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A Great Feat in Transportation

One of the finest feats in street railway transportation ever witnessed was the way the street railway companies of St. Louis handled the crowds on St. Louis Day at the Louisiana Purchase Exposition. This was the day when the people of St. Louis set aside all work as far as possible and devoted themselves to swelling the attendance at the Exposition; the attendance being about 400,000 on that day. With the memory of the enormous congestion of people at the Columbian Exposition, Chicago Day, Oct. 9, 1893, in mind, it is not strange that some uneasiness was felt lest the transportation lines be swamped with traffic. They were not overcrowded, however, and the way in which the street railways did their work on that day could not fail to excite the admiration of every intelligent street railway man who witnessed it. It is all very well to say that larger numbers of people are carried daily by the street railways of Greater New York. That is not the point. The admirable thing about the St. Louis Day street railway performance is that the street railways were on a special day and to a special place able to carry about double the normal traffic of the corresponding date a year before, and were able to do it with such clock-work regularity of service that the jam and crush of people at terminal and transfer points, usually considered inseparable from such great special days, were nowhere to be found. Cars and crowds moved along so freely that it was difficult to realize that the greatest day of the Louisiana Purchase Exposition was in progress. Photographers who went out with their cameras expecting to get photographs of great masses of packed humanity, were doomed to disappointment. The crowds flowed to and from the street car terminals like great rivers, and the stream being unbroken by any shortcomings of the car service, there was no time for the lakes and seas of humanity to form that are thought usually to be the necessary evils of such special events. It is not without a justifiable humorous twinkle of the eye that St. Louis street railway men relate how for a time in the morning the street cars landed people at some of the Exposition gates faster than the Exposition management was able to perform the simple task of passing them through the gates. The whole thing showed not only the results of excellent street railway management for the day, but also the results of the months of well planned preparation. We feel that we must metaphorically take our hats off to the gentlemen of the St. Louis Transit Company and of the St. Louis & Suburban Railway Company who were responsible to so great a degree for the comfort of the St. Louis public on that day, as well as on previous similar occasions.

Soldered Rail Bonds

It is now about four years since the first bonds using solder for electrical connection between the bond and rail were described in these columns. In that time there has been a steady increase in the use of soldered bonds, and more than one manufacturer is putting out bonds designed to be soldered to the rail. As to the superior qualities of a soldered contact when the soldering is thoroughly well done there can be no doubt, for as long as the solder is intact there is no possible chance for oxidizing or electrolytic action between the contact surfaces. That the soldered bond has not been used more heretofore is probably due to fear on the part of constructing engineers that they cannot be sure that the soldering is well done in every case, and if not well done, the bond is much worse than any

riveted or pressed terminal. It has been argued that it is more likely that the class of labor which is employed on bonding work will secure a fairly good contact with the pressed terminal than with soldered. One of the principal dangers with soldered bonds is a lack of heat during the soldering process. As the veriest novice in the art of soldering knows, plenty of heat is one of the first essentials in soldering, and it takes considerable heat to raise a 70-lb rail to a temperature which will melt solder and to keep it at that temperature long enough to do the job. As the rail is large it has the ability to conduct away a great amount of heat. The heat must be so intense and so localized at one spot that the rail cannot conduct heat away fast enough to cool the spot that is to be soldered. Recent types of blow torches, both for kerosene and gasoline, can be obtained which overcome the difficulty of insufficient heat. Could the rail temperature be raised high enough to melt brass, brazed rail bonds would apparently be even better than soldered bonds, on account of the greater mechanical strength of the joint. The joint, however, seems to be abundantly strong on most of the soldered bonds where the area of contact is large.

In connection with soldered bonds, the question comes up of the best location. Some of the first soldered bonds which were installed in paved streets in Seattle were placed under the base of the rail, the rail being bonded in lengths of a block or more and then turned over into position on the ties. Some light bonds, or wire, have been made by riveting the terminals of the wire into the rail base and then soldering the terminal to the base. This kind of bonding can be done after the track is laid. Another form of soldered bond is adapted to go under the angle-bars and to be soldered to the web of the rail after removing one of the angle-bars. An interurban road on private right of way now being finished in the Middle West has adopted the novel plan of using a short soldered bond on the head of the rail opposite the flangeway. The points urged in favor of this location are ease of installation after the angle-bars have been applied and ease of inspection, as the condition of the bond can always be seen at a glance. On an interurban road on a private right of way the danger of injury to the exposed bond is not great, although, of course, the danger from theft is ever present. It is, of course, desirable to have a bond which depends entirely upon solder for its connection, where it can be inspected, although testing would reveal the fault if it were concealed. On a small road, testing would be considerably more expensive than inspection. Altogether there is much to be said on both sides of this latter question.

Controller Burn-Outs

The burning out of controllers on double-truck, four-motor equipments is becoming so frequent that it is high time that some plan of relief from it be sought. Indeed several operating companies are experimenting in that direction. About eleven years ago the type K series-parallel controller was first put on the market, and as this controller used the magnetic blow-out for extinguishing the arc, and was well designed in other particulars, it filled the bill admirably for the sizes of motor equipments common in those days. The controller problem for street cars was so completely solved for the time being by the K types of controller, which have practically become universal for city railway service in the United States, that the matter of controllers and car wiring for 20-ton and 25-ton city cars has possibly not received the attention from operating companies that it should.

The increased troubles from controller burn-outs recently are due almost entirely to the larger volumes of current that must be interrupted at the controller and the larger arcs that must be broken. While the typical city car of a few years ago weighed, say, 7 tons or 8 tons and took a maximum acceleration current of 60 amps. to 130 amps., the typical big city car of to-day will weigh from 18 tons to 25 tons, and will take from 160 amps. to 400 amps. maximum acceleration current. This means that the car fuses and circuit breakers must be adjusted to pass at least this current, and the feeder circuit breakers at the power station must at least allow several of these cars to accelerate on a section at once without opening. Car circuit breakers now are frequently set to open at a greater current than feeder circuit breakers would open at a few years ago. The dimensions of street car controllers, however, have changed but little. There have been a number of important improvements in details and some increases in contact areas, but the dimensions have not altered in any such proportion as the current which must be carried. These controllers do their work very well on the large four-motor equipments until something goes wrong with the motors or car wiring. In the old days a ground in a motor or in the car wiring would be almost certain to open the car fuse or circuit breaker, and very likely would open the circuit breaker on that feeder at the power station as well. The controller, therefore, would not have to open the circuit under a heavy short-circuit current, as this was done by the fuses and circuit breakers. In modern practice, however, circuit breakers and fuses will frequently pass enough current so that a ground on the car will not open them at once. In such a case this heavy current will be broken in the controller when the motorman throws it off. The result is usually a terrific arc in the controller that wrecks it, and causes such a display of fireworks on the front platform that the company considers itself fortunate if the terrified passengers do not land themselves promiscuously in the street before the car stops, to the detriment of the accident account. When four-motor equipments were new, "fireworks on the front platform" were seldom heard of, because motors and car wiring had not had time to develop defects. Now that such equipments have been in use several years, the faults are becoming more numerous, as are the accompanying pyrotechnic displays. As the difficulty lies primarily in the fact that the heavy currents incident to short-circuits on the car are interrupted by the controller rather than by the circuit breakers and fuses, several companies operating four-motor equipments with the K forms of controller have begun to experiment with fuses placed in each of the four-motor circuits. As each fuse can be of a size sufficient only for the current required by one motor, it can be one-fourth the size of the main fuse, as the main fuse must pass the current taken by the four motors in multiple. The presence of a fuse in each motor circuit which will open upon one-fourth the current that the main fuse or circuit breaker will open, should relieve the difficulty considerably. It further has the advantage that it absolves the motorman of all responsibility of experimenting to find out which motor to cut out. These four individual motor fuses add to the complication of car wiring and equipment, to be sure, but the complication is not serious. A move of this kind, it may be said, is in accordance with the present general tendency in lighting and power work to depend mainly on small branch circuit fuses near the point of consumption and to fuse all main supply circuits very heavily or not at all. The use of individual motor fuses would result in automatically opening all grounded motor circuits. As grounds are more frequently in motors than in car wiring, unless car

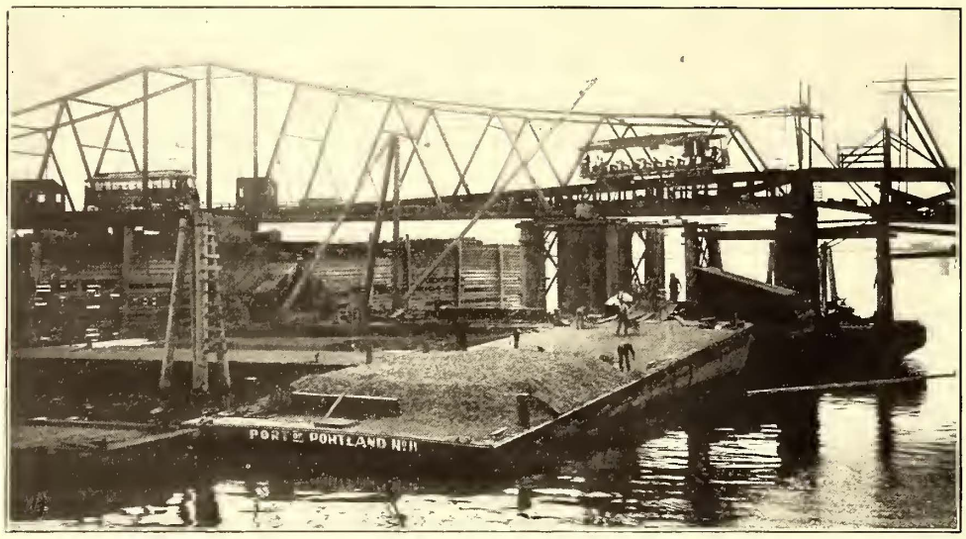
wiring is inexcusably bad, such fuses should prevent the majority of controller burn-outs and possibly save the spread of trouble in a motor. Controller burn-outs can, of course, be decreased by taking care that the main car breaker or fuse is never set for a greater current than is necessary and by maintaining high insulation of motors by means of frequent tests. The use of multiple-unit controllers which will safely interrupt very heavy currents is one effective solution of the difficulty, but as such control adds 15 per cent to 20 per cent to the cost of a city car there will be considerable casting around in other directions for relief before that solution is generally accepted. It is coming to be more and more the case that the problems in connection with the successful breaking of heavy circuits and the prompt isolation of short-circuit troubles before they can spread are calling for the best electrical engineering talent of anything in connection with handling large quantities of electrical energy.

A Consideration of Single-Phase Motors

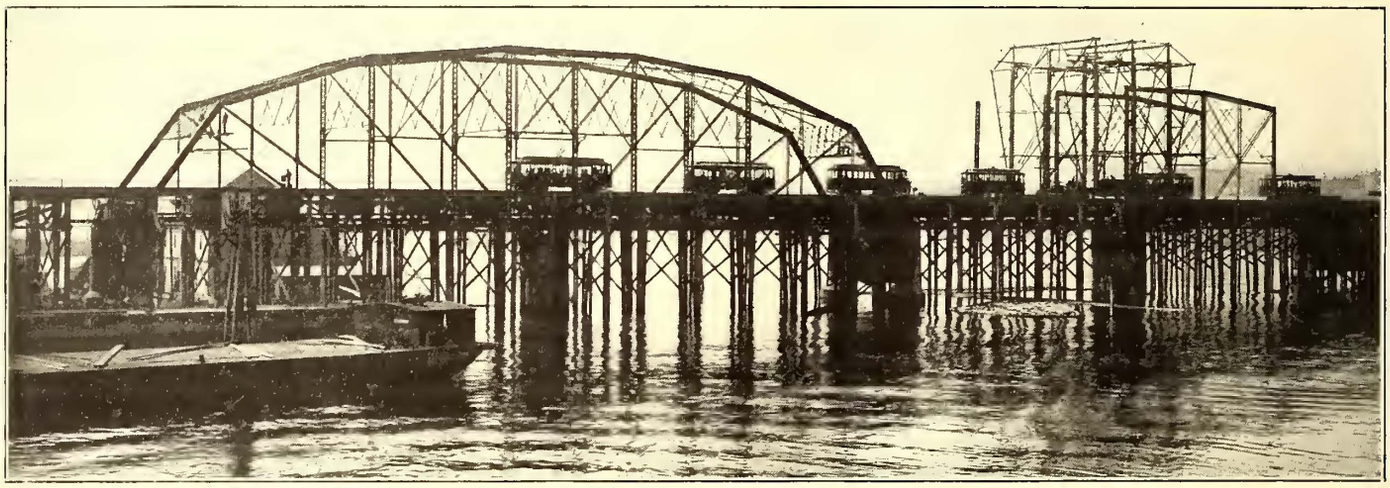
At the Electrical Congress just closed, a special meeting on Sept. 14 and a large part of the closing session, Sept. 16, was devoted to a discussion of the present movement in favor of alternating railway motors. The subject is, of course, one which has been of great interest to the profession for some time past, and the papers dealing with it have been eagerly anticipated. At the earlier session the development of the idea was considered at length by Dr. Steinmetz and Mr. Lamme. These gentlemen, who can speak with authority as having been themselves in the front of the movement, made plain the necessity of turning in this direction and the importance to the larger railway field of the methods proposed. It has long been clear that for the extension of electric traction the fundamental need is a higher working voltage, enabling the distribution of power to be made with some regard for economy. The present method of distributing to sub-stations, however efficient and desirable within its proper range of application, yet touches only here and there the difficulties of the situation when the coming larger work of the electrician is at hand. The various efforts at polyphase traction motors were gone over, and the inherent difficulties of the type, in particular the trouble encountered in getting variable speed, and in such speeding as would enable time to be made up when the necessity should arise. Given then the problem of working out an alternating system which should possess, so far as motors were concerned, the characteristics of series motors such as were in regular use, the natural and logical result was the series alternating motor at low frequency. Once this was obtained, it had, in addition, the most valuable property of working direct-current circuits quite as effectively as, and, in fact, rather better than on alternating-current circuits. Thus was evolved a machine which could not only work successfully on long lines where a simple alternating distribution was of primary value, but which could, in addition, operate with admirable results on circuits such as are now usual in electric railroading. Mr. Lamme gave a most interesting account of his work in the evolution of the type first announced at the Great Barrington meeting of the American Institute of Electrical Engineers, and later elaborated into its present form, while Dr. Steinmetz contributed his theoretical consideration of the question in addition to drawing on his rich practical experience. Owing to the shortness of the available time, the discussion had to be cut short and was held over until Friday, when it was again taken up at some length. Dr. Duncan, Mr. Sprague, H. W. Leonard, Mr. Armstrong and several of the distinguished foreigners present took a hand in this adjourned presentation of the subject. This session drew out somewhat divergent opinions. The importance of the work done was fully recognized, but its relation to the art at large was considered by no means fixed as yet. Particularly in heavy railroading, there seemed to be an impression that the proposed remedy was scarcely drastic enough to meet existing symptoms. In fact, considerable doubts were expressed of the likelihood of the larger railroad work being taken up to a marked extent in the near future. The requirements are of very great severity compared with even the most ambitious interurban roads yet built. The backbone of railway earnings is the freight traffic, and any application of electric power to railway working which is not prepared to undertake such traffic fails of that completeness which is necessary to full success. The single-phase commutating motor, even if it fully meets the requirements of ordinary interurban traction, might still fall far short of the freight haulage requirements. There does not seem to be a full consensus of opinion among engineers as to the real value of these novel systems even for interurban working. It seems clear that the types of motor considered have the very valuable power of working admirably on direct-current railway circuits. Indeed, it would be strange if they should signally fail here, for a series-wound motor with laminated field, low inductance and special precautions against sparking must certainly work on a direct-current circuit, if anywhere. It is the performance on alternating circuits that is just now of most interest and will soon be settled by practical use. There seems to be good reason for thinking that this will be satisfactory at least for certain cases, and even if this be all, a very material success will have been scored. There seems to be little doubt that this d. c.-a. c. series motor is intrinsically somewhat more bulky and heavy and materially more costly than the ordinary railway motor at the same output and efficiency. This is perhaps the necessary penalty of its discontinuous energy supply, and there need be small expectation that further improvements will modify this relative situation. Quite possibly we may have an a. c. type not materially heavier than present standard motors, but, granting this, the same designing would produce a still lighter d. c. motor, and the same comparison would doubtless hold as respects costs. Of course, there are no data as yet on the probable cost of maintenance and repairs. It is not at all improbable that these may be somewhat higher on the alternating-current equipment as a whole than upon the now standard forms. When judged in comparison with the maintenance and repairs of the usual long line equipment, including the sub-stations, the alternating motors should have the better of the argument. But high cost and possibly high maintenance, may seriously affect the adoption of the compromise motor in cases where a large part of the work is likely to be over existing d. c. lines. By far the best hold of the newcomer lies, it seems to us, in the lighter suburban and interurban lines having urban terminii. Suburban work requiring high acceleration will hardly prove a good field, so far as may be judged by current opinion of the alternating motor. A fortiori large railway work seems unlikely to be a suitable field. Most engineers not directly concerned with the production of these motors seem to take rather a conservative view of the situation, while expressing admiration for the ingenious solution of a most interesting problem. A few trials on hard-working commercial lines are, however, more important than anybody's opinion, and we hope they will soon be had.

HANDLING TRAFFIC DURING BRIDGE CONSTRUCTION IN PORTLAND, OREGON

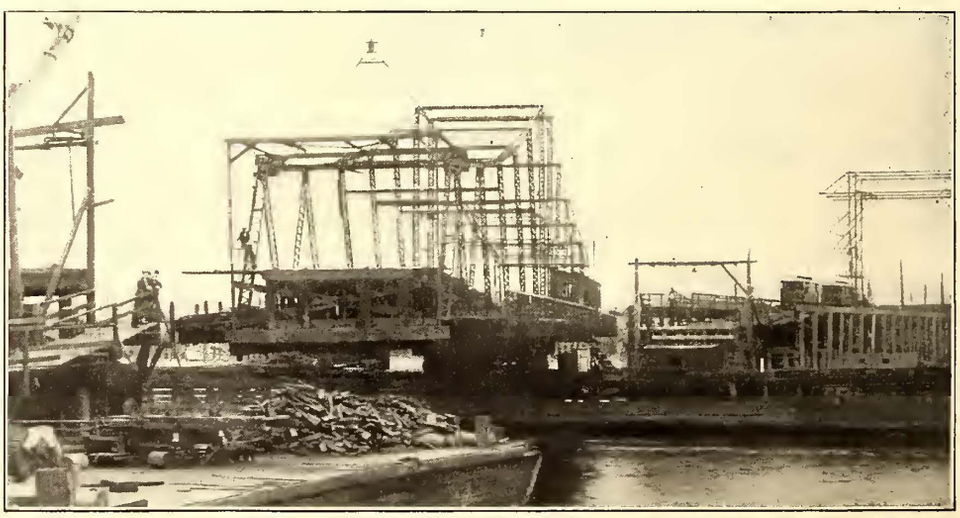
The Morrison Street Bridge across the Willamette River in Portland, Ore., is being replaced by a new steel structure, and it is interesting to note that the work is being carried on with very little interruption to electric railway traffic. This bridge is used by the City & Suburban Railway Company for connection between its loop in the business center of Portland and several lines in East Portland, as well as for a bridge car, which makes frequent trips back and forth across the bridge. The old structure was built of wooden trusses on pile and stone piers, and, as it was deemed unsafe, the city determined to replace it with a modern steel-truss bridge. The contract was let to the Pacific Construction Company, of San Francisco, and work was begun last January. One of the conditions of the contract was that the street car traffic should not be interrupted during the entire period of construction more than a total of thirty days. As about 900 cars cross the bridge every day, it is seen that the difficulties of tearing out the old bridge and putting the new one in place without interfering with the traffic are by no means small. The old structure was at an elevation of 38.6 ft. above datum, while the floor of the new bridge is to be 42.5 ft. above the datum line. The first thing done was to put in false work the entire length and raise the floor 6 ft. above the old bridge, thus leaving just enough room beneath for the placing of the floor of the new bridge. Temporary pile bents were put in to support the floor. Most of them are about 60 ft. deep, but in some cases 120-ft. piles are necessary. The steel I-beams of the new bridge were used for stringers on these pile bents. A traveler was erected by which the old spans were removed and the new ones placed in position. The new bridge is to have two 267-ft. 6-in. spans, one 200-ft. span, a 384-ft. draw span and 600 ft. of wooden trestle approaches, the total length being 1719 ft. The new spans were purposely designed of different lengths from the old ones, to aid in placing the permanent piers, which are of the concrete caisson type. The old bridge was 21 ft. wide, while the new one is to have a roadway 36 ft. wide, with a 7-ft. sidewalk on each side. The railway tracks will be placed with 9-ft. 6-in. centers (the gage being 3 ft. 6 ins.) on a single floor in the center of the roadway, with a



MORRISON STREET BRIDGE, PORTLAND, SHOWING OLD DRAW AND FALSE WORK SO AS TO RAISE TRACKS ABOVE FLOOR OF NEW BRIDGE—TAKEN AUG. 28, 1904



MORRISON STREET BRIDGE, PORTLAND, SHOWING TWO NEW SPANS. ALSO ILLUSTRATING TEMPORARY FLOOR FOR TRACKS—TAKEN AUG. 30, 1904



MORRISON STREET BRIDGE, PORTLAND, SHOWING FALSE WORK UNDER TEMPORARY TRACK ON OLD DRAW—TAKEN JUNE 17, 1904

guard timber along the edges of the two wagon roads. The latter will be paved with wooden block paving.

The accompanying illustrations show the method of constructing the bridge and of raising the floor and tracks so as to permit the permanent structure to be placed in position. Two of the permanent spans are now in place, and during the eight months of work the car traffic has been shut off but four days. During that period passengers cross on a temporary foot-path. It is expected that the work will be completed by the first of next year. The bridge was designed by F. A. Koetitz, chief engineer of the Pacific Construction Company, and is being erected under the direct supervision of F. M. Butler, secretary of that company. The cost of the entire work will be $40c,000, and will be borne by the city, as it receives its remuneration from the City & Suburban Railway Company for the railway service through a rental charge of $1,000 a month.

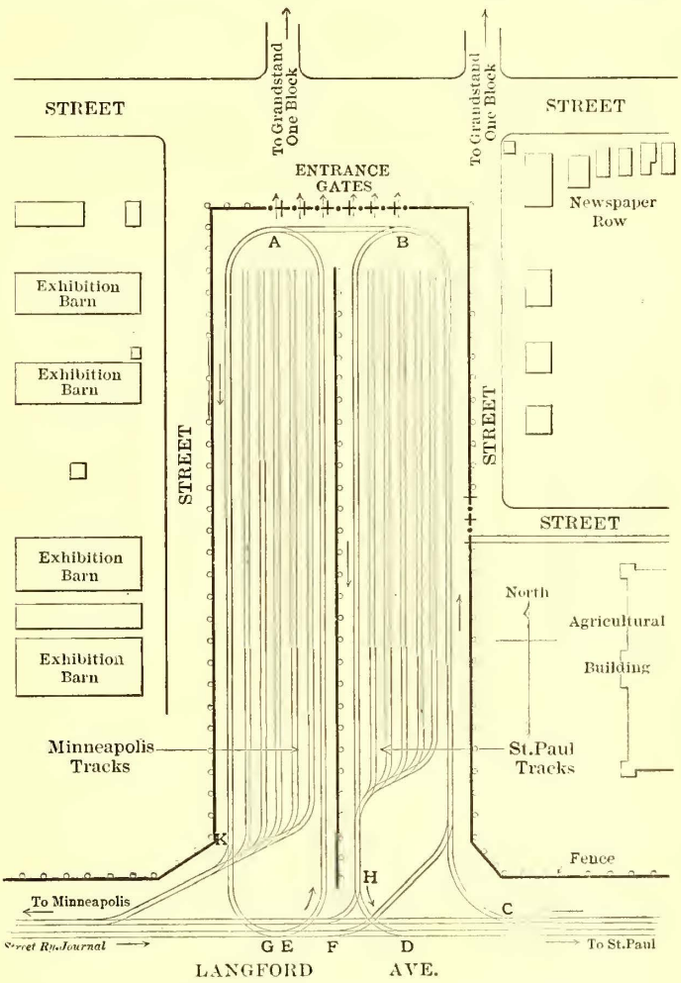
NEW TERMINAL FACILITIES AT THE MINNESOTA STATE FAIR GROUNDS

The Twin City Rapid Transit Company, operating in St. Paul and Minneapolis, has recently completed some very interesting new terminal facilities at the Minnesota State Fair Grounds. The State Fair is an annual occurrence of great attraction to the citizens of Minnesota and its neighboring States, as it illustrates the agricultural, manufacturing and commercial resources of the Northwest in a way which is perhaps more effective than any other method of exploitation. In recent years the great crowds attending the Fair have made the problem of transportation exceedingly difficult, as the electric railway facilities were confined to the Langford Avenue double track on the Como-Harriet line of the company.

All the buildings on the Fair Grounds are of a permanent character, and this year an important addition to the existing layout was found in the new Manufactures' Building, whose erection was made possible by the legislative appropriation of $30,000, secured by the Northwestern Manufacturers' Association. This building is the most substantial structure on the grounds, being of pressed brick, 120 ft. x 160 ft., with a stone foundation, concrete floor, and galvanized iron roof, supported by steel trusses. The architect was C. H. Johnston, of St. Paul. This and other additions to the attractions of the Fair, led the officials in charge to expect an unusually heavy traffic during the week of its opening and operation, Aug. 29 to Sept. 3, inclusive, and accordingly a space covering nearly 4.9 acres was set apart for improved street railway terminal facilities.

The State Fair Grounds are located in the Midway district of St. Paul, slightly west of Como Park, and are reached from either St. Paul or Minneapolis by the Como-Harriet line of the Twin City Company. The new terminal has wisely been laid out at a side, rather than the main entrance of the grounds, so that a considerable part of the traffic coming from St. Paul may split from the terminal traffic through the passing of the main entrance by the cars before the terminal is entered. A considerable amount of carriage and pedestrian traffic at the main entrance was thus freed from the congestion which would have resulted if all the street railway, foot and vehicle traffic had been handled at one place.

The accompanying diagram shows the general plan of the terminal tracks, which occupy a section of the Fair Grounds 700 ft. long x 300 ft. wide, approximately. The area is divided into two loops, A and B, each of which encloses five parallel spur tracks for the storage of cars in anticipation of the enormous rush of traffic which follows the conclusion of the afternoon and evening performances on the race track and at other places on the grounds. A fence encloses the sides of the terminal, entrance and exit to and from the grounds being through ticket booths and turnstiles at the north end of the enclosure. In general, Minneapolis traffic is handled by the "A" loop and spur tracks, St. Paul being cared for by the "B" loop and spurs. A fence separates the two sections, in the middle of the enclosure. In ordinary operation through cars from St. Paul to Minneapolis are deflected to the terminal at the point C; they pass up the east side of the loop "B," discharge and load, and pass on to Minneapolis either by the west side of the loop A or the loop B, depending upon the traffic on the tracks at any particular time. Local cars from St. Paul to the Fair Grounds generally follow the same course, returning, however, to the eastbound Como-Harriet track at the point D. Through cars from Minneapolis to St. Paul take the switches at E or F, according to the conditions in the terminal, and after traversing the loop corresponding, return to the main eastbound track at point G or point D. Local cars



NEW STREET RAILWAY LOOPS AND STORAGE TRACKS AT THE MINNESOTA STATE FAIR GROUNDS

from Minneapolis to the grounds follow the same course, according to circumstances, returning to the westbound main line by the switches at H or K. The capacity of the spur tracks is about 120 cars, and these, added to perhaps thirty cars on the loops, give a total of 150 cars that are ready for instant occupancy at the close of the afternoon and evening performances. The cars in St. Paul and Minneapolis run in one direction only, being single-ended, so that it is necessary for stored cars to back upon the stub tracks before taking their loads. This, however, was done before the rush of traffic comes. The spaces between the tracks are laid out in gravel and cinder walks.

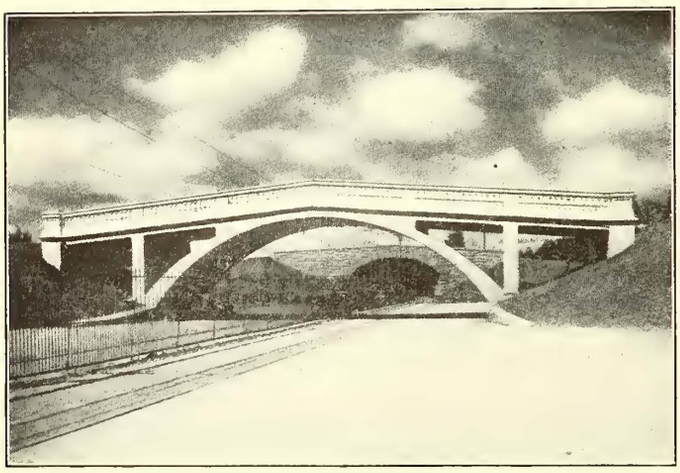
The limited space available crowded the switches somewhat, but the main line movements are so flexible that little trouble was experienced on this score. A special force of inspectors and starters was appointed to supervise the traffic in detail, and

the facilities planned were found capable of handling at least 15,000 to 20,000 passengers per hour, if not more. It was found that the stub tracks met with special favor among patrons with families, women and children, who preferred to walk a short distance to make sure of seats, to standing in the more crowded cars upon the loops.

NEW BRIDGES AT COMO PARK, ST. PAUL

The Twin City Rapid Transit Company has recently completed two new bridges at Como Park, St. Paul, which are of considerable interest both from an architectural and operating standpoint. Como Park is located on the double-track Como-Harriet line of the company, and is one of the most popular resorts of the Twin Cities, being situated between Minneapolis and St. Paul's thickly settled district, a 5-cent fare being charged from either place to the park. On account of the traffic obtaining during busy hours it was found necessary to improve the existing facilities for handling the crowds, and in the early part of the summer the bridges were placed in service, constituting, with the platform arrangements adjoining, a thoroughly modern type of way station.

One of the bridges is devoted principally to carriage and



FOOT BRIDGE AND CARRIAGE BRIDGE BUILT BY THE TWIN CITY RAPID TRANSIT COMPANY AT COMO PARK

automobile traffic, the other taking care of the foot passengers. The foot-bridge is the prominent one in the accompanying illustration. Both were built primarily to avoid any crossing of tracks at grade by visitors to the park.

The wagon bridge is about 150 ft. west of the "foot"-bridge, so called, and is 100 ft. long and 50 ft. wide, with a 21-in. parapet of sandstone at each side, the parapet being about 3 ft. high above the roadway. The roadway is about 40 ft. wide, leaving space for two gravel sidewalks beside the parapet, each 5 ft. wide. The arch of the bridge is about 40 ft. wide and 21 ft. high, approximately. The bridge is of concrete-steel construction, the facing of the side walls and inner surface of the abutments being of sandstone masonry. Two qualities of concrete were used in the construction of the bridge, No. 1 and No. 2, respectively. The composition of each was:

No. 1

American Portland cement	1 part
Sand	2 parts
Broken stone	4 parts

No. 2

American Portland cement	1 part
Sand	3 parts
Broken stone	5 parts

No. 1 was used for the arch, piers and beams, and No. 2 for the abutments. The cement was required to show a tensile strength of 600 lbs. after seven days, and when mixed with sand in the proportion of one part cement to two parts sand by measure it showed a tensile strength of 200 lbs. per square inch in seven days. Clean, coarse, sharp sand was used and screened before mixing, and the crushed stone employed was native blue limestone. The facing of the side walls and inner surface of the abutments is bonded into the concrete backing with headers extending at least 18 ins. back from the face, one-quarter of the facing being headers. The backing of the side walls is ordinary rubble, and the mortar used in the joints and arch ring was composed of one part cement to two parts sand. All the other mortar, except that used in pointing, was of one part cement to three parts sand.

The reinforcement of the wagon bridge consists of sixteen steel ribs imbedded in the concrete of the arch. These ribs are made up of 5-in. 9¾ lbs. per foot I-beams bent to conform to the arch curvature. They are in two pieces and are tied together with five lines of ¾-in. round rods extending entirely across the bridge and secured to the arch ring stone with dowels at right angles to the face of the joint in the arch ring. The arch ribs are anchored into the abutments by being riveted to 2-in. by 2-in. by ¼-in. angles. After the completion of the arches and spandrels, and before any fill was put in, the top spaces of the arches, piers and abutments and the lower 6 ins. of the spandrel walls were coated with a heavy coat of semi-liquid mortar consisting of one part cement, one-half part slaked lime and three parts sand, spread to leave a smooth finish, and after this set hard it was given a heavy coat of pure cement grout.

The foot-bridge is approximately 88 ft. long over the top, with a 21-ft. arch. The width of the walk is 15 ft., each side sloping downward from a center line. Each side is protected by a handsome concrete parapet 4 ft. 10 ins. high and about 14 ins. wide at the railing. The parapets terminate in four corner posts 4 ft. by 3 ft. 6 ins. in cross section. Three longitudinal grooves for drainage purposes are cut in the bridge walk, the foot-bridge likewise being of concrete-steel construction. Parallel grooves are also cut in the walk several inches apart for drainage and the prevention of slippage by pedestrians. These grooves are staggered in the two outer rows. The same quality of concrete was used as in the wagon bridge, No. 1 being used for the arch, piers and beams, and No. 2 for the abutments. Native blue limestone was also employed. The steel-work is of I-beams, five 7-in. ribs being imbedded in the concrete of the arch and anchored into the abutment by being riveted to two 2-in. by 2-in. by ¼-in. angle irons extending across the bridge. The waterproofing was carried out as on the wagon bridge.

Between the two tracks which run through both bridges is a double picket fence of bar-iron 7 ft. high and set 3 ft. from the nearest rail. This fence extends from the end of the wagon bridge to the end of the curve that begins at the east end of the concrete platform which receives passengers as they alight from the cars on either track. This fence divides the east and westbound traffic, passengers coming from Minneapolis to Como Park being obliged to cross the foot-bridge in order to enter the park, while passengers going to St. Paul from the park likewise cross the foot-bridge. Matters are made even, however, by the westbound track, which discharges passengers from St. Paul to Como without the necessity of crossing the bridge, and takes Minneapolis passengers from Como in the same way. A resident of either city who goes to Como is thus obliged to cross the bridge but once. The picket fence runs about 100 yds. down the track to the east and perhaps 180 ft. to the west, so that there is no chance for evading the foot-bridge and making a dangerous grade crossing by way of short cuts. In the middle of the picket fence is an inconspicuous padlocked gate 26 ins. wide for the use of employees.

There are two concrete platforms supplied by the Portland

Stone Company, of St. Paul. Each is 190 ft. long, 26 ft. wide in the maximum and 13 ft. 6 ins. wide in the minimum dimension beneath the bridge arch. On each side of the track is a plank walk 32 ins. wide set between the inner rail and the platform. Each platform is made of concrete blocks 24 ins. square. Gravel ballast is used between the tracks.

On the approach to the foot-bridge the trolley suspension changes from span to double bracket construction, one pole being set at each side of the bridge. Figure 8 trolley is used under the bridges, and over each track at the bridges the trolley wire is supported by two pairs of clips, each pair being attached to the end of a wooden bar about 8 ins. long. The bar is hung by an eye from a rectangular iron plate which is screwed into a wooden base-board about 1½ ins. thick, the base-board being about 10 ins. long and 6 ins. wide. The center of each of these base-boards is located about 18 inches from the edge of the bridge arch. Feeders and arc light wires are carried in insulating bushings mounted upon wooden bases, one at each end of the arch center line. A notable feature of the layout is the use of the straight track in all but about 6 ft. of the platform run, and the curvature here is so slight as to amount to nothing as far as passengers are concerned. For the convenience of passengers four wooden seats with backs have been provided, two for each platform, beneath the arch of the foot-bridge. Each of these is 16 ft. long and 18 ins. wide. The bridges and platforms are lighted by six series arc lamps, and a locked telephone box is also provided for railway use on one of the arc light poles. An iron trellis is now being set up at the Como Park end of the foot-bridge, and next season this will be decorated by various floral growths.

As a feature of the landscape, the new bridges and platform arrangements at Como deserve special praise. Their graceful design reminds one of the artistic engineering structures of the European continent, and as additions to the Twin City Rapid Transit Company's new physical property they deserve more than passing notice. They exemplify the rapid extension of reinforced concrete in engineering construction and give the impression of strength and permanence to even the casual observer. Costing in the vicinity of $15,000 together, these two bridges mark the passing of experimental construction in work of this character, and are worthy of imitation in the progressive practice of the future. The writer is under obligation to General Manager Hield and Roadmaster Wilson, of the Twin City Rapid Transit Company, for courtesies extended in connection with this article.

PROGRAM OF THE ST. LOUIS MEETING

Secretary Penington has announced that the St. Louis convention of the American Street Railway Association will be held Oct. 12 and 13, 1904, on the second floor of the Transportation Building at the Exposition grounds, St. Louis, Mo.

Papers will be presented on the following subjects: "Steam Turbines," "Reciprocating Engines," "Gas Engines," "Transfers, Their Uses and Abuses," and "Signals."

The week of Oct. 10 will be Street Railway Week, the American Railway Mechanical and Electrical Association holding its meetings on Oct. 10 and 11, and the Accountants' Association, Oct. 13, 14 and 15. Wednesday, Oct. 12, has been designated as Street Railway Day by the Fair officials. It is expected that addresses will be made by President D. R. Francis, Mayor Rolla Wells and Prof. Goldsborough. Headquarters will be at the Southern Hotel.

The Manufacturers' Committee has prepared a fine programme of entertainment for the members of the association. It will have one of the finest bands in the country, which will give a concert at the hall before the opening of each session and numerous concerts during the week.

ST. LOUIS STREET RAILWAYS ON ST. LOUIS DAY

On Sept. 15 the people of St. Louis and vicinity turned out to celebrate St. Louis Day at the Louisiana Purchase Exposition. Great efforts were put forth to bring out a large attendance. Much depended on the efficiency of the street railway transportation facilities. When the street railways carried the World's Fair opening day crowds so rapidly and regularly they gave the people of St. Louis an idea of what they could do that was a pleasant surprise, and those who expected that the facilities, ample on opening day, would fall short of promptly taking care of the much larger crowds on St. Louis Day were agreeably surprised. The attendance registered by the World's Fair turn-stiles was about 400,000, or approximately double the previous largest day of the Exposition.

The St. Louis Transit Company's traffic figures for the day were:

Receipts	$38,498.12
Revenue passengers carried	788,536
Transfer passengers	363,249
Total, including transfers	1,151,785

The company ran about 1100 cars, which is not much more than the number now in daily service, but the number of cars on the lines leading to the Fair was increased by adding a few cars on each line. The fact of the matter is that on the Olive Street line, which, being the most direct, gets by far the heaviest World's Fair travel, cars are operated regularly on such short headway that more cars can not be added without having them so interfere with each other as to at least necessitate a much slower schedule and perhaps actually defeat the purpose of moving the greatest number of people per hour. A count made at the corner of Olive and Twelfth Streets at 9 a. m. showed forty cars passing in fifteen minutes, or a little less than three-minute average. This gave a headway so short that cars interfered with each other slightly, so that regular speed could not be made, but the interference was not sufficient to prevent moving the maximum number per hour, thus showing that the company had struck a nice balance between too many and not enough. The traffic on St. Louis Day was nearly double the traffic of Sept. 15, 1903, but it is not greatly in excess of the company's regular traffic the past month, which, of course, includes both the regular traffic and the World's Fair traffic; while the St. Louis Day traffic was mainly World's Fair traffic.

The St. Louis & Suburban Railway Company carried approximately 141,000 people, of which a very few were transfer passengers. From 127 to 134 cars were operated.

It was a fascinating sight to see the great continuous streams of people moving away from the street railway terminals in the morning and toward them afternoon and evening without interruption due to any hitch in the car service or inability to carry the people as fast as they came. All the way out Olive Street nothing but a continuous string of cars was to be seen.

Three kinds of terminal loops are in use at the Fair Grounds. The Suburban has an enclosed loop with gates, opposite which gates the cars stop and receive passengers at front and rear platforms. The fence is directly alongside the track, and passengers are not admitted to the loop except as they pass directly through the gates onto the car platforms. The St. Louis Transit Company's Olive Street loop has ticket-selling booths and turn-stiles, as explained in previous issues of this paper. Other loops are entirely open.

The smooth performance of the street railway service has elicited many kind words from St. Louis press and public for Vice-President and General Manager Robert McCulloch, of the St. Louis Transit Company, and John Mahoney, general superintendent of the St. Louis & Suburban Railway Company.

THE PROCEEDINGS OF THE UTICA CONVENTION

The twenty-second annual convention of the Street Railway Association of the State of New York met at Utica, Sept. 13 and 14, and was very largely attended. The meetings were held at the new Century Club auditorium and, as mentioned in the last issue, a number of exhibits were made in the same building. A report of the business sessions of the meeting is published below:

TUESDAY MORNING SESSION

The meeting was called to order by President E. G. Connette at 10:45 a. m. On motion of C. L. Allen, duly seconded and carried, the official registration made by the secretary was accepted in lieu of the roll call.

On motion, duly seconded and carried, the minutes of the preceding meeting, at printed, were approved.

The president then introduced Hon. Charles A. Talcott, Mayor of the city of Utica, who welcomed the delegates to Utica in a felicitous speech.

The President—In behalf of the association, I thank you for your kind and cordial welcome.

The secretary, W. W. Cole, then read the report of the executive committee, and of the secretary and treasurer, both of which were approved.

The secretary then read a communication from the Central New York Telephone & Telegram Company, offering the facilities of its service to the delegates during the convention. The thanks of the association were tendered to the company for this generous offer.

The president then read his annual address, which is published in abstract below:

PRESIDENT CONNETTE'S ANNUAL ADDRESS

President E. G. Connette, after reviewing the salient points in the progress of the traffic industry in the State since 1811, said:

"While the year past has not been as thrifty and prosperous as the preceding year or two, still the gross earnings of the street railroads of this State for the last fiscal year show a healthy increase over the previous fiscal year.

"The increase in the operative mileage of street surface railroads during the past year was 111.9—a large majority of which increase is interurban mileage.

"According to the last annual report of the Board of Railroad Commissioners, the casualties on street surface railroads are less than they were during the preceding fiscal year, which is encouraging, and shows that the roads are being operated with more care and improved methods. Defects in methods of train despatching on electric railroads has resulted in more serious accidents during the last year than from any other cause. Head-on collisions have occurred on two roads using the most approved systems of train despatching. A more perfect method of operating cars by train signals should be devised, if possible, to prevent collisions, or some other means adopted by which such accidents can be avoided.

"The increase in the freight and express business on electric railroads during the past five years is shown by the following table:

Year	Tons
1899	120,940
1900	133,343
1901	237,311
1902	394,641
1903	516,470

"This indicates that the package or parcel business is increasing rapidly, but there is yet a large field for development in this line. The running of express service on electric roads creates a convenience which can scarcely be appreciated until it has been tried. It connects the jobbing house in the city with the hamlet and village store, so that they can replenish their stock of goods from time to time with promptness and with much less expense than under the old methods, and furnishes the farmer a quick and easy market for his produce; the future of this class of business and the advantages to the public thereby can scarcely be estimated.

"Interesting papers have been prepared and will be read before this convention upon the subject of freight and express business on electric roads, and I trust that the convention will give particular attention to this as one of the liveliest subjects to be developed by the street and interurban roads.

"There was no legislation enacted during the past year which adversely affected the street railway interests of this State; while there was some legislation which more or less benefited some of the roads.

"The development by the electrical companies of the compensated a. c. railway motor is a long step forward, as the advantages of this system are the lesser cost of conversion and distributing and reduced operation in sub-stations. Its application is especially desirable where the density of traffic is low—that is, where a more or less infrequent service is maintained over reasonable distances, or where a more frequent or heavy service is maintained over distances greater than are now customary in direct-current work. It is also particularly applicable where trains are run in such large numbers that the current drawn from the line at a given point is very large and would necessitate converter sub-stations at frequent intervals if direct current was used. Where large loads are concentrated at a few points on the line as against the load uniformly distributed over the whole system, or where the cost of motor car equipment is small compared with the cost of transmitting and distributing, the a. c. system is most suitable. These motors have a decided advantage from the fact that they can be used either with a. c. or d. c. current.

"As a matter of statistics, it is doubtless interesting to know that the average number of persons employed on all street surface railroads during the past fiscal year was 30,028, and that the amount paid out in salaries and wages during that time was $17,841,895.49. It is not only interesting from a statistical standpoint, but it gives an idea of the large number of men and the immense amount which is paid out in wages, which should in itself accentuate the importance of the State association in representing an industry of such large proportions.

"The committee appointed at the last meeting of the association, at the instance of the State Board of Railroad Commissioners, to act jointly with the American Society of Electrical Engineers and the National Board of Underwriters for the purpose of making high voltage tests, to determine the danger of transmission lines under present methods of construction, have performed their duty in a zealous and commendable manner. I especially call the attention of the association to their report, which will be submitted at this meeting.

"The standard rules committee have done excellent work in connection with their duties. Their report has been printed in pamphlet form, showing the rules as now recommended, together with reports of the minutes of the committee, showing why certain changes have been made.

"The work on the system of interurban rules has not yet reached a point which is entirely satisfactory to the members of the rules committee, but they have incorporated in their report certain recommendations in regard to interurban rules.

"This committee should be continued in order that the work of standardization may be perfected, especially so far as interurban rules are concerned, and I would suggest that this committee especially consider the question of train despatching.

"The cordial relations existing between employees and the street railroad companies of the State is a pleasing condition, and is doubtless due to the up-to-date methods in the management and control of men. No concern which employs men can reach the maximum of success and attain the best results without a thorough co-operation of its employees. All men are human and the position they occupy in life should not effect their self-respect. The Golden Rule applied to the management of employees is one which will always bring good results.

"There is a common interest among the street railroads which can only be fostered and protected by united action. This association was organized for the purpose of attaining the end suggested; that is, to provide the avenue for unifying the work, and caring for and looking after the interests of the street railroad companies of this State, and every street railroad company in the State should, therefore, become a member. Nearly all of them are, but there are yet a few roads which have, for some reason, never joined the association, and I therefore respectfully suggest that every effort be made to have every street railroad company in the State become a member of this association. It is not only beneficial from the standpoint of looking after the common interests of its members, but the annual meetings are becoming more and more popular and interesting. The papers submitted and the subjects discussed are of such a nature as will harmonize the ideas of management and develop up-to-date plans for the proper operation of the different departments.

"A 'question box' has been introduced as a new feature of the programme at this meeting and an interesting discussion of the various topics contained therein is desired.

"One of the pleasant features of our annual meetings is to meet the supply men and greet them in a social way, and the large number which are in attendance at this meeting is a reassurance of their unflagging interest in and good will for this association.

"In closing, I do not forget to express my hearty thanks and appreciation for the loyal and active support of the executive committee, and for the live and active interest of the members and friends of the association and especially the STREET RAILWAY JOURNAL in the effort to make this meeting an interesting and pleasant occasion.

The association has shown its usefulness and importance in the past several years, and its importance and usefulness can yet be increased and broadened, and I therefore bespeak for the association the same hearty support and co-operation of its members, officials and executive committee as has been contributed during my incumbency as president of the association.

The President—The next order of business is the reading and discussion of the papers which have been prepared for this meeting. The first paper which will be read has been prepared by M. G. Starrett, chief engineer of the New York City Railway Company. Mr. Starrett is unavoidably absent, and W. B. Reed will read the paper.

This paper is published elsewhere in this issue.

The President—I will ask C. E. Roehl, of the Brooklyn Heights Railway Company, to lead in the discussion of this paper.

Mr. Roehl—I am sure we have all enjoyed the reading of Mr. Starrett's paper. The Metropolitan Company, I believe, marked an era when it started in with a large a. c. station and distributing by high-tension feeders to sub-stations. We in Brooklyn have not quite as large a plant as the Metropolitan system, but we will approach it gradually. In four years we have doubled our power output, and if the plan of our operating department this winter is carried out, we will have trebled it; in other words, we will have it developed 300 per cent over what it was four years ago. Brooklyn began in the early days with electric traction, and it has, therefore, a number of small direct-current stations. Four years ago we started a 32,000-hp combined a. c. and d. c. power station. This station is now in operation and has been for about six months, and we are able to get some results from it. Since that time, last summer, we started with a new station, entirely a. c. This station when completed will be about 100,000 hp. This, I think, is one of the largest stations yet planned. Like the Metropolitan, we have the 6600 volts three-phase alternating current, with six sub-stations. We have storage batteries in two of them. These batteries were fallen heir to, and we did not feel disposed to throw them out, and so we are still using them. We are not, however, using storage batteries in any of our new sub-stations. A careful study of the Brooklyn situation shows that we cannot build the same kind of sub-stations that the Metropolitan system did. I think that company has rotary sub-stations of 10,000 kw. Our largest sub-station is 6000 kw, and most of them are 5000 kw. Our standard rotary unit is 1000 kw. Where the territory carries more than a 5000-kw load, we find it is cheaper to revise the boundaries of the sub-station district and build another sub-station, finding that it is cheaper than the expense of maintaining one station with longer low-tension feeders. In our new plan for our new power station we have decided to change to 11,000 volts. We find that we will make a saving of about $300,000 in our high-tension feeders alone after changing our present a. c. generators from 6600 volts to 11,000 volts. We propose to rewind them so that they can be operated either at 6600 volts or 11,000 volts on the star connection with neutral grounding. Our high-tension feeders are not insulated as heavily as the Metropolitan. Whereas they use seven thirty-seconds of an inch paper insulation around each conductor, we use five and a half thirty-seconds around each conductor. We have also adopted as a standard feeder 250,000 circ. mils. That is uniform throughout. We carry about 2500 kw per feeder. To go back to the size of the sub-stations, we have now six sub-stations, and we are planning to have fourteen. I was very much interested in the statement of Mr. Starrett that they were able to save $1,650,000 in their a. c. distribution as compared with a number of d. c. stations. That figure compares very closely with the estimate which we made four years ago on our Brooklyn station. We found that we were able to save about a million and a half dollars by using a. c. distribution as compared with sub-stations for the direct current. Our station, as compared with the Metropolitan station, has smaller units. We have 4000-hp engines and 2700-kw generators, as against the 3500-kw generators in the Metropolitan system. Our cost of coal is somewhat less. I note that Mr. Starrett states that 67 per cent represents the coal cost. Ours is 65 per cent. That is explained by the fact that we use a very low grade of hard coal, No. 3 buckwheat, paying about $1.45 a ton for it. On the other hand, our labor cost is somewhat higher. We have 24 per cent as against 19 per cent for the Metropolitan. This is probably due to the fact that we have entirely hand-firing boilers, it being impossible to burn so low a grade of coal with the automatic stoker, which is used by the Metropolitan, I believe. Having both direct-current stations and a. c. distribution, we have an opportunity to compare the old method with the new. It is cheaper for us to generate the alternating current and send it out over high-tension feeders and distribute it from the rotary sub-stations than it is to generate the current at our direct-current stations. That reminds me of an editorial which I read in the STREET RAILWAY JOURNAL recently, questioning the advisability of using the alternating current, and citing the case of the Boston Elevated. There, I think, the lowest cost of their direct-current system is seven-tenths of a cent per kw-hour. We are able to beat that at our sub-stations thus far; so that I think that the Boston Elevated Company can probably beat its present figure by going into the a. c. distribution.

H. H. Vreeland—I want to say one word with reference to the ancient history which has been mentioned, and which is chiefly valuable to the association when it is remembered that the Metropolitan station now being discussed was planned in 1897. I recall a series of conferences held at that time between some of those interested in the property and various electrical and mechanical engineers as to whether it was safe to attempt to build that character of station and use that character of distribution. In fact, some of the financial interests connected wih the property, and who had large interests in other sections of the country at the same time, were getting ready to build d. c. stations. The lesson to the members of the association, particularly to the younger men, is that they have got to study very hard to keep up with the procession. It was only the other day that this association was considering what was the best medicine to remove botts from horses and what was the best horse feed; then there was the question whether electricity was practical at all; then the question whether we need have high-tension power stations. Now it is a grave question, considering Tesla's latest developments, whether we will require any stations—d. c. or a. c.—at all in the next year or two.

Mr. Ely—I regard this paper on power distribution as one of the most important I have had the pleasure of hearing or reading at any of these conventions. Of course, we are here to get the greatest possible amount of benefit. We all know that there are no questions which are more important to our business than those of power generation and distribution, and we all recognize the truth of the idea suggested by Mr. Vreeland, as to the rapid advance of the art—the doing away with old things by the new within so short a period of years that it seems almost incredible. Just a word in illustration of that. At Niagara Falls, when the plans were being matured for power house No. 1 of the Niagara Falls Power Company, or rather just prior to that, in about 1890, George Westinghouse, of Pittsburg, visited the Falls and talked with the people who

were promoting that power enterprise, and suggested that it was a great mistake to think of distributing that power by means of elecricity. He suggested as the result of their experience that compressed air be considered for the purpose of distribution. In 1895, or about that time, five or six years after Mr. Westinghouse made that statement, the first current was turned out of the power house, and the 5000-hp generators that supplied the alternating current were manufactured by the Westinghouse Company. I don't know of anything that better illustrates the rapidity of advancement in that part of the art than the fact mentioned. In 1899 the International Railway Company installed a power distribution at Buffalo, consisting of sub-stations arranged for the stepping down and distribution of the alternating current from the high-tension lines of the Niagara Falls Power Company. Since that time some of our sub-stations have been consolidated. I would like to ask of Mr. Vreeland the distance between the sub-stations of the Metropolitan at 129th and 146th Streets?

Mr. Vreeland—It is about 1 mile.

Mr. Ely—As a result of your experience, Mr. Vreeland, is it more economical to maintain two sub-stations at distances of a couple of miles apart than it would be to consolidate those two sub-stations into one? Of course, I mean to leave out of consideration the question of cost of real estate and all that sort of thing. If you had to do it over again, would it be better to consolidate those two sub-stations than to maintain two so close together?

Mr. Vreeland—The stations referred to were placed where they are for peculiar local reasons. There is a very heavy grade both ways on Amsterdam Avenue from 128th Street, and very heavy service—one of our heavy lines on which cars on holidays and Sundays are run on about twenty-second intervals. A very long hill runs nearly two-thirds of the distance to the next power station. It is more economical to distribute from this point. Probably if we had had the present arrangement originally, there might have been some changes. When we built the Ninety-Sixth Street station our operation was confined entirely to Manhattan Island and the lower sections of the city. The Third Avenue Railroad, to which we fell heir, had its station and sub-stations under contract and partially constructed when we took the road over, and it was principally a question of getting the system completed and in operation at as early a day as possible, as they did not have sufficient power for their operation, so that less consideration was given to these points. But in direct answer to your question, the stations would have been arranged in that way, owing to the peculiar conditions.

Mr. McNamara, of Albany—Before passing from this subject of the generation and distribution of power, I would like to call the attention of the convention to the fact that Mr. Starrett says in his paper that, with a few exceptions, a storage battery is installed in connection with each sub-station. The gentleman from Brooklyn, however stated that they were using storage batteries inherited from their predecessors, and that with their new power house they were not going to install storage batteries. It has been a question with me why those using storage batteries have not inquired why the gentlemen in Brooklyn are not going to install storage batteries in their new power house.

Mr. Roehl—I will answer that by saying that it would take a very large battery to smooth out the fluctuations in the load of an elevated railroad—an excessively large and excessively expensive storage battery. It will do it, as we know, from the Metropolitan condition; but we don't find it to be satisfactory with an elevated road.

Mr. Vreeland—The chief thing that led us to consider the storage battery in connection with our sub-stations was the enormous loads that we carry. A drop in our voltage slows down our speed, and we have to keep up our speed to the maximum to conform to any schedule at all. The loss in time on our schedule is a very serious matter with us, and causes a congestion of cars in many localities. We found that we must keep a voltage of 550 absolutely to meet that condition, and that was one reason why we went so largely into the use of storage batteries. Another reason was that our service is very heavy eighteen hours a day on our principal lines. We have a peculiar condition in New York with the theater section and the club section. Take first the theaters from Twenty-Third Street to Forty-Sixth Street on and adjacent to Broadway. With the new theaters, they have a seating capacity of 68,000 people, all of whom are discharged on Broadway at night inside of about ten minutes. Taking this in connection with the club service, our traffic is extremely heavy at such times, and in order to do the work we had to have the relief of a storage battery. Again, on some of the east side lines, we have carried our load from 12 o'clock or 1 o'clock in the morning to 4 o'clock on our batteries, and then shut down the power station completely to do work that was necessary on the equipment. This is a great advantage; but, as I said, an important reason, and a very important one, was that the drop in voltage affected our service in the central lines and all of our more important heavy lines.

Mr. McNamara—Inasmuch as the United Traction Company has invested about a hundred thousand dollars in storage batteries, I am very much gratified to learn that we have got something which is useful.

T. E. Mitten, of Buffalo—I want to say something of our experience with storage batteries. We are rather dissimilar in conditions from almost any other system, in that we use a very large proportion of power generated at Niagara Falls. It is supplied to us twenty-four hours in the day, 365 days in the year. We have only about a 33 per cent load factor, and while we purchase 8000 hp from the Falls, a portion of the time we only use perhaps 2000, so that we have 6000 hp for six hours out of the twenty-four going to waste, except so much as we are able to utilize in the storage batteries. Then we find, too, that our storage battery eases up on our machines and relieves them of the great strain of the fluctuating load. We have combined some of our sub-stations. One of our reasons for that is that by that means we are able to centralize our storage battery nearer the center of the load, which enables us to use it to much better advantage.

The President—We will now take up the next paper on the programme, "Maintenance of Electric Cars and Their Equipment," by H. A. Benedict, of the United Traction Company, of Albany and Troy. (This paper is published elsewhere in this issue.)

R. E. Danforth, of Rochester—I would like to ask Mr. Benedict concerning his inspection. The methods differ somewhat in the frequency with which cars are brought into the shop and overhauled. The practice in some cities is to overhaul cars according to the calendar—that is, every three to six months. In other cities it is according to the mileage made by the cars, the number of miles being determined by the equipment and the character of the service. It seems to me that the latter method is the more economical generally, as the older types of motors require careful overhauling after 10,000 miles to 15,000 miles, while modern motors may possibly run 25,000 miles. The practice followed in our city has been along the latter line. The cars are generally overhauled—trucks, motors and bodies—on that basis, depending on the equipment, which brings the cars into the shop on an average of every four months. On the third visit of the cars to the shop the bodies are revarnished. In the daily inspection the work is only carried so far as is necessary to keep the car in good operating condition in respect to trucks, controllers, wheels, commutators, brushes, etc., including the inspection of the lubrication. Mr. Benedict referred to the matter of lubrica-

tion in his paper, intimating that he preferred oil. I believe that is a subject which might be discussed somewhat profitably, and I would like to know what experience he has had in the use of oil on motors.

Mr. Benedict—The experience that we have had with oil has been that we do not get hot bearings as we do with grease. The difficulty comes in the use of oil on the older type of motors, which motors were designed for grease boxes. For the use of oil it has become necessary to design a box which will go inside of the grease box, and by means of a peculiar method feed the oil to the journal. We have used oil to a considerable extent and the only difficulty that we have had with it is in regulating the flow of the oil.

Mr. Mitten—I have made some study recently of the methods adopted by different railway companies in their care and maintenance of cars, and I have found that in two of the larger cities quite a change is being made. In fact, they are advocating doing away entirely with car storage in car houses, and letting their cars stand out at night. The inspection is done at the ends of the line during the day instead of at night, as it is done now by many, and as it was formerly done by us all. While at the first glance this seems to be a questionable proceeding, I have found that in many cases of car house inspection, where car houses were originally built for horse cars, the pit capacity was inadequate, and the inspection was such that it did not recommend itself to me at all. The railways that I speak of placed their inspectors in the morning at the ends of each line, and they inspected the cars as they passed. Usually the car stands the interval between cars—that is, the headway of five minutes or ten minutes, as the case may be. In the meantime the crew takes the following car. We had some experience last winter in attempting to house some of our cars out of doors, with not very good results. We found that the working parts would stiffen up and the grease would freeze and we would have rather bad work on our first two or three trips in the morning, particularly after heavy snow falls. Our car roofs would also become covered with snow and the windows would be obscured. What I am trying to emphasize particularly, however, is whether we do get proper inspection at night, and whether in many cases we do not run our cars until something breaks or the armature gets down on the bearings, or something of that kind. It seems to me that the daily inspection at the ends of the lines, unless the car house facilities are of the best, could be done better than if an attempt is made to do it in car houses such as I have seen in many cities built for horse cars. The cars are crowded in with no possibility of getting under the cars. Now compare the inspection under these conditions with that at the end of the line, where the crew bringing the car into the end of the line can readily tell the repair crew of any particular trouble that they are having with the car. It seems to me it is well worth considering whether that is not the better method, considering our car houses, than the one which is in general use.

Mr. Ely—I have a fact to relate which may not prove uninteresting in this connection. I first heard of the proposition of "housing cars out of doors" a year ago last February, coming from the meeting of the executive committee of the American Street Railway Association which was held at Saratoga. The statement was made to me that in certain places that method was about to be tried, and I asked the gentleman who spoke about it what precedent could be cited for such treatment. He said: "Why, steam railroads keep their cars out doors either all or a large portion of the time." The difference that suggested itself at once to my mind was that the electric car is not only a passenger coach, but it answers also to the locomotive of the steam railroad; and I said to him: "But you don't know of any place where steam roads keep their locomotives out of doors?" They always provide storage for them. For electric cars it would seem to me economy would require other treatment than that suggested. We have had the experience cited by Mr. Mitten. While at St. Louis last Saturday, I met the same gentleman again and we had a further discussion, and at the end of two years' experience on his part, and after having been in consultation with a number of others who were trying this method, he confessed to me that he would not care to go on record in favor of any such proposition if there were any way of avoiding it.

Mr. Cole—I have some figures that I have been collecting that may be of considerable interest on this point. Our man at the switchboard puts out a chart of the car operation each day which shows the coal consumption per kilowatt-hour and also the temperature and the mileage. It is of considerable interest to know that the coal consumption follows the temperature very much closer than it does the mileage. We had one car house near which we had a power station, and we heated the car house from our station. This plan was abandoned, but early in the winter the switchboard man began to complain that the cars starting out of this house, for some reason, used an excessive amount of power. Tests were made, and it was found that a car 38 ft. long, equipped with two 35-hp or two 50-hp motors, would average a consumption of current of about 160 amps. to 171 amps., but the same car starting out of the car house in the morning with the journals all freely lubricated, would consume from 50 amps. to 60 amps., so that suburban cars starting from this place would use about three times as much current as they did ordinarily. I think that when you consider that running the cars represents only about 7½ per cent of the original energy of the coal pile, while in using the coal to heat the car houses directly you are getting practically all the energy out of it, it is very much cheaper to heat the car house and start the cars out warm in the winter months.

Mr. Ely—I am a great believer in the experience of other men and the things that come to us from a close observance of the common happenings of life, the things that pertain to the great mass of people. Now, traveling through the country in a wagon, what better indication of the character of the farmers, their credit at the bank, their standing among their neighbors and in the community could be afforded than by this: We pass the farm of A and observe that his barnyarn, his woodshed and other buildings are in good order, and the yards are clean and free from all kinds of incumbrances. Then we come to the farm of B and observe a valuable reaper "stored out of doors" instead of being run in the barn. I do not wish to enlarge upon the difference; that thought is not in my mind; but wherever you have observed a farmer who leaves his machinery out of doors you find a chap who has no credit at the bank and he has no standing anywhere. And if we leave the valuable machinery used in these great enterprises out of doors in the storms, it would not take long for one to draw the same comparison as between the farm of A and the farm of B.

Mr. Benedict—I think all of us have been apt to neglect the proper inspection of our cars, and on account of improper inspection perhaps we have had many extra expenditures at the power stations and many extra expenditures in our repair shops. In our operation our cars are brought into the house from thirty seconds to perhaps a minute and a half or two minutes' headway. With that headway inspection has been made of portions of the cars while passing over the inspection pit. We have pits under each entering track, and try to make a thorough inspection. Within the past year or so we have been paying much more attention to giving the cars careful inspection. We now test carefully our circuit breakers, and we have found a great benefit to be derived therefrom. We are also careful to test our wheels and armatures in the house with proper appliances, and pay especial attention to the cleaning and examination of the controllers, and we have found that it has saved us considerable in expense and in many

ways been a great advantage. It is pretty difficult to inspect properly a car operated with an underground current of electricity where we cannot have pits. In the use of the overhead trolley I think the proper method of building the house is to build it all pits. It gives the men opportunity to thoroughly inspect the under portions of the car. I think we also should try and have our tracks laid further apart in the house than has been the general practice, so as to enable the men to get around them and make proper inspection. This is a matter that is deserving of considerable attention.

Mr. Allen—I would like to ask Mr. Benedict which method of inspection he prefers, an inspection on the mileage basis or an inspection on the time basis, after a certain number of months have passed?

Mr. Benedict—I prefer the time method—that is, not in months, but in days. I believe that a car that goes out and runs for eighteen hours should have its working parts thoroughly inspected each day. In reference to bringing the cars in and overhauling them every four or five months, our experience has been that we have to bring the car in and change the wheels oftener than every four to five months. And when you have to change the wheels in a car that is the time to put the truck in perfect shape before it goes underneath the car again. I believe that a man who is an inspector should be as well paid as any man in the maintenance department which is doing the labor.

Mr. Rockwell, of the Syracuse, Lakeside & Baldwinsville Railway Company—I would like to say a word or two in regard to the inspection of cars. I don't think we have gone into details sufficiently. The mere taking out or examination of portions of a car I do not consider inspection by a good deal. It seems to me that the principal portion of the running part of a car is composed of simply two things: one is to make the car go and the other is to be able to stop it. Therefore, the motor and the brakes are the vital points about a car. There are very few other things in connection with a car that would seem to me likely to lead to the causing of an accident or hampering the road by stalling the cars in any way. I believe that the only way that you can operate a road which is carrying a great many people with frequent service, is to inspect the cars so thoroughly that there is no question when they go out of the car house that they will come back in proper condition, barring possible accidents or collisions. The only way to do that is to have a systematic way of inspecting your cars. In order to do that the motors have got to be taken down, the copper dust and the carbon dust swept out—cleaned all through, the commutators thoroughly examined and put back in place. That should unquestionably be done on the mileage basis; days and months have nothing to do with it. It frequently depends on the business done, whether the car is in use or not. When I was running a certain road operating eighty-eight cars on a minute headway, I established a system of inspecting a car every time it ran 3000 miles. Now that mileage will not be considered sufficient by many managers. A car may be able to go 5000, 10,000 or 20,000 miles, but in my estimation it is best to say from three to six. Every time a car made 3000 miles I brought it to the car house and had it entirely overhauled, the same as if it had been in a smash-up, leaving nothing untouched. Understand, that is in addition to the ordinary twenty-four-hour inspection, as to the controller and such things. This is more particularly true of the motors and brakes. Thoroughly test them. I believe in putting the full test on your brake chains. In that case the result was that we ran the road for over three years without having a car stalled on the line from any motor defect. I don't think you can do it in any other way than a systematic way of that kind. If you keep track of your mileage you know just where your car is. One word in regard to storing cars. I think the only excuse for not housing cars is that you haven't got the money—and that is inexcusable. My experience is that the cost of the paint alone on the cars would pay the interest on four times the price of a car house.

The president then announced the appointment of the nominating committee, which consisted of Mr. Vreeland, of New York; Mr. Ely, of Buffalo; Mr. Rogers, of Binghamton; Mr. Shannahan, of Gloversville, and Mr. Clarke, of Syracuse. The convention then took a recess until 2 o'clock.

TUESDAY AFTERNOON SESSION

The President—The first order of business is the report of the standard rules committee, of which Mr. Mitten is chairman. I would like to say in connection with this report that it has been printed in pamphlet form and distributed throughout the convention hall, so that each member can secure a copy.

Mr. Mitten read the report of the standard rules committee.

Mr. Mitten—I want to say that the association is much indebted to Mr. Barnes for his assistance in the rearrangement and revising of these rules. He attended our meetings in New York and went over the whole matter very carefully with us, and the thanks of this association are due to Mr. Barnes and the commissioners. Many suggestions have been received by the rules committee as to changes in the code. The main point which we have tried to cover has been to so arrange the rules under the different headings as to permit of changes being made by a continued rules committee as they might find necessary. Under the old arrangement of the rules, where the numbers ran consecutively from one to the last number, and different headings were inserted, it was absolutely impossible to insert rules pertaining to any of the headings without disturbing the arrangement of the numbering. But with the wide scope now given between the numbering of the three sections, there is abundance of room for the addition of rules required by various systems without in any way interfering with those rules which have been made standard.

On motion of Mr. Allen, duly seconded, the report of the standard rules committee was adopted.

The President—I believe that Mr. Barnes, representing the State Board of Railroad Commissioners, has some remarks to make in regard to the rules. We will be pleased to hear from Mr. Barnes.

Mr. Barnes—I want to take this occasion of expressing my gratification at the adoption by this association of a standard set of rules. My position has given me opportunities for observation which have impressed me with the importance of the adoption of a set of rules by the State Association perhaps more forcibly than some others. In the investigation of accidents the necessity for such a set of rules is very apparent. I find that accidents may happen on railroads that are governed by proper rules, and I can add that accidents will happen on railroads that are not so governed. It would surprise the members of this association who have expended time and study on the question of rules to know how many railroads are operated without any attempt at rules, and it would surprise some of the larger managers to know how closely situated to them are railroads that are operated without any attempt at government of employees or discipline by rules. While the rules perhaps have not been extended as far as might be wished, the work done by the committee on rules is certainly a gratifying one, and they are entitled to the thanks not only of this association, but of every street railroad man in the country, and for my part, as I said before, I wish to express my gratification that such a set of rules has been adopted.

Mr. Fassett, of Albany—As a member of the rules committee I want to have placed on record the appreciation which that committee feels for what Mr. Barnes has done for them. Mr. Barnes, as the representative of the Railroad Commission, has met with the committee on rules, has helped us, and has done a great deal of work for us which is not understood by the association generally. I move that a vote of thanks be ten-

dered to Mr. Barnes for the work that he has done in assisting the committee to get up this standard set of rules.

The motion was duly seconded.

The President—I think it is eminently proper that this association should express its appreciation of Mr. Barnes' services. I know personally that he has contributed valuable service toward the compilation of the standard code of rules. I know that I, as one member of the association, appreciate what he has done. Gentlemen, the motion is before you.

The motion was carried unanimously on a rising vote.

Mr. Allen—Unless I am out of order, it seems to me that a vote of thanks is due to the members of the rules committee, and I think a resolution should be passed by this convention continuing this committee for another year. In the report that has been made by the rules committee they do not ask a complete adoption of all of the rules. They refer to the fact that there is much work to be done in the future. That being the case, I would move you that this committee be continued in the future.

The motion was duly seconded and carried.

Mr. Van Etten not being able to be present, the secretary read the paper prepared by him and which is printed elsewhere. Mr. Clark, of Syracuse, then read a paper on "The Question of Freight," prepared by L. W. Serrell, consulting engineer of the Oneonta, Cooperstown & Richfield Springs Railroad Company, and George Dunford, the general express agent of the Utica & Mohawk Valley Company, read a paper on "A Method of Handling Interurban Express Matter." Both of these papers are printed elsewhere in this issue.

The President—I know that the convention would be pleased to hear from Mr. Sanderson, who has charge of the express business on the lines of the New York City Railway Company.

Mr. Sanderson, of New York—The express company which conducts the business on the lines controlled by Mr. Vreeland began business some three years ago. We began with the idea of doing a local business, but we found that to get any local business at all we were compelled to adopt the same rates as our competitors. It may be surprising to the members of the association to know that there are over 3000 local expressmen in New York City. The average express company (so-called) may consist of a man and his son, operating two wagons, running from one point to another. They get a very good income and they make rates which are sure to get them business. In order to get that business we had to adopt rates which were such that we made a loss. The only arrangement we were able to make with the old-line companies was for territory which was not profitable. If the territory was profitable they took it themselves. We were able to undertake the collection and delivery of matter for two old-line companies in sections which they did not care to cover with their wagons. Our chief trouble was in our wagon experience. Sixteen per cent of our total expenditure was in horses and wagons and stabling. I notice in one of these papers a list of the gross income from various localities in this State. The Metropolitan Company did more business than all those companies put together. The only reason why we found local business unprofitable was by reason of the short haul. As stated in one of these papers, it costs as much to transport a package a short distance—to put it on the wagon and carry it to the station and load it on the car and carry it to another depot and then retransfer it and make the ultimate delivery in New York at any point—as it would cost a big express company to transport it to Chicago or St. Louis, for which it receives $2.50 or $2 a hundred. Again, we had to put up with a cheaper grade of labor on our wagons, and the result was that our losses were heavy.

This paper of Mr. Dunford, I think, is most interesting. It shows a successful operation on a small scale with horses and wagons, and a very complete system of accounting. I think I can say, however, that there would be no possibility of that system of accounting being successful for large operations. For instance, we handle as high as 8000 shipments per day, and frequently send cars out of our downtown depot on twenty minutes' headway, and we could not check from the platform to the car; nor could we check from the car to the platform. The result is that there is a great deal of loss, and the loss is very expensive. In spite of all express history and experience, we had to largely devise our own system of accounting. We find the old-line express companies very conservative. It is hard to get them out of a rut. On the other hand, the system of accounting used by the railroad companies answered for our service very well. In our traffic between stations where we were able to put out carload lots, we could afford to make rates which were less than the steam roads were giving, and make money on it. The loss on that class of traffic is practically nothing, but the losses we incurred were through express operations where we had to use wagons. We had one line of business that was most profitable, and that was the carriage of beer. For illustration, we could take beer from Hastings down to New York and carry it to New Rochelle in carload lots at 22 cents a hundred, and get the business away from the railroad company, which was charging only 18 cents. The reason was that the electric service was more satisfactory and more economical to the brewers, because our cars moved so rapidly from the point of shipment to the destination that the brewers did not have to ice their beer, and they could afford to pay us more than they paid the steam railroad company, where the shipments were frequently delayed forty-eight hours or more, even in that short haul.

Another paper read here speaks of traffic relations with the old-line companies and railroad companies as being more or less impossible. We have found that these companies are not inclined to do business with the trolley lines. On the other hand, we have entered into a number of contracts and agreements with the steamship lines. A shipper sending goods from Yonkers to St. Louis could ship by the Metropolitan Express (perhaps requiring a day or two longer in transit) than he could by an all-rail route. We could take freight from Yonkers, transport it to one of the coast lines (more particularly the Old Dominion), and they, at Norfolk, would transfer to connecting rail lines, giving us the advantage of a differential rate. In this way the shipper from Yonkers paid no more to send his goods through us than the man who had his freight at the water side in New York, and he paid less than the man who was three or four blocks away from the steamship dock. The railroad company divided with the steamship company and the steamship company divided with us; so in that respect we were recognized. In fact, the Southeastern Freight Association put us on their list, and we were a connecting line with all the Southeastern Freight Association lines, indicating that the steam lines eventually, and perhaps not far in the future, may be in a frame of mind to enter into relations with the trolley companies.

It does seem to me, though, that there ought to be a way of getting a profitable business for street or local lines, if those lines confine themselves largely to freight, if they do not go too largely into the wagon business. The express business is a craft by itself. There is no use of trying to go ahead and devise your own system. You have got to get expert assistance if you are going to do a large business. But if you pick up and deliver goods along your line and do not build up a costly system of operation, it seems to me you are bound to make money from the start; and after you get your business going, as on the lines we have heard about in these papers, it is not going to be long before the steam roads are going to be compelled to enter into relations with you. We have had a number of applications for terminals or connections into the buildings of the larger shippers. In New York City this is a different question from that which is presented with

a country line, because underground construction is so very expensive; but could we have got sidings we could have made profitable and advantageous arrangements. You must understand that in New York City there are many thousands of tons of freight going out and in one building annually. For every pound that a department store sells it must take a pound in. We found no difficulty as far as we went in that line in getting the shipper to agree to assume the cost, could he get the line into his building. It would be rather difficult to get cheaper service, but you can give more satisfactory service than there is in existence to-day. You can't get much cheaper service with the short haul generally, because there is so much competition; but you can certainly give a more satisfactory service, and that appeals to the average shipper.

The President—Mr. Beebe, of the Auburn & Syracuse Railroad, has recently inaugurated an express service on his line. We would like to hear from him.

Mr. Beebe—The matter of inaugurating the express business has been in charge of the general manager and others, and they can say more about it than I can. In that connection it has occurred to me that we have had some interesting events in the last two months which might affect our freight and express business. I understand in the city of Rochester they are having considerable difficulty with the city authorities regarding the entrance of express cars and freight cars of the express type over the existing city lines. At a convention of the Mayors of various cities, held, I think, at the instance of the Mayor of Rochester or at his suggestion in the city of Syracuse during the last week, there was much discussion among the gentlemen present as to what steps they ought to take in connection with the entrance of interurban lines, especially of freight and express business, into their cities. The question was discussed of taking some steps toward some legislation this winter, or the possibility of securing some legislation. Of course, all of us are interested in any such discussion or any such question, because we are affected either in one way or another. Another interesting phase of this situation, suggested here in some of these papers, is the relation of the steam railroads to the interurban trolleys through the recent action of the New York Central, the accounts of which, I suppose, all have seen in the daily press and in the street railway journals. It is said that that company or its representatives or those representing its interest, have come into control or are acquiring control of a good many of the large trolley enterprises now paralleling their routes. The question comes up, when they do take control, if they get control, what stand they will take in connection with those roads that connect with them. That, of course, would apply to Syracuse, and it probably would apply to many other lines. It looks as though this coming winter, in the general interest of the trolley roads, we have got to look after our interests in connection with our express business, and that we have got to take some decided stand and unite in protecting whatever rights we have in that line. If there is a future in that line of business, it is worth looking after, and, of course, we will need a united front on the part of our organization to protect those interests.

Mr. Robinson—There is one matter in connection with this subject to which I would like to call the attention of the members present, and that is the position the street railway company may find itself in in case of loss by fire or other destruction, possibly through the negligence of the railroad company, and possibly not. People on the legal side of the situation listen with great pleasure to the engineers' talk about a. c. and d. c. currents. They seem to handle them as children would toys in the nursery. I do not wish to intimate that the breaking out of fires does result from the negligence of the employees. It seems that such fires often arise from the burning out of fuses and matters of that kind which cannot be guarded against, but the situation might be such that a jury would have to say whether the loss resulted from the negligence of the company, either in the construction or method of operation of the machinery or something used in connection with the cars. I have not had much experience in that line, but I have no doubt these express cars at times carry a thousand dollars' worth of goods, and possibly one article might be worth $300 or $500. The question is where the railroad company stands with reference to such costly property which is destroyed by reason of fire which results from some negligence. The receipts of the express companies were drawn loosely in the beginning. It was not until after some actions went to the Court of Appeals that attention was given to the construction of those papers. The Court of Appeals has enunciated the doctrine that a man may contract against his own negligence, but if he attempts to make such a contract he must specify the cause which he intends to guard against, and that any loose forms of expression will not protect him in cases where negligence has been proved. The United States Courts, on the other hand, say that although a man may make such a contract, it is against public policy and it will not be enforced. The large express companies shipping to other States have therefore left out the limitations in their bills of lading as a rule, omitting any stipulation against negligence. The question as it involves the street railroad companies of this State is not affected by the doctrine of the United States Supreme Court, but it seems to me that the decision of the Court of Appeals should be carefully regarded in the preparation of these receipts. A great many railroad companies themselves operate an express service; others contract with the express companies. I think it is a grave question as to whether a railroad company, under the power given it by the statute, has power to have a large force of wagons and men for the purpose simply of transporting express matter; I think there is some doubt about that as a legal proposition. The express companies, as a rule, are better equipped and better educated in their operation, and can handle matter in better shape than isolated companies engaged in railroad operation. It may seem to be rather unkind to select Mr. Allen as an example, but he is the only one who has enlightened us much as to this express matter. You will find in the samples of forms used in his express business the caption, "Utica & Mohawk Valley Electric Express," where the fact is left to the imagination as to whether a shipper is dealing with a railroad company or an express company. The liability clause says they shall not be held liable for loss or damage outside of their own lines, nor for any loss or damage by fire. There is no reference, you will see, to any negligence of the operating company, and no stipulation against it. On a fair construction of that language, it seems to me that the word fire so used would refer to a fire which was not caused by negligence, and if there was a fire in the cars which was caused by the negligence of the motorman or the conductor the company would be liable. You will see a few lines further on that the clause says: "Nor for the fault, negligence, or mishap of any connecting or intermediate line," thus looking after his neighbors better than for himself. And an attempt is also made to provide against a liability for any amount exceeding $50 in any shipment. I again say the decision of the Court of Appeals applying to this question would not limit the loss to $50 in case it was proved the damage resulted from the negligence of the company. I think street railroad companies are exposed to the risk of great loss if they are to carry very valuable goods. Too much attention cannot be given to the preparation of receipts which will protect the company in many cases against fraudulent claims. If the companies are willing to settle express losses without a fight—showing the same readiness to settle and the same liberality that they do in all accident cases—my criticism falls; but for their legal protection I think these papers should be prepared in a more strict form than they are at present.

Mr. McNamara—I take the same view of this that Mr. Robinson does. I think this express business is entirely overrated so far as suburban companies are concerned. He has pointed out where we are likely to get into trouble. We have appreciated for a long while the liability of our company in relation to goods destroyed by fire. We had a case of that kind. The insurance companies under our policies insisted that they were not liable. I said: "You are liable to us because we are liable to the shippers, because they have sustained this loss." "But," they said, "they cannot show you were negligent." I said: "They can show our negligence, because their goods were destroyed by a fire which we might have prevented, and which would not have occurred if we had been more careful, and you must certainly pay us," and they did pay us, and we settled with the shippers. I doubt whether for the amount of business of that kind that we do, it is worth while to take the risk we are taking, and I don't know how much longer we will take it. We have been informed by the gentleman from Auburn that somebody is moving to prevent us from operating freight cars in the streets. We took that question into account when we started our freight business, and we made our express cars as unobjectionable in appearance as possible, resembling closely a passenger car, no longer and no higher, and making no more noise.

The President—If there is no further discussion of this subject we will take up the report of the committee on high-tension tests. This committee was appointed at the last meeting of the association at the suggestion, I believe, of the State Board of Railroad Commissioners. Mr. Storer, the chairman, will present the report.

Mr. Storer read the report of the committee on high-tension tests, which is printed elsewhere in this issue.

The President—The work of this committee is of great importance to the interests which this association represents, and I think the thanks of the association are due to the committee for their labor, and as they have suggested that the committee be continued, I don't see any objection to it.

It was moved, and the motion duly seconded, that the thanks of the association be tendered to the committee for their services, and that the committee be continued.

Mr. Barnes—I don't want to occupy the time of the convention, but this matter was brought up at the last convention, and at that time and since then it has been considered a very important subject, and one as to which a great many people are awaiting the report of this committee. Without wishing to hurry the report of the committee at all, it appears from a statement contained in the report that a series of tests indicates that under certain possible conditions of high-voltage transmission, wooden poles may become sufficiently charged to render them dangerous. That would indicate that the committee has reached a decision of the question which was submitted by the convention to them for consideration. They still further suggest a remedy for that difficulty which seems feasible and a good one. I fail to see what they are going to do in the future, and I do not see why action should not be taken immediately if the report is adopted by the convention.

The President—It seems to me that at least the report that has been made by the committee should be adopted because of the recommendations contained in it. What action do you want to take, gentlemen?

Mr. Storer—Without wishing to take a final stand in the matter, our position is that there certainly are a good many more experiments that could be made with different types of poles or different voltages. While we believe that the results obtained will be practically proportionate to the voltage used, it may be that the conditions on a line 100 miles long would not fully coincide with those existing on the short experimental line which we used. I don't know of any conditions which would vary, and yet there might be such conditions. We have endeavored to take this matter up with the committee of the American Institute of Electrical Engineers, and we find that as individuals some of them are in favor of the recommendations or suggestions for the prevention of danger to the public, while others do not favor them. We don't see any objection to either of the methods of prevention suggested by the committee. I don't believe that they will be obnoxious from the transportation companies' point of view. If Mr. Barnes is satisfied with the report of the committee at this time and is willing to take action on these findings, I believe that the commitee would offer no objection to such action on his part.

WEDNESDAY SESSION

The convention assembled pursuant to adjournment, and the secretary, in the absence of Mr. Struble, read a paper on "Block Signaling of Electric Railway with Track Circuit Control," by J. B. Struble, of the Union Switch & Signal Company." This paper is published elsewhere in this issue.

The President—Mr. Barnes is perhaps as well posted on block signals as any man in the State of New York. I would be pleased to have Mr. Barnes address the convention or lead in the discussion of this paper.

Mr. Barnes—The question, to my mind, is of such importance and, to-day, is in such a position that I deemed it best not to present a written discussion on the subject, for the reason that too much might be said on a subject which, to my mind, covers such a magnitude of ground as this one. The question of controlling the movement of trains is one of vital importance not only to the electric railroads of this country, but to the steam railroads. The system of handling train orders in use at the present time is one which has resulted from the best efforts of the most practical steam railroad men of this country. That it has its defects no one will dispute. Before coming to this convention I investigated an accident on Monday on a steam railroad where two trains came together head-on. In the pockets of the dead engineer of one of the trains the order was found, the disobedience of which resulted in the collision. To my mind, that man was guilty of no greater breach of memory than the man who at night brings home the letter which his wife gave him in the morning to mail. The results were more serious, on account of the responsibilities which a certain method of handling trains placed on him. If the train despatching system is itself defective, where are we to look for more perfect control of the movement of trains? Only to some means of block signals. I was in hopes that the paper to be presented by the representative of one of the leading block signal companies of this country would be of such a nature that valuable information would be given this convention on that subject. To put it mildly, I am disappointed. I don't know that I have anything further to say at present, except that more intelligent papers, papers conveying more information on this important subject, should be expected at future conventions; and I will, for one, undertake at some future time to prepare a paper on this subject. (Applause.)

Mr. Potter, of the General Electric Company, then addressed the convention on the subject of the General Electric Company's single-phase motor. This motor was described in the STREET RAILWAY JOURNAL for Aug. 27.

The President—Gentlemen, if there is no objection, we will only read and discuss one more paper. There are three other papers on the programme. One is practically a statistical paper, and it is a valuable one. It is entitled "The Minimum Population Necessary to Make Interurban Roads Pay." It will be printed in the proceedings of the convention. It has been prepared by Mr. Beardsley, of Elmira, who has been securing statistics for a year or more from roads all the way from San Francisco to New York from which to compile this information. Another paper is "The Relation of the Technical School to the Business and Profession of Electric Railways," by Prof. Norris, of Cornell University. That has been printed

and distributed here, and will also be printed in the proceedings.

Prof. Norris' paper was published in the last issue. The table prepared by Mr. Beardsley and distributed at the meeting is printed in this issue with the other convention papers.

The President—We will now take up the paper prepared by W. J. Davis, Jr. (This paper is printed on another page.)

Mr. Cole—I think that in cities of the second and third class there are two points that will bear very close investigation; they are the load factor at the power station and the interest on the idle investment in extra cars, which in cities of the third class runs up to a considerable amount. A city of the third class will ordinarily operate from twenty-two to twenty-eight regular cars, and from ten to twelve of what may be called regular extra ones, and on holidays and days of celebration they will operate from sixty to eighty cars, if they have them. That necessarily means that the power station is being operated either overloaded or underloaded a good portion of the time. There are several points which have got to be filled up in the valleys between the peaks of load. Another feature is the increasing tendency to put on very heavy cars in cities of the third class, even on the shorter lines. I believe this is wrong, and that a car 20 ft. or 22 ft. long is amply large for operation on most lines, with the exception of suburban lines, for the reason that a car 20 ft. long will consume but a small percentage of the power required by a 36-ft. to 38-ft. car in ordinary operation, and because the repairs on a double-truck car are about 75 per cent more than on a single-truck car. That is, you can operate two 20-ft. cars on a ten-minute schedule as against one double-truck car or a 38-ft. car on a fifteen-minute schedule, and the expense of operation is almost the same. Again, in operating your two 20-ft. cars you are getting a more frequent schedule, giving the people a more constant service and increasing your riding, instead of putting on the large, heavy cars, for which they claim they are increasing the weight so as to take care of collisions. I think if that is the case they ought to design some sort of a pneumatic platform to take care of the collisions and keep the weight of the cars down, because with 3 tons or 4 tons of increased weight the current consumption and cost of operation is extremely heavy. Most of us now are putting in loops at the ends of our lines, so that a three-car train can be operated without the old delay and obstruction of having to shift the cars at the end of the line. A double car with thirty-six seats, weighing 11.75 tons, and operated with two 35-hp motors, will take about 12,040 watt-hours, while a single-truck car weighing 8 tons will take about 8471 watt-hours. So that the same car, taking two trailers, will only take 12,680, as against 12,040 with the double-truck car, yet will have a seating capacity of sixty-three, as against thirty-eight in the eight-wheel car. Then you have this condition, that instead of having an expensive car of the double-truck variety, costing about $5,200, you have got two trailers, which, if you want to buy second-hand, you get very good ones nowadays for about $250. In a city of the third class the regular extra cars will average about four hours a day, but you are paying interest on them for twenty-four hours each day. I don't think that an eight-wheel car in a city operating suburban lines should be equipped with more than two motors of 35-hp to 50-hp capacity. On regular suburban lines where you are operating 18 miles to 20 miles on a high-speed basis, a heavier car might be desirable, because it is necessary for the interurban lines to put the weight into the car on account of high speed. In the same double-truck car, having a seating capacity of thirty-six, taking it in comparison with a trailer, the average watt-hours per mile with the double-truck car are 1334; on the single-truck car with trailer it is 1440. The average speed per mile is 9.3 in both cases. The average watt-hours per seating capacity in the double-truck car is 335, as against 201 on the single-truck car. The average watt-hours per ton empty is 1025 with a double-truck car, and 1208 with a single-truck car with trailers.

Mr. Lewis—I want to ask Mr. Cole his reason for stating that he doesn't believe in four-motor equipments for city cars. Does he wish to make that unqualified statement, or is not that it may be very much modified by local conditions?

Mr. Cole—Of course, conditions alter cases, but in general operation I make that statement, because of the following conditions: With a road operating twenty-four or twenty-five cars, the power house is generally either underloaded or overloaded, so that the peaks of load are increasing all the time, and attention should be directed to getting a better load factor at the station than is usual in the ordinary city of the third class. One of the principal reasons why the cost of power is so much larger in a small city than in a large city is that they can give better attention to the load factor and fill up the valleys between the peaks of load.

The President—We will now take up the Question Box. This has been printed and distributed, and it will be advisable, in order to handle it properly, for each member to provide himself with a copy. I will request Mr. Cole, the secretary and treasurer, to conduct the discussion.

The Question Box, which was published in the last issue, was then read.

(After the reading of Question 32.)

Mr. Barnes—On the question of block signals, I don't want to take up the time of convention, but I take it that the passing of these questions by this convention gives a semi-indorsement to them, or, rather, while not a direct indorsement, that it carries some weight. Without detaining the convention too long, I wish to mention the fact that in the answers to No. 32, I find an argument in favor of manual signals, or signals operated by hand. I simply wish to say that they are subject perhaps to some of the same objections as automatic signals. For instance, in this city, before the present efficient management of this railroad company, I had occasion to investigate three accidents, resulting fatally, caused by the use of manual block signals.

Question 33 was then read.

Mr. Barnes—In answer to that I wish to say that no block signal system ought to attempt any such thing; that more than one car never should under any circumstances be allowed in a block. The block system should be arranged to accommodate the travel, not the travel to accommodate the block signals. And I want to add to my previous remarks on the block signal system, that while I suggested that the future safety of operation pointed in the direction of block signals, I do not wish to be understood as referring to the present block signals. I make the statement that with the present block signals a collision can occur despite their use, and that applies to block signals on steam as well as on electric roads. In this connection it should be understood that any remarks which I may make on this floor are spoken only in a private capacity, and in no sense as necessarily representing the opinions of the Railroad Commission.

Mr. Lewis—Does Mr. Barnes say he does not approve of allowing more than one car to pass in the same direction in the same block?

Mr. Barnes—I certainly do not. My idea is that a block signal should be absolutely safe. With the permissive block signal system as used on steam railroads, collisions do occur which should not occur.

Mr. Lewis—It seems to me that in the operation of city cars it becomes absolutely necessary to allow the passage of more than one car in a block in the same direction. The Schenectady Railroad Company has been experimenting for the last two years with nearly every type of signals which attempts to serve the purpose stated in this question, and with quite indifferent success. We are still experimenting. We hope to discover some form of apparatus that will solve the question,

but so far we have not found the apparatus, and it seems very probable that we will have to fall back on hand signals.

Mr. Hart, of Fall River—May I say a word in regard to block signals? I had considered the block signal as the only real hope that we ever had in regard to anywhere near a signal that would be operative. It seems to me that that ray of hope that we had for some device to utilize the track circuit has been blasted by the paper read this morning, and no one being here to suggest any other way to do it, it seems almost as if we must drop back for the handling of the roads to about the same system as steam roads have been using since 1895 under the new standard code. We know that the number of accidents has been reduced about 50 per cent from what it was at that time. Of course, we cannot prevent the men violating their train orders, and they do violate them at all times. I think that in a paper of last year read before this association, it was said that the control of any car or any crew should be from the central office, allowing one man to do the thinking for the entire road, and taking the control of the road out of the hands of the crews. I believe that would be a step in the right direction. I will say that on a street railroad running 25 miles out from New Bedford for four years there has been in operation a system of telephonic intercommunication, operated under a set of rules prepared for that purpose, and in that time we have never had two cars meet on a piece of single track. They run on that line of 25 miles on a half-hour schedule, and sometimes two express cars and two or three work trains are operated. If there is a new meeting point to be made, they set the two signals, give the order to the two crews and allow them to go to the new meeting point. The orders are entirely verbal. The order is given to the four men; the conductors take it first, the O. K. being given by the despatcher, and the crew answering. There are four men to take the signals; the first two men are the conductors. They receive the order in exactly the same words. If an order reads "Smith and Jones will meet at a certain turnout," it is repeated by four men in exactly the same language, not reversing the wording. The system is almost identical with that of the standard code adopted in 1895 for the use of steam roads, and no deviation is made from that.

The reading of the Question Box was then concluded.

The President—Gentlemen, the next order of business is the report of the nominating committee.

The officers nominated and elected were announced last week.

Mr. Allen—The conventions of the New York State Street Railway Association, it seems to me, have grown to a size where it is not practicable for many cities of this State to entertain and care for the guests, delegates and attendants at the conventions. I am sure that those who are in attendance at this convention, and who have partaken of the hospitality of this city, have had much to excuse in the way of hotel accommodations. That has been true of conventions in the past. This matter has been considered by the executive committee during the last year, but, through some oversight, was not presented to the convention at the time of making their report. If I may be pardoned, I would suggest to this convention that for the next annual meeting some hotel resort be selected where sufficient accommodations for all may be secured. There is no State in the Union that affords larger and better hotel resorts than the Empire State. It is a matter for the executive committee or for this association to choose a meeting point at one of these resorts. The best convention the New York State Street Railway Association ever held was at Lake George, in that there was more solid, hard work done at that convention. It placed us all under one roof; the entertainment offered to members and delegates was confined almost to the ladies. In cities it is a hard matter at times to gather together enough delegates to convene the meetings of the association. There is another feature. We have in attendance at these conventions a number of supply men. I have talked with many of them, and I know that the conveniences offered to them for the exhibition of their apparatus have not been what they should be. It is almost impossible in a majority of the cities of the State to secure a place where a convention hall and an exhibition hall can be fairly close together. In view of these suggestions, and to bring the matter before the association, I would move that we try for the next year, or for one year at least, the selection of some of the hotel resorts for our convention.

The motion was duly seconded and carried.

Mr. Colvin then extended an invitation to meet next year at the Fort William Henry Hotel at Caldwell. It was voted to refer this invitation, with the date of meeting, to the executive committee.

Mr. Robinson—I move that a vote of thanks of the association be extended to C. Loomis Allen for the great courtesy and consideration that he has shown the association in his entertainment of its members through the present session of the convention.

The motion was seconded and carried unanimously by a rising vote, amid great applause.

Mr. Robinson—I move that the thanks of the association be extended to E. G. Connette for his efficient and courteous discharge of his duties and careful attention to the affairs of the association during the past year.

The motion was seconded, and on being put by the secretary was unanimously adopted.

On motion of Mr. Robinson, duly seconded, the convention adjourned sine die.

THE SOCIAL FEATURES OF THE UTICA CONVENTION

Pleasant recollections of the Utica convention will always remain in the minds of those who attended the meeting, which will be remembered as one of the most enjoyable ever held. The hosts of the occasion, the Utica & Mohawk Valley Railway Company, were most hospitable in their entertainment of the delegates.

In the morning of Tuesday, the ladies' entertainment committee extended an invitation to the visiting ladies to accompany them on a trolley ride over the line of the Utica & Mohawk Valley Railway to Clinton, where carriages were waiting for a drive to the summit of College Hill and about the campus of Hamilton College. They were then escorted to the Yahnundasis Golf Club, where a luncheon was served. Later in the afternoon a trip was made from the Yahnundasis Golf Club to Frankfort, Ilion, Mohawk, Herkimer and Little Falls by electric car.

In the evening, the annual banquet was held at Masonic Temple; the toastmaster was Hon. John D. Kernan, who was most felicitous in introducing the speakers of the evening. The latter included E. G. Connette, George E. Dunham, H. H. Vreeland, Addison B. Colvin, Dr. M. Woolsey Striker, J. M. Wakeman and W. W. Cole.

On Wednesday morning the ladies were given a carriage drive through the Sauquoit Valley to the Sadaquada Golf Club, where luncheon was served, after which there was a trip to the Oriskany Battlefield and Rome. They were then met by the gentlemen, who had concluded the business of the forenoon, and proceeded to Summit Park, where an extensive clambake was given. The party returned to the city in the evening.

A number of the delegates on Tuesday afternoon spent considerable time in inspecting the new General Electric single-phase motor car which was running on one of the lines of the Utica & Mohawk Valley Railway, a section 7 miles in length having been equipped with a special alternating-current trolley wire for this purpose.

CORRESPONDENCE

THE CONTINENTAL STANDARD FORM OF OPERATING REPORT

Chicago, Sept. 16, 1904.

EDITORS STREET RAILWAY JOURNAL:

Your editorial on "The Continental Standard Form of Operating Report," appearing in the STREET RAILWAY JOURNAL of Sept. 10, 1904, is most interesting and instructive. Personally, as a member of the Street Railway Accountants' Association of America, and as a street railway man, I take the liberty of writing you to express my appreciation of the article. Your criticisms of the form of report, as well as your criticisms of the Great Britain report in August, 1903, are just, proper and to the point. Your indorsement of the American report and the suggestion that the two European reports be modeled after and conform with the American, is a strong indorsement of our work, which I have no hesitation in saying is most gratifying.

As you know, I was in correspondence with Mr. Dalrymple, of Glasgow, on the question of the Great Britain report, and I hoped to be at the Glasgow convention when the matter was up, as the representative of our association, but, unfortunately, I found it impossible to leave Chicago. What I especially hoped to accomplish, and what I urged upon Mr. Dalrymple, was the modeling of a report and classification that would be international and world-wide in its application and practice. I took the position that the American report should answer all the purposes of the British or any European report, that it had stood the test of practice and had not been found wanting. I urged Mr. Dalrymple to follow, or at least conform to, the American report.

As you also know, I discussed extemporaneously at the Saratoga convention the British report, endeavoring to point out wherein it differed from the American report, and wherein the latter, in my judgment, was better.

I was not aware until I read your article that the preliminary work done on the Continental report was presented to the July, 1902, convention in London, neither did I know that the association held conventions only every other year. Had I known of this I would have had you put me in communication with the people working on the report in 1902, and possibly something might have come out of it in 1904.

I am firmly convinced not only that an international report is desirable and necessary, but that every effort ought to be made to bring together all those in Great Britain, the Continent and America who are interested in this matter, so that a form of international report can be agreed upon.

Opportunity has not permitted me to study and analyze the Continental report as I would like to do, but from the little time I have devoted to it, I was not at all favorably impressed with it, and I do not think it compares with the British report. In addition to what you have said as to the absence of the balance sheet, the indiscriminate mixing of statistics with results of operation, the great amount of detailed information with respect to power plant statistics, and the absence of such information with respect to other departments, I think there are entirely too many accounts.

My idea of a report is that only the main accounts should be shown in "Operating Expenses," and that the thirty-eight accounts of the American report are ample for that purpose. Anything more is a sub-division and refinement of accounts and details based on the special conditions of operation according to the desires or demands of each particular company. I do not favor the use of such detail in the report, nor the statistics of the Continental report appearing in the standard report. A report should be comprehensive, but concise, and a mass of details and statistics should not be incorporated in it, but used rather as building up to the main features.

One thing that I noticed in use of the decimal system is that the arrangement of the detailed operating accounts and the grouping of the headings have been planned with the idea not only of following the decimal arrangement, but of grouping departmental expenses, so to speak, under the nine different heads. If the departmental idea is followed, the three important sub-divisions of a street railway company's operating expense accounts, viz., "Maintenance," "Transportation" and "General," are rendered valueless. From the street railway operating standpoint, it is all important to know what the distribution, as between these three heads, is, and whether the manager has "skinned" the "Maintenance," been extravagant in his "General," or has not given "Transportation" a fair show in the matter of expenditures in connection with the proper service.

As I said at Saratoga, and as all of the reports of the standardization committee will show, one of the most important things that we sought to accomplish and keep ever before us, was the drawing of the line between "Maintenance" and "Operation," but this question has been entirely lost sight of in the Continental form of report.

Pardon me for transgressing upon your valuable time with such a lengthy letter, as I fear my interest and enthusiasm will encroach upon your good nature and patience.

C. N. DUFFY.

BONDING ON 95-LB. RAIL

Sept. 13, 1904.

EDITORS STREET RAILWAY JOURNAL:

I have read with great interest the article in your issue of Sept. 3 upon rails and joints by William H. Cole.

I wish to say, however, that I should never advise the use of No. 2 plastic bonds upon a 95-lb. girder rail 6½-in. high. That this bond is altogether too small for the rail is shown when he says that two of the plastic bonds "had very little contact between the fish-plates and the web of the rail." I am surprised that they had any contact at all, and more than surprised to learn that at end of a year's service they showed over 77 per cent of the conductivity of a section of rail of equal length.

I feel that Mr. Cole is also somewhat unfair to the Chicago and Crown bonds since he reports the use of two of these at the joints of only No. 00 size. This would give a copper section of but .204 sq. in. to the joint, while the rail has approximately 9½ sq. ins. and a conductivity which would run from a ratio of 6½ to 1 of copper down to a ratio of 11 to 1 of copper. Under the circumstances the performance of the bonds seems remarkable, especially since none of them were applied to the best advantage, since he says: "One of the copper-bonded joints was actually loose."

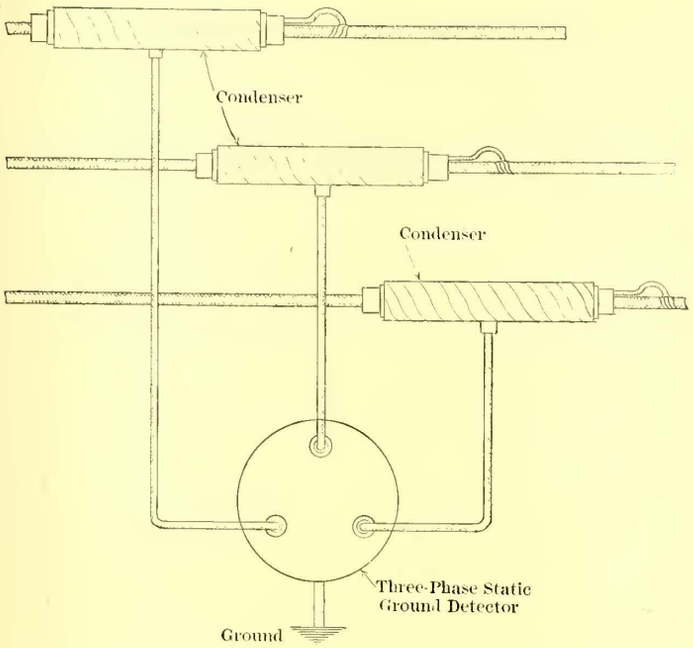
Proper maintenance of rail joints is absolutely essential to obtain good service from any type of bond. That these joints were not of best design nor well maintained is shown when he says: "All of the fished joints showed appreciable wear at the joints, with considerable pounding as the wheels rolled over them. One of the fished joints required attention during the time of the test."

There are several rail joints on the market which properly support the base of the rail and prevent wear or pounding. Had one of these types been used and the bonds been of proper section, the performance of the bonds would have been much better. To show what properly proportioned plastic bonds will do on a rail of this description, I quote the following from a letter received from the Dublin United Tramways Company recently: "I have much pleasure in informing you that we have used about 60,000 Edison-Brown bonds of 1500-amp. capacity. They have been in use for from three to four years, and have been giving good satisfaction when properly applied."

HAROLD P. BROWN.

A NEW THREE-PHASE STATIC GROUND DETECTOR

Static ground detectors, designed to enable the central station operator to determine at a glance whether a ground exists on a single-phase circuit, have become well recognized as a necessary part of every first-class installation. These single-phase instruments are entirely satisfactory on two-phase circuits as well. For three-phase circuits, however, although the practice has been to use two or three single-phase instruments either in separate cases or combined in the same case, this arrangement is open to the objection that the indications of the pointer are not direct, some time being required for a person not familiar with the instruments to determine what line is grounded. It is only recently that a design has been produced by the Westinghouse Electric & Manufacturing Company which enables a ground in a three-phase circuit to be indicated directly by one instrument. This instrument is supplied for circuits of from 1000 to 50,000 volts potential.



CONNECTIONS OF THREE-PHASE STATIC GROUND DETECTOR

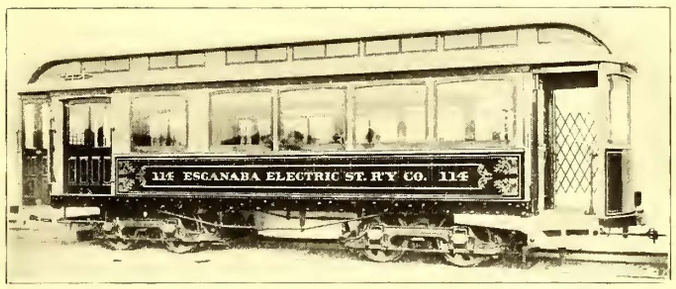
Its method of operation is indicated by the diagram of connections. It will be seen that each of the three fixed vanes is connected to a line of the three-phase circuit. The central movable vane is electrically connected to the case, which is grounded. When there is no ground upon the circuit the attraction or pull upon the central vane from each of three fixed vanes is balanced and it does not deflect from a central position. Should one of the lines become grounded, and the potential of that line become the same as that of the movable vane, there will be no pull in that direction, and the movable vane will be deflected away from the grounded line. The instrument is reliable in its indications and is not complicated.

In the diagram the three leads to the ground detector are shown with a condenser inserted between each line and the instrument. This obviates the necessity of carrying high-tension wires to the front of the switchboard. Each of the condensers consists of a brass tube covered with insulating material and placed within a copper sheath, the line being connected to the inner tube and the lead to the copper sheath.

This ground detector is ornamental in appearance. In shape and size it corresponds with the other Westinghouse round pattern switchboard instruments. The interior of the case is given a dull black finish, against which the aluminum vanes stand in distinct relief, while the angles of deflection marked upon the glass face form a pleasing geometrical design.

INTERESTING CARS FOR ESCANABA, MICHIGAN

Two cars lately delivered to the Escanaba Electric Street Railway, of Escanaba, Mich., by the American Car Company, of St. Louis, are especially interesting on account of several unusual features. Although but 28 ft. over the bodies, they are 8 ft. 11¾ ins. over the sills and sill-plates; this unusual width allows the aisle to be 28 ins. wide, thereby providing a large amount of standing room. The windows are extra wide, the distance between the centers of the posts being 4 ft. 2 1-3 ins. The seats are placed vis-a-vis with the backs centered at the side posts. The passenger compartment seats thirty-two persons and is 17 ft. 4 ins. long; the baggage compartment is 10 ft. 8 ins. long and has a sliding door on either side with 40-in. openings. The windows are arranged to drop into pockets in the side walls. These pockets accommodate double sashes, which may be seen in the view of the interior on the right-hand side. The double sashes assist largely to keep the car warm in winter, and, as the winters are long and very cold in that region, this is an excellent feature. The interiors are plainly finished in cherry, with bird's-eye maple ceilings neatly decorated. The baggage compartment is stained a cherry color and provided with folding seats for the use of smokers. High folding gates guard the platform entrances when the doors are folded against the ends. The platform knees are of oak reinforced with angle-iron. The height of the platform steps from the rails is 16½ ins., and from the step-treads to the platforms 14 ins. The cars are mounted on the American Car Company's No. 11-A trucks, having 4-ft. 4-in. wheel-base and 33-in. wheels.



NEW CAR FOR THE ESCANABA ELECTRIC STREET RAILWAY COMPANY

INTERIOR OF ESCANABA CAR

The railway company operates 7½ miles of lines at Escanaba, and reaches Macabie and South Parks. Escanaba has an excellent harbor and a large system of docks. It is a large ore shipping port and has a population of about 10,000.

PRESIDENT BANCROFT'S HANDSOME PRIVATE CAR

The private car shown in the accompanying illustrations was built by the G. C. Kuhlman Car Company, of Cleveland, for President W. A. Bancroft, of the Boston Elevated Railway Company, and was recently placed in commission on the surface lines which are a part of the company's extensive system. The length of the car over the body is 24 ft. and over the bumpers 37 ft.; the width over the side panels is 8 ft. 2½ ins., and the over-all dimensions are 8 ft. 4 ins. The car is capable of very high speeds, as it is mounted on Brill No. 27-E trucks, having 6-ft. wheel-base and 33-in. wheels. The car is set on the trucks in a manner which enables them to swing sufficiently to take the short curves that are encountered at corners of some of the narrow streets in the heart of the city. The illustrations give an excellent idea of the tasteful decorations and the fine appointments of this beautiful car, making it unnecessary to describe them in detail.

AN INTERIOR VIEW OF PRESIDENT BANCROFT'S CAR

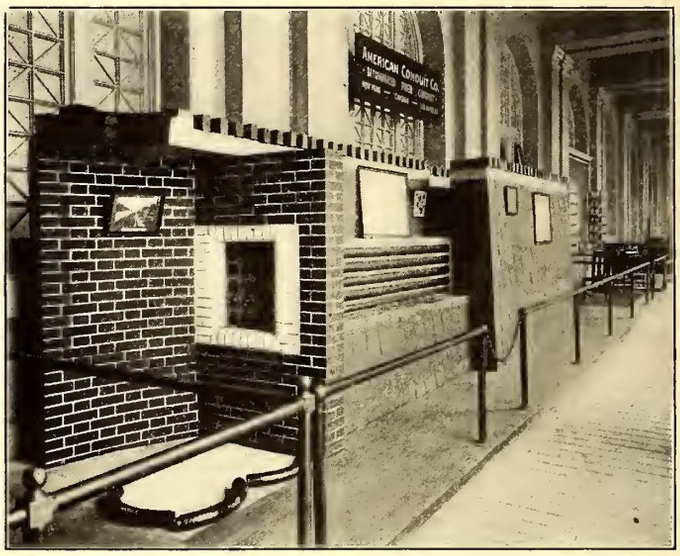
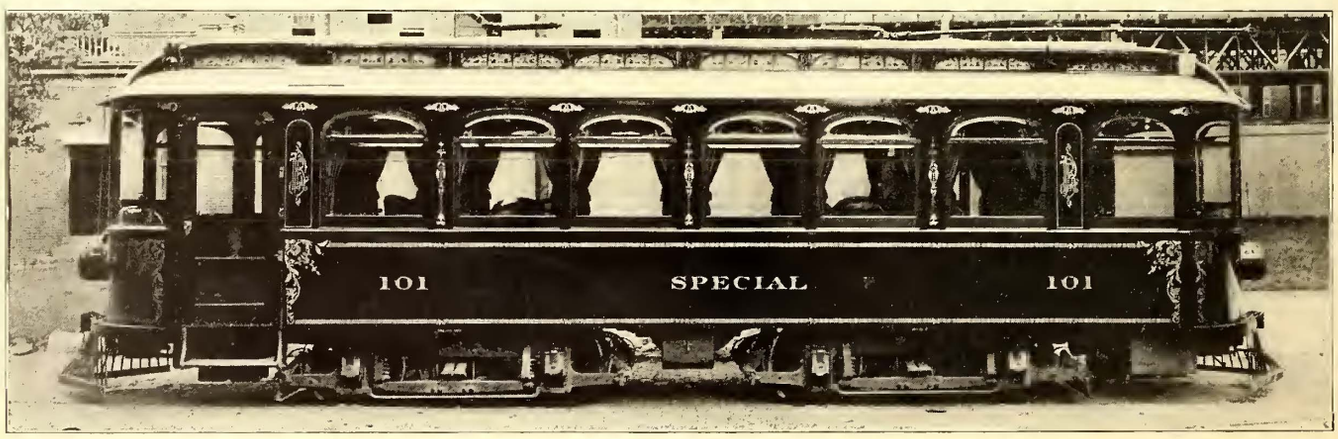


EXHIBIT SPACE OF THE AMERICAN CONDUIT COMPANY IN THE PALACE OF ELECTRICITY



PRIVATE CAR BUILT FOR W. A. BANCROFT, PRESIDENT OF THE BOSTON ELEVATED RAILWAY COMPANY

The sugar beet industry on the line of the Toledo & Western Railway will provide that company with over 1200 carloads of freight during October and November, not to mention heavy grain crops which will be moved.

THE AMERICAN CONDUIT COMPANY AT THE EXPOSITION

Among the several exhibits of conduits and conduit construction in the Palace of Electricity at St. Louis is that of the American Conduit Company. This exhibit occupies a space about 50 ft. long in the west colonnade of the interior court. This company, which has offices in Chicago, New York and Los Angeles, Cal., shows here in a very attractive manner the use of its bituminized fibre conduit in underground electrical work.

This conduit is constructed by rolling layers of specially prepared (fibrous) paper on a mandrel. The paper is saturated with a bituminous compound, which, under the high temperature and pressures to which it is subjected in the process of rolling, so unites the several layers that the resulting product is a solid, stiff tube, resembling very little the original paper used in its manufacture.

The main feature of this exhibit in the Palace of Electricity is a section of a city street, showing the details of construction of underground cableways when bituminized fibre conduit is used. At one end of the section is shown a manhole, where the twenty ducts of the group terminate. A side view of the conduits show them laid in cement, after the method of construction most usually followed. The end of the trench in which the conduits are laid is also shown. This illustrates how the successive layers of the conduits are laid, and also the method of joining the successive 7-ft. lengths of conduits. This is done by a male and female joint turned in a lathe to an accurate fit. At the time of construction, the female joint is

dipped in a solution, which soon hardens and seals the joints between each of various units, preventing any leakage of water or gas into the conduit.

In this exhibit are also shown conduits of several diameters, ranging from 1 in. to 10 ins. in diameter. Some of these are shown crated ready for shipment. The walls of the space are covered with numerous photographs of installations in Los Angeles, Pasadena and other cities.

Among the claims of superiority of the American bituminized fibre conduit over others is that it is electrolysis-proof, non-abrasive, moisture-proof and non-corrosive.

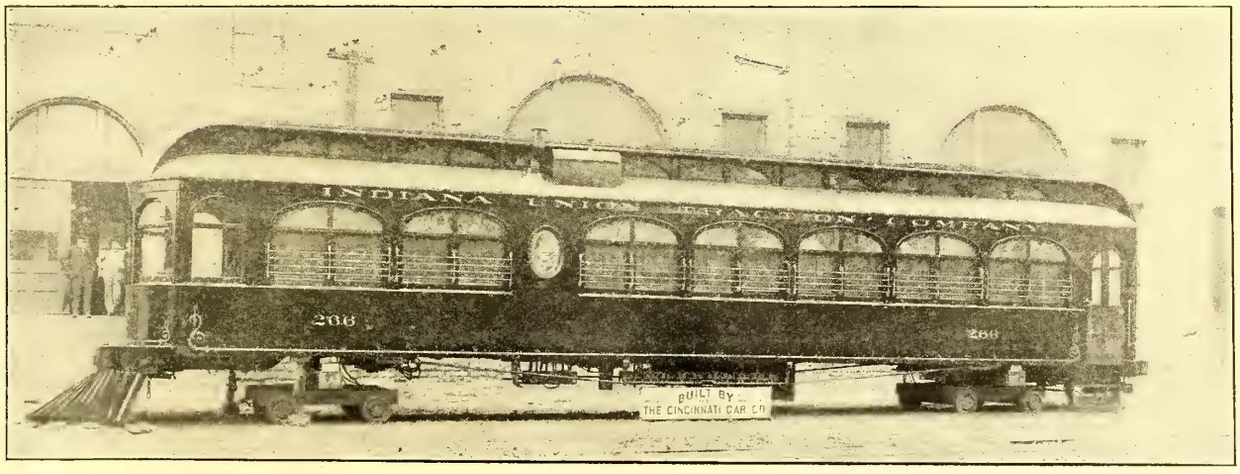
ONE OF THE INDIANA UNION TRACTION COMPANY'S INTERURBAN BUFFET CARS AT THE ST. LOUIS EXPOSITION

On the test track, just north of the Transportation Building, is an interurban car which, partly by reason of its locomotive type of pilot, at once attracts the attention of the visitor. This is an electric buffet car built by the Cincinnati Car Company, of Cincinnati, Ohio. It is one of a lot of twenty constructed for the Indiana Union Traction Company, of Anderson, Ind. The others are now in service as limited cars on the line for which they were constructed.

The car has a length over all of 53 ft. 5½ ins., being 8 ft. 6 ins. over side sills. The interior is divided into two compartments. The forward compartment is used as a smoker, and is supplied with ten comfortable wicker chairs. The rear compartment extends the length of five of the double windows and contains cross seats. A toilet room occupies a position to the left of the aisle in the forward end of the rear compartment. The heater is completely hidden in a room in the rear of the smoker. Across the aisle from the heater room is a compartment of similar size used as a buffet kitchen.

The interior is finished in Honduras mahogany. In general, the finish is plain, paneling and molding having been omitted, but this is partially relieved by marqueterie work of neat design. An upper deck of the Pullman style, the head-lining of which is given a light blue finish, gives an effect of height quite in contrast to the low appearance of the usual construction. The exterior of the car is made unusually attractive by the cathedral glass in the top sash of the side windows and of the upper deck sash. The oval windows of the buffet and heater compartments, too, add much to the appearance.

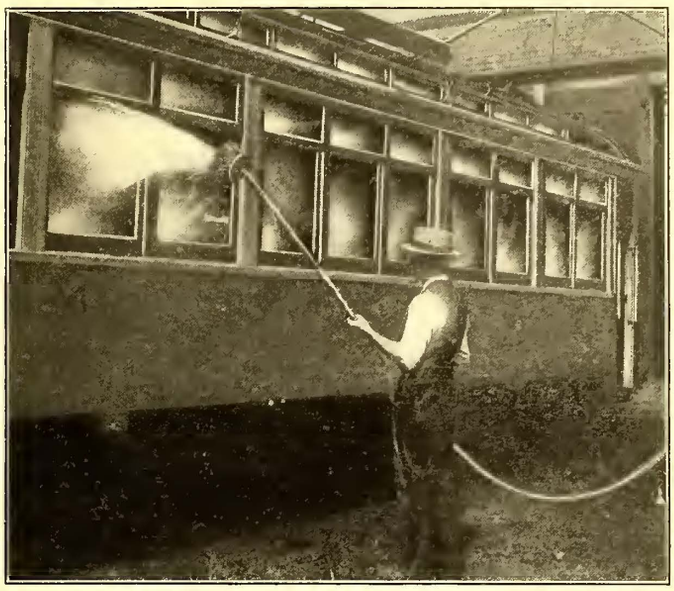
The appearance of the lower portion of the car is greatly enhanced by the steel needle beams and queen posts. The car is mounted on Baldwin trucks and is equipped with four Westinghouse motors, controlled by the Westinghouse unit switch-group system.



INTERURBAN BUFFET CAR, BUILT FOR THE INDIANA UNION TRACTION COMPANY

METAL BRUSH FOR CAR WASHING

George A. Vickery, of Lexington, Mass., has recently placed on the market a car-washing brush with fountain attachment, which differs from others in being made of metal instead of wood. Wooden washing brushes are naturally subject to shrinkage or swelling, and frequently become so water-soaked as to be useless long before their time. A metal brush possesses none of these disadvantages and consequently lasts much longer. The type described is giving excellent service to the Lexington & Boston Street Railway Company and other Massachusetts railways.



METAL CAR BRUSH, WITH ATTACHMENT FOR SPRAYING

This metal brush is made in three sections, consisting of a durable metal plate backing with socket attached, a rubber cushion and the face or bristle-holding member. The three parts are held together by one center screw, allowing the face and rubber cushion to be revolved, so as to wear it even, by loosening this screw and setting it tight again. When the bristles are worn out they may be easily renewed without using another cushion.

The Wheeling & Lake Erie Railway (steam) is taking active steps to regain some of the suburban business which it has lost to the Lake Shore Electric Railway. It has reduced its regular rates on Sundays below those of the electric line. So far the new measure has not been at all effective.

A NEW WIRE COUPLING

A device for coupling stranded wires together, known as the Dossert type B joint, has just been placed on the market by Dossert & Company, of New York. Exceptional claims are made for it as superior in convenience, cost, conductivity and durability to the soldered joint. The joint is made of seven parts, six of which are in pairs. They consist of an inside ring, an outside ring and a compression nut. The remaining part carries nipples, on which compression nuts carrying the wire properly prepared are screwed. These nipples may be in the form of crosses or tees or may be cast on to bus-bars or fittings of any kind, and will enable the cable to be fastened securely thereto. The joint is made in the following way:

The end of the cable is stripped the length of the compression nut and cleaned in the ordinary manner. The compression nut is then slipped upon the cable together with a small outside ring. The outer strands of the cable are then stripped and an inside ring is driven around the inner core of strands with a steel tube provided for the purpose, although any expedient can be employed. The inside ring is V nosed and very readily driven in place. The outer strands are then molded back as nearly as may be to their original position. This can be done with a screw-driver, but a steel tube provided for the purpose is more convenient. It is not necessary to be particular about this matter, for if the assembly can be made sufficiently good so that the cable end can be entered into the nipple, and screw pressure applied, the parts will mould themselves at once to their correct positions. The application of a joint of this character in the manner shown in Fig. 1 requires only seven minutes on a 1,000,000-circ. mil cable. Figs. 2 and 3 being actual pictures of the joint itself, display its construction to better advantage. In Fig. 2 strands are cut away so as to show the inside ring. Fig. 6 displays this joint and its alternative soldered joint and underneath parts of the new joint.

The makers of this joint have subjected it to unusual tests before putting it upon the market. On millivoltmeter test the joint shows a conductivity greater than that of an equal length of wire. Not satisfied with this, however, the joint was subjected to a test in a welding transformer, and it was found that as the current was gradually raised the wire would melt before the joint broke circuit, thereby conclusively testing its continuity. The makers argue that no soldered joint could possibly stand this temperature, as the melting point of solder is much below that of copper. (Fig. 4.)

The mechanical strength of the joint was tested in a tension machine, where it developed more than two-thirds of the strength of the cable it united. (Fig. 5.) The makers do not hesitate to guarantee the joint to stand 50 per cent of the strength of the cable, which they claim is superior to the soldered joint on account of the amalgamating and deteriorating effect of the solder on the copper.

It is also asserted that the soldered joint well made requires a skilled man, while an ordinary helper has no difficulty in making the Dossert joint; furthermore, the soldered joint is deceptive. It may look well soldered and yet be very defective in this respect; in fact, it may deceive even the expert. Furthermore, the acid fluxes, which are commonly, though illegitimately, used, creep into the cable strands and corrode them and weaken the combination. Lastly, the soldered joint is very expensive in larger sizes and requires several hours of time of both man and helper, a large amount of solder and tape and wastes a considerable length of cable, which is very expensive in the larger sizes. The new joint wastes no cable and involves no other expense than its own cost and the time of putting it on, which can be done in less than ten minutes.

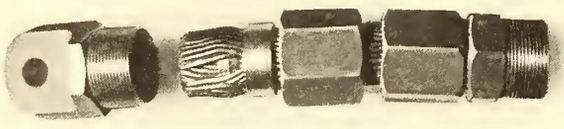


FIG. 2.—A 1,000,000-CIRC. MIL JOINT WITH STRANDS CUT AWAY

FIG. 4.—RESULT OF A MELT-DOWN TEST

FIG. 3.—VIEW OF COMPLETE JOINT

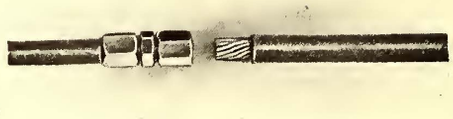


FIG. 5.—MECHANICAL TEST ON THE JOINT

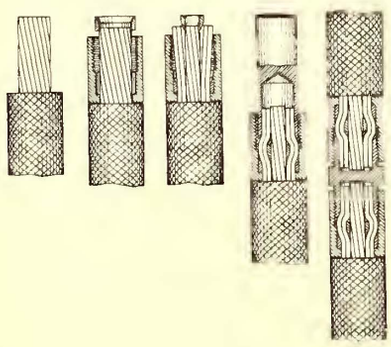


FIG. 1.—MANNER OF ASSEMBLING JOINT

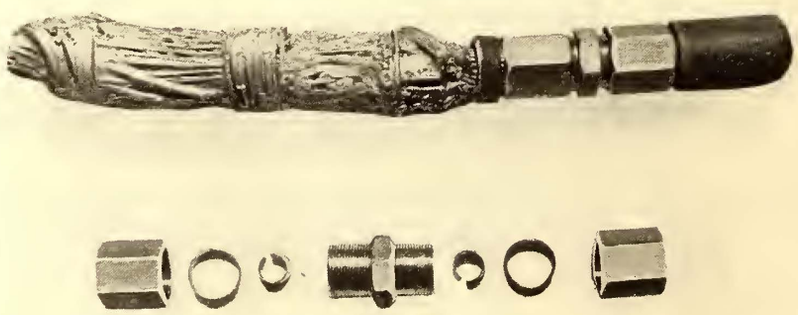


FIG. 6.—SHOWING SOLDERED JOINT AND NEW COUPLING, AND PARTS OF THE LATTER

PAPERS AT THE UTICA CONVENTION

POWER PRODUCTION AND DISTRIBUTION ON THE METROPOLITAN STREET RAILWAY SYSTEM

BY M. G. STARRETT
Chief Engineer New York City Railway Company

In order to understand the conditions governing the economic production and distribution of power on the system in question, one must be reasonably familiar with the physical characteristics of the area served and its density of population. A brief description of this system may, therefore, not be amiss.

The Metropolitan system embraces all the street surface railway lines in the boroughs of Manhattan and the Bronx. Its lines in the Bronx also extend widely into the adjoining county of Westchester, its northern termini, in the villages of Tarrytown, White Plains and Mamaroneck being distant about 33 miles from the southern extremity of the system at the Battery. Within these limits, with about 500 miles of track, it serves a resident population of nearly two and one-half millions, of which all but about four hundred thousand are south of the Harlem River.

The system is separated into two general divisions by the Harlem River; the lines north of the river being operated independently of those in the borough of Manhattan, although supplied with power from power stations common to both divisions.

These two divisions differ radically in their physical characteristics. The system in Manhattan is essentially and completely urban with dense traffic on every line. The main lines extend north and south over nearly the whole length of Manhattan Island, and by far the greater part of the traffic is done over these longitudinal lines. Crosstown lines, 2 miles or less in length, occur at intervals of about ten blocks.

In the territory north of the Harlem River different conditions prevail. The lines do not follow a generally north and south direction, but spread out, fanwise, from their points of junction with the Manhattan lines, and run through suburban territory with rather light traffic.

This system is supplied with electric power generated at two main power stations and distributed through eleven sub-stations over nearly 500 miles of track. The power stations are situated at Ninety-Sixth Street and East River, and at 218th Street and Harlem River, and are, approximately 7 miles apart. The Ninety-Sixth Street power station was planned in 1897, to furnish power for the entire Metropolitan system as it then existed. The 218th Street power station was planned two years later by the Third Avenue Railway Company to feed its lines on Manhattan and the allied lines in the borough of the Bronx.

The electric distribution of the combined Metropolitan street railway system is distinctive as being the largest polyphase alternating-current distribution for surface railways yet put in operation. It is also notable on account of the large amount of energy distributed per square mile of the territory served due to the heavy traffic and the large number of lines in any given area, especially in the borough of Manhattan.

When the plans for the Ninety-Sixth Street power station were under discussion, the high-voltage alternating-current system of distributing power was not so well known in its application to street railway work as to-day, and the question of high tension alternating-current vs. low tension direct-current distribution was, in general, an open one.

Two plans of distribution over the Metropolitan Street Railway Company's territory were considered. One of these was by the direct-current plan from two direct-current power stations; the other was by the alternating-current plan of distribution through sub-stations, as afterwards adopted and now in operation.

Without going into the plans in detail, it may be said that the preliminary estimate for two direct-current plants, including the real estate and feeder system necessary to deliver the current at the conductor rails was 1,650,000 higher than for one alternating-current plant with six sub-stations and all feeders for a capacity of 26,000 kw. The feeders for supplying the territory from the two direct-current plants were estimated to cost $835,000 more than the sub-stations and the high and low tension feeders for the polyphase distribution.

The territory served by the Ninety-Sixth Street power station, and covered by the estimate, it is about 10 miles long and averages about 2 miles wide, or the width of Manhattan Island.

The foregoing figures are sufficient to show the reasons, from a financial standpoint, that led the company to adopt alternating-current transmission from one power house, distributed through sub-stations, rather than direct-current, distributed from two or more power houses. The same considerations influenced the Third Avenue Railroad Company towards the adoption of plans for the Kingsbridge power station, which is of the same general type as the Ninety-Sixth Street power station.

The apparatus at these power stations, and at the various sub-stations operated in connection with them, has been described in length in the technical papers. We will, however, refer to it briefly.

At the Ninety-Sixth Street power station the current is generated by 3500 kw General Electric generators, eleven of which are installed and in use.

These generators give a three-phase current at 6100 volts to 6400 volts, 25 cycles. This is conducted by underground cables to seven sub-stations which are of the following capacities:

Location	Present Capacity Kw Rotaries		Ultimate Capacity Kw Rotaries
146th Street and Lenox Avenue	6	990	.....
129th Street and Amsterdam Avenue	4	1,000	.....
96th Street and First Avenue	3	990	.....
65th Street and Second Avenue	3	1,000	4 1,000
50th Street and Sixth Avenue	8	990	4 990
25th Street, between Lenox and Third Aves.	8	990	8 990
No. 15 Front Street	3	990	4 990

At the sub-stations static transformers reduce to a proper voltage to supply rotary converters giving 550 volts on their direct-current commutators. Storage batteries are also installed at the sub-stations. The direct current is taken by underground feeders and supplied to the conductor rails of the conduit system.

At the Kingsbridge power station eight 3500 kw Westinghouse generators are installed. These generators give also a three-phase current at 6100 volts to 6400 volts at 25 cycles. Part of this current is conducted through submarine cables beneath the Harlem River and by underground cables to a sub-station at West Farms, another in the city of Mt. Vernon and another in the city of Yonkers. The sub-stations are of the following capacities:

Station	Present Capacity Kw Rotaries		Ultimate Capacity Kw Rotaries
West Farms	3	1,000	4 1,000
Mount Vernon	3	500	4 500
Yonkers	3	500	4 500

This power station can also furnish current to the sub-stations located at 146th Street and Lenox Avenue, and at 129th Street and Amsterdam Avenue; interchanging this load with the Ninety-Sixth Street power station as the exigencies of the service may require. Westinghouse static transformers and rotary converters are used at the sub-stations taking current from the Kingsbridge power station. Storage batteries are not installed in connection with the sub-stations at West Farms, Mt. Vernon or Yonkers, as in the case of the other sub-stations mentioned.

In general the arrangement of switchboard and switches for controlling the current generated at these power houses, and its distribution to the various sub-stations, is the same for both power stations. In both power stations all switches are manipulated from one central point where are located the controller boards for the generator circuits and for the feeder circuits. The feeders are grouped on different bus-bar sections, so that as far as possible feeders supplying any given sub-station are divided among the various bus-bar sub-sections, in order that if any given bus-bar section is cut out of service there will still be plenty of feeders in service leading to each sub-station. As far as possible the feeders supplying any given sub-station are run by separate underground routes to avoid failure of current supply to a sub-station in case of local conduit trouble which might cut off all the feeders in one conduit.

To conduct the 6600 volt current from the power house to the sub-stations a uniform size of three-conductor lead-covered cable is employed throughout. This high-tension, lead-covered cable has three stranded conductors, each equivalent to No. 0000 B. & S. gage wire, with insulation 7-32 in. thick. The first order of the company was partly for rubber insulated, and partly for paper insulated cable. The thickness of insulation was 7-32 in. in both cases. The results with paper insulation having been most satisfactory, all subsequent orders placed for high-tension cable have specified paper insulation.

It was originally intended to run the rotary converters at the sub-stations with compound-wound fields, so as to raise the voltage automatically, as would a railway generator, as the load rises, and thereby compensate for the direct-current line loss. This plan would have necessitated the complication of safety devices to prevent the rotary converters from running away in case current was cut off the alternating-current end, and the direct-current supply

was continued to them. As a temporary expedient, the rotary converters were started with simply the shunt winding in use, and it was finally decided to do away with the complication of safety device and to operate all the rotary converters on the system as plain shunt machines. The line loss on the direct-current feeders is low enough so that this is done without having an undue variation in voltage on the conductor rails, and the results have been perfectly satisfactory.

In connection with each sub-station is a storage battery with a capacity of about 25 per cent of that of the rotary converter part of the plant. In charging these batteries a shunt-wound booster is used, which raises the voltage of the sub-station bus-bars a maximum of 120 volts. In discharging the batteries float on the line, discharging more or less according to requirements. Whether charging or discharging the momentary fluctuations are smoothed out by the action of the battery. In addition to taking up fluctuations the battery is useful to tide over emergencies, if there should be an interruption of the current supply from the power house.

The question of efficiency of a polyphase distribution of this kind is one that has been the source of much speculation and argument. On our system we have been able in every-day practice to come very near the rated efficiency of the apparatus, as shown by full load acceptance tests. The system being so large, it was possible to install large and efficient rotary converters (900 kw being the standard size adopted), and at the same time to have rotary-converter units in sufficient number at each sub-station, so that the number in use could be accurately adjusted to the load, and all could be kept with a full, and hence economical, load upon them. The batteries also aid in keeping an economical steady load on the rotary converters and transformers. We have recording wattmeters in all the 6600 volt three-phase feeders, leaving the power house, and in all the direct-current bus-bars at the sub-stations. The difference between the readings of these wattmeters for any given period, of course, should give the efficiency of that part of the distribution which includes the high-tension feeders, static transformers and rotary converters, but excludes the storage batteries, the batteries being connected to the feeders outside the wattmeters. This efficiency is found from records to be 90 per cent to 91 per cent. The loss in the high-tension feeders varies from 3 per cent to 7 per cent on different lines at various hours of the day.

It will be noted that the electrical apparatus used in connection with the Ninety-Sixth Street power station and its sub-stations is of the General Electric Company's type and manufacture, while that pertaining to the Kingsbridge power station and its sub-stations is of the Westinghouse Electric & Manufacturing Company's type and manufacture; this affords us an opportunity for comparing the performance of the two makes of apparatus, which should give us some instructive and valuable data.

The electric generators at the Ninty-Sixth Street station are driven by vertical cross-compound condensing engines, built by the E. P. Allis Company, directly connected to the generators. Surface condensers are used for each engine, and all station auxiliaries are steam driven.

Steam is furnished to the engines by eighty Babcock & Wilcox boilers, arranged in batteries on the first, second and third floors of the boiler house; each battery is rated at 500 hp nominal.

The coal used in this station is taken from boats by steam shovel and automatic conveyors to coal bunkers in the roof of the boiler house having a capacity of 9000 tons. The coal descends by gravity to the automatic stokers with which all the boilers are equipped.

The output of this power station has been, in time of heaviest load, which occurs about Christmas, as high as 575,000 kw-hour per day. The output during the maximum hour of the day has frequently gone as high as 36,000 kw, or nearly the rated load for the eleven generating units. The load factor of this power station varies from 60 per cent to 66 per cent.

The coal consumption at this power station is about 2.8 lbs. per kw-hour. The coal consumption for the maximum output above mentioned would, therefore, be 718 tons per day. The total output of this power station for the year ending Dec. 31 last, amounted to over 149,000,000 kw-hours.

The engines, boilers and piping in this station, as well as the electrical apparatus are so arranged that the station can be operated as three independent stations if desired. It has not been found necessary to make this sub-division, however, and the station has thus far been operated as one unit.

In the last four years of operation there have been but two interruptions to the steady delivery of electric current from the Ninety-Sixth Street power station, and in both these instances the trouble was due to causes outside of the power station itself.

The Kingsbridge power station is at present supplying current to the two northern sub-stations on Manhattan Island and to the sub-stations at West Farms, Mt. Vernon and Yonkers. This station has only recently been completed, the first unit having been put in operation about one year ago. In its arrangement this station follows the same general plan of the Ninety-Sixth Street station. As before noted, the electric units are of the same size and general type. The generating units are driven by vertical cross-compound condensing engines, built by the Westinghouse Machine Company, directly connected to Westinghouse generators. The steam is supplied by Babcock & Wilcox boilers, arranged on the first and second floors of the boiler house and set in batteries of 1000 hp each. The coal bunkers are built above the boilers, coal being delivered to them by mechanical conveyors and fed from the bunkers by gravity to automatic stokers with which the boilers are equipped. The condensing plant of this station is of the type known as the "central jet condensing," and is arranged in duplicate, as are all of the station auxiliaries. All auxiliaries are steam driven.

The following table shows the space required in boiler room and in engine room per kw of capacity:

	Ninety-Sixth Street	Kingsbridge
Boiler room	.56 sq. ft.	.58 sq. ft.
Engine room	.68 sq. ft.	.58 sq. ft.
Totals	1.20 sq. ft.	1.16 sq. ft.

In these power stations the arrangement of apparatus is such that they are practically several power stations under one roof. The sub-division holds from boiler room to switchboard.

The coal used at these power stations is, depending on the market, sometimes anthracite, buckwheat size, approximately 12,000 B. T. Us. per pound, and sometimes semi-bituminous, having a heating value of 14,500 B. T. Us. The average amount of water evaporated per pound of coal for the twenty-four hours, as measured by water meters, is 8½ lbs. The water required per kw-hour at the switchboard is about 23 lbs., including all the auxiliaries.

The cost of coal is 67 per cent. The cost of repairs to power plant is 7.6 per cent, and the cost of labor is 19 per cent of the total operating and maintenance cost of these power stations, while the yearly cost of repairs is about 1.61 per cent of the first cost of the power plant.

The efficiency of the engines and generators taken as a unit, that is, the ratio between the indicated mechanical hp and the electrical hp at the switchboard averages about 90 per cent. The line loss between the generator switchboard and the sub-station switchboard is 5 per cent. The conversion loss in the sub-station is, approximately 6 per cent, while the loss on the low tension feeders averages approximately 5 per cent; giving an efficiency for the whole generating and distributing system of 76 per cent.

A METHOD OF HANDLING INTERURBAN EXPRESS MATTER

BY GEORGE DUNFORD
General Express Agent, Utica & Mohawk Valley Railway

The Utica & Mohawk Valley Electric Express is operated on the same plan as the old line express companies, having offices and express wagon service at the following named cities and villages: Rome, Oriskany, Whitesboro, N. Y. Mills, Yorkville, Utica, Frankfort, Ilion, Mohawk, Herkimer, Little Falls, New Hartford and Clinton, There are employed in the express service thirty-three men, sixteen wagons and three cars (two 40-ft. cars and one 24-ft. body).

The earnings for twelve months ending June 30, 1904, were as follows:

Gross receipts	$36,187.96
Operating expenses	22,177.24
Net income from operation	$14,010.72
Deductions for power and interest on investment	4,557.91
Net income	$9,452.81

Total tonnage, 17,208,715 lbs.
Average rate per 100 lbs., 21.03 cents.
Gross earnings per car-mile, 41 cents.
Dollars per car-hour, $4.27.

Our loss and damage account for the year ending June 30, 1904, with all claims paid, was $17.34.

The territory through which our lines are operated is served by the old line companies over the New York Central Hudson River Railroad, West Shore Railroad, New York, Ontario and Western Railroad, Delaware, Lackawanna & Western Railroad, and in addition the Erie Canal. During seven months of the year steam packets are operated upon the Erie Canal and picked up by wagon, haul by boat, and deliver at destination by wagon the same class of express matter that is handled by the electric express at the flat rate of 5 cents per 100 lbs.

FORM E-500-5-5-04 400 Books.

EXPRESS REOEIPT

Utica and Mohawk Valley Electric Express.

.....190

Received from .....

By THE UTICA AND MOHAWK VALLEY ELECTRIC EXPRESS, the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked consigned and destined as indicated below, which said Company agrees to carry to the said destination, if on its road, otherwise to deliver to another carrier on the route to said destination.

Subject to conditions, endorsed on the back of this Receipt.

Marks, Consignees and Destination.	DESCRIPTION OF ARTICLES	WEIGHT Subject to correction

..... Agent.

FORM E 500-5-5-04-400 Book.

EXPRESS ORDER.

Utica and Mohawk Valley Electric Express.

..... 190

THE UTICA &.MOHAWK VALLEY ELECTRIC EXPRESS will receive and carry the property marked, consigned and destined as indicated below to the said destination, if on its road, otherwise will deliver to another carrier on the route to said destination.

Subject to conditions endorsed on the back of this Order.

Marks, Consignees and Destination.	DESCRIPTION OF ARTICLES	WEIGHT Subject to Correction.

..... Consignor.

FORM E-500—ORIGINAL AND CARBON

FORM E-501

Agents will make way-bill for each shipment, allowing bill to accompany shipment. When possible to do so without crowding, put more than one consignment on each W. B. Every way-bill in this book must be accounted for, and in case a way-bill is to be made void, leave the way-bill in the book to show auditor. Number way-bills consecutively, commencing with No. 1 first of each month.

LOCAL EXPRESS WAY-BILL

The Utica and Mohawk Valley Electric Express 190

FROM ..... TO .....

W. B. No. .....

Car ..... A. M. ..... P. M.

Cond. .....

Stub of

Way-Bill No.

Date *190*

From

To

SHIPPER	MARKS—CONSIGNEE AND DESTINATION	ARTICLE	WEIGHT	RATE	EXPRESS	ADVANCE CHARGES	PREPAID	COLLECT

FORM E-501

FORM E 508. 1-18-'04-10M Sheets.

Office ..... 190 Received in good order from the UTICA AND MOHAWK VALLEY ELECTRIC EXPRESS, Per .....

The following articles set opposite our respective names:

Office From	W. B. No.	Date	CONSIGNEE	DESTINATION or Street and Number	Articles	Charges	Advance Charges	Total To Collect	Prepaid	Time of Delivery	SIGNATURE OF CONSIGNEE
			1								1
			2								2
			3								3

FORM E-508

FORM E-511-7-12-04-25B.

UTICA AND MOHAWK VALLEY ELECTRIC EXPRESS.

Cash Receipts.

DR. ..... *Station* 190

Date of W. B.	Pro. No.	W.-B. No.	FROM	CONSIGNEE	Express Charges Collectible	Advance Charges Collectible	Prepaid Express Forwarded	Miscellaneous	TOTAL

FORM E-511—RECEIPTS

FORM E-511-7-12-04-25B.

UTICA AND MOHAWK VALLEY ELECTRIC EXPRESS.

Disbursements.

CR. ..... *Station*..... 190

DATE	W.-B. No.	TO	CONSIGNOR	Advance Charges	Miscellaneous	Remittances	TOTAL

FORM E-511—DISBURSEMENTS

The following forms and methods are used in the transaction of business:

Form E500 is made up in a book of 100 leaves in duplicate. It it distributed among the shippers and used as their receipt. The driver or agent receiving the shipment, checks each item on the ter destined for that station to the agent or driver who signs for them on Form E-510. This is in duplicate, and is the messenger's receipt for way-bills and goods delivered. When the agent receives the express matter he also checks the way-bill on receiving same. This makes a complete check of all express from shipper

THE UTICA AND MOHAWK VALLEY
Electric Express Company.
Purchasing Department.

190

Please request your Company at
to call at
for the following articles to be forwarded by return express:

Signed
Address
Destination
Agents Will Instruct Hereon if Goods shall be Purchased on Account or Sent Forward C. O. D.
I hereby acknowledge receipt of above order.
Time *Date*

FORM E-519

Utica and Mohawk Valley
ELECTRIC EXPRESS.

COPY OF DEPOSIT MEMORANDUM
TO BE KEPT AT STATION

No *Station*
Express remittance for *190*
Cash sent to Cashier, Main office, Y. M. C. A. Building, Utica.

Nickels and Pennies	
Silver Coin	
Gold Coin	
Bills	
Check	
"	
"	
"	
"	
"	
"	
"	
"	
"	
"	
Total,	

PASTE RECEIPT HEREON WHEN RECEIVED.

Remittance **MUST** be made as directed

Utica and Mohawk Valley
ELECTRIC EXPRESS.

OEPOSIT MEMORANOUM TO GO TO CASHIER WITH CASH.

No *Station*
Express remittance for *190*

Nickels and Pennies	
Silver Coin	
Gold Coin	
Bills	
Check	
"	
"	
"	
"	
"	
"	
"	
"	
"	
"	
Total,	

Agent.

FORM E-506

Utica and Mohawk Valley
ELECTRIC EXPRESS.

☞DO NOT DETACH THIS RECEIPT FROM OEPOSIT MEMORANOUM

This Receipt will be returned by Cashier.

Agent.
Station

EXPRESS REMITTANCE
FOR
190
No. *Amount $*

Agents MUST fill up the above blank ready for Cashier's Receipt and when returned it muet be kept on file for uee of Auditor.

Received *190*
Cashier.

190

M

No. *Street,*

Dear Sir:
Please ship all our Express Goods by the Electric Express Company.
Yours truly,

FORM 249

receipts from the original marks on shipments, signing his name for same. He also detaches the stub or duplicate which accompanied the shipment to the office and delivers it to the warehouseman, who weighs the shipment, enters the weight and checks same and the stub is then delivered to the way-bill clerk. The way-bill clerk on receiving the stub enters the shipment, weight and charges, collect or prepay, whichever it may be, or Form E-501 or E-502, which are in duplicate, and which differ only as regards length. (Form E-502 is not shown.)

Form E-501 is what is known as a "Quarter-Bill," and is used for small stations. Form E-502 is called the "Half-Bill," and is used for the larger stations. When the express matter has been received and way-bills are made out for same and it is time to begin loading the cars, the way-bill clerk totals the weight and charges on way-bill and enters same on office register. The way-bills are then delivered to the messenger who signs for same. When the messenger has received the way-bills, the motorman and warehouseman call off the shipments as they are loaded in the car, the messenger making a check mark on the way-bill opposite each item.

The car being loaded proceeds on its route and upon arrival at the first station the messenger delivers way-bills and express matter to office at destination. After checking up is complete, the agent enters each consignment on driver's sheet, Form E-508, which is a receipt from consignee and is filed in the office for further reference.

When the agent has delivered the shipments and collected the

Form 520. 10M-9-1-'08.

Utica & Mohawk Valley
ELECTRIC EXPRESS.

When FILLED forward
To
At
When EMPTY return
To
At
Messenger will remove this Coupon when empty can has been delivered.

Shipper must fill out this Ticket before forwarding can.

VOID IF DETACHED.

Good for transportation of one can milk with a maximum capacity of ten gallons.

From (Name of shipping point.)
To (Destination.)

10

This Check will be detached from second Coupon by Messenger and forwarded to General Express Agent with Form 510 daily.

GEO. DUNFORD,
Gen'l. Exp. Agt.

№ 12202

Shipper must fill out this Ticket before forwarding can.

FORM 520

Form E-510 11-2-'02-50 Books

Utica and Mohawk Valley Electric Express. ORIGINAL.

RECEIPT FOR WAY BILLS AND EXPRESS.

Messengers will enter W. B. No. in this Book and take receipt from Receiving Agents, keeping this Original in Book and send Duplicate to General Express Agent.

Date, 190

	FROM	W. B. No.	DESTINATION	WEIGHT	NET CHARGES	TIME RECEIVED	EXPRESS COMPANY OR SPECIFIED W. B'S RECEIVED BY
1						1	
2						2	
3						3	
4						4	
5						5	
6						6	

FORM E-510

Form E-525. 1-19-'04-3M.

No.

Utica and Mohawk Valley
Electric Express.

$ *for Collection.*
$ *Charges for Return of Money.*
$ *Total amount to be returned.*

From

On

190

C. O. D.

Bill to be Collected on delivery of goods.

Goods billed to

☞Return proceeds in this Envelope, CAREFULLY SEALED, without delay. Do not deliver the whole or any part of the goods accompanying this bill until you receive pay therefor; ***and be careful to notice what money you receive,*** and as far as practicable ***SEND THE SAME AS RECEIVED,*** and follow the special instructions of the shippers, if any are given on the bills or on the packages. If goods are refused, or if the parties cannot be found, notify the superintendent or the agent of office from whence received, with names and dates, and await further instructions.

RATE FOR RETURN OF PAID C. O. D.'S., 10 CENTS FOR AMOUNTS UNDER $50.00; 25 CENTS FOR AMOUNTS OVER $50.00. MAKE REGULAR W.-B. FOR THE RETURN C. O. D. CHARGES, SHOWING CHARGES FOR RETURN COLLECT OR PREPAID AS THE CASE MAY BE.

NOTICE TO AGENTS.

Agents and all employes concerned are referred to the Company's Rules and Instructions concerning C. O. D.'s and will be held to strict accountability for compliance therewith.

REMARKS.

Counted and Sealed by

FORM E-525

charges for the day's business, he compares the driver's sheet with way-bills and if correct enters it on cash book. Form E-511 enables the auditor to make a complete check of the office at any time he may desire to do so.

The cash book having been written up and balanced the agent makes a report to the cashier of railway, using form E-506 in making remittance.

Forms E-504 and E-505 (not reproduced) are a received and forwarded abstract of way-bill and are made out by agent at each station four times each month. It is forwarded with all way-bills to auditing department. This enables the auditor to check one station against another.

Form E-516 (which is also not reproduced), is a correction in duplicate used in case of an error in billing. If way-bill clerk should overcharge or undercharge for shipment, the agent at destination fills out this form and sends it to the general agent for approval. An investigation is made and if found correct the general agent signs and returns copy, retaining the original. The amount is credited or debited to him at the end of the month on monthly balance sheet.

Form E-519 is used in the purchasing department. Our agents call on the different merchants each morning to ascertain if anything is needed from any town on our line. This order is forwarded on the first passenger car after order has been received and is delivered on arrival at destination. For instance a merchant at Little Falls, wishing to purchase an article in Utica, 22 miles from Utica, gives our agent at Little Falls an order in the morning and he can receive the goods between one and two o'clock the same afternoon.

Form E-525 is an envelope accompanying C. O. D. shipments and is used for the return of the money.

Form 520 is a milk ticket, sold to shippers and attached to the can. When the messenger receives this shipment he detaches the coupon, which is delivered to the auditor, the balance of the tag remaining on the can returns same, free of charge, to shipper, when empty.

Form 249 is used as a soliciting card and is distributed to merchants by our agents.

Form E-509 (not reproduced) is the monthly balance sheet. It is made out by the local agent at each station and sent to the general agent, who checks each period of abstract to ascertain if the accounts of his office are correct.

REPORT ON HIGH VOLTAGE TRANSMISSION LINES

BY S. B. STORER, H. O. ROCKWELL AND R. E. DANFORTH
Committee

The committee appointed to investigate the dangers incident to high voltage power transmission lines, have the honor to report to you the following:

The committee, in their investigations, have assumed that the principal objects to be attained were the determination of the conditions under which high voltage power transmission lines become dangerous to the general public, and also to determine, if possible, the proper measures to be taken for the prevention of such dangers. With this end in view, and by the courtesy of Mr. C. Loomis Allen, general manager, and Mr. W. J. Harvie, E. E., of the Utica & Mohawk Valley Railway Company, of Utica, N. Y., a short transmission line was erected and arrangements made to conveniently subject the conductors to the worst possible conditions that might arise in the operation of any high voltage line.

This experimental line was built on the railway company's property adjacent to their Frankfort sub-station, which is supplied with 20,000 volt, three-phase, 60-cycle, alternating-current power generated at the Trenton Falls water power plant of the Utica Gas & Electric Company. Poles No. 1, 3 and 6 are cedar; poles No. 2 and 5 are chestnut, and pole No. 4 is of iron, being a standard 4 inch, 5 inch, 6 inch tubular type, 28 ft. long. The wooden poles are 35 ft. in length and set to a depth of 7 ft. Poles No. 2 and 4 are set in concrete and the others set in earth in the usual way.

For convenience the poles are numbered beginning with the one adjacent to the sub-station.

A double set of cross-arms are provided, the upper one carrying four conductors and the bottom one two, arranged so that the wires on each side of the pole form an inverted triangle approximately 24 ins. on a side. The wires on one side of the poles were copper and those on the opposite side aluminum, all being mounted on Locke No. 100, chocolate colored insulators. Tests were made, however, only on the aluminum conductors. The upper cross-arm was 7 ft. 5 ins. long, and the lower one 5 ft. 4 ins. long, both being 4¾ ins. by 4 ins. These cross-arms are set in gains and fastened on with a single bolt passing through the pole and supported by a one-piece galvanized iron brace which is lag-screwed to the pole and bolted to a small angle iron attached to the arm.

The above is the standard type of construction used by the Utica & Mohawk Valley Railway Company.

The cross-arms on the iron pole were held in place by a collar and bolts, no braces being used.

In order to obtain the necessary high voltage current without causing trouble to the main transmission system, two 330 kw oil insulated, self-cooling transformers were supplied and connected so as to receive current at 360 volts, raising it to 20,000 volts for use on the experimental line. The transformers are V connected so as to transform from three-phase to three-phase, giving regular working conditions. The switching of the current was all done in the low voltage side of the transformers in which there was also connected three alternating-current ammeters supplied by the Westinghouse Electric & Manufacturing Company for use during the tests. One meter was connected in each phase. The voltmeters used were of the Weston portable, alternating-current type and a Westinghouse static ground detector reading from 0 to 3000 volts, all of which had been recently calibrated. One of the Weston meters had a double scale for either 150 or 300 volts and the other one a double scale for 300 or 600 volts.

In order to approximate the conditions which might be met by a person leaning against a pole and receiving a shock, due to possible leakage through the pole or over its surface, an aluminum cable was wrapped around poles No. 2 and No. 3 about 6 ft. from the ground, three turns being taken around each pole and a connection to the center of the pole being made by a large spike driven into the pole and around which the ends of the alumnium cable were fastened. The difference of potential between this aluminum band around the pole and the ground would represent the maximum shock or voltage obtainable by any person leaning against the pole or coming in contact with it.

With the line in normal operating condition, either wet or dry, it was impossible to find any difference of potential between these points as determined either by voltmeter or by personal contact; nor could any be found when different wires were laid on cross-arms on adjacent poles until they were tied to the iron braces.

With one conductor removed from the insulator and lying on top of the cross-arm, as well as being connected to the iron brace, no leakage was obtainable with the pole dry; with the pole wet after a twelve hour's hard rain, the Weston voltmeter showed a difference of potential of 90 volts. The shock obtained by personal contact was somewhat in excess of this amount owing to the higher resistance of the human body than that of the voltmeter. The closing of the voltmeter circuit between the aluminum band wire and the ground would materially reduce the shock.

In order to obtain severe conditions one of the other conductors was removed from its insulator on pole No. 3, laid on the cross-arm and connected to the iron brace exactly in the same manner as on pole No. 2. This arrangement gave a difference of potential of 20,000 volts between the two cross-arms on pole No. 2 and pole No. 3, and is the shortest path obtainable for the current flowing through the entire length of the poles and the intervening ground.

Under these conditions, with both poles soaked after a twelve hour's hard rain, the difference of potential between the band wire on No. 2 pole and the ground was 270 volts, and that between the band wire on No. 3 pole and the ground was 170 volts. This difference was probably due to the fact that the one showing the higher difference of potential was set in concrete, while the other was in wet earth. This shows that the resistance of the concrete even though wet, is considerably higher than that of wet earth.

As the worst possible conditions, the third wire of this line was removed from its insulator and laid on the cross-arm supported by the iron pole. It will be noted that this arrangement gave all three phases with conductors removed from their insulators and laid on the cross-arms of three consecutive poles—the two wires on the wooden poles being in addition tied to the iron braces—one of the poles of iron and the two wooden ones, water soaked after a heavy rain. Between the band wire on pole No. 2 and the ground the voltmeter indicated 320; between the band wire on pole No. 3 and the ground the voltmeter indicated 300; while between the iron pole and the ground there was no difference of potential—showing that although set in concrete its base probably extended through to wet earth, making a good ground.

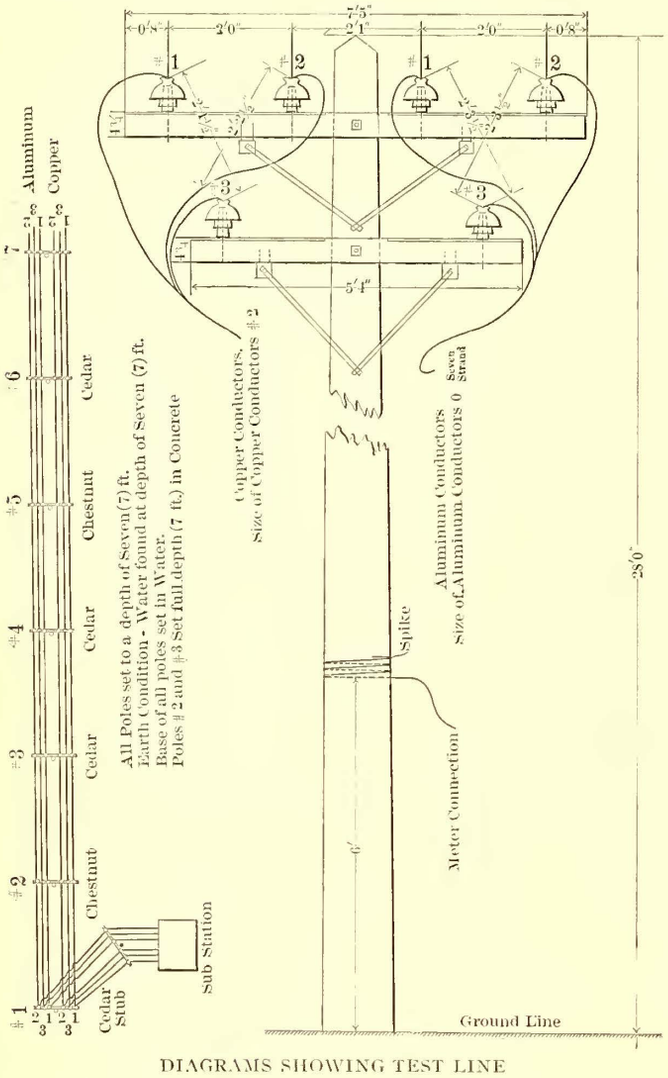
The voltmeter was then connected in circuit between the band wire of pole No. 2 and that on pole No. 3, showing a difference of potential of 370 volts, which by calculation from current and voltmeter resistance shows a resistance of approximately 1400 ohms between these two points. During a later test after several days of dry weather, the poles having been wet down with a hose, the resistance of pole No. 2 from the band wire to the ground was determined as approximately 1780 ohms, a static voltmeter being used. This difference in resistance is due to the fact that in the later test the body of the pole contained less moisture than in the

first test. The latter test also seemed to show that at least 75 per cent of the total drop in potential occurred at the point of contact between the brace or lag screw and the pole.

It should be noted that as stated previously the shock obtainable by a human being would be considerable in excess of that indicated by a Weston voltmeter and would be correspondingly less than that indicated by a static voltmeter.

The above results were obtained by using a line voltage of 20,000, but the effect of increasing or decreasing the line voltage would be to modify the results obtained in practically the same proportion.

The most interesting experiment performed was for the purpose of determining the possible danger to persons standing on the ground and holding a hose throwing a stream of water on either a trolley wire or a high voltage transmission line. For the purpose



DIAGRAMS SHOWING TEST LINE

of this demonstration a fire engine was secured from the village of Frankfort and placed so as to take water from the Erie Canal, which is within about 300 ft. of the sub-station. A line of 3½-inch hose with a 1⅛ in. nozzle, was carried to the experimental line, the nozzle being placed at an angle of about 60 degs. and throwing the stream directly on the 600-volt trolley wire, and later on the 20,000-volt transmission wires. In neither case was it possible to obtain the slightest shock even while standing on the rail or the wet ground and holding the brass nozzle in bare hands. The length of the stream from nozzle to trolley wire was about 20 ft., and about 30 ft. to the transmission wires.

It was also found that it was impossible to short circuit the 20,000-volt line even by throwing the stream so as to strike two of the wires, which as stated previously are only 24 ins. apart; nor did any change in the ammeters in circuit indicate that any current passed between the two wires over the stream of water.

The series of tests indicate that under certain possible conditions of high voltage transmission, wooden poles may become sufficiently charged to render them dangerous. These conditions while possible are, however, extremely improbable, but it is nevertheless advisable that proper means be devised for affording necessary protection; and we therefore offer the following suggestions in relation to such protection.

It was shown that when the band wire which was wrapped around the wooden poles was grounded it was practically impossible to obtain a shock by standing on the ground and touching any portion of the pole below the band wire. We therefore suggest that all wooden poles in exposed locations, which are carrying high voltage transmission lines, be supplied with a metal band placed tightly around the pole about 6 ft. from the ground and permanently and durably connected to the ground.

Where iron poles or towers are used if they are merely set in earth, no protective device of the above character is required. If they are set in concrete there might be a slight shock obtained if the concrete was very dry and covered every portion of the pole where placed in the ground. This condition can be avoided by having the pole project several inches through the concrete into the earth. Galvanized iron poles or towers set in earth without the use of concrete are therefore preferable as regards safety from accidental shock over any other type.

For protection from possible danger due to wires carrying a high voltage breaking in and lying on the ground, we would suggest that poles or towers in exposed places be fitted with thoroughly and permanently grounded iron shields or brackets which extend on each side of each pole and cross-arm to a sufficient distance and at a proper height, so that a break in the wire would cause the ends to come immediately in firm contact with the grounded shields by dropping upon them. In this case no one received a severe shock from the broken ends which might be lying on the ground or suspended within reach, as the wires would be at the same potential as the earth on which the person was standing.

A grounded network suspended under the transmission wires, if properly installed, would accomplish the same results.

The suggestions embodied above are the results of experiments conducted on three different occasions under widely varying conditions.

The committee feels that this is a highly important subject and demands further investigation before final recommendations are made.

RELATIVE ECONOMY IN THE OPERATION OF LONG AND SHORT CARS

BY W. J. DAVIS, JR.
Of the General Electric Company, Schenectady, N. Y.

In cities of the first and second classes the headway between cars on the principal lines is as short as safe operation will permit, and on many of the less important lines is such that no stipulation in travel will result from further decrease. In such cases it is obviously necessary, in order to handle the traffic, to use long heavy cars having the greatest seating capacity allowed by clearance diagrams and other local conditions. Not only are the gross receipts increased thereby, but the expense of operation is materially less on account of the reduced cost of transportation wages per passenger carried.

In cities of the third class, however, the question becomes more complicated and difficult of solution. In the first place the frequency of service must be regulated with reference to securing maximum patronage; secondly; the size of the car best suited to the average travel must be determined, consideration being given to the initial cost of equipment and to gross operating expenses. Finally, the above items must be balanced one against the other in order to make the most economical selection of equipment and schedule.

This paper will be limited in scope to a discussion of power consumption of cars of various sizes and weights, and relative cost of operation as applying to cities of 30,000 to 50,000 inhabitants.

POWER CONSUMPTION

It is assumed that the cars will operate at schedule speed of 8.5 m. p. h., making 6 to 10 stops per mile and giving maximum speed of about 22 m. p. h. on tangent level track. We will consider four sizes of car, having seats for twenty-two, thirty, forty and forty-eight passengers respectively. The following data will apply:

DESCRIPTION				
Type Trucks	Closed Single	Closed Max. Track	Closed Max. Track	Closed Double
Length of body, feet	16	22	28	35
Length over all, feet	22	30	37	45
Seating capacity	22	30	40	48
WEIGHTS	Pounds	Pounds	Pounds	Pounds
Car body	6,000	8,400	11,700	18,000
Trucks	4,500	6,700	6,700	12,400
Equipments	4,600	5,200	6,200	7,100
Passengers	3,000	4,000	5,400	6,500
Totals	18,100	24,300	30,000	44,000
Tons, taken	9	12	15	22

EQUIPMENT				
Number of motors	2	2	2	2
Horse-power, each	25	35	40	60
COST				
Car equipped complete	$2,550	$3,120	$3,640	$5,650
POWER				
Watt-hours per ton-mile	140	140	140	140
Kw-hours per car-mile	1.26	1.68	2.10	3.08
Average kilowatt at power house.	10.7	14.3	17.9	26.2
Maximum kilowatt at starting	57	70	86	125

Attention is directed to the estimate of energy consumption as shown above. The values given are based on wattmeter tests and indicate the average energy throughout the day as recorded at the power station switchboard—modern equipment, good bonding, adequate feeder system and capable handling of the car being assumed. Observation has shown that energy demanded by cars of equal weight varies largely in different localities, in some instances running as low as 110 watt hours per ton mile, and in others reaching as high as 180 and even 200 watt hours per ton mile. This wide variation is due largely to local conditions, such as obstruction of the tracks by teams, necessitating frequent slow downs and considerable running on resistance, a gear reduction giving a maximum speed too high in proportion to the average frequency of stops, or careless and inefficient handling of the controller by the motorman. The latter item is of more importance than it is ordinarily credited with, as trials with recording wattmeters placed upon the cars have shown a possible saving of 15 to 20 per cent due to motorman giving closer attention to track and car conditions having an influence on power consumption. The value of 140 watt hours per ton mile as given above is being regularly obtained in actual service in many places, but does not include power demanded by the heating and lighting circuits. The average energy at the power house is seen to vary from 10.7 kw for the 16-ft. car, to 26.2 kw for a 35-ft. car. Assuming rate of acceleration of 1.5 to 1.75 m. p. h. per second, power at starting will vary from 57 kw for the 16-ft. car to 125 kw for the 35-ft. car.

COST OF OPERATION

For purpose of illustration, the writer has assumed operating conditions such as would normally exist in a city of about 40,000 inhabitants. The average mileage per car per day has been taken at 112, average car mileage per day 3650, cost of power, exclusive of fixed charges, 1 cent per kw-hour, and total wages of motorman and conductor 42 cents per hour.

In making a general comparison between long and short cars two cases must be considered, one based on constant seat mileage and the other on constant car mileage per day.

CASE I.

Number of cars in service and headway between them adjusted to give constant seat mileage per day:

Size of car (length of body), feet	16	22	28	35
Number of seat-miles per day	80,300	80,300	80,300	80,300
Number of car-miles per day	3,650	2,670	2,010	1,670
Number of cars in service	33	24	18	15
Kw-hours per day	4,600	4,220	3,780	4,400
COST PER CAR-MILE IN CENTS				
Power-house expenses	1.26	1.68	2.10	3.08
Transportation wages	4.94	4.94	4.94	4.94
Maintenance, car bodies and trucks	.64	.91	.93	1.06
" electrical equipment	.45	.54	.60	.65
" roadbed	.36	.49	.65	.79
" overhead lines	.24	.24	.24	.24
Salaries and general expenses	1.30	1.73	2.23	2.84
Legal expenses	.40	.55	.73	.87
Total per car-mile	9.59	11.08	12.42	14.47
Total per seat-mile	.44	.37	.31	.30

CASE II.

Number of cars in service and headway between them constant for all sizes of cars:

Size of car (length of body), feet	16	22	28	35
Number of seat-miles per day	80,300	109,500	146,000	175,200
Number of car-miles per day	3,650	3,650	3,650	3,650
Number of cars in service	33	33	33	33
Kw-hours per day	4,600	5,770	6,860	9,640
COST PER CAR-MILE IN CENTS				
Power-house expenses	1.26	1.68	2.10	3.08
Transportation wages	4.94	4.94	4.94	4.94
Maintenance, car-bodies and trucks	.64	.91	.93	1.06
" electrical equipment	.45	.54	.60	.65
" roadbed	.36	.36	.36	.36
" overhead lines	.24	.24	.24	.24
Salaries and general expenses	1.30	1.42	1.56	1.87
Legal expenses	.40	.40	.40	.40
Total per car-mile	9.59	10.49	11.13	12.60
Total per seat-mile	.44	.35	.28	.28

From the above tabulated data it appears that while the cost of operation per car mile increases directly with the size of the car, the cost per seat mile decreases. Also that both of these items are diminished up to a certain point by increase in the number of cars operated.

In cities of the third class, the normal headway between cars will vary from five minutes on the trunk lines to fifteen minutes on the suburban lines. This frequency cannot be diminished without danger of reduction in traffic as the average able bodied citizen will walk a mile rather than wait twenty minutes or half an hour for a car to carry him that distance. Generally speaking, a 16-ft. or 18-ft. car will be found large enough to handle the average travel, extra cars being put on during morning and evening rush hours. There may be cases, however, where the use of a 22-ft. or even a 28-ft. car for normal service would be justified by the necessity of moving a large number of passengers during hours of opening and closing of business. Such a case would occur where the business section lies at one end of the city and the residence section at the other end. As an example, assume that normal service on a given line requires four 16-ft. cars operating on fifteen minute headway, and that for two hours in the morning and two hours at night five minute service is necessary, calling for twelve cars. Equal carrying capacity during rush hours may be secured with six 28-ft. cars. Assuming maintenance of permanent way and general expense charges to be unchanged, the following comparison may be made:

	16-Ft. Car	28-Ft. Car
Number of cars	12	6
Car-miles per day	884	680
Cost of power, transportation wages and maintenance of equipment per car-mile	$0.0729	$0.0857
Cost of power, etc., per day	64.64	58.28
Initial cost of cars	30,600.	21,840.
Average kilowatt at power house	128.4	167.4

It will be seen that there is a saving in operation for this particular line of $6.36 per day, or $2,300 per annum, a reduction in initial cost of rolling stock of about 30 per cent and a reduction in power of 15 per cent. Another point in importance not shown by the tables is that the number of extra crews is reduced, thus simplifying arrangement of runs and introducing other small economies in general expense.

It may be broadly stated that when double service is required on any line for at least three hours per day, the use of long cars is preferable. The operating cost will just about equal that of small cars having equal aggregate carrying capacity, the gain consisting in considerable decrease in cost of equipment and appreciable reduction in average power consumed.

Another condition favorable to the use of long cars exists on those roads catering especially to holiday and pleasure travel during the summer months. An investment in thirteen and fifteen-bench open cars will obviously yield larger net income than an equal investment in seven and nine-bench cars, although frequently a combination equipment will be found economical, small single truck cars with two motors being employed for normal daily service and large double-truck cars mounting four similar motors held as reserve for special service. The motors will thus be all alike and interchangeable from one style of equipment to the other.

THE QUESTION OF FREIGHT

BY L. W. SERRELL

The primary object in the construction of railroads is to move both passengers and property from place to place, landing the passengers as near as possible to the place at which they wish to alight and delivering freight and express matter at its destination.

The development of the electric railway has been very rapid. In the early part of 1888, only 86 miles of electric railway were in operation in the United States, using about 172 cars. The census report for June 30, 1902, shows 22,589 miles of electric railway, using 67,199 cars, and requiring 1,298,133 hp for its operation. The total number of passengers carried during the year was nearly 6,000,000,000, with gross earnings of almost $242,000,000. This enormous development has taken place principally with the idea of picking up and dropping passengers along highways, but the electric railway has long since passed from a city road and is to-day in practical competition with the steam railroads. It operates its cars over private rights of way at a high speed between cities and the day is not far distant when Albany and Chicago will be connected with trolley railways.

During most of the time this development has been taking place the idea of carrying freight has received scant attention, as the energies of electric railway managers have been taxed to their

uttermost to successfully handle the crowds of short riders. In many places, however, the municipalities have had an idea that possibly this development would in time lead to the carrying of freight through their streets and they have exacted franchises prohibiting such uses of the highway, but with the development of the interurban road operating largely on private rights of way, even such restrictions cannot altogether prevent the profitable handling of interborough freight.

The possibilities of freight business are now so generally recognized that it is seldom promotors present a prospectus for a new electric road which does not include large estimated freight receipts, usually much in excess of what the roads will actually earn.

In order to successfully handle freight, it must be carried to its destination, which is usually its market, and up to the present time electric railway companies have been practically limited in the amount of freight handled to that which is produced and consumed along its own line of road.

Some idea of the amount of this business may be gathered from the following data:

In New York State for the year ending June 30, 1903, we find the following:

NEW YORK STATE

	Freight and Express	Car Miles	Receipts per Car-Mile Cents
Albany	$37,936	49,797	75
Rochester	28,381	46,764	60
Newburgh	12,881	16,516	78
Hudson Valley	22,190	54,842	40
Brooklyn Heights	75,658	189,494	40
Buffalo	89,354	219,672	41

It will be noted from the above that the freight receipts per car mile are large.

The freight business on electric roads in the Eastern West has been developed more than in any other section of the country. For the year ending April 30, 1903, I have been able to secure the following information:

OHIO

	Freight	Express	Total
Eastern Ohio Traction	$44,000	.....	$44,000
Toledo & Western	23,000	.....	23,000
Cincinnati, Georgetown & Portsmouth	37,500	$10,200	47,700
Cleveland & Southwestern	10,000	7,200	17,200
Lake Shore Electric	26,200	4,700	30,900

No details are obtainable as to car mileage or cost of operation.

No information is published that is absolutely reliable for the State of Pennsylvania.

The following roads report incomes from other sources than passenger for the year ending June 30, 1903, as follows:

Incomes Other than Passengers	
Altoona & Logan Valley	$29,562
Lancaster	22,305
Harrisburg Traction	40,411
Lehigh Valley Traction	34,193

It is probable that these figures are largely made up of freight and express receipts.

An examination of thirteen steam railroads in the State of Pennsylvania, averaging in length from 10 to 30 miles, with steam railroad connection and facilities for shipment without transfer from cars, shows the average gross freight earnings per mile of track per annum $2,270. Of this amount two-thirds is the product of mines, and one-third, or about $750 per mile per annum, is made up of the products of agriculture, animals, forests, merchandise, manufacturing and miscellaneous freight.

The Street Railway Journal of April 18, 1903, places the average freight receipts at $650 gross per mile of track per annum, and in the Sept. 12, 1903, issue of the Street Railway Journal, Mr. J. B. McClary places the average gross receipts of thirty-seven roads of the Middle West at $27,000 per road per annum.

In some sections of New York State, the following table gives the average yield per acre in tons for agricultural products: Hay 1½ tons; wheat, ½ ton; barley, 1 ton; oats, 6 tons; buckwheat, 1 ton.

The amount of milk produced varies considerably with different sections of the country, although usually the suburbs of large cities are quite large producers of milk, on account of the city demand. I have some figures before me that show about 6500 gallons of milk per square mile per annum for such localities.

It is almost hopeless for electric railways to hope to handle coal, until steam railroads are willing to entrust their coal cars laden with coal to the electric roads for delivery. The best figures that I have been able to obtain show that there is consumed for household purposes about 2 tons of coal per capita per annum.

It is not the purpose of this article to deal with the question of freight rates, neither with the methods of billing the same and the books of account, but simply to discuss the freight business that can be secured under present conditions, and point out some methods, the adoption of which would probably lead to large increases in receipts from this source.

I have already stated that the freight business now done on electric railways is confined very largely to the freight produced and consumed along the line of each individual road. This, of course, includes a small percentage of freight originally shipped on the line of some steam road and consigned to some station on the line of an electric road, the freight being broken in bulk and taken by the electric road to its destination.

There seems to be a settled policy among steam railroads to decline to do business with electric roads under any form of traffic agreement. To illustrate this point, some time ago the Delaware & Hudson Railroad posted notices in all of their stations instructing agents not to receive freight consigned to any point on the Oneonta, Cooperstown & Richfield Springs Electric Railway. The Lehigh Valley Railroad recently positively refused to enter into any traffic agreement with a certain electric railroad to receive from or deliver to it any freight, even though by so doing they would have secured from the electric road a terminus in a city of over 100,000 population. They likewise declined to allow the electric railway to sell tickets from said city to any point on their road, or to sell tickets themselves from any of their own stations over the electric railway to the large city in question.

The Delaware, Lackawanna & Western Railroad has recently been fighting in the Courts to prevent an electric railway putting in a switch from the center of the highway that was intended to connect with their tracks to facilitate freight handling.

SOME STATISTICS ON POPULATION AS RELATED TO OPERATION OF INTERURBAN ROADS (JUNE 30, 1902)

Presented and Compiled by H. M. Beardsley, of Elmira

Name	Total Population	Miles of Road	Pop. per Mile	Bonds	Bonds per Mile	Rate	Stock	Dividend	Total Capitalization per Mile	Passengers Carried	Passengers per Mile	No. Times Pop.	Surplus over Interest and Op. Expenses	Income	Op. Exp.	Per Ct.
				$			$		$				$	$	$	
A	79,293	62.96	1,260	2,000,000	31,766	5	2,000,000	-	63,532	6,058, 66	96,224	76	61,165	381,511.28	220,346 38	57.7
B	61,941	30 50	2,039	1,037,000	35,640	4	600,00)	..	55,311	4,642,836	119 437	75	18,970	192,799.10	130,349.58	67.6
C	49,401	38.09	1,288	1,400,000	36,755	5	1,000,000	..	63,009	4,262,493	111,643	86	Def. 26,787	307,823.73	264,610.01	85.9
D	41,044	56.18	721	1,00 1,000	17,860	5	627,100	..	28.962	4,436,152	78,963	108	19,052	213,100 37	144,048 99	67.6
E	45.255	30.00	1,508	300,000	10,000	4 and 5	350,000	6	21.666	3,765,154	125,505	83	64,976	201.248.04	121,272.26	65.4
F	62,684	27.60	2,271	490,000	17,753	5	150,000	..	23,185	2,328,243	84,357	37	16,613	113,174.96	72,061,72	63.7
G	41,568	18.00	2,309	100,000	5,555	5	200,000	6	16,666	2,204,066	122 448	53	28,100	116,111.00	83,010.28	75
H	36,323	34.31	1,060	350,000	10,201	4 and 5	525,000	3	25,300	2,906,377	84,651	80	26,614	145,092.60	100,978.99	69.6
I	66,009	27.70	2,383	400,000	14,440	5	600,000	8	36,100	6,160.597	222,404	93	104,341	326,124.59	201,783.69	61.8
J	44,119	37.00	1,192	45,000	1,216	5	779,000	5	27,687	4,013,804	108 481	91	66,686	196,979.07	128,043.09	65
K	83,413	34 59	2,411	250,000	7,227	5	520,500	..	22,275	5,427,947	156,922	65	19,181	235,171.76	203,490.92	87
L	41,156	50.00	823	1,350,000	27,000	5	1,500,000	..	144,847	3,921,701	78,434	95	10,500	200,000.00	122,000.00	61
M	45,354	36.76	1,233	1,267.000	34,466	5 and 6	731,860	2	54,376	5,031,090	136,863	110	18,653	202,633 10	120,630.65	60
N	41,876	27.24	1,537	660,000	24,229	5	224,000	..	62,385	4,155,206	152,540	99	Def. 5,324	160,865.02	133,189 69	82
O	43,345	36.12	1,200	1,000.000	27,685	4½	600,000	..	45,681	4,536,949	125 600	105	21,879	202,128.57	225.249.11	77.1
P	86,646	76.20	1,137	2,150,000	28,215	4½ and 5	461,237	..	41,726	9,849,445	129,260	113	27,637	388,981.02	253.844.13	65.2
Q	74,244	42.25	1,757	920,000	21,775	5	920,000	..	43,550	3,337,148	78,985	44	102.660	334,932.89	186,372 69	55
R	57,992	34.53	1,680	1,887,500	54,662	4 and 5	4,000,000	..	170,504	5,515,401	159,727	95	8,803	344 227 40	241,049.97	72
S	30,985	30.60	1,000	750,000	24,509	5 and 6	1,250,000	..	63,359	3,657,750	119,534	118	9,714	169,459.91	119,745.20	70
T	39,231	19.71	2,000	.....	.....	.....	500,000	8	25,368	3,665,635	185,900	93	48,819	183,878.30	135,059.63	74
Totals and av.	1,071,879	750.34	1,428	17,406 500	.....	.....	17,738,697	..	46.839	89,876,260	119,780	84	.....	.....	.....	....

One might wonder why steam railroads should thus oppose connection with electric roads that would result in a profitable business to them. The answer is probably this. The majority of steam railroads are banded together through traffic associations to maintain freight rates and prevent traffic wars. These associations exist throughout different sections of the country and each association is made up of the traffic managers of steam railroads which belong to the association. It is possible that the proceedings of these associations are secret and that they are guided by unwritten laws. At any rate, at the present time, the associations are accomplishing good results in maintaining rates. There seems to be an understanding that the members of the associations will not invade new territory, other than that already occupied, and the probabilities are that any member of such an association entering into a traffic agreement with any electric railway to receive from them or to deliver to them freight in bulk, shipping the same through on one bill of lading from shipping point to destination, would subject itself to a freight war at some other more important point. This is doubtless the reason why the steam railroads do not dare to make any traffic agreement with electric railways that would result in a profitable and increased business to both.

I have recently received official figures regarding the freight business done on an electric railway 37 miles long which formerly was operated by steam and was a member of certain traffic associations, and thus received and delivered freight on one through bill of lading in the original cars. Since the equipment of this road and its operation by electricity, the management have been unable to make any arrangement to pro rate the freight charges, but have operated with the advantage of through shipments in their favor, each railroad charging its own rate. The business done this last year under these conditions was as follows:

Freight	$32,000
Express	5,500
Milk	3,000
Total	$40,500

or practically $1,100 gross per mile of track per annum, which is half as much again as most electric railways are able to earn operating without this advantage. The express receipts are large, owing to the fact that the arrangement is made with the American Express Company who do business on the electric road the same as on any steam road.

During the past few years, a number of steam railroads have purchased electric railroads paralleling their own tracks. It has generally been the impression that these purchases have been made so that the steam railroads might control important links that would prevent the formation of a large system of competing electric roads, but doubtless the steam railroad people, whose business consists largely in handling freight, have appreciated the possibility of a traffic organization being formed similar to their own among the electric railroads by which freight could be handled and distributed over a large section of country as a greater menace to their business than simply controlling some important link to prevent through passenger traffic. It is the writer's belief that this possibility has not before been brought home to the managers and owners of the electric properties that exist to-day. Suppose, for example, a traffic association was formed having as its members all of the electric railways that will shortly reach from Albany to Chicago, the object of this association being to ship freight over the electric road lines without breaking bulk to any points in the territory covered by them. Such an association, properly organized and fostered, would result in far more dangerous competition to steam railroads than any through passenger business that can ever be built up. And it seems possible that in the purchase of important electric links by steam railroad corporations they have had in mind the prevention of this development more than anything else.

From the investigations the writer has made regarding the amount of freight now handled by electric railways which has covered a number of individual cases, except in unusual cases, the amount of this business under present conditions will not exceed $750 gross per mile of track per annum, and it is the writer's belief that the time has now come to organize a freight traffic association among the electric railways now operated for the purpose of establishing interchange of freight and broader markets for the same, and that the establishment of such an association is necessary if the electric railways would hope to largely increase the freight business they are now doing.

An attempt was made to hold up a street car in Portland, Ore., Monday evening, Sept. 5, and a police officer was shot by the daring criminal in making the arrest. It is thought the bandit is the same person that held up a Portland Heights car a few weeks ago.

BLOCK SIGNALING OF ELECTRIC RAILWAYS WITH TRACK CIRCUIT CONTROL

BY J. B. STRUBLE
Of the Union Switch & Signal Company

The system of protecting railway traffic by means of signals automatically controlled by track circuits has been in operation on steam roads a number of years, but only recently has the demand been felt for a like means for protecting electric traffic.

As applied on steam roads, the track circuit consists in insulating the tracks so as to form sections or blocks. Across the rails at one end of the section are connected the terminals of a few cells of a gravity battery, and across the rails at the other end are connected the terminals of the relay.

A track circuit so equipped is not applicable to a road using direct-current electric propulsion, provided the rails serve as return conductors for the motor current, because of the influence which the return current would have upon the track relay, which in turn controls the circuit governing the position of the signal. To overcome this difficulty it is necessary to employ a current for the track circuit which has such characteristic difference from that of direct-current as will operate selectively upon the track relay. Alternating-current accomplishes this because of its ability to induce a current in another circuit brought within its magnetic field, a property not possessed by direct-current.

The track relay is, therefore, of the induction type and responds to alternating-current and not to direct-current. An excess of direct-current cannot cause a wrong operation of the signal other than to cause it to indicate danger, for if a fuse or other protective device fails to open the circuit, the relay coils would be destroyed, resulting in the signal indicating danger. With this relay there is no such thing as residual magnetism; in this respect differing from the direct-current relay.

Two main feed wires bearing alternating-current at, say 60 cycles and 2000 volts, extend the length of the system, and across these are connected the primaries of the track circuit transformers, the secondary leads of which are connected through low ohmic resistance, across the rails at the exit end of each track circuit. Across the rails at the entering end are connected the terminals of the induction relay. We now have a circuit consisting of the secondary of the transformer, the rails and the coils of the track relay. Through the track rails of this circuit passes simultaneously two kinds of current, alternating, induced by the primary of the transformer, and direct, the return from the car motors. Since direct-current tends to make ineffective the alternating-current, an impedance coil is connected across the relay terminals, or the track rails; this has low ohmic resistance, but high inductive resistance or impedance to the passage of alternating-current, and serves to shunt the direct-current from, while compelling the alternating-current to pass through the relay.

In one arrangement of the track circuit it is necessary to insert insulations in but one of the rails at the end of each section, the other rail remaining continuous and serving as a return conductor of the motor current.

Another arrangement is that of continuing the use of both rails in their original capacity, while at the same time serving the purpose of block rails for the operation of signals. This is done by applying insulations in one or both rails at the terminals of block sections and connecting around these insulations by inductive bonds. These bonds are simply impedance coils of very low ohmic resistance, permitting the return direct current to pass through them but impeding the passage of alternating-current.

The track circuit, whether operated by direct or alternating-current, and whether applied to steam or electric roads, has no relation to the type of signal which it governs. Signals are of many designs and are actuated manually or by power in a number of different forms, but the functional relation of the track circuit to all of them is the same, i. e., the signal is caused to indicate danger as long as the track section which it governs is occupied by a pair of wheels. There are, however, usually certain conditions associated with track circuits which make signals of a certain type preferable.

Thus the alternating-current track circuit, which applies almost exclusively to electric roads, is associated with electric power which is at all points available for the operation of purely electric signals. Such signals are of various types, but the simplest in form is that of the direct-acting solenoid. This preferably uses for its operation the direct-current of the propulsion system. Another form is that of the motor-geared, using storage batteries which are charged through resistance from the trolley or third rail.

Should trains other than electric traverse the system at times when the power is shut down, these batteries serve to keep the signals alive and operative. Then again a signal driven by induction

motor, drawing power from the alternating mains which supply the track circuits, has advantages, one of which is that of making the signal system self-contained and independent of other departments of the road.

The important matter of lighting the signals at night is a valuable incidental feature to the alternating-current track circuit system. For this purpose the track transformers are supplied with two secondary coils, thus securing any desired voltage for the lights.

Way stations may be lighted from the signal mains, thus securing the advantage of high voltage transmission. Usually the size of the mains need not be increased because of this additional duty, because at high voltage a wire of sufficient mechanical strength has a larger section than that required for supplying current to the signal system.

The first signal installation in service, using alternating-current, is that on the North Shore Railroad in California. This was installed by the Union Switch & Signal Company about one year ago, and has given the best of satisfaction. The same company is now installing a similar and very extensive system in the subway of the Interborough Rapid Transit Company in New York City.

In developing this system great care has been used to exclude any apparatus or feature of design, the failure of which might result in a clear signal indication. This is not a new principle in signaling apparatus, but it is of such vital importance, and is, moreover, so frequently lost sight of, that it will bear repetition. Any failure of the apparatus or of the active forces employed, must result, due to the force of gravity, in the display of a danger signal.

MAINTENANCE OF ELECTRIC CARS AND THEIR EQUIPMENT

BY H. A. BENEDICT
Electrical and Mechanical Engineer, United Traction Company, Albany

The street railway company of to-day, operating in each of our large cities, is formed in many cases by the combination of a number of railway companies each operating over individual lines with its special type of car. In the operation of such a combination a number of problems present themselves:

First—The adoption of standard types of car bodies.
Second—Standardization of trucks and electric equipment.
Third—Reconstruction of car houses and repair shops.
Fourth—Equipment of repair shops.
Fifth—Organization of maintenance department.

In the adoption of standard types of car bodies many local conditions are to be considered and only in a general way can certain characteristics be decided upon. If the car is for city service on short lines, requiring many stops with fast time, the 20-ft. box car mounted on single truck for winter service and the ten bench open car mounted on a single truck for summer service, have a number of points in their favor. If it is city service on lines of 10 miles or more, the light, double-truck box car of 28 ft. or 30 ft. long for winter service and the thirteen bench open car for summer service, present a number of points in favor of their adoption. For interurban service, the high speed, double-truck box car is the only type that may well be considered, although there is a tendency at the present time to enlarge upon this type of car and copy steam railways as to size, weight and general outline of car, giving the interurban car the appearance of the steam "Pullman" coach. If this type of car is to be adopted for use upon private right of way, and does not have to be operated through city streets, it then becomes practically steam railroad operating conditions, and the experience of steam roads, in the development of their type of car, should be given consideration.

If, however, the interurban car is to be operated not only upon private right of way from one city to another, but is obliged to run through city streets on tracks laid under franchises granted for the operation of street surface cars propelled by horses, it then becomes a very important question, should the interurban car resemble the steam coach? The public have rights which must be considered, and it is the writer's opinion that the interurban car which operates through city streets should not exceed 50 ft. in length and should in appearance resemble the city service car.

The standardization of trucks and electrical equipment is determined largely by local conditions and the type of car body. If for city service under a 20-ft. body the single-truck with 7 ft. 6 in., or 8 in. wheel base, with two 40-hp motors, should give good service. If for city service on long lines, under 28 ft. or 30 ft. car bodies, the double-truck, with 4 ft. 6 in. wheel base and four motor equipment will give satisfactory service. The trucks for interurban cars have been developed upon steam railroad principles, and the standard adopted should follow closely those trucks developed by many years of experience upon high speed steam roads, such changes being made as is required for the adoption of the electric equipment which for high speed necessarily means four motors of from 50 hp to 125 hp each, as speed and local conditions may require.

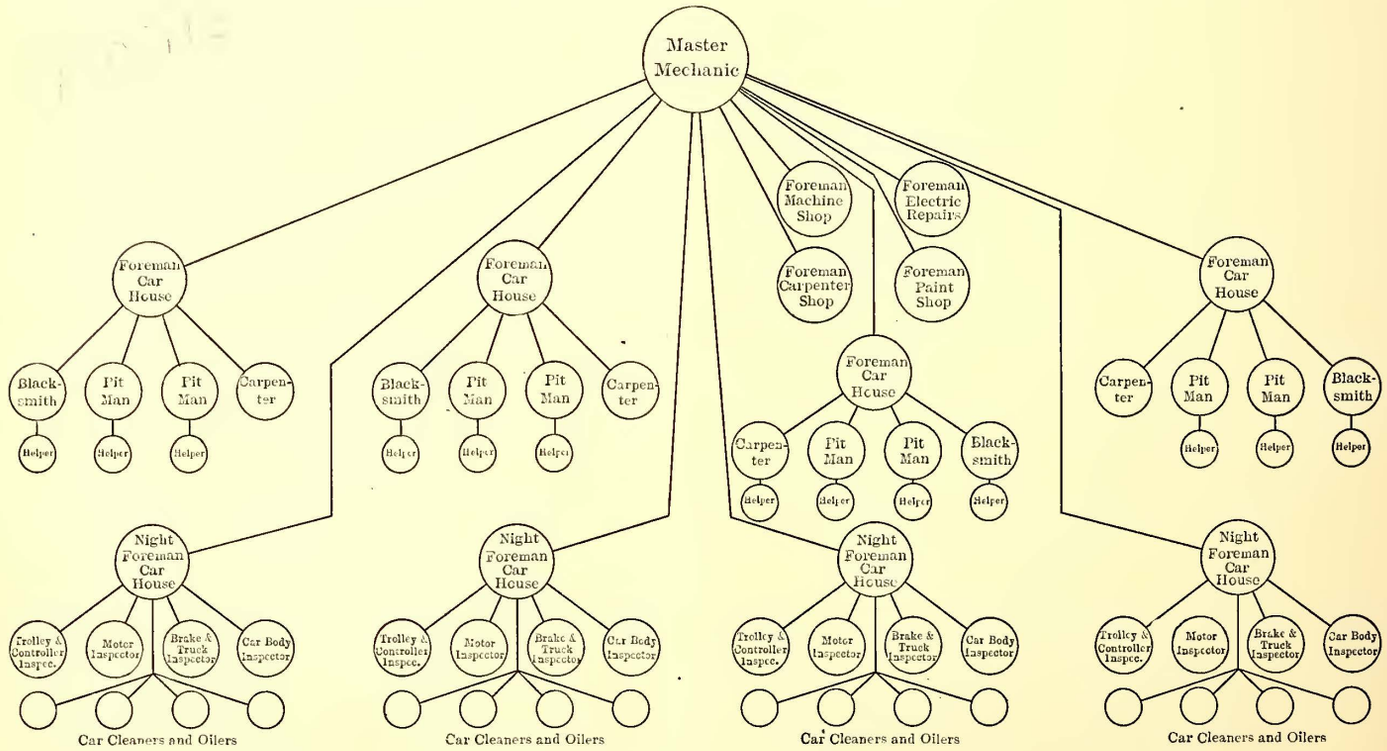


DIAGRAM SHOWING ORGANIZATION OF MECHANICAL DEPARTMENT OF UNITED TRACTION COMPANY

Upon the adoption of a standard type of car and the rearrangement of the various lines to meet the conditions caused by consolidation and the demands of the public for increased facilities for transportation, it becomes necessary to rearrange buildings for the storage of such cars and arrange the proper facilities for inspection and repairs. The remodeled horse car house which has answered the purpose of storing cars since the introduction of electricity is no longer satisfactory. In some cases the local conditions may have so changed that it becomes necessary to change the site of the car house, in which case the problem is somewhat simpler than adopt-

ing and remodeling the horse car house for the storage and inspection of the standard types of electric cars.

In the erection of a car house the following general points are considered:

First—The fire risk.

Second—Facilities for inspection, cleaning and making light repairs.

Third—Heating and lighting of the car house.

The insurance companies have given the subject of fire risks on electric cars and car houses considerable study, and the Board of Underwriters have adopted standard rules for their protection in the construction of car houses. The writer is of the opinion that improvements can be made in the construction of fireproof car houses. It is necessary for economical operation in the large cities to have 100 or more cars operated from a given point. The problem presented is, how to reduce fire risk on the car house which at times will contain half a million dollars worth of rolling stock. It has been found that concrete is one of the best fire proof materials, and also a poor conductor of heat; it therefore becomes one of the best materials for the construction of car houses. By the use of concrete, reinforced with steel bars for the roof and wall construction, and introducing a 4-inch partition wall between each track, one practically has as many fireproof car houses all contained in one building, as there are tracks. In a car house constructed on these lines the fire risk is reduced to a minimum.

For inspection, each track should have a pit between the rails, 4 ft. deep, extending from rail to rail. Upon the walls of these pits should be installed steam pipes for heating that compartment of the car house and also for the purpose of drying out the electric equipment. A narrow skylight constructed of wire glass inserted in two rows over the side aisles of each compartment will furnish satisfactory light.

REPAIR SHOP

The general repair shop should be centrally located with reference to car houses, where all general repairs can be done economically and quickly. The general repair shop of an electric road for both city and interurban service should consist of a paint shop, carpenter shop, machine shop, electric repair shop, blacksmith shop and truck shop.

Floor space, light and heat are the most important factors in the paint shop. The tracks should be so arranged as to give ready access to cars so that any car can be removed without the necessity of moving but one or two other cars. Light obtained by skylights in the roof gives satisfactory distribution of light. Steam is the most economical and satisfactory form of heat for the paint shop. The carpenter shop, under the same roof as the paint shop, with the same general design as to trackage, light and heat, has proven very satisfactory. The machine shop, electric repair shop, blacksmith shop and truck shop can be under the same roof and arranged to meet the local conditions. They should all be upon one floor and lighted by means of skylights as well as side windows.

STOREHOUSE

All supplies required in the operation of the railway system should be stored in a building located conveniently to the repair shop and should be a building devoted entirely to the storage of supplies and separate from the other buildings.

The equipment of repair shops depends largely upon local conditions. The truck shop in general should be equipped with overhead traveling cranes which span at least two tracks. The floor level between the tracks should be depressed 12 ins., and the floor between the rails of each track should be 4 ft. 6 ins. lower than the tread of the rail, with a light narrow gage track in the bottom of the pit, so formed for the use of a hydraulic jack. In making repairs to motors the hydraulic jack is found to be very useful with those types of motors which allow the removal of the bottom half of the motor, thus permitting the removal of the fields and armature without removing truck from underneath the car body.

The electric repair shop should be equipped with forms for making armature and field coils, and arrangements made for their proper insulation; also armature banding machine with other labor saving devices depending upon the type of electric equipment to be maintained.

The machine shop should be equipped with lathes, drill presses, a milling machine, a 36-in. boring machine, hydraulic wheel press, emery wheel and grind stone and such other special devices as the local conditions may demand.

In the organization of a department of maintenance, the personality of the organization should be of a high order. In order to obtain the best results the men should not only be thorough mechanics in their respective lines, but should be conscientious, industrious and faithful. The following organization has proven satisfactory:

Particular attention should be given to the inspection of cars. As much depends upon, not only the system of inspection, but the care with which cars are inspected. All cars should be thoroughly inspected at least once every twenty-four hours, and records should be kept of such inspection, not only for the benefit of the master mechanic and foreman, but these records will be found valuable in damage suits, in refreshing the memory of the inspector as to the condition of the particular part of the car in question at the given time immediately preceding the accident. The greater part of the inspection of cars must necessarily be done at night, but repair work at night should be avoided as much as possible. Night work is generally found to be expensive and unsatisfactory. When a car is reported by the night inspector showing certain defects, at the time the repairs are made the following day, the work of the night inspector should be checked by the repair crew and the car tested in all details before the car is again placed in service, and the record of all repairs made should be turned in at the office of the master mechanic. With the individual mileage of the cars the master mechanic is then in a position to know the wearing qualities of all the materials going into the maintenance of the cars.

Well designed electrical equipment having been installed to meet the local conditions, the wearing parts of such an equipment which need the most attention are the motor armature bearings, which, being babbit-lined, lubricated by either oil or grease (preferably oil), need close attention from the motor inspector. The quality of babbitt required depends largely upon the conditions of operation. A tin base metal consisting of about 80 per cent tin, 10 per cent antimony and 10 per cent copper will give satisfactory service on interurban motors and city service requiring high speed. A lead base metal will be found permissible under some conditions for lining axle bearings, but will not be found satisfactory for armature bearings where high speed and heavy pressure are required.

FREIGHT AND EXPRESS BUSINESS ON STREET RAILWAYS

BY C. R. VAN ETTEN

General Freight Agent, Brooklyn Rapid Transit Company.

The progress made in handling property on the street railway lines is of benefit to the public and railroads alike, the public by finding a cheaper and more satisfactory method of transportation, the railroad a new source of profit. A study of local conditions will determine whether a street railway can profitably engage in the transportation of freight. The volume, class of traffic, length of haul, existing rates, and, if in competition with another carrier, the accessibility of competing terminals and probable result of competition must be considered.

TERMINALS

Well located terminals for the receipt and delivery of traffic are of first importance. The best are private sidings located on the property of carload shippers. The cost and maintenance of these sidings are generally paid by the shipper, and once installed, a steady business is assured. Public team tracks and warehouses, located in the business centers are also necessary, and, since accessibility of terminals influence the amount of traffic handled, the expenditure for property located in the heart of the business district will be justified by the increased tonnage a good location commands.

EQUIPMENT

Where tonnage is heavy, the employment of an electric locomotive handling cars in trains will effect economy in the expense of operation. The first cost of the locomotive will be offset by saving the expense of electrical equipment on cars. It is seldom, however, that this class of operation would be permitted on railroads that do not own private right of way.

Cars should be of as great capacity as structures, track, and clearance permit. The difference in cost of handling cars containing fifteen or twenty-five tons is small and the revenue is increased proportionately to the tonnage carried. Steel under-framing, direct air brakes, and, on cars with independent power, four motors are recommended.

A desirable type of car has drop sides 18 ins. to 2 ft. high, hinged to the side sills. It can be converted by the crew from a flat to a gondola car in a minute's time, and is available for any class of traffic that does not require protection from the weather.

Hopper or peaked bottom cars are not desirable, except where there is sufficient traffic adapted to such special construction to keep them employed. Derrick cars are convenient for handling heavy machinery, building stone, and structural steel. The derrick with its motor is located at one end of the car and carries the trolley stand. It does not greatly decrease the load space and saves considerable time and labor. Box cars with a double floor handle ice in carloads without damage to electrical equipment, and,

by sealing the inside with ordinary flooring, the shrinkage is minimized. Where box cars effect delivery on main line or carry small lots of freight from station to station, two doors on each side of the car facilitates the loading and unloading.

RATES

Rates should be arranged with a view to securing all that the traffic will fairly stand. The cost by other methods of transportation should be considered. In competitive territory, there is too much profit sacrificed by the manipulation of rates, and a skillful traffic manager will come to an early understanding with his competitor.

The detention of cars, loading and unloading, must be watched While steam railroads allow forty-eight hours and charge $1 day thereafter, a like practice should not be followed by street railways, and particularly with cars electrically equipped. Forty-eight hours is unreasonable where the haul is short and practice shows it is unnecessary. On cars of 20-ton capacity, electrically equipped, it has been found practicable to limit time for loading and unloading to two hours, and collect $1 per car-hour for detention thereafter.

In handling traffic under commodity rates where time consumed in loading and unloading effected the rate basis, some interesting records have been made. Cars of paving block being loaded in thirty minutes, broken stone and brick in thirty-five minutes and lumber in one hour, each with approximately twenty tons. The paving block was unloaded in six minutes, brick and broken stone in twenty minutes and lumber in forty-five minutes.

ACCOUNTING

The method of way-billing and accounting used by steam railroads is generally followed, but, as there is no check on traffic from time receipt is given until way-bill is issued, the suppression of duplicate receipts may cover thefts for a considerable time. There is also opportunity for the forwarding agent to accept "prepayment" and bill charges "collect," and, by selecting the shipments, this may be worked for a long time before it is known at the general office. On local business the forwarding and receiving agents may act in collusion and suppress way-bills.

A system, that has been suggested to do away with these abuses, consists of duplicate receipts with stub, all bound in book form and consecutively numbered, so that each one must be accounted for. The stub showing consignee, weight and charges goes to the auditor when original receipt is issued to the shipper. The duplicate shows all charges and goes with the shipment in place of a way-bill. The consignee receipts for the goods on the same blank, which is then forwarded to the auditor, giving him original entries for the entire transaction.

Street railways sometimes fail to take into account items that are common to the general operation and maintenance of the road, charging only such direct expenses as cannot well go elsewhere. There should be charged against the expense of handling freight a proper amount for maintenance of way, structures, equipment and power, comprehensive of the difference in weight of cars and miles traveled.

EXPRESS

When shipments are handled under a rate that provides special privileges of transportation, with store door collection and delivery, they may properly be classed as express.

Steam railroads have demonstrated that it is more profitable to let the express companies operate on their lines than to run an express department, the few exceptions being railroads now handling their own express profitably, who have extensive mileage through territory where there is little competition.

Street railway companies are seldom justified in going into the express business, particularly if it is possible to make a satisfactory contract with one of the express companies. The outlay for horses and wagons, and expense of their maintenance and operation is so great that short haul traffic cannot stand rates high enough to support it. The large express companies make their profit on long haul business, and 35 per cent of their total receipts is paid out for expenses at terminals. Since the terminal cost is no greater on a package from New York to Chicago, with rate of $2.25 per hundred pounds, than on a short haul shipment handled for 25 cents, it follows that a short haul business, if taken by itself, would be handled at a loss.

Thousands of dollars have already been lost in trying to build up a profitable short haul business. One company thus engaged on a street railway for several years, after trying every expedient and losing a large sum of money, recently sold out to one of the large express companies.

When satisfactory arrangements cannot be made with a regular express company and there is sufficient traffic requiring terminal collection and delivery that cannot be secured on a freight basis, it is preferable, until the business is established, to engage a resident drayman in each locality to perform the terminal collection and delivery, for a fixed sum per hundred pounds or of a percentage of the through rate. If the traffic will not move at such rates as can then be quoted, it will not justify the purchase and maintenance of horses and wagons.

AUTOMOBILES

The progress that has been made with motor-driven wagons for handling property must not be overlooked. Within a few years they will become an important factor in handling short haul traffic, since they can effect store door collection and delivery without breaking bulk.

PUBLIC BENEFITS

The transportation of property by street railways is an advantage to the community at large. It reduces the delivered cost of goods to the consumer, diverts the wear and tear of heavy trucking from streets, maintained at public cost, to tracks maintained by the railway, and is a factor in relieving street congestion. A freight car 40 ft. long will carry 20 tons of freight 10 miles an hour. It will take ten teams occupying five times the street space, three times as long to do the same work.

A sanitary and economic result is accomplished through the disposition of city waste by street railways. A description of the method employed was given in April 23 issue of the Street Railway Journal.

Steam railways and steamship lines are beginning to apply the same rates to stations located on a street railway as obtain at their own terminals, and the charges of the street railways are paid by the railway or steamship line that secures the long haul. Factories thus save the expense of cartage and secure all the advantages they would have if located on the tracks of a steam railway. This tends to encourage the location of new industries at points where property is cheap, and the employees can live convenient to their work with greater comfort and less expense than when crowded into the older sections of the city.

Recently there have been radical changes in the position of steam railroads toward street railways. A steam railroad that three years ago threatened to cancel all traffic arrangements with a smaller line, which proposed to change to electrical operation, is to-day considering the purchase of electric roads as feeders for freight as well as passenger traffic. The steam railroad traffic managers are alive to the possibilities of the street railway as a carrier of freight, and, they realize, that unless encouraged as feeders, the street railways will act in combination as competitors.

NEW FREIGHT STATION AT CINCINNATI

The Interurban Railway & Terminal Company has opened its new freight and express station on Sycamore Street. The building, which is of brick and steel, has a frontage of 50 ft. on Sycamore Street and extends back 240 ft. The station adjoins the handsome passenger station and general office building of the company, which was described and illustrated in the Street Railway Journal of Nov. 28, 1903. Heretofore the company used a portion of the passenger station for its freight business, but it proved wholly inadequate for the large amount of business that had been worked up, and an exclusive freight station was found necessary. In addition to being used by the three lines of the Interurban Railway & Terminal Company, the station will be utilized by the Cincinnati, Dayton & Toledo Traction Company, which heretofore has brought express only as far as the outskirts of Cincinnati owing to the difference in gage between the tracks of the interurban company and those of the city company. The company has built two special broad gage express cars which will operate between the station and the old station at Cumminsville, where the packages will be transferred to cars on the main line.

THE ST. LOUIS & SPRINGFIELD ELECTRIC RAILWAY

Active work on the electric railway which is to connect St. Louis with Springfield has been started in Edwardsville, Ill. The interurban system known as the McKinley syndicate, and incorporated under the titles of the St. Louis & Springfield Electric Railway Company and the Illinois Central Traction Company, connect Springfield, Champaign, Urbana, Decatur, Bloomington and Carlinville, and are now reaching out for St. Louis. Beyousset & Laing, of Dallas, Tex., have been awarded the contract for the first work on the new line from Staunton to Edwardsville, a distance of 19 miles. Tracks in Edwardsville are now being laid along Second and Purcell Streets and Hillsboro Avenue. The decision of the company to run from Edwardsville via Staunton instead of Bunker Hill, marked the conclusion of a pretty fight between those towns for the line. The route is now being surveyed from Edwardsville south to Granite City.

FINANCIAL INTELLIGENCE

WALL STREET, Sept. 21, 1904.

The Money Market

Business grew decidedly more active in the money market during the week. Rates at the same time reflected the heavy cash losses of the local banks, hardening appreciably for both call and time loans. At the outset of the week demand money was supplied abundantly at 1 per cent, but toward the close the quotation advanced to 2 per cent, and that is the ruling figure at this writing. Time money was considerably more active, owing to the heavy trading in the securities' market, and rates for all periods were put up ¼ to ½ per cent above those of a week ago. Sixty-day money, which was obtainable until recently at 2½ per cent, has been marked up to 3 per cent, while ninety-day loans now command 3½ per cent. Over-the-year funds are quoted at 4 per cent. The bulk of the week's business consisted of ninety-day maturities at 3½ per cent, the money being supplied very largely by foreign houses against exchange transaction. The commercial paper market has not perceptibly changed. A limited supply of high-grade paper is reported, the minimum rate being 4 per cent. Demand for these accommodations continues good, and all offerings are readily absorbed. According to the statement issued by the Clearing-House Association last Saturday the banks now hold a surplus reserve of $29,000,000 against $38,000,000 the previous week, and $13,000,000 a year ago. Although this item is still well above what it has been for corresponding periods in recent years, it is also true that the withdrawals of cash for crop-moving purposes are exceptionally heavy. The unusually high level at which all agricultural commodities are selling is the chief reason why larger sums are needed in the interior this autumn than usual. It is a question now whether, with these withdrawals in prospect for another two months, and with the low Treasury reserve to prevent any relief measures from that quarter, the money market will get through the autumn without something of a strain. At all events a further rise in money rates is fairly certain.

The Stock Market

Indications of a decisive check to the upward movement have appeared very plainly during the week on the Stock Exchange. Some further advances have occurred in individual stocks, notably the Steel issues and Pennsylvania Railroad. But as a rule, it has been the minor specialties that have gained, while the greater part of the list have been slowly but surely receding. The Western railroad shares have been sold on estimates of heavy damage from recent cold weather in the corn belt. It is the accepted belief, however, that predictions of low corn yields put out by so-called "experts," are very much exaggerated to suit speculative interests. The much more solid reason behind the decline in the Western security group, is that these shares were rather freely distributed on the recent rise, and that the motive for influential support has, therefore, been withdrawn. Along with this comes the question whether the advance in the market has not gone as far as it ought to for the time being, in the line of discounting outside business recovery. While reports agree that some improvement has occurred in general trade, as compared with several months ago, the outlook for another forward movement is still quite uncertain. The high agricultural prices will offset to a large extent deficient crop yields, so far as the profits of the farm communities are concerned. But the loss in railway grain freight will be none the less heavy. The prospect for railway earnings must be set down as less promising than it was a short while ago. Taking these matters into account along with the rapidly dwindling bank reserve, and remembering that at the top of this summer's advance prices of stocks had covered half the ground lost during the great decline of 1903, it is not surprising that a sentiment of caution and hesitation should have now gained the upper hand on the Stock Exchange.

The traction issues have shared in the reaction in the general market, with some special weakness in Metropolitan Securities and rather noticeable heaviness in Brooklyn Rapid Transit. The announcement of another lot of the Brooklyn bonds for sale caused some weakness in the market for those securities, and probably had more than anything else to do with the backwardness of the stock. Liquidation in Metropolitan Securities followed Mr. Ryan's declaration that no deal had been arranged for the transfer of the property. It is believed, however, that negotiations are well under way, and that some definite announcement may be expected before long. The Metropolitan Street Railway shares have been exceedingly firm in the week's dealings.

Philadelphia

Traction shares in Philadelphia are generally lower on the week. After 350 shares had changed hands at 48½, American Railways dropped to 48 on the sale of 80 shares. Several hundred Consolidated Traction of New Jersey were dealt in at 72. Philadelphia Electric went to 7 3-16, receded to 7, and rallied to 7⅛. Philadelphia Company common was decidedly heavy, declining from 42⅜ to 41½ on rather large transactions. The preferred was firm, however, rising nearly a point to 45½. Realizing sales were also in evidence both in Philadelphia Rapid Transit and in Union Traction. The former lost a half point from 16½ to 16. Union declined from 56¼ to 55½, and recovered to 56. Philadelphia Traction sold several times at 97¾.

Chicago

Very little of an interesting nature has transpired in Chicago street railway circles during the past week. There have been some minor preliminaries on the part of the city officials and the Union Traction interests concerning the franchise matter, but so far negotiations have not yet reached even a tentative stage since the summer vacations terminated. It is expected that Judge Grosscup will inspect the Union Traction system early during the coming week to satisfy himself concerning the nature of the improved service wrought by the expenditures of something like $500,000 some months ago. It is believed, however, that the interested parties will soon get together and hurry a franchise settlement. Trading has been fairly active in the various street railway issues during the week. City Railway, on the purchase of 150 shares, rose from 185 to 190. Fifty shares sold later at 185, then 50 were taken at 189¾. A speculative movement in Union Traction common carried the common stock up from 7 to 8. Three hundred North Chicago sold at 87, but West Chicago, after selling at 56½, dropped to 55 on one transaction of 10 shares. Chicago & Oak Park common sold at 6⅜ and 6¼. One hundred Metropolitan Elevated common went at 21⅛, and odd lots of the preferred at 59½ and 58½. Northwestern common, on sales of 550 shares, declined from 21⅛ to 20½. Fifty shares of South Side Elevated sold at 92.

Other Traction Securities

The liquidation which has been in progress for sometime past in the Massachusetts Electrics continued during the early part of the week, the common getting down to 12¼ and the preferred to 58. Subsequently, prices rallied to 13 and 60 respectively. Boston Elevated sold down to 153 and back again to 154. West End common went as high as 92¼, while the preferred changed hands at 110. Six hundred United Railways of Baltimore were dealt in at an advance from 7⅛ to 7½. The incomes were steady between 44¾ and 45, but the general 4s were rather heavy, declining from 90½ to 90. Other Baltimore transactions included City & Suburban of Baltimore 5s at 114, City & Suburban of Washington 5s at 101½, North Baltimore 5s at 119½, Augusta Railway & Electric 5s at 101½, Norfolk Railway & Lighting 5s at 85⅞, and Citizens' Railway and Lighting of Newport News 5s at 80. On the New York curb, Interborough Rapid Transit reacted last week from 150 to 145, and rallied to 147¼, 7000 shares changing hands. On Monday 200 shares sold at 147. New Orleans common rose from 10½ to 12 on sales of 275 shares, and 200 of the preferred sold between 29½ and 30. Washington Electric preferred (500 shares) was dealt in between 70 and 72. The bonds were active, selling freely at 83½ and later at 83.

Tractions in Cincinnati last week were marked by an almost entire absence in the sale of bonds, which has been heavy during the past few weeks, but the sale of several leading issues of stocks was remarkably heavy, this being particularly true of Cincinnati, Newport & Covington. About 5300 shares of the common sold at a range of 32 to 33¼, the opening and the closing being both at the former figure. About 1700 shares of the preferred changed hands with a range of from 93½ to 94⅝, the former the close. Cincinnati Street Railway continued active, about 4200 shares selling at 145 to 146, the former the close. Toledo Railways &

Light sold at 20½ on several small lots, and Detroit United at 66¾ and 67. Several small lots of Miami & Erie Canal sold at 1½, an advance of ½ from former sales.

Tractions were inactive in Cleveland. Cleveland Electric was in stronger demand and 267 shares sold with a range of from 73 to 74½. Northern Texas Traction sold at 40 and 40½ on sales aggregating 270 shares. A small lot of Northern Ohio Traction & Light sold at 13½. Northern Texas 5s sold at 84½ for $7,000 worth and Aurora, Elgin & Chicago 5s receipts at 77 for $5,000 worth. The deal for the sale of large blocks of Northern Ohio Traction & Light 4s to W. E. Hutton & Company, Cincinnati, is still hanging fire, and as time passes there is less inclination on the part of the Cleveland holders to accept the proposition. The earnings of the property are showing satisfactory gains, and they would have to decline 33 1-3 per cent before the fixed charges would be in danger of default. At present figures these bonds yield about 7½ per cent.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid	
	Sept. 14	Sept. 20
American Railways	48½	47½
Aurora, Elgin & Chicago	a15	a13
Boston Elevated	153	153
Brooklyn Rapid Transit	55⅞	54⅞
Chicago City	180	185
Chicago Union Traction (common)	7	7½
Chicago Union Traction (preferred)	31	36½
Cleveland Electric	72¾	72¾
Consolidated Traction of New Jersey	72½	71½
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	67	66⅛
Interborough Rapid Transit	148¾	*145
Lake Shore Electric (prefered)	—	a16
Lake Street Elevated	3½	3½
Manhattan Railway	157..	*152½
Masachusetts Electric Cos. (common)	12¼	13
Massachusetts Electric Cos. (preferred)	59	60
Metropolitan Elevated, Chicago (common)	—	20½
Metropolitan Elevated, Chicago (preferred)	—	57
Metropolitan Street	122	121⅝
Metropolitan Securities	817⅛	80
New Orleans Railways (common)	—	10¾
New Orleans Railways (preferred)	—	30
New Orleans Railways, 4½s	—	74½
North American	—	91
Northern Ohio Traction & Light	14	a14
Philadelphia Company (common)	44¾	41
Philadelphia Rapid Transit	16¼	15½
Philadelpria Traction	99¼	*97¾
St. Louis (common)	—	11
South Side Elevated (Chicago)	—	*89½
Third Avenue	122	125
Twin City, Minneapolis (common)	98½	96¾
Union Traction (Philadelphia)	56	56
United Railways, St. Louis (preferred)	—	55
West End (common)	92¼	92
West End (preferred)	111½	110

a Asked.

Iron and Steel

Uncertainty is still the keynote of the steel trade. Leading authorities report that the Steel Corporation is keeping over three-fourths of its pig iron capacity working, and that independent producers are making their purchases of raw material freely. These are signs that the current output of finished products is keeping up well. But there has yet been no hearty response of new business to the recent price reductions, and it is still as great a question as ever whether the concessions have gone far enough to give the needed stimulus to new orders. Quotations are as follows: Bessemer pig iron $12.75, Bessemer steel $19 to $20, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 12½ to 12⅝ cents, tin 28 cents, lead 4⅛ cents, and spelter 5⅛ cents.

The Indianapolis & Northwestern Traction Company has found that cheap excursions on Sundays in connection with the steam roads pay well. No steam road excursions are run from Indianapolis to Chicago, but specials are run from Frankfort and Lafayette. The Traction line supplies the link between Frankfort and Indianapolis and does a large business.

A DENIAL FROM MR. RYAN ABOUT NEW YORK CONSOLIDATION

Because of the many reports which have been afloat in financial circles regarding a Metropolitan Securities-Interborough transaction, Thomas F. Ryan has issued a statement denying that control of the company or an option on its stock has been given to any one. He has not, however, explained in any way his circular to the syndicate, which gave rise to all the rumors. Mr. Ryan said:

"I have refrained from denying the many false rumors regarding Metropolitan Securities which have been circulated during the last few months, except in the case of inquiries by bona fide stockholders, to whom I have always made prompt replies. But the papers have been imposed upon in such a glaring manner, evidently by persons knowing their statements to be false, that I feel it my duty to the stockholders of the Metropolitan Securities Company to say that neither I nor any one representing the management of the company has given an option to any one on a majority or any other amount of its stock, or knows of any such project, and that no one with the authority of the management has entertained or will entertain in the future, with my consent, any proposition for the control of the company which does not give to every stockholder an equal opportunity of participation."

COLORADO & SOUTHERN TO ELECTRIFY LINES

The important announcement is made by the Denver & Southern Railroad Company that plans have been made for electrifying part of its system extending from Denver. The question of substituting electricity for steam on the lines that will be converted has been under consideration for nearly three years, and the announcement of the changes to be made comes only after the most careful study of the problem both in the East and the West, and more particularly on the lines of the New York, New Haven & Hartford Railroad.

The change of power will be made by the Denver & Interurban Railway Company, whose stock of $3,000,000 is owned by the Denver & Southern Company. The directors will be the following officials of the Colorado & Southern: Frank Trumbull, president; J. M. Herbert, vice-president and general manager; E. E. Whitted, general counsel; T. S. McMurray, special counsel; A. D. Parker, general auditor, all of Denver, and Granville M. Dodge, Edwin Hawley and Harry Bronner, of New York.

The first line of the Colorado & Southern to be equipped with electricity will be that between Denver and Boulder, to be followed with the Louisville-Lafayette line and the Denver, Golden & Idaho Springs line. The incorporation papers will cover the right to secure a franchise for terminals in Denver and to operate on Denver streets. This latter plan, however, is not contemplated in the immediate future. The question of the use of the trolley or the third-rail system has not yet been decided.

MIAMI & ERIE INVESTIGATION CONTINUED

The efforts of the Cleveland committee to settle the affairs of the Miami & Erie Canal Transportation Company out of court by buying up the claims embracing the floating debt, which amounts to about $100,000, have failed owing to the refusal of some of the creditors to settle on the basis proposed, and as a result the investigation into the affairs of the company before Referee Fuller will be continued. The claims of the Cleveland Construction Company, the original plaintiff, have been bought out by Will Christy and Ralph A. Harmon, and the suit will be continued in their name. Several hundred prominent men, among them Governor Myron T. Herrick, will be brought into court to detail their connection with the company and tell from whom they bought their stock and what they paid for it. All the stock brokers in Cleveland have been subpœnaed to appear in court with their books to show their transactions in Miami & Erie Canal stock, the idea being to obtain the names of the present stockholders in order that they may be assessed for stockholder's liability.

The leading promotors of the electric mule scheme are now working on a plan to induce the State to sell them that part of the canal between Cincinnati and Dayton. Admitting that the electric mule scheme is a failure, the promotors plan to convert the canal, if sold to them, into a railroad.

THE CONSOLIDATION AT ALTON

Final consolidation of the Alton Light & Traction Company with the St. Louis & Granite City Railway was arranged in Alton last week, and within a short time the Alton, Granite City & St. Louis Traction Company will own the interurban line in course of construction between Alton and St. Louis, and the Alton Gas & Electric Company will own the electric lighting, gas and hot-water heating franchises and systems in Alton. E. W. Clarke & Company, of Philadelphia, have formally entered into business relations with the Allen-Francis syndicate of St. Louis and the owners of the Alton street railway system, the latter owning a controlling interest in the new company.

The Alton & Southern Railway Company was organized last week, with headquarters in Alton, as an intermediate company in the formal transfer. The officers of this company are: J. F. Porter, president; F. A. Allen, vice-president; H. E. Weeks, secretary; J. F. Porter, treasurer. J. S. Clarke, a representative of E. W. Clarke & Company, was in Alton to assist in making the transfer. The capital stock of the Alton & Southern is nominally $100,000. The new Alton Gas & Electric Company was organized with the following officers: F. E. Allen, president; J. F. Porter, vice-president; Geo. G. Kuhn, secretary; O. S. Stowell, treasurer. This company, with a capital stock of $500,000, will take over the gas and electric plants and the hot-water heating system of the old company, leaving the street railway system a part of the interurban line.

The only surviving companies of all the corporations organized within the last few years to build the interurban line to St. Louis will be the Alton, Granite City & St. Louis Company, with a capital of $3,000,000, and the Alton Gas & Electric Company, with $500,000 capital, the latter being owned by the former. It is said that the electric railway to St. Louis will not be ready for business until early next year.

SPECIAL TRAIN TO ST. LOUIS CONVENTION

The transportation committee of the American Street Railway Association, consisting of James H. McGraw, H. H. Vreeland and Albert H. Stanley, has arranged for a special train to St. Louis, via the Pennsylvania Railroad, leaving New York at 10 a. m. Saturday, Oct. 8, and arriving at St. Louis the following day at 1 o'clock.

The train will consist of Pullman buffet, smoking and drawing room sleeping cars, and will stop at Trenton, Philadelphia, Harrisburg, Pittsburg, etc. The fare will be the regular St. Louis Exposition rates: For round trip from New York, 15-day limit, $26.25; for round trip from New York, 60-day limit, $32.35. There will, of course, be a proportionate reduction in this rate from places south and west of New York. Reservations may be made of Mr. Colin Studds, General Eastern Passenger Agent, Pennsylvania Railroad, 263 Fifth Avenue, New York.

MORE TURBINES FOR BOSTON & NORTHERN STREET RAILWAY

The Boston & Northern Street Railway Company has placed an order with the General Electric Company for five 500-kw turbo-generators. The Massachusetts Electric Companies, which controls the Boston & Northern, was one of the first street railway companies to make a test of the turbine in actual service.

PROVISIONS OF THE LABOR SETTLEMENT IN NEW YORK

The agreement of the Interborough Rapid Transit Company, of New York, with its employers concerning the terms of service of the men has been signed on behalf of the men. As previously stated in the STREET RAILWAY JOURNAL, the bitterly contested questions were the right of priority of men working on the elevated lines to positions in the subway, and the question of wages of the motormen of subway trains. Failure to reach a basis of settlement for these questions threatened a strike at one time, but concessions made Tuesday, Sept. 6, removed these fears. It was on Friday, Sept. 10, that the peace compact was finally signed.

Under the terms of the agreement motormen of the first class are to be paid $3.50 a day for ten hours or less. Men promoted to be motormen are to receive $3 a day for the first six months, $3.25 for the second six months, and $3.50 after one year. No motormen are to be discharged for serving on committees to present grievances or for other purposes. They are not to be discharged without a full hearing. If a man is exonerated, he is to be reinstated and paid full wages for any term of his suspension he may have undergone.

The conductors are to receive $2.10 a day for ten hours for the first year, $2.25 for the second and $2.50 after the second year. Guards employed until Jan. 1, 1905, are to receive $1.70 a day. Guards employed after Jan. 1, 1905, will be paid $1.55 the first year, $1.70 the second year, $1.80 after the second year, and $1.95 after the third year. Hand switchmen will receive $2 per day for the first year, and $2.35 after the first year. Tower men will receive $2.40 per day of eight to ten hours for the first year, and $2.50 afterward.

Agents will receive $1.75 for twelve hours for the first year, and $2 after the first year. Platform men will receive $1.75 for a day of twelve hours. Gatemen will receive $1.40 for a day of twelve hours for the first year, and $1.55 after the first year.

Engineers from other roads who are employed as motormen will receive $3.25 a day for the first year and $3.50 afterward. Fifty per cent of the situations in the subway are to be open to the motormen, guards and switchmen on the elevated roads, provided that number apply and qualify for the work. Seniority of employment for elevated railroad men is only allowed in the subway when the men take the same positions as they occupied on the elevated roads. The standard physical test is to be the one adopted.

THE TRACTION SITUATION IN CHICAGO

Another attempt is to be made to settle the franchise dispute between the city of Chicago and the Union Traction Company. The local transportation committee has decided to invite Judge Grosscup and the receivers and attorneys of the company to appear before the committee and discuss a basis for negotiations.

The new invitation to the receivers to consider a franchise extension ordinance was based on the correspondence between Mayor Harrison and Judge Grosscup which had been sent to the committee. After the letters of the Mayor and the Judge had been read Alderman Raymer proposed the renewal of negotiations. He said the committee realized that the greatest difficulty in the settlement of the traction question was the franchise of the Union Traction Company, but he thought the decision of Judge Grosscup in the ninety-nine-year case might open a way for negotiations. He suggested that the Judge, the receivers and the attorneys be invited to appear before the committee at as early a day as possible to discuss the question. The suggestion was adopted.

The committee has directed Commissioner of Public Works Blocki to notify the Union Traction Company to vacate the Washington and La Salle Street tunnels by Jan. 1, in order that work on lowering them may begin early next year. The committee has adopted the plans presented by George A. Yuille for rerouting the North and West Side cars in the downtown district while the tunnels are being lowered. The plans contemplate trolley systems on the present cable loops.

An offer has been made for a controlling interest in the stock of the Chicago City Railway Company by a syndicate representing the Union Traction Company. This fact is admitted by John J. Mitchell, president of the Illinois Trust & Savings Bank, and J. H. Wrenn, of J. H. Wrenn & Company, brokers. Mr. Mitchell is conducting the Chicago end of the negotiations and Mr. Wrenn is a member of the protective committee of the Union Traction Company. Both gentlemen were in consultation with R. R. Govin during his recent stay in Chicago. The price proposed to shareholders is said to be $200 a share for 91,000 to 103,000 shares The large individual holdings which are pledged in the new move for control include those of Marshall Field, John J. Mitchell, the Leiter estate, the Hoxie estate and the Armours.

One report has it that John A. Spoor, president of the Union Stock Yards & Transit Company and the Chicago Junction Railway, has been decided upon for president of the Chicago City Railway Company should the Union Traction reorganization syndicate succeed in getting a majority of the South Side Company stock. Mr. Spoor will succeed President D. G. Hamilton on the City Railway directorate. P. A. Valentine, of Armour & Company, will enter the board of directors of the Chicago City Railway Company.

A PECULIAR SUIT

The Hoosac Valley Street Railway Company, of North Adams, Mass., is suing the town of Williamstown because it established a quarantine against its neighbor, North Adams, excluding North Adams people entirely from its boundaries. This action was taken recently when there was an outbreak of small-pox in North Adams. The railway company claims that the quarantine was unnecessary and illegal and that the passenger traffic betwen North Adams and Williamstown was so far reduced by it that the company suffered considerable financial loss. Pecuniary damages covering the amount of this loss are asked. The company argues that the ordinary precautions of vaccination and inspection should have been held sufficient to preserve Williamstown from infection by North Adams.

REPORT OF ELECTRICITY ON CONSOLIDATED BETWEEN MERIDEN AND BERLIN

The New York, New Haven & Hartford Railroad is buying a strip of land 30 ft. wide between Meriden and Berlin, Conn., lying alongside the tracks of the Hartford Division of the road between these places. No announcements have been made as to the purpose to which the land will be put, but it is said that it will be used as right of way for a trolley or third-rail line between the cities.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED SEPTEMBER 13, 1904

769,698. Electric Switch; James C. Keller and Otto F. Kadown, Cleveland, Ohio. App. filed June 10, 1903. An electro-magnet of ring shape open at one point and hinged at the opposite point, draws together when energized and by means of connections moves the switch tongue of a railway track.

769,854. Trolley Wheel; William T. Wilkinson, Medford, Mass. App. filed Dec. 18, 1903. The entire groove for the wire is formed in a removable tread portion confined between the two side cheeks.

769,862. Guard for Third Rails; John H. Guest, Brooklyn, N. Y. App. filed Dec. 12, 1903. A protecting strip rests upon the third rail and is lifted by the shoe as the train progresses.

769,900. Switch Operating Device for Street Railways; Henry S. Hale, Philadelphia, Pa. App. filed Jan. 5, 1903. Details of construction of pneumatically operated mechanism on the car for engaging levers in the roadbed to thereby throw the switch point in advance of the car.

769,929. Railway Sanding Device; Christian Allenbach, Chicago, Ill. App. filed July 5, 1904. The hopper is provided with a false bottom, packing interposed between the false bottom and the adjacent walls of the hopper, said hopper and false bottom being provided with registering outlet openings, and a valve-seat surrounding the opening in the hopper, a spring-actuated valve controlling the opening and having a sharp annular edge bearing on the valve-seat and adapted to cut its way through the flowing sand to become seated and thereby prevent leakage.

770,040. Motor Control System; Charles E. Barry, Schenectady, N. Y. App. filed April 18, 1903. The contact operating devices are automatically and successively controlled by a number of relays which are adjusted to respond to certain successive increments of counter-electromotive force in the motor circuit as the motor increases in speed.

770,107. Street Car; Charles B. Price, Oakmont, Pa. App. filed Dec. 30, 1903. A street car provided with a receiving compartment extending along one side thereof, a registering turnstile between said compartment and the body of the car and an exit therefrom.

770,113. Trolley Harp; Edward D. Rockwell, Bristol, Conn. App. filed Jan. 13, 1904. The construction permits a swivel movement of the trolley wheel and its shaft with relation to the harp.

770,132. Car Construction; Henry F. Vogel, St. Louis. Mo. App. filed Jan. 16, 1904. Relates to reinforcing metal posts introduced between the wooden window-posts of a car; also a novel form of car lines connected to the reinforcing posts and means whereby the wooden window-posts are secured to the reinforcing posts.

770,158. Third-Rail Covering; Thomas Buckley, New York. N. Y. App. filed April 28, 1904. A hinged roof over the third rail adapted to open and close as the shoe passes.

770,161. Car Chair; George W. Chambers, Newark, Ohio. App. filed Jan. 2, 1904. Details of a walk-over seat.

NO STRIKE ON LAKE SHORE ELECTRIC

The matter of a strike of the employees of the Lake Shore Electric Railway Company has been grossly exaggerated. The company recently instituted a policy of retrenchment, and consolidated the Sandusky division with the Cleveland division, L. K. Burge, of the Cleveland division being given charge of the consolidated division. The report became current that the company intended to cut the wages of all employees, and the men held a meeting and asked the company for a conference. There was not, however, any talk of a strike. The officials of the company declared that there had been no intention of cutting motormen and conductors, and explained that the change made in division was merely in keeping with a policy of retrenchment that had been rendered necessary.

PERSONAL MENTION

MR. PHILIP W. MOEN, of Worcester, Mass., formerly of the Washburn & Moen Manufacturing Company, died Sept. 12 from a stroke of apoplexy. He was a director of the Worcester Consolidated Street Railway and the Boston & Worcester Street Railway.

MR. W. C. SMITH has resigned as general manager of the Pennsylvania & Mahoning Valley Railway Company. He has been identified with this company for three years, and will return to Pittsburg, his former home, where he is said to have accepted a better position.

MR. M. J. KINCH, of Holland, Mich., has been appointed superintendent of the Green Bay Traction Company, operating the new interurban line between Green Bay and Kaukauna, Wis., on the west side of the Fox River, and the Green Bay-Depere line on the east side of the river, to succeed Mr. P. F. Goodrich.

CHANGES IN THE PERSONNEL of the Winnebago Traction Company, of Oshkosh, Wis., have resulted in the retirement from the company of Mr. Frank Farquhar, superintendent, and Mr. James Gaffney, electrical engineer. Hereafter Mr. John Davey, now chief engineer and engineer of power station, will perform the duties of superintendent and electrical engineer.

MR. GEORGE F. CHAPMAN, general manager of the United Railways Company, of San Francisco, is visiting in the East. While in New York he will consult with the Eastern owners of the San Francisco company regarding the future of the property. His stay will probably be prolonged for a month. Mr. Chapman, it will be remembered, was connected with the North Jersey Street Railway Company before the absorption of that company by the Public Service Corporation.

MR. FREDERICK G. SYKES, for the last two years electrical engineer of the Schenectady Railway Company, of Schenectady, N. Y., has resigned from the company, to take effect Oct. 1. Mr. Sykes will become general superintendent of the Portland General Electric Company, of Portland, Ore. Previous to his connection with the Schenectady Company, Mr. Sykes was employed by the General Electric Company in installing the Sydney Tramway system in Sydney, Australia. His connection with the General Electric Company followed his serving as operating superintendent of the Brooklyn Edison Company.

MR. GUIDO PANTALEONI, for many years manager of the St. Louis office of the Westinghouse Electric & Manufacturing Company, has been relieved of these duties to act as the personal representative of Mr. George Westinghouse during the St. Louis Exposition in the reception and entertainment of distinguished visitors. He has been appointed general southwestern manager of the company, in which capacity his duties will be with the large financial interests of the southwest. Mr. Wm. Clegg. Jr., who has for the past five years been Mr. Pantaleoni's associate, has been advanced to the position of special agent for the handling of particularly important contracts in this field. This mark of the high regard in whch Mr. Clegg is held by the company is due to his excellent record, and to the desire to leave him free from the executive duties coming upon a district office manager, so that his marked ability as a salesman may have wider scope. Mr. D. E. Webster comes from the Denver office to be acting manager of the St. Louis office. During his eleven years with the Westinghouse Company, Mr. Webster has held a number of important positions, including that of chief of the testing department at East Pittsburg, so that he brings to his new office ability as an engineer as well as commercial experience.