from motor buses.

At the next semi-annual meeting of the company, held Feb. 4, 1909, at which the report for the half year ending Dec. 31, 1908, was submitted, it was stated that there had been an increase of 5,350,003 in the number of passengers carried during the half year, the average receipts per passenger being 2.03 pence, as compared with 2.01 pence in the half year ending December, 1907, the cost per passenger being 1.02 pence, as compared with 1.28 pence in the corresponding period.

It is regretted that the semi-annual reports of this company from this period up to Jan. 30, 1911, throw but little light upon the actual result secured through advancing rates of fare. This is for the following reason: The competition from motor buses has had a more important effect on the traffic of all local London railway companies than has anything else, and since its first appearance in 1905 and 1906 there have been wide differences in its severity.

At the outset, and for a few years thereafter, a wild craze for their introduction existed and the number which were put in service was astounding. Then it was discovered that the operation of these vehicles was far from profitable; principally because of poor construction and design. This resulted in nearly all of those originally installed being taken out of service and a return to the use of horse vehicles.

More recently better designed and constructed motor buses have been put into service and their use is increasing rapidly.

It should perhaps be stated that so far as I can ascertain there was little objection raised by press or public to the increase in fares being made by the companies above mentioned.

MEMORANDUM BY H. G. BRADLEE, PRESIDENT STONE & WEBSTER MANAGEMENT ASSOCIATION

Sooner or later the street railway companies throughout the country will have to modify their present system of charges. They may possibly adopt a zone system similar to that used abroad, or some entirely different basis may be worked out, but it is perfectly clear that some change must be made eventually if the lines are to be extended further and further from the center of the city, which seems inevitable. Such a change in the basis of charge can only be brought about after the public have been educated to the fact that there is a limit to the distance which a passenger can be carried for 5 cents, and after they have been given, in a general way, some information to show what this limit is.

I think it is possible to show definitely in figures the distance which passengers may be carried for 5 cents with a reasonable profit, and I should be glad to see our committee report to the convention that we have been far enough into the matter to believe that this is a possibility and to recommend that a new committee be appointed which will endeavor during the next year—first, to determine a basis by which such calculations may be made, and second, to obtain, as far as possible, from a number of companies information which may be useful to show either the distance to which passengers may be carried in each of the prominent cities of the country, or at least enough information to throw some light on the average distance in such cities.

With regard to the particular method which I have suggested, this is, of course, only one way of going at the problem, and I have no doubt that there are other ways of arriving at the desired results, and very likely something simpler and clearer might be worked out. I do think that it would be very helpful to the entire street railway industry if we could place in the hands of every street railway man in the country definite information which would enable him to figure out how far his road could afford to carry passengers for 5 cents, and it would be still more helpful if we could furnish him with similar information with reference to other cities which he might use in public discussion and in educating the particular community which he serves. Moreover, if all of the companies were working along the same line I think we should very shortly see a decided improvement in the public sentiment on this question.

SUPPLEMENTARY MEMORANDUM BY MR. BRADLEE WITH REFERENCE TO DISTANCE WHICH URBAN ELECTRIC CARS MAY BE OPERATED WITH PROFIT FOR 5-CENT FARE

If four factors with reference to a company's business are known, it is possible to figure accurately the distance which cars may be operated with profit for a 5-cent fare. The four items to be known are as follows:

First—The total cost per car mile of operating expenses, taxes, depreciation and obsolescence;

Second—The average number of 5-cent fare passengers carried per half round trip;

Third—The investment made in the company's property for each $1 of gross business;

Fourth—The percentage return on the company's investment which must be earned to attract capital freely to the business.

The first three of these items can be obtained with reasonable accuracy for any property; the fourth item is more indefinite, but may usually be determined within comparatively narrow limits.

Herewith are published two sets of curves, for one of which I have assumed that an average investment of $4 is necessary for each $1 of gross earnings, and in the other that an average investment of $5 is necessary for each $1 of gross earnings. In both I have assumed that 8 per cent must be earned on the company's investment freely to attract capital.

Considering the first of these sets of curves, namely, that based on $4 investment per $1 of gross earnings, the average distance which cars may be operated profitably may be figured as follows:

Eight per cent on $4 is 32 cents; therefore, 32 cents must be set aside out of each $1 of gross earnings to provide 8 per cent on the investment.

The receipts per half trip equal the average number of 5-cent passengers per one-half trip times 5 cents, as shown in Table VI.

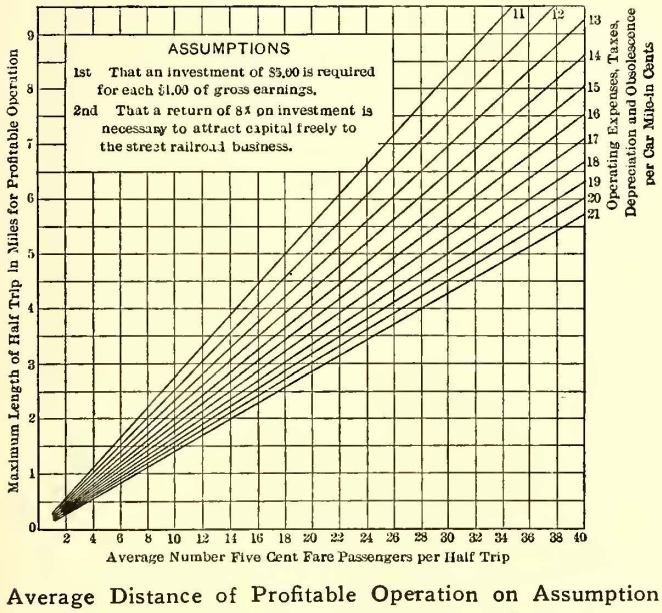
TABLE VI.—RECEIPTS PER HALF TRIP WITH DIFFERENT TOTALS OF PASSENGERS.

Five-cent passengers per one-half trip	Receipts per one-half trip	Five-cent passengers per one-half trip	Receipts per one-half trip
10	$0.50	21	$1.05
11	.55	22	1.10
12	.60	23	1.15
13	.65	24	1.20
14	.70	25	1.25
15	.75	26	1.30
16	.80	27	1.35
17	.85	28	1.40
18	.90	29	1.45
19	.95	30	1.50
20	1.00		

TABLE VII.—AMOUNT AVAILABLE FOR OPERATING EXPENSES AND TAXES WITH OPERATING RATIO OF 68 PER CENT.

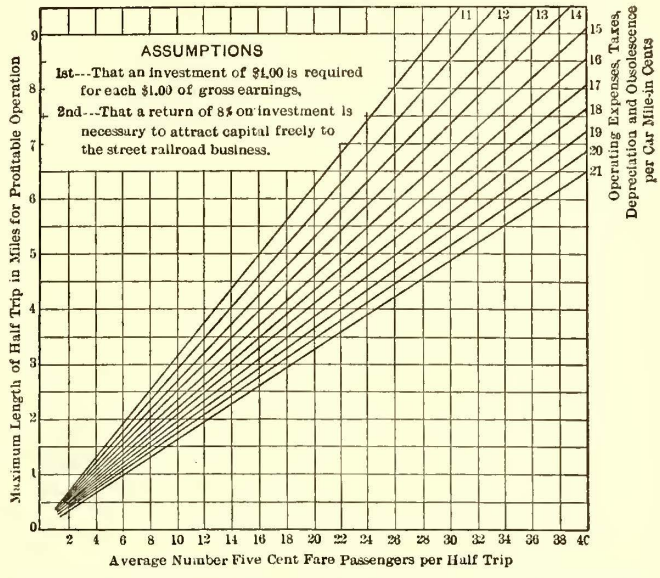
Five-cent passengers per one-half trip	Amt. available for operating expenses per one-half trip	Five-cent passengers per one-half trip	Amt. available for operating expenses per one-half trip
10	$0.34	21	$0.71
11	.37	22	.75
12	.41	23	.78
13	.44	24	.82
14	.48	25	.85
15	.51	26	.88
16	.54	27	.92
17	.58	28	.95
18	.61	29	.99
19	.65	30	1.02
20	.68		

If 32 cents is required per $1 of gross earnings to provide 8 per cent on the investment, 68 cents will remain for operating expenses, taxes, depreciation and obsolescence. In other words, 68 per cent of the company's receipts will be available for these items. Table VII may, therefore, be easily derived from the preceding by taking 68 per cent of the receipts per half trip as the amount available for operating expenses, taxes, depreciation and obsolescence per half trip.



Average Distance of Profitable Operation on Assumption that Investment of $4 Is Required for Each $1 of Gross Earnings

The maximum length of a half trip in miles which can be operated profitably may now be obtained by dividing the amount available for operating expenses, taxes, depreciation and obsolescence per half trip by the operating expenses, taxes, depreciation and obsolescence per car mile.



Average Distance of Profitable Operation on Assumption that Investment of $5 Is Required for Each $1 of Gross Earnings

TABLE VIII.—BASED ON AN INVESTMENT OF $4 IN THE PROPERTY FOR EACH $1 OF GROSS EARNINGS

Operating expenses, taxes, depreciation and obsolescence in cents per car mile	Maximum length in miles of half trip with average of— 10 5-cent passengers per one-half trip	20 5-cent passengers per one-half trip	30 5-cent passengers per one-half trip
11	3.08	6.16	9.24
12	2.83	5.66	8.50
13	2.62	5.24	7.85
14	2.43	4.86	7.28
15	2.26	4.52	6.80
16	2.12	4.24	6.37
17	2.00	4.00	6.00
18	1.89	3.78	5.68
19	1.79	3.58	5.37
20	1.70	3.40	5.10
21	1.62	3.24	4.85

TABLE IX.—BASED ON AN INVESTMENT OF $5 IN THE PROPERTY FOR EACH $1 OF GROSS EARNINGS.

Operating expenses, taxes, depreciation and obsolescence in cents per car mile	Maximum length in miles of half trip with average of— 10 5-cent passengers per one-half trip	20 5-cent passengers per one-half trip	30 5-cent passengers per one-half trip
11	2.72	5.44	8.17
12	2.50	5.00	7.50
13	2.31	4.62	6.93
14	2.15	4.30	6.44
15	2.00	4.00	6.00
16	1.88	3.76	5.63
17	1.76	3.52	5.29
18	1.67	3.34	5.00
19	1.58	3.16	4.74
20	1.50	3.00	4.50
21	1.43	2.86	4.29

A similar calculation would give the maximum length of a half trip on the assumption that $5 of investment is required for each $1 of gross earnings.

The results of these calculations would be as shown in Tables VIII and IX.

MEMORANDUM BY E. C. FOSTER, NEW YORK

Obviously, the solution of this matter of fares means as well the solving of perhaps the most vital problem confronting our business, that of a return upon required investment commensurate with the direct service afforded, the risk involved and the substantial indirect value to the communities served. Certainly there seems to be every reason why an industry involving such an immense invest-

ment, which acts as a convenience to so many of our people every day and during all hours of every day in each year and yields to its employees a much higher rate of wages than the average in many other lines, should be entitled to earn at least as great a return upon its capital as other and far less important enterprises. Our association has heretofore been favored with valuable papers on this subject, equally helpful discussions have resulted, and the fact that, so far as I know, no definite action has anywhere been taken to put into effect any of the remedial measures suggested impresses one as indicating the magnitude of the difficulties to be met with in the application of the suggested plans.

To bring about such an end, the first thought is the matter of reducing operating expenses, but there appears to be little opportunity to accomplish much in this direction. It is conceded that labor should not suffer and the best we can hope for in other operating items is that they will remain stationary. It would seem, therefore, that the practical thing to consider is the rate of fare and the length of ride provided for a single fare. In order to plead our case successfully, it is necessary to refer to the early development of transportation lines, the evolution from stage coach to horse car, to cable car and finally to the electric car of to-day. When doing so we should not fail to point out the insidious way in which the rides have lengthened and the errors of judgment which have been made in calculating operating costs and expected returns.

EARLY CONSTRUCTION

Early track construction consisted of rails laid and affixed permanently to a stringer running parallel with the street, resting on cross ties. The rails were light in weight and in size about 1¼ in. by 2½ in., spiked directly to the wooden stringer. The ballast used was that which had been excavated to permit of placing cross ties and stringers, no attempt being made to create a more substantial structure by use of gravel, as is the case to-day. Paving, except in the center of a few of the larger cities, was almost unknown, and in many of the Eastern cities, where used at all, consisted of common field stone, costing about 75 cents to $1 per yard, and stone from the ocean beach at a slightly higher price. Equipment can hardly be compared, the cars and horses used in the early days representing but a small fraction of the cost of the modern electric car. Yet even in those days the rate of fare established was a 6-cent cash or a 5-cent ticket for a ride which averaged not more than 1½ miles, while passengers traveling distances of from 8 to 12 miles were required to pay from 12 to 20 cents, and even on that basis many of the pioneer roads were dismal financial failures.

What is commonly known as the horse railroad did not receive a great deal of attention nor acquire much prominence until about the year 1870. Between that and 1890, however, these roads were operated by men of ability, and in the larger cities seemingly became moderate dividend earners. In reality, however, they were not even the financial successes they appeared to be, because of the failure of the owners to lay aside funds out of the earnings to provide for replacements of worn-out property. During this period 5 cents had become almost universally adopted as the rate of fare, but, as already stated, this was done without provision being made for replacement costs. Up to this time comparatively few burdens had been imposed upon the railways through franchise grants. Beginning with the year 1884 and continuing through 1888, the adoption of electricity as a motive power for street railway cars was discussed and its installation begun, the road at Appleton, Wis., constructed in 1886, being practically the first commercial venture with the new method of locomotion.

Once begun, however, the evolution of the horse railroad into the electric railroad was extremely rapid, and the necessary equipment was soon installed on many lines at great expense, much of this expense being due to the fact that the new motive force was in the experimental stage, and the cost of much experimental work necessarily was naturally borne by the railway companies in the rebuilding of their lines. Despite the incipient state of the art at this time, those in charge of the transportation companies did not hestitate to risk the expenditures of enormous sums of money, to say nothing of possible loss of reputations for this early adoption of electricity, in the discarding of the old for the new traction force, and it is probably not too much to say that, had it not been for these pioneers and the incentive thus given to the development of electrical motive power, its application to city and interurban transportation lines would still be an accomplishment of the future or, at best, have been many years delayed. It is easy to realize how greatly this would have retarded the growth and prosperity of American cities, to say nothing of the rural districts so splendidly served by the interurban railroads of to-day. The great sums required to rebuild the roads could not usually be raised through local subscriptions, or provided from earnings, as it has been possible to do with the comparatively small amounts required for horse railroads, and, as a result, the properties, in many instances, were acquired by new owners who were in a position to command large amounts of capital.

As was to be expected, many of these new owners were inexperienced in transportation matters. There were others among them who viewed the new venture much as a child does a new toy, and it was this combination of inexperience and enthusiasm which, to my mind, was largely responsible for the effort to obtain increased earnings by the wholesale adoption of the free transfer system. However, this is not the only condition that these conditions created, for by means of glowing prospectuses the idea was soon instilled in the public mind that street railways were veritable gold mines in earning power. Then commenced the placing of municipal and other burdens upon these supposedly prosperous railway corporations; taxes were increased, demands for better service began to pour in, higher rates of wages had to be paid and, with the rate of fare remaining unchanged, profits began to disappear.

ARREST DECLINE IN NET EARNINGS

The problem now confronting us is to arrest the decline in net earning power and give to our railway companies sufficient return to enable them to maintain their properties in first-class condition, provide for replacement of worn-out or obsolescent equipment or apparatus and give to those interested an opportunity to realize a reasonably substantial remuneration for capital risked and time, physical and mental effort expended. All these conditions must be adequately cared for in order that the public may be satisfactorily served. It would seem to be necessary, in order to bring such a condition about, that free transfers be materially curtailed, that exchange tickets at an additional cost be substituted therefor, that no further extension of rides for one fare be granted, that a fractional amount of the basic rate be charged for these longer rides provided, or the zone system adopted, that no burdens for maintaining public highways be imposed upon electric railways and that the whole method of taxation be revised and placed on a more logical and equitable basis.

One of the questions which will naturally arise in any campaign having for its object the realization of an honest return on the investment is as to what really constitutes a satisfactory profit. It would seem that this is a question that must more or less depend upon the individual case, but in every case there should be substantial recognition of the creative force responsible for the unit, of the burdens assumed, the risks taken and the years of early development when profits were unknown. In too many cases is the tendency displayed to ignore the rights of the man with the courage to blaze the way to that financial profit for which he takes the risk and without which incentive enterprise

would cease. Perhaps in no other industry is this tendency to grant the right to only limited return, when viewed and discussed from the outside, more marked than in our own line of work.

As justification of the necessity for a satisfactory earning power, we may well point to the many lines of business which net anywhere from 15 to 30 per cent in each year, and in demanding our permit to work for a good return our critics should realize that an electric railway to-day is not in any sense comparable with the street railways of two or three or four decades ago. The extensions, rehabilitation and maintenance are fully 100 per cent more costly, and the reasons for this are readily seen in the following comparisons:

Rails to-day weigh from 70 to 120 lb. per yard, are laid upon a concrete substructure or upon ties 6 in. by 8 ft., spaced 24 in. apart, rock and gravel ballasted. Rails in the early days weighed from 30 to 40 lb. per yard on light stringers and ties with no ballast other than the previously excavated dirt. The paving requirements to-day usually mean granite blocks of specified dimensions, vitrified brick or wooden blocks, and in many cases necessitate the laying of concrete on top of the ballast to provide a base for the pavement. Pavement in the early years was hardly in evidence. The cost of track construction to-day is from $5 to $6 per running foot of single track, while in the early years $1.50 to $2 was ample.

The differences in equipment are still more marked, the early installation consisting of a one-horse car seating twelve people and a two-horse car seating twenty-two people, while to-day the cars in most general use seat anywhere from forty-two to sixty people; the cost of the horse car and horses was about $2,400 for the operation of one car, while that of the electric car and equipment of the type referred to is from $5,000 to $12,000 per car. Again, consider the buildings for housing cars and horses, usually light frame structures costing certainly less than 50 per cent of those of the present day, to say nothing of the expenditures now required for the installation of power stations, overhead lines and electrical equipment.

One mile and a half was perhaps a good average horse car ride with the 6-cent cash and 5-cent ticket charge, as heretofore stated, and an additional charge for transfers and for longer rides, the latter of which ran the cost as high as 12 cents. To-day a 20-mile ride for 5 cents is not uncommon, a situation which has been brought about through the increased area of municipalities, some of which have been increased by more than 100 per cent, and by the installation of the free transfer system by municipal requirement or voluntarily by the companies themselves.

ADVANTAGES TO THE PUBLIC

It is hardly necessary to call attention to the advantages which have accrued to the public aside from the quick, ready and comfortable means of transportation provided. The construction of these railroads has been a powerful aid to the relief of congested districts by enabling the population to obtain cheap homes in outlying districts, thus promoting sanitary and healthful conditions and, from a material point of view, enhancing the prosperity of municipalities enormously through increased taxable values and adding to the efficiency of the individual by affording him the opportunity for speedy movement in the pursuit of his daily toil.

If it were possible to develop a study of the value of the electric railways in this last regard, it would establish a powerful argument why the individual should be willing to approve plans such as are herein suggested. Distances that are now traversed in from ten to twelve minutes required forty-five to sixty minutes in the past. This saving in time reduced to a dollar and cents basis would produce an impressive total.

Personally I have evidence that desirable changes could be brought about if the public could be fully informed and would carefully analyze the evidences we are ready to submit, and the railways would thus be enabled to put into effect plans such as have been heretofore suggested and which contemplate the material curtailment of the free transfer:

The substitution of exchange tickets at a fractional cost;

That no extension of one-fare rides beyond those at present in effect be granted;

That a proportional cost of the unit fare be charged as extensions of existing lines are constructed, or the zone system adopted;

That burdens upon the railways for the maintenance of public highways be eliminated; and

That the present methods of taxation be revised and placed on a more logical and equitable foundation.

HEARING ON EXPRESS PLANS OF BOSTON ELEVATED RAILWAY

The Massachusetts Railroad Commission opened at Boston on Nov. 24, 1911, the hearing in connection with an appeal of the Boston Elevated Railway for the right to carry freight and express in Boston, against the previous adverse action of the Boston City Council. More than 500 persons appeared at the offices of the commission in behalf of the company's petition, and the hearing had to be adjourned to the State House. Special cars were run from Worcester and other points to Boston to enable the residents of the cities affected to be present on behalf of the proposed service. The arrangements for the presentation of the company's case were made by Matthew C. Brush, assistant to the vice-president of the Boston Elevated Railway, counsel being represented by Arthur A. Ballantine.

Mr. Ballantine opened the hearing by stating that the company had brought its petition under Chapter 402, Acts of 1907, after two fruitless efforts to secure from the Boston City Council the privileges of a common carrier of freight and express. The company operated a metropolitan system which was the key to the transportation service on the streets of the Boston district. The system was not fully taxed at all hours and places, and outside communities were demanding the economic benefits of modern express facilities. The rights desired by the company would, if granted, be subject at all times to the regulation of the local authorities and the commission. He then called upon Mr. Brush, who, in stating the company's plans and desires, said in part:

"Our company anticipates conducting this business in a manner similar to that in which freight and express service is conducted in the 823 other cities and towns. One or more terminals will be established as near the center of the metropolitan district of the city as conditions will permit. From this terminal cars will be operated to terminals in the outlying districts, over such routes and in such manner as will not interfere with the passenger business. The company will receive and deliver baggage, express and freight at the various terminals, occupying a position in that respect similar to that occupied by the steam railroads in their freight business, without discrimination or favor to any person or corporation. All freight or express so received will be transported over the rails of the company to outlying terminals or to connecting routes in cars very similar in design to the large passenger cars. The company will transport in these cars articles in accordance with the schedule on file with the commission, such schedule including freight similar to that transported by express companies, and restricted to exclude, besides explosives, all articles and commodities the transportation of which may hereafter be prohibited by the Railroad Commission.

"The company intends if the petition is granted to establish first a terminal at Mott Street, Boston. This we believe to be a proper point at which to receive and ship goods,

and add other terminals in accordance with the traffic demands. All goods will be transported at a regular tariff, such tariff to be published and subject to inspection by the shipper and the public.

"It is impossible to state specifically at the present time the exact rates to be charged, but this, we believe, will automatically regulate itself. The Railroad Commission has jurisdiction in the regulation of rates, and we should assume, of course, that we would be governed by the regulations of the board at any future time in this connection.

"We appreciate that our primary duty is in the proper conduct of our passenger business, but we also believe that there is opportunity for us to act as common carrier without interfering with the passenger service.

"In other cities and towns where this service is in effect there has been no difficulty as a result of interference with the passenger traffic. Moreover, the Railroad Commission has distinctly stated in previous orders that the exercise of authority to operate freight and express cars shall in no way alter or abridge the duty and obligation of the company relative to the transportation of passengers, nor in any way interfere with the conduct of passenger service.

"We do not anticipate stopping freight and express cars on tracks in the highway used for passenger service for the purpose of unloading or loading. A map filed with the board shows that in Massachusetts there are thirty-seven electric railways with freight and express rights in 180 towns, and we believe that Boston furnishes a proper terminal for most of these companies to assemble and distribute merchandise susceptible to proper transportation by this means."

Bentley W. Warren, counsel for the Bay State Street Railway, appeared for residents of the company's territory, representing about 1000 miles of electric railway in Eastern New England. The Bay State Street Railway operated an electric express service in twenty-eight municipalities in Massachusetts, and had acquired rights to conduct this business in seventy-nine cities and towns of Massachusetts, Rhode Island and New Hampshire. All these communities were closely connected with Boston, and needed the service which the Boston Elevated Railway could give. He filed a map of electric express service and grants in Massachusetts which showed that Worcester and Boston were the only large cities which broke the chain of complete service across the State in both directions. He filed with the board petitions from sixty-five boards of aldermen and selectmen urging the commission to grant the petition, and presented letters from twenty-two municipal officials testifying to the benefits of the existing service.

Several hours were then devoted to the presentation of cumulative testimony on behalf of the petition by municipal authorities, officers of boards of trade, trustees of public institutions, state legislators and prominent citizens. A. E. Paddock, Rhode Island Company, Providence, outlined the character of service performed by the trolley electric organization in his district, and C. V. Wood, traffic manager of the street railways centering at Springfield, spoke briefly of the feasibility of handling trolley express business without interfering with passenger traffic, the advantages of locating terminals in side streets, and the policy of letting others perform the work of collecting and delivering merchandise.

W. M. Butler, president of the Boston & Worcester Street Railway, said that his company would be unable to give a satisfactory and profitable service so long as the Boston Elevated Railway could not co-operate in the handling of freight and express traffic over its own system.

Answering several questions, Mr. Brush said that about seven cars would be required to start the business.

HEARING ON NOV. 27

At the hearing on Nov. 27 the principal opposition was voiced by the Boston Expressmen's League. In rebuttal, A. A. Ballantine, for the company, analyzed the opposition as coming almost entirely from existing express interests. He emphasized the point that petitions in favor of the company's project had been filed by no less than seventy-five municipalities. He reiterated the point that the company was determined to preserve the quality of its passenger service at all hazards, and stated that he failed to see the force of the argument that the establishment of the service would create a monopoly, as the facilities were to be placed at the disposal of everybody, including the expressmen themselves. It had been clearly shown that the people of Boston want this service. The Cost of Living Commission reported in favor of trolley express as a means of improving the conditions of living around Boston. Bentley W. Warren, counsel for the Bay State Street Railway Company, emphasized the absence of any opposition from officials of the Boston city government. He contended that the creation of an express monopoly by the use of electric railways for such service was a practical impossibility. Closing, he alluded to the strict control placed in the hands of the board, and said that if the scheme did not work well the commission could terminate its operation.

CHICAGO INVESTIGATION OF SMOKE ABATEMENT AND ELECTRIFICATION OF RAILWAY TERMINALS

At the municipal dinner given by the Chicago Association of Commerce on the evening of Nov. 28, the first official progress report of the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals was made public. This report, prepared under the supervision of the chief engineer for the committee, sketched the origin and progress of the investigation of the subjects assigned to the committee. A brief history of attempts at smoke abatement in Chicago was given, which concluded with the 1910 report of the smoke inspector of Chicago, in which the statement was made that there was need of a radical change in existing conditions of smoke abatement, so far as the railways were concerned. The electrification of railway terminals within the city was recommended in explicit form by the smoke inspector.

The recent history of the agitation for railway terminal electrification in Chicago was taken up by the city authorities and by the Chicago Association of Commerce in October, 1909. A committee of experts appointed by the Association of Commerce had reported favorably on electrification as a mechanical problem, but the experts were less confident as to the financial feasibility of the plan. About that time co-operation between the city administration and the Association of Commerce was suggested, and the formation of a joint committee of investigation was proposed. It was understood that the railways would provide the funds for the promotion of the investigation. At a meeting of the association held in September, 1910, the leading representatives of several railways declared that the electrification of the railway terminals in Chicago would involve a great expense which would have to be borne by the commerce of the city and that immediate electrification was premature. Smoke abatement, it was added, need not depend wholly upon electrification. At a meeting of the Chicago Association of Commerce held on March 18, 1911, a general committee of eighteen was appointed to investigate the whole subject. This committee consisted of representatives of the city, steam railway executives and other citizens. Jesse Holdom was appointed chairman and Frederick H. Rawson secretary. It is this committee which has charge of the elaborate investigation which is being conducted.

The engineering staff organized by this committee is as follows: Chief engineer, Horace G. Burt; electrical engineer, Hugh Pattison; terminal engineer, Louis H. Evans;

mechanical engineer, Theodore H. Curtis; consulting electrical engineers, Gibbs & Hill, New York; consulting mechanical engineer, George R. Henderson, Philadelphia; assistant engineer, James Walker; editor for the engineers' staff, Benjamin C. Burt. Headquarters are maintained in the People's Gas Building, Chicago.

The scope of the investigation includes: (1) A determination as to the necessity of changing the motive power of steam railways to electric or other power; (2) the mechanical or technical feasibility of such a change; (3) the financial practicability of such a change. In the scope of the investigation as to the necessity of changing the motive power of steam roads to electric or other power are embraced the following heads: (1) safety, (2) health, (3) comfort and convenience, (4) loss and damage. Under each of these heads are included the subdivisions "passengers," "employees," and "the public." Each of these subdivisions is in turn subdivided.

One feature of the investigation is the collection of information on yard locomotives, freight trains, freight transfer trains, passenger transfer trains and passenger trains operating within the city and in and out of the city. Much of the attention of the engineering staff so far has been devoted to the smoke-abatement portion of the problem, and much information has been collected on the subject. A definite conclusion has been reached in relation to the use of coke as locomotive fuel, and it has been decided to eliminate coke entirely from further consideration.

Such subjects as brick arches and stack blowers in locomotives, as well as down-draft furnaces, steam jets and under-feed stokers, have received attention. Various printed documents have been issued by the committee and a memorandum of maps has been prepared for the study of the territory or territories covered by the investigation. Various advisory committees to the general committee have been formed. One of these consists of motive power and mechanical representatives of railways operating in Chicago. Another consists of representatives of railway transportation departments who are discussing the subject of the proper forms to be used in providing reports of terminal train movements.

In concluding its progress report, the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals says that the investigation up to Nov. 24, 1911, has been chiefly occupied with the subject of locomotive smoke abatement. Nevertheless, the subject of the electrification of terminals has been kept constantly in view, and a beginning has been made in the consideration of it. Much time and attention have been given to developing the means of collecting data and information as to present physical and operating conditions. It is expected that in the course of the next few months progress will be made in the study of electrification. The report concludes:

"In proportion as it has progressed, the problems presenting themselves for solution have rather increased than diminished in number, and it is sufficiently clear, even at the present stage, that for the accomplishment of definite and valuable results much labor and considerable time will be required. The task imposed upon the committee proves to be one that is rather special, even unique, in scope and character, and while much may be learned from what has already been accomplished in various lines, yet very much will have to be done for the first time. And it is confidently hoped, and even believed, that if that which has to be done is well done the results will be of interest and value not only for the present time and place but for other times and places as well."

Belgrade is the only town in Servia which has tramways. All the lines, aggregating 19 miles, are operated by electricity. The tramways are owned by a Belgian company, which has a concession for forty-nine years.

PROGRESS IN METROPOLITAN AND THIRD AVENUE REORGANIZATIONS

A statement was issued on Nov. 28 by Guy E. Tripp, chairman of the joint committee of bondholders of the Metropolitan Street Railway of New York, giving a summary of the final plan of reorganization. The Interborough-Metropolitan Company, owner of a majority of the stock, has decided to accept the plan, which provides for an assessment of $12.90 per share. The original plan provided for an assessment of $17.67 per share.

An abstract of Mr. Tripp's statement follows:

"The final plan of reorganization provides for an assessment of $12.90 per share on the $52,000,000 stock of the Metropolitan Street Railway and the $600,000 of stock of the Central Crosstown Railway; the $4,000,000 of improvement notes of the Metropolitan Street Railway not in the hands of the receivers of the New York City Railway are also given the opportunity to participate on the payment of $129 for each $1,000 face value of notes. For this payment the stockholders and noteholders will receive for each share of old stock at $100 par value and each $100 face value of notes the following securities: $8.83 in new 4 per cent mortgage bonds, $5.30 in new adjustment bonds, $30.91 in new stock.

"There has been no change in the character or amount of securities offered to depositing bondholders. The total amount of securities that will be outstanding against the new company is $97,655,500, a reduction of nearly $42,000,000.

"The 5 per cent bonds will receive, as under the original plan, 50 per cent in new 4 per cent bonds and par in adjustment bonds. This includes accrued interest.

"The 4 per cent bonds receive as formerly 75 per cent in new adjustment bonds and 25 per cent in new 4 per cent bonds. This also covers accrued interest.

"The tort claimants are still given 100 per cent of their claims in new adjustment bonds and 50 per cent in 4 per cent bonds, thus giving them the same allotment of securities that is offered the 5 per cent bonds.

"The amount of money to be raised is substantially $7,300,000.

"I believe the committees have succeeded in working out a plan which does justice to the property itself as well as to the public interests. It keeps down capitalization and fixed charges to the minimum and at the same time gives the utmost consideration consistent with conservatism and due regard for the lessons of the past to the bondholders."

THIRD AVENUE RAILROAD

James N. Wallace, chairman of the bondholders' committee of the Third Avenue Railroad of New York, has published a statement of "facts as to capitalization and valuation of property." The existing capitalization of the old company to be readjusted is as follows: Capital stock issued at par for cash, $15,995,800; consolidated mortgage 4 per cent bonds "issued for fully 99 per cent of face value in 1900-03 in connection with electrification of road and subsidiary lines," $37,560,000; receiver's certificates issued at par, $2,500,000; total, $56,055,800. The underlying issue of $500,000 of first mortgage 5 per cent bonds outstanding is not affected by the reorganization.

In addition most of the net earnings since the appointment of the receiver in January, 1908, have been expended on the property. To the above there are added accrued interest on the 4 per cent bonds to Jan. 1, 1910, $4,324,680; and new cash, to be added by stockholders after deduction of receiver's certificates, $4,700,000; making a total of $65,080,480. The plan of reorganization provides for the issue of the following: Refunding 4 per cent bonds, $15,790,000; adjustment income bonds, $22,536,000; stock, $16,590,000; total, $54,916,000. The statement then adds:

"The dividends on the stock since 1864 have averaged

only 5.2 per cent and during the past twenty years have averaged less than 2 per cent. Most of the capital ($8,995,800) has been contributed in cash since 1895, and the dividends thereon from 1895 to 1907 averaged 3.18 per cent and have been nothing since 1907. The consolidated bondholders have received no interest since the July 1, 1907, coupon.

"The capital expenditures made by the Third Avenue Railroad, as shown by its unimpeached books of account and sworn reports, including expenditures by the receiver and current assets and cash in his hands Feb. 28, 1910, were proved to have been $68,954,593, or more than $9,000,000 in excess of the proposed new capitalization and outstanding first mortgage bonds. To the figures of Feb. 28, 1910, should be added accumulated net earnings for nearly two years.

"The cost of reproducing or duplicating the properties of the Third Avenue Railroad System was shown by competent evidence to be over $58,000,000, without any allowance whatever for the value of the franchises (which could not be now duplicated on as favorable terms) or for the value of the property as a completed system and going concern.

"The uncontradicted proof in the proceedings before the commission showed that the actual depreciation did not exceed $2,500,000 (the greater part of which has already been made up by the receiver), but the commission allowed for theoretical depreciation the sum of $11,807,691.

"The net earnings of the Third Avenue system since July 1, 1908, after deducting interest on underlying securities and taxes, have been as follows: Year ending June 30, 1909, $1,353,928; year ending June 30, 1910, $1,871,385; year ending June 30, 1911, $2,123,670."

The committee of bondholders of the Third Avenue Railroad has instructed its counsel, William D. Guthrie, to carry out the reorganization plan in accordance with the decree of the Court of Appeals, and, if possible, to make the plan effective before Jan. 1, 1912.

It is understood that, in view of the decision of the Court of Appeals and the interpretation of the public service commissions law which this involves, the New York Public Service Commission, First District, will ask for an amendment of the law at the forthcoming session of the Legislature.

INDEPENDENT MOTOR CARS IN GERMANY

The following information in regard to the use of storage battery and gasoline-electric motor cars for trunk line service in Germany is taken from a chapter on that subject in "Das Deutsche Eisenbahnwesen der Gegenwart," a two-volume book just published in Berlin.

Tests with storage battery passenger cars for trunk line service have been conducted in Germany since 1894. In the earlier cars the batteries were carried under the seats, where they were hard to get at, where they required a rather inconvenient form of seat and where they interfered with the heating. There was also some trouble from gas from the batteries. In later cars the batteries are carried in a low cab which projects beyond each end of the car. Most cars have series motors, but shunt motors were put in service in 1907 on the Limburg line and gave such satisfactory service that five cars of similar equipment were placed in operation early in 1911. The purpose of using shunt motors, of course, is to avoid resistance losses and to return energy to the batteries on down grades.

The Prussian Railways have built ninety-seven accumulator cars since 1907 and plan to have thirty-three more in service by the end of 1911. These cars are of the twin-unit or articulated type. Each half has three axles and the entire unit is 84 ft. long over all, including the buffers. Each half-car body, not inclusive of the battery cab which is at the end of the car, is 25.4 ft. long. Two of the three axles are placed under the storage battery cab about 5 ft. apart and the driving axle of each half is 25 ft. from the nearest front axle. The entire car has seats for eighty-two passengers and standing room for twenty-four others. The cars are lighted electrically and are heated by means of briquette stoves placed under the seats.

The metal framework of the battery chamber is lead-covered to prevent corrosion from fumes. Each chamber contains eighty-four cells, making a total of 168 cells per twin-motor car. Each battery has a capacity of 368 amp-hours when discharging 180 amp. This capacity is equivalent to a run of 62 miles on level track at a speed of 37.2 m.p.h. The current consumption is about 28.8 watt-hours to 32 watt-hours per ton mile. The greatest permissible current may vary from 160 to 200 amp. About 400 amp-hours are required to recharge the battery after it has been fully discharged.

The series equipments consist of two 85-hp motors, whereas two 115-hp motors are required for the shunt equipment. The controller has a deadman's handle whereby the circuit is broken and the emergency brakes applied in two seconds. The lamps are of the 80-volt tantalum type and of 25 cp each. All circuits are carried in asbestos cables.

The total weight of a twin car is 60 metric tons, and its cost is $20,000. During 1909 the average performance of each battery on these lines was 24,346 miles, and in one district an average of 31,760 miles was obtained. The expenses for operation and maintenance including interest on the investment were about 19 cents per motor car mile. 3.6 cents per mile being allowed for the maintenance and renewal of batteries. The battery manufacturer guarantees to have experts at all installations to show the employees how to maintain and charge the batteries in the best manner. An expert takes charge of no more than ten cars and four charging plants. The compensation of the battery company is on a mileage basis. It receives 3.6 cents for every mile made by the twin cars under their own power and 1.2 cents per mile for the mileage of trail cars. These figures are based on an average mileage of 18,600 miles per car per annum. If this figure is not attained, the user pays 0.6 cent for every missing motor car mile. The manufacturer agrees to deliver all materials for replacement, including acid and distilled water, etc., and owns all scrap. The railway company makes no charge to the battery company for hauling these materials to their point of use. This contract has proved very satisfactory to both parties. The batteries of the twin car run on the average about 43,400 miles before they require to be cleaned for good results.

Experiments with gasoline and gasoline-electric cars have also been undertaken in Germany because the economical employment of storage battery cars is thought to be limited largely to lines which radiate from large cities where cheap electrical energy is available. The maximum economical distance from the charging station is placed at 31 miles. The Württemburg State Railways now have four Daimler cars in service, while the Prussian-Hessian State Railways will have in service by the end of this year twenty gasoline-electric cars. These cars are 68 ft. in length with a cab at one end for the gasoline-electric machinery. The car accommodates ninety-five seated and standing passengers. The gasoline engine has six cylinders and is started by compressed air. The electrical equipment included a d.c. 90-kw, 650-volt generator and exciter, the latter being used also for lighting. The total hourly capacity of the series motors is 82 hp. At a 100-hp load the gasoline engine requires about 0.8 gal. of gasoline per hour. About two-thirds of this quantity is used in average operation. The cooling water of the engine is used for heating the car. The total weight of a complete car is 54 tons and its cost is about $14,600.

EXECUTIVE COMMITTEE MEETING OF TRANSPORTATION & TRAFFIC ASSOCIATION

A meeting of the executive committee of the American Electric Railway Transportation & Traffic Association was held at the headquarters of the association in New York on Monday, Nov. 27. Those present were: President, J. N. Shannahan, New York; W. O. Wood, New York; J. Stanley Moore, Syracuse, N. Y.; C. B. Buchanan, Richmond, Va.; Dana Stevens, Cincinnati, Ohio; H. E. Reynolds, Boston, Mass.; H. W. Fuller, Chicago, Ill.; A. Gaboury, Montreal, and H. A. Nicholl, Anderson, Ind.

The first order of business was a discussion of the resolution to dispense with the reading of papers in open meeting as presented at the last convention by W. B. Rockwell, manager Eastern Pennsylvania Railways, Pottsville, Pa. In accordance with a motion made by Mr. Stevens, the committee decided to adopt this plan so far as long reports are concerned. At future meetings the chairman of each committee which has a long report will be instructed to prepare and read at the convention an abstract of his report instead of the full report. The committee also decided that the secretary will call the attention of city and interurban roads to those papers and reports which are of particular interest to each class.

COMMITTEE ASSIGNMENTS

The executive committee then proceeded to indicate the lines which should be followed by the various committees appointed by the president. The first subject was "City Rules." It was suggested that a further elaboration of the prepayment car rules would be advisable. Upon motion of Mr. Buchanan, it was decided to arrange for a joint meeting of the committees on city and interurban rules, preferably before the annual meeting in January, to harmonize inconsistencies in the present city and interurban codes. The chairmen of both committees will also be asked to make a joint inquiry into all laws and public utility commission rulings to learn whether any of them conflict with regulations in the two codes.

Upon motion of Mr. Nicholl, the interurban rules committee will be asked to systematize terms and to endeavor to work together with the American Railway Association in the contemplated revision of that portion of the steam association's code which is applicable to joint steam and electric operation. This committee will also be asked to prepare rules on block signal operation, conferring, if necessary, with the block signal committee of the Engineering Association. President McCarter, of the American Association, will be asked to sign a letter prepared by the city and interurban rules committees, inquiring of member companies whether they have adopted the codes, and, if not, the reasons therefor.

Upon motion by Mr. Nicholl, a resolution was adopted that it would be desirable to have not less than 50 per cent of the members of the committees on city and interurban rules reappointed from year to year. It was felt that this practice would eliminate a great deal of the preliminary work which now has to be done by new members because of their unfamiliarity with the reasons which led to the conclusions of earlier committees.

The committee on the training of transportation employees will be asked to consider methods of engaging employees between the periods of their application and their acceptance, the training of interurban employees, forms for permanent records of employees, minimum breaking-in period for both city and interurban men, uniform records for use during the breaking-in period, regulations affecting the employment of trainmen, and merit and demerit systems. This committee will also be requested to arrange a meeting with representatives of the Claim Agents' Association to discuss problems of mutual interest.

In outlining the work for the committee on express and freight traffic, Mr. Reynolds suggested that it could do much good in compiling information on rates, hours of service, the desirability of adding pick-up and wagon delivery service, the design of terminal lay-outs, the laws relating to the handling of express and freight traffic by electric railways, and, in fact, any information that would be of value to companies which contemplated entering the express and freight field. The data so secured should be on file for reference in the secretary's office. The secretary will also ask the member companies what line of inquiry would be of most value to them.

It was suggested that the principal work of the joint committee on express and freight accounting should be a study of the ton-mile basis.

In discussing the work of the committee on passenger traffic, Mr. Moore said that previous committees had thoroughly covered the promotion of summer traffic through parks and the like. There was still much to do, however, in other lines, such as chartered-car rates, parlor cars, chair cars, winter resorts, the handling of foreign cars and interline tourist business.

Mr. Nicholl said that recently some travelers from San Francisco had purchased in their home city a combination ticket which included transportation over electric lines in Indiana.

Mr. Reynolds referred to the exhibit which his company had made at the New England Products Exposition as described in the ELECTRIC RAILWAY JOURNAL of Oct. 21, 1911, page 906. This display of the products along the lines of his company and the listing of land available for factory and other purposes had brought more than 2000 inquiries.

Mr. Buchanan had found it a good thing to sell mileage books which were not restricted to one person.

The suggestion was made that more through business might be obtained by increasing the number of "limited" cars. Mr. Moore said that it was desirable to educate the public to the advantage of these cars having but one or at most a very few stopping points in every town along the route instead of making many stops.

Mr. Fuller alluded briefly to the burden which many street railways must carry in cities where the working hours of almost all of the factories are alike. In Washington, for instance, he had been asked for a rush-hour service which would have given many of the cars only one load a day. It was desirable, therefore, that large employers of labor should be prevailed upon to change their labor schedule so that the traffic load would be spread over a longer period.

Mr. Fuller also suggested that the committee prepare standard definitions of such terms as dispatcher, car starter, day car, trip card, etc. Upon motion of Mr. Buchanan, it was decided to have the president appoint a committee of three to standardize the terms used by the transportation department.

The committee on schedules and timetables will be asked to consider such question as rules as to misses, carhouse records boards showing seniority and working lists, methods of keeping the time of trainmen, forms of detention reports, meal time and layover time, desirability of showing trippers and extras on the regular schedule and the operation of trains according to classification.

It was also the sense of the committee that a working timetable should include the speed limits permitted in the various municipalities, a list of surgeons and a list of stop numbers and the distances between them. It was pointed out by Mr. Wood, however, that it would be dangerous to include extracts from the rule book, as this might create the impression among the trainmen that the other rules were of less importance.

Upon motion of Mr. Nicholl, the president was requested to appoint a committee of three to work with a like committee of three from the Engineering Association to report on multiple-unit train operation.

There were no additional instructions for the committee on block signals.

The final business was the adoption of a motion made by Mr. Stevens that a committee of three be appointed to study the merits and demerits of the car mile, car hour, seat mile and other traffic units and determine their value as units of comparison of operating results on different properities.

The meeting was then adjourned.

HEARING BY MASSACHUSETTS COMMISSION ON FENDERS

The Massachusetts Railroad Commission gave a public hearing at Boston on Nov. 28 in accordance with Chap. 74 of the Acts of 1911, which requires the board to investigate the equipment of street cars with fenders and wheel guards and to report upon the subject to the next Legislature. The hearing followed various tests of the working of typical fenders on a track at Newtonville, Mass., as described on page 919 of the issue of this paper for Oct. 21, 1911. Many officers of the larger street railway systems in eastern Massachusetts were present, and the consensus of opinion as presented to the commission was that the modern fender and wheel guard cannot attain the maximum usefulness until the paving and street conditions at the top of the rail are much improved.

President W. A. Bancroft, of the Boston Elevated Railway Company, said that his attention had been attracted to the fender question about seven years ago by a cablegram received by him when on a European trip, requesting him to visit Liverpool, Eng., at the suggestion of the commission, to investigate the use of protective devices in that city. He became convinced that for Liverpool conditions the problem had been as nearly solved as possible, although it appeared that no fender could completely prevent the results of accidental contact with a moving car. The majority of injuries seemed to occur at the side of the car rather than at the ends. The good results at Liverpool were in large measure due to the smooth pavement, which permitted the carrying of the wheel guard within about 2½ in. of the rail. Liverpool had never had a human being pinned beneath a car since the present type of wheel guards was adopted. In Boston it was not feasible to carry any fender close to the rail, on account of the irregularity of the pavement. Gen. Bancroft said that 291 surface cars would soon be fully equipped with fenders designed by H. L. Libby, of the company. These cars were of the prepayment type, and were also equipped with two wheel guards surrounding the trucks. In the Newtonville tests the dummy was in no case pinned beneath the car but was pushed along or deflected by the guard, the protective equipment being lower than was possible in Boston on account of the smooth roadway upon which the track was laid. The Boston Elevated company had invested nearly $5,000,000 in streets and paving between and adjacent to tracks, and intended to improve this construction so that the guards and fenders might be carried lower. This work could not be done all at once, however. Temporary crossovers and carhouse transfer tables militated against carrying fenders as low as was desirable from the protective point of view. The company was keenly interested in the fender problem, but the result of its studies and experiments indicated that the best which could be done was to prevent human beings from being pinned under the equipment of a car. On a smooth track, using both fenders and wheel guards, the company could generally be sure of pushing the individual off the track, but the weight and speed of modern rolling stock made the momentum of the blow inevitably dangerous.

R. S. Goff, general manager of the Bay State Street Railway Company, concurred with Gen. Bancroft. On the lines of this company, which include many miles of suburban and country trackage, life guards must be carried from 4 to 4½ in. above the rail, on account of the uneven roadway. Mr. Goff cited the bad effects of frost on track surface, and stated that in his opinion no fender fully met the conditions of service now existing.

President C. Q. Richmond, of the Berkshire Street Railway, Pittsfield, cited the difficulties of maintaining satisfactory fender heights in western Massachusetts, where the weather conditions were even more severe than around Boston. E. P. Shaw, Jr., general superintendent Boston & Worcester Street Railway, stated that his company used the Pfingst fender, the elevation being about 10 to 12 in. above the rail. He was opposed to the drop type of fender. Gen. Bancroft called attention to the fact that the wheel guard facilitated plowing snow. Replying to an inquiry, he stated that while the use of a guard might slightly delay getting at trucks and equipment in case of trouble, the benefits outweighed the disadvantages. E. S. Wilde, general manager Union Street Railway Company, New Bedford, said that a minimum height of 4½ in. was necessitated in fender practice on his road, on account of plank crossings. John H. Carter, Boston, also spoke in criticism of the drop type of fender. The board took the subject under advisement.

TRANSFER ORDER TO BE ISSUED IN NEW YORK

The Public Service Commission of the First District of New York has instructed the counsel of the commission to draw up a formal order directing the street railways in Manhattan and the Bronx to restore free transfers at 151 points in addition to about 160 points in the two boroughs at which transfers are now exchanged between different routes under the same management. The additional points to be established under the order will include points at which the routes of companies under separate managements intersect. It is expected that the companies will appeal to the courts in case this order is issued. Douglas Robinson, receiver of the Metropolitan Street Railway, and F. W. Whitridge, receiver of the Third Avenue Railroad, when interviewed, are said to have refused to comment on the proposed action of the commission, saying that the subject was a matter to be considered by the reorganization committees. Guy E. Tripp, chairman of the committee of bondholders of the Metropolitan Street Railway, is, however, reported to have said that the Metropolitan Street Railway will probably contest the proposed order. George W. Linch, receiver of the Second Avenue Railroad and the Central Park, North & East River Railroad, refused to be quoted.

The hearings before the commission were long drawn out and have been reported in the Electric Railway Journal. It is quite possible that the commission anticipated that the case would go to the courts if in favor of transfers, because it exercised great care in rulings on the testimony which was submitted and in the admission of evidence, realizing that the courts might hold that it had prejudiced the case.

The extension of the Central London Railway, London, Eng., from the Bank to Broad Street and Liverpool Street is expected to be ready for traffic in June, 1912. Five hundred trains a day will use the new station, which will be provided with an escalator platform between the two stations. Twenty-six minutes will be allowed for the full journey between Wood Lane and the new eastern terminus. The half mile of double tunneling will cost $564,000, this sum also including the purchase of certain property which will enable a widening of the street to be effected by the civic authorities. About 180,000 persons leave Liverpool Street Station in a day and 70,000 depart from Broad Street.

THE SULZER STEAM TURBINE

The result of balaneing the advantages and disadvantages of impulse and reaction turbines has been the so-ealled "eombination turbine" whieh was first sueeessfully introdueed in 1904 by Sulzer Brothers, Winterthur, Switzerland. In this system the high-pressure part of a reaetion turbine is replaeed by a single impulse wheel, in whieh the greater part of the drop of temperature is eonverted into kinetie energy, so that only slight drops and low temperatures fall to the share of the low-pressure stages. The intermediate diaphragms, with their paekings, whieh are most troublesome in working, are dispensed with, the over-all length is rendered short, the weight is greatly reduced, the shaft is very rigid and the axial thrust is small. The design is intended to insure great eeonomy of steam, absenee of any risk in applying high degrees of superheating, little axial thrust and high effieieney. In brief, this turbine eonsists of an impulse turbine with partial admission as the high-pressure stage and a reaetion turbine with full admission as the low-pressure stage. The following is a detailed deseription of the latest type of Sulzer turbine:

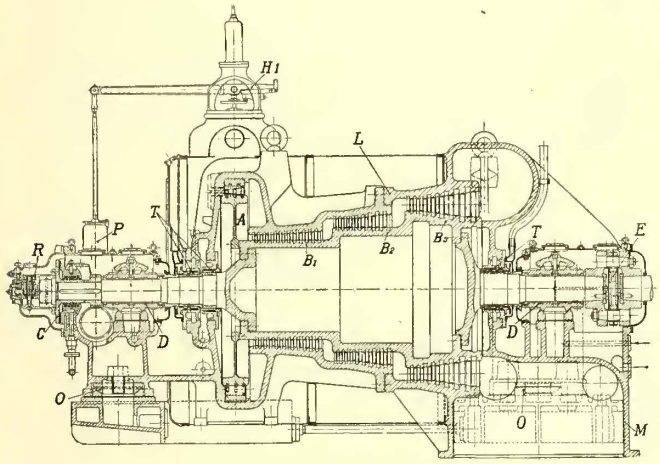


Fig. 1—Cross-Section of 10,000-hp Combination Turbine

Fig. 1 is a longitudinal seetion and Fig. 2 shows a 10,000-hp turbo-generator. Fig. 3 shows the construction and the conneetion of the various regulating organs of the turbine, wherein the parts seen from the front of the turbine are cut in a vertical plane. The letters in Figs. 1 and 3 refer to the table on page 1171.

DETAILS

The seetions of the cast-iron easing *L* (Fig. 1), constituting the upper end and the lower half respeetively, are permanently joined by serews at the vertieal flanges so that to open the turbine it is only neeessary to unserew the horizontal flanges. The easing is supported on the base-plate at three points; that is, by one pedestal *O* (Fig. 1), at the high-pressure end, and two at the sides of the exhaust neck, arranged to slide in speeial guides so as to follow the expansion of the easing by heat. In view of the high temperatures the nozzle chamber *K* (Fig. 3) is made independent as a separate steel casting serewed on to the turbine easing. The nozzle segments are maehine-eut out of solid metal.

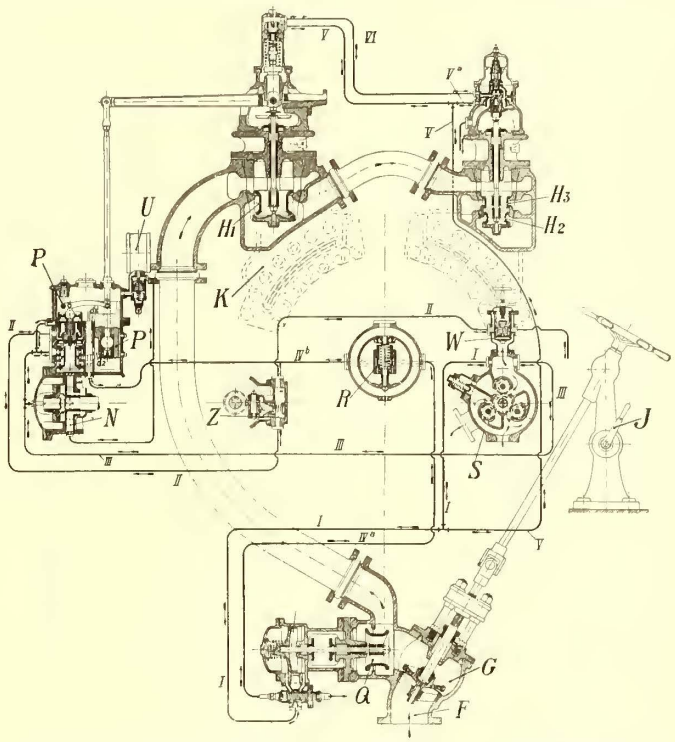


Fig. 3—End Cross-Section of 10,000-hp Turbine, Showing Oil-Pressure System

The shaft or rotor *B* (Fig. 1) consists of a hollow steel drum, machined inside and out, with solid, polished shaft-ends joined to the rotor by flanges.

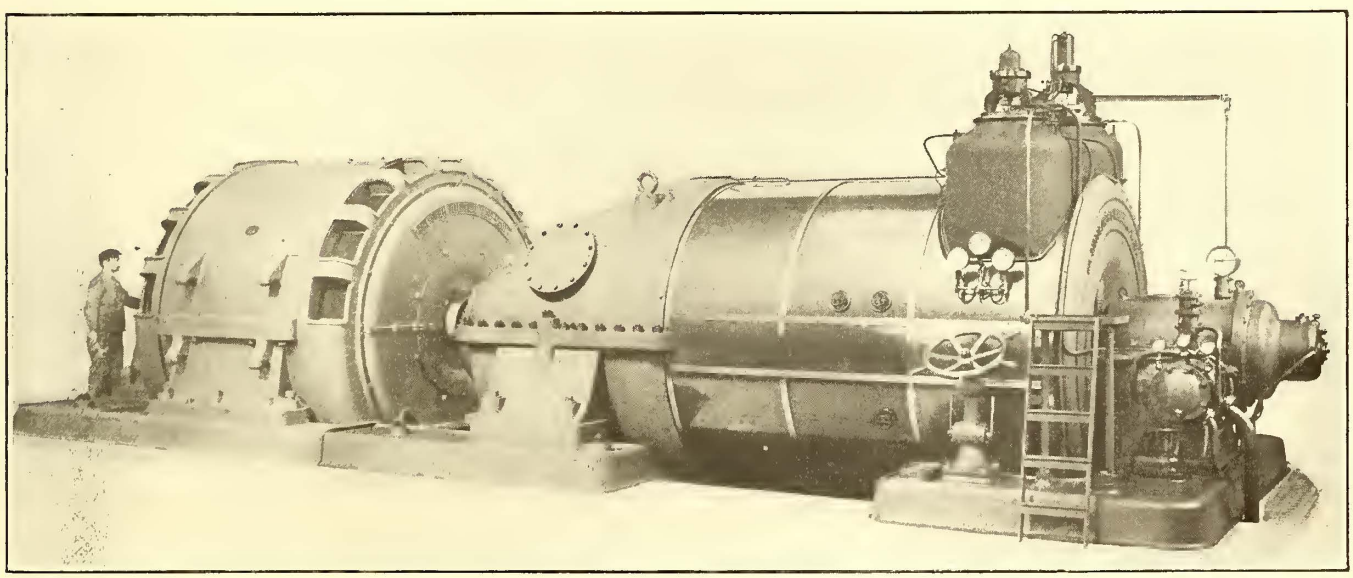
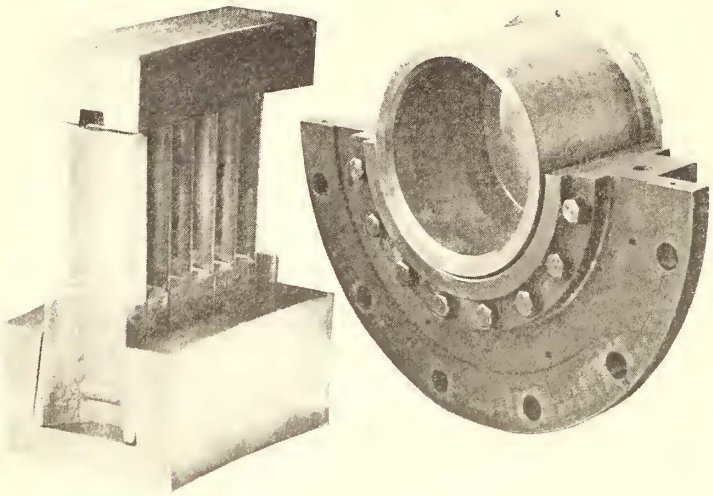


Fig. 2—Turbo-Generator Set of 10,000-hp Capacity

The fastening of the blades (Fig. 4) is done without riveting or calking and therefore does not call for skilled workmen. A ridge on the concave side of the drop-forged distance block corresponding to a notch in the back of the blade firmly secures the latter. The high-temperature blades are made of special steel and the low-temperature blades of special bronze.



Figs. 4 and 5—Blade Fastening and Shaft Packing

Seamless rolled shroud rings are shrunk on around the blades of the impulse wheel *A* (Fig. 1), thus closing the steam passage on the circumference (Fig. 4). The cast-steel bearings *D* (Fig. 1) are arranged to adjust themselves automatically in true alignment with the shaft. Lubrication is effected by cooled oil circulated under pressure. The shaft packings (Fig. 5) are frictionless; they are not affected by longitudinal displacement of the shaft and require neither lubrication nor readjustment. They consist of a large number of thin brass segments, ground to the diameter of the shaft and tightened up into firm packets with interposed segments of wider bore. A specially designed coupling *E* (Fig. 1) is employed to join the shaft of the turbine to that of the generator. This coupling is arranged to compensate differences in the position of the two shafts. The slight axial thrust which arises from the low-pressure side is taken up in the smaller sizes by a simple collar thrust bearing and in the larger sizes by an oil-balancing disk *C* (Fig. 1). The oil is delivered by a special pump into the space between the thrust-balancing disk and the thrust-block. Thence it escapes through the annular slot at the periphery of the disk, which is narrowed in proportion as the axial thrust increases, thus automatically regulating the oil pressure.

THE OIL-PRESSURE SYSTEM

The most characteristic feature of the turbine is the oil-pressure system (Fig. 3). Oil is used not only for the lubrication of the bearings, but part of it serves to operate all the controlling and safety mechanism of the turbine, namely, governor *N*, servo-motor *P*, speed-changing device *W*, overload valves H_1, H_2, emergency governor *R*, thrust-balancing disk, emergency stop-valve *Q* and change-over valve to work "non-condensing." The oil pump *S*, worked by the worm-driven transversal shaft, keeps the pressure of the oil system constant at about 22 lb. per square inch. After circulation all oil is collected and conducted into coolers and filters upon which it is drawn up by the pump for use over and over again.

The governor *N* consists of a centrifugal pump-impeller keyed on the same transversal shaft as the oil pump. The additional pressure generated by the impeller acts upon a spring-loaded piston valve and upon the servo-motor piston which controls the steam admission valve. Any change of oil pressure, that is, speed of the turbine, causes a displacement of the spring-loaded piston valve, thus admitting oil to the servo-motor or relieving the same. The difference of speed between full load and no load depends upon the law according to which the force of the spring varies.

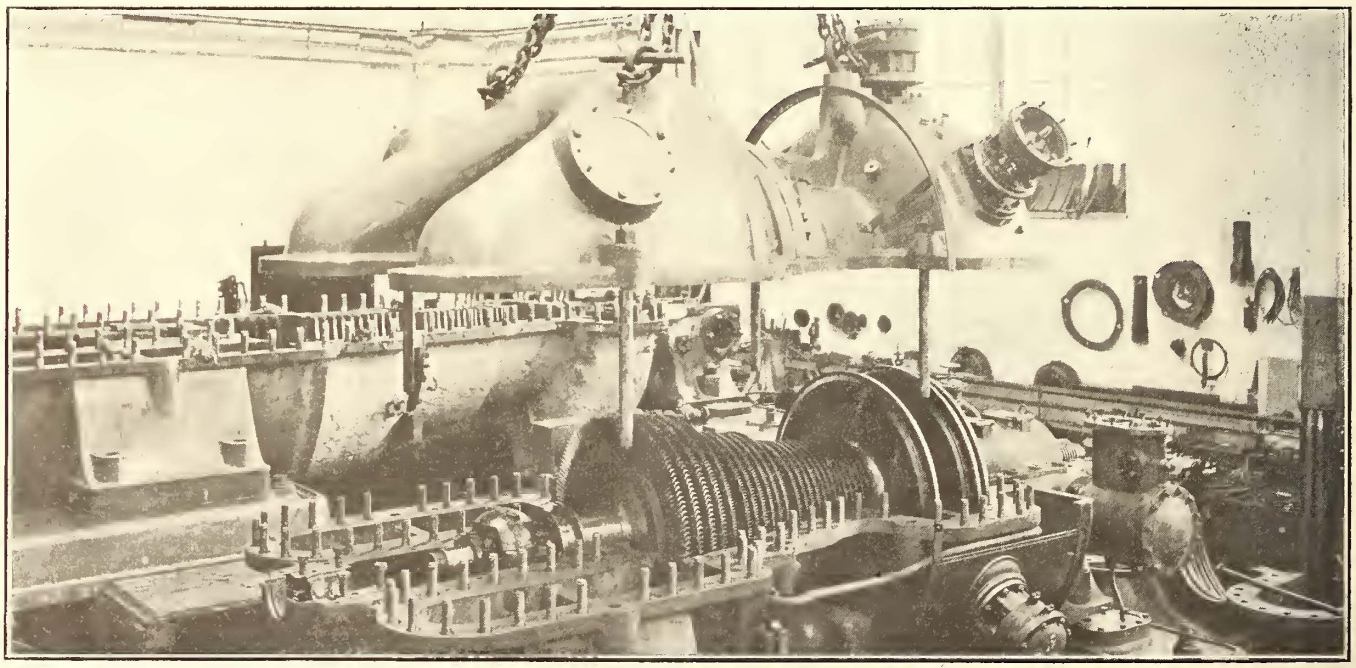


Fig. 6—Tapped Turbine with Upper Casing Removed

Rough regulation is effected by opening or closing whole groups of nozzles, but fine regulation is obtained by throt-

tling. In order to increase the precision of the governing action by eliminating the friction of rest an oscillating device Z acts upon the oil system and keeps the whole column of oil, and all the parts connected therewith, in constant motion. The speed-changing device W can be worked by hand or from the switchboard while the turbine is running. It consists of a reduction valve, admitting oil to the upper face of the spring-loaded piston valve of the servo-motor, thus supplementing more or less the force of the spring. By alteration of the passages of the speed-changing valve the turbine speed can easily be fixed within the necessary limits.

To prevent racing of the turbine there is provided an emergency governor R which has its centrifugal weight arranged to form a slide-valve piston and which, as soon as the admissible speed of revolution of the turbine is exceeded by about 10 per cent, releases the pressure of the oil-pressure system, whereby the main throttle valve H, and a second "emergency" throttle vale Q inserted between the main stop valve G and the main throttle valve H_1 are closed at once. All these parts are arranged to open only when a full oil pressure exists, otherwise they are always closed and it is impossible to start the turbine unless the oil system is under pressure. Hence to start the turbine an auxiliary oil pump is employed to generate pressure in the oil system before starting. This pump is stopped as soon as the turbine is in normal action.

STEAM TURBINES FOR SPECIAL PURPOSES

The Sulzer designs can be adapted for use as exhaust turbines, mixed-pressure turbines, tapped or bleeder turbines and back-pressure turbines. In the exhaust turbine the irregular supply of steam is equalized by heat accumulators between the reciprocating engine and the turbine. If the exhaust steam alone does not suffice, the mixed-pressure turbine is employed. This consists of two impulse wheels with a reaction drum behind them. Normally, the second impulse wheel and the reaction drum only are at work, but as soon as the exhaust steam falls short of a certain pressure live steam is automatically admitted to the first impulse wheel, expanding in it down to the pressure of the low-pressure steam and mixing in the second impulse wheel with the exhaust steam supplied from the reciprocating engine.

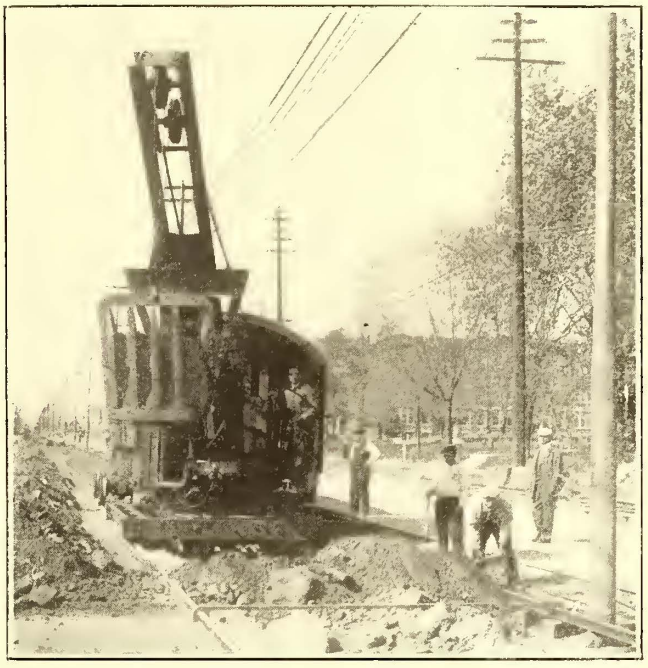
When some of the steam of the turbine at a stated pressure is required for other uses, say for boiling or heating, the turbine adapted is a tapped or "bleeder" turbine which is constructed like the mixed-pressure turbine. Fig. 6 shows one of these turbines at the shops and with cover open. All of the steam is expanded in the first impulse wheel down to the pressure at which a supply of steam is to be tapped from the turbine and is then partly carried off by a supply pipe for other uses and partly passed on to the second impulse wheel, while the pressure at which the steam is tapped is maintained at a uniform level in case of varying loads by means of a mercurial governor. When all of the exhaust steam of the turbine is required for other purposes the turbine used is a back-pressure turbine, which resembles the ordinary steam turbine in construction except that it is of shorter all-over length. If the back pressure (or the pressure at which the steam is to be carried off) is sufficiently high, the reaction turbine portion may even be dispensed with entirely.

TABLES SHOWING NAMES OF PARTS OF COMBINATION TURBINE.

A, Impulse wheel.
B_1, B_2 and B_3, reaction drum.
C, Thrust-balancing disk.
D, Bearings.
E, Elastic coupling.
F, Live steam inlet.
G, Main stop-valve.
H_1, Main throttle valve with yoke and governing gear.
H_2 and H_3, Auxiliary valve with yoke.
I, Engineer's foot-plate with lever for drain-cock and change-over valve (if any).
K, Nozzle chamber.
M, Steam exhaust branch.
N, Hydraulic governor.
O, Supporting feet.
P, Oil servomotor for governor.
Q, Safety or emergency stop-valve.
R, Safety or emergency governor.
S, Oil pump for bearings.
T, Shaft packings.
U, Tachometer.
W, Speed-changing adjustment.
Z, Oscillating device.

ELECTRIC SHOVEL FOR CITY TRACK TRENCH EXCAVATION

The United Railways Company, of St. Louis, has obtained very satisfactory results with an electrically operated shovel which is used to excavate trenches for new and rebuilt track. The shovel installation and the preliminary work leading to the determination of the most efficient methods of use were made under the supervision of Richard McCulloch, assistant general manager. By means of the shovel a trench 21 in. deep, to accommodate ballast, ties and a 9-in. rail, is excavated under city conditions at the rate of about 300 ft. of track in ten hours. It is expected, however, that this rate of digging will be considerably exceeded next year after more experience has been had in the operation of the electric shovel. Trench excavation in the suburbs in clay soil can be made at a faster rate. It has been found most economical to rough out the trench with the shovel, which leaves a smooth bottom, and then shape the sides of the trench with hand shovels. In this way the electric shovel is pushed forward as fast as it can be done and the trimming is done by hand. With three or four laborers the electric shovel is thus used to its full capacity. Track trenches may be excavated and the dirt placed on the adjacent pavement at one-half the cost for hand labor.



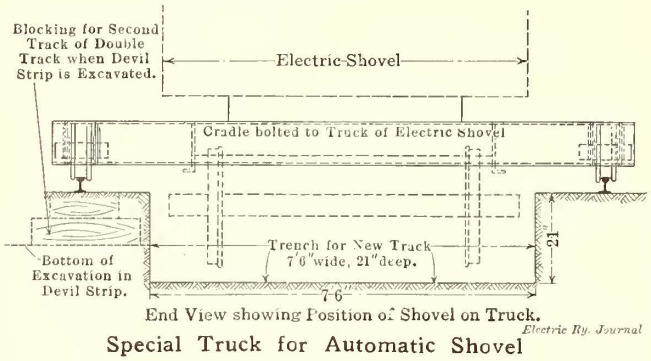
View of Shovel on Paved Street, Showing Cradle Support and Wide-Gage Track

The labor cost is still less if the street conditions permit loading from the shovel directly into cars or wagons.

The type of shovel used is the No. 0 size, manufactured by the Thew Automatic Shovel Company, of Lorain, Ohio. It is constructed entirely of steel and has a ⅝-cu. yd. capacity dipper, supported by a structural-steel boom and operated by chains and a ½-in. steel lifting cable. The shovel boom and cab are mounted on a common base, which is supported on a steel subframe in such a way that the boom and the cab may be swung to either side at the will of the operator. The sub-carriage wheels are connected by gears with the single 30-hp motor which operates the entire shovel. This motor, through different trains of gears and winches, not only does the digging and swings the boom for depositing the material at the side of the track but also serves to propel the shovel along the street.

When a trench is to be dug, say in the suburbs in an ungraded street where the depth of the excavation will be 3 ft. or 4 ft. deep, the truck on which the shovel is mounted is run on 4-ft. sections of temporary track which can be

moved from the rear to the front of the shovel as the work proceeds. As earlier stated, the shovel propels itself along these rails under the control of the operator and is mounted on 27-in. flanged street-car wheels. In paved streets, however, the shovel needs to be advanced much faster, because the shallow trench is more quickly excavated, and thus a cradle had to be devised for mounting the shovel truck over



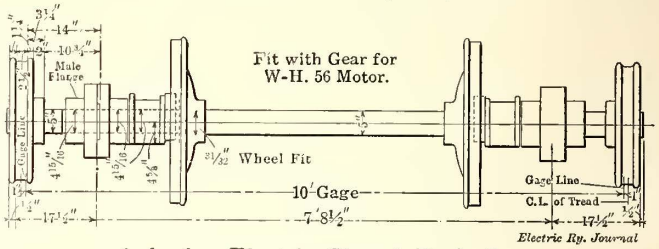
Special Truck for Automatic Shovel

the trench on the temporary track which could be built somewhat in advance of the work. To provide support for the shovel when digging in paved streets, rails are laid on each side of the trench to a 10-ft. gage, being placed directly on the pavement and held by temporary spacing rods clamped over the railheads. A special cradle was built in the United Railways shops to carry the electric shovel truck on these rails at 10-ft. gage. The cradle is bolted to the truck of the electric shovel. It is built of 10-in. channels reinforced at the corners and carrying four 12-in. double-flanged running wheels which support the cradle and in turn the truck on the 10-ft. gage temporary tracks.

The position of the electric shovel, its truck and the cradle over a trench in a city street is illustrated in one of

conduit, was tried for advancing the shovel along paved streets, but the windlass and connecting ropes occupied so much of the street that this method was abandoned and the push car scheme was tried and found very satisfactory.

The push car is an old single-truck, two-motor street car to the axles of which have been added extensions with double-flanged wheels designed for the 10-ft. gage of the temporary shovel track. These axle extensions are bolted onto flanged couplings which are fastened to the ends of the car axles, as shown in an accompanying illustration. Three or four rail lengths of temporary track are laid in

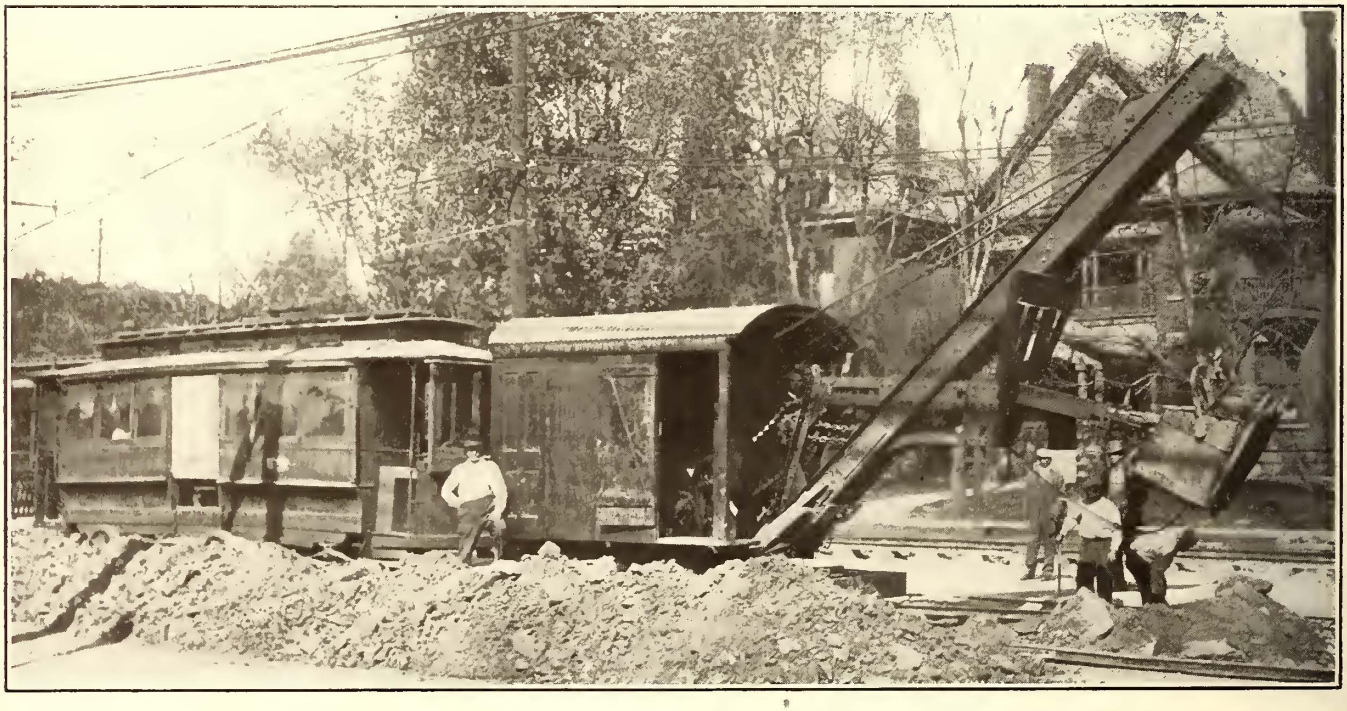


Axle for Electric Shovel Push Car

advance of the shovel. The shovel can be moved forward and back as desired by the use of the motors on the push car.

The body of this type of shovel has a very short overhang and the shovel can be operated continuously without interference with cars passing on an adjoining track. It is said to be one of the few electric shovels which meet this condition. This was one of the reasons for choosing this particular type.

When excavating within the congested district during the daytime the material is deposited on the pavement, but at night, when the line is free from cars, it is deposited directly into dump cars. During the night also the electric shovel may be run back over the scene of its day's work



Electric Shovel and Push Car Digging a Shallow Trench in Paved Street

the half-tone views, and a cross-section showing the position of the shovel in relation to the trench is published in a line cut on this page.

It will be noted that when supported by the cradle the propelling mechanism of the electric shovel is useless, because the shovel wheels are held free of the ground by the cradle; therefore when working in paved streets a push car is coupled to the rear of the shovel. At first an electric windlass, such as is used for pulling feeder cables into

and used to reload the excavated material into the dump cars. This shovel is said to work satisfactorily in the hardest kind of subsoil. Trenches are dug at a good rate of progress in macadam pavement with a Telford foundation. It is the practice of the United Railways, when tearing up old track, to remove the rails and the ties by pulling them up with cranes. This method leaves some ties embedded in the dirt. These are easily removed by the shovel as it excavates the new trench.

LONDON LETTER

(From Our Regular Correspondent.)

A bill is to be introduced in Parliament to secure power to construct an underground electric railway to connect the railway stations in Manchester. The capital stock of the company will probably be £1,000,000. The road will be 4⅓ miles long. The speed of the trains is to be 15 m.p.h.

The conductors of the Sheffield Tramways are now requesting passengers who board the cars at stations other than the busy city stopping places, and intend to ride on the upper deck, to pay their fares on the platform before mounting. The object is to lessen the number of journeys of conductors to the top deck to collect fares and give them more time to attend to their actual duties as conductors. The patrons look upon the request as reasonable and to their own advantage and comfort.

The City Council of Oxford has a contract with the National Electric Construction Company to complete the construction of a combined conduit and overhead system by Jan. 1, 1913. The company approached the Council recently and explained that it was difficult to raise the necessary capital for the combined system, since a similar system at Bournemouth has been abandoned owing to the general inconvenience to passengers and the operating expenses. The company recommended that the overhead system should be used for the entire line, but the City Council has declined the proposal.

The stockholders of the British Electric Traction Company have adopted the amended scheme of reorganization outlined in the ELECTRIC RAILWAY JOURNAL of Nov. 4, 1911, page 1005. Although no pledge has been given, it is understood that on account of the sacrifices made by the preferred stockholders the suggestion to reduce the capital will not be revived.

The East Ham Municipal Tramway shows a deficit of nearly £4,000 for the year as the result of spending a large sum of money on renewals. The gross revenue increased £2,000 over the previous year, but the operating expenses increased £5,500 over the previous year. As there was no reserve fund upon which to draw, all the renewals had to be charged to operation. In previous years the Council has handed over the surplus to the relief of the rates and carried only a small reserve. In the report of the engineer and manager it was stated that maintenance had been increased by the excessive wear caused by motor buses run in competition with the tramway, and it was pointed out that there seemed to be no way to make the bus companies bear any part of the cost of repairing the roads.

The scenery at Bath is very beautiful, and the Bath Electric Tramways has added to its rolling stock two motor charabancs which each accommodate twenty-eight persons to make excursions to parts of Bath not reached by the tramways. Last summer nine excursions were made every week. The company has opened a bureau in London where seats may be booked. Photographs of the places of historical interest at Bath are also exhibited at the London office.

Philip Dawson, the consulting electrical engineer of the London, Brighton & South Coast Railway, has announced that for some time past the company has been preparing plans and estimates for the electrification of its line as far as Brighton. So great was the success of the electrification of the South London line and the extension from Victoria to the Crystal Palace that the use of electricity to Brighton was inevitable. Mr. Dawson hopes to complete the report on the question of the electrification of the main line to Brighton inside of another year. Mr. Dawson will then be able to put before the directors a complete tender for the work so that it can be proceeded with at once if favorably considered. With the present terminal facilities in London and Brighton it is practically impossible to improve the service as run by steam trains. With electricity as motive power service could be doubled, and fifteen-minute trains could be run. The express trains could make the journey in from forty to forty-five minutes, and Brighton, though 50 miles from London, would in a measure become a suburb of London.

Work has been begun on the extension of the Charing Cross and Hampstead tube, which will give direct access to the Charing Cross Station of the District Railway and to the Bakerloo tube at the Embankment station. The new terminus for the Hampstead tube will be built under the Embankment Gardens, to the east of the present station of the District Railway, and an escalator will be provided to carry passengers from the one station to the other. An escalator will also be installed between the Charing Cross station and the Bakerloo Embankment station and the two tube stations on the deep level will be connected by tunnel. The attempt to effect a physical connection between the three railways for the interchange of rolling stock has been given up.

The sum of £11,600,000 has been invested by the London County Council in tramways, and of this only £2,000,000 has been repaid. To complete the Council's present schemes £2,500,000 more will be required. Comparing the tramways and the bus lines, Sir Marcus Samuel said recently that the London General Omnibus Company, with a capital of only £2,500,000, carried 8,000,000 passengers a week, as compared with 10,000,000 for the tramways. Where there is competition between the omnibus and the tramcar the omnibus appears to get more than its share of the traffic. In this connection it is interesting to note that the Council has decided not to proceed with the proposed tramways from Marble Arch to Cricklewood, and the plan to install tramways on the new St. Paul's Bridge has also been put off for the present.

A composite committee from both sides on the London County Council is to be formed to inquire into the future of the electric supply in London and to form rough proposals to be submitted to the Council.

The Town Council of Brighton will promote a bill in Parliament to construct a trackless trolley system in Brighton. The deputation which visited Bradford and Leeds has reported favorably on the trackless trolley, and it is hoped that the adjoining town of Hove will apply for powers so that the two systems can be connected. The Corporation of Hull is also considering the extension of its tramway to Stoneferry and may decide to use the trackless trolley. In Yorkshire there is a scheme to install trackless tramways from Guiseley to Otley and Ilkley, a distance of about 6½ miles. The Corporation of Dundee has ordered some trackless trolley cars. The tramway committee of the Edinburgh Town Council has decided not to apply to Parliament for permission to install the trackless trolley as the members of the Council wish to investigate further the new motor omnibuses placed in service recently in London.

The following operating statistics have been made public by the Sheffield (Eng.) Tramways relative to the cost of repairs and renewals on that system during the year: Car mileage, 7,618,383; car mileage per mile of single track, 96,161; total cost of repairs, £5,370, and of renewals, £10,385; cost of repairs per mile of single track, £67, and of renewals, £244; cost per car mile of repairs, 0.169d., and of renewals, 0.610d; combined cost of repairs and renewals per mile of single track, £312, or 0.779d. per car mile.

The London & North Western Railway has announced that the North London Railway, which it operates, will be electrified and that the new electric railway which it is building from Watford to Euston will be modified. This is to be a surface railway from Watford to Willesden, but an underground line from Willesden to Euston Station. It has, however, been decided to build the London & Northwestern line only to Queens Road. From that point a new tube will be built by the London Electric Railway to connect with the Bakerloo tube. This will permit suburban traffic to reach the West End of London. The line from Earl's Court and Kew Bridge to Willesden, the Hampstead Junction line from Willesden to Camden Town, and other sections, will also be electrified. A. C. S.

G. M. Patterson, chairman of the official map committee of the Central Electric Traffic Association and general freight and passenger agent of the Toledo & Chicago Interurban Railway, Kendallville, Ind., announces that the ballot on the advisability of jointly publishing a map to cover all the interurban railways in the Central Electric Traffic Association territory has been carried. Forty-four of the fifty-three lines interested so far have approved the plan. It is expected that proofs of the map will be available in January.

News of Electric Railways

Conference with Pennsylvania Railroad President on Pittsburgh Transit Matters

E. V. Babcock and J. P. Kerr, members of the City Council of Pittsburgh, Pa., conferred in Philadelphia on Nov. 23, 1911, with James McCrea, president of the Pennsylvania Railroad, in regard to the problem of providing Pittsburgh with improved means of rapid transit. Following the conference an official statement in regard to the matter was issued by the Pennsylvania Railroad in which it was stated that the attitude of the company had been explained to Mr. Babcock and Mr. Kerr and that any further information should come from them. Subsequently Mr. Babcock said:

"While we received no encouragement from President McCrea as the head of the Pennsylvania Railroad, he made several suggestions that will be helpful in solving our transit problem. While we are disappointed in failing to get the support that we expected from the company, both Mr. Kerr and I are well pleased with the outcome of the conference. We explained that the Pennsylvania Railroad was best prepared financially to take the matter up, and gave Mr. McCrea our ideas as to how the railroad could benefit and at the same time solve the transit problem. We explained that it was the opinion of those who had taken up the matter before it was presented to Councils that the Pennsylvania Railroad and the Pittsburgh Railways could agree on some plan between them which would prove beneficial to both sides. The needs of our general public were fully gone over by all, and we pointed out that the Pennsylvania Railroad might build a subway under its right-of-way from Wilkinsburg and also an elevated on its present tracks. At the end of our interview Mr. McCrea said that he regretted that the company could not assist the project in any way. He said the railroad was bending its efforts toward improving the through traffic facilities and that at this time it was not taking up questions relating to short hauls. We could not get even the encouragement that there was a possibility of the railroad taking the matter up at a later date. We were given to understand that, as far as the company was concerned, there could be no help from that source to the project which is now before the Council of Pittsburgh."

A. E. Anderson, counsel for the Painters' Run Railroad, has sent a letter to Councilman W. G. Wilkins, chairman of the committee on public service and surveys, covering the subway proposition, in which he points out that his company will pay to the city for the franchise at least $2,500,000 in the first twenty-five years of the operation of the system. His company agrees, he says, to file with Council within six months contracts and full specifications and complete the first line within three years.

Report of Special Master at Kansas City

According to the report filed by Hermann Brumback, special master, with Judge W. C. Hook in the United States Circuit Court at Kansas City, Mo., $8,274,840 will be required in the next ten years to rehabilitate the physical property of the Metropolitan Street Railway in Kansas City, Mo., and Kansas City, Kan. The two cities petitioned the court to require the receivers of the company to make repairs to tracks, roadbed and paving and furnish additional cars to keep the service up to the requirements of the agreement between the company and the cities. Judge Hook amended the petition by directing the master to base his findings on possible requirements covering ten years. The representatives of the cities maintained that the service should be improved immediately at an estimated outlay of $3,000,000, which would include sixty-seven new cars at $7,000 each.

The report urges the extension of the Woodland-Holmes line to connect with the Swope Park line and the construction of a connection between the Dodson and Roanoke lines. The proposed extension of the Indiana line to Swope Parkway, the proposed Sixty-third Street crosstown line and the extension of the Troost Avenue line south on Troost hill are denied. Mr. Brumback's report indicates that more cars are needed, and he recommends an expenditure of $877,000 for cars, divided as follows: Fifty-four new cars, $378,000; fifty cars, bought but not paid for, $240,000; twenty-four new cars for extensions, $168,000, and thirteen new cars for emergencies, $91,000.

Publicity in Syracuse

The Syracuse (N. Y.) Rapid Transit Railway has printed in pamphlet form for general distribution a synopsis of the recent report by the Public Service Commission of the Second District of New York on street railway operation in Syracuse. Twenty-five thousand of the booklets have been placed in the boxes in the cars of the company for distribution and 15,000 will be delivered at houses in different sections of the city. The pamphlet is introduced with the following statement:

"The Syracuse Rapid Transit Railway presents to its patrons this pamphlet as worthy of their attention and study. It is the aim of this company, as well as its interest, to give the best service possible. The growth of the city and the prosperity of the company are bound together. What helps one helps the other. The business of the company is to provide frequent and adequate service and to secure a reasonable return upon its investment. The goodwill of the communities it serves is one of the company's chief assets, and because good service aids in the growth of these communities and this growth increases the revenues of the company the interests of both are to a very large extent the same.

"That the company's facilities have kept pace with the growth of the city is shown by the following statistics, taken from the Public Service Commission's report:

TEN YEARS' GROWTH OF POPULATION AND FACILITIES COMPARED.

	Per Cent Increase.
Population	27.1
Passengers carried	128.4
Car miles operated	62.8
Miles of track	40.4
Cars owned	127
Seating capacity	172
Gross income	137.7
Operating expenses	210
Additional deductions from income	69.4

"This company wants the confidence and assistance of the public. It is willing to give the public its confidence, and for this reason it welcomed as likely to prove of mutual benefit the recent thorough investigation of its operations by the Public Service Commission. This investigation, made primarily by the expert of the commission, was carefully considered by the commission as a whole before the commission made its recommendations.

"This report of conditions and its accompanying recommendations for improvements are of such importance that the company desires that it should receive the earnest consideration of every patron of the road, and for that reason presents herewith a synopsis thereof, hoping that the patrons of the Rapid Transit service will realize the existence of many obstacles in the way of giving that perfect service which is the aim of this company and at the same time the intention of the company to do every reasonable thing to better such service."

Extracts are next presented from the report proper covering the subjects of service furnished, amount of service furnished, conditions in the eastern sections, power conditions, car equipment, finances, etc. Following this are printed the recommendations made to the commission by Charles R. Barnes, electric railroad inspector of the commission, and the comments of C. Loomis Allen, vice-president and general manager of the company, giving the company's answer. The pamphlet is concluded with a statement of expenditures for extensions of track, purchases of right-of-way and for pavements yearly since 1901, and similar statements of expenditures for the extension and construction of the overhead system, for new cars and for power facilities.

The company has also published in the daily press a half-page advertisement headed "The Service of the Syracuse Rapid Transit Railway Company," based on the contents of the pamphlet. This advertisement is concluded with the statement: "For further information read booklet being distributed in company's cars."

The recommendations of the commission to the company were published in the ELECTRIC RAILWAY JOURNAL of June 17, 1911, page 1082.

Progress Under the New Regime in Cleveland

Peter Witt, street railway commissioner-elect at Cleveland, has announced the selection of George G. Mulhern as superintendent of operation under him. A brief biography of Mr. Mulhern is published elsewhere in this issue.

President Stanley of the Cleveland Railway is quoted as saying that the fare will have to be advanced in a short time. The interest fund is now only $65,000 in excess of $300,000, at which minimum limit the rate of fare must then be increased under the Tayler franchise.

It is possible that the Cleveland Railway, instead of erecting a new power house, will purchase power from the Cleveland Electric Illuminating Company, which is completing a new station. Negotiations have been resumed since the need for increased power has become immediate on account of the addition of a large number of cars. S. Scovil, vice-president of the Cleveland Electric Illuminating Company, stated a few days ago that the terms submitted during the early negotiations were not final.

At a meeting of officers of the Cleveland Chamber of Commerce with Mayor-elect Newton D. Baker, the plan to amend the Tayler franchise so as to allow freight cars or trains to be operated over the streets at night was discussed. Mr. Baker suggested that the cars should be operated over special interurban tracks or through tubes. Munson A. Havens, secretary of the Chamber of Commerce, agreed with Mr. Baker, but impressed upon him the necessity of immediate freight service.

Association Meetings

Street Railway Association of the State of New York.—Syracuse, N. Y., Dec. 5 and 6, 1911.

Pennsylvania Street Railway Association.—Annual meeting, Harrisburg, Pa., Dec. 8, 1911.

Massachusetts Street Railway Association.—Boston, Mass., Dec. 13, 1911.

Central Electric Accounting Conference.—Annual meeting, Toledo, Ohio, Dec. 16, 1911.

New England Street Railway Club.—Boston, Mass., Dec. 28, 1911.

Central Electric Railway Association.—Annual meeting, Dayton, Ohio, Jan. 18, 1912.

B. J. Arnold's San Francisco Investigation.—The committee on public utilities of the Board of Supervisors of San Francisco, Cal., has requested Bion J. Arnold to begin about Dec. 15, 1911, the work of investigating street railway conditions in San Francisco upon which he is to report to the Council.

Express Derailed in New Haven Electric Zone.—An express train of the New York, New Haven & Hartford Railroad, from Boston, due in New York at 5:42 p. m., was derailed on Nov. 27, 1911, at a cross-over at New Rochelle, N. Y., in the electric zone. None of the passengers was injured. An investigation of the accident is being made to determine the cause of the derailment.

Date of C. E. R. A. Meeting Changed.—At the session of the executive committee of the Central Electric Railway Association held in Louisville, Ky., during the recent meeting of the association, it was decided to hold the annual meeting of the association in Dayton, Ohio, on Jan. 25, 1912. As the mid-winter meeting of the American Electric Railway Association is to be held on Jan. 25, 1912, the executive committee of the Central Electric Railway Association has since changed the date for its annual meeting to Jan. 18, 1912.

National Civic Federation Committee Meetings.—Arrangements were made for a meeting of the executive committee on interstate and municipal utilities of the National Civic Federation on Dec. 2, 1911, in New York. Emerson McMillin, chairman of the executive committee of the American Light & Traction Company, is the chairman of the committee, and Prof. John H. Gray, head of the political economy department of the University of Minnesota, is the secretary of the committee. The federation's department on compensation for industrial accidents and their prevention, of which August Belmont is chairman, will meet on Dec. 8, 1911, in New York. Among the subjects to be discussed will be "The Next Step in Workmen's Compensation in New York State," "The Situation in New York Concerning Proposed Amendments to the Constitution Permitting the Enactment of Workmen's Compensation Law," "Compulsory Compensation vs. State Insurance" and "Compulsory Compensation vs. the Elective Plan."

PROGRAM OF ASSOCIATION MEETINGS

Pennsylvania Street Railway Association

The annual meeting of the Pennsylvania Street Railway Association will be held in the auditorium of the Harrisburg Club on Dec. 8, 1911. The session will commence at 11 a. m. A paper, "Value and Uses of the Surface Contact System," will be read by S. R. Hipple, general manager of the Simplex Surface Contact Company, Williamsport, Pa. This system has been installed on the railway between Lewisburg and Montandon, Pa. Lunch will be served at the Harrisburg Club at 2:30 p. m.

Street Railway Association of the State of New York

The fourteenth quarterly meeting of the Street Railway Association of the State of New York will be held at the Hotel Onondaga, Syracuse, N. Y., on the evening of Tuesday, Dec. 5, and on Wednesday, Dec. 6. The Tuesday evening session will be opened with an informal dinner at 7:30 o'clock at the Hotel Onondaga, after which a prominent speaker will make an address. There will be morning and afternoon sessions on Wednesday, Dec. 6, at the Hotel Onondaga, at which the following program will be carried out:

Paper, "Pay-As-You-Enter Cars," by Thomas W. Casey, general manager of the Pay-As-You-Enter Car Corporation, New York.

Discussion by T. C. Cherry, superintendent of the Utica & Mohawk Valley Railway, Utica, N. Y.; J. E. Duffy, superintendent of the Syracuse (N. Y.) Rapid Transit Railway, and C. H. Smith, superintendent of the United Traction Company, Albany, N. Y.

Paper, "Prevention of Accidents," by R. E. McDougall, claim agent of the Utica & Mohawk Valley Railway, Utica, N. Y. This paper will consider (a) what can be done to increase the interest of employees of all departments in this work, (b) the best means of promoting greater caution on the part of platform men, and (c) how the public can be educated in the prevention of accidents.

Discussion by C. J. McAleer, claim agent of the Schenectady (N. Y.) Railway; Dr. F. J. Ryan, chief surgeon of the Syracuse Rapid Transit Railway, and H. C. Beatty, secretary of the Auburn & Syracuse Electric Railway.

Papers, "Life of Railway Physical Property."

(A) "Accounting," by W. O. Ingle, assistant auditor of the New York State Railways, Rochester, N. Y.

Discussion by W. C. Austin, auditor of the Otsego & Herkimer Railroad, Hartwick, N. Y., and F. E. Belleville, auditor of the Schenectady (N. Y.) Railway.

(B) "Engineering," by F. A. Bagg, chief engineer of the Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y.

Discussion by M. J. French, engineer of the Oneida (N. Y.) Railway.

Those who intend to be present are requested to notify J. Stanley Moore, general passenger agent of the Rochester, Syracuse & Eastern Railway, Syracuse, N. Y., who will make arrangements for accommodations at the Hotel Onondaga, Syracuse, N. Y.

Financial and Corporate

New York Stock and Money Markets

November 29, 1911.

Business in the New York market during the past few days has been quiet, and prices have been irregular. Acceptance by the Interborough-Metropolitan officials of the plan for settlement of the affairs of the Metropolitan Street Railway to-day brought about an advance of 1¼ points in the preferred shares of the Interborough-Metropolitan Company and a sharp advance in Metropolitan Street Railway bonds. Approach of December payments and large withdrawals of gold for export increased call money rates to-day to 3¾ per cent, the highest rate since January. Time money rates were 3½@3¾ per cent for sixty days.

Other Markets

Prices in the Chicago market to-day were very irregular. Kansas City Railway & Light shares advanced, the common gaining fractionally, and the preferred about 2½ points.

Small gains were made in Philadelphia Rapid Transit and Union Traction in the Philadelphia market yesterday.

Fractional improvement in United Railways income bonds was shown in to-day's transactions in Baltimore. Trading was moderate in volume, but firm in general.

Trading in Boston is fairly active, with interest centered in the copper shares.

Quotations of traction and manufacturing securities as compared with last week follow:

	Nov. 22.	Nov. 29.
American Brake Shoe & Foundry (common)	a89	a90
American Brake Shoe & Foundry (preferred)	127	a133½
American Light & Traction Company (common)	a295	a295
American Light & Traction Company (preferred)	a107	a107
American Railways Company	a45¾	a46¼
Aurora, Elgin & Chicago Railroad (common)	a39½	a37½
Aurora, Elgin & Chicago Railroad (preferred)	a86¼	a84½
Boston Elevated Railway	a129½	a129⅞
Boston Suburban Electric Companies (common)	a15	a15
Boston Suburban Electric Companies (preferred)	a75	a75
Boston & Worcester Electric Companies (common)	a12	a12
Boston & Worcester Electric Companies (preferred)	a58	a58
Brooklyn Rapid Transit Company	77¾	77¾
Capital Traction Company, Washington	a127	127
Chicago City Railway	a180	a180
Chicago Elevated Railways (common)	a30	a30
Chicago Elevated Railways (preferred)	a94½	a93
Chicago Railways, ptcptg., ctf. 1	a95¾	a97
Chicago Railways, ptcptg., ctf. 2	a33	a33⅝
Chicago Railways, ptcptg., ctf. 3	a11	a11¼
Chicago Railways, ptcptg., ctf. 4	a7	a6¼
Cincinnati Street Railway	a129½	*129½
Cleveland Railway	a105	a104½
Cleveland, Southwestern & Columbus Ry. (common)	a47⅞	*47⅞
Cleveland, Southwestern & Columbus Ry. (preferred)	a33¾	*33¾
Columbus Railway & Light Company	a37½	*37½
Columbus Railway (common)	83	*83
Columbus Railway (preferred)	90½	90½
Consolidated Traction of New Jersey	a75½	75½
Consolidated Traction of N. J., 5 per cent bonds	a105	a75½
Dayton Street Railway (common)	a25	a105½
Dayton Street Railway (preferred)	a101	a25
Denver & Northwestern Railway	145	a101
Detroit United Railway	a80	*80
General Electric Company	154¼	154⅛
Georgia Railway & Electric Company (common)	a159	159
Georgia Railway & Electric Company (preferred)	a92	a91½
Interborough Metropolitan Company (common)	*14¾	15⅛
Interborough Metropolitan Company (preferred)	47¾	47
International Traction Company, 4% notes, rcts	70	*70
Indiana Union Traction Company	12	12
Kansas City Railway & Light Company (common)	a21	18
Kansas City Railway & Light Company (preferred)	48	a52
Lake Shore Electric Railway (common)	a7	*7
Lake Shore Electric Railway (1st preferred)	81½	*81½
Lake Shore Electric Railway (2d preferred)	a25	*25
Manhattan Railway	134¾	a136
Massachusetts Electric Companies (common)	a23	a22
Massachusetts Electric Companies (preferred)	a95½	a94
Metropolitan Street Railway, New York	*8	*8
Milwaukee Electric Railway & Light (preferred)	105	105
North American Company	a74¼	73⅞
Northern Ohio Light & Traction Company (common)	a58	58
Northern Ohio Light & Traction Company (preferred)	a105	105
Philadelphia Company, Pittsburgh (common)	a53¼	a53
Philadelphia Company, Pittsburgh (preferred)	a43¾	a43¾
Philadelphia Rapid Transit Company	a23½	a23⅞
Portland Railway, Light & Power Company	99½	99½
Public Service Corporation	a110	a110
Public Service Corporation, ctfs	a106	106¼
Seattle Electric Company (common)	a108	a107
Seattle Electric Company (preferred)	101¼	101½
Third Avenue Railroad, New York	7¾	3⅝
Toledo Railway & Light Company	a8	8
Twin City Rapid Transit, Minneapolis (common)	106	106
United Ry. & Electric Company (Baltimore)	*18½	18½
United Rys. Inv. Co. (common)	35	34
United Rys. Inv. Co. (preferred)	63	61¼
Washington Ry. & Electric Company (common)	a46¼	46¼
Washington Ry. & Electric Company (preferred)	a88	88
West End Street Railway, Boston (common)	a88	88
West End Street Railway, Boston (preferred)	a103½	103½
Westinghouse Elec. & Mfg. Co.	65⅝	65⅛
Westinghouse Elec. & Mfg. Co. (1st pref.)	a117	a118

aAsked. *Last sale.

ANNUAL REPORT

Northwestern Elevated Railroad

The annual report of the Northwestern Elevated Railroad of Chicago for the year ended June 30, 1911, with a comparison with the preceding year is as follows:

Year ended June 30.	1910	1911
Passenger earnings	$1,969,833	$2,023,963
Other earnings (including loop net earnings)	662,205	707,412
Total earnings	$2,632,038	$2,731,375
Maintenance of way and structure	$56,435	$63,027
Maintenance of equipment	149,593	153,407
Conducting transportation	737,671	751,011
General expenses	111,987	117,359
Total operating expenses	$1,055,686	$1,084,804
Net earnings	$1,576,352	$1,646,571
*Taxes	$244,379	$257,468
Bond interest	944,100	944,100
Other interest	11,775	7,494
Total charges	$1,200,254	$1,209,062
	$376,098	$437,509
Dividends on preferred stock	$150,000	$200,000
Surplus for year	$226,098	$237,509
Ratio of operating expenses to earnings (excluding loop net earnings)	51.25	51.11
Ratio of operating expenses, loop account and taxes to earnings (excluding loop net earnings)	68.49	68.80

*Includes compensation to city on account of loop. Reserve for maintenance has been kept at $250,000.

Britton I. Budd, the president, says in the report:

"Since the close of the fiscal year ended June 30, 1911, the company has made a new mortgage, covering all of its property, to secure $25,000,000 bonds, dated Sept. 1, 1911. All of these new bonds have been issued and sold and the proceeds have been or will be devoted (a) to the payment and discharge of the principal and interest of the company's bonds which matured Sept. 1, 1911; (b) to the payment and discharge of other indebtedness of the company and (c) to other corporate purposes."

The total number of passengers carried in the year ended June 30, 1911, was 44,471,566, as compared with 42,815,132 in the preceding year. The daily average number of passengers carried last year was 121,840, an increase of 4539, or 3.72 per cent over the previous year.

Earnings of Philadelphia Rapid Transit Company for October and Four Months

The report of the earnings of the Philadelphia (Pa.) Rapid Transit Company for October, 1911, and for the four months ended Oct. 31, 1911, has been approved by the executive committee of the company. Earnings in October, 1911, were larger than for any other October in the history of the company, gross receipts being $1,947,003 as compared with $1,858,068 last year. The report for October and for the four months to Oct. 31, 1911, follows:

October.	1911.
Gross passenger earnings	$1,868,739
Receipts from other sources	78,263
Gross receipts	$1,947,003
Operating expenses	1,154,925
Net earnings from operation	$792,077
Fixed charges	737,017
Surplus	$55,059
Four months.	1911.
Gross passenger earnings	$7,167,112
Receipts from other sources	331,048
Gross receipts	$7,498,160
Operating expenses	4,553,472
Net earnings from operation	$2.944,687
Fixed charges	2,948,189
Surplus	*$3,502

*Deficit.

Rumors of Michigan United Railways Sale Denied

George G. Moore, chairman of the executive committee of the Michigan United Railways, Jackson, Mich., has denied that negotiations are pending for the sale or lease of the property of the company as has been persistently

stated in the daily press recently. Mr. Moore is quoted as follows:

"The statement that the Michigan United Railways has leased its properties to an Eastern syndicate is untrue. The statement that there is any relation contemplated with the Commonwealth Power, Railway & Light Company is also untrue. The only thing which could at all give color to the misleading statements which have been recently published is the fact that negotiations have been conducted with a view to providing capital for building additional interurban lines in the State to increase the area now served by the company. These plans are immature. Should the operations of the company be enlarged there will be no change in the personnel of the company. The policy adopted by municipalities with regard to franchises and the lack of help from the Legislature has made it most difficult to do any interurban building within the State for the past five years. The State requires several hundred miles more of interurban railways to serve its needs. Whether we shall be able to provide for this, or any part of it, at the present time, is now most uncertain."

Annual Report of the New South Wales Government Railways and Tramways

The report of the New South Wales Government Railways and Tramways for the year ended June 30, 1911, shows that the tramway system has 189¾ miles of track. The total earnings were $6,828,155 as compared with $5,927,840 for the preceding year, an increase of 15.19 per cent. After making liberal provision for general maintenance and providing $225,000 toward depreciation of the Ultimo power house and $50,000 toward the insurance fund, the expenditures amounted to $5,719,745 as compared with $4,917,935 for the previous year. This expenditure was equivalent to 83.77 per cent of the receipts compared with 82.96 per cent for the preceding year. The surplus was $238,135 as compared with $229,395. During the year 230,275,938 passengers were carried without an accident resulting in the loss of life. There were operated 22,541,429 car miles in the last fiscal year compared with 20,579,386 car miles for the year before. The earnings per car mile were 29 cents and the operating expenses per car mile were 24½ cents. For the year ended June 30, 1911, the tramways employed 6804 people as compared with 6217 during the preceding year. In accordance with a superannuation act, which became operative on Oct. 1, 1910, 1½ per cent is deducted from the salaries of all officers except those who are already entitled to a pension under an earlier act.

Massachusetts Northern Railways Organized

The announcement has been made through the officials of the Connecticut Valley Street Railway, Greenfield, Mass., that there was organized in Boston on Nov. 16, 1911, an association known as the Massachusetts Northern Railways, which is to manage and control the present lines of the Connecticut Valley Street Railway, the proposed Millers River Street Railway, the Athol & Orange Street Railway, the Gardner, Westminster & Fitchburg Street Railway and the Templeton Street Railway. The administration of the association under an agreement with the American Trust Company, Boston, Mass., provides for seven trustees, who for the first five years have been named as follows: Russell G. Fessenden, president of the American Trust Company, Boston; Richard M. Saltonstall, of Galton, Snow & Saltonstall, lawyers; Joseph W. Stevens, president of the First National Bank, Greenfield; Robert L. Warner, of Warner, Tucker & Company, bankers, Boston; Edward C. Crosby, capitalist, Brattleboro; Frederick E. Pierce, president of the Massachusetts Northern Railways, Greenfield; Daniel P. Abercrombie, Jr., clerk and treasurer of the Massachusetts Northern Railways.

According to the announcement the lines controlled by the Massachusetts Northern Railways will include 88 miles of road, passing through fifteen cities and towns, having a population of more than 125,000. The physical value of the property passing into the control of the Massachusetts Northern Railways is stated to be $2,350,000, and the earnings for the year ended on June 30 last exceeded $377,000. The office of the association is to be at Greenfield, where the office of the Connecticut Valley Street Railway is now situated, and the control of the properties is in the hands of the same persons as the control of the Connecticut Valley

American Railways, Philadelphia, Pa.—The holders of the $2,435,500 of collateral trust 5 per cent bonds of the American Railways, due on Dec. 1, 1911, have been notified that the principal and interest of this loan will be paid in Philadelphia on and after Nov. 27, 1911, with interest to Dec. 1, 1911, upon presentation at the offices of Bioren & Company, Philadelphia; Newburger, Henderson & Loeb, Philadelphia, or the Provident Life & Trust Company. A limited amount of the bonds may be exchanged for the new convertible refunding 5 per cent bonds of the company, due 1931, bond for bond, with a payment to holders of maturing bonds at the rate of $35 per $1,000 bond, plus due adjustment of interest, provided acceptance of the offer is filed not later than Dec. 1, 1911, with Bioren & Company or Newburger, Henderson & Loeb.

Angola Light & Power Company, Angola, Ind.—The Angola Light & Power Company has been incorporated in Indiana with a capital stock of $50,000 by W. E. Massman, W. J. Vessey, A. J. Vessey, D. M. Vessey, John Dreibiss, Ft. Wayne, Ind., and Eugene Reilly and M. B. Kelly, Pittsburgh, Pa., presumably as the successor to the Angola Railway & Power Company, now in the hands of receivers.

Chicago & Milwaukee Electric Railroad, Chicago, Ill.—Judge Carpenter has declined the draft of the reorganization plan of the Chicago & Milwaukee Electric Railroad prepared by the interests representing the Illinois branch of the system and has referred the case back to the master for further testimony.

Chicago & Oak Park Elevated Railroad, Chicago, Ill.—Britton I. Budd, president of the Chicago Elevated Railways, has been elected president of the Chicago & Oak Park Elevated Railroad to succeed Mason B. Starring, resigned. E. C. Noe, general manager of the Chicago Elevated Railways, has been appointed general manager of the Chicago & Oak Park Elevated Railroad. These changes are the result of the receivership proceedings.

Columbus (Ohio) Interurban Terminal Company.—The Columbus Interurban Terminal Company has applied to the Ohio Public Service Commission to issue $125,000 of twenty-five-year 5 per cent bonds, the proceeds to be used to complete the new interurban terminal at Rich and Third Streets, Columbus.

Grand Rapids, Grand Haven & Muskegon Railway, Grand Rapids, Mich.—W. H. Morley, vice-president and general manager of the Grand Rapids, Grand Haven & Muskegon Railway, issued the following statement on Nov. 16, 1911, in regard to the negotiations which were pending for the sale of the property of the company: "There was a deal in prospect for the sale of the road, but I did not know the prospective purchasers. They had an option that expired at the close of banking hours on Nov. 15, 1911, but they did not exercise the option."

Indianapolis & Louisville Traction Company, Louisville, Ky.—The report of John E. Greely, Scottsburg, Ind., receiver for the Indianapolis & Louisville Traction Company, has been filed with the United States Court in Indianapolis, Ind. The gross earnings for October, 1911, were $11,036; operating expenses, $5,705, and net earnings, $5,350.

Macon Railway & Light Company, Macon, Ga.—The purchase of practically all of the common stock of the Macon Railway & Light Company, and a majority of the stock of the Central Georgia Power Company by A. B. Leach & Company, New York, N. Y., was noted in the ELECTRIC RAILWAY JOURNAL of Nov. 18, 1911, page 1078, as was also the purpose to organize the Georgia Light, Power & Railways Company. W. J. Massee, president of the Macon Railway & Light Company and the Central Georgia Power Company, has issued a statement in regard to the financing, in part as follows: "A. B. Leach & Company, at the solicitation of the Georgia interests in the Macon Railway & Light Company and the Central Georgia Power Company, have undertaken to finance proposed improvements. The sale of these securities means the immediate expenditure of several hundred thousand dollars in the betterment and extension of the property of the Macon

Railway & Light Company, the construction of the Griffin and Atlanta transmission line and the erection of a gas plant. An organization has been formed to hold the securities of the several companies and furnish capital for improvements. I am now, with one exception, the largest stockholder in these different companies and in no sense have the former owners of these properties parted with their holdings or interests. My associates and I have simply secured additional outside capital to make improvements suggested by the growth and demands of this community."

Massachusetts Electric Companies, Boston, Mass.—The trustees of the Massachusetts Electric Companies on Nov. 23, 1911, in addition to declaring the usual semi-annual dividend due on Jan. 1, 1912, recommended the payment of the accrued dividends of 17¾ per cent on the preferred stock in preferred stock at par on July 1, 1912. This will increase the outstanding preferred stock from $20,557,400 to $24,206,338. In a statement which they issued the trustees say in part: "It is the opinion of the trustees that the time has come when the probable future earnings justify the adoption of such a plan. The preferred shareholders are, of course, entitled to their accumulated dividends in cash, but only from net earnings to be so appropriated. To undertake to pay the same in cash in the near future is impracticable, because it would involve the creation of a floating debt which might seriously impair the credit and resources of the association. The issue of preferred shares for such arrears will be of advantage not only to the preferred shareholders but also to the common shareholders, who can receive no dividends until such accumulations have been liquidated. The trustees therefore recommend that the powers given the shareholders by the trust instrument be so exercised as to authorize the trustees to issue as of July 1, 1912, $3,647,000 (par value) of additional preferred shares and to offer these at par in payment of the claims for arrears of dividends on the outstanding preferred shares. At the expiration of the trust, all preferred shares, old and new, will be entitled to payment in cash at par."

New York & North Shore Traction Company, Roslyn, N. Y.—The New York & North Shore Traction Company has applied to the Public Service Commission of the First District of New York for permission to issue $771,764 of stock and $1,500,000 of bonds.

Point Shirley Street Railway, Winthrop, Mass.—It is proposed to apply to the next Legislature for permission to sell or lease the Point Shirley Street Railway to the Boston, Revere Beach & Lynn Railroad.

Springfield & Washington Railway, Washington C. H., Ohio.—The Ohio Public Service Commission has granted the Springfield & Washington Railway the right to issue $200,000 of stock to be sold at par and $300,000 of thirty-year bonds to be disposed of at not less than 85. The proceeds will be used to extend the line from South Charleston to Washington C. H.

Toledo, Ann Arbor & Jackson Railroad, Toledo, Ohio.—The Toledo & Ann Arbor & Jackson Railroad, which has taken over the property of the Toledo, Ann Arbor & Detroit Railroad, as noted in the Electric Railway Journal of Nov. 11, 1911, page 1042, has organized as follows: L. E. Ingalls, Chicago, president; R. E. Hamblin, formerly general manager of the Toledo (Ohio) Home Telephone Company, vice-president; George E. Fisher, Detroit, secretary; J. O. Zabel, attorney. All the grading between Toledo and Ann Arbor, with the exception of 2½ miles, has been completed, and 18 miles of track has been laid. Seven miles of poles with cross-arms have been set, two-thirds of the right-of-way has been fenced, and the power house at Petersburg, Mich., has been about two-thirds completed. The new company expects to have 20 miles of the road in operation by Jan. 1, 1913. The distance between Toledo and Ann Arbor is 45 miles, and between Ann Arbor and Jackson, 55 miles.

Twenty-eighth & Twenty-ninth Streets Crosstown Railroad, New York, N. Y.—Joseph B. Mayer, receiver for the Twenty-eighth & Twenty-ninth Streets Crosstown Railroad, has filed suit against the directors of the Metropolitan Traction Company at the time of its dissolution, to compel them to give an accounting for $1,100,000 of bonds issued for the Twenty-eighth & Twenty-ninth Streets Crosstown Railroad, the proceeds of which, the receiver alleges, were not used for the company's benefit. In their answers to the suit Thomas F. Ryan and P. A. B. Widener say that the bondholders have no legal cause for complaint.

Dividends Declared

American Railways, Philadelphia, Pa., quarterly, 75 cents.

Brooklyn (N. Y.) Rapid Transit Company, quarterly, 1¼ per cent.

Chicago (Ill.) Elevated Railways, quarterly, 1½ per cent, preferred participation.

Citizens' Traction Company, Pittsburgh, Pa., $1.50.

Columbus (Ohio) Railway, quarterly, 1¼ per cent, common.

Ft. Wayne & Northern Indiana Traction Company, Ft. Wayne, Ind., quarterly, 1½ per cent, preferred.

Indianapolis (Ind.) Street Railway, 3 per cent.

Massachusetts Electric Companies, Boston, Mass., $2, preferred.

Norfolk Railway & Light Company, Norfolk, Va., 2½ per cent.

Rochester Railway & Light Company, Rochester, N. Y., quarterly, 1¼ per cent, preferred.

Washington Railway & Electric Company, Washington, D. C., preferred, 2½ per cent; common, 1 per cent.

ELECTRIC RAILWAY MONTHLY EARNINGS

Period.			Gross Revenue.	Operating Expenses.	Net Revenue.	Fixed Charges.	Net Income.
ATLANTIC SHORE RAILWAY, SANFORD, ME.							
1 m.,	Oct.	'11	$23,369	$22,982	$387	‡$582	†$195
1 "	"	'10	28,743	20,695	8,048	‡606	7,442
BANGOR RAILWAY & ELECTRIC COMPANY.							
1 m.,	Oct.,	'11	$53,129	*$24,672	$28,457	$12,756	$15,701
1 "	"	'10	49,593	*21,771	27,822	12,004	15,818
4 "	"	'11	226,848	*98,440	128,408	51,991	76,417
4 "	"	'10	216,472	*94,459	122,013	47,725	74,288
CAPE BRETON ELECTRIC COMPANY.							
1 m.,	Sept.,	'11	$30,314	$14,455	$15,860	$6,174	$9,686
1 "	"	'10	28,835	13,113	15,722	6,149	9,574
12 "	"	'11	333,472	172,402	161,070	73,793	87,276
12 "	"	'10	317,733	170,922	146,811	73,972	72,839
CHATTANOOGA RAILWAY & LIGHT COMPANY.							
1 m.,	Oct.	'11	$83,698	*$49,247	$34,451	$20,198	$14,253
1 "	"	'10	77,993	*42,746	35,247	18,545	16,702
10 "	"	'11	780,934	*456,002	324,932	198,132	126,800
10 "	"	'10	728,940	*422,643	306,297	183,068	123,229
DALLAS ELECTRIC CORPORATION.							
1 m.,	Sept.,	'11	$131,249	$83,301	$47,948	$25,605	$22,343
1 "	"	'10	119,804	75,538	44,266	26,013	18,253
12 "	"	'11	1,582,597	984,873	597,724	313,760	283,964
12 "	"	'10	1,426,433	935,236	491,197	320,133	171,064
GALVESTON-HOUSTON ELECTRIC COMPANY.							
1 m.,	Sept.,	'11	$130,685	$75,550	$55,135	$25,468	$29,667
1 "	"	'10	110,146	63,308	46,838	26,199	20,638
12 "	"	'11	1,468,266	860,378	607,889	301,603	306,286
"	"	'10	1,278,075	776,278	501,798	281,319	220,279
GRAND RAPIDS RAILWAY.							
1 m.,	Oct.,	'11	$93,587	*$54,182	$39,405	$14,980	$24,425
1 "	"	'10	91,267	*50,832	40,435	15,299	25,136
10 "	"	'11	966,461	*546,967	419,494	150,341	269,153
10 "	"	'10	947,929	*508,729	439,200	152,129	287,071
LEWISTON, AUGUSTA & WATERVILLE STREET RAILWAY.							
1 m.,	Oct.,	'11	$47,242	*$28,531	$18,711	$14,430	$4,281
1 "	"	'10	49,090	*26,563	16,527	13,145	3,382
4 "	"	'11	226,149	*119,767	106,382	57,828	48,554
4 "	"	'10	217,712	*119,174	98,538	52,560	45,978
MONTREAL STREET RAILWAY.							
1 m.,	Oct.,	'11	$442,393	$232,201	$210,191	$35,697	$174,494
1 "	"	'10	386,688	205,750	180,938	31,998	148,940
NORTHERN TEXAS ELECTRIC COMPANY.							
1 m.,	Sept.,	'11	$136,089	$71,382	$64,707	$25,399	$39,308
1 "	"	'10	118,192	61,594	56,598	19,690	36,909
12 "	"	'11	1,579,244	819,380	747,343	288,322	471,543
12 "	"	'10	1,391,000	759,865	643,658	223,911	419,747
PORTLAND RAILWAY, LIGHT & POWER COMPANY.							
1 m.,	Oct.	'11	$540,764	*$264,614	$276,150	$127,179	$148,971
1 "	"	'10	503,485	*256,748	246,737	120,599	126,138
10 "	"	'11	5,238,372	*2,563,030	2,675,342	1,246,723	1,428,619
10 "	"	'10	4,609,974	*2,236,501	2,373,473	1,155,080	1,218,393
ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER COMPANY.							
1 m.,	Oct.,	'11	$91,442	*$54,746	$36,696	$19,043	$17,653
1 "	"	'10	87,613	*49,046	38,567	18,870	19,870
10 "	"	'11	903,306	*565,038	338,268	192,519	145,749
10 "	"	'10	854,363	*504,396	349,967	181,556	168,411
WHATCOM COUNTY, RAILWAY & LIGHT COMPANY.							
1m.,	Sept.,	'11	$35,912	$16,998	$15,914	$9,771	$6,143
1 "	"	'10	33,781	17,331	16,450	9,084	7,366
12 "	"	'11	482,624	208,185	183,438	127,491	55,947
12 "	"	'10	410,968	240,704	170,264	104,216	66,049

*Including taxes. †Deficit. ‡Taxes.

Traffic and Transportation

United Railroads, San Francisco, Issues Bulletin on Courtesy

E. D. Hibbs, general superintendent of the United Railroads, San Francisco, Cal., has issued the following bulletin "Concerning Courtesy" to all employees of the company:

"The attention of conductors, motormen, gripmen, inspectors and other representatives of this company is called to the following reasons why courtesy to patrons is expected and insisted upon:

"First—Do unto others as you would they should do unto you. If positions were reversed you would expect to be treated courteously and would naturally resent any lack of it.

"Second—You, with your experience and training, are thoroughly familiar with many things that strangers in the city, and even local people, are in ignorance of, and you should bear that fact in mind, and, in replying to questions, always courteously give the information fully and plainly in as few words as possible and without any suggestion of superiority born of a greater knowledge.

"Third—The manner in which a statement is made or question answered is frequently more aggravating and offensive than the words in which it is framed. A kind and gracious manner is the mark of a self-respecting man—and a man who respects himself rarely fails to command the respect of others with whom he is brought in contact.

"Fourth—True courtesy does not discriminate between a rich man or woman and a poor one—or between a well-dressed person and a poorly dressed one. 'A man's a man for a' that.'

"Fifth—Courtesy is not only something the public has a right to expect of you, but it pays. It pays in the friends it makes for you personally and as a representative of the company. It pays in minimizing the friction of your life, as well as that between the company and its patrons. It pays in raising your standard with the company. It pays in the personal satisfaction resulting from having done the right and kindly thing by your 'neighbor.' It is the wish of the management of this company that all its representatives whose work brings them into contact with the public may appreciate and fully measure up to their duty in this respect."

Joint Service Between New York and Newark.—The joint service over the Hudson & Manhattan Railroad and the Pennsylvania Railroad between New York and Newark, N. J., was inaugurated at 12:01 a. m. on Nov. 25, 1911.

Hearing on Grade Crossings in Indiana.—The Railroad Commission of Indiana has called a hearing for Dec. 5, 1911, on petitions filed with the commission for the elimination of grade crossings of interurban electric railways and steam railroads in Indiana.

Through Cars Between South Bend and Hammond.—It is stated that negotiations have been completed for operating through cars between South Bend and Hammond, Ind., as soon as the 16-mile link between Gary and Goodrum is completed by the Gary & Interurban Railway, Gary, Ind.

Rules for Transporting Dogs in Connecticut.—The Connecticut Company, New Haven, Conn., has decided to charge an extra fare for the transportation of dogs over its lines in Connecticut. The dog must go on the front platform with the motorman. In summer the dog will be permitted to ride with the smokers on the five rear seats. A 5-cent fare will entitle a dog to a transfer.

Police Whistles for Street Railway Employees.—Police Commissioner Waldo of New York has approved an application of the Metropolitan Street Railway for permission to equip its conductors with police whistles. The application was filed after an attempt was made to rob one of the company's conductors. The conductor had a police whistle in his possession and when he blew it his assailants fled.

Hearing in Regard to Fares in Seattle.—The Public Service Commission of Washington has decided to hold a public hearing to determine the reasonableness of an application filed with it to require the Seattle (Wash.) Electric Company to charge a fare of not more than 4 cents with transfer privileges and to sell eight tickets for a quarter, these tickets, however, to carry no transfer rights.

Hearing in New York on Car Temperature.—The Public Service Commission of the First District of New York has ordered a public hearing on Dec. 8, 1911, to determine whether or not it shall issue an order to require a thermometer to be installed in each and every surface, subway and elevated car in Greater New York and to increase the minimum temperature requirement from 40 deg. Fahr., as fixed by the commission some time ago.

Competition in New Jersey.—The Raritan River Railroad, a steam railroad operating between New Brunswick, N. J., and South Amboy, N. J., has filed with the Board of Public Utilities Commissioners of New Jersey a schedule of passenger rates to take effect Jan. 1, 1912, which reduces the average fare from 3 cents a mile to 1¼ cents a mile. The new rates are made the same as those of the Public Service Railway, which parallels the steam railroad. The railroad has also reduced its commutation rates.

Connecticut Company Expects to Comply with Fare Decision.—The Connecticut Company, New Haven, Conn., has issued the following statement in regard to its attitude toward the Public Utility Commission of Connecticut in relation to the fare case before the commission involving passenger rates between Hartford and Manchester, referred to previously in the ELECTRIC RAILWAY JOURNAL: "The Connecticut Company expects to comply with the orders of the commission in the Manchester fare case; therefore, there is no reason for raising any issue regarding the constitutionality of the utilities law."

Complaint Against Syracuse, Lake Shore & Northern Railroad.—The Public Service Commission of the Second District of New York has received a complaint against the Syracuse, Lake Shore & Northern Railroad, Syracuse, N. Y., signed by residents of Syracuse and patrons of that road, protesting against the increased rate of fare charged between Syracuse and Long Branch, or Stop 11, and stops en route, which was put into effect on Oct. 6, 1911. The complaint states that the increase from 5 cents to 10 cents between Syracuse and Stop 4 and from 10 cents to 15 cents between Syracuse and Stop 11 is unjust and unreasonable.

Experimental Owl Service in Portland, Ore.—The street committee of the City Council of Portland, Ore., has postponed action on the proposed ordinance to compel the Portland Railway, Light & Power Company to operate cars on all lines on an hourly schedule between 12:30 a. m. and 6 a. m. Meanwhile the company will establish the special night service suggested by B. S. Josselyn, president of the company. This provides for the operation of each present last car one more trip. Thus on practically every line the last car will leave the down-town terminal at 1:30 a. m., instead of 12:30 a. m., as at present. The fare on the last trip will be 10 cents to compensate for the extra expense involved.

Right to Abandon Line Desired.—The Public Service Commission of the Second District of New York has received from the International Railway, Buffalo, N. Y., a petition for the approval of a declaration of abandonment of the single track of that company's line in Buffalo in North Division Street between Main and Washington Streets, and the single track in Eagle Street, between Main and Washington Streets, which were a part of the William Street line and the Clinton Street line, and which are no longer used because of the removal of the single track in Main Street. The petition states that the portions of the route sought to be abandoned are no longer necessary for the successful operation of the road or for the convenience of the public, as the cars of these routes are operated between Eagle and North Division Streets over the double track railway in Washington Street.

City Restrained from Enforcing Car Capacity Ordinance.—Judge Dykeman has temporarily restrained the city of Seattle, Wash., from proceeding under the ordinance regulating the number of passengers to be carried on street cars and fixing a schedule of running time. Judge Dykeman, in granting the temporary restraining order, held

that the question should await the adjudication of the higher court. The Seattle Electric Company contends that to place cars enough in service during rush hours to comply with the ordinance would block traffic and that to procure extra motormen and conductors for a few hours each day would impose a great financial hardship upon the company. The company also informed the court that a case is pending before the State Public Service Commission in which the commission is requested to make an order prescribing a schedule for the company, and that the divided authority of city and State renders the position of the company confusing.

Report of Metropolitan Street Railway Association.—The report of the Metropolitan Street Railway Association, composed of employees of the Metropolitan Street Railway, New York, N. Y., has been made public for the year ended Sept. 19, 1911. The total amount paid during the year on account of sickness or injury, for death claims and the estimated value of medical advice and attendance was $41,972. The amount of dues and initiation fees received from members was $29,901, making the excess of benefits over the amount paid by members $12,070. The number of members at the close of the association year was 4284. The association was organized in February, 1897. Since then $139,683 has been paid out in death claims, $114,272 in sick and injury benefits, and $114,081 for medical advice and attendance (estimated), making a total of $468,036. The total amount received in dues and initiation fees since 1907 is $374,896, making the benefits over the amount paid by members $93,139. Reference is made in the report to the social gatherings, the lunchrooms, and the loan fund. The pamphlet contains a number of half-tone illustrations, including a group picture of the officials and trustees of the association.

Changes in Schedule of Los Angeles Lines.—With the opening of the Watts-Athens cut-off to Redondo Beach, on the Pacific Electric Railway, Los Angeles, Cal., a number of changes were made in the schedules and running time of various lines of the company. The through operation on the narrow-gage line between Los Angeles and Redondo Beach, via Moneta Avenue, Inglewood and Sunnyside, has been discontinued. The service via Playa del Rey has been extended to Cliffton-by-the-Sea. Thirty minute local service is operated between Hawthorne and Belvidere. The time on the Covina-San Dimas line has been changed so that now there is a thirty-minute service instead of a fifty-minute service as heretofore. The La Habra line has been extended to Stern. A new schedule has been put in effect between Los Angeles and San Pedro, via Vermont Heights, making connections at Hermosillo with the Redondo through line. The direct San Pedro line by the way of Dominguez has been changed so that there is a forty-minute service instead of fifty minutes and one hour as heretofore. The Santa Ana schedule has been rearranged so that several more trains have been added to the run and there is an entirely new service between Los Angeles and Artesia.

Injunction Against Seattle Ticket Ordinance Denied.—The application of the Seattle (Wash.) Electric Company for an injunction to restrain the city from enforcing the ordinance to compel the company to place street car tickets on sale on the cars has been denied by Judge C. H. Hanford of the United States Circuit Court. In asserting jurisdiction, Judge Hanford said: "The ordinance in question is a legislative act of a municipal government. The State constitution is the primary source of the legislative power of the City Council, and the power of the Council to legislate is subordinate, but not secondary, to the power of the State. It is subordinate because the State constitution prescribes that the charter must be consistent with the constitution and subject to it and the laws of the State. If the ordinance does impair the obligation of contracts it is under the ban of the constitution of the United States and the alleged exertion of the legislative power of the State brings it under the constitution of the United States and therefore under the jurisdiction of the federal courts." The attitude of the company toward the ordinance was explained in the statement by Jacob Furth, president of the company, published in the Electric Railway Journal of Nov. 18, 1911, page 1079.

Personal Mention

Mr. Roy Antibus, formerly with the Roberts & Abbott Company, Cleveland, Ohio, has been appointed engineer in charge of construction of the Northern Ohio Power Company's property, at Cuyahoga Falls, with offices at Akron, Ohio.

Mr. H. M. Beardsley, for some time secretary and treasurer of the Elmira Water, Light & Railroad Company, Elmira, N. Y., and for more than a year acting general manager of that company, has been appointed general manager of the company.

Mr. C. Nesbitt Duffy, comptroller of The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., spoke on the subject of "Some Features of Electric Service Rates and of Municipal Ownership" before the Milwaukee Company section of the National Electric Light Association on Thursday evening, Nov. 23, 1911.

Mr. E. J. Emerson has resigned as superintendent of the Rapid Transit Railway, Dallas, Tex., controlled by the Dallas Electric Corporation, to become general manager of the Beaumont Ice, Light & Refrigerating Company, Beaumont, Tex. Mr. Emerson was presented with a gold watch and chain by the employees of the Dallas Electric Corporation as a token of esteem when he left Dallas.

Mr. T. G. Wood has been appointed superintendent of transportation of the Bloomington & Normal Railway & Light Company, Bloomington, Ill. Mr. Wood was first employed by the Illinois Traction System as superintendent at Champaign, Ill. When the division of that company between Springfield and St. Louis was opened he was placed in charge of it. He resigned from the company to go into business for himself.

Mr. A. B. Coryell, who resigned recently as general manager of the Dayton Construction Company and the Greenville Railway & Light Company, Greenville, Tex., has been appointed general superintendent and purchasing agent of the Waycross Street & Suburban Railway, Waycross, Ga., in charge of the purchasing of all material and the construction of the company's system. Mr. Coryell entered upon his new duties on Dec. 1, 1911.

Mr. William S. Sargent, for six years chief clerk of the Middlesex & Boston Street Railway, Newtonville, Mass., was tendered a banquet at the Woodland Park Hotel, Auburndale, Mass., on Nov. 20, 1911, in connection with his departure from the company to enter another field of business. Mr. George M. Cox, manager of the company, presided, and at the conclusion of the dinner presented Mr. Sargent with a gold pin on behalf of the officials of the Middlesex & Boston system.

Mr. Samuel Higgins, general manager of the New York, New Haven & Hartford Railroad, New Haven, Conn., who temporarily retired from active service several months ago because of ill-health, has decided to retire from the service of the company, effective with the close of this year. As a result of Mr. Higgins' resignation, Mr. H. J. Horn will be appointed a vice-president of the company in charge of the operating department, effective on Jan. 1, 1912. The position of general manager will remain in abeyance for the immediate future.

Mr. George G. Mulhern has been appointed superintendent of operation under Mr. Peter Witt, street railway commissioner-elect of Cleveland. When the street railways in Cleveland were merged as the Cleveland Electric Railway several years ago, Mr. Mulhern was made superintendent of the system, under Mr. John J. Stanley, general manager. Mr. Mulhern went into politics later and was elected sheriff of Cuyahoga County. At the expiration of his term of office, he built the loops about the Public Square, Cleveland, for the late Mayor Johnson. Later on as a contractor he did much work for the Cleveland Railway.

Mr. Carroll R. Phenicie has resigned as electrical engineer and master mechanic of the Chicago & Milwaukee Electric Railroad, Chicago, Ill., with which company he has been connected for the last eight years, to become electrical engineer for Mr. Clement C. Smith, who is managing the following properties: Eastern Wisconsin Railway & Light

Company, Fond du Lac; Wisconsin Electric Railway, Oshkosh; Green Bay Traction Company, Green Bay Gas & Electric Company, and the Northern Hydroelectric Power Company, Green Bay, Wis.; the Lee County Electric Company, Dixon, Ill.; Sterling, Dixon & Eastern Electric Railway, Dixon, Ill.; Winona Railway & Light Company, Winona, Minn., and receiver of the La Crosse Water Power Company.

Mr. W. A. Clader has resigned as auditor of the C. H. Geist Company, Philadelphia, Pa., to organize the Audit Company of Philadelphia, which will specialize in audits and examinations of public utility corporations. Mr. Clader became connected with the United Gas Improvement Company in 1901. When the company acquired the electric railways at Providence, R. I., in 1902, he was employed there as statistician. He became connected with Mr. S. S. Bush, Louisville, Ky., in 1907, as auditor of street railroad and lighting properties controlled by Mr. Bush and his associates. In November, 1908, Mr. Clader was appointed traveling auditor of the Mohawk Valley Company and the New York State Railways. After doing some special work at Penn Yan, N. Y., for Mr. W. T. Morris, Mr. Clader in November, 1910, was appointed auditor for Mr. C. H. Geist, who is interested in public utility properties. Mr. Geist will be associated with Mr. Clader in the Audit Company of Philadelphia as president of the company.

Mr. P. B. Sawyer has resigned as general manager of the Des Moines Electric Company, Des Moines, Ia., one of the McKinley properties, to become general manager of the Union Electric Company, Dubuque. He is thirty-two years old. He was graduated from Purdue University in the electrical engineering course in 1900. During the summer of 1900 he was connected with the Chandler & Taylor Company of Indianapolis, Ind. In 1901 he completed a postgraduate course at Purdue University in electrical engineering, and later was made assistant to the construction engineer on the underground installation with the Des Moines Edison Light Company. He continued with this company and was appointed superintendent in January, 1902. In April, 1906, he was made general manager of the company, which position he has held until the present time, having been continued in charge of the property when it was sold to the McKinley interests in 1910. He succeeds Mr. L. D. Mathes at Dubuque, whose appointment as manager of the Montgomery (Ala.) Traction Company and the Citizens' Light, Heat & Power Company was noted in the ELECTRIC RAILWAY JOURNAL issue of Nov. 11, 1911.

OBITUARY

John F. Dryden, president of the Prudential Insurance Company, Newark, N. J., and a director of the Public Service Corporation of New Jersey, Public Service Railway and other corporations, died at his home in Newark on Nov. 24, 1911. Mr. Dryden was born in Farmington, Me., in 1839. He attended Yale, but did not graduate. As early as 1865 he entered the insurance field, and in 1873 he and others established the Prudential Insurance Company. Mr. Dryden was elected to the United States Senate from New Jersey in 1901.

J. J. Ferrier, who was connected with the staff of Mr. A. H. Babcock, electrical engineer of the Southern Pacific Company, San Francisco, Cal., died suddenly on Oct. 29, 1911, at his home in Fruitvale, Cal., from overexertion in physical culture exercises. Mr. Ferrier was born in Sussex County, England, in 1883, and came to America in 1903. His first work was with the Mergenthaler Linotype Company, New York, N. Y. In 1905 he joined the electrification department of the New York Central & Hudson River Railroad and rose to chief draftsman in the steam engineering branch of this work. In April, 1907, he entered the office of the electrical engineer of the Southern Pacific Company at San Francisco, Cal., and took a prominent part in the steam and mechanical engineering work of the Oakland, Alameda and Berkeley electrification. Subsequently he was promoted to the position of office engineer, and in this capacity handled many details connected with the Oakland, Alameda and Berkeley installation. He was a member of the Masonic Order, the Foresters and the Eastern Star, and an associate member of the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterisk (*) indicates a project not previously reported.

RECENT INCORPORATIONS

***Fresno & Eastern Railroad, Fresno, Cal.**—Application for a charter has been made in California by this company to build a 78-mile electric railway between Fresno and Shaver Lake. Capital stock, $1,500,000. Incorporators: Fayette M. Meiggs, Oakland; Albert B. Dodd, San Francisco, and George J. Aldrich, Audubon, N. J.

***Marysville-Colusa Railway, San Francisco, Cal.**—Application for a charter has been made by this company, as a subsidiary company of the Northern Electric Railway, to build a 30-mile electric railway between Marysville and Colusa. Capital stock, $1,500,000. Directors: Charles H. Hammon, Berkeley; Leon J. De Sabla and Samuel Lilienthal, San Francisco; George B. Springer, Piedmont, and Herbert W. Turlong, Pleasanton.

***Arkansas Valley Railway, Light & Power Company, Pueblo, Col.**—This company has been incorporated in Colorado in the interest of H. M. Byllesby & Company, Chicago, Ill., to take over the Pueblo Suburban Traction & Lighting Company and the Colorado Light & Power Company, Canon City, recently acquired. Capital stock, $10,000,000. Incorporators: W. F. Raber, T. H. Devine and F. W. Insull.

Angola Light & Power Company, Angola, Ind.—Incorporated in Indiana, presumably as the successor to the Angola Railway & Power Company, now in the hands of receivers. Capital stock, $50,000. Incorporators: W. E. Massman, W. J. Vessey, A. J. Vessey, D. M. Vessey, John Dreibiss, Ft. Wayne, Ind., and Eugene Reilly and M. B. Kelly, Pittsburgh, Pa.

Perry (Ia.) Electric Railway.—Incorporated in Iowa to build an electric railway in Perry. Capital stock, $100,000. Incorporators: B. C. Dilenbeck, J. E. Hambright, Chas. E. Wilson, C. C. McCreery, H. C. Modlin, J. E. Wilson and H. G. Giddings. [E. R. J., Oct. 28, '11.]

Toledo, Ann Arbor & Jackson Railroad, Monroe, Mich.—Chartered in Michigan to take over the Toledo, Ann Arbor & Jackson Electric Railway. Of this line 18 miles are completed to Petersburg and from Petersburg to Ann Arbor, 26 miles, the grading is done and the bridge abutments are built. The right-of-way is secured to Jackson, which is 48 miles from Toledo. Capital stock, $500,000. Officers: L. E. Ingalls, Chicago, Ill., president, and George E. Fisher, 433 Majestic Building, Detroit, secretary. [E. R. J., Oct. 28, '11.]

Elwood City & Kopple Electric Railway, Elwood City, Pa.—Chartered in Pennsylvania to build a 1-mile electric railway from Elwood City to Koppel. Capital stock, $6,000. Incorporators: T. A. Wilson, R. A. Todd, F. C. Johnson, H. K. Gregory and W. J. Coursin, all of Beaver Falls. [E. R. J., July 29, '11.]

FRANCHISES

Phoenix, Ariz.—The Salt River Valley Electric Railway has asked the Common Council for a twenty-five-year franchise in Phoenix. This 60-mile railway will connect Phoenix, Scottsdale, Tempe, Mesa, Chandler, Alhambra, Glendale and Peoria. F. M. Winter, Phoenix, president. [E. R. J., Nov. 18, '11.]

Bakersfield, Cal.—The San Joaquin Valley Electric Railway, Stockton, has received a forty-nine-year franchise from the City Council on North Chester Avenue in Bakersfield.

Covington, La.—W. J. Tracy, Cleveland, Ohio, has received a franchise for an electric railway from Slidell to Houltonville. It is said that this line will be a link in a proposed electric railway between Slidell and Hammond, and that the proposed road will eventually be extended to Baton Rouge. [E. R. J., Oct. 28, '11.]

Elizabeth, N. J.—The Public Service Railway, Newark, has received the approval of the joint committee on railroads, streets and street railways to double-track its line on South Broad Street in Elizabeth. The company will next ask the City Council for a franchise.

New Rochelle, N. Y.—The Public Service Commission, Second District, has given its permission for the construction of the extensions of the Westchester Street Railroad in New Rochelle.

Statesville, N. C.—The North Carolina Public Service Company, Greensboro, will ask the City Council for a franchise in Statesville.

Cleveland, Ohio.—The Cleveland, Youngstown & Eastern Railway has asked the Mayor to approve the franchise to build its line down Kingsbury Run to the center of Cleveland.

Dayton, Ohio.—The Dayton, Springfield & Xenia Southern Railway has asked the City Council for a twenty-five-year extension of its franchise in Dayton.

North Dayton, Ohio.—The People's Railway, Dayton, has received a franchise from the City Council in North Dayton to construct curves, switches and turnouts along the loop in North Dayton, provided it conformed with certain conditions that were outlined.

Pittsburgh, Pa.—The Pittsburgh, Steubenville & Wheeling Street Railway has asked the City Council for a franchise in Pittsburgh. This line will connect Pittsburgh, Pa., Steubenville, Ohio, and Wheeling, W. Va. Surveys have been made and most of the right-of-way secured. W. H. Hildebrand, Pittsburgh, is interested. [E. R. J., Dec. 10, '10.]

Providence, R. I.—The Rhode Island Company has received a franchise from the Board of Aldermen to double-track its Plainfield Street line from Olneyville Square westerly in Providence.

Spartanburg, S. C.—The Greenville, Spartanburg & Anderson Railway, Greenville, has received a fifty-year franchise from the City Council in Spartanburg.

Salt Lake City, Utah.—The Salt Lake & Los Angeles Railway has asked the City Council for a franchise to extend its tracks in the western part of Salt Lake City and to run its cars over certain tracks of the Utah Light & Railway into the business section of Salt Lake City.

***Salt Lake City, Utah.**—The Saltair Railroad has asked the City Council for a franchise to operate an electric railway over certain streets in Salt Lake City.

Weston, W. Va.—The Clarksburg & Weston Electric Railway, Clarksburg, has asked the City Council for a franchise to extend its line in Weston to Mount Clare.

Milwaukee, Wis.—The Milwaukee Electric Railway & Light Company has asked the Common Council for a franchise for a crosstown line over the Twenty-seventh Street viaduct in Milwaukee.

TRACK AND ROADWAY

***Bassano, Alta.**—The Gorman, Clancy & Grindley Company, Calgary, has received a contract to build a 5-mile electric railway between Bassano and the Canadian Pacific Railway's irrigation dam.

Lethbridge (Alta.) Municipal Tramway.—At the municipal elections on Dec. 11 the citizens will be asked to vote on a by-law for the raising of $450,000 for the construction of an electric railway in Lethbridge next year. The sum of $300,000 will go to the railway, the remaining $150,000 to be used for the necessary extensions to the power plant. [E. R. J., Nov. 25, '11.]

Ft. Smith Light & Traction Company, Ft. Smith, Ark.—It is reported that this company has awarded a contract for grading its extension to South Ft. Smith to Hays & Payne Company.

Phoenix (Ariz.) Railway.—This company expects to extend its Glendale line to Marinette, a distance of 16 miles northwest of Phoenix.

Clear Lake Railroad, Lakeport, Cal.—Work has been begun by this company on its 24-mile line between Hopland and Lakeport, with branches through Kelseyville and Upper Lake. Charles M. Hammond, Lakeport, is interested. [E. R. J., Oct. 14, '11.]

Oakland (Cal.) Traction Company.—Plans are being considered by this company to build several extensions in Santa Clara County.

Washington Railway & Electric Company, Washington, D. C.—This company plans to build an extension of its Ninth Street line as far as Soldiers' Home Junction on Georgia Avenue in Washington.

Macon Railway & Light Company, Macon, Ga.—This company will spend $300,000 on various improvements and extensions of its lines. Among these extensions will be a line to the Idle Hour Country Club, for which the contract has already been awarded.

Waycross Street & Suburban Railway, Waycross, Ga.—This company has placed orders for material and work will soon be begun on its line to connect Hebardville, Deenwood, Winona Park, Waresboro and Waycross. H. H. Burnet, secretary. [E. R. J., Oct. 21, '11.]

Waukegan, Rockford & Elgin Traction Company, Waukegan, Ill.—During the next two months this company will award contracts to build 7 additional miles of track. It will purchase 56-lb. or 60-lb. relaying rails for this work.

Chicago, Lake Shore & South Bend Railway, Michigan City, Ind.—It is reported that this company plans to build from Kensington to Chicago, a distance of 14 miles.

Indianapolis, New Castle & Toledo Railway, New Castle, Ind.—It is reported that this company will soon build its extension from Indianapolis to Muncie.

Eastern Indiana Traction Company, Richmond, Ind.—Surveys will be begun at once by this company on its 85-mile electric railway. The southern terminus will be Hamilton, Ohio, from which point the line will extend northwesterly across the Indiana line to Oxford, Ohio, College Corner and Richmond, Ind. From Richmond the line will extend northeast to Union City and Portland. Financial backing has been secured and it is expected to begin construction in the spring. Sharon E. Jones, president. [E. R. J., Oct. 7, '11.]

Kansas City & Ft. Scott Electric Railway, Stanley, Kan.—Surveys are being made and right-of-way obtained by this company for its projected line between Kansas City, Mo.; Rosedale, Stanley, Stilwell, Louisburg, Pleasanton and Ft. Scott, Kan. Capital stock, $10,000, to be increased as soon as the surveys are completed. Officers: W. T. Quarles, Stanley, president; John Roe, Meriden, vice-president; A. J. Calvery, Stilwell, secretary; J. H. Schroeder, Stanley, treasurer, and M. M. Sweetman, Stanley, general manager. [E. R. J., Nov. 18, '11.]

Frederick (Md.) Railroad.—Plans are being made by this company to begin the construction of its line between Jefferson and Brunswick.

Milford & Uxbridge Street Railway, Milford, Mass.—Plans are being considered by this company to extend its lines from Milford to the North Milford district.

Meridian Light & Railway Company, Meridian, Miss.—This company plans to build an extension of its Compress Street line in Meridian to the cotton mills.

Yazoo Valley Electric Railway, Light & Power Company, Yazoo City, Miss.—James H. Collins, Chicago, has been awarded the contract by this company to make a survey for the proposed interurban railway between Yazoo City and Canton and which may later extend to Jackson via Tougaloo, Ridgeland, Madison and Gluckstadt. It is reported that financial backing has been secured. H. Wise, Yazoo City, is interested. [E. R. J., Oct. 7, '11.]

Nebraska Transportation Company, Omaha, Neb.—This company is receiving bids for material and will let contracts during December to build its electric railway to connect Omaha, Elk City, Arlington, Craig, Oakland, South Sioux City and Fremont. A single track from Omaha to Fremont will be built first. C. W. Baker, Omaha, president. [E. R. J., Nov. 5, '11.]

Public Service Railway, Newark, N. J.—Plans are being considered by this company for an extension on Bloomfield Avenue in Newark.

United Traction Company, Albany, N. Y.—This company has placed in operation its new Arbor Hill line in Albany.

Catskill (N. Y.) Traction Company.—This company plans to build an extension from Cairo to East Durham and Oak Hill.

Elmira Water, Light & Railroad Company, Elmira, N. Y.—Work has been begun by this company on the construction of a double-track line between Elmira and Rorick's Glen.

New York & Queens County Railway, Long Island City, N. Y.—In the spring this company will double track all its lines in Flushing, and between Flushing and Jamaica and over the causeway to College Point.

North Carolina Public Service Company, Greensboro, N. C.—It is reported that this company plans to extend its line to Statesville.

North Carolina Interurban Railway, Raleigh, N. C.—This company has removed its principal office from Rutherfordton to Shelby. This line will connect Charlotte, Gastonio, Dallas, Cherryville, Shelby, Rutherford, Fairview and Asheville. J. A. Harrill, president and J. T. Gardner, secretary. [E. R. J., May 20, '11.]

Springfield, Wilmington & Cincinnati Railway, Cincinnati, Ohio.—It is reported that this company has financed and will begin construction in the spring on its line which is to connect Springfield, Cincinnati, Wilmington and Norwood. G. H. Frey, Springfield, is interested. [E. R. J., Aug. 5, '11.]

***Coshocton, Ohio.**—Frank A. McGowan, Canton, plans to build a line in Coshocton. It is proposed to operate storage battery cars.

Shawnee-Tecumseh Traction Company, Shawnee, Okla.—The people of Sulphur have accepted the proposition of this company and will give the company a bonus of $40,000, depot grounds and a franchise to operate a line from the Artesian Hotel in Sulphur to Bromide Spring.

London & Northwestern Railway, London, Ont.—Extensive preparations are being made by this company for the construction of a radial railway between London and Sarnia. Daniel A. Stewart, London, is interested. [E. R. J., Oct. 15, '11.]

Niagara, St. Catharines & Toronto Railway, St. Catharines, Ont.—It is reported that this company will extend its lines early next year from Port Colborne to Ft. Erie, and from that place to Niagara Falls.

***Portland, Ore.**—An extension of the Hawthorne Avenue line in Portland 2½ miles eastward on Division Street and the Section Line road has been definitely arranged for by the property owners along the proposed route. A provisional company is to be organized with a capital stock of $30,000, which will construct the line and turn the property over to the Portland Railway, Light & Power Company when completed.

Montreal & Southern Counties Railway, Montreal, Que.—This company has leased the lines of the old Central Vermont Railroad from McGill Street, Montreal, to Richelieu, 14 miles from St. Lambert. The line will be electrified and, besides new rails, a new bridge with a span of 140 ft. is to be built over the Little Montreal River near Chambly Basin.

Valley Street Railway, Sharon, Pa.—Plans are being made by this company to construct an extension in Sharon and at South Sharon.

Sunbury & Northumberland Electric Railway, Sunbury, Pa.—Surveys are being made by this company for its extension from Sixth Street via Queen Street over Kapp Heights to the upper end of the company's yards in Northumberland.

Woodland & Southern Railway, Woodland, Pa.—This company has completed its line and will place it in operation early in December. It connects Woodlawn and Aliquippa with a branch line on Franklin Avenue, Woodlawn, extending toward New Sheffield. J. I. Moore is interested. [E. R. J., May 6, '11.]

Knoxville Railway & Light Company, Knoxville, Tenn.—Surveys are being made, right-of-way has been obtained and construction will be begun soon on the extension of this company's Sevierville Pike line to the Island Home property.

Middle Tennessee Traction Company, Nashville, Tenn.—About 19 miles of grading have been completed by this company from Franklin to Eagleville. This 40-mile line will connect Franklin, Eagleville, Shelbyville and College Grove. P. E. Cox, Franklin, president. [E. R. J., Sept. 23, '11.]

Greenville, Spartanburg & Anderson Railway, Greenville, S. C.—Contracts for the grading and laying of all necessary piping, etc., for the main line entering Anderson and for that connecting the Riverside-Toxaway and Orr Mills have been awarded by this company to J. C. Ross.

Galveston-Houston Electric Railway, Houston, Tex.—This company has completed its railway between Galveston and Houston via Virginia Point, Texas City Junction, Lamarque, Dickinson, League City and Genoa.

***Mission, Tex.**—At a recent meeting of the Mission Business League, Mission, the plans of the proposed electric railway from Mission to Monte Cristo were accepted. The construction of the line is to begin two weeks after the bonus of $15,000 is secured. The ultimate terminus of this line will be San Antonio. S. Robertson, San Benito, is interested.

San Antonio (Tex.) Traction Company.—A 1-mile extension will be built by this company on Nogalitos Street, from South Flores Street, in San Antonio.

San Benito (Tex.) Interurban Railway.—Construction will be begun at once by this company on the extension of its Santa Maria line. The right-of-way is being cleared.

***Centralia Light & Power Company, Centralia, Wash.**—This company will build a 10-mile electric railway between Centralia and Rochester. It is proposed to extend this line to Gray's Harbor. The right-of-way has been secured. Current will be supplied by the Eastern Railway & Lumber Company.

Olympic Electric Railway, Port Angeles, Wash.—The necessary money has been raised by this company to obtain the right-of-way in Jefferson and Clallan Counties. The line will connect Port Angeles, Port Ludlow and Oak Bay, from which a fast ferry service will be established to Seattle. J. A. Adams is interested. [E. R. J., Sept. 16, '11.]

Merrill Railway & Lighting Company, Merrill, Wis.—Plans are being made by this company to build an extension to the Sixth Ward in Merrill.

SHOPS AND BUILDINGS

Pacific Electric Railway, Los Angeles, Cal.—This company has begun work on its new station in Long Beach. The Townsend-Vandewater Realty Company has the contract for the construction of the building and J. Y. Parker has the contract for the brick work.

San Diego (Cal.) Electric Railway.—This company plans to build a new station on the north side of Adams Avenue in San Diego.

Chicago & Southern Traction Company, Chicago, Ill.—It is reported that this company is considering plans to build a new freight station on North Schuyler Avenue in Chicago.

Gary & Southern Traction Company, Crown Point, Ind.—Work will be begun at once by this company on its new carhouses and repair shops at Lottaville, south of the Gary city limits. The structure will contain a storehouse and general offices for the company.

St. Joseph Valley Traction Company, Elkhart, Ind.—This company's carhouse and machine shops at Lagrange, which were destroyed by fire on Nov. 11, will be rebuilt at once and new equipment will be purchased.

Kokomo, Frankfort & Western Traction Company, Kokomo, Ind.—Work has been begun by this company on its new interurban depot in Russiaville. The structure will be one story high and of brick and steel construction.

United Railways & Electric Company, Baltimore, Md.—A tract of land on the Hartford Road, adjoining Weber's Park, has been bought by this comapny, on which it will begin shortly the erection of a large carhouse and station.

POWER HOUSES AND SUBSTATIONS

Macon Railway & Light Company, Macon, Ga.—Among the various improvements to be made in the near future by this company will be the construction of a new power house on Ocmulgee Street in Macon.

Gary & Southern Traction Company, Crown Point, Ind.—This company will begin work at once on the construction of its new power plant at Lottaville.

Gulfport & Mississippi Coast Traction Company, Gulfport, Miss.—This company is installing a new 450-hp boiler at its power house in Gulfport.

Manufactures & Supplies

ROLLING STOCK

People's Traction Company, Galesburg, Ill., is in the market for heaters for two cars.

Waukegan, Rockford & Elgin Traction Company, Palatine, Ill., expects to purchase a gasoline motor car.

Macon Railway & Light Company, Macon, Ga., expects to be in the market shortly for six cars. This order may be increased to twelve cars.

York (Pa.) Railways has ordered four 26-ft. semi-convertible motor car bodies mounted on Brill 27-GE1 trucks from The J. G. Brill Company.

Chillicothe Electric Railroad, Light & Power Company, Chillicothe, Ohio, has ordered four Brill 39-E trucks from the G. C. Kuhlman Car Company.

Capital Traction Company, Washington, D. C., has ordered fifty Brill 39-E plow carrier trucks without wheels and fifty Brill 39-E non-plow carrier trucks without wheels from The J. G. Brill Company.

Omaha, Lincoln & Beatrice Railway, Lincoln, Neb., has ordered one 24-ft. electric switching locomotive from the Baldwin Locomotive Works. It will be equipped with Westinghouse motors and type HL control.

Metropolitan Street Railway, Kansas City, Mo., has been recommended by Hermann Brumback, special master appointed by Judge Hook of the federal court, to expend $537,000 for the purchase of ninety new cars.

American Railways, Philadelphia, Pa., has ordered for the People's Railway, Dayton, Ohio, ten single-truck cars from the St. Louis Car Company through Wendell & MacDuffie. The cars will be 26 ft. 6 in. long and equipped with Warner trucks.

Oregon Electric Railway, Portland, Ore., has ordered ten 57-ft. 8-in. passenger trail car bodies, three 57-ft. 8-in. combination passenger and baggage motor car bodies, and three 57-ft. 8-in. combination passenger, baggage and smoking motor car bodies from the American Car Company, through Pierson, Roeding & Company.

Chicago (Ill.) Railways is building 215 closed double-truck cars of the pay-as-you-enter type in its own shops. The car bodies are 31 ft. 2 in. long. The company will also rebuild seventy-seven old double-truck cars to the pay-as-you-enter type. This will make a total of 1620 double-truck pay-as-you-enter cars to be operated by this company by the end of 1912.

Bakersfield & Kern Electric Railway, Bakersfield, Cal., has included the following in its specifications for the six California type combination motor cars which are being built by the American Car Company:

Seating capacity.....40	Axles .....Brill
Bolster centers, length, 23 ft. 4 in.	Bumpers.....American Car
	Curtain fixtures...Cur. S. Co.
Length of body....28 ft. 3 in.	Headlights ....Crouse-Hinds
Over vestibule.....41 ft. 2 in.	Journal boxes.....Brill
Width over sills..7 ft. 10½ in.	Motors..... .....GE-203
Over all.....8 ft. 5 in.	Registers .....S. & M.
Height, rail to sills...33⅜ in.	Seats .....H. & K.
Sill to trolley base, 8 ft. 11 13/16 in.	Step treads.....QMS
	Trolley catchers, Elec. Serv. S. Co.
Body .....wood	
Headlining .....agasote	Trucks.... ....Brill, 27-GE1
Roof .....monitor	Varnish .....Valentine
Underframe .....semi-steel	Ventilators ...American Car

TRADE NOTES

Edgar Allen Manganese Steel Company, Chicago, Ill., has appointed Walter H. Evans manager of the motor-gear department with headquarters in Chicago. Mr. Evans was formerly superintendent of motive power of the Indiana Union Traction Company, Anderson, Ind.

Canadian Car & Foundry Company, Montreal, Que., reports net profits of $1,007,137 for the year ended Sept. 30, 1911, and a surplus after paying preferred dividends of $622,137. After dividends amounting to 4 per cent were paid on the common stock, there remained $467,137 to be added to the profit and loss account. The gross sales for the year, which aggregated over $12,500,000, showed a considerable increase over those of the previous year.

The J. G. Brill Company, Philadelphia, Pa., has received the following orders for export: E. G. Long & Company, New York, N. Y., ten Brill 21-E trucks; Noyes Brothers, Australia, two Brill 21-E trucks, without wheels and axles; Alejandro Angel & Company, New York, N. Y., four 30-ft. second-class passenger cars mounted on Brill 57-D trucks; Dick, Kerr & Company, London, Eng., for Newcastle Tramways, six Brill 21-E trucks without wheels and axles.

General Electric Company, Schenectady, N. Y., has received the following orders for export: Havana Central Railway, Havana, Cuba, one ABH 25-500 430-volt, 25-cycle transformer, one 3000-cu. ft. blower set, one 500-kw rotary converter and switchboard; Australian General Electric Company, twenty K-11 controllers, twenty circuit breakers, six 6000-cu. ft. blower sets, ten complete air brake equipments; South American General Electric Company, twelve GE-90 double motor equipments with controllers.

Wonham, Sanger & Bates, New York, N. Y., report that during October, in addition to an order received from the Chicago Railways for 900 H-B life guards and from the Chicago City Railway for 576 guards, repeat orders were received from the Westchester Electric Company for twenty sets and the Third Avenue Railroad for thirty sets for the equipment of their new cars. The Philadelphia Rapid Transit Company also applied 1675 guards and the Montreal Street Railway 600 guards during the month. The company has appointed the Railway Sales Company, with offices at 1224 First National Bank Building, Chicago, Ill., as its Western agents.

Scholey & Company, Ltd., is a new firm recently organized in London which will make a specialty of stimulating the export of British electrical manufactures. Mr. Scholey, the organizer of the firm, has had a long and successful career in the electrical business. For ten years he was assistant editor of *The Electrical Review* of London. Afterward he gained a few years' experience in electrical manufacturing and the sale of electrical goods while in the employ of Mather & Platt, of Manchester. For the last ten years he has been intimately associated with Dick, Kerr & Company. For some time, however, Mr. Scholey has been considering plans for increasing the export trade of British electrical manufactures. Many millions of money are invested in Great Britain in the smaller companies manufacturing electrical goods. A large number of these companies have specialized in their lines and are thus in a position to make their own specialties much more cheaply and accurately than companies making a greater variety of material. Such firms, however, are frequently so engrossed by their manufacturing that they have little time for the marketing of their goods outside their own local territory, and especially outside of Great Britain. Mr. Scholey believes that by creating a selling organization and by making special arrangements with a number of these specialists in electrical manufactures he will be able to supply the wants of foreign companies that may be desirous of getting the best British manufactured goods but do not well know where or from whom to buy them. At the same time he will be benefiting these manufacturing companies by taking the expense and worry of selling off their shoulders. Scholey & Company have already entered into definite agreements with a number of firms manufacturing electrical specialties, and in time they will add others to their list. Though the main feature of the business of the new firm will be the development of export trade, it is not intended to neglect the home markets. Mr. Scholey has taken into partnership with him C. W. Hill, who until within the last few weeks was the manager of the Bournemouth Tramways. The new firm has taken offices at 151 Queen Victoria Street, London, and has already done a considerable business. As quickly as opportunity occurs agencies will be opened up in this country and in the most prominent cities in the British colonies and South America.

ADVERTISING LITERATURE

General Electric Company, Schenectady, N. Y., has issued Bulletin No. 4899, illustrating and describing its expulsion fuses and fuse holders. These are for use on circuits having voltages up to and including 110,000 volts.