Street Railway Journal

VOL. XXIV. NEW YORK, SATURDAY, DECEMBER 31, 1904. No. 27.

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

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

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)..... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy).....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid..... $6.00
25 shillings. 25 marks 31 francs.

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

Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

Copyright, 1904, McGraw Publishing Co.

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

EDITORIAL NOTICE

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

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

Address all communications to

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Per Capita Earnings of Interurban Properties

We present on the last page of this issue a table which represents considerably more work than the space occupied might suggest, but which we believe will be of interest to all students of interurban traffic problems. The table has been compiled from the reports of the various electric railway companies of Ohio to the Auditor of that State, and covers the operation of those properties during the year ending April 30, 1904. As Ohio has shown a greater development in electric railway work than any other State in the Union, the figures are of considerable interest. The table is also valuable from the fact that it is the first attempt, so far as we are aware, to publish the per capita riding for a considerable number of the different railways of any large State.

Those who have had anything to do with estimating the per capita riding for an interurban railway know how unsatisfactory is any basis which may be selected. In calculations on city roads, where the lines of the system are actually or practically confined to the municipal limits, a proper basis for comparison can very easily be secured, but with interurban lines it is always a question whether to use the population of the terminal city or, if a portion of this population is taken, what the proper percentage is. Again, it is difficult to obtain any figures of population along the route of an interurban railway unless an actual count is made of the inhabitants or the houses along the track. This is because the only population figures given in the Census Reports, outside of those for cities and towns, are for townships. If the entire population of the townships through which the lines run is taken, it will include a considerable number of people who are so distant from the line as to have practically no effect upon the riding. On the other hand, the railway, while crossing one township, may pass so near the boundary of another as to be patronized to a considerable extent by its inhabitants, so that its population ought, theoretically, to be included.

The plan adopted in the table of the Ohio railways, published in this issue, was to credit each road with the population of all the incorporated villages and towns along the line, and to add to this number a figure to represent the intervening population. This latter was obtained by assuming that the population outside of the villages was evenly distributed over the township, and by then taking the proportion of this population which would be within 4 miles of the track. While not a thoroughly accurate method of arriving at the tributary population of the different lines, this plan is perhaps as satisfactory as any. As stated in the article which accompanies the table, the Census of 1900 was used in the calculations, although the figures of the increase between 1890 and 1900 show that for the decade between 1890 and 1900, twenty-two counties out of eighty-eight in Ohio showed a decrease in population. The net gain of the State of 13.2 per cent was confined principally to the larger towns and cities. To satisfy those who believe that the population of the terminal large cities should be included in the per capita estimate of riding, as well as those who do not hold this theory, columns for both cases have been given for all roads which serve cities of over 75,000 population.

Making Provisions for Accidents

We have before commented on the fact that in designing cars there is often very little attention given to the convenience of making repairs on them in case of injury in a wreck. All thought is usually concentrated on the appearance and the ability to stand up in an accident. It is not presumed that accidents will occur, and it seems to be the prevailing idea that to spend much thought in so designing the car as to facilitate repairs, after being in a collision, would be admitting inability to properly operate the road. But again, putting so much material in the bottom framing is an admission of the fact that accidents may happen. After such an admission it would certainly be sensible to place some thought on how repairs are to be made when accidents do occur.

A few specific points might be noted. The tie rods of the bottom framing, when wood construction is used, are often headed on each end by a nut sunk in the side sill, and then the ends covered over by the siding, which in this case extends to the bottom of the side sill. No provision is made for tightening the rods other than by removing a portion of the siding. This so mars the side of the car that it is done only as a last resort. No matter how well seasoned the timbers of a car may be at the time of construction, a few months of use will often so loosen up the joints that all the nuts on the tie rods should be given a turn. But if this necessitates the removal of the greater portion of the siding, which has been carefully glued to the furring, the nuts will in all probability remain loose. While a side plate on the outside of the side sill and underneath the sheathing, in which all rods are made to terminate, may not present as good an appearance as does the construction when the siding extends to the bottom of the side sill, it nevertheless facilitates repairs, and thereby adds to the life of the car. The rods may be readily tightened by simply applying a wrench to the exposed nut. There are numerous other points in the construction of cars that may be provided for in a similar manner.

It might be well to go a step further and order duplicate parts to be used in case of injury. Where a road is operating fifty or more cars of the same type, it would often be a good investment if duplicate parts of the vestibules were ordered. This would apply especially to the posts. These are usually rather complicated in cross section, and when cut out by hand in the small shop are rather expensive. But when they are turned out in the car shop, where the machinery is already set for making them, their cost is little more than the material in them. The difference in price would often justify their purchase and storage until an accident renders them useful.

Some Problems of Car Heating

As the winter draws toward its climax the question of heating the cars grows more serious, and not a few roads are finding themselves really hard pushed for power to spend in heating. The trouble comes from a variety of causes. One large system was subjected to great temporary inconvenience by the breaking down weeks ago of a single large generating unit. Other roads find that increasing traffic pushes the plant beyond its proper capacity, and in one or two instances roads are reported as complaining of the cost of energy required for heating. Now as to these last, if such there be, we have nothing to say, except that in the present stage of civilization they had better face the issue even if they have to pass a dividend. As to the victims of accident and of unexpected demands, they have our sympathy in so far as they suffer from circumstances beyond their control. But even with all reasonable foresight and care, the question of the extra power required for heating is a pretty serious one. As everybody knows, the energy required to heat an electric car is a very preceptible fraction of that required to run it, and when a cold snap comes on and every heater is busy, the load on the station may run up to embarrassing proportions.

What then shall be done? Generally the extra load can be handled well enough, but now and then there is trouble. In any event, the power bill increases considerably, and that of itself is disagreeable. We have been watching the situation from the standpoint of the passenger pretty assiduously this season and have about come to the conclusion that the best remedy is to heat with more discretion and less zeal. The average electrically-heated car goes through the following cycle of operations: (1) The conductor puts on full heat and gets the chill off the car. (2) He lets it stay on as he accumulates his load until a general flavor of grilled overshoes permeates the car and oozes out upon the platform. (3) He comes to and turns off the heat until cold drives the passengers to protest. (4) The cycle is repeated until the car runs in for the night. As a frequent variation, the conductor keeps the heaters on and cools himself by standing on the platform a large part of the time.

A street car gets perforce a liberal supply of cold air, and when doing a large local business it is well-nigh impossible to keep it at a high temperature, say up to 65 degs. or 70 degs. Moreover, even if this were possible, it would be very undesirable since the passengers, being heavily wrapped to meet the external cold, would be seriously overheated. We can lay down the rule therefore that in city service considerable less heat than is usually supplied is entirely adequate to prevent the passengers from being chilled, which is really all that heat is needed for. The steaming air of a crowded and overheated car is far more to be feared than a car which is merely kept a few degrees warmer than the air outside. The regulation of electric heaters should be adjusted so that while the heat can be pushed so as to take the chill off the car quickly, it should usually be kept down considerably below the point now customary for steady running. It goes without saying that passengers would sometimes complain, but they often complain now of overheating, and with good cause. Of course, there will be kicking anyway, that privilege being part of the consideration for which the passenger delivers his nickel. However, few people would kick at cars being less heated and better ventilated than is now usual. The proper course is to see that each car is thoroughly ventilated and freshened over night, and that it is comfortably warm before it starts out.

Considering now the heating on the road, we believe that it is an excellent plan to do as is done in several cities, and that is to keep the heater switches locked and allow no one to touch them except an inspector. The conductor on a crowded car has troubles enough without having his attention distracted by complication in the heating scheme, and where the plan outlined has been adopted it has been followed with eminently satisfactory results. A modification of this plan would be to have the last notch of the heater switch accessible to the inspector only and to allow the conductor to manipulate the other points. We Americans have an almost irresistible inclination toward keeping our houses too hot and dry in winter, and reap the reward of our vice in a plentiful crop of coughs and colds. The number of these that can properly be charged up to temporary overheating of street cars is no inconsiderable fraction of the whole. With only the lower degrees of heat under the control of the conductor, the present overheating would be obviated and the car would merely be kept gently warm. The energy required would be materially reduced, perhaps to half the present average value, and with a little care it would prove feasible to keep the heavy heating load away from the traffic peak, which is sometimes more important than diminishing the average energy. If, in addition, the warming up process were always carried out at the car house, the cars could be made comfortable at any convenient time and kept so by the expenditure of very little energy until they were needed. A somewhat larger heater area at a relatively lower temperature than is usually used would probably be an improvement for this kind of work.

In interurban cars, and others doing a large amount of long distance work, somewhat higher temperature needs to be car-

ried than in city work where few passengers ride any great distance, yet even here the energy needed for heating can be kept within more moderate limits than are usual. Steam trains are very generally overheated, but there is no reason why electric trains should follow their bad example. The ideal condition is one in which the average passenger will find the car comfortable if he does not shed his overcoat. Warmth near the floor to keep the feet warm is the most important, and this can be supplied by a relatively modest expenditure of energy. If your cars are never overheated no one will wish them to be, or grumble if one car is a few degrees cooler than another, and everybody will run a lessened risk of "catching cold in those draughty street cars."

Two Railway Problems in New England

Two very important street railway problems are crystallizing in Southern New England. When they come up for direct consideration their disposal will call into action all the cleverness of the Boards of Railroad Commissioners in order to protect vested interests and safeguard the rights of the general public. The absorption of a number of Massachusetts and Connecticut street railways by the New York, New Haven & Hartford Railroad has not, so far, raised even a ripple of protest. There is a feeling that the company will bring to these properties the benefits of its wide experience in maintenance of way and its valuable knowledge in the art of operation, assuring thereby the maximum of safety in the handling of passengers. Further, that in case of accident, recovery for damages will be more certain than if the companies were continued as separate organizations, a fact that has not escaped notice.

Consideration of the more important of these problems was initiated the other day at a hearing before the Massachusetts Board on a petition brought by the residents of Webster, in that State, in which they prayed for a restoration of former train service on the steam line running between that town and Southbridge. The New Haven Company were the remonstrants. The evidence showed that for the past twenty years a train had been run from Webster to Southbridge at 8:15 in the morning. The patrons were largely business men and officers of the court, sessions being held three times a week at Southbridge. This train was due to arrive at destination at about 9 o'clock. Under a new schedule a mixed train had been substituted. This was made up of freight cars, with a passenger coach attached. At a number of the way stations the train took on heavy shipments of merchandise, the delays making it late at Southbridge most of the time. This disarranged the machinery of justice, as was testified by Judge Clark, and led to embarrassments in meeting business engagements. The petitioners did not complain of the character of the train, but simply asked that it might be run nearer to schedule time. The remonstrants, in answer, set forth the fact that the business of the steam road had been greatly lessened by the competition of an electric line, and that the change in train service was warranted from the standpoint of economy. It was shown that receipts at a number of the stations had decreased fully 50 per cent since the invasion of the trolley line, which was offered as the burden of the defense.

So far as surface indications go, this case is hardly worth a second thought, but underneath it will be found to involve a principle in rail transportation that will prove of extended interest when the matter shall have been fully developed. Suppose, for instance, this colloquy should take place between the New Haven road and the general public: General Public—"Who owns the steam line under consideration?" New Haven Road—"We do." General Public—"Who owns the competitive electric line?" New Haven Road—"We do."

The question would then appear to be: How far can one of two systems of transportation, both being under the same management, curtail its accommodations to compensate for the losses inflicted by the other? When all the facts are fairly in the light, an avalanche of discussion may be expected. The Massachusetts Railroad Commissioners will be the final arbitrators in this dispute, and as they are not disposed to injure capitalistic interests, and are also prone to give the traveling public all that justly belongs to them, it will be seen that in reaching a final judgment their path will be beset with many obstacles.

The second of these problems relates to the future development of street railways in Massachusetts and Connecticut, and the question has been asked: If the New York, New Haven & Hartford Railroad continues its policy of buying up competing electric lines, how far will it discourage the development of electric traction in the sections where the company has absolute control of both systems? It is argued that the steam company will be in a position to discourage the construction of contemplated new lines in the territory affected, and it is problematical how far this may result in keeping street railway growth at a standstill in the sections under consideration. Local students of transportation matters are giving this peculiar condition more or less thought, and it may result in asking the Legislature to take a hand. In no other States in the Union are the relations of the steam roads with the electric lines fraught with as much interest as they are in the two mentioned.

The Retirement of Secretary Brockway

The announcement is made in this issue of the election as secretary and treasurer of the Street Railway Accountants' Association of America of Elmer M. White, of Hartford, and of the retirement from that office of Walter B. Brockway, who accepted re-election at the St. Louis convention only with the understanding that his successor would be appointed before the first of the year. We congratulate the association upon having selected such an excellent successor to Mr. Brockway, but consider that the retirement of the latter should be signalized in this paper by more than a passing tribute to the services which he has rendered the association with which he has been so prominently connected. Under our modern methods of association management, the success of any association or society depends largely upon the ability displayed by the secretary and treasurer. He is in most cases the only permanent officer of the body, and upon him necessarily devolves the greater part of the work of preparing for each annual meeting and of maintaining throughout the year in the members an enthusiasm in the aims and objects of the association. The retiring secretary has accomplished this work in a most satisfactory manner during the seven years in which the association has been in existence, which included the early critical years and those in which the present series of standards was adopted. The annual reports and other literature published by the association during this period have been generally recognized as models of their kind, both in typographical appearance, clearness of expression and arrangement and in accuracy of statement. The association has been fortunate that it has been able to retain in this office for so long a gentleman who has had such a wide accounting experience as Mr. Brockway, and one who in spite of his arduous duties as auditor of some half-dozen important properties has been willing to give part of his time to this work.

NOTES ON THE PORTLAND RAILWAY COMPANY'S SYSTEM

Portland, Ore., because of its picturesque situation on the banks of the Willamette River, with a background of heavily timbered hills to the west, and a vista of snow-capped mountains to the east, has long had the reputation of being one of the most beautiful cities in the country. It is popularly known as the Rose City, and deserves the name; since flowers bloom there every month in the year, and roses in profusion. On the hills to the southwest, where, in clear weather, a superb view is obtained, many very beautiful residences have been built, and just over the first ridge a natural city park has been laid out. Until last summer the only means of reaching Portland Heights, as the most prominent of these residence hills is called, except on foot or by circuitous drives, was a cable incline, operated in connection with the Jefferson Street line of the Portland Railway Company. This incline, however, reached only about half way up the hill, and did not offer any special attraction in the way of good views. To provide a branch of its system which would replace the cable road and would be a truly scenic line, and also to open to the public the excellent building sites on these hills, and make them more desirable, the Portland Railway Company has built an electric line, connecting with its main line on Washington Street, and reaching, with rather heavy grades, nearly to the top of Portland Heights. The summit, known as Council Crest, is circled by a loop, the highest point of which is 742 ft. above sea level, or 714 ft. above the business section of the city. The views to be had from this line, in clear weather, are exceptionally fine. Just below lies the city of Portland, the Willamette River winding through it, to the left the Columbia River in all its grandeur, while in the distance, virgin forests stretch for many miles, backed by five snow-crowned mountains that embrace a range of vision of nearly 200 miles.

A typical view from the new line is reproduced in Fig. 1. A faint glimpse of the Columbia is obtained at the extreme left. Mount Hood stands out at the right, with the Willamette River below and to the right.

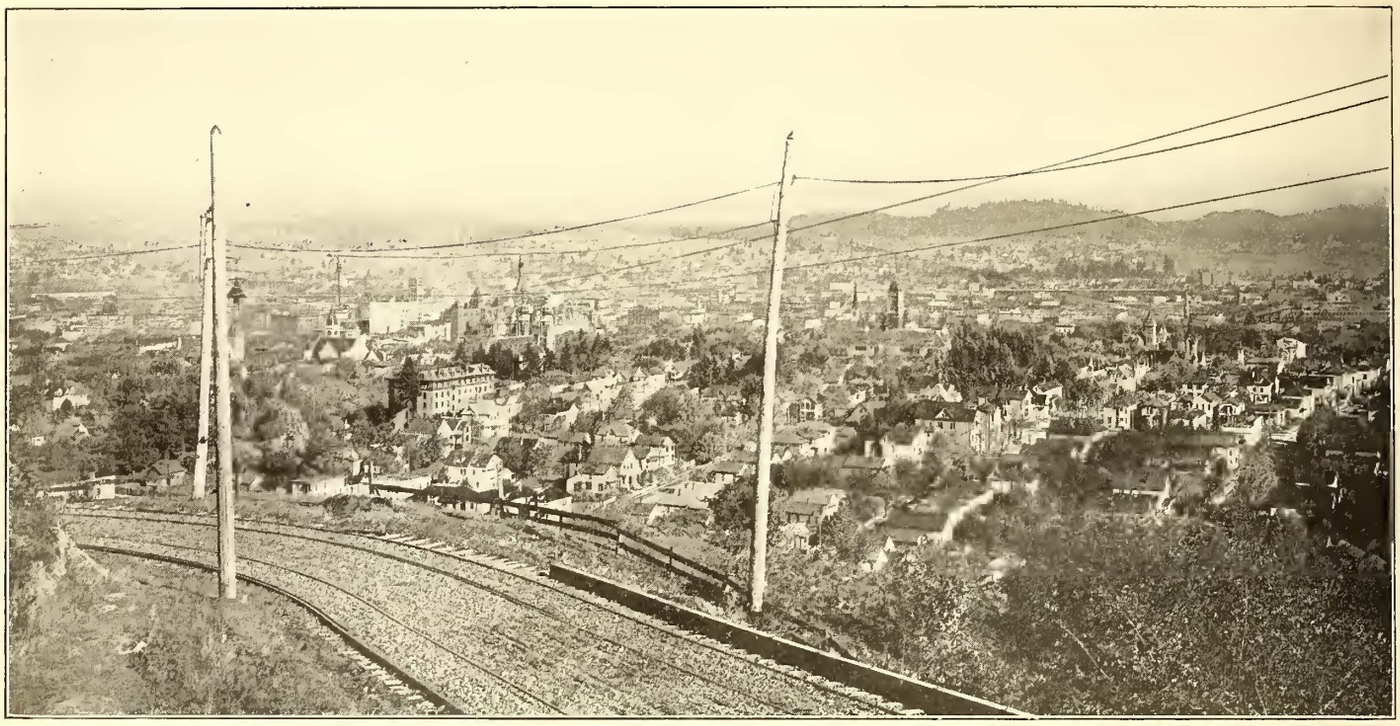


FIG. 1.—A VIEW OF PORTLAND FROM PORTLAND HEIGHTS

PORTLAND HEIGHTS SCENIC LINE

The route of the Portland Heights line is indicated on the accompanying map, Fig. 2. The new track swings off from the Washington Street line and starts up Ford Street on a heavy grade. A picture taken at this point, Fig. 3, gives an idea of the incline, which for 150 ft. has a 12 per cent gradient. For about five blocks the track consists of 60-lb. 6-in. shanghai T-rail, laid with cast-welded joints, the street being paved. The track then swings off over Jefferson Street and crosses a deep gulch on a steel bridge. The bridge, known as the Ford Street Viaduct, is an expensive and substantial structure, and outside of one of the river bridges, it is the first steel bridge to

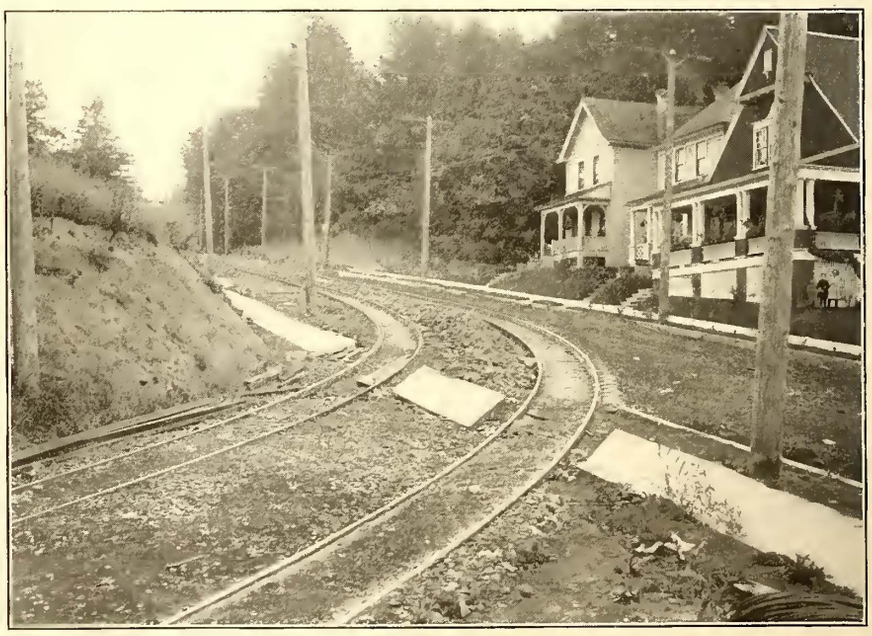


FIG. 3.—BEGINNING OF NEW PORTLAND HEIGHTS LINE ON 12 PER CENT GRADE

be built in Portland, although others are now in course of construction. Fig. 4 is a view of the complete viaduct, with a Portland Heights car, while below is a small electric car on the Jefferson Street line, which crosses under the bridge and runs to City Park. From bank to bank, the bridge is 560 ft. in length, and at the center is 117 ft. above the ground. It is supported at the ends on bents 25 ft. wide, spaced 20 ft. center to center, while the bridge proper consists of a 330-ft. truss resting on two towers 25 ft. x 30 ft. at the top and three panels high, the posts being given a batter of 1⅜ ins. in 1 ft. All posts rest on concrete footings. A clear driveway, 90 ft. wide, is left on Jefferson Street between the towers. The deck of the bridge is 45 ft. in width, including two 6-ft. sidewalks, and is floored with plank, since it is a public street viaduct. The roadway has a grade of 6.6 per cent. The viaduct was built after plans made by the contractor, Robert Wakefield, of Portland, being first approved by General Manager F. I. Fuller, of the Portland Railway Company. Although used jointly by the city and the railway, the cost was largely borne by the latter.

The remainder of the route, from the bridge to and including the loop, is characterized by heavy grades and sharp curves, since the topography is quite rough and broken. A further disadvantage encountered by the company was that the territory was already platted, and, although by no means entirely graded, the track had to be constructed in the streets, whereas easier grades and better curves could have been followed on a private right of way. However, much assistance was rendered by the city in raising and lowering the streets to the established grade as the railway work progressed. Leaving the viaduct, the line runs onto a portion of the Market Street drive, which it follows in a large double-S curve until it reaches the northern and lower end of Twentieth Street. A view from this point, looking back down the track, is shown in Fig. 5. Twentieth Street is followed its entire length of seven blocks, and, at the upper end, at Spring Street,

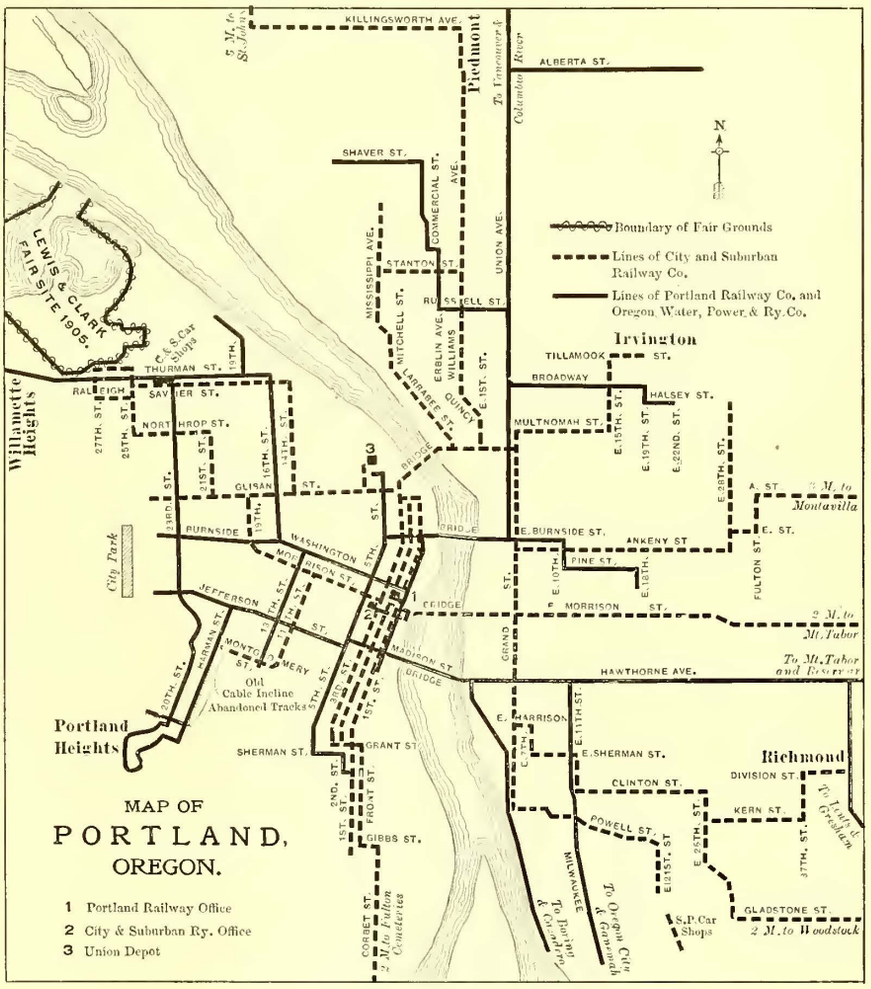


FIG. 2.—STREET RAILWAY MAP OF PORTLAND, ORE.

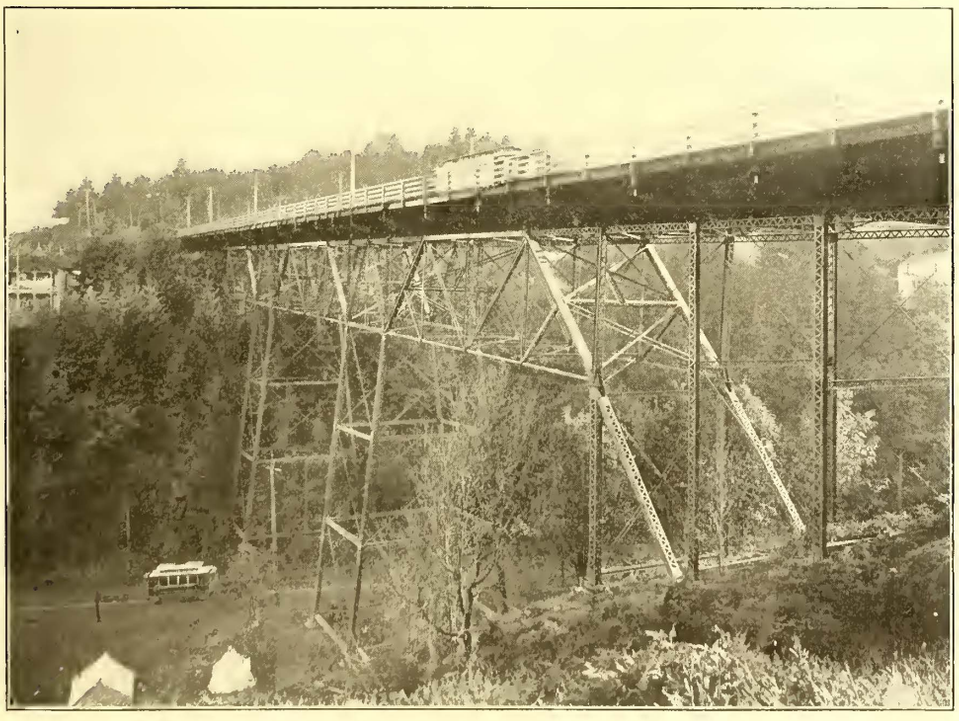


FIG. 4.—FORD STREET STEEL VIADUCT ON PORTLAND HEIGHTS LINE, 117 FT. HIGH AND 560 FT. LONG

the cars pass onto the single-track loop, which follows Terrace Road until the summit is reached, the return track passing along Ravens View drive, Elizabeth, Chapman and Spring Streets to Twentieth Street, thus completing the loop. The last two blocks of the loop on Spring Street are on the upper end of the old cable road, and two tracks are maintained, the south one being used as a spare track for the storage of cars, as will be mentioned later.

Twentieth Street is a succession of steep grades formed into terraces by the cross streets, the grades of the track crossing the latter not exceeding 3 per cent or 4 per cent. As a safety precaution, the track on this street has been equipped with two sets of derailing switches. One of these sets is shown in Fig. 6, which is a view looking up the street. The switches are regularly left open, and, on the down track, the car has to be brought to a stop and the switch closed by the conductor by means of a hand lever from the ground before it can be passed.

At the corner of the loop, Fig. 7, the first 100 ft. of single-

track is on a comparatively steep grade, and, as may be noticed in the illustration, the spare track at the left is made continuous with it, while the main track is connected by means of a spring switch. This switch is always left open as a safety precaution, so that, should a motorman lose control of his car on the heavy grade, it would simply fall back into the level spare track, where

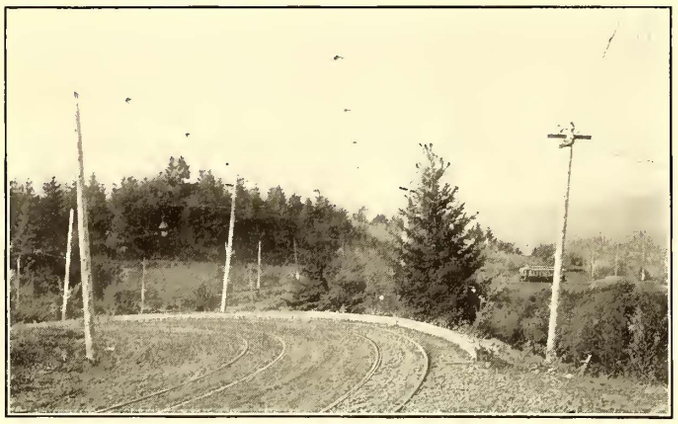


FIG. 5.—VIEW ON PORTLAND HEIGHTS LINE AT FOOT OF TWENTIETH STREET

it would soon come to a standstill. The track shown in the foreground of Fig. 7 is the down track of the loop.

In addition to the safety switches mentioned above, there is one installed at the lower end of a steep grade and near a sharp curve on the stretch of track shown in Fig. 5. This is arranged so that if a car should leave the track above this point it would run into a hill instead of going down the bank on the opposite side. In an hour's trip over the entire Heights line, a car passes over four safety derailing switches on the up trip, and over

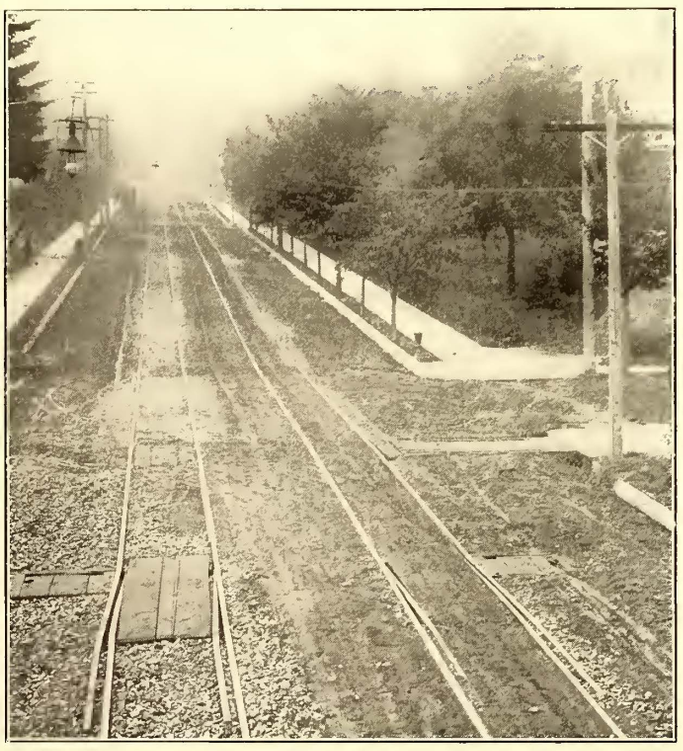


FIG. 6.—PORTLAND HEIGHTS LINE, LOOKING UP TWENTIETH STREET, SHOWING SET OF DERAILING SWITCHES

three on the down trip. Those on the track going up are closed automatically by the car in passing, and are brought into service only when a crew loses control of a car and it backs down the grade. Thus in regular operation only the three switches on the down track have to be closed by the crew during the hour's trip, and Mr. Fuller, under whose supervision the switches were installed, thinks that the inconvenience and time taken in operating them are unimportant considerations when compared to the safety of operation which they insure. The line, with its long, heavy cars and its large traffic, including many sightseers and tourists, is an important one, and it was essential that the liability of accidents on its heavy grades and sharp curves should be reduced to a minimum. There is a possibility that when the trainmen have become thoroughly accustomed to the cars and to the line, some of the switches on the down track may be kept closed.

With the exception of the large Ford Street viaduct, there are but two bridges on the line, and they consist of wooden trestles about 18 ft. high, on the western side of the loop. One of these is shown in Fig. 8. This view also gives an idea of the scenery along the route. The trees pictured are native Oregon firs. In Fig. 9 is shown a double-S curve on the down track of the loop, which may be taken as illustrative of the construction necessary in following the contour of the streets.

Of the track construction on Ford Street, mention has been made. All the track above that viaduct, including the loop, is laid with 60-lb. standard A. S. C. E. section T-rail, with continuous-rail joints, bonded with No. 0000 solid copper wire. The gage is 3 ft. 6 ins., the same that prevails on all of the company's system. The ties are of cedar, 6 ins. x 8 ins. x 6 ft. in size, and are laid on 2-ft. centers. The track is well ballasted with crushed rock, extending 6 ins. below the ties, and a large portion of it is drained by means of 4-in. tile, laid below the ballast and connected to sewer manholes every second corner. The soil is an impervious clay, so good drainage was a necessity. On the main double-track line the curves vary from 350-ft. to 70-ft. radius, and on the loop the sharpest curve has a 75-ft. radius. For all curves on the up track with less than 160-ft. radii, the track is compensated. On the down track there are three small sections of 12 per cent grade, and on the up track there is the 12 per cent grade near Washington Street, which has already been mentioned. Several 11 per cent grades occur on both tracks. Nearly all the stopping places or stations at street crossings have been arranged so as to have a grade not exceeding 3 per cent or 4 per cent. The new Portland Heights line beyond Washington Street embraces 1.2 miles of double track and one mile of single track. In the 3-

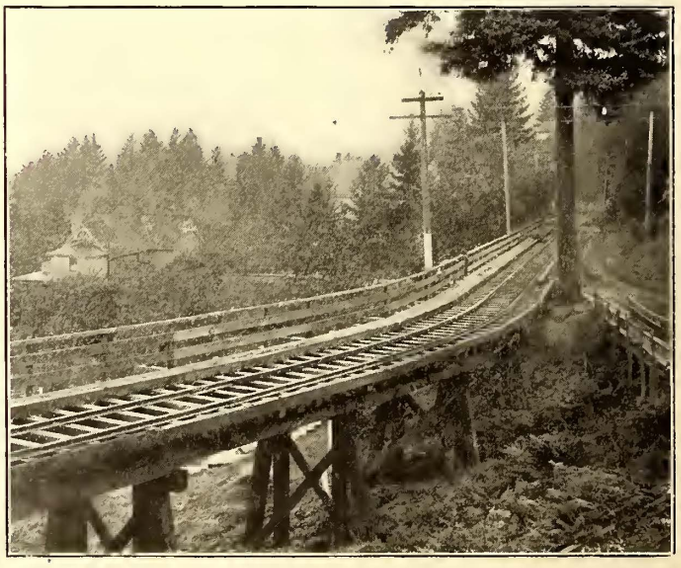


FIG. 8.—WOODEN TRESTLE ON WESTERN SIDE OF LOOP ON PORTLAND HEIGHTS LINE

mile run from the company's waiting room at First and Washington Streets, the cars make a total rise of 714 ft., the last 570 ft. of which is made in about 1.8 miles. In coming down hill some of the motormen, with the aid of the magnetic brakes, are able to make all necessary stops and coast their cars as far as Sixteenth and Washington Streets, a distance of about 2½ miles, without using any current from the line.

TRACK WORK

During the last year the Portland Railway Company has laid several miles of new track, 3 miles of which has been in paved streets, and of the standard construction illustrated in Fig. 10. It consists of 91-lb. 7-in. full-groove Lorain section-350 rail, laid in 62-ft. lengths on concrete girders 8 ins. deep, with tie rods, and basalt paving blocks between the rails.

Recently the company has been doing some interesting track work on Fifth Street, where until last August a cable road was operated. This line extended from the Union Depot to Jefferson Street and the City Park, and ran to Portland Heights on the steep incline, which has since been abandoned. This cable system was originally installed by the Portland Cable Railway Company, and later passed successively into the hands of the Portland Traction Company and the Portland Railway Company. It was the last cable line to be operated in Portland, and when it was finally abandoned, and electric cars installed last summer, immediate steps were taken to replace the old tracks on Fifth Street with the company's standard construction. This work has been accomplished without delaying traffic; the method employed being well depicted in the illustrations, Figs. 11 to 16, which were taken near the Union Depot.

The old track and slot rails were first pried up by breaking off the bolts, and then the concrete bed was broken up and removed to a depth of about 15 ins. below grade. The upper ties holding the cable yokes were removed, and the yoke posts were broken off at the lower bolt of the tie. This procedure left the bottom ties and all the lower portions of the yokes firmly embedded in the original concrete construction, thus insuring a very solid foundation for the new roadbed, and also saving time and expense. Figs. 11 and 12 illustrate the method of removing the old rails, cutting off the yoke posts and preparing the trench for the new track.

The new rails are laid on cedar ties, spaced 12 ft. apart for alignment purposes, with 6 ins. to 8 ins. of new concrete under the rail to form the girder foundation. The tie rods have $\frac{7}{8}$-in. threads, and are spaced 6 ft. apart. A portion of the track is of the 91-lb. 62-ft. Lorain section, as used in the company's standard construction, Fig. 10, and the rest, including that illustrated in the photograph, is 84-lb. 7-in. 35-ft. full-groove rail of Belgian section. The trench was filled with concrete to the bottom of the rails, the old concrete removed being broken up and employed in the new mixtures. This left a bed for the paving blocks which just covered the tops of the broken yoke posts, as is shown in Fig. 13. The basalt blocks, which are $3\frac{1}{2}$ ins. wide, 5 ins. deep, and from 5 ins. to 9 ins. long, were then laid firmly in moist cement mortar, and grouted in with a mixture of $2\frac{1}{2}$ to 1. Fig. 14 shows the paving work, and Fig. 15 illustrates a finished portion of the track, and also shows the manner of cast-welding the joints. About 145 lbs. to 150 lbs. of iron went into each of these joints. Only the east track has been cast-welded, the west being bonded at each joint with two No. 0000 Brown-Edison plastic bonds under the fish-plate, one on each side. The two methods of bonding were employed to determine their relative merits with the test of years of service.

In Fig. 16 is shown a completed portion of the new track on

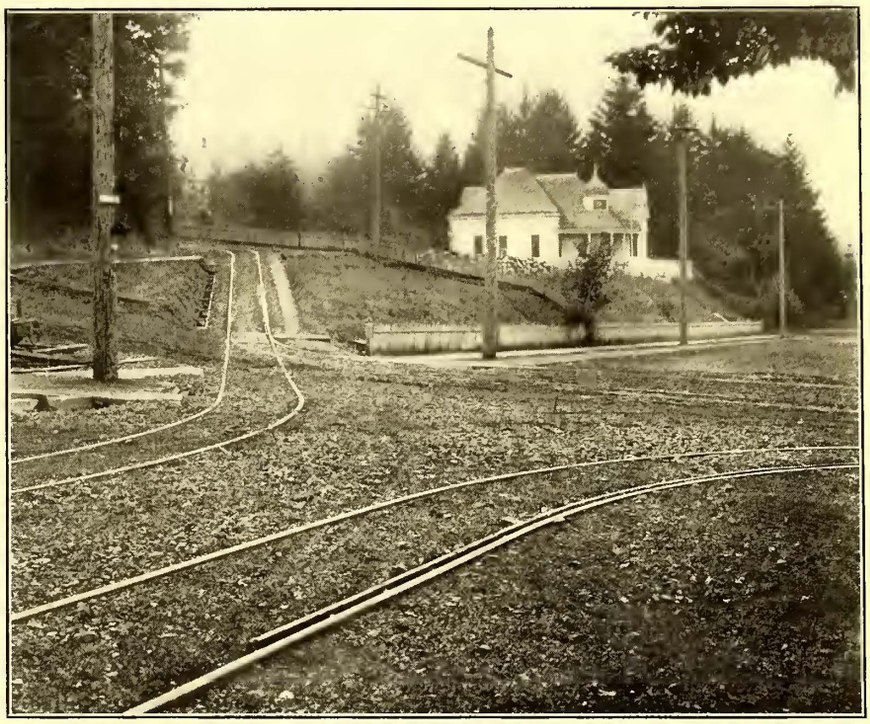


FIG. 7.—CORNER OF LOOP, SHOWING SPARE TRACK AT LEFT, RETURNING DOWN TRACK OF LOOP IN FOREGROUND

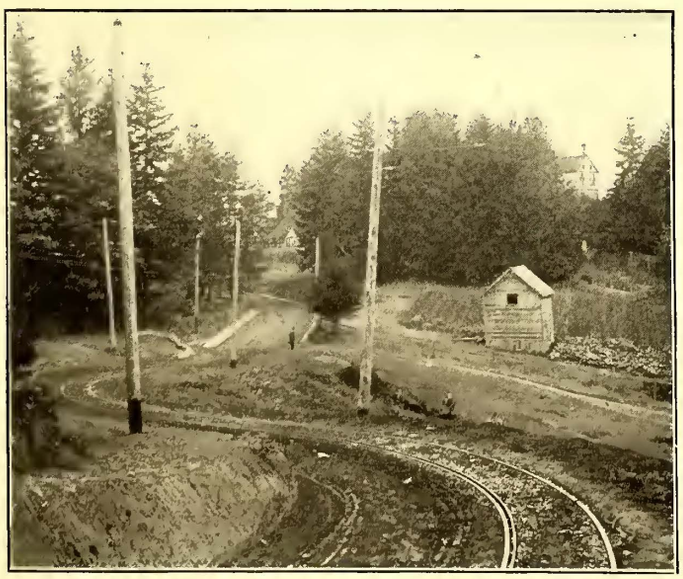


FIG. 9.—DOUBLE-S CURVE ON LOOP OF PORTLAND HEIGHTS LINE, ILLUSTRATING SOME OF THE SPECIAL TRACK CONSTRUCTION NECESSARY ON THIS DIVISION

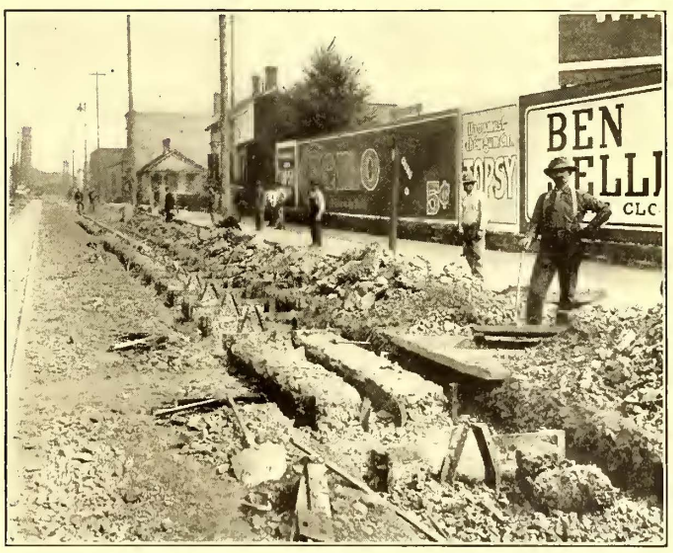


FIG. 11.—NORTH FIFTH STREET, NEAR UNION DEPOT. TEARING UP CABLE TRACK AND BREAKING OFF YOKE POSTS BEFORE LAYING NEW TRACK

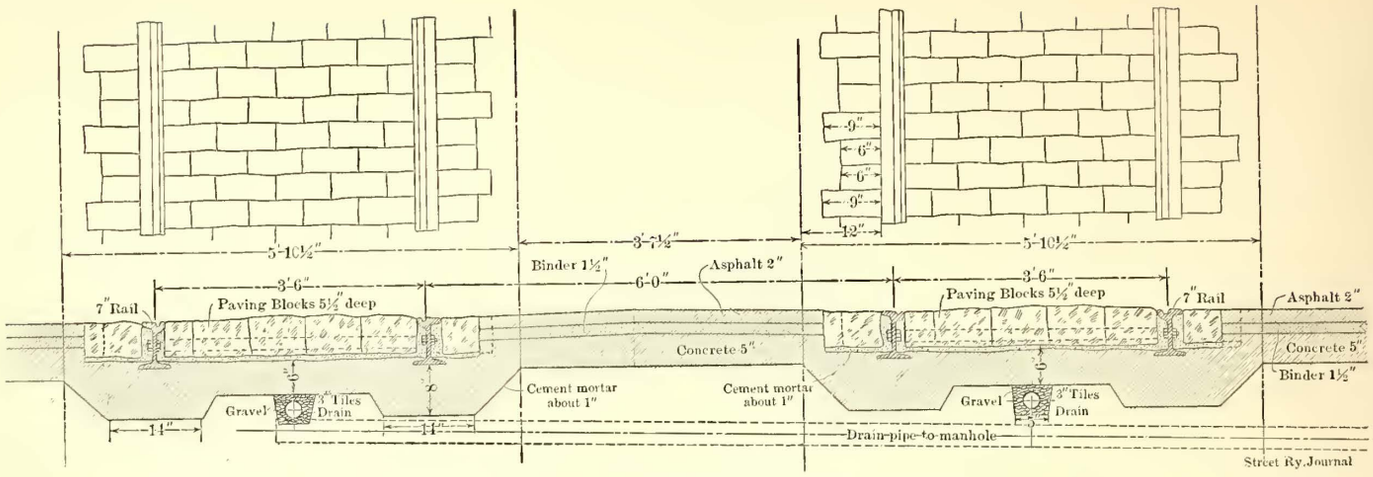


FIG. 16.—STANDARD PAVED STREET TRACK CONSTRUCTION

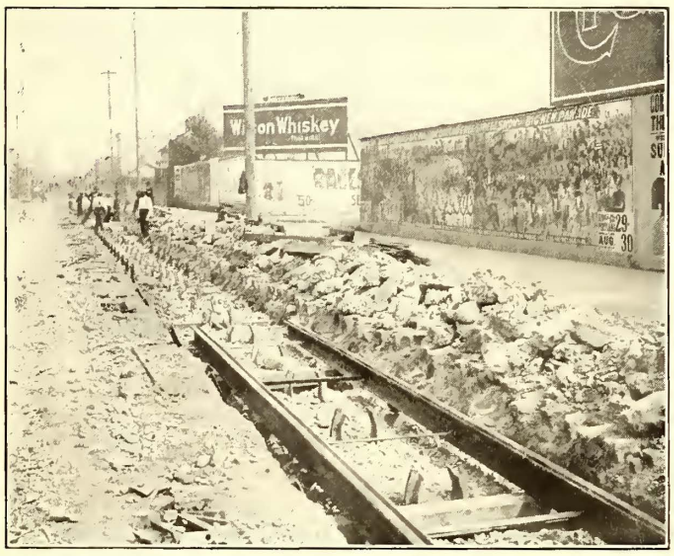


FIG. 12.—NORTH FIFTH STREET, PREPARING TRENCH OF OLD CABLE TRACK FOR NEW RAILS

FIG. 14.—PREPARING CEMENT MORTAR AND LAYING BASALT PAVING BLOCKS IN NEW TRACK

FIG. 13.—MAKING THE BED FOR THE PAVING BLOCKS AND LAYING NEW TRACK ON CONCRETE STRINGERS

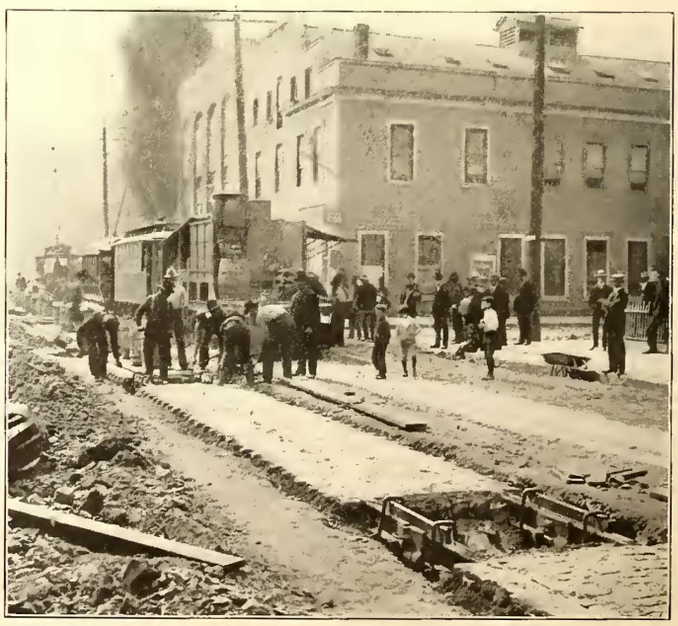


FIG. 15.—FINISHED SECTION OF TRACK AND CAST-WELDING OF JOINTS ON EAST TRACK ONLY

Fifth Street just after the street work was completed. The company is required to pave between and within the tracks, and to a distance of 1 ft. on each outer side. These tracks are laid on 10-ft. centers, but the standard construction on the other lines is 9 ft. 6 ins., this width being required by the narrowness of the streets throughout the city.

For emergency use on some of the streets, the company has installed raised cross-overs of Mr. Fuller's design, which leave the main track rails unbroken and perfectly smooth. For guard rail on curves, and also on some of the special work, old horse car rail has been used, being installed vertically with the ball up and with cast-iron fillers between it and the main rail. This construction has served the purpose well and has been used throughout the system.

At the intersection of Fifth and Washington Streets there has been installed an expensive piece of special work, consisting of a double-track crossing with two double-track and one single-track connecting curves. Grooved 101-lb. 7-in. rail is used, with a cast-welded construction and chrome-steel inserts. It is laid on 8 ins. of concrete and paved with stone blocks grouted in. The track is drained to sewer manholes with drain pipe. The crossing and switches were built by the Paige Iron Works, of Chicago.

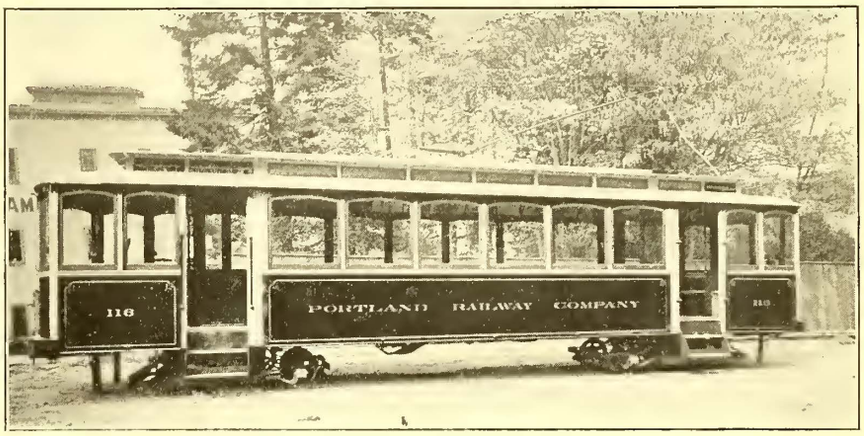


FIG. 17.—STANDARD COMBINATION CAR BUILT BY PORTLAND RAILWAY COMPANY

STANDARD CARS

The company has obtained good results from the standard type of double-truck cars which it has built after plans prepared by Mr. Fuller. One of these cars is illustrated in Fig. 17, while Fig. 19 is a plan drawing of the car. The closed section is 20 ft. 4 ins. long, and each vestibule is 8 ft. 9 ins. long, making the total length of the car 38 ft. The long vestibules allow room for 5-ft. longitudinal seats at the sides. During pleasant weather the windows are left open, and the effect is that of an open-ended car like the California type. In all kinds of weather these vestibules are used by smokers. The closed section has longitudinal seats, which are covered with carpet to give the car interior a tone of warmth and cheerfulness. The seating capacity of the car is forty-eight.

FIG. 16.—COMPLETED PORTION OF NEW TRACK ON NORTH FIFTH STREET JUST AFTER STREET WORK WAS COMPLETED

The company now has twenty-two cars of this type. They all have been built in the company's own shop, and, as may be noticed from the illustrations, are distinguished by several interesting features. For side sills there are used 8-in. I-beams, 34 ft. in length. Being set in to the extent of 8 ins., they allow the steps to be recessed that amount. A double step is used, the top tread being partially supported by the lower web of the sill. The motorman's space is partitioned off from the rest of the vestibule, as is shown in Fig. 18, by an iron-pipe railing, about 30 ins. high, open at the inner end. Sheet-iron curtains hang from the railing to prevent the feet of passengers from interfering with the motorman. Under the vestibule seats are sand boxes, lockers with spring doors for the trainmen, and open spaces in which car-wheel replacing irons and jacks are kept. All the standard cars are equipped with DeWitt sand boxes.

An unusual arrangement of the doors of the closed section consists in their being placed as far on one side as the seat inside will allow, as may be noticed in Fig. 19. The reason for this is two-fold: the arrangement allows the use of a single 2-ft. 5-in. door and also throws the rear entrance to the right, thus facilitating the unloading and loading of passengers; and also, by leaving only a narrow space between the right hand steps and the door opening, prevents the crowding of standing passengers in the direct passage way of those passing into or out of the closed section. When the door is pushed back there is a clear opening of 2 ft. 2 ins. The narrow panel at each end of the closed section is 1 ft. 7½ ins. wide, and the large one 2 ft. 5 ins. in width. The cars are plainly but attractively finished in oak, and are provided with push buttons, the bell signals being used merely to attract the attention of the conductor and not for signaling the motorman.

In addition to the cars above described, which have been built complete in the shops, the company has rebuilt eight cars along the same lines, a reconstructed car being shown in Fig. 20. For this type, old 16-ft. car bodies were used, and new vestibules were built on, as shown, the completed car being 34 ft. long, and having a seating capacity of forty-four people.

For summer use the company has built also eleven open 39-

ft. cars of the type illustrated in Fig. 21. They are framed on 8-in. I-beam sills, with 4-in. x 8-in. wooden sills on the outside, from which are supported running steps the entire length of the car. The seating capacity is fifty-two, there being ten short double seats on each side of a center aisle, and two longitudinal end seats which are placed back to back, with space between for the motorman. The seats, all but those at the end, have reversible wooden backs. The center aisle is 14 ins. wide between arm rests. Glass vestibules are placed at the ends, and the sides are protected during inclement weather by curtains rolling up inside the car.

Fig. 22 illustrates a combination car recently built by the company, which was designed for use as a passenger, freight or construction car. Primarily it will be used for construction purposes, and is built so that 60-ft. rails can be carried on both sides of the cabs. If used for passengers it will be fitted up as a moonlight excursion car, and movable benches have been built which fit onto the car floor and are securely held in position by the side posts. The car is equipped with magnetic track brakes so that it can be used on the new Portland Heights line.

The standard equipment for all the passenger cars consists of two GE 58 motors, K-11 controllers and a double-lever hand brake, which will receive mention below.

STANDARD TRUCKS

The motors are mounted on the company's standard truck, which has been designed by Mr. Fuller. It is of the maximum traction type, that form being required on account of the many steep grades and short curves on the Portland lines. One of the trucks is shown in the foreground of Fig. 23, while Fig. 24 illustrates its design. It is built of a cast-steel frame and yoke, the side-frame castings being bolted together by means of angle irons. Fig. 25 shows the form upon which the side frames are placed and bolted accurately into position.

DOUBLE-PURCHASE LEVER BRAKE

All of the standard cars of the company are equipped with a double-purchase lever brake of Mr. Fuller's design. The details of this brake are shown in Fig. 26. The two hand levers are both connected to the same brake rod, through an auxiliary lever link. When the right hand lever is pulled way over, it moves the brake rod through about three-fourths of its travel, and the left lever is used when necessary to complete the travel. A very flexible braking device is thus afforded. As a rule, for ordinary stops and braking on down grades, one lever is sufficient, but when the car is to be held on a grade or to be brought to a quick stop, both are brought into play.

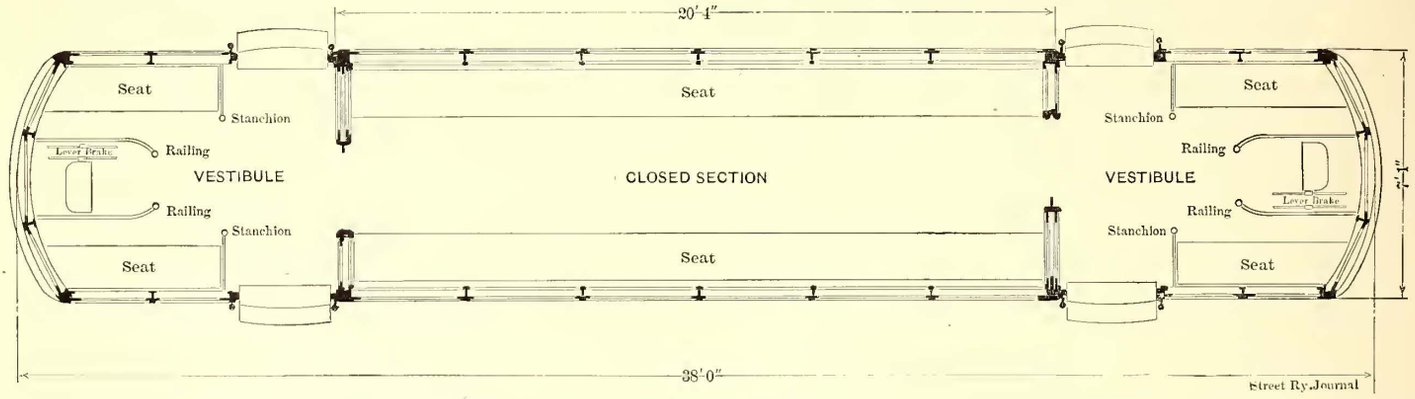


FIG. 18.—PLAN OF THE PORTLAND RAILWAY COMPANY'S STANDARD CAR

MAGNETIC BRAKES FOR PORTLAND HEIGHTS LINE

For operation on the Portland Heights line, the company purchased ten new cars of the Brill semi-convertible type, with 28-ft. bodies. They are mounted on 27-G trucks, equipped with four GE 58 motors. The sand boxes are arranged so that the motorman can open both of them from either end of the car, this provision being especially useful on grades when it is necessary to sand the rear truck. All of these cars are equipped with the Westinghouse magnetic traction brakes, on account of the heavy grades. On one of the cars, Mr. Fuller has installed a special brake rigging for connection to the hand brake, and by means of this about three times the braking effort is obtained than is possible with the rigging installed by the manufacturers. The design of this special arrangement, with the exception of some slight changes which have since been made in the details of construction, is illustrated in Fig. 27. The attachment provides for independent inside-hung brakes instead of hanging outside as on the other cars. The new arrangement has worked very satisfactorily.

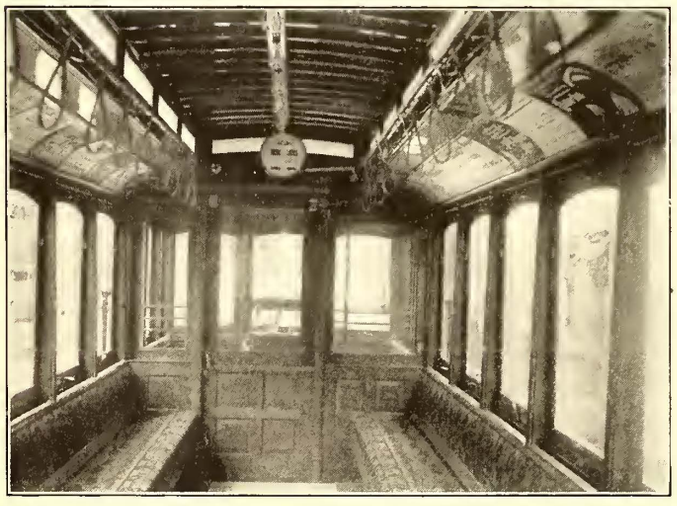


FIG. 19.—END OF STANDARD CAR, SHOWING DOOR SET OVER AT ONE SIDE

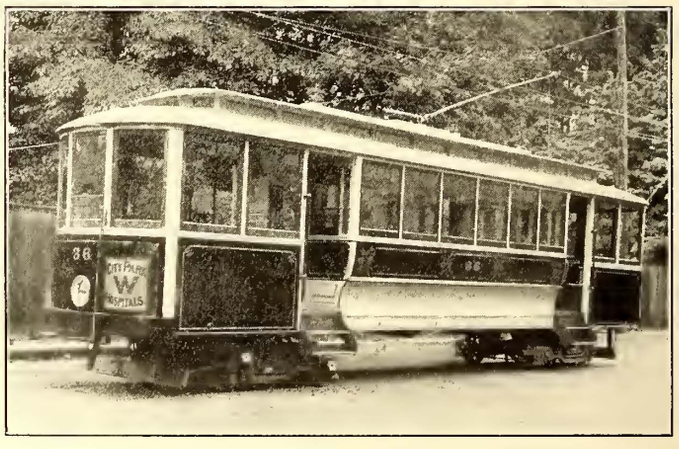


FIG. 20.—STANDARD RECONSTRUCTED CAR, BUILT BY THE PORTLAND RAILWAY COMPANY

REPAIR SHOPS

The main repair shops for the Portland Railway system are conveniently located on Washington Street at the junction of the Willamette Heights and the new Portland Heights lines. The main building, shown in Fig. 28, has a paint shop, lumber storage, boiler room and three storage tracks on the ground floor; the entire second floor, 67 ft. x 178 ft., being given up to the carpenter shop. Back of this building are car houses, repair shop and armature, blacksmith and machine shops.

That the carpenter shop is a well-lighted floor may be seen from the pictures, Figs. 29 and 30. The former shows several of the standard cars of the company nearing completion, and the latter is a view of the woodworking shop at the other end of the room. The machinery equipment comprises a rip saw, sticker, planer, joiner, combination saw, mortiser, tenoner, sander, shaper, boring machine, pattern lathe, band saw, and cut-off and dado saw. The band saw was designed and built in the shops, and is said to give as good satisfaction as, if not better than, one from a regular manufacturer. All the machines are connected with the boiler furnace by means of a shaving exhaust, so the room is always neat in appearance. Power for the operation of the machines is supplied by two Sprague motors. The elevator used to carry the car bodies between the first and second floors is shown at the right in Fig. 31. It is 40 ft. x 10 ft. in size, and is hoisted by means of four steel cables operating over drums driven by a Sprague motor.

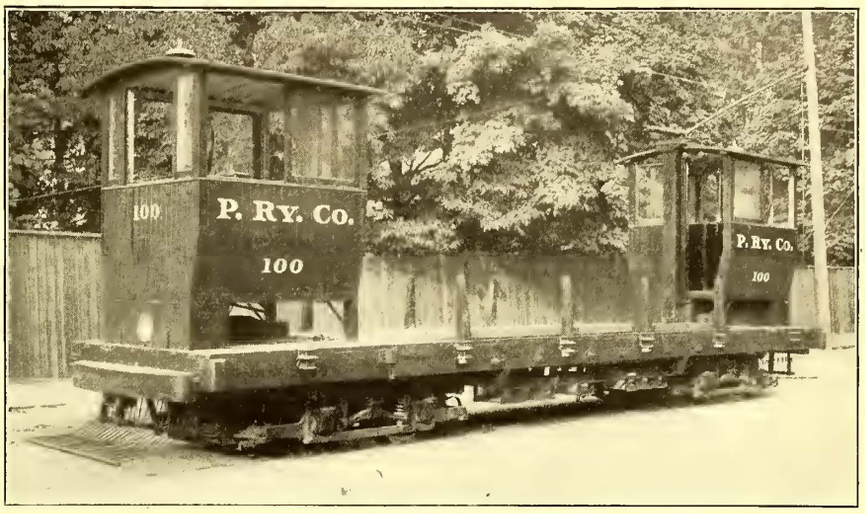


FIG. 22.—COMBINATION CAR BUILT BY PORTLAND RAILWAY COMPANY

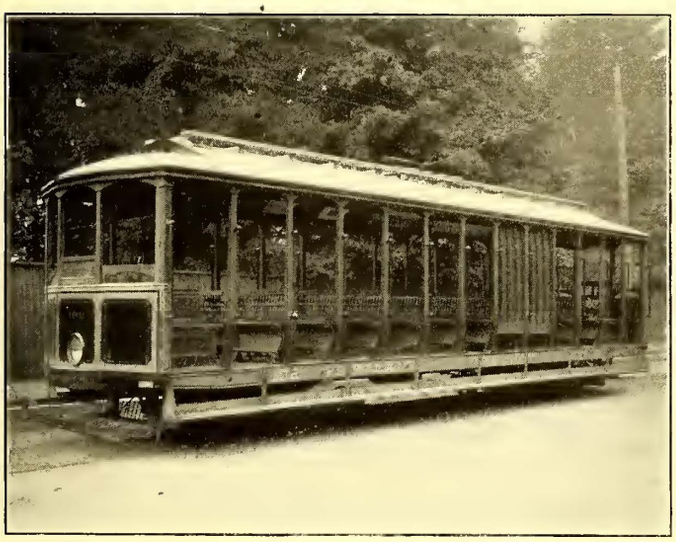


FIG. 21.—OPEN CAR BUILT BY PORTLAND RAILWAY COMPANY

In the main repair shop light repairs are made in the pits, but when it is necessary to remove the trucks, the car bodies are lifted by means of the sling hoist illustrated in Fig. 23. The car rests on two cross timbers, to the four ends of which are hooked cables that hang from the ends of two longitudinal beams above the car. The front and rear ends of these beams are in turn respectively connected by cables to two hand blocks

FIG. 23.—VIEW IN REPAIR SHOP, SHOWING SLING CAR HOIST AND STANDARD MAXIMUM TRACTION TRUCK

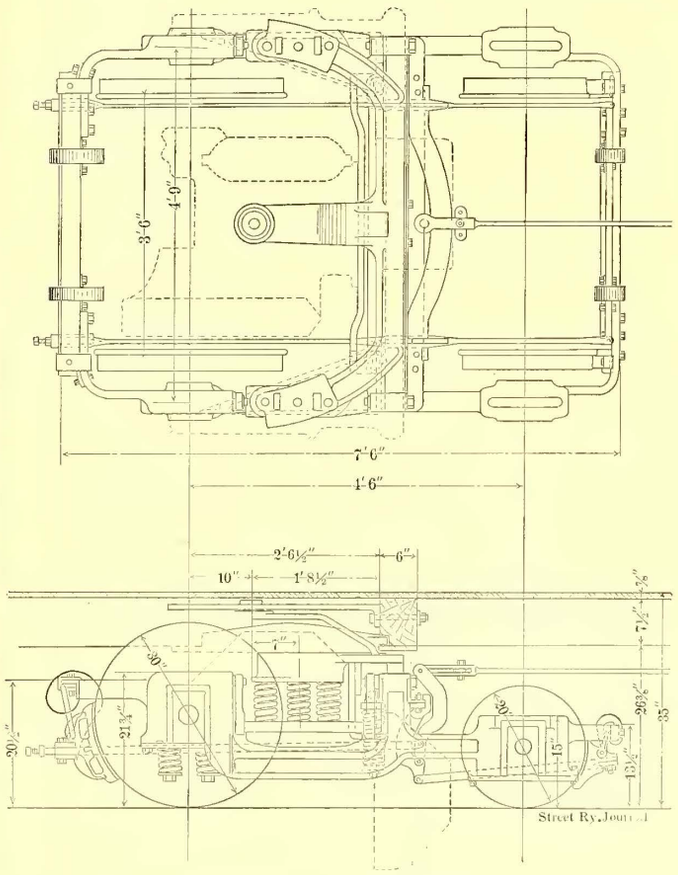


FIG. 24.—THE PORTLAND RAILWAY COMPANY'S STANDARD MAXIMUM TRACTION TRUCK

which are operated from the floor. This method of lifting a car is a simple but comparatively rapid one, and it has the advantage of hoisting the body evenly and without wrenching, as is apt to happen when jacks are used.

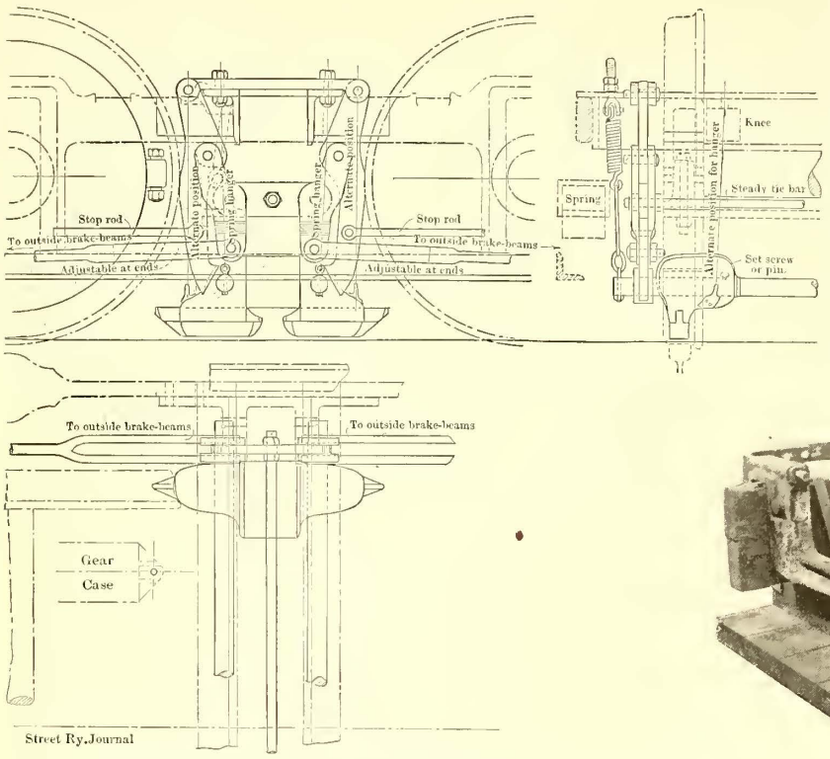


FIG. 27.—SKETCH FOR ATTACHMENT OF SEPARATE WESTINGHOUSE MAGNETIC BRAKE RIGGING

ARMATURE SHOP

There are several interesting kinks in connection with the methods and apparatus used in the armature shop. For a baking oven a pit in the floor is used. It is 4½ ft. wide, 7 ft. long and 5 ft. deep, and is constructed with concrete walls, the trap door being lined with asbestos. In the bottom are set five sections of No. 12 galvanized-wire coils, the total current taken being between 6 amps. and 7 amps. The walls are arranged so that if desired sheet-iron partitions may be set in across the pit, dividing it into five sections, if different degrees of heat are required. At the ends of the pit are placed iron doors which, when open, allow the shafts of large armatures to project through the end walls, thus affording accommodation for large pieces of work. Considerable outside armature repairing is done for other railways and electrical companies in Portland. In the oven just described, a large armature is baked thoroughly in three days, while ordinary railway armatures require but twelve hours. Fig. 32 gives a good view of the pit and an armature suspended over it by means of a block and chain from a small traveling crane which serves most of the armature shop. The armature is hung in a special stilyards type of saddle that was designed in the shops.

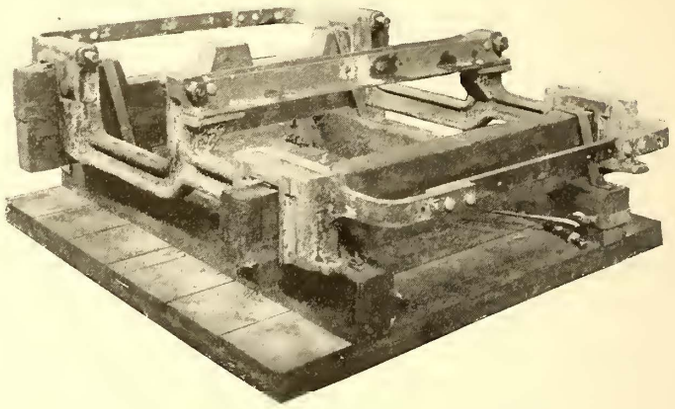


FIG. 25.—FORM FOR ASSEMBLING STANDARD TRUCK FRAME

Although the shop is small, the facilities are such that a GE 58 six-turn or four-turn armature can be completely recoiled and repaired, ready to put in the motor in twenty hours, this time not including that required for baking. As already mentioned, a considerable amount of outside work is done in the shop, and Fig. 33 shows an armature for a 200-kw Edison bipolar 500-volt generator, which was nearing completion when the photograph was taken. Furniture shellac is used for all winding work. There has been very little field-coil repairing necessary.

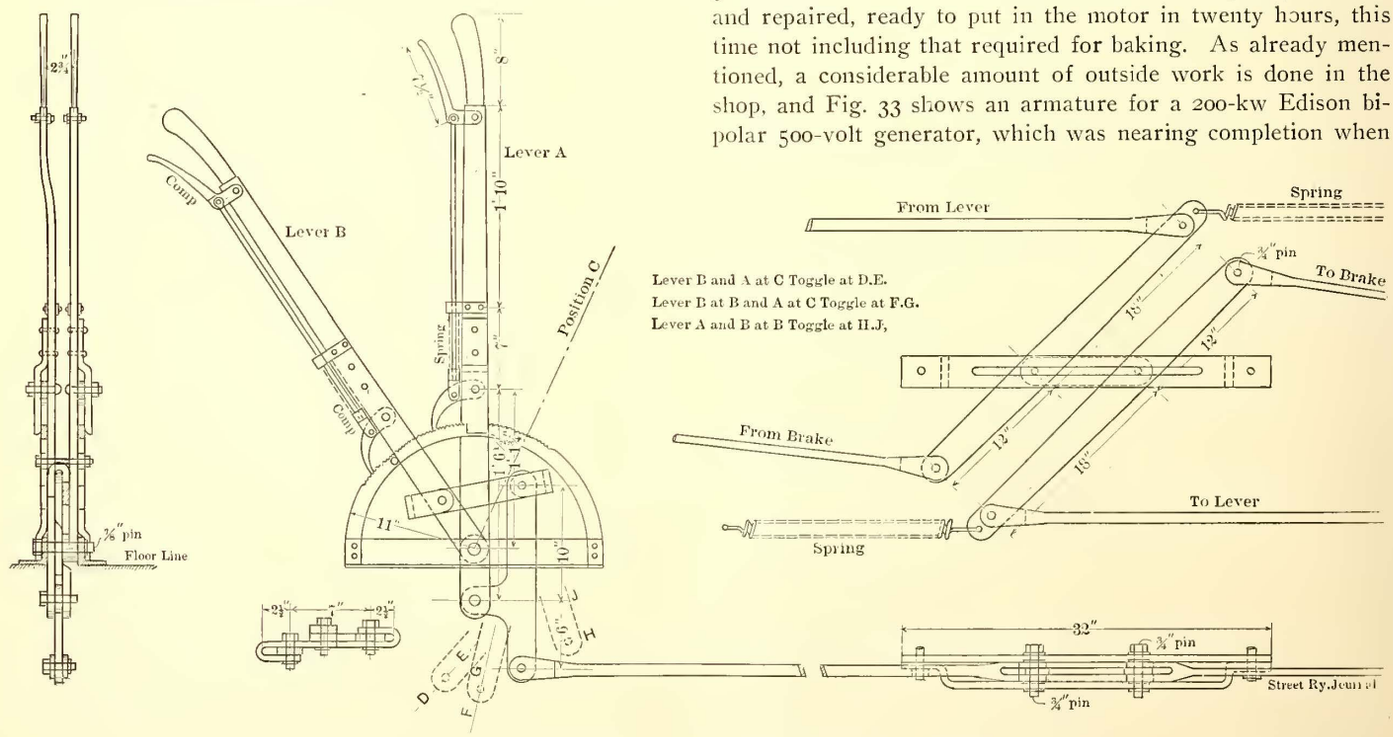


FIG. 26.—OPERATING DETAILS OF DOUBLE-PURCHASE LEVER BRAKE

Fig. 33 also shows the form of band-wiring horse used. It is turned by hand by a 4:1 gear and pinion. In Fig. 34 at the right is illustrated the horse used for winding field coils. The form is turned by a crank on a geared pinion, in the same way

as in the banding machine. At the left of this picture is shown a commutator-segment compressor designed in this shop for use in forming commutators for Edison No. 14 and Westinghouse No. 3 motors. The commutator segments are held by ring pieces that fit inside of an iron band, the compression being exerted by bolts that bear normally on the sixteen different pieces. There are thirty-two of these bolts, two for each ring piece. Although it takes a little time to tighten up all the bolts, yet any pressure desired can be obtained and held as long as wished. For winding GE 800 armature coils, the foreman has adopted the form used by the Columbus (Ohio) Railway & Light Company, which was illustrated and described in the STREET RAILWAY JOURNAL of July 9, 1904, for its merit was readily recognized.

A tool that has been found very useful in the armature shop is a Curtiss & Mitchell paper or card cutter. It is used principally for cutting and trimming fibre and paper, but can be used equally well on cloth or tin.

FIG. 28.—REPAIR SHOP AND CAR HOUSES OF PORTLAND RAILWAY COMPANY

OPERATING FEATURES

For the operation of the lines of the Portland Railway Company, the system is divided into three divisions—i. e., into the Traction division—embracing those lines formerly owned by the Portland Traction Company; the Multnomah division, taking in the rest of the city lines west of the river; and the Portland & Vancouver division, including the lines in East Portland and the suburban road to Vancouver, Wash. The principal one is the Multnomah division, with headquarters at the Washington Street car house.

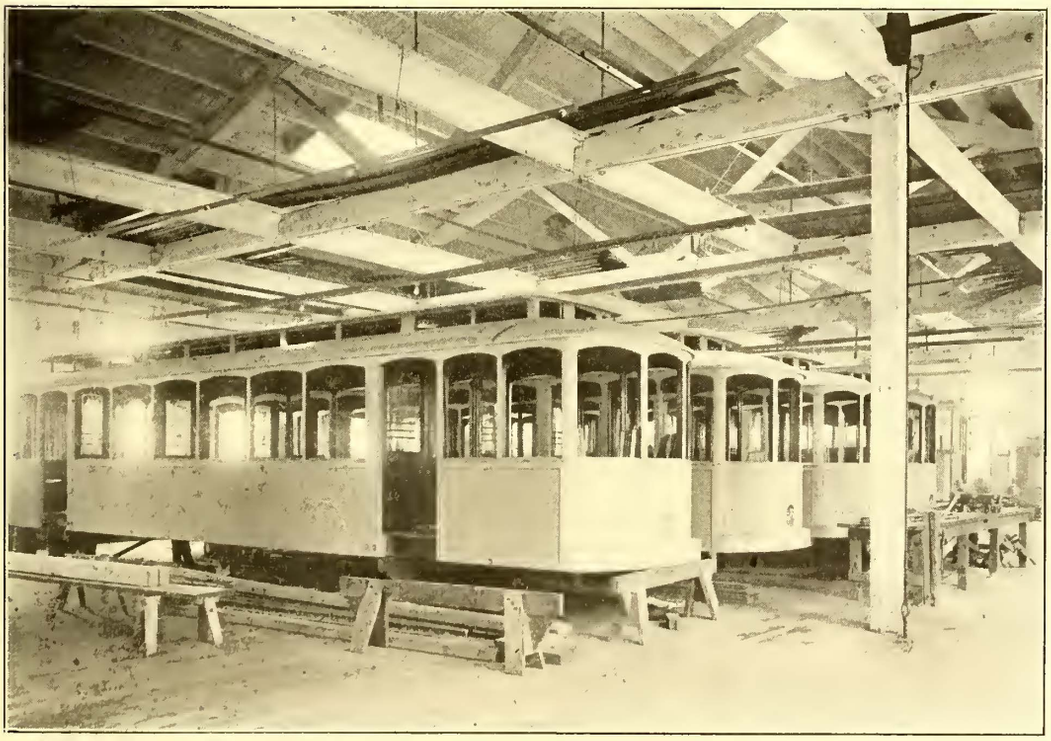


FIG. 29.—CARPENTER SHOP, SHOWING STANDARD CARS NEARING COMPLETION

At the head of each division is a superintendent, who has entire charge of the men under him, the three superintendents reporting directly to the general manager. In employing new men, the candidates are required to fill out an application blank, in which the applicant answers the customary questions as to age, weight, height, health, use of intoxicants, profession or trade, etc. Spaces are provided for a complete record of the applicant's employment during the previous five years, and at the bottom of the form are given the names and addresses of not less than five persons as possible references. When an application is filed, the references are sought and the man's record carefully investigated. After being engaged, he is required to give of his own time four or more days to breaking in. He is placed in the hands of competent regular trainmen for instruction, each of them being required to sign a "Carmen's Certificate of Efficiency," Fig. 35, declaring the student's competency. Each of these certificates is turned in to the superintendent's office and filed, together with the candidate's application and letters of recommendation, in a large envelope and kept as a permanent reference. Then the man buys a cap and is placed at work on trial for thirty days. If at the end of this period he is considered competent, he is instructed to buy a uniform and to make a deposit of $20. He then enters into the permanent employ of the company. The schedule of wages now in force is 21 cents an hour for the first year, 22½ cents for the second year, 24 cents for the third, and 25 cents thereafter. The oldest men in service are given the choice in runs, new assignments being made whenever there is a vacancy caused by resignation or discharge. Discipline is enforced principally by repri-

mands, suspensions being used to only a very small extent.

On one of the divisions the blank shown in Fig. 36 is used for keeping a record of extra men. When a man is given a run he is credited with the number of hours, and this, added to the time he has previously completed, indicates his standing as to total number of hours employed. Only the last two figures are used in the total, as the hundreds are not necessary to indicate who has worked least and should accordingly receive the next assignment. This record is made up each afternoon and posted for the next day.

The trainmen use a special report, Fig. 37, for reporting general damages to cars, line and track, interruptions to service, etc. Fig. 38 is a defect report made out by the division superintendent to the shop foremen, calling their attention to repairs needed. These reports are signed by the foreman and returned when the repairs are made.

For use on the new Portland Heights or Ford Street line, the special report, Fig. 39, is designed, the trainmen reporting thereupon all damage to the new cars on that line, and especially any accidents to the magnetic-brake equipment, so that a complete record can be kept on that type of apparatus. An account of the repairs made is noted on the back of the report.

Fig. 40 is the carmen's daily time report, which each man fills out and turns in at the end of his day's work. These reports are used in checking up the men's time. There has been provided in the trainmen's rooms a special vertical case with pigeon holes ¼ in. high and the size of the blanks for the filing of reports by the men. The fronts of the partitions are cut in in curves so that the slips can be removed with facility in their proper order. The accident report is in the customary form.

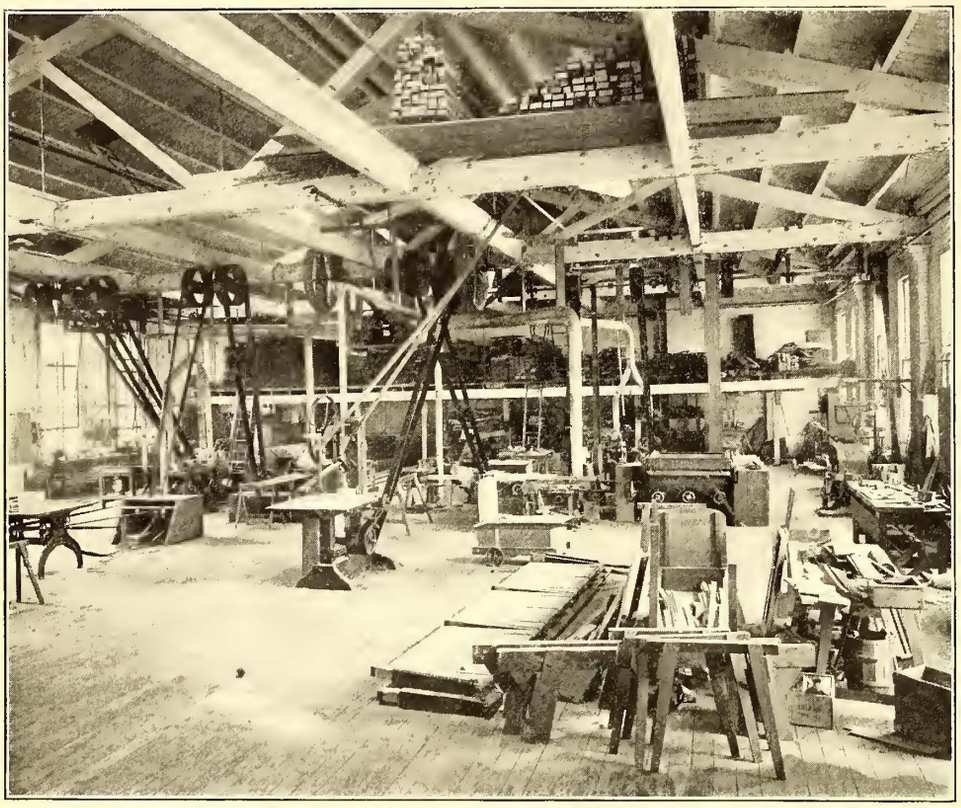


FIG. 30.—WOOD-WORKING SHOP, PORTLAND RAILWAY COMPANY

PORTLAND RAILWAY CO.

Special Report for the Ford Street Line

I received Car ____ *from* ____ *at* ____

____*M., and after running* ____ *trips*

on reaching ____ *Street, going* ____

I noticed that the ____
(STATE THE TROUBLE)

Thinking it best I ____
(STATE FULLY ALL THAT WAS DONE)

Name ____ *Date* ____ *190*__

FIG. 39.—SPECIAL REPORT FOR THE FORD STREET LINE

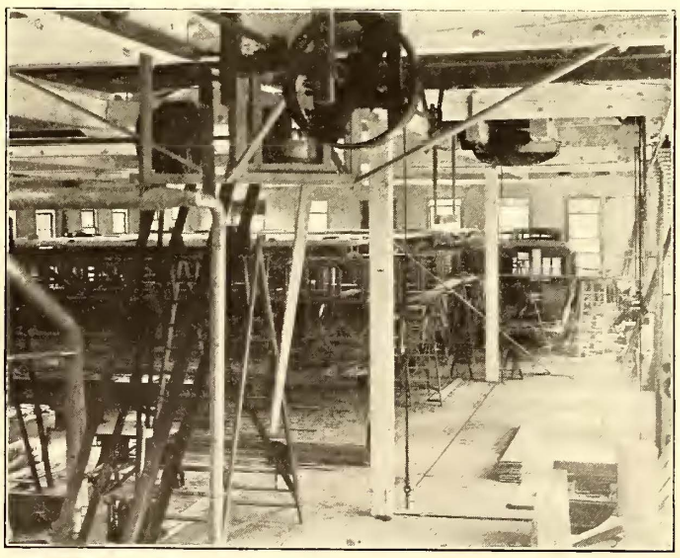


FIG. 31.—CARPENTER SHOP, SHOWING CAR ELEVATOR

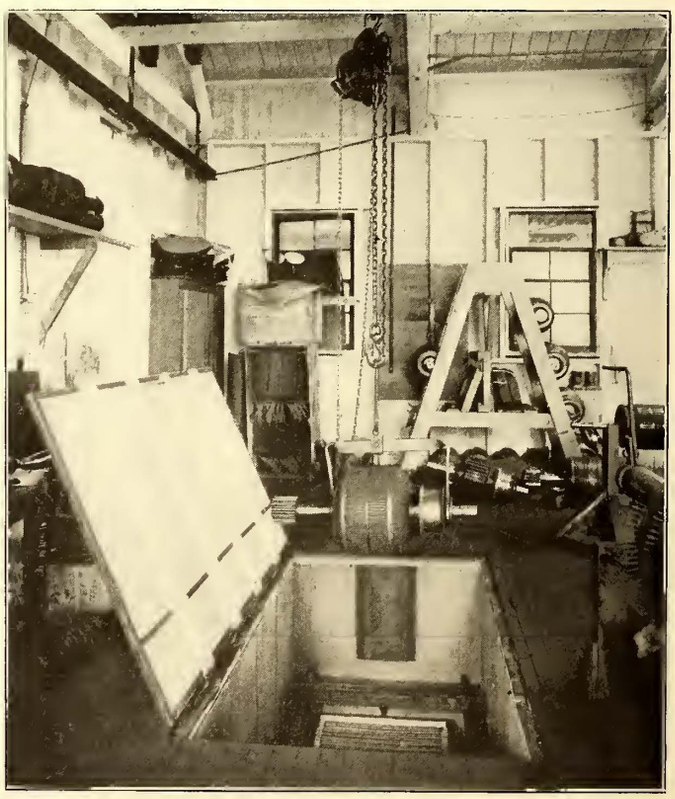


FIG. 32.—BAKING OVEN IN ARMATURE SHOP

CONCLUSION

F. I. Fuller, the general manager of the Portland Railway Company, is a practical civil engineer, and in addition to his operating duties, has supervised all the engineering work of the company, besides, in a great many cases, some of which have been noted, designing and constructing special apparatus and equipment to increase the efficiency of the system. Mr. Fuller went to Portland from Providence, R. I., and was appointed manager of the Portland Cable Railway Company in 1892, two years after the building of that system. In 1894 he took a similar position with the Portland Traction Company, and remained there until 1900, when, upon the consolidation of the Traction Company and the Portland Railway Company, under the name of the latter, he assumed the general managership, which position he still holds. Recently Mr. Fuller has been elected to the same office in the new Portland Consolidated Railway Company, a union of the Portland Railway Company and the City & Suburban Railway Company, embracing 120 miles of track.

The operating and shop officials of the Portland Railway Company, who, together with Mr. Fuller, assisted in the gathering of the above notes, are as follows: Division superintendents, F. Cooper, J. G. Mann and R. Sloan; foreman of machine shop, W. Fragmeier; foreman of woodworking shop, H. Vander Worth; foreman of paint shop, F. J. Bates; foreman of armature shop, Charles Gehrig; foreman of track department, John Bond.

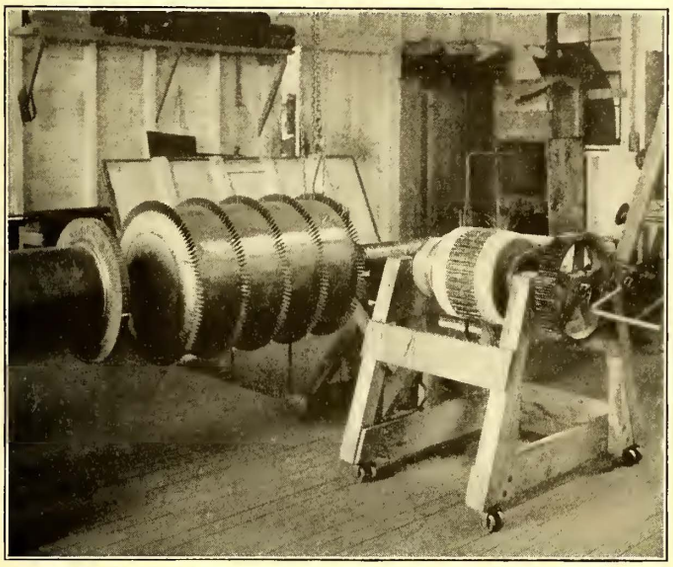


FIG. 33.—REWOUND 200-KW ARMATURE AND BAND WIRING HORSE IN ARMATURE SHOP

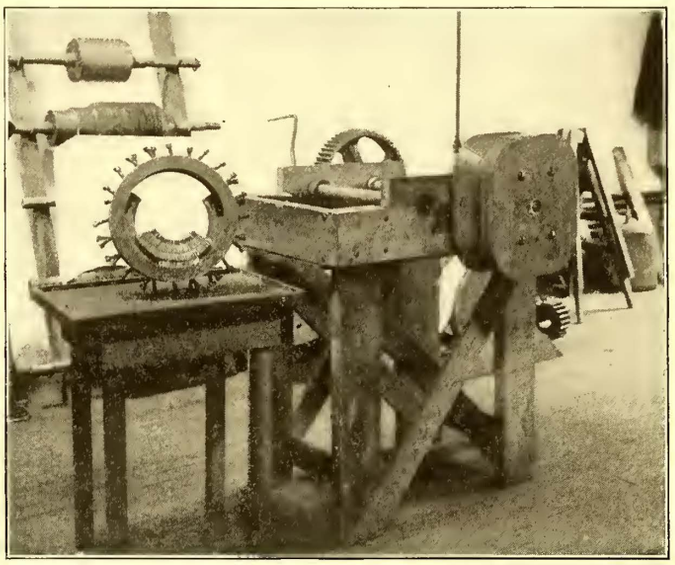


FIG. 34.—FIELD-COIL WINDING APPARATUS AND COMMUTATOR-SEGMENT COMPRESSOR IN ARMATURE SHOP

PORTLAND RAILWAY COMPANY.
CARMEN'S CERTIFICATE OF EFFICIENCY.

Mr _____ has received instructions under my direction as _____ and in my opinion I consider him competent in the capacity above mentioned.

Name _____ Line _____ Hrs. _____ Date _____ 190__
Name _____ Line _____ Hrs. _____ Date _____ 190__
Name _____ Line _____ Hrs. _____ Date _____ 190__
Name _____ Line _____ Hrs. _____ Date _____ 190__

FIG. 35.—CARMEN'S EFFICIENCY REPORT, MADE OUT BY INSTRUCTOR

PORTLAND RAILWAY CO.

RECORD FOR EXTRA MEN

MOTORMEN	HOURS Credit	Added	Total	Rank	RUN	CONDUCTORS	HOURS Credit	Added	Total	Rank	RUN

FIG. 36.—RECORD OF RUNS GIVEN TO EXTRA MEN

PORTLAND RAILWAY COMPANY

CARMEN'S SPECIAL REPORT

ALL ACCIDENTS MUST BE REPORTED ON ACCIDENT REPORTS FOR THAT PURPOSE

Date _____ 190__ Car No. _____
Cond. _____ No. _____
Motor _____ No. _____
Time _____ M. Direction _____
Line _____
Place _____
Report below all Damages to Cars, Line, Track, Interruption to Service, Controversies with Passengers, etc. or any Repairs needed.

Return this report into office of your division at the end of your day's run

FIG. 37.—CARMEN'S SPECIAL REPORT REGARDING DAMAGES TO EQUIPMENT, ETC.

PORTLAND RAILWAY CO.
DEFECT CARD.

No. _____ DATE _____ 190__
Mr. _____ Repairs are needed.
To _____

Signed _____
When repairs are made, sign and return to the above.

DATE _____ 190__
Mr _____ Repairs made this date.
To _____

Signed _____

FIG. 38.—DEFECT CARD

PORTLAND RAILWAY COMPANY

CARMEN'S TIME RETURN

Badge No. _____ Date _____ 190__

RUN	CAR No.	ON CAR	OFF CAR	TIME	WORK
		M	M		
		M	M		
		M	M		
		M	M		
		M	M		

Name _____ Total time _____

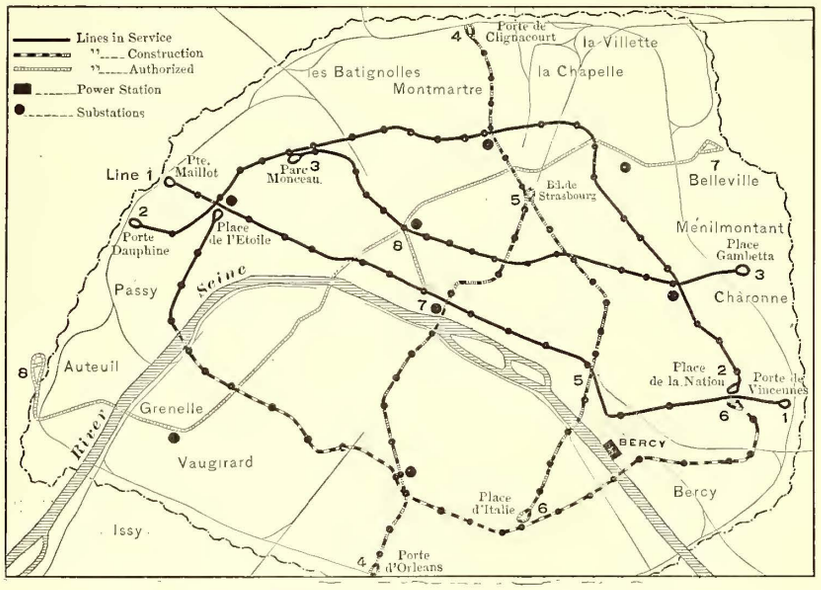
FIG. 40.—CARMEN'S TIME RETURN BLANK

DETROIT-CLEVELAND ELECTRIC TRIP.

Officials of the Lake Shore Electric Railway and the Detroit, Monroe & Toledo Short Line recently made a trip over the two lines from Detroit to Cleveland in six hours. The companies are making arrangements to run through limited cars from Cleveland to Detroit, and it is expected that the schedule will be seven hours for the 177 miles. This will be the longest continuous run in the country.

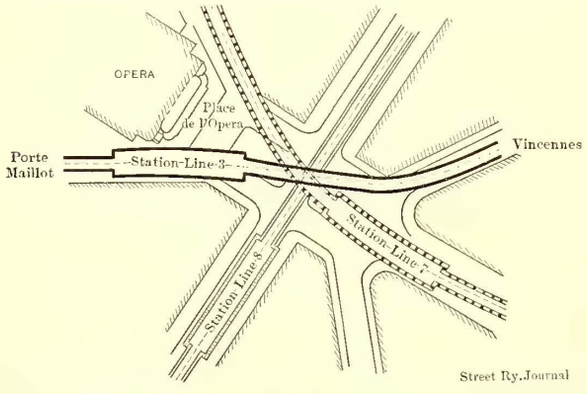
RECENT DEVELOPMENTS ON THE PARIS-METROPOLITAN RAILWAY SYSTEM

The comprehensive transportation system of the Paris-Metropolitan Railway has been brought one step nearer completion by the opening of line 3, running from Courcelles, in the northwest of the city, skirting the Gare St. Lazare station and passing the Opera to the Place Gambetta, just beyond Père Lachaise Cemetery in the east. Until the opening of this section, the length of lines in service was about 24 km (15 miles). Line 3, now open, divides the irregular ellipse formed by the first two lines, serves the central boulevards of the city and adds 5 miles to the system. The southern portion of line 2 is also practically ready for service, and only requires the completion of the two bridges over the Seine—one at Passy and the other close to the Pont de Bercy—to form a circle with the northern portion. These two bridges will be ready for service during the first half of 1905.



MAP OF THE PARIS METROPOLITAN RAILWAY

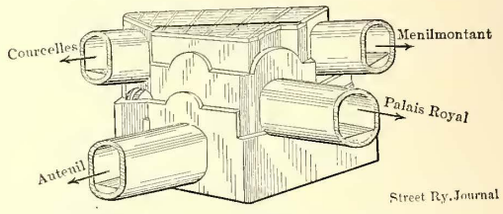
Reference to the accompanying map will show that the lines of the Metropolitan Railway, in service, constructing and authorized, number eight, none of which will extend beyond the city walls. To be sure that the operations of the railway should be confined to local transportation, the National Government originally specified that the Paris municipality should install a narrow gage. The gage of 1.44 meters now in service was agreed upon later, but the tunnel dimensions remain as first designed—that is, a few inches smaller than the standard required by the French railway cars. The object of this was, of course, to prevent the rolling stock of the Metropolitan lines being used on other systems, and vice versa. It is difficult to see the practical value of this step, which may ultimately prove a great drawback, but the feeling between the State and the municipality appears to have played an important part in the question.



PLAN OF CROSSINGS OF LINES 3, 7 AND 8 AT THE PLACE DE L'OPERA

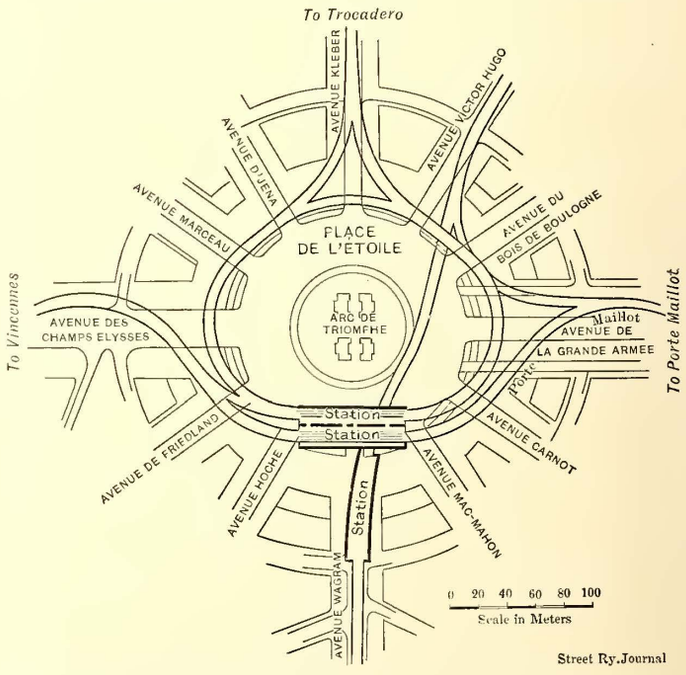
It will be remembered that the cost of constructing the tunnels is defrayed by the municipality, while the operating company provides the rolling stock, track, lighting, signaling, etc. The rent charged by the city for the subway amounts to about 30 per cent of the gross receipts.

From the last annual report of the Metropolitan Railway Company it appears that the rolling stock in service over the 24 km then operated, consisted (May, 1904) of 132 motor cars and 462 trail cars. Since this time a number of cars have been added.



PERSPECTIVE OF CROSSING OF THE THREE LINES AT THE PLACE DE L'OPERA

The trains normally are made up of one motor car and three trail cars. During rush hours they consist of two motor cars and five trailers, the second motor car being placed either at the head or rear of the train, according to convenience. Immediately after the disaster of Aug. 10, 1903, it was recommended that the two motor cars should always be coupled at the head of the train, the safety being presumably greater, but the old way of coupling the motor cars at each end of the train has again come into vogue.



PLAN OF CROSSINGS OF LINES 1 AND 2 AT THE PLACE DE L'ETOILE

Before leaving the two lines already in service, it should be stated that a number of the Westinghouse motor cars in use on them have recently been provided with the Westinghouse electro-pneumatic system of control, sixty equipments in all having been installed. These equipments are intended for use only on line 2 (Nation-Etoile), and are mounted on double-truck cars, with a length of 13 m, three motor cars being used per train. The use of double-truck cars on this line presented certain dif-

ficulties, due to the fact that the tunnel was not constructed with a view to their use. On line 3, and succeeding lines, the tunnels have been devised for the use of longer cars, and in consequence the trains are of greater carrying capacity.

It has been found by actual test that there are a number of advantages in placing the motor cars at rear and head of trains. Contrary to some expressed opinions, no danger of derailment has been proved, and the movement of the train, especially during acceleration, is much more regular than with two motor cars at the head. The motors used (two per car) on the two-axle cars of line 2 are called TH-4, and are rated at 245 amps. at 500 volts (one-hour rating), with a temperature rise of 75 degs. C. The gear ratio is 2.30.

On line 3 an intense traffic is anticipated, and this fact and the uneven profile were the principal reasons for adopting the multiple-unit system of train control The length of each car is 14.5 m (44 ft. 3 ins.), and five cars per train are used, the first, third and fifth being motor cars. Two motors per car are installed, each of 175 hp, with a gear ratio of 2.44. The loaded train weight is 160 metric tons, each train having a capacity of 800 passengers.

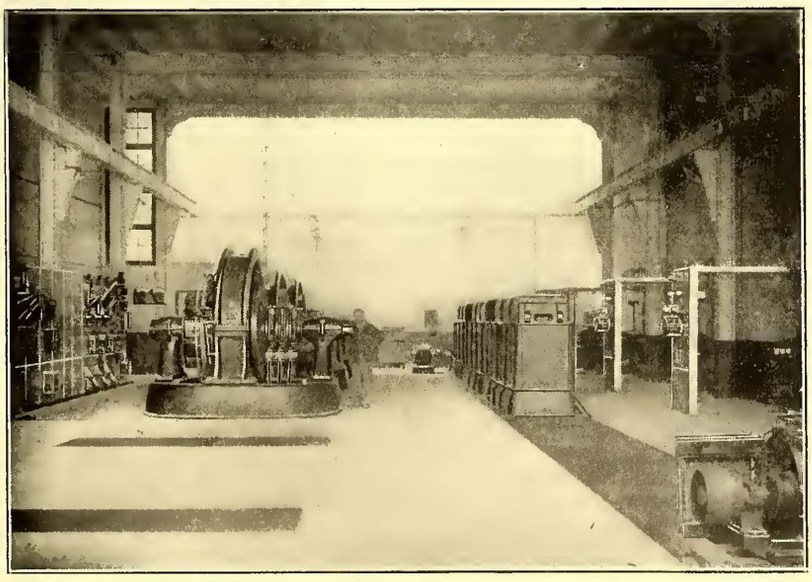
The lighting of the tunnel of line 3 is different in character to that of lines 1 and 2. The wiring is placed beneath the track and the small lead wires pass through insulating (Bergmann) tubes placed in the tunnel walls. In lines 1 and 2 bare wiring was used along the walls of the tunnel, 8 ft. from the surface of the track, and owing to the fusing of these wires during the accident of August, 1903, many lives were sacrificed. The station lighting was thereupon made independent of the tunnel circuit, which precaution is, of course, repeated in line 3. A trolley wire is also run through the tunnel of line 3 to enable repairing cars to circulate when the current is cut off from the third rail after service is suspended.

By far the most important work undertaken in connection with line 3 is the large passenger station in front of the Opera and the construction of the line between this point and the Gare St. Lazare (Ouest Railway Station). The Metropolitan lines are here very shallow and the cut and cover system was employed, so that the surface of the roadway rests on the steel structural work. The earth displaced by the Opera station was transported along tracks temporarily laid in the tunnel, by means of compressed air locomotives, to the Gare St. Lazare, and there taken away by the Ouest Railway, a special junction having been made for this purpose. In about ten months some 300,000 tons of material were removed by this means.

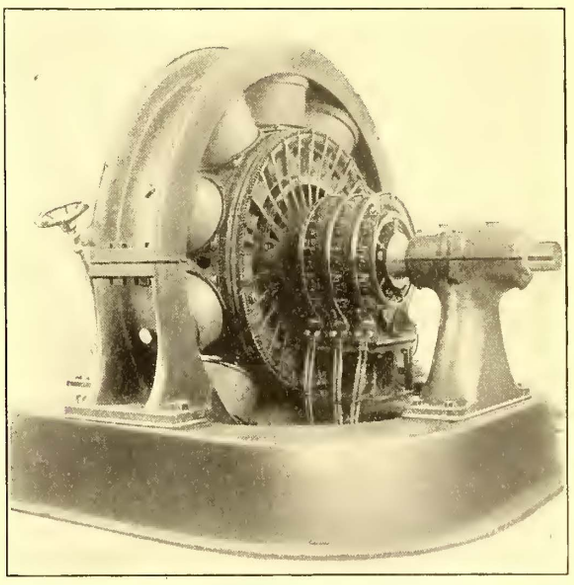
The Opera station consists of three tunnels superimposed, the track levels being 6 m, 11 m and 16 m, respectively, beneath the street surface. The top tunnel is used for line 3, the other two being destined for lines 7 and 8, which as yet are only proposed. The whole forms an exceedingly solid construction of reinforced concrete. The platforms are 75 m in length and 4 m wide. When lines 7 and 8 are constructed, elevators will be used between the various levels.

AN ELEVATED SECTION OF THE PARIS METROPOLITAN RAILWAY

The cost of the lines in service per lineal meter is: For line 1, Frs. 2,646; line 2 (N), Frs. 2,811; line 2 (S), over Frs. 3,095. The figures for line 3 are not yet complete, but estimates give Frs. 2,605 as an approximation. The higher cost of line 2 (S) is due to the fact that it is composed mainly of viaducts, and includes the expensive bridging of the Seine. The bridge at Passy will consist of steel cantilever, with roadway for ordinary traffic, over which is erected a steel superstructure for the Metropolitan lines. The Bercy bridge is formed of masonry arches.



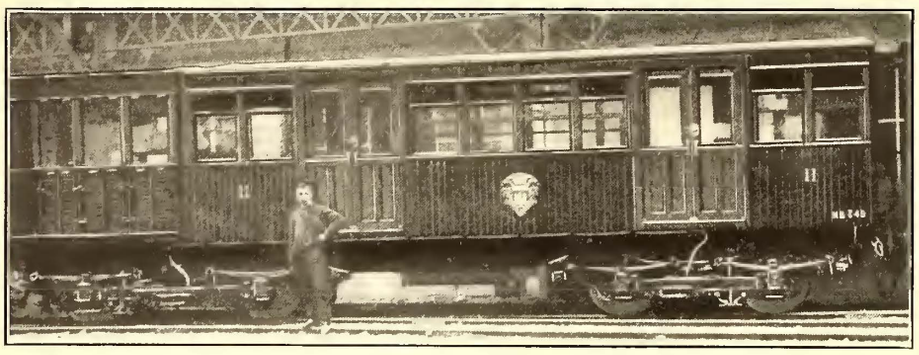
INTERIOR OF BARBES SUB-STATION



TEN-POLE, 6-PHASE, 750-KW ROTARY CONVERTER BARBES AND PERE LACHAISE SUB-STATIONS

Power for the Metropolitan Railway is derived partly from its own Bercy power station, containing two direct-current groups of 2000 kw, 600 volts; four alternating-current groups of 1500 kw, 5000 volts, 25 cycles, 38 poles, and one 1500-AH battery, and partly from power stations owned by private com-

panies and situated outside the city boundaries. One of these is at Moulineaux (6000 kw), on the southwest of Paris. Another is at Asnières, on the banks of the Seine, 3 miles northwest of the city. The newest, and one which has been constructed with especial reference to the needs of this railway, is at St. Ouen, a northern suburb. The machinery in this latter station consists of three Brown-Boveri-Parsons turbo-alternator groups, 5000 kw, 25 cycles, 5500 volts, three-phase; one of 3000 kw; two turbo-exciter groups of 200 kw; one motor-generator group, 250 kw; boosters, etc. All the machinery was supplied by Brown, Boveri & Company. The power station has been designed for 35,000 kw of machinery to be eventually installed, of which 18,000 kw is now under construction or in operation. The boilers are of the Babcock & Wilcox marine type, of which some twenty have been provided. The heating surface of the units is 420 sq. m, and mechanical stokers, superheaters and economizers are used.



NEW DOUBLE-TRUCK CARS FOR LINE 3

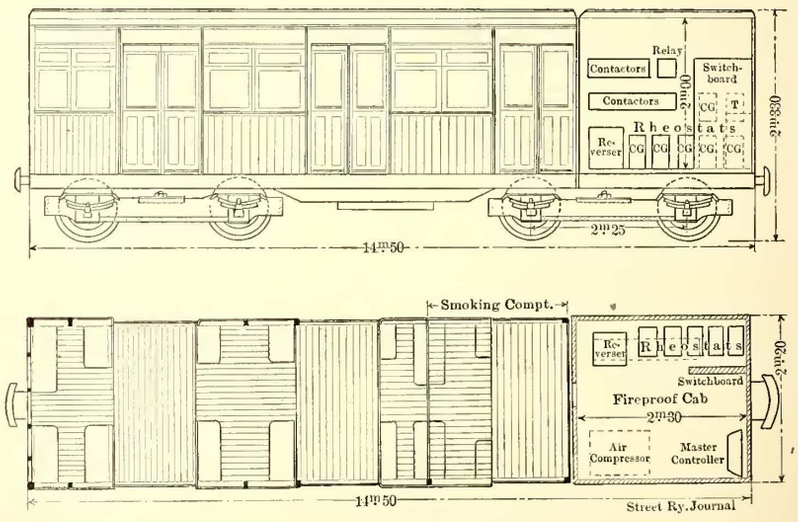
It may be a matter of surprise that such an important railway company should buy current instead of constructing its own power stations. The answer is found in the franchise conditions under which company's property reverts to the municipality within the short period of thirty-five years after the completion of the system, the material being taken over at a bare valuation. Scant encouragement is thus offered to a concern to build expensive power stations which must be handed over to the city later at probably below their real value. The group of capitalists controlling the Metropolitan lines have thus seen fit to create separate companies owning generating stations, with the certainty that the current will be sold to the Metropolitan lines during the period of its concession and afterward, in all probability, to the city as well; the latter, it is assumed, would be obliged to continue the purchase of current or else expend large sums on new generating stations.

All current is supplied at a tension of 5500 volts, 25 cycles, three-phase, and is reduced in the sub-stations, of which there are at present five in operation. The most important is at the Etoile, on which some $300,000 has been expended to date. Barbes and Opera sub-stations are also quite important, over $100,000 having been expended on each.

The last annual report of the Metropolitan stated that over the 24 km opened for traffic some 102,000,000 passengers were carried in 1903. The average receipts per kilometer were Frs. 185,818, and the train-km run amounted to 29,050,000. The fares vary according to the time of day and the class. Before 9 a. m. return tickets cost 20 centimes (4 cents), after which hour single tickets only are issued at 15 centimes, with first-class at 25 centimes. The cheap return tickets constituted 18 per cent of the total issued, and single second-class, 69 per cent. First-class tickets amounted to 12.5 per cent only, with receipts 18 per cent of total. The tickets are available for any distance over the system. The receipts for 1903 were greatly affected by the disaster of Aug. 10, with its 100 victims, the falling off in receipts for the few days following being about 40 per cent. The returns thus far for 1904 show a large increase in traffic, although no further lines were put into service until the opening on Oct. 20 of the present line 3. The average daily returns for the first nine months of 1904 were Frs. 295,000 ($59,000), and the total passengers carried, some 81,000,000, with Frs. 14,000,000 in receipts. The average receipts for line 3 during the first ten days after its opening were Frs. 75,080, and passengers, 432,600.

As regards the lines at present under construction or authorized, line 4 is regarded as the most important. This line, and also line 5, are well in hand, but the tunnel beneath the Seine is not yet commenced. It is estimated that eighteen months must elapse before this line is placed in service. For the construction of this and succeeding lines, the municipality issued in May last a special loan of Frs. 170,000,000 ($34,000,000), with interest payable at 2½ per cent. The bonds of Frs. 500 were issued at Frs. 440. As usual in city loans in France, annual drawings take place, with various prizes allotted to wining numbers. The Grand Prix of this series is $40,000.

The effect of the Metropolitan Railway on surface tramway and omnibus lines has been disastrous. A monopoly of the omnibus traffic is vested in the Compagnie Générale des Omnibus, whose concession expires in 1909. The condition of this company is critical in the extreme on account of the competition created by the Metropolitan lines, and routes and districts served have been changed several times in order to create fresh traffic. Horse tramways have, in several cases, been changed to mechanical traction, a case in point being the northern circular line (No. 2), above which a horse tramway existed over a great part of its length, and where steam trams with a three-minute headway are now run. All applications for trolley concessions, however, have been refused by the municipality. The whole question of surface traction has thus been forced into prominence, and at the present moment a municipal commission is traveling through the principal cities of Europe and the United States in order to study the conditions affecting tramway interests, with the view of dealing effectively with the demands of the several surface traction companies in Paris, some of which are in a state of insolvency.



NEW CARS FOR LINE 3, METROPOLITAN RAILWAY

THE INDIANA-OHIO TROLLEY TRIP

The trip of Indiana managers over Ohio and Indiana interurban lines, referred to in the Dec. 17 issue of this paper, demonstrated to a remarkable degree not only the possibilities for through travel now offered by the interurbans of this district, but it indicated that if the various connected properties get together and arrange for through limited trains, they can offer service which, in the matter of speed, will compare very favorably with the great steam trunk lines of the country. The schedule laid out by the entertainment committee of the Ohio Interurban Railway Association for the roads in Ohio alone called for a trip of 644 miles to be made in thirty and three-quarter hours, with an average speed of 21 m.p.h. The actual figures kept by a representative of this paper while on the trip showed the total mileage to be 784 miles, with actual running time of something over twenty-seven and one-half hours, an average of 27.96 m.p.h. for the entire trip. The routes traversed, mileage and times for the entire trip are shown in the accompanying table.

	From To	Miles	Departed Arrived	Deductions for Stops	Actual Running Time	M. P. H. Includ'g Term'ls
			Monday			
Indianapolis & Eastern Ry.	Indianapolis to Dublin	52	7.50 a. m. 9.30 a. m.	.....	1 h. 40 m.	31.2
Richmond St. & Interurban Ry	Dublin to Richmond	16	9.30 " 10.45 "	32 min.	43 m.	22.2
Dayton & Western Ry.	Richmond to Dayton	40	10.47 " 12.07 p. m.	10 min.	1 h. 10 m.	34.2
Dayton, Springfield & Urbana	Dayton to Springfield	27	12.10 p. m. 1.07 "	.....	57 m.	28.5
Columbus, London & Springfield	Springfield to Columbus	49	2.38 " 4.30 "	.....	1 h. 52 m.	30
Columbus, Buckeye Lake & Newark	Columbus to Newark,	37	4.40 " 5.51 "	.....	1 h. 11 m.	31.26
Columbus, Newark & Zanesville	Newark to Zanesville	28	5.52 " 7.17 "	35 min.	50 m.	33.6
Columbus, Newark & Zanesville	Zanesville to Newark	28	8.40 " 9.31 "	.....	51 m.	32.9
Columbus, Buckeye Lake & Newark	Newark to Columbus	37	9.31 " 10.50 "	.....	1 h. 19 m.	28.1
			Tuesday			
Columbus, London & Springfield	Columbus to Springfield	49	7.43 a. m. 9.22 a. m.	.....	1 h. 39 m.	29.7
Dayton, Springfield & Urbana	Springfield to Dayton	27	9.23 " 10.23 "	.....	1 h.	27
Dayton & Troy Ry.	Dayton to Piqua	30.2	10.32 " 11.27 "	.....	55 m.	34
Western Ohio Ry.	Piqua to Lima	49.9	11.28 " 12.50 p. m.	.....	1 h. 22 m.	36.5
Fort Wayne, Van Wert & Lima Tr. Co.	Lima to Elida	5	2.31 p. m. 2.43 "	.....	12 m.	25
Fort Wayne, Van Wert & Lima Tr. Co.	Elida to Lima	5	2.51 " 3.06 "	.....	15 m.	21.2
Western Ohio Ry.	Lima to Piqua	49.9	3.07 " 4.41 "	10 min.	1 h. 24 m.	35.6
Dayton, Covington & Piqua	Piqua to Dayton	34	4.45 " 6.03 "	2 min.	1 h. 16 m.	26.9
			Wednesday			
Cincinnati, Dayton & Toledo	Dayton to Cincinnati	54.5	7.45 a. m. 9.52 a. m.	6 min.	2 h. 1 m.	27
Cincinnati, Dayton & Toledo	Cincinnati to Dayton	54.5	2.22 p. m. 4.42 p. m.	.....	2 h. 20 m.	23.3
Dayton & Western Ry.	Dayton to Richmond	40	5.30 " 7.10 "	.....	1 h. 40 m.	24
Richmond St. & Interurban	Richmond to Dublin	16	7.20 " 8.10 "	2 min.	48 m.	20.4
Indianapolis & Eastern	Dublin to Indianapolis	52	8.10 " 9.40 "	.....	1 h. 30 m.	34.6
		781 8	.....	.....	27 h. 15 m.	28.7 av

The trip was of intense interest to all who participated. The Ohio roads were new to all the Indiana managers, while a number of the Ohio managers who joined the party at various points were enabled to go over properties which they had not seen before. The schedule laid out by the Ohio committee provided comparatively high speed over every property, but practically every manager laid plans to beat the schedule and give the visitors the fastest ride of the trip, and as a result some remarkable records were made. On nearly all of the roads extra precautions were taken to insure speed and safety for the visitors. Regular cars were side-tracked and watchmen with flags or lanterns were placed at grade crossings and dangerous points. Each road furnished a pilot and a conductor, while each manager placed a superintendent or train master in charge of the car as it reached his property. The arrangements provided that men should be stationed in each repair shop ready to make immediate repairs to the car in case they should be needed, and that each road should have a car ready to take the place of the special in case of emergency. At the end of each day's run the car was overhauled in the nearest shop, and it was constantly in charge of a mechanic. Fortunately no serious accidents occurred, although, as outlined in the last issue, it was impossible to take the Indianapolis & Eastern car over the entire trip, owing to the inability to turn it in Springfield. Also in going over the Cincinnati, Dayton & Toledo Traction Company's line, it was found desirable to use one of that company's cars, owing to short curves and short clearances.

From a social standpoint the trip was most enjoyable. The cares of business were set aside and every manager devoted his attention to the construction and methods of operation on the various roads. As the car passed from one road to another, the manager in charge was made the object of a constant flow of jokes, but as each man had his turn, no partiality was shown, and not a man escaped. The anxiety of the various Ohio men to make the best showing resulted in some remarkable stories as to speed and distances, and in self-defense the STREET RAILWAY JOURNAL representative, the only disinterested man on the trip, was forced to keep his own score. The times mentioned in the accompanying table are all measured from center of city to center of city. Some of the runs over shorter distances are worthy of mention.

The Dayton & Western made a run of 38 miles in fifty-nine minutes, while 6 miles were made in eight minutes. The Columbus, London & Springfield made the 45 miles from Springfield city limits to Columbus city limits in one hour and ten minutes. The Columbus, Buckeye Lake & Newark Traction Company made 24 miles in thirty-five minutes; 40.8 m.p.h., and its 65 miles from Columbus to Zanesville was made in thirty minutes less time than its regular limited cars. The Dayton & Troy made 14 miles in twenty-one minutes, and its through run of 30½ miles in fifty-five minutes was five minutes faster than its regular limited cars. The Western Ohio made 21½ miles in thirty minutes; 42.6 m.p.h. The through run from Dayton to Lima, 80 miles, was made in two hours and sixteen minutes, which was twenty-four minutes faster than the regular limited service, and six minutes faster than the fastest train on the parallel steam road, which has a shorter route than that of the electric. A short run was made over the new Fort Wayne, Van Wert & Lima Traction Company's line, demonstrating that this will be one of the finest high-speed roads in the country. The Dayton, Covington & Piqua established a new record of one hour and three minutes over its 32 miles outside of cities. The Cincinnati, Dayton & Toledo, which, by reason of tremendous grades, numerous short curves and great city mileage, lays no claim to being a high-speed road, clipped one hour and fifteen minutes from its regular schedule from Dayton to Cincinnati. On the run back to Indianapolis, Manager Chipman, of the Indianapolis & Eastern, laid out to beat all the records

of the Ohio roads. The run from Dublin to the Indianapolis city limits, 47 miles, was made in one hour and twelve minutes; 39.12 m.p.h., but the average for the through run was reduced considerably, owing to 5 miles of city tracks. The Indianapolis & Eastern car, which was used on about two-thirds of the trip, weighed 32 tons, and was fitted with four 50-hp motors, geared to 55 m.p.h., and at no time during the long runs did the motors heat perceptibly.

The entertainments provided by the Ohio managers were of the most lavish description. Banquets were served at Springfield by Manager Stebbins, of the Appleyard System; at Zanesville by J. R. Harrigan, of the Columbus, Newark & Zanesville; at Lima by F. D. Carpenter, of the Western Ohio, while at Cincinnati the party was entertained at the Queen City Club by Manager Sloat, of the Cincinnati, Dayton & Toledo. At Dayton the party was entertained at the Dayton Club by all of the Dayton managers. At this gathering, a special meeting of the Ohio Interurban Railway Association was called, and the Indiana visitors were voted honorary members of the Ohio organization. The most unique entertainment of the trip was given by President Valentine Winters, of the Dayton & Western,

THE BRIDGE THAT SEPARATES INDIANA FROM OHIO. INDIANAPOLIS & EASTERN SPECIAL CAR GOING OVER OHIO LINES. TROLLEY BEING REMOVED.

who served an elaborate little luncheon to the entire party on the company's buffet parlor car running between Dayton and Richmond. The car was in regular service, and the luncheon was from the regular menu served to other passengers. An elaborate little menu card, designed especially for the occasion by General Passenger Agent Morrell, of the company, attracted much attention. Incidentally it might be mentioned that shortly after the first of the year the buffet parlor cars of this company will be operated in regular service through from Dayton to Indianapolis.

The advantages of a closer alliance between the Ohio and Indiana managers were brought out many times during the trip, and both parties benefited by the mingling of ideas. A cordial invitation was made to the Ohio men to arrange for a trip over Indiana roads, and it is probable that this will be carried out after the first of the year. At the Cincinnati banquet the officers of the Ohio Interurban Railway Association made an informal proposition for the consolidation of the newly-formed Indiana Electric Railway Association with the Ohio organization, and it was stated that if desirable the name of the organization could be changed so that it would signify an interstate association. While admitting that they had many objects in common and that better results would ultimately be obtained by joining forces, the general sentiment among the Indiana managers was that it would be better to delay such consolidation until the Indiana managers had become more thoroughly acquainted with their needs and until their association had accomplished certain results. The Indiana Association aims to hold frequent meetings, as the Ohio Association is doing, and it was thought that until both associations had solved some of the more important problems and had relieved the necessity for such frequent meetings, it would be better for each State to go it alone. It was agreed, however, that a number of reforms could be worked in a uniform manner so that the results would be of equal benefit to the roads in both States.

The Ohio interchangeable transportation has now been adopted by twenty Ohio roads, and it is probable that the Indiana Association will adopt something similar. The opinion was expressed that arrangements could be made whereby the roads of one State could honor the transportation issued by the other association, thus making the two forms interchangeable. The subject of interline tickets is one that will soon be adjusted by the Ohio Association, and this will be brought to the attention of the Indiana Association with a view to securing uniformity. Ohio roads are now selling tickets through to Indianapolis and other Indiana points, but thus far it is impossible to buy through tickets in the other direction. The subject of interline handling of baggage is of even greater importance than through ticketing. At present a passenger starting on a long trip has no means of knowing when or how his baggage will be delivered. Some roads have combination cars and others handle baggage only in express cars. Some charge, and others do not. Both associations will thrash out this point at the earliest possible moment, as it is a great drawback to interline business.

After finishing the trip back to Indianapolis, the Street Railway Journal representative accepted the invitation of C. B. Reynolds, general manager of the Indianapolis & Northwestern, to make a run to Lafayette over this line in one of its new limited cars. This is a beautiful high-speed road, having 60-ft. cars, low grades and few curves. The regular schedule is two hours and thirty minutes for 69 miles. Returning from Lafayette, the run was made to Marion on one of the famous limiteds of the Indiana Union Traction Company; 57 miles in two hours and ten minutes. This completed a tour of practically 1000 miles in thirty-nine hours, certainly the fastest and probably the longest journey of the kind ever made by electric cars.

CHECKING THE ADJUSTMENT OF CAR CIRCUIT BREAKERS

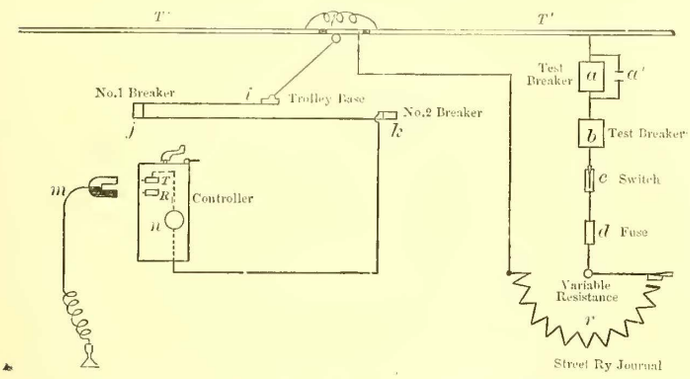
BY E. C. PARHAM

Many railway companies have suffered as a result of violent spectacular demonstrations caused by a short-circuit under the car and which created a panic among the passengers. Later investigation often shows that the short-circuit causing the demonstration was prolonged and possibly intensified by failure of the car circuit breaker to interrupt the circuit, and that this failure was due to the breaker being "stuck," or to its operating coil being roasted, or to the substitution of an irregular tension spring for a broken one, or to the pulling out of part of a broken spring to "make it do."

It is fairly reasonable to assume that if a test at a given hour shows a car breaker to be operatable at a current value within 5 per cent of that for which it is supposed to be adjusted, twenty-four hours later the breaker will operate at approximately the same current value, provided that during the intervening time it has not been subjected to some extraordinary operating or renewal contortion, such as having its handle tied, wedged or held over, its tension spring replaced by a straight wire, or tuned up to concert pitch, or its interference lug inverted in such a manner as to lock its mate and render operation impracticable. It is certainly safe to assume that, barring the conditions just named, or equivalent ones, twenty-four hours after adjustment a breaker will operate on the current due to a

short-circuit. If some simple method can be devised for hastily but reliably testing the adjustment of car breakers in place—daily if necessary—a step will have been taken toward removing these safety devices from the list of electric railway combustibles. The import of the present article is to suggest a method whereby the adjustment of a car circuit breaker can be tested in from one to three minutes, and unless the test shows that breaker parts must be renewed, an adjustment will require but little longer. The test does not involve the use of measuring instruments, excepting initially for purposes of calibration, and thereafter occasionally as a factor of safety in checking adjustments, and can be conducted by any one to whom it may have been explained.

In the accompanying diagram, $T'T'$ is the house service trolley wire, and t a short length insulated from $T'T'$ by line breakers on both ends. Circuit breakers a, b, in series with



WIRING DIAGRAM FOR CHECKING CAR CIRCUIT BREAKERS

each other, are also in series with switch c, fuse d and variable resistance r, which may be a water rheostat. There is on circuit breaker a, a pair of contacts a', which, in connection with a blade carried on or operated by the moving member of the breaker, closes the circuit at a' immediately after the regular circuit breaking contacts have been effective in opening the circuit at a ; i. e., operation of breaker a momentarily opens the circuit, then closes it immediately. The short section of trolley wire t cannot have connection with live trolley wire $T'T'$, except through test path T'-a-b-c-d-r-t. When all breakers, switches and fuses of this path are closed, section t is alive; under this condition if the trolley wheel of a car bears up against t and one of its controllers is advanced to an operating notch, the car will take current through its normal working circuit, including car breakers j and k, and would tend to start; as this tendency to start could not be conveniently and safely restrained during the passage of the heavy currents incident to the test of the breakers, it is advisable to provide means whereby the test currents may be diverted from the car motors. This can be done by the forked device m, terminating on a flexible lead which is grounded to a track rail as indicated; the unshaded tongue of the fork is made of flat copper and the shaded tongue of hard flat insulation; in applying the device to the controller, the metal fork is slipped under the trolley finger and the insulation tongue under the R_1 resistance finger, so that current cannot reach the motor circuit as long as the controller is not advanced beyond the first notch. Any current entering on the controller trolley wire passes through its magnetic blow-out coil n to the trolley finger, thence through the metal strip and its attached lead directly to the ground. When a controller is put on the first notch and fork m is inserted and all breakers closed, the current will take path T'-a-b-c-d-r-t-i-j-k-controller T-finger m to ground, and any breaker adjusted to operate at a current value less than what happens to obtain will do so.

The initial calibration of the test circuit for checking breakers is as follows: Suppose that the standard adjustment of the car breakers on a given road is 200 amps.; by means of an ammeter and the variable resistance r, test breaker a is adjusted to operate at about 190 amps., and test breaker b at about 210 amps., the allowable margin between their adjustments being later corrected according to experience with the particular type of car breakers to be checked. Where a car has two breakers connected in parallel, unless each controller has an independent trolley connection, one must be left open while the other is being checked; if the two breakers are in series, however, provision must be made for keeping the idle one closed.

The test is conducted as follows: A car is run in position for its trolley wheel to rest on insulated section t; the controller nearest the car breaker to be tested is advanced to the first notch and forked contact m shoved under controller fingers T and R_1, as already explained. The test breakers are then closed and the rheostat operated to increase gradually the current until some breaker acts. If the adjustment of the car breaker under test happens to be approximately correct, test breaker a will be the first to operate, and thereby indicate that the adjustment of the car breaker requires a greater current than 190 amps. Breaker a closes the circuit after opening it, and the operation of increasing the test current is continued until another breaker acts. Should the car breaker under test operate next, it becomes certain that its adjustment lies between 190 amps. and 210 amps., and such a condition would be considered good. If test breaker b acts before the car breaker does, the adjustment of the car breaker requires an operating current greater than 210 amps., which condition would require a slacking off of the breaker adjusting screw. Operation of the car breaker before test breaker a would show the former to be adjusted for too low a current value, an undesirable condition, likely to inconvenience the motorman and invite him to abuse the breaker by holding, tying or wedging it closed, and one that can be corrected by taking up on the adjusting screw.

In general, a breaker that operates between test breakers a and b is safe; if it operates before either, its adjusting screw needs taking up; if it operates after both, its adjusting screw must be slacked off.

On first going over a lot of car breakers that have been in operation for some time, and with no particular care, there will be adjustment surprises that will require repairs and renewals to straighten out; but after the breakers have once been over, the test will require but two or three minutes at the outside, and, if considered desirable, a house full of cars can be checked daily without great loss of time, and with the assurance that all breakers will at least respond to the current of a short-circuit.

The object of providing breaker a with auxiliary contacts to immediately close the test circuit after opening it, is to avoid loss of time that would be required to manually reclose the breaker and lock it or short-circuit it to admit of increasing the test current to values beyond that at which the breaker operates. If the test circuit must be adapted to check breakers of several capacities, more than two test breakers are required. All of the test breakers must be connected in series, and all except the one set for the highest operating current value must be provided with the auxiliary contacts for automatically closing the circuit again after operation. For example, suppose the test circuit to include five breakers, adjusted to operate respectively at 130 amps., 150 amps., 170 amps., 190 amps. and 210 amps. This equipment would be qualified to check car breakers of any standard adjustment from 135 amps. to 205 amps. To check breakers of 200 amps. standard adjustment, all test breakers except the last two should be thrown to their auxiliary contact side to avoid having their operating coils injured.

When it is considered that a car breaker is not safe except when protected by a fuse, and when is weighed the advantage of being able to show a judge and jury that every reasonable

means has been taken to protect the fallibility of car breakers, the urgency of systematically checking their adjustment will be appreciated.

THE CAR-HOUSE FORCE

BY E. B. CARLISLE

The street railway manager does not always fully appreciate that the work done in the car house has a powerful effect upon the cost of maintenance. By this work is meant the minor repairs and inspection incidental to keeping the rolling stock of a railway in service, and not general repairs which necessitate taking a car out of service and sending it to the general repair shop. The efficiency of such car house work is shown clearly by the mileage a car makes before it has to be sent to the repair shop.

It is true that on many roads the car house and repair shop are under one roof, but that does not prevent a separation of the work which is thought by many to be of considerable importance, especially where car house work is under the operating department and the repair shop is not.

On roads of average size we often hear of the "night man," while the day force may be four or six men. If the night man, who may have a sweeper and a window cleaner with him, did his full duty, it would generally be found that he should have two or three assistants in order to accomplish the necessary inspection and light repairs which should be done between the hours of midnight and morning. As a general thing, he does not have this assistance, and the result is break-downs in service for which he cannot always be blamed. Here is a point where the management of many roads are weak. If a car is turned in at night and reported O. K. and the same car breaks down after an hour or two in service the next morning, whose fault is it? It is nearly always due to lack of proper inspection or to bad handling by the motorman. On some roads it seems that it is the custom to lay the blame always on the car house men, but it is well known that a motorman can easily damage the apparatus by careless handling of the controller.

On all steam roads an accident to the mechanism of a locomotive is at once investigated with great care, and if possible its cause is found and the proper steps taken to prevent its repetition. If the cause can be traced to carelessness of the engine crew, or the roundhouse men, they are sure to be called upon to explain. Too little attention is paid to such details by electric roads. If a car breaks down it is often taken as a matter of course—it is the fault of no one, it would have happened anyway.

In many car houses the night force, exclusive of the cleaners, consists of a single inspector, who is expected to look over all the apparatus and renew controller fingers and brushes on from thirty to forty cars. As the time in which he is supposed to do this work is usually limited to five or six hours, it seems that it must be impossible to give the cars the careful inspection they should have. On the general principle that "a stitch in time, etc.," it should be conceded that thorough daily, or rather nightly, inspection is a money saver, and at the end of the year will materially reduce the cost of maintenance.

A car house containing thirty to forty cars should have at least two cleaners or sweepers and two inspectors. One of the latter should look over all trucks, motors, motor leads and connections, making sure that all brushes are in good order, tighten all loose bolts or nuts, see that connections are tight and that motor leads are not chafing on any part of the truck. He should also see that all bearings are properly supplied with oil or grease, and should have a good idea either from mileage or measurement as to the amount of wear on the armature bearings, for under normal conditions he is held responsible for armatures dropping down on the pole pieces.

The usual inspection of trucks, wheels and brake rigging is done by both inspectors, as their time allows, but the second man looks over the controllers, cleaning and filing up the contacts and supplying new fingers when necessary. He also inspects the car wiring, the connections to fuse boxes, controllers or circuit breakers, as well as the lighting circuits, the trolley stand, pole, wheel and cord. It is evident that if the above work is properly done, when the cars go into service in the morning with the "O. K." of the night force, they should reasonably be supposed to stay out all day; but if one does develop trouble it is generally easy to determine the cause and place the blame, if any, where it belongs. Of course, there are troubles which will inevitably occur in spite of strict vigilance, but a systematization of the work outlined above will reduce greatly the number of such occurrences, and thus improve the service to the public.

Where, as is too often the case, all the work is left to the usual "night man," he is a much overworked man when he is not asleep, and the attempt to economize by not organizing a night force and holding them responsible, in a reasonable degree, for the inspection and work necessary to be done, is nearly always the primary cause of the running down of a road's equipment.

As an example, a new interurban road recently started with six fine high-speed cars, modern in all their equipment. The road was over 20 miles in length, but no car house was built, and for some months after the opening of the road not even a pit was provided. One man by day and one by night constituted the whole force, and each had a wrench and a pair of pliers for tools. Of course, there may have been what seemed to the management good reasons for such a policy. It might have been financial, or, as has been remarked by one manager, "new cars need no repairs and very little attention," but to an outsider it looks like the worst shortsightedness.

Possibly they think that the new cars should be allowed to wear themselves out before being repaired, overlooking the fact that it would have been possible to keep them nearly as good as new for many years.

THE EAST BOSTON TUNNEL

The opening to traffic of the East Boston Tunnel, which is scheduled for Dec. 30, is an event of noteworthy importance in the transportation history of the New England metropolis. Up to this time the most direct, and in fact the only, route to East Boston from the business district consisted of a surface or elevated car trip to the wharves on Atlantic Avenue, followed by a ferry trip across the harbor. Free transfers were given on each side for further use in surface cars or elevated trains, as the case might be, but the time required from Scollay Square to Maverick Square, East Boston, was at best about twenty minutes, the distance being 1¼ miles in an air line. To-day the passenger enters the new tunnel at Court Street station, just off Scollay Square, and passes under Court Street, State Street and Boston Harbor to Maverick Square in about six minutes, the length of the run being about 1 2-5 miles. The fare is 6 cents, of which 1 cent goes to the city for toll, and 5 cents is for the transportation, which is furnished by the Boston Elevated Railway Company.

The tunnel was begun in May, 1900, and is notable by reason of its size, its projected length under the harbor, and the materials and method of its construction. Its exterior diameter is about 2 ft. greater than that of the Blackwall tunnel under the Thames River at London, and the interior diameter is, respectively, 15 per cent and 20 per cent greater than that of the St. Clair and Hudson River tunnels. Fresh concrete was largely used in the construction of the walls, including the upper arch and invert, and the tunnel is believed to be the first

successful example of walls made of fresh concrete in connection with shield tunnelling. From an operating standpoint, the curvature is easy, but the depth to which the tunnel strikes beneath the bottom of the harbor necessarily introduces long grades on each approach to the submarine portion. Thus, on the East Boston side, the incline from Maverick Square to the bottom of the tunnel consists of about 2000 ft. of grades, varying from 4.7 per cent to 5 per cent, while on the Boston side the heavier grades vary from 2.5 per cent to 4 per cent. While these grades present nothing unusual in steepness from what is often found in street railway practice, their length was undoubtedly the controlling cause of the Boston Elevated Railway Company in first adopting single-car units instead of trains in the tunnel service.

Special precautions in the matter of duplicate lighting circuits and signals have been taken. In comparison with the Tremont Street subway, the spaciousness of the station platforms and absence of sharp curves and sudden severe changes in grade are noteworthy. The prevention of any such catastrophe as occurred in Paris in 1903 has constantly been in the minds of the officials in charge of the tunnel's construction and operation. In round numbers, the total cost of the tunnel to date has been not far from two and three quarters millions of dollars.

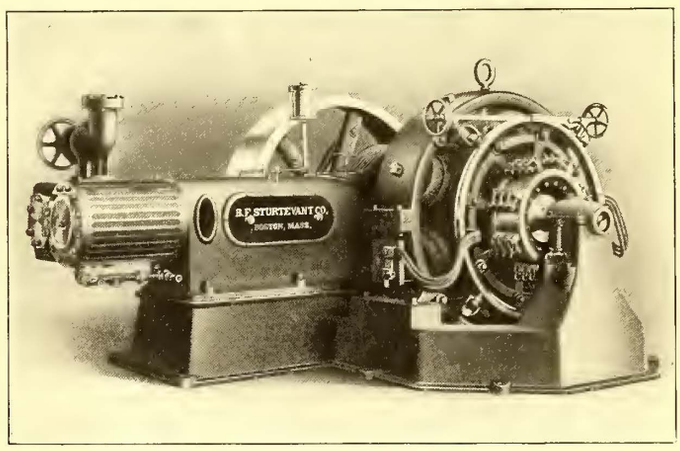
While the East Boston Tunnel is in no sense as important a feature of the rapid transit system of Boston as the elevated division opened for business in 1901, it is extremely interesting as an illustration of the radial character of the transportation routes which connect the residential suburbs with the city proper. It constitutes the first through high-speed line running east of the business section. Not a single station stop occurs in the mile run between the Atlantic Avenue station and Maverick Square. Between Atlantic Avenue and Court Street station is but one station stop—Devonshire Street. This explains the high schedule speed in vogue in the tunnel, perhaps a little above that maintained by the elevated trains themselves.

It is in its relation to the whole scheme of rapid transit development in Boston, however, that the new tunnel possesses the greatest interest to the transportation engineer. It has well been said by Gen. Bancroft, in reference to the probable development of these facilities in Boston: "With a trunk line for elevated trains under Washington Street and a subway for surface cars to the west under Tremont Street, and a subway for surface cars, when built, to the east under Post Office Square and other points, providing shallow stations, together with the East Boston Tunnel and the proposed route for elevated trains to Cambridge, running east and west, the community would have a well-nigh ideal system, furnishing connections both underground and above. * * * "

A GENERATING SET EMBRACING NEW FEATURES

In response to the growing demand for a high-class generating set, the B. F. Sturtevant Company, of Boston, Mass., is manufacturing the form illustrated herewith. The general design of the engine embodies all the latest improvements to the horizontal type. The reciprocating parts are substantially constructed and counterbalanced with lead load discs. A feature of construction is that of forging the crank shaft solid in one piece and shrinking the discs onto it. A special arrangement of the Rites governor gives a regulation within 1 per cent to 1½ per cent from full load to no load, and by a modification of the Marshall valve gear an adjustment of the cut-off from zero to 70 per cent is attained. The main bearings, crank pin, valve stem and slides of this engine are well babbitted with the company's white metal. A recent and important improvement is the water-shed partition, which prevents the water from the piston rod stuffing box reaching the interior of the engine frame, and the oil on the reciprocating parts from being thrown out into the engine room. The main body of the engine is enclosed on both sides by removable plates, as may be seen from the cut, and the crank webs are enclosed by a cast-iron hood having two holes with removable covers, one for the purpose of cleaning the crank pin box while it is in motion, and the other for removing the box without taking off the large hood. Between the water-shed partition and the front end of the cylinder is a hand hole for reaching the stuffing box bolts without communication to the oil spaces.

There are two oiling systems for this type of engine, the gravity or tank system and that by forced pump lubrication. With the former, shown in the illustration, an oil tank supplies the pipes leading to the parts to be oiled. At each point where the oil is delivered is a little gage glass and valve for regulating the flow at that point. A valve just below the tank regulates the entire oiling system. With the pump, or forced lubricating system, a pump is located in the base of the engine and is operated by the crank shaft. Oil is delivered from this pump to the main bearings, and from them through holes in the crank shaft and web to the crank pin. From this point the oil is conducted up through a hole in the connecting rod to the cross-head pin. A separate set of pipes conveys the oil from the cross-head guides to the valve stem guides. The pressure of oil



EIGHT-POLE DIRECT-CURRENT GENERATOR CONNECTED TO HORIZONTAL ENGINE

in the bearings under this system will vary from 12 lbs. to 18 lbs. per square inch. The mechanical efficiency of the engine is so materially increased by this system of lubrication that the demand for it is rapidly increasing.

The generator of this set is of the 8-pole type, and is capable of carrying momentary overloads of 50 per cent without any shifting of brushes or flashing of the commutator, and an overload of 25 per cent for a period of two hours without undue heating. After a continuous run of ten hours at full load, the increase in temperature above that of the surrounding air never exceeds 40 degs. C. upon the armature and field coils, and 45 degs. C. upon the commutator. The average temperature rise is about 33 degs. to 35 degs. C. Before being shipped, the generator is given a break-down insulation test of 1500 volts alternating for sixty seconds between the conductors and the frame. The magnet frame is of cast iron, split horizontally. The pole pieces are of wrought iron, with cast-iron shoes or horns, and are secured to the magnet frame by through bolts. Any of the pole pieces may thus be removed to repair the field coils. The latter are wound up in two sections, with an air space between the shunt and series coils. The shunt winding is of double cotton-covered magnet wire of highest conductivity, thoroughly insulated, and practically waterproof. The series winding is of solid copper bars insulated like the shunt coil.

The armature is of the ironclad, form wound, ventilated drum type, having a core built up of charcoal iron plates, which, after being thoroughly japanned, are mounted upon a cast-iron

spider and securely held in position by end flanges. No bolts pass through the armature laminations. The armature spider has an extension, upon which is mounted the commutator, making the armature and commutator one unit. The armature conductors are solid copper bars, without joints, except at the commutator end. When these bars are formed, they are insulated by material not perceptibly affected by heat or ordinary atmospheric moisture.

In the construction of the commutator, only drop-forged or drawn segments are used, these being secured in cast-iron shells of spider construction and clamped in place with a steel ring. No cast segments of any nature whatever are used. The segments are insulated with the best quality of carefully selected mica, of a degree of hardness to allow the mica and segment to wear uniformly, obviating trouble from high mica. The end insulation consists of micanite rings, and the whole commutator is assembled while hot, under great pressure. Carbon brushes only are used, the commutator being so proportioned and the brushes of such size as to allow at least 1 sq. in. of brush area to every 30 amps. carried. These brushes are carried in holders of most approved construction, each mounted upon a self-contained brush rigging so arranged that the entire set of brushes may be rotated completely around the commutator. Hand wheels are furnished for adjusting the brushes in position from either side of the generator.

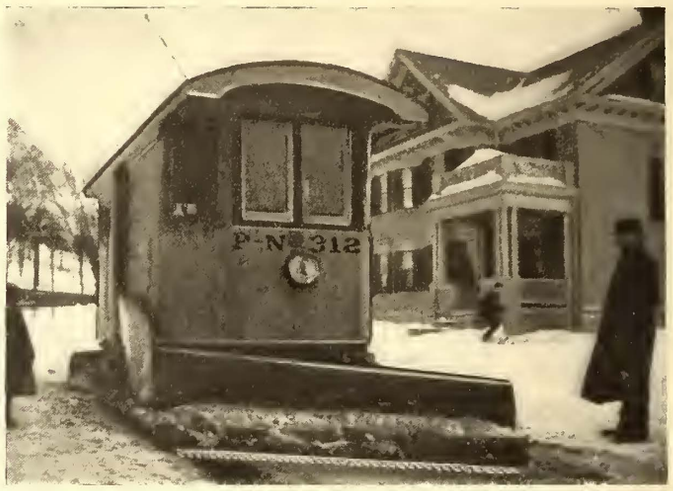
A NOVEL ICE PLANER

During the severe winter of 1903-1904, the Wm. T. Wood Company, of Arlington, Mass., which has been manufacturing ice-cutting machinery for over seventy years, received an urgent request from the city of Fitchburg, Mass., to make a machine to rip up ice in the streets so that the surface should conform more nearly to the level of the car tracks. Although the company had never built a contrivance for such work, its long experience in the manufacture of ice-harvesting machinery proved very valuable in designing a device for the purpose wanted, and when the planer was tried out it proved successful, particularly in cutting away the ridge of ice between the tracks of a double-track railway, and also the shoulder of the traveled way adjoining both double and single-track locations.

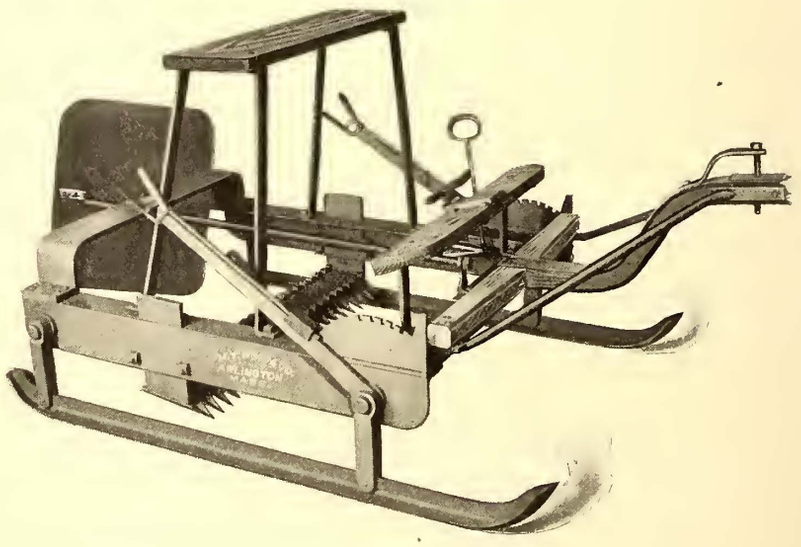
FLANGED TOOTH USED ON PLANER AND SNOW-PLOW

The success of this first planer led to a number of inquiries from adjoining cities for duplicates, and resulted in the company's determination to build it for general sale. This planer or leveler, which is shown in the accompanying cut, is constructed in a very substantial manner, and has an extra heavy 6-in. x ¾-in. Eureka knife bar fitted with Eureka flanged teeth. Four good horses should be employed to do the most effective work. The weight of the leveler and pole is 775 lbs.; the length of the cutter bar, 3 ft. 6 ins.; extreme width, 4 ft. 2 ins. The seat is high, to enable the driver to see ahead. The wide runners can travel on the rail by setting the levers in the proper notches, or they can be set for street work independent of the notches, when required, the driver regulating the levers from his seat.

The Eureka flanged teeth used on this leveler have been found well adapted for railway snow-plows, as is shown in the accompanying illustration of a snow-plow used by the Boston & Northern Street Railway Company. The teeth are attached to the snow-plows to cut the level of the ice surface between the tracks to a depth that will clear the motor cases. The teeth are made of fine tool steel, carefully tempered to withstand severe usage. As illustrated, each tooth is complete in itself, needing no auxiliary wedges or holders of any kind, and the flanges are sufficient to hold the tooth firmly with two tenthead bolts. The points are 1¾ ins. apart when bolted into place. The Boston & Northern Street Railway Company and the Old Colony Street Railway Company, who are large users of these teeth, bolt them to an iron bar ½ in. thick, and bolt the bar to the under side of the snow-plow beam. A ½-in. bar has been found to be thick enough when bolted to a scraper beam.



VIEW SHOWING THE APPLICATION OF FLANGED TEETH ON A SNOW-PLOW OPERATED IN LOWELL, MASS., ON A LINE OF THE BOSTON & NORTHERN STREET RAILWAY COMPANY



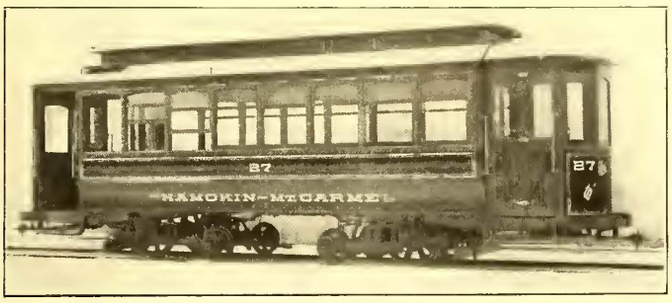
THE ICE PLANER COMPLETE

A car of the Ft. Wayne & Wabash Valley Traction Company loaded with fire-fighting apparatus made a run from Logansport to Peru, Ind., a distance of 18 miles, in twenty-three minutes on Dec. 19 to fight a fire which entailed a loss of $100,000.

In his biennial report to Gov. Pennypacker, Secretary of the Commonwealth Fuller states that of the 2982 charters granted during the two years ending Dec. 1, 1904, 194 were to street railway companies and 54 to steam railroad companies.

SEMI-CONVERTIBLE CARS WITH LONGITUDINAL SEATS

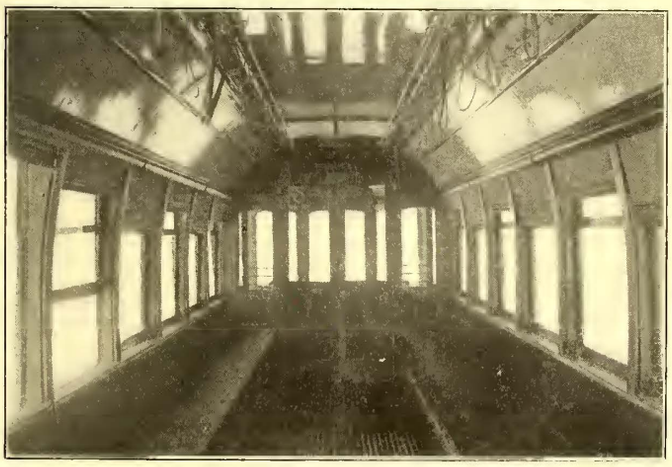
The first semi-convertible cars of the J. G. Brill Company's type to be built with longitudinal seats have recently been delivered to the Shamokin & Mt. Carmel Electric Railway Company. The railway company operates a system in the city of Shamokin, in the east central part of Pennsylvania and connects the towns of Mt. Carmel, Ashland and Centralia, extend-



EXTERIOR VIEW OF SEMI-CONVERTIBLE CAR FOR THE SHAMOKIN & MT. CARMEL ELECTRIC RAILWAY COMPANY

ing for a distance of over 16 miles. Shamokin is one of the important coal centers, and is at the junction of several main steam lines.

The cars are of two sizes, 18-ft. and 22-ft. bodies, and the use of longitudinal seats with the semi-convertible window system is intended to adapt them to both city service and the service of the lines connecting the towns mentioned. There are many "short trippers" carried between towns and villages on the long lines, and at certain times of the day the capacity of the cars is taxed to its fullest extent. Therefore, by using longitudinal instead of transverse seats a larger standing space is afforded, and the cars are suited also to summer service on



LONGITUDINAL SEATING OF SEMI-CONVERTIBLE CAR OPERATED ON THE LINES OF THE SHAMOKIN & MT. CARMEL ELECTRIC RAILWAY COMPANY

account of the semi-convertible window system. The longer type of car, shown in the accompanying illustration, is 22 ft. over the end panels, and 31 ft. 5 ins. over the vestibules; width over sills, 6 ft. 6 ins., and over posts at belt, 7 ft. 6 ins. Cherry in natural color constitutes the interior finish of the car. Ceilings are of decorated birch veneer.

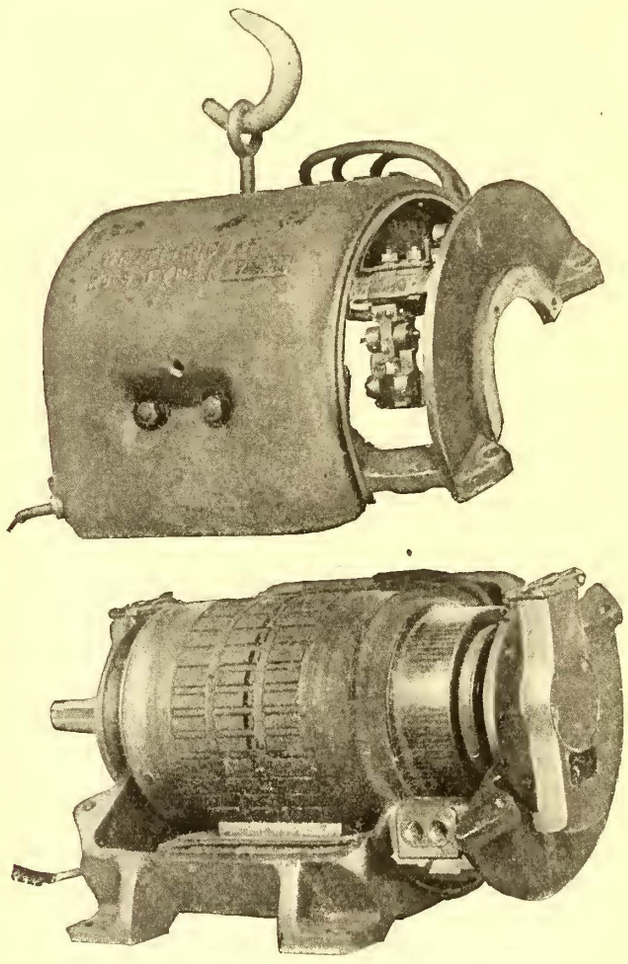
Sections of the seats 18 ins. long are arranged to be raised for the purpose of getting out sand boxes, which are of the builders' design. Other specialties of the same make with which the cars are furnished are radial draw-bars, ratchet brake handles, angle-iron bumpers, "Dedenda" gongs, Retriever conductors' bells and vestibule folding door controllers. The platform timbers are reinforced with angle iron. This car is mounted on "Eureka" maximum traction trucks, while the shorter cars are carried on the No. 21-E single truck.

A NEW CRANE MOTOR

The electric crane has been one of the most important factors in the great advance in manufacturing methods made during recent years. No service is more exacting, and in no application of electric drive is it more important that the apparatus employed be selected with the greatest care. The problem of repairs and maintenance must also be considered, and its solution leads to the same conclusion. At the end of a year's service inferior machinery is usually found more costly than the best, not only because of the repairs involved, but also on account of the loss caused by shut-downs and delays.

The Westinghouse Electric & Manufacturing Company has been closely identified with the problem of crane and hoisting service, and for more than a decade has been actively engaged in the construction of electric crane machinery.

It has developed the type K motors especially for the operation of cranes, hoists and similar apparatus, and for intermit-



NEW CRANE MOTOR WITH UPPER HALF REMOVED

tent service in which heavy starting torques and wide speed variation are required. They represent the latest development and include the most recent improvements in machinery of this kind. Many new features of the highest practical value have been incorporated in their construction. They are strong and compact, convenient to install, adaptable to every practical form of mounting, and are reliable, economical and powerful in operation. Ten sizes are standard, including capacities from 2 hp to 40 hp.

The frames are of the wholly enclosed form, to guard against dirt and moisture, but designed that the working parts may be exposed for inspection or adjustment without dismantling. If local conditions permit, the cover about the commutator may be removed and the motor operated open, with improved ventilation and increased capacity. Type K motors have four in-

wardly projecting poles, each of which is magnetized by a separate field coil. This arrangement is considered superior to that in which but two poles are directly magnetized, and the others are consequent. These motors are series wound and are designed for operation on direct-current circuits of 220 volts and 500 volts. Since the current passes successively through armature and field winding, the torque of such a motor increases nearly as the square of the current, up to the point of saturation of the iron. For this reason the series motor is particularly well suited to the starting and acceleration of heavy loads. Governed by change of voltage at the motor terminals, the speed of the motor is carried through a wide range, the change in the resistance of the motor circuit being made by a special controller.

The motor frames are of cast steel (except in the three smallest sizes, where they are cast iron). They are extremely compact and are nearly square in section. Two poles project inward in a horizontal and two in a perpendicular plane, this arrangement being the most compact possible with a four-pole motor. The frame is built in two parts, divided in a plane passing through the axis of the armature and at an angle of 34 degs. with the horizontal, an arrangement which allows the upper half of the field to be removed without disturbing the gears or shaft, and makes it easy to take out a pole piece and field coils, or to remove the armature. The lower half of the frame has four feet, with holes for bolting to the support, and has also two finished faces or pads to which bearings for a countershaft may be bolted or which may be used for side mounting.

The four pole pieces are built up of soft steel punchings, riveted together between wrought-iron end plates, and are secured to the frame by bolts which pass well into the punchings, but leave the pole face smooth and unbroken. The coils of the larger motors are of copper strap, and the terminals are insulated with asbestos ribbon. Being machine wound, they are perfectly interchangeable. The coils are fitted to the pole pieces, protected at the ends by oiled duck and held in place by the spreading tips of the pole pieces. Shells lined with bronze or babbitt and mounted in housings which may be removed without separating the motor frame constitute the bearings. Great strength has been provided, with the wear distributed over a large surface, so that they are suitable for the most severe service. Cast brass bearings are standard on all sizes up to and including the No. 4; on all frames above No. 4, babbitt bearings are used. Grease lubrication is employed in all except the larger sizes—Nos. 9 and 10—the bearings of which are designed for lubrication by oil and waste. Drip cups are provided under the bearings for all motors. The bearing housings may be turned and bolted in several positions without modification of design or the addition of special parts.

The armature core is built up of carefully annealed soft steel punchings of high permeability. These punchings are, in all except the smallest sizes, assembled on a spider and held from turning by a steel key. The pinion end is provided with a bell-shaped flange, which forms a support and shield for the armature coils. Ducts between the punchings are provided, through which air, drawn in through openings in the spider, is forced out against field coils and core, maintaining a uniform temperature throughout all parts of the motor. The coils are placed in slots and retained by bands laid in grooves below the surface of the core, except in the case of armatures for the Nos. 9 and 10 motors, which have fish paper wedges forced in between V-shaped grooves near the top of the slots. Covers of oiled duck adequately protect the ends of the winding. Wiper rings or oil guards are provided at each end of the armature to protect the winding from oil. The shafts are of great strength and may be extended at either end to accommodate pulleys, pinions or brake dises. The commutator is built up of bars of hard-drawn copper, insulated by prepared mica, and mounted on the armature spider. The commutation is particularly good, in spite of the heavy rushes of current to which a motor of this class is subjected. This end has been attained by the same elements of design which have employed and have produced the good operation found in Westinghouse railway and type S motors.

With all but the two smaller sizes (frames Nos. 1 and 2) a shunt is connected to the tip of the spring, extended back over the spring and securely fastened to the brush holder, thus relieving the spring of the duty of carrying current, insuring good contact, low operating temperature and a permanent and even tension. With every carbon brush 5/8 in. or more in thickness, an additional sheet is provided connecting the carbon itself to the carbon holder, improving the contact between carbon and holder, and preventing that pitting of the brush which is so annoying and troublesome, besides offering a further protection to the temper of the spring. Flexible leads are brought out through insulating bushings in the upper frame, and are either connected to terminal blocks mounted on the top of the motor or are arranged for direct connection to the controller lines.

CHANGES IN THE L. E. MYERS COMPANY

On Jan. 1, 1905, important changes will take place in the L. E. Myers Company, of Chicago, which has for many years been carrying on an extensive business in the construction and operation and management of electric railways under the presidency of L. E. Myers. After the date mentioned, Theodore P. Bailey, who for a numbers of years has been assistant manager of the General Electric Company in the West, will become vice-president and general manager of the L. E. Myers Company, as announced in the personal column elsewhere in this issue. Mr. Myers will continue as president. C. E. Collins, who has been in charge of the construction work of the company, will continue his duties as general superintendent. William H. P. Weston, formerly secretary of the company, is to become treasurer as well as secretary. The company has always carried on its operations in a very quiet way, and it is probably not generally known outside of a few people in the electric railway field what a large amount of work this company has done, nor how completely organized it is for construction work. The company has in its organization specialists in every department required for complete electric railway construction. It has within the last year completely reconstructed the system of the Topeka Railway Company, including the erection of five buildings, and is now managing the property. It has branch offices at Topeka, Kan.; Dubuque, Iowa, and Springfield, Ill. The latter office, by the way, is headquarters for the construction during the coming season of an important road regarding which but little has been heretofore made public. This is the Springfield & Northeastern Railroad, which is to comprise in all 111 miles of track, of which 60 miles connects Springfield, Ill., with Bloomington, and runs parallel with the Chicago & Alton Railway. From Lincoln, which is about midway between Springfield and Bloomington, a branch is to be run to Peoria. The power house will be at Lincoln. It is understood that the single-phase system is to be used.

The Cicero Light, Heat & Power Company, of Oak Park, a suburb of Chicago, is one of the companies managed by the L. E. Myers Company. The Peoria & Pekin Terminal, the Canton-Akron and Canton-New Philadelphia roads are among those constructed by this company in the past. Mr. Bailey's intimate acquaintance and standing in the railway and lighting business, together with the financial and executive ability already in the L. E. Myers Company, should make this already strong concern stronger, if possible. The company's offices in the Monadnock Building, Chicago, will be enlarged to include the suite 1115 to 1119.

FINANCIAL INTELLIGENCE

WALL STREET, Dec. 28, 1904.

The Money Market

Not in recent years has the local money market displayed such extraordinary ease in the last week of December as that which has characterized the market during the past week. It is generally admitted that the supply of lendable funds has been materially increased during the past few weeks, as a result of the return movements of funds from interior cities, but the ease is all the more remarkable when the impending demands upon the banks are taken into consideration. This year the Jan. 1 interest and dividend disbursements promise to be unusually heavy, and in addition the national banks will be obliged to pay 10 per cent of the government money on January 15. The new Japanese war loan, as well as several railroad bond issues, will also have to be provided for in the near future. Thus far these factors have not caused the slightest disturbance. Money on call has been in abundant supply at rates ranging from 2 to 3 per cent, the ruling rate for the week being about 2½ per cent. In the time loan department business was practically at a standstill. Contracts for all maturities up to six months were offered with considerable freedom at 3½ per cent, but practically all the new business transacted was at 3¼ per cent for ninety days. At the close of the week six months' funds were also obtainable in quantity at that figure, but borrowers generally were not disposed to pay more than 3 per cent. Commercial paper continued in fair supply and good demand at 4 to 4½ per cent. Sterling exchange has ruled firm, but somewhat below last week's closing rates. The bank statement published last Saturday was rather disappointing. Instead of a gain in cash of about $3,000,000, as indicated by the preliminary figures, the actual gain was limited to $200,100. This difference, however, was readily explained by the withdrawals of cash incident to the holiday expenditures. The decrease in loans was also smaller than expected, and amounted to $2,600,000. Deposits decreased $2,002,000. Surplus reserve increased $700,600 to $15,247,225. The week closed with all indications pointing to a continued easy market. The opinion prevails in banking circles that there will be no material improvement in the situation until the opening of the spring trade. There was no appreciable change in discount rates at the principal European centers. At London the quotation ruled at 2⅞. At Berlin the rate was unchanged at 4 per cent, while at Paris the rate was 2⅝ per cent.

The Stock Market

There was a further shrinkage in the volume of business on the Stock Exchange this week, the aggregate dealings being the smallest recorded since the beginning of the bull movement last summer. The general tone of the market, however, was decidedly strong, prices reflecting the gradual return of confidence. At the opening prices showed strength, but later on the movement developed more or less irregularity, as a result of realizing sales, and the evening up of contracts incident to the Christmas holiday. The advice from Washington to the effect that a modified bill to regulate railroad rates would probably be passed by the lower branch of Congress during the present session, also caused some apprehension, but subsequently the market developed material strength, and prices for a number of issues advanced sharply. Otherwise, the news of the week was of an encouraging character. The half-yearly reports of the Vanderbilt lines were extremely favorable, and the weekly traffic returns continued to show substantial gains over those for the corresponding period of last year. The money market ruled remarkably easy, and stimulated the investment demand for high-class railroad and other bonds. During the latter part of the week, the market developed considerable strength, and in many issues the highest prices of the week were recorded. New York Central and Rock Island were specially strong, the strength in the first-named being accompanied by excellent buying and indefinite rumors of rights soon to be offered to stockholders. The bond market was also quiet, but generally strong, the features being United States Steel Sinking Fund 5s, Union Pacific, Chicago, Burlington & Quincy joint 4s, and the Rock Island issues.

The local traction isues were dull, reflecting the quietness prevailing in other parts of the market, but apart from a decline of 1¼ points in Metropolitan Street Railway, price changes were insignificant. Brooklyn Rapid Transit was dealt in moderately at from 60½ to 61. Manhattan Railway rose 1½ to 164¾, and Metropolitan Securities advanced ¼ to 80.

Philadelphia

Dealings in the local traction issues were upon an extremely small scale this week, and reflected the dullness prevailing in other parts of the market. Prices, however, remained decidedly firm, with the exception of Philadelphia Rapid Transit stock, which, after a strong opening at 18⅛, subsequently sagged off to 17 on comparatively small transactions. Philadelphia Traction advanced a small fraction, several hundred shares of the stock selling at 98¾. United Gas & Improvement, which was an exceptionally strong feature of last week's trading, continued in good demand at prices ranging from 105¼ to 106¼, a gain of ¼. Union Traction sold at 59 and 58¾ for several hundred shares, and Consolidated Traction of New Jersey was firm at 79½ and 80 Philadelphia Company common and preferred were practically unchanged, about 1800 of the first-named selling at from 41¼ to 42 and back to 41¾, while small amounts of the preferred brought 47. United Companies of New Jersey sold ex-dividend at 273. American Railways and Railways General changed hands at 48¼ and 3⅞, respectively. Fairmount & Oak Park Elevated changed hands at 16¼.

Chicago

The most interesting development in the local traction situation this week was the decision rendered by Judge Grosscup that the Chicago Union Traction Company must meet its obligation falling due on Jan. 1, next, or steps will be taken by the court to return the properties over to the underlying companies. As was generally expected, the decision did not touch upon the franchise question. According to well-informed parties, the decision is just about what was expected by the Eastern interest in the company, and steps will be taken to comply with the court's ruling. It is understood that the necessary funds are on hand with which to meet all payments falling due on Jan. 1, and it is not improbable that arrangements will be made to do so at the next hearing on the matter which is scheduled for Dec. 31.

The local traction issues failed to reflect to any great extent the ruling on the Chicago Union Traction Company's affairs. Trading in them were comparatively light, and apart from the sharp declines in the Chicago Union common and preferred, prices held relatively firm. Chicago Union Traction common opened at 11 and broke to 9, while the preferred, which closed at 44 a week ago, declined to 38½, but subsequently recovered to 40. The Elevated Railroad stocks were extremely dull. Chicago & Oak Park sold at 7 for 110 shares, while a small lot of the preferred brought 25. Metropolitan Elevated sold at 22 to 22⅛, and 100 South Side Elevated changed hands at 96. West Chicago held strong at 60, about 1000 shares selling at that price, but North Chicago ran off from 87½ to 85, from which it rallied only a small fraction.

Other Traction Securities

Interest in the Baltimore market centered almost entirely in the United Railway issues, dealings in which were accompanied by further fractional losses. About $35,000 of the 4 per cent bonds sold at prices ranging from 92¾ down to 92½, a net loss of ½ point, while upwards of $110,000 of the incomes changed hands at from 50½ to 50, a net loss of 1⅜. The stock was fairly active, about 3000 shares being marketed at from 13⅞ down to 13¼, and closing at the lowest. The Boston market was dull and featureless. Boston Elevated was firm, all sales taking place at 153. Massachusetts Electric common declined ½, several hundred shares selling at from 14 to 13½, while the preferred advanced ½ from 57 to 57½ on the change of about 20 shares. West End common sold in small amounts at 93 to 93½, and the preferred at 113½ and 114. On the New York curb, Interborough Rapid Transit ruled dull and firm, about 1500 shares selling at from 162 to 164, and closing at the highest.

Rather a quiet week in Cincinnati. A few small lots of Cincinnati Street Railway sold at 144½, the old price. Cincinnati, Newport & Covington preferred sold at 91½ and 92½, and the 5 per cent bonds at 110½. Small lots of Cincinnati, Dayton & Toledo stock sold at 17 and 17½, a decline from old figures due to the report that the new leasing arrangement will probably lead to a stock assessment. Several blocks of the bonds sold at 80. A large block of Indianapolis Street Railway 4s sold at 86¾.

Cleveland Electric sold at 75¼ to 76¾ on small lots. Lake Shore Electric preferred sold at 15 for a small lot. Western Ohio receipts advanced from 8 to 10¼ on report of probable leasing of the property.

International Traction of Buffalo 4s have been in excellent demand during the past week, but no sales resulted, the market being absolutely bear of the bonds at prevailing quotations. At the opening 79½ was strongly bid, and later the bid was advanced to 79¾, with offers of 80¼. The last previous sale was made several weeks ago at 81. North Jersey Street Railway 4s have been quiet at 76 bid, with none offered under 78.

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	
	Dec. 20	Dec. 27
American Railways	48	48
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	153	153
Brooklyn Rapid Transit	60¾	61
Buffalo Con. 5s	—	109
Buffalo Deb. 6s	—	105
Chicago City	181	—
Chicago Union Traction (common)	10¼	8¾
Chicago Union Traction (preferred)	40	38
Cleveland Electric	74½	74¼
Consolidated Traction of New Jersey	79	79½
Consolidated Traction of New Jersey 5s	108¼	108¼
Detroit United	77¼	77½
Interborough Rapid Transit	163½	163½
Lake Street Elevated	—	7
Manhattan Railway	163	164¾
Massachusetts Electric Cos. (common)	14	13¼
Massachusetts Electric Cos. (preferred)	56½	57½
Metropolitan Elevated, Chicago (common)	22⅛	22
Metropolitan Elevated, Chicago (preferred)	65	65
Metropolitan Street	121⅞	*120⅝
Metropolitan Securities	79	79⅞
New Orleans Railways (common)	3	2½
New Orleans Railways (preferred)	13¼	12
New Orleans Railways, 4½s	72	72
North American	101	100½
Northern Ohio Traction & Light	17	17
North Jersey Street Railway	—	24
Philadelphia Company (common)	41¼	42
Philadelphia Rapid Transit	17¾	17¾
Philadelphia Traction	98	97⅞
South Side Elevated (Chicago)	97	96
Third Avenue	131	131
Twin City, Minneapolis (common)	106	105½
Union Traction (Philadelphia)	58⅞	58¾
West End (common)	93	93
West End (preferred)	113½	113½

* Ex-div. a Asked.

Iron and Steel

The "Iron Age" says the outlook is very encouraging in nearly every direction. While generally speaking the volume of business during the week has naturally been rather light, still quite a number of large transactions have been closed. A good deal of tonnage has been entered by the structural shops, and some very large requirements are still in the market, among which is the lot of 14,000 tons of bridge work for the Harriman lines. Those of the large steel rail contracts pending have been closed during the week, but the volume of business already done is indicated by the fact that the United States Steel Corporation's mills have now on the books 425,000 tons of rails for next year's delivery. Some export business of great magnitude is pending. Steel makers in Eastern Pennsylvania have purchased good-sized lots of basic pig at $16.50. The outlook for a large tonnage in steel merchant pipe for pipe lines is regarded as very good.

A CANADIAN STREET RAILWAY ASSOCIATION

There has just been organized at Montreal among Canadian street railway interests an association for mutual benefit that will be fashioned after the American Street Railway Association, the parent organization among street railway interests in the United States. W. G. Ross, managing director of the Montreal Street Railway Company, has been elected president of the new association. The other officers of the association are:

W. H. Moore, assistant to the president of the Toronto Railway, vice-president; Allan Royce, vice-president of the Toronto Suburban Railway, secretary-treasurer; C. E. A. Carr, general manager London Railway; E. A. Evans, manager Quebec Railway; D. McDonald, manager Montreal Street Railway, executive committee; H. H. McLean, St. John Railway, St. John, N. B., attorney.

THE NEW ORLEANS REORGANIZATION

The plan of reorganization of the New Orleans Railway Company to comply with the terms of the compromise of the suit for the forfeiture of the franchises instituted by the Attorney-General of the State, has been made public by President Foster, of the company. A new company is to be organized, capitalized at $30,000,000, thirty-year 4½ per cent gold bonds, $10,000,000 5 per cent preferred stock, and $20,000,000 common stock. Present bondholders are to receive 75 per cent in new bond and 25 per cent in new preferred. Present preferred holders are to be assessed $20 a share, receiving 20 shares of new preferred and 100 of common. Present common holders will be required to pay $10 a share, getting 10 per cent of new preferred and 35 per cent of new common. As previously stated, the plan was made necessary by the litigation by the State of Louisiana, which was settled on condition that the capital of the company, now amounting to $80,000,000, should be reduced by $20,000,000. The underwriting syndicate taking the securities of the present company expires Jan. 1 next, at which time it would be necessary to distribute the securities.

CHICAGO TRACTION MATTERS

Judge Grosscup, on Dec. 22, denied the petition of the receivers of the Chicago Union Traction Company to issue receivers' certificates to pay rentals due to underlying companies, and for needed improvements. The receivers wished to issue these certificates to hold priority over the mortgages of the underlying companies, the North & West Chicago Street Railroad Companies. This means that those interested in the Chicago Union Traction Company will have to raise the money for the payment of these rentals and improvements on their own account, and not at the expense of the security of the underlying stockholders and bondholders. Judge Grosscup announced that if by Dec. 31, the Chicago Union Traction Company had not put into the hands of the receivers the money needed on Jan. 1 for interests and rentals, and by Jan. 18 the sum needed for rentals, and by Feb. 1 the balance needed for payment of rentals and the adjustment of outstanding accounts, he will consider that the Chicago Union Traction Company's obligation had been defaulted. In case of such a default, the property will revert to the underlying companies, pending the expiration of the five months of grace which are given the Union Traction Company to redeem its obligations. It is not believed, however, that this will come to pass, as it is generally understood that interests behind the Chicago Union Traction Company will come forward with the money at the proper time. The court refused to wind up at once the affairs of the Union Traction Company and order an auction sale because of the great sacrifice of small investments which such a sale would cause. In this connection he said:

"The bondholders of these companies number perhaps 10,000 persons. These stockholders number as many more. Of these, the great majority have made their investments out of personal savings. No one charges them with personal connection with the causes that have brought these companies into trouble. They are not practiced traction people and cannot command the sources of financial strength with which alone a purchase of a property like this could be undertaken. Should a sale of these properties at this time be ordered, there would be on hand at the auction block the active, wideawake, experienced traction people."

"Who that knows this court expects that in obedience to the mere beating of the tomtoms in court and out of court by the selfish who know and the sincere who only think they know opportunity would be given to do this wicked act? For what purpose is the arm of the chancellor made strong if not to be used to protect the weak against the strong, to save the little against the great; to see to it that whatever loss is to be borne by these companies in their present troubles will not be recouped out of the disappearing holdings of the little stockholder by the big stockholder able to command financial strength?"

"Traction properties of this size, and involving such an expenditure, are purchased only by active and experienced traction men. A sale at auction such as is suggested might make the big stockholder bigger by wiping out the little, but it would be nothing else. It would not change the identity of the active traction men, with whom the city would have to deal. It would change some names, but nothing else, except that, in the whirl given, another instance might be added to a history that has made investment in corporate enterprises a thing to be avoided. I will not knowingly furnish that instance.

"The traction interests, as an entity, have asked for and received protection. The individuals interested as stockholders and bondholders will receive the same measure of protection. On that basis a fair and just settlement with the city can be made, for on no other basis ought the city or the public conscience to permit a settlement to be made."

WIDENER-ELKINS PLANS IN THE WEST

The daily papers in the Central West have recently published sensational stories relative to the leasing of a number of important Ohio and Indiana street railway properties to the so-called Widener-Elkins syndicate of Philadelphia. It was reported that the Philadelphia syndicate would lease or absorb the Cincinnati, Dayton & Toledo Traction Company, the Dayton & Troy Railway, the Western Ohio Railway, and the Toledo, Bowling Green & Southern Traction Company, forming a through line from Cincinnati to Toledo. It was also reported that the syndicate would lease the Indianapolis & Eastern Railway, the Richmond Street & Interurban Railway, the Dayton & Western Railway, together with the Appleyard properties, forming a through line from Indianapolis to Columbus.

While such moves are well within the range of possibility, and consolidation seems to be the logical course for the numerous connecting lines in this district, the STREET RAILWAY JOURNAL is in a position to state authoritively that the reports are premature, and that they are greatly exaggerated. The facts seem to be about as follows: The Pomeroy-Mandelbaum syndicate, which formerly owned the Cincinnati, Dayton & Toledo, and which built and owned the Western Ohio Railway more than two years ago, proposed consolidating the roads between Cincinnati and Toledo, and it is generally understood that the syndicate obtained options on the other lines necessary to complete this system. The financial depression in Cleveland, and the loss of control of the Cincinnati, Dayton & Toledo, prevented this plan from being carried out. The Widener-Elkins syndicate, which now controls the Cincinnati, Dayton & Toledo Traction Company, finds it necessary to rebuild the property in order to make it a high-speed road. It is planned to lease the road to a new company on a guaranteed dividend basis, thus obtaining funds with which to rebuild the line from Cincinnati to Dayton. The track will be placed on private right of way, and a large power station will be erected. These matters will be settled at a meeting of Cincinnati, Dayton & Toledo stockholders to be held Jan. 26.

Appreciating the possibilities of through traffic, the Widener-Elkins interests decided that, before going ahead with the purchase of new equipment and commiting itself to power and transmission systems that might not work in with those of the other roads, it would be well to learn from the other roads the possibilities of a leasing agreement. In the case of the Pomeroy-Mandelbaum-Western Ohio interests the time was quite opportune. The Western Ohio, while a magnificent property, is not at present a profitable one, owing to its incomplete condition. It has an immense power house and all material purchased for the extension from Lima to Findlay, but for two years the right of way has not been touched. Recently the syndicate laid plans to form a new company to build the extension next spring, thereby completing the through system. Therefore, the tentative proposition was made by the Widener-Elkins syndicate to lease the property and operate it as part of the through line. The newspaper stories doubtless emanated from the fact that the syndicate managers, who hold the Western Ohio stock in a pool, asked the stockholders to grant an extension on the pool agreement, so that the managers might have time to consider a proposition to lease the property.

The Toledo, Bowling Green & Southern is owned by Cincinnati interests, who are supposed to be friendly to the Widener-Elkins syndicate, if not actually identified with it. The other link in the Cincinnati-Toledo chain is the Dayton & Troy Electric Railway, extending from Dayton to Piqua. Under date of Dec. 27, Harry P. Clegg, vice-president and general manager of this property, wired the STREET RAILWAY JOURNAL as follows:

"The Widener-Elkins syndicate has made no overtures for leasing this property." This would seem to indicate that the plans have not reached a stage where actual propositions could be made.

As to the plans for an Indianapolis-Columbus line, the prospects are even more obscure. The Indianapolis & Eastern is owned by Indianapolis people who are independent of the Widener-Elkins syndicate. The Dayton & Western is owned by Dayton people, and Valentine Winters, president of the company, on Tuesday of this week telegraphed the STREET RAILWAY JOURNAL as follows:

"We have heard nothing of the leasing proposition." For some time there have been rumors that the Appleyard roads might be absorbed by other interests, but there is nothing tangible in the reports.

The system, as outlined, would unquestionably make a magnificent proposition. The Cincinnati-Toledo line is 187 miles long, connecting three large cities and many large towns. With improvements to the Cincinnati, Dayton & Toledo, and the building of the Findlay-Lima sections, cars could make the run in less than seven hours. The Indianapolis-Columbus line is complete and consists of modern roads that are in shape for high speed. The 190 miles between these centers has been covered in less than seven hours. These properties, together with the system of the Indiana Union Traction Company, would give the Widener-Elkins syndicate a system of 600 miles of high-speed interurban roads, the very core of the system in the Central West.

NEW JERSEY TUNNEL GIVEN RIGHTS IN NEW YORK

The New York & New Jersey Railroad Company, which is constructing a tunnel under the Hudson River, from Fifteenth Street, Jersey City, to Morton Street, New York, has, as predicted in the STREET RAILWAY JOURNAL of Dec. 24, been granted a franchise to build a subway from the tunnel terminal in New York along Morton Street to Greenwich, to Christopher, to Sixth Avenue, to the southerly side of Thirty-Third Street, where it will connect directly with the Pennsylvania Railroad terminal, and also a branch subway from Christopher Street and Sixth Avenue eastward along Ninth Street, to Second Avenue, where there will be a loop.

It is provided that the franchise shall become void unless the New York & Jersey Company shall, within six months, secure the consent of the Aldermen and Mayor, and within a year the consents of at least 50 per cent of the abutting property owners. The New York & New Jersey Company binds itself to begin work within six months after securing such consents and to have the subway completed and in operation within five years from the date of the signing of the contract between the company and the Rapid Transit Commission.

For the privilege, the company will pay to the city a rental of 50 cents per lineal foot of track and station platforms for a period of ten years and $1 per foot after that time and up to the expiration of the contract, as well as 4 per cent on the estimated valuation of the vault space occupied in the operation of the road. For the first ten years of operation it will pay to the city $9,000 a year rental in lieu of a percentage on the receipts, and thereafter will pay a rental equivalent to 5 per cent of the gross earnings of the road. This latter rental will be subject to readjustment at twenty-five-year periods so long as the franchise exists. Both the Sixth Avenue and the Ninth Street lines may be purchased by the city at the end of twenty-five years of operation for the actual cost of construction.

APPOINTMENT OF SECRETARY OF ACCOUNTANTS' ASSOCIATION

The announcement of the appointment of Elmer M. White, cashier of the Hartford Street Railway Company, of Hartford, Conn., as secretary of the Street Railway Accountants' Association of America, was made this week by Acting Secretary W. B. Brockway, in the following notice:

CIRCULAR NO. 33

December 27, 1904.

To All Concerned: Notice is hereby given that, in accordance with the resolution of the eighth annual convention, the executive committee has filled the position of secretary-treasurer, which was left vacant when the officers for the year 1904-05 were elected, in the person of Elmer M. White, cashier Hartford Street Railway Company, Hartford, Conn.

Therefore, from this date all matters relating to the duties of secretary-treasurer and blanks and forms should be addressed to him.

Respectfully,
W. B. BROCKWAY, Acting Secretary.

Approved: W. G. Ross, President.

Mr. White, the new secretary, has taken a prominent part in the councils of the association in past years, and was third vice-president in 1899-1900, and a member of the executive committee in 1902-1903. A year ago he was appointed a committee of one to revise the association's collection of blanks and forms. During the following twelve months he collected the forms shown at the St. Louis convention, and arranged them systematically in an exhibit which attracted wide attention and commendation from all who inspected it. He has been for a number of years cashier of the Hartford Street Railway Company, an office on that road which corresponds very largely to that of auditor on many other railways.

The J. A. Fay & Egan Company, of Cincinnati, Ohio, the large builder of woodworking machinery, has just added another triumph to its already long list, having at the Louisiana Purchase Exposition at St. Louis captured the "Highest Award" on band rip saws, the only tool exhibited by the company.

THE NEW YORK CENTRAL'S NEW STATION IN NEW YORK

Plans for a new Grand Central Station in New York for the New York Central Railroad, were placed before the city board of estimate on Friday, Dec. 23, by Ira A. Place, general counsel for the company, and by George H. Daniels, general passenger agent. The plans involve the tearing down of the present structure and the erecting of a magnificent building instead, extending much further north than the present building. The board referred the entire matter to a special committee for a report. According to the plans filed by the railroad officials, the new terminal will involve the use of an area of more than nineteen city blocks between Forty-Second and Fifty-Seventh Street and Madison and Lexington Avenues.

The station proper, together with the Post Office and express buildings, will cover the blocks between Vanderbilt and Lexington Avenues from Forty-Fifth to Forty-Third Street, inclusive and the block fronting on Forty-Second Street between Vanderbilt Avenue and Depew Place.

The frontage of these buildings will be 680 ft. on Vanderbilt Avenue, 625 ft. on Forty-Fifth Street, 460 ft. on Lexington Avenue, 275 ft. on Forty-Fourth Street, 260 ft. on Depew Place, and 300 ft. on Forty-Second Street.

The suburban trains will be on a lower level than the express trains, thus separating the commuter from the express passenger and affording better facilities for both. The suburban concourse will provide for nine tracks. The express concourse will be slightly depressed below the street level, and will provide for twenty-two passenger train tracks, two baggage tracks two mail tracks, and eight express tracks, making forty-three tracks in all, with platforms so connected by subway and elevators that baggage, mail and express may be quickly transferred without crossing the tracks. In fact, the whole station is planned on a scale so elaborate and generous as regards facilities as to eclipse anything heretofore planned for terminal facilities in any other city.

SINGLE-PHASE EQUIPMENT FOR THE CHICAGO & MILWAUKEE

The Chicago & Milwaukee Electric Railroad Company, of which M. W. A. Blanck, formerly of the Arnold Electric Power Station Company, is now the electrical engineer, will use the single-phase system on the extension of its line north from Waukegan, Ill., to Kenosha, Wis. The track is now being graded for the extension. The company's line from Evanston to Waukegan is operated with direct current equipment. The extension from Waukegan to Kenosha runs through a much less thickly settled territory, hence the decision to use the single-phase system.

GROWTH OF THE STAR BRASS WORKS

The Star Brass Works, Kalamazoo, Mich., makers of the famous "Kalamazoo" trolley wheels and harps, have, during the year just closed, made rapid progress over the entire country in the sale of their products, and have also secured many orders from foreign countries. To meet this increasing demand the works have recently added several expensive automatic machines, built especially for them, and will, shortly after the first of the new year, increase their plant by the acquisition of adjoining property. Since the final harp decision by the Supreme Court, which resulted favorably to the works, the sales of their harps have been very large, and to-day their wheels, in combination with their harps, are giving universal satisfaction. There is a growing feature, in connection with their business, which during the past year has proved very satisfactory, and while it is quite an expense to the company, yet it in every case strengthens the company, and the results are most satisfactory to the roads.

Reports have often been received by the company from customers to the effect that the wheels ordered by them would not remain upon the wire; neither go through switches; the bushings would not stand the wear, and the trolley poles were being broken, and that in consequence of these troubles it was impossible to make schedule time. Their complaints were accompanied with the request that the works send someone to investigate the trouble. This has been done, and the investigations showed no fault with the wheels, but that a groove was not right for the overhead construction causing the wheel to jump; that the tension was too high, destroying the bushings; the base springs too weak, allowing the pole to sag; imperfect spring contacts in harp; poles too long, causing the wheel to be switched off around curves, and many other causes, which, on being righted ended the troubles.

The works, through their representative, Mr. Pratt, have made the trolley wheel question, in relation to the overhead conditions, a study, and their years of experience given by contact with the most trying conditions have eminently fitted them to furnish, not only a satisfactory wheel and harp, but to demonstrate that the different conditions existing on the different roads can be met and satisfactory results obtained by the use and adoption of their designs.

An all important factor which has brought the works into prominence, is the quality of the products. During the past year there have been but three cases that have come to the knowledge of the company where the mileage of the "Kalamazoo" wheels has fallen below the average of competitive test wheels, and one of these cases recently reported that the mileage had been shown in excess over that of the "Kalamazoo" at the expense of expensive line material, and that the "Kalamazoo" was good enough for them. It is not the question of first cost of a wheel which should be taken into account, for many cheap first cost wheels have been dearly paid for in the end, by the renewal of expensive line material. A hard wheel of any material should give high mileage, but not at the expense of the material against which it comes in contact. The "Kalamazoo" wheel is made of pure lake copper, free entirely from alloys which are so easily effected by an arcing. It is absolutely free from scrap, which is never used, is soft and pliable, does not damage or deteriorate from the overhead line, and the secret process of treating the metal produces a soft wheel, and yet gives it lasting qualities. A wheel combining these qualities is a safe and profitable one to use, and though it is perhaps a trifle higher in first cost, is the cheapest in the end. It not only meets the demand for ordinary speed, but is equal to the increasing demand for higher speeds and higher voltages.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED DEC. 20, 1904

777,691. Trolley Head; Edwin V. Newcomb, Kansas City, Mo. App. filed Dec. 15, 1903. The trolley harp has recessed terminals with slotted walls, bearing-blocks therein slidable across the slots, and a trolley wheel carried by the blocks.

777,801. Electric Switch; William J. Murray, Leavenworth, Kan. App. filed May 2, 1904. Switch mechanism mounted above the trolley wire and adapted to be actuated by a trolley wheel passing thereunder.

777,810. Passenger Car; Hermann Romunder, Bloomsbury, N. J. App. filed Aug. 20, 1903. Details of construction.

777,852. Grip for Cable Railroads; Winfield O. Gunckel, Chicago, Ill. App. filed April 22, 1904. Details.

777,883. Control System; Eugene R. Carichoff, East Orange, N. J. App. filed June 2, 1904. A plurality of normally open switches, means for closing each of said switches, a controlling device arranged to be placed successively under strain by the closing of each switch and adapted by its movement to actuate successively the closing means of the remaining switches and means for retarding the movement of said device.

777,912. Trolley Crossing; Edward R. North, Webster Groves, Mo. App. filed May 6, 1904. An electro-magnet encrgized by the approaching trolley wheel touching a suitable contact, moves a bridge-piece into position to allow the wheel to pass uninterruptedly.

777,889. Street Car Switch Mechanism; John H. Fitch, Ludington, Mich. App. filed Sept. 14, 1904. A rocking lever across the roadbed is adapted to throw the switch in one direction when depressed at one end, and in the opposite direction when depressed at the other end.

778,002. Railroad Bond; Horace M. Bellows, Huntingdon Valley, Pa. App. filed Aug. 29, 1904. The rails have aligned recesses in adjacent ends, and a longitudinally-expansible spring movable in the recesses and material of adhering and electro-conducting nature on the end portions of the spring and recesses.

778,017. Trolley Guard; Mack H. Dorsey, Woodlawn, Ala. App. filed May 24, 1904. Hinged guard arms for holding the wire in place upon the wheel.

778,198. Life-Saving Attachment for Motor Cars; Benjamin Lev, Cleveland, Ohio. App. filed March 21, 1903. Details.

778,199. Cushioning Device for Safety Attachments for Cars; Benjamin Lev, Cleveland, Ohio. App. filed March 21, 1903. A cushioning roller for attachment to the front of fenders.

778,200. Flexible Roller for Safety Attachments on Motor Cars; Benjamin Lev, Cleveland, Ohio. App. filed Aug. 1, 1903. An improvement upon preceding patent.

PERSONAL MENTION

MR. W. FORMAN COLLINS, vice-president and business manager of the Electrician Publishing Company, of Chicago, publisher of the "Western Electrician," died very suddenly on the morning of Dec. 21.

MR. R. W. KING, formerly superintendent of the Rapid Transit Company of Chattanooga, Tenn., has been appointed general manager of the company to succeed Mr. H. M. Littell, who, as previously noted in the STREET RAILWAY JOURNAL, has become vice-president and general manager of the Southern Light & Traction Company.

MR. E. S. DIMMOCK, of Boston, has succeeded Mr. George W. Rounds as general manager of the Canton-Akron Railway Company, of Canton, Ohio. Mr. Dimmock formerly was manager of a street railway at Cape Breton, N. S. Mr. Rounds has been with the Canton-Akron system for about two years, and will continue with the Tucker-Anthony syndicate, which owns this and a number of other interurban systems.

MR. E. KILBURN SCOTT, M. I. E. E., of London, has just accepted the position of professor of electrical engineering at the Sydney University of Sydney, New South Wales. Mr. Scott has contributed several papers on European tramway topics to this paper, and was one of the party from the British Institution of Electrical Engineers that visited this country last September, at the time of the International Electrical Congress in St. Louis.

MR. THOMAS V. D'ORNELLAS has signed a contract with the Peruvian Government to act as electrical engineer and adviser to the government. Mr. T. V. d'Ornellas, who had been for some time previously connected with the Union Elektricitäts Gesellschaft, in Berlin, has been these recent years in charge of the technical department of the Compania Iberica Thomson-Houston, in Madrid. Mr. d'Ornellas' new headquarters will be in Lima, Peru.

MR. R. W. HARRIS has resigned as superintendent of the Norfolk Railway & Light Company, of Norfolk, Va., to become superintendent of the Michigan Traction Company, of Battle Creek, Mich. Mr. Harris has been at Norfolk about two years. Previous to that time he was connected with the Richmond Traction Company, of Richmond, Va. Mr. Harris' successor at Norfolk will be Mr. George Jennings, now in charge of the Norfolk Railway & Light Company's property in Berkley.

MR. CAMPBELL SCOTT has resigned his position of secretary and general manager of the C. & C. Electric Company, New York, to take effect Jan. 1, 1905. Mr. Scott has been prominently identified with the "C. & C." Company for some seven years, acting formerly as general sales manager, and for the last five years as secretary and general manager. Mr. Scott has not yet announced his reason for his retirement or his plans for the future, but it is rumored that he is going into business on his own account.

MR. ERNEST GONZENBACH has resigned his position as engineer of the Youngstown & Southern Railway Company to accept that of general manager of the Sheboygan Light, Power & Railway Company, of Sheboygan, Wis. This company operates 31 miles of city and interurban railway, a lighting plant and an amusement park. Mr. Gonzenbach will assume the duties of his new office on Jan. 1, 1905. His successor on the Youngstown & Southern Railway has not been appointed, and construction work on that road will be discontinued until next spring.

MR. GEORGE S. RICE, who has been chief deputy engineer to the New York Rapid Transit Commission for several years, has been appointed acting chief engineer to succeed Mr. William Barclay Parsons, who, as previously noted in the STREET RAILWAY JOURNAL, will devote himself to private work, and to the duties of his commission in connection with the Panama Canal. Mr. Rice was first employed by the city of New York in 1887 as the deputy chief engineer of the Aqueduct Commission. This was after an experience of about eighteen years in general engineering. In 1888 Mr. Rice was made a Civil Service examiner for the Aqueduct Board by Mayor Grant, continuing in that office until he resigned as deputy chief engineer. The Aqueduct Board placed Mr. Rice in direct charge of remedying the defective work on the aqueduct. Mr. Rice occupied the place of deputy chief engineer until 1891, when he was made chief engineer of the Boston Transit Commission. The preliminary studies of the Boston rapid transit work were made by him. In 1895 the rapid transit work performed by Mr. Rice attracted the attention of Mr. Parsons, and the greater part of the year 1895 was spent in working out with Mr. Parsons the original schemes for rapid transit for New York. At that time, 1895, Mr. Parsons expressed the desire that Mr. Rice assist him in the conduct of the rapid transit work, and in 1900 Mr. Rice was appointed deputy chief engineer. Since that time, during the absence of Mr. Parsons, Mr. Rice has acted as chief engineer. Mr. Parsons has, at the solicitation of the commission, agreed to act as consulting engineer to that body.

MR. J. A. MAC ADAMS, general superintendent of the Oneonta, Cooperstown & Richfield Springs Railway Company, of Oneonta, N. Y., is a man whose experience in street railroading began in the horse car days and has extended to almost every phase of city and interurban electric railway operation. Mr. Adams was born in Cleveland, in 1865. In 1881 he became associated with Mr. Tom L. Johnson in the operation of horse cars on the Brooklyn Avenue line in Cleveland, and in 1886 assisted in equipping this line with electricity. The pretentious project of the Johnson interest in 1893, the building of the Nassau system in Brooklyn, resulted in Mr. Adams being made responsible for a part of the construction work in that city. Upon the completion of these lines Mr. Adams was made a division superintendent in charge of the Fifth Avenue division, over which there was a one-minute schedule to Coney Island. The next arduous task for which Mr. Adams was chosen, was that of superintendent of the Marcy Avenue division of the same system. Here Mr. Adams was responsible for a barn of 100 cars, and the transportation of passengers not only to Coney Island, but to Manhattan Beach. When the Nassau system was sold, Mr. Adams, whose services had become almost indespensible to the Johnson interests, was made superintendent of the Bangor division of the Lehigh Valley Traction Company. Later there was added to the duties of this office the task of superintending the Easton division of the system. In all, Mr. Adams was at the time directly responsible for the operation of 90 miles of city and interurban electric railway. With the change of administration in the property Mr. Adams retired from this position. Before becoming connected with the Oneonta, Cooperstown & Richfield Springs Railway, Mr. Adams began the construction of a line from Yardly to New Hope, Pa., and Lambertville, N. J.

MR. THEODORE P. BAILEY, assistant manager of the Western office of the General Electric Company, leaves that Company on Jan. 1, 1905, to become vice-president and general manager of the L. E. Myers Company, of Chicago. Mr. Bailey has been associated with General Electric interests for more than twenty years and leaves the company with very great reluctance on his own part, and with the sincere regret of the officials of the company. His connection with the L. E. Myers Company means an important enlargement and extension of scope of that company's business by virtue of his aggressive policy and his long and successful experience in electric railway and light affairs. Mr. Bailey entered the employ of the Van Depoele Electric Light Company in 1882, and soon thereafter was elected secretary of the company. He held this position until 1884, when he became selling agent for the arc lighting apparatus of the Thomson-Houston Company in the West. His success in that work made him easily the choice of his company to assume the management of its railway department in the West when it took up that work in 1887. At that time the territory of the Chicago office covered everything in the United States west of Chicago. When the consolidation took place in 1892, and the General Electric Company was formed, Mr. Bailey continued the management of the railway department. One feature of Mr. Bailey's early electric railway career he refers to with some amusement and satisfaction in view of later developments. In 1890 he read a paper before the Chicago Electrical Club, in which the prediction was made that electricity would eventually supplant the cable as a motive power on street railways. This statement was bitterly attacked at the time by interests controlling cable railways, in the fear that such statements would, if undenied, depreciate the value of cable railway stock, and partly, no doubt, because many street railway men at that time honestly thought that the day would never come when the cable would be displaced from the streets of heaviest traffic in larger cities. Mr. Bailey has had the satisfaction of seeing his prediction come true, except in a few places where for special local reasons a change has been impossible. Later Mr. Bailey had his duties as manager of the railway department somewhat enlarged by being made assistant manager of the western office. In Mr. Bailey the L. E. Myers Company has secured a strong addition to its forces.

THEODORE P. BAILEY.

EARNINGS OF OHIO ROADS

The table of earnings of Ohio roads presented on the following page was compiled from sworn statements made by the auditors of the various roads to the Auditor of State, and covering the year ending April 30, 1904. The population tributary to the various roads was arrived at by crediting each road with the population of the incorporated villages and towns along the line and adding to this the population of the portions of the townships within 4 miles of the tracks, assuming that the population is evenly distributed over the township outside of the villages. The census of 1900 was used in the calculations.

A number of roads sell light and power, and in these cases the earnings per capita and per mile of track are figured on railway earnings only. On several roads the freight and express business is handled by an express company, and in these cases only the net receipts for express are given. Where interurban roads touch cities of over 75,000 population the earnings per capita are shown, both including and excluding the terminal city.

TABLE SHOWING STATISTICS OF OHIO STREET RAILWAY PROPERTIES

Name	(Issued) Capital Stock	(Issued) Bond. Ind.	City Mileage	Interurban Mileage	Total Mileage	Population, Excluding Terminals over 75,000 (1900)	Population, Including Terminals (1900)	Passenger Earnings for Year Ending Apl. 30, 1903	Passenger Earnings for Year Ending Apl. 30, 1904	Freight and Express, 1903	Freight and Express, 1904	Other Earnings, 1903	Other Earnings, 1904	Total Earnings Year Ending April 30, 1903	Total Earnings Year Ending April 30, 1904	Earn'gs per Capita Excluding Term'l	Earn'gs per Capita Including Term'l	Earning per Mile of Track (1904)
	$	$						$	$	$	$	$	$	$	$	$	$	$
Ashtabula Rapid Transit Co	150 000	75,000	5.21	----	5.21	----	12,939	51,740	54,322	----	----	----	----	51,740	54,322	----	4.19	10,426
Camden Interstate Railway Co	1,000,000	1,325,000	----	19.08	19.08	----	[1]14,055	------	[1]50,972	----	----	----	[1]18,572	[1]69,158	[1]69,544	----	4.94	7,657
Canton-Akron Ry. Co	1,678,000	1,046,000	16	34	50	----	96,339	280,804	361,976	2,902	4,902	11,414	24,527	293,120	392,407	----	4.17	7,848
Canton-New Philadelphia	600,000	565,000	----	23	23	----	12,460	------	57,171	----	----	----	----	--------	57,171	----	4.59	2,842
Central Market St. Ry., Columb's	1,250,000	500,000	15.6	----	15.6	----	125,560	------	51,512	----	----	----	----	18,065	51,512	----	.41	3,302
Chillicothe El. Ry. Lt. & Power	100,000	75,000	4.5	----	4.5	----	18.735	16,966	------	----	----	33,381	33,200	50,347	51,934	----	[2]2.57	[2]7,418
Cincin., Georgetown & Portsm'th	1,500,000	1,000,000	----	49	49	18,817	344,717	74,443	76,359	47,726	55,745	8,461	10,862	130,631	142,966	7.49	.41	2,918
Cincin., Dayton & Toledo Tr. Co.	3,500,000	3,500,000	5	67.9	72.9	65,900	477,135	465,819	480,058	[3]14,163	[3]19,043	2,800	5,287	482,782	504 387	7.65	1.05	6,918
Cincin., Hamilton & Dayton Tr. Co	10,000	------	1.41	----	1.41	----	------	1,540	2,153	----	----	----	----	1,540	2,153	----	----	1,385
Cincinnati Interurban Ry.	750,000	------	----	30	30	51,914	377,616	73,460	151,688	----	----	1,240	----	74,690	151,688	2.92	.43	5,056
Cincin., Newport & Covington Ry	3,600,000	2,500,000	[4]2.38	----	2.38	----	325,902	357,404	411,302	----	----	19,510	18,982	376,914	430,993	----	1.32	185,290
Cincinnati Traction Co	2,000,000	------	217.76	----	217.76	----	325,902	3,504,603	3,600,810	9,589	13,506	29,434	27,523	3,543,626	3,641,839	----	11.17	16,724
City Railway Co., Dayton	2,597,000	65,000	28.75	----	28.75	----	83.333	376,410	403,781	----	----	22,360	20,023	398,770	423,804	----	5.08	14,741
Cleveland El. Ry. Co	23,400,000	6,000,000	236	----	236	----	381,768	[5]4,460,653	4,495,702	[5]13,309	18,643	[5]43,173	30,598	[5]4,517,124	4,544,868	----	11.90	19,258
Cleveland, Painesville & Eastern	1,556,000	1,402,000	1	40.86	41.86	33,848	414,608	182,767	192,554	[6]10,148	[6]12,577	4,502	4,931	201,034	217,988	6.49	.52	5,231
Cleveland & Southwestern Tr. Co	4,800,000	2,100,000	----	134	134	78,809	460,577	320,188	390,610	[6]19,377	[6]26,454	39,401	29,969	382,722	447,082	5.67	.97	3,336
Col'bus, Buckeye Lake & Newark	1,500,000	1,125,000	----	39.13	39.13	25,894	151,454	118,404	171,554	7,251	11,557	4,905	8,394	130,561	191,504	7.39	1.26	4,894
Columbus, Delaware & Marion Ry	1,500,000	1,000,000	5	56	61	34,460	160,020	------	108,086	----	7,432	----	----	60,219	[7]115 518	[7]3.35	[7].72	[7]1,893
Columbus, Grove City & Southw'n	250,000	210.000	----	15	15	4,500	130,060	------	38,069	----	2,189	----	----	--------	40,254	8.94	.30	2,683
Columbus, London & Springfield	2,500,000	1,500,000	----	52	52	50,764	176,330	116,718	143,425	3,257	13,624	----	151	119,975	157,200	3.09	.88	3,023
Columbus, New Albany & Johnst'n	150,000	150,000	----	8.6	8.6	2,476	128,042	19,467	21,276	2,059	3,003	----	----	21,626	24,279	9.80	.19	2,822
Columbus Railway & Lt. Co	5,000,000	------	94	12	106	2,360	127,926	1,203,273	1,167,725	3,725	----	7,019	276,590	1,214,037	1,444,315	----	[8]9.12	[8]11,582
Dayton, Covington & Piqua Tr. Co	1,050,000	450,000	----	33	33	26,281	111,614	51,919	74,393	2,311	10,02	----	----	54,230	84,388	3.21	.75	2,551
Dayton & Northern Tr. Co	450,000	450,000	----	40	40	20,550	105,883	87,455	83,320	9,330	11,217	150	----	96,936	94,530	4.59	.89	2,363
Dayton, Springfield & Urbana	1,500,000	750,000	----	[9]72.75	[9]72.75	[9]74,112	[9]159,445	183,835	[9]214,541	11,864	[9]16,602	----	----	195,700	[9]231,143	[9]3.12	[9]1.45	[9]3,177
Dayton & Troy El. Ry	1,000,000	------	----	33	33	28,950	114,283	111,626	125,884	[4]4,845	[3]3,915	236	1,161	117,769	140,179	4.84	1.23	4,248
Dayton & Western Tr. Co	1,300,000	------	----	30	30	34,081	119,414	62,731	95,082	7,821	10,380	696	833	80,251	106,293	3.12	.89	3,543
Dayton & Xenia Tr. Co	800,000	800,000	----	53	53	21,666	104,999	93,472	101,293	3,626	6,413	1,813	3,036	98,911	110,736	5.10	1.05	2,089
Eastern Ohio Tr. Co	2,259,000	1,893,000	----	86	86	22,748	404,516	144,559	144,374	50,180	57,048	----	----	197,504	205,597	9.03	.50	2,391
Electric Ry. & Power Co., Tiffin	50,000	------	7.3	----	7.3	----	10,989	------	------	----	----	----	----	11,982	15,285	----	1.41	2 094
Fairfield Traction Co	50,000	------	5.2	----	5.2	----	8,991	4,816	5,840	5,598	1,936	122	----	10,635	7,864	----	.87	1.512
Interurban Ry. & Terminal Co	2 500,000	------	----	101	101	45,367	371,269	------	142,972	----	17,148	----	732	142,239	[7]160,852	3.54	.43	[7]1,582
Lake Erie, Bowling Gr. & Napol'n	300,000	------	----	14	14	----	8,867	18,325	12,141	----	----	7,547	17 005	25,872	29,146	----	[8]1.37	[8]867
Lake Shore Electric Ry	7,468,000	4,900,000	15	145	160	101,806	615,392	456,904	585,363	27,788	[6]15,788	4,740	5,028	493,533	610,075	5.99	.99	3,812
Lancaster Traction Co	100,000	------	3.5	----	3.5	----	8,991	18,851	21,558	----	----	223	2,122	19,074	23,679	----	2.63	6,762
Lima El. Ry. & Lt. Co	850,000	500,000	19.26	----	19.26	----	21,723	------	------	----	----	----	----	75,814	92,502	----	----	----
Lorain St. Ry	750,000	200,000	----	11.6	11.6	----	26,656	83,169	93,285	716	564	3,199	2,013	87,085	95,863	----	3.59	8,264
Mahoning Valley Ry. Co	2,500,000	------	21	40	61	----	76,993	396,972	446,826	12,174	12,541	1,926	1,469	411,073	461,016	----	5.98	7,557
Mansfield Ry., Lt. & Power Co	1,000,000	650,000	9	12	21	----	25,475	80,930	91,038	642	1,301	39,587	47,097	121,149	139,437	----	[8]3.62	[8]4,397
Marion Ry., Lt. & Power Co	50,000	------	4.8	----	4.8	----	11,862	30,110	29,363	----	----	200	24,824	30,310	64,287	----	[8]3.13	7,729
Maumee Valley Ry. & Lt. Co	1,000 000	800,000	----	20.2	20.2	8,823	140,645	57,927	56,736	4,144	4,656	13,314	9,988	75,385	71,381	[8]6.96	[8].43	[8]3.039
Mt. Vernon El. Ry. Co	75,000	30,000	4.8	----	4.8	----	6,633	7,493	9,290	----	----	3,322	1,355	10,815	10,644	----	1.62	2,428
Newark & Granville Ry	300,000	190,000	7	7	14	----	21,924	59,946	80,337	1,531	1,563	2,022	4,402	63,499	86,302	----	3.93	6,164
Northern Ohio Tr. & Lt. Co	6,500,000	5,750,000	30	68	98	78,364	460,132	615,297	726,444	[6]16,213	[6]23,276	95,420	111,713	726,930	864,514	[8]9.60	[8]1.63	[8]7,679
Oakwood St. Ry., Dayton	19,000	------	8	----	8	----	85,333	126,704	------	----	----	445	----	127,149	125,494	----	1.47	15,688
Ohio Central Tr. Co	1,150 000	400,000	----	30	30	----	40,992	58,567	------	2,030	----	167	----	60,765	85,055	----	2.07	2,835
Ohio River El. Ry. & Power Co	300,000	315,000	7	7	14	----	19,200	39,020	41,688	4,121	4,162	2,293	3,217	45,435	49,067	----	2.55	3,505
Pennsylvania & Ohio Ry	700,000	700,000	----	26	26	----	27,228	70,783	82,365	2,280	2,071	----	386	73,063	84,822	----	3.12	3,262
Parkersburg, Marietta & Inter'b'n	440,000	------	10	17.5	[11]27.5	----	------	146,395	171,896	----	----	50.956	55,485	[10]197,351	[10]227,081	----	----	[10]6,251
Peoples Ry. Co., Dayton	1,100,000	500,000	31	----	31	----	85,333	245,177	272,895	----	----	20,189	25,263	265,366	298,158	----	3.49	9,611
Portsmouth St. Ry. & Lt. Co	125,000	83,000	4	4	8	----	19,670	44,366	49,733	----	----	24,911	32,143	69,277	81,776	----	[8]2.82	[8]6,945
Salem El. Ry. Co	100,000	50,000	3.2	----	3.2	----	5,780	8,501	9,279	18	18	----	----	8,519	9,297	----	1.60	2,905
Sharon & New Castle Ry. Co	380,000	------	----	4.36	[4]4.36	----	------	------	[4]10,090	----	254	----	----	[4]6,613	[4]10,335	----	----	[4]2.370
Springfield Ry. Co	1,000,000	600,000	28.6	----	28.6	----	38,253	184,165	202,280	----	----	748	827	184,912	203,107	----	5.31	7,102
Springfield & Xenia Tr. Co	500,000	500,000	----	20	20	----	53,653	------	53,360	----	----	----	2,435	------	55,798	----	1.04	2,789
Steubenville, Mingoe & O. Valley	150,000	150,000	----	9	9	----	19,503	------	54,984	----	2,974	----	----	--------	57,958	----	2.97	6,439
Stark Electric Ry	850,000	750,000	6	26	32	----	50,241	19,200	105,424	----	----	808	1,395	20,008	106,819	----	2.11	3,340
Steubenville & Pleasant Heights	--------	------	2.2	----	2.2	----	14,349	573	8,212	----	----	----	----	--------	8,212	----	.57	3,733
Steubenville Tr & Lt. Co	1,000,000	700,000	5	12.5	17.5	----	21,975	65,691	78,562	378	1,436	6,568	----	[8]72,637	[8]79,998	----	3.64	4,572
Toledo, Bowling Green & Southern	1,500,000	1,350,000	5	51	56	46,901	178,723	178,876	189,104	1,022	2,806	52,176	61,854	232,074	253,762	[8]4.12	[8]1.09	[8]3,451
Toledo, Fostoria & Findley Ry	450,000	450,000	----	16.8	16.8	----	30,922	53,423	48,147	2,499	2,806	3,398	2,147	59,074	53,428	----	1.72	3,180
Toledo & Indiana Ry	215,000	220,000	----	29.7	29.7	11,895	143,717	------	56,237	----	8,935	----	----	--------	65,168	5.48	.45	2,194
Toledo Ry. & Lt. Co	12,000,000	------	110	----	110	----	131,822	1,089,296	1,175,239	----	----	410,009	477,882	1,499,305	1,653,220	----	[9]9 43	[8]11,307
Toledo & Western Ry	1,576,000	1,500,000	----	78.5	78.5	34,820	166,642	95,644	123,637	26,106	48,303	412	4,826	122 163	175,767	5.04	1.06	2.239
Tiffin, Fostoria & Eastern	175,000	175,000	----	17	17	----	23,619	43,722	45,690	3,066	2,647	598	751	47,386	49,087	----	2.08	2,886
Tuscarawas Tr. Co	250,000	100,000	----	13	13	----	25,797	53,295	------	2,994	----	571	----	56,860	60,666	----	2.36	4,666
United Power Co., E. Liverpool	900,000	600,000	8	7	15	----	25,315	145,191	147,694	----	----	31,525	34,816	176,716	182,510	----	[8]5.83	[8]9,846
Victory Park Ry	5,000	------	1.5	----	1.5	----	------	------	------	----	----	----	----	126,573	127,438	----	----	124,959
Western Ohio Ry	3,000,000	2,250,000	----	83.5	83.5	----	71,819	116,728	195,003	[4]4,275	[9]9,717	----	1,086	120,993	204,806	----	2.85	2,453
Wheeling Traction Co	1,836,700	1,404,000	7.28	1.5	22.78	----	------	------	------	----	----	----	----	--------	[4]195,465	----	----	8,590
Youngstown Park & Falls Ry	200,000	200,000	6.5	----	6.5	----	44,885	62,976	------	----	----	18,178	----	81,154	65,553	----	1.46	10,083
Youngstown & Sharon Ry	712,500	600,000	----	13.43	13.43	----	60,401	108,529	101,087	3,671	7,204	----	----	112,201	[4]108,292	----	[4]1.79	[4]8,064
Zanesville Ry. & Lt. Co	1,000,000	750,0 0	14	----	14	----	-- ---	------	------	----	----	----	----	287,140	298,621	----	4.19	7,051
Total	--------	------	----	----	----	----	------	------	------	----	----	----	----	18,595,575	21,449,246	----	----	----

[1]Includes Ohio portion only. Total capital stock is given. [2]Does not include lighting earnings. [3]Net from Southern Ohio Express Co. [4]Figures for Ohio portion only. [5]Figures of Cleveland City Railway included with Cleveland Elevated Railway in 1903. [6]Net from Electric Package Co. [7]Part of road not in operation for full year. [8]Based on railway earnings only. [9]Includes mileage of Urbana, Bellefontaine & Northern, and earnings of same for part of year. [10]Figured on passenger earnings only. [11]Includes West Virginia part. [12]Operated only in summer.