Street Railway Journal

VOL. XXV. NEW YORK, SATURDAY, JANUARY 7, 1905. No. 1.

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, Mexico and the Canal Zone.

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.

Hereafter the exact circulation of the Street Railway Journal each week will be stated in this column. Of this issue, 10,000 *copies are printed.*

The Collection of Fares

There would seem to be no simpler work on a street railway than the collection of fares, and yet no small inconvenience and delay may easily result on a crowded car if the matter is not properly handled. Emerson's remark that there is always a best way of doing everything, even piling up wood in a cellar, applies with equal force to the gathering of nickels, and the subject is all the more important as one realizes that nearly all the revenue of an operating city company comes in instalments of 5 cents each.

Two points are of vital importance in the collection of fares. First, that no fares shall be lost, and second, that the movement of the car shall not be hindered. To a certain extent these considerations are antagonistic on roads which admit passengers to their cars, as practically all surface roads must, before exacting the fare payment. If the conductor takes up many fares at once he should begin at the rear end of the car, if that is the only exit, so as to allow no passenger to leave until his fare is paid. If the front platform is also used as an exit, it is probably better, when a large number of fares are to be collected, to begin at that end, because passengers will then recognize that his trip through the car is to collect fares and will have their change ready.

Most railways require the conductor to collect fares as soon as possible after the passenger enters the car. This is undoubtedly the best plan, but we do not see any objection, in the case of crowded cars, to require the conductor to make a special effort to collect the fares of those who have boarded the car at any corner, immediately after starting his car. As a rule, in a crowded car, the incoming passengers stop a short time on the platform or near the door after the car is started and before looking for standing room elsewhere, and if their fares can be collected during this interval there is less danger of missing them afterward.

Track Maintenance on Interurbans

Steam railroad men accustomed to the large amount of labor spent on the maintenance of track and roadbed of our most important steam trunk lines, no doubt hold up their hands in horror at the small amount spent for this purpose on the majority of interurban electric roads, yet the average condition of the track on interurban roads is much better for the work such track has to perform than it is on the majority of branch steam lines. The reason for this is not far to seek. The interurban track is usually 60-lb., 70-lb. and 80-lb. T-rail, which is as heavy or heavier than that found on the branch steam roads, and the maximum load such rail has to carry is much less than on the steam road. In ordinary interurban service there is nothing to compare with the weight of modern steam locomotives. The result is that the interurban track once lined up, well ballasted and settled, will remain in good condition much longer than any steam railroad track of the same weight and ballast.

Nevertheless, interurban track seldom gets any too much attention, and the natural tendency is to neglect it in an unwise attempt to keep down maintenance expenses rather than to spend too much on it. Of course, as long as the track rides smoothly it can reasonably be said that it is accomplishing the purpose for which it is laid, in a satisfactory manner, and one might as well leave well enough alone. The only question under such circumstances is whether weeds are not getting in their work so actively that they will cause undue depreciation of ties and roadbed. Indeed, the keeping down of weeds is often one of the most expensive items in interurban roadbed maintenance. They do little harm at first, but the tendency is for them to

cause rotting of the ties, both on account of the shade they produce and because of the tendency of the roots to prevent the ballast from draining as it should. By preventing draining, the roots not only rot the ties but destroy some of the benefits of the ballast, as the main object of ballast is to give a bed for the ties which will drain itself sufficiently so that ties will always rest on a firm foundation. Several years ago some of the steam roads experimented with high-voltage currents for killing weeds. The results were not entirely satisfactory, although, with the supply of electrical energy available on interurban roads, the scheme might prove more feasible.

Cast-Welding

Although cast-welding of rail-joints has now been in use so long by electric railway companies that it has almost ceased to be a matter of discussion, there appear to be many points in connection with this work which might be considered with profit. It is now almost exactly ten years since the first cast-welded track was laid and a description of the process was made public. The process was originally developed by a corporation which supposed that it owned valid patents on the system, and this company perfected the details, advertised the process and introduced it much more rapidly than would have been done had it not been taken up in this way. We have not before us any statistics on the relative amount of cast-welding done now and eight or nine years ago, but it is tolerably certain that the process of cast-welding is not being pushed now as formerly. One reason is that it is free to every one, and no manufacturing company has the financial incentive to keep it before the street railway companies that there was in the early history of the business. It is certainly a reflection on human nature that a thing sometimes ceases to be considered desirable or worth seeking after the moment its use is free to all.

However this may be, it is certainly in order now, after cast-welding of rail-joints has been in practical use for ten years, to inquire into the results and to summarize the lessons that have been learned. This is something which the track men will undoubtedly take up at the conventions of the next few years. Cast-welding is the standard type of construction of some of the largest companies in the country for paved streets, while other companies operating under the same conditions apparently have no use for it. It is inconceivable that local conditions should cause such differences in results as to justify the great variance in the opinions held as to the value of cast-welding. The cause must be attributed to differences in methods and to the care with which certain details are looked after. It was with the idea of bringing out some of these points that we obtained from H. M. Sloan, of the Calumet system in Chicago, the material for an article on cast-welding as practiced by his company, which appears elsewhere, and in which many details are brought out which are frequently forgotten in connection with cast-welding. It is hoped that similar data can be obtained from other companies using the process.

It has been our observation that cast-welding has been commonly blamed for a mistake which is not the fault of the cast-welding process, and the same thing would have been true of any other welding process had it been applied as extensively as cast-welding was at one time. It was common at one time, as a last resort, to cast-weld the joints of track which had already been laid so long that the joints are slightly low. The process lengthened the life of the track, but in the ends the joints would be so poor that relaying would be necessary. The result was exactly the same as if there was a slight depression in the rail between joints before it was laid. The car wheels, in passing, constantly hammered a slight depression into a larger one until the track was ruined. Thus it is that cast-welding has been charged with softening the rail heads in some cases, where in reality it was nothing more or less than the mechanical hammer blow which did the mischief, this blow being due to a depression of the rail at the joint in the first place. We do not say that this has always been the case where cast-welded joints have given out before the rail head was worn out, but we do know that many miles of track with low joints have been cast-welded with the idea that the track would be as good as new as regards the joints. Such track has lasted many years as a result of the cast-welding, where otherwise it might have lasted but a few months, but in the end the joints have been hammered lower than the rest of the rail, except in cases where the joints were raised so as to make an absolutely straight surface for the car wheels to roll along. However, the question of changing the temper by the heat of cast-welding is worth considering, and the method adopted by Mr. Sloan to keep the head of the rail cool is certainly a safe precaution, even if it is not absolutely necessary. The facts that bolted joints have made some remarkably good records on rails weighing from 80 lbs. to 100 lbs. to the yard, and that other improved joints have been placed on the market, have perhaps lessened interest in cast-welding, but we need more data on the whole subject of the life of joints, and this should be one of the first subjects taken up by the track and way men at coming conventions.

Pit Lighting

Some large companies are doing away with pit work in repair shops as far as possible, and many others would like to abandon it if the motor equipments which they own permitted it. There is also a tendency to do away with night inspection and repair work as much as possible, but, at the best, railway companies have, and probably always will have, a great deal of pit work and night work to do. It is seldom that one sees a well lighted pit in a car-house or repair shop, and it is remarkable that this is so when one considers that the pit of all places should be well lighted. In inspection work around motors and trucks, the portable hand-lamp plays the most important part, for it is impossible to get light in the pit from above for close inspection around motors and trucks, or even from permanent points from below. Everything depends, therefore, on the hand-lamps, as these can be put just where the light is wanted.

Hand-lamps, as used in pits, however, are usually not anywhere near as effective as they might be. Very few people realize how important it is to keep the source of light shaded from the eye. Hand-lamps usually have no shade or protection of any kind which will prevent the glare of the light striking the workmen squarely in the eyes. When working around the pit the lamp is usually brought somewhere near the work. In order to look at his work, the workman must turn his eyes so that the rays from the lamp fall directly in them. If the light were very intense it would blind him under such circumstances, but as it is not very intense the average person does not suffer enough discomfort to realize that he is losing a great deal of the benefit of the light. The light being in the range of vision, the pupil of the eye contracts as it always does to prevent injury to the eye when a bright light strikes it. This contraction of the pupil reduces the amount of light entering the eye so much that one cannot see the objects surrounding a lamp nearly as well, if the lamp is uncovered, as if something is placed between the eye and the lamp. This can be demon-

strated by anyone to his own satisfaction by trying to read the figures on a blackboard or bulletin board in front of which an unshaded lamp is hung, and then shading the lamp so that the light falls on the board but does not strike the eye. By shading the lamp there is apparently an enormous increase in the amount of light on the board, and reading becomes at once easier and more comfortable.

Portable lamps for use in pits, therefore, should always be equipped with something to shade one side of the lamp. One very good way to do this is to fasten a sheet of tin just inside the wire guard, or if preferred some of the regular half shades that are on the market can be put over the lamp. The effectiveness of pit work can be very greatly increased by this simple precaution which is dictated by common sense, but which is frequently disregarded.

The Economics of Power Transmission

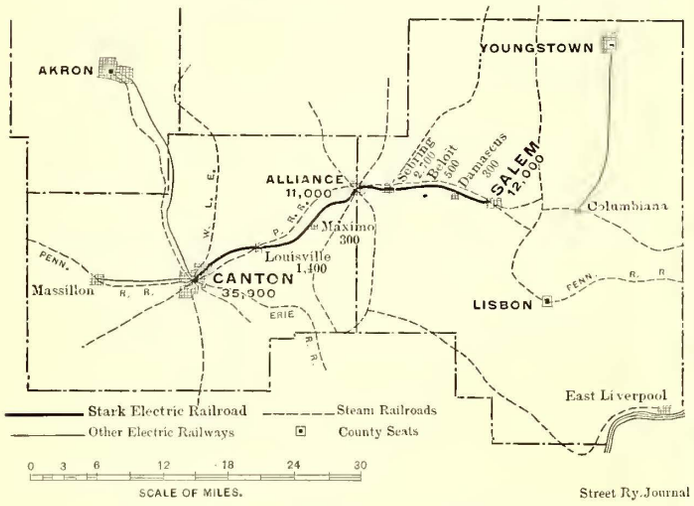
At the last meeting of the American Institute of Electrical Engineers a very interesting and suggestive paper was presented by Mr. Mershon dealing with the economic features of long distance power transmission, and especially with the extensions to which we may look forward in the near future. Such computations as these are always involved in a haze of assumptions which render it difficult to get a clear view of the results, but Mr. Mershon's conclusions involve some striking, not to say startling, features. He finds, as was to be expected, that in the last resort the cost and maintenance of the line is the limiting feature, but the distances to which even with this limitation it is possible to transmit power and still make a profit under not inconceivable conditions, are somewhat appalling. To clear the situation of unnecessary details, he has assumed that power is bought at the low-tension bus-bars of the step-up station for $10.90 per kw-year, and is sold at the low-tension bus-bars of the receiving station at $34 per kw-year. These figures are, of course, open to some criticism, the former as being too low even for a hydraulic plant of large size, the latter as too high. But it is reasonably certain that power costs in steam-driven stations are on a permanent upward gradient, subject, of course, to minor variations. Fuel is steadily appreciating in price as a whole, and in the long run that means dear power. Granting the figures taken, he finds that from a plant of 100,000-kw output, power can be economically transmitted 350 miles, and from a plant of 200,000 kw, a trifle over 500 miles. At 400,000 kw, the radius stretches out to the enormous span of over 700 miles. As the net profit for which this calculation is made is 12 per cent, there is sufficient leeway to allow for the errors in assumed prices, and the conclusion may be regarded perhaps as a first approximation to the fact. Power has actually been transmitted 350 miles to customers in California in a temporary emergency with good operative results, although we hardly fancy the supply company would enjoy having much of its load at that distance. The transmission voltage in this instance was about 50,000. Mr. Mershon wants about 125,000 for his 350-mile work and about 155,000 for the 500-mile run.

While we agree with Mr. Mershon's broad conclusions we are not in entire accord with all of his assumptions. When power in large blocks becomes saleable at $34 per kw-year, or anywhere near that figure, one can safely count on having investments on less than a 12 per cent basis. This figure may be necessary where the investment is represented by the bond issue and where the stock represents profit. But we believe that when the merits of power transmission plants are more generally recognized the people who have the money will gradually awake to the fact that 100 per cent is too much to pay for organizing their investments, and they will buy and develop properties for actual returns. If one figures out a great power transmission on the basis of 5 per cent or 6 per cent on the actual cash put in, he will reach some very surprising figures, and it is this situation that will follow when fuel costs have risen and the economic struggle has grown fiercer. One cannot count on 200,000-kw power transmissions in a country in the "boom" stage of its history. Save in very rare cases, the consideration of hydraulic stations of the capacity of 200,000 kw or more is sheer moonshine. There are three cataracts of magnitude enough to justify such computations—Niagara, already well developed, and selling power much below Mr. Mershon's figures in large blocks; the great falls of the Zambesi, in the heart of Africa and 500 miles from anything above the rank of a village populated largely by natives, and the huge cataract, bigger than Niagara and Victoria Falls together, recently reported from the backwoods of Brazil, 1000 miles from any considerable city. Niagara has great possibilities, but its tendency is very strongly toward nearby utilization at present. The chance at Victoria Falls will some day be magnificent, for Africa, if we mistake not, will be the scene of the world struggles of the next few centuries. South America, too, has a future that we of the North fail to appreciate.

But the big power transmissions of the future are likely to be of a sort not considered by Mr. Mershon. They will not be straightaway transmissions of enormous amounts of power from a single source, but colossal distributions for large districts from groups of allied stations. In this case the average distance of transmission is relatively moderate, since the area covered and with it the average amount of power required increases with the square of the radius. On the other hand, the network of lines required to distribute the output becomes very costly and difficult to maintain. The difficulty as regards voltage is comparatively small, but the extent of line is many times as great as in the case of a typical straightaway transmission. The fundamental difficulty of power transmission is in the upkeep of the line, and in protecting it against dangers from within and without. Most of all, improved insulators are needed before any work of the magnitude discussed by Mr. Mershon is undertaken. It must be remembered that at the present time the highest voltages worked commercially are below 60,000, and that the insulators used have relatively very small factors of safety, all weathers taken into account. The factor of safety is certainly less than 2, and probably not over 1.5. This is the weak spot in high-voltage transmission, and until very material improvements are made Mr. Mershon's 125,000 or more is a figure not to be considered seriously. We have little doubt that the improvements in insulation will be great, but it is necessary to more than double the current-confining power of the best insulators yet constructed before we can with reasonable safety pass to pressures above 100,000 volts. And the climatic conditions are in this instance far more serious factors than the mere insulator structures. Nevertheless, power transmission on a big scale is certain to come, and Mr. Mershon's figures are important in that they show on a broad view that transmissions of power over distances reckoned in hundreds of miles are not to be counted as commercially unfeasible, granting conditions within measurable distance of those now in sight. Operating all the industries and railroads in a State from a single network is something better than a remote possibility. Even now the difficulties are less physical ones than those due to political and commercial machinations.

THE SYSTEM OF THE STARK ELECTRIC RAILROAD COMPANY

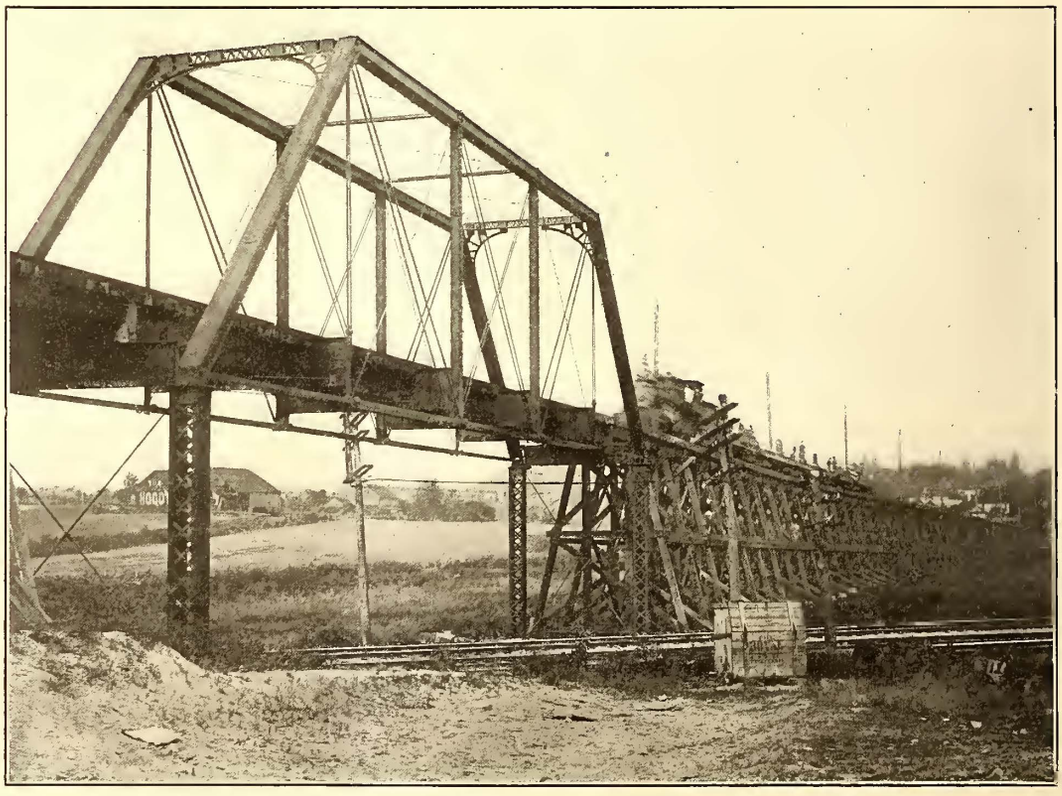
The plan of building an interurban electric railway wholly on private right of way even in cities is admitted by all engineers and operators to be ideal practice, but in the great majority of cases the cost of securing such entrance to cities and towns is deemed prohibitive. Some of the latest interurban roads have adopted the practice of building around the outskirts of small hamlets and towns, while others have gone a step further and have kept off public streets almost entirely.



MAP OF THE TERRITORY SERVED BY THE STARK ELECTRIC RAILWAY

CROSSING ABOVE THE PENNSYLVANIA RAILROAD AT LOUISVILLE

One of the most striking examples of a road built on private right of way is the Stark Electric Railway in Ohio. The line extends from Canton to Salem, a distance of about 37 miles, touching Louisville, Alliance, Sebring, Beloit and several smaller towns. At present the interurban cars traverse less than 4 miles of city or village streets, and in the near future, by means of a cut-off around the center of Alliance, the street trackage will be reduced to less than half a mile for the through cars. To accomplish this the company was obliged to spend what would be considered by many an excessive amount for right of way, but it is thereby enabled to operate fast passenger service without the delays and danger of accidents incident to operating on city streets, to handle standard freight cars if it desires to do so, and, above all, to place its securities in a position where municipal franchises have no bearing on their value.



OVERHEAD CROSSING APPROACHING SALEM. A 5 PER CENT GRADE INTO CITY ON PRIVATE RIGHT OF WAY

The line traverses one of the most populous districts of Ohio. The population in the towns and other territory tributary to the road is about 70,000, which gives an average of not far from 2000 per mile for the interurban line. The route, connecting steam lines and the population of the towns are shown in the accompanying map. Canton is an important manufacturing center and a beautiful residence city, noted as the home of the late President McKinley. It has many factories, including those of the Dueber-Hampden Watch Company, the Canton Steel Company, the Carnahan Iron & Steel Company, Canton Bridge Company, Berger Manufacturing Company and the Diebold Safe & Lock Company. In entering Canton the company bought private right of way for a distance of 2 miles alongside the right of way of the Wheeling & Lake Erie Railroad (steam). This brought its tracks to within five blocks of the court house. An endeavor was made to secure a franchise for the balance of the way, but this was blocked by the parties who at that time owned the Canton city lines. The Stark Company started condemnation proceedings, and realizing that the new company was likely to get in, the city company agreed to build the necessary track, pay half the expense of maintenance and give the interurban company exclusive use of the same, the city company receiving a portion of any local fares that might be collected on this short division. This arrangement gives the Stark Company a loop of its own. The cars traverse the court house square, where there are five parallel tracks, one used by the Stark Company, two by the Canton-Akron in-

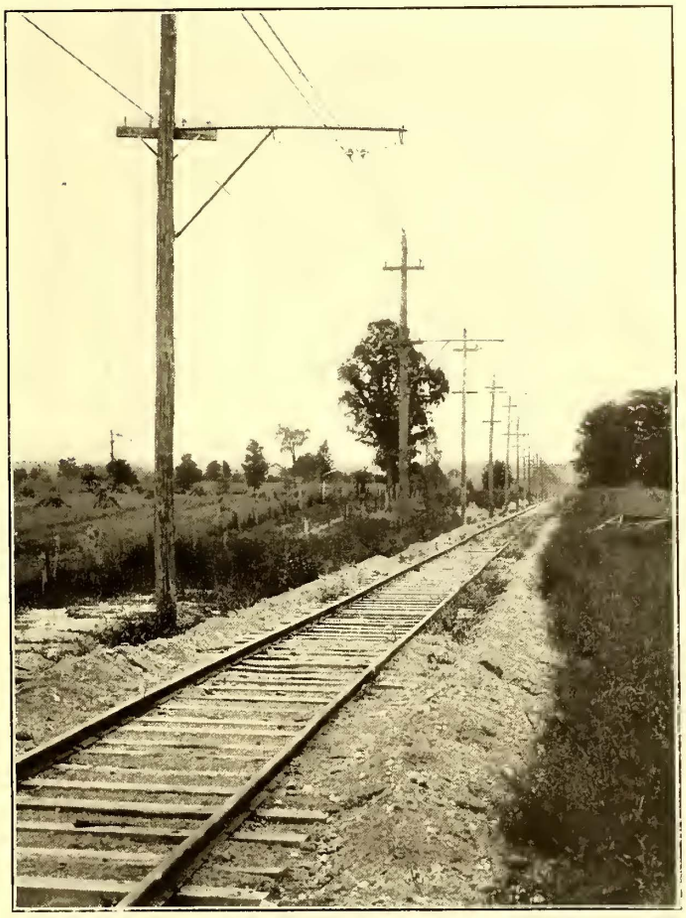
terurban cars and two by the city cars. The waiting rooms are held in common, and all interurbans arrive and depart at the same time, giving direct connection for Akron and Cleveland to the north, and Massillon, New Philadelphia, Canal Dover and Uhrichsville to the south. Louisville is a manufacturing village, while Maximo is an agricultural town and shipping point for dairy products. Alliance is a busy manufacturing and railroad center. Its factories include the enormous plant of the Morgan Engineering Company, the Reeves Boiler Works, American Steel Castings Company, Alliance Machine Company, a plant for producing concrete blocks, and the roundhouses and division headquarters of the Pennsylvania Railroad. One of the first steps of the promoters of the Stark Company was to acquire the property of the Alliance Street Railway Company, including 6 miles of city tracks. These lines are laid out in three routes, starting at the village of Mount Union, now the southwesterly corner of the city; north to Main Street, east on Main Street to the business section of the

STEAM SHOVEL WORKING IN GRAVEL PIT

city, then south and then east, striking the city limits near the southeasterly corner of the city. This circuitous route of over 4 miles through Alliance is a great disadvantage to the through services, besides being contrary to the company's policy of

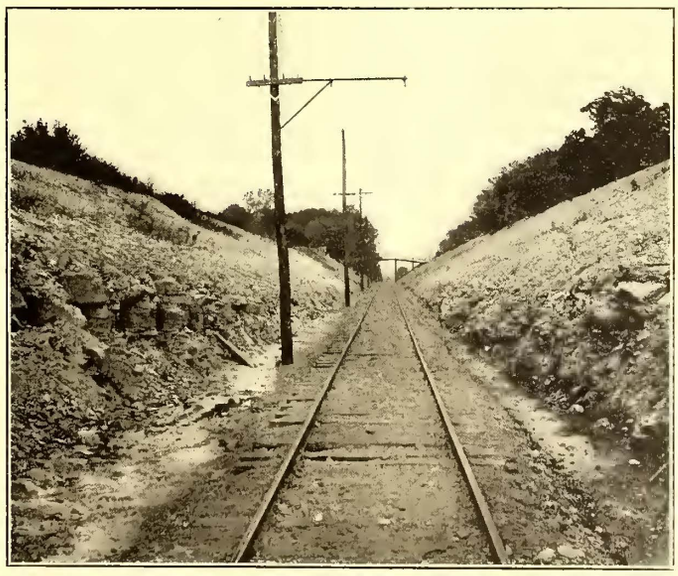
A HEAVY FILL ON THE STARK ELECTRIC RAILWAY

operating on private right of way. In consequence, it has secured a strip along the southerly border of the city to a point where connection is made with a switch from the Lake Erie, Alliance & Western Railroad (steam), extending around to the plant of the Morgan Engineering Company on the easterly border of the city. The company secured a half interest in this switch, and with a short extension, also on private right of way, the main line to the east is reached. This cut-off will be used



A CUT AND GRADE ALONG THE LINE OF THE STARK ELECTRIC RAILWAY

for the through limited cars, which it is the intention to alternate with local cars; also for through freight and express service. Alliance passengers for the limited cars will be handled in and out of the city with the city cars, direct connection being



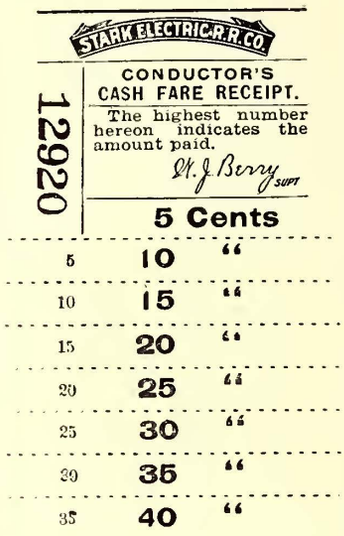
AN EXAMPLE OF THE OVERHEAD WORK

made with these cars. Five miles east of Alliance is the town of Sebring. Three immense potteries have produced a town with a resident population of nearly 3000, where three years ago there was scarcely a hamlet. Large numbers of the employees of these plants live in Alliance, and the company gives

extra service morning and evening for the benefit of these people. Beloit, an agricultural village, has 500 population, while Damascus is somewhat smaller. This district was settled largely by Quakers, who still predominate. They were extremely liberal in the sale of right of way and are good patrons of the road. At Damascus is a famous Quaker university. Salem, the present easterly terminus of the road, has a population of 12,000, and is an important iron manufacturing center.

A FIVE-CAR EXCURSION TRAIN ON THE STARK ELECTRIC RAILWAY

It is the home of the Buckeye Engine Company, one of the oldest and best known manufacturers of steam engines in this country; the Deming Company, pump manufacturers; Silver Manufacturing Company, castings; and one of the largest nail plants of the American Steel & Wire Company. Going into Salem, the company bought a private right of way adjoining an alley at the rear of Main Street, the principal street, running east and west. This brings it to within 200 ft. of the City Hall. It secured a franchise for a Y at the head of this street,



CASH RECEIPT

THE SALEM TERMINAL OF THE STARK ELECTRIC RAILWAY

but the cars lay up on a siding adjoining a building which was leased and fitted up as a passenger and freight station, as illustrated.

It is possible that the company may decide to build beyond Salem, to either Columbiana or Lisbon, or perhaps to both points. The former place is now connected with Youngstown by the Youngstown & Southern Railway, at present run as a steam line, but designed for third-rail operation, which would give through electric connection from Canton to Youngstown. Lisbon is the county seat of Columbiana County, but the present steam service between Salem and Lisbon is very poor. There are also indications that a line will soon be built from Lisbon to East Liverpool, forming a direct route to Pittsburg, and which, before many months, will have electric connection with Steubenville, Wheeling and other Ohio Valley points.

As will be noted by reference to the map, the Stark Electric closely parallels the main line of the Pennsylvania Railroad, and competes with it at every point, with the exception of the village of Damascus. This company has always maintained a liberal policy towards electric roads, and it has made no attempt to meet the rates or increase its local train service. On the contrary, it has appeared willing to permit the electric road to handle the short-haul business. Owing to the strong position of the Pennsylvania, the electric road will probably make no attempt to do a strictly freight business with trains of box cars, although the road is adapted for this work, but it will undoubtedly derive considerable business from switching cars to factories and other points not reached by the steam line. At present it is handling express matter in combination cars, and it will shortly install a 47-ft. express car. It will handle high-class freight at rates somewhat higher than steam freight rates, and will operate express service at rates about the same as those of the old-line companies, making deliveries in Salem, Alliance and Canton. The company interchanges business with the Canton-Akron Company for points on its system, and negotiations are on with the Electric Package Company, of Cleveland, whereby that company may take goods for Cleveland in

THE OLD AND THE NEW—AN ANCIENT NEGRO CABIN CONTRASTED WITH A MODERN INTERURBAN CAR

connection with the business it already handles over the Canton-Akron line from Canton. Through shipments are at present possible, but the goods have to be reshipped at Canton. Goods from Louisville, Maximo, Sebring and Salem are frequently taken to Alliance and shipped to Cleveland over the Pennsylvania, which has a direct line from Alliance. The express rate from Salem to Cleveland is 60 cents, and from Alliance to Cleveland, 50 cents, so the electric road gets the 10 cents on goods from Salem. On non-delivered goods the company receives 15 cents from Alliance to Canton, and 20 cents

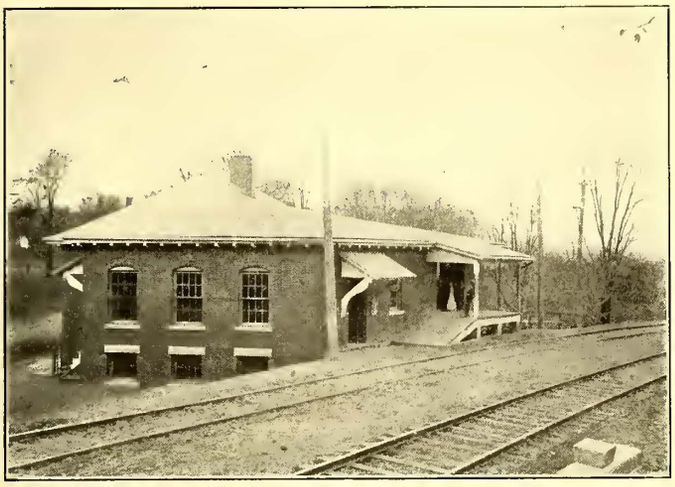
from Salem to Canton. The company has just installed an express car service over the line from Canton to Salem, and wagon service is to be given in the larger towns on the line. An arrangement for through shipments over these lines has been made with the Canton-Akron Company and the Canton-New Philadelphia Company.

The company maintains waiting rooms and ticket offices in all towns to make it convenient for prospective passengers to buy tickets in advance at lower rates than the through fares on the train. The ticket, cash and round trip fares to various points are given herewith:

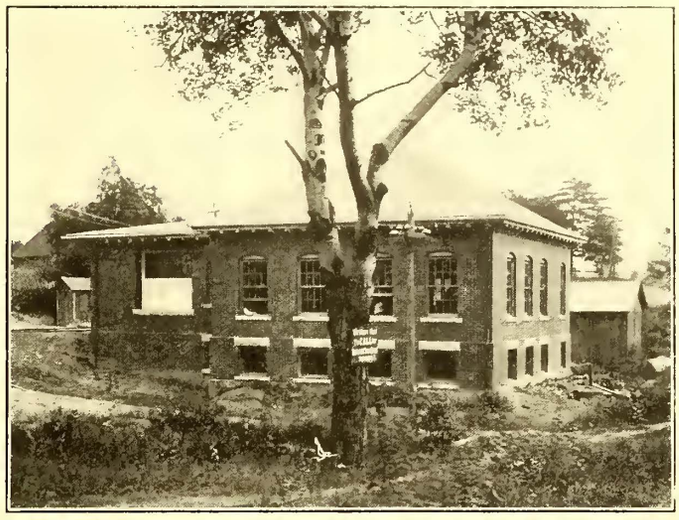
Miles	Town	Ticket Fare	Cash Fare	Round Trip
..	Canton	.....	$0.05	.....
7	Louisville	$0.10	15	$0.20
14	Maximo	25	25	50
19	Alliance	35	40	70
24	Sebring	40	45	80
25	Beloit	45	50	90
33	Salem	60	70	1.20

In Alliance the company sells six tickets for 25 cents, or twenty-five for $1. For the traffic between Alliance and Sebring it sells twenty tickets for $1, good only for purchaser. It sells monthly commutation books between any two points, no rebate, good only for signer, giving a straight rate of 1 cent a mile. It also has mileage books which are interchangeable with the Canton-Akron Company, and which are sold at the rate of 500 miles for $7.50. Conductors pull the exact mileage except when the trip is less than 5 miles, the latter mileage being taken in such instances because 5 cents is the minimum fare. Cash fares are registered on Ohmer registers and the simple cash receipt reproduced herewith is given. Local fares collected in Alliance are recorded on a separate register for the credit of the local system. Local traffic on interurban cars is discouraged, however, and is not very troublesome, as the local cars run on a fifteen-minute headway.

With the exception of a short stretch between Damascus and Salem, which adjoins the old stage pike running from Pittsburg to Cleveland, the right of way is back from the highway, and over a considerable portion of the distance it immediately adjoins that of the Pennsylvania Railroad. The strip is from 40 ft. to 100 ft. wide, and even in the cities is broad enough for double track. The maximum grade is 2 per cent, with the exception of one 4 per cent grade on the private entrance into Salem, which might be reduced if the city would permit the company to carry out its plan of elevating its track over a dangerous road crossing. The company has gone to a large expense to secure a good grade by making numerous cuts and fills. There is one cut nearly half a mile long, part of it through 13 ft. of rock, and one fill over 2000 ft. long, averaging 20 ft. Another cut is 1450 ft. long and 19 ft. deep, with 27-ft. slope. Some interesting comparisons may be made between the practice employed in locating a line half a century ago and at the present time. The adjoining steam road was laid out in the forties, and in many places it makes detours to avoid grades which the electric road takes care of by cuts and fills. Crossing certain lowlands where the ground was swampy, the old Pennsylvania engineers went around the place, necessiating a 40-ft. cut and a fill 50 ft. high, with a reverse curve between, the whole work being nearly a mile long. By making soundings, the later engineers of the electric railway found a safe route with solid foundation and crossed the low places with a 22-ft.



THE DAMASCUS SUB-STATION



THE LOUISVILLE SUB-STATION

HANDLING THE CROWDS IN TRAINS ON A BASEBALL DAY

fill and a 19-ft. cut, its grade being .5 of 1 per cent, while that of the steam road is .9 of 1 per cent. In doing this work the engineers uncovered what is believed to be Stark County's only gravel bank, which has been of immense value in ballasting. With the exception of two 15-deg. curves near towns, the curves are all from 1 deg. to 4 degs., and so spiraled that they

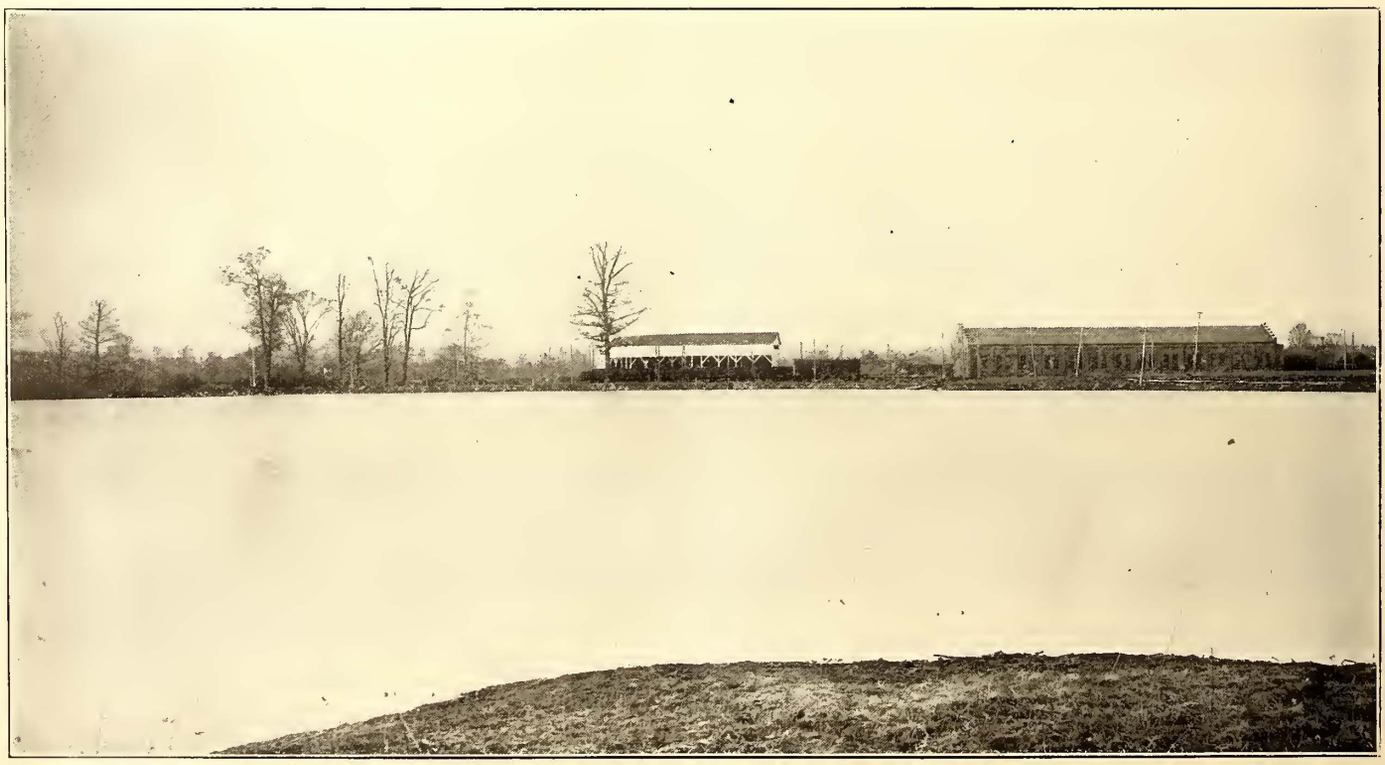
ONE OF THE STARK ELECTRIC RAILWAY COMPANY'S STANDARD CARS

may be taken at full speed. The only grade crossings are in Alliance and Sebring. At Louisville is a large timber and steel structure over the Pennsylvania Railroad, while the same road is crossed again near Salem over a trestle 912 ft. long, with a 105-ft. steel span. All trestles have concrete foundations, and the smaller bridges have concrete abutments. With the bridge crossing the Mahoning River, the concrete abutments were carried 8 ft. below the bottom of the river to blue clay, building piers 30 ft. wide and 25 ft. high. The company did its own concrete work, using a combination of three parts of sand and gravel and five parts of crushed stone to two parts of cement.

The track is laid with 70-lb. T-rail in the country and in all towns, except the short stretch in Canton, which has a 9-in. girder rail, and the city lines in Alliance, which are laid with a 7-in. T-rail on paved streets and 9-in. girder on unpaved streets. Staggered suspension joints are used, with four-bolt 24-in. angle bars. The bonds are, in part, of the Ohio Brass Company's "all-wire" type, the balance being soldered. All ties are of standard white oak. The ballast consists of 8 ins. of good gravel. The company has its own steam shovel, two steam locomotives and ballast cars. Sidings are 400 ft. long and placed 4 miles apart. All switches are on one side of the track and are locked open for eastbound cars to take the siding. They are of the Cleveland Frog & Crossing Company's No. 12 type, with high stand targets. Chestnut poles are used, 35 ft. tall, with 7-in. tops. Brackets are Ohio Brass Company's 9-ft. 1½-in. pipe, with knee brace and supporting rod. Ears are 16-in. heavy clinch type, and support two 000 figure 8 trolley wires; the south wire takes all sidings, while the north wire is continuous from end to end. There are two cross-arms, one on a level with the bracket, carrying two 300,000-circ. mil d. c. feeders, and No. 10 iron wires for despatching system; while the upper arm has two 20,000-volt Ohio Brass Company's porcelain insulators, the third for the three-phase circuit being mounted on an iron ridge pin at the top of the pole. The high-tension wires are No. 4 copper.

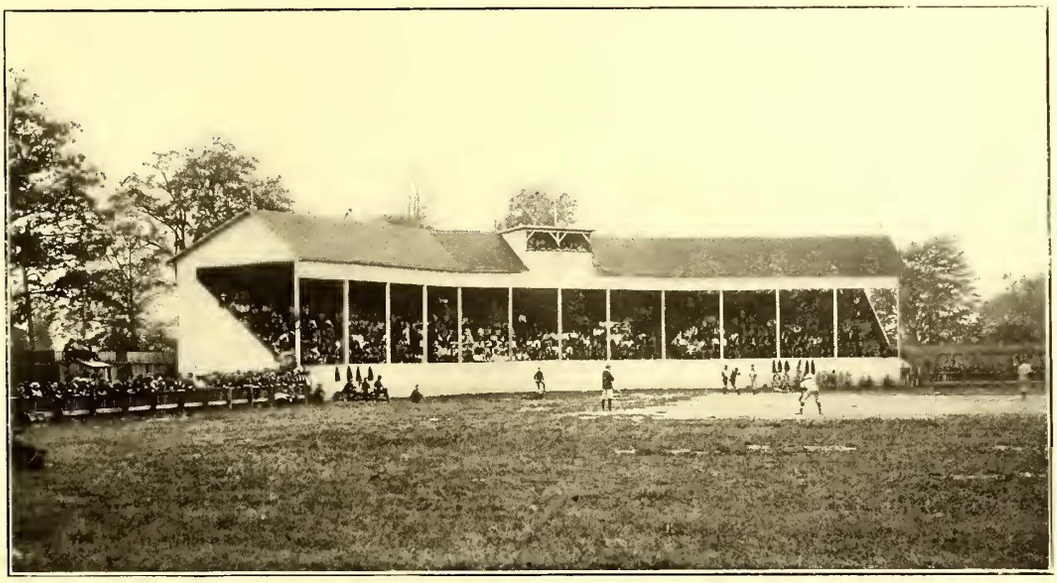
For interurban service the company has ten motor cars—six 47-ft. cars built by the Niles Car & Manufacturing Company, and four 50-ft. cars built by the Kuhlman Car Company. For Alliance it has four single-truck box cars and three 16-ft. summer cars. The Niles cars have Dorner M. C. B. trucks, four Westinghouse No. 56 motors and Christensen air brakes. The Kuhlman cars have four Westinghouse No. 76 motors, Peckham trucks, Westinghouse straight air brakes, Nichols-Lintern sanders, four to the car; Knutson trolley retrievers, and are fitted with the Universal Steel Tire Wheel Company's malleable center, cast-steel tire wheel, having a ⅞-in. flange and 3¼-in. tread, with 6-in. axle. These cars were illustrated and described in the issue of this paper of July 2, 1904. They are used largely in handling trains.

The company operates a baseball park between Alliance and



PART OF PANORAMIC VIEW OF LAKE, SHOWING CAR HOUSE AND BACK OF BASEBALL GRANDSTAND

Sebring, and regular games have been played there all summer. For the large crowds thus attracted, unusual transportation facilities was required at times. It was deemed undesirable to purchase additional motor cars for this service, so the company took advantage of an opportunity to buy eight of the old steam coaches discarded by the Manhattan Elevated some years ago. The cars are 45 ft. long, and have divided side seats for forty-four persons. The aisles are very wide and the cars will hold a hundred or more. They have steel-tired paper center wheels, with excellent trucks, and are remarkably easy riding cars. Steps were cut in at the company's shops, and they were repainted, varnished and wired for lights, bringing the total cost up to less than $500 per car. Five of these cars heavily loaded have been handled in one train. After a baseball game the company has trains going in both directions, and it is generally possible to handle the crowds without interfering with the regular cars. Views of baseball special trains are shown. The company figures that these cars practically paid for themselves last summer.

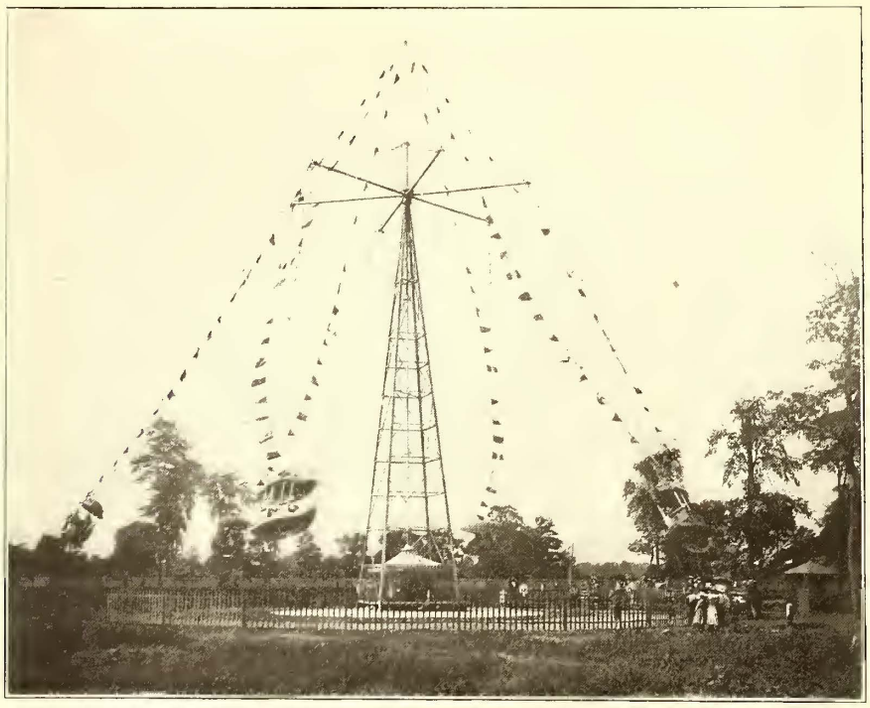


BALL PARK AND STAND

The power station and car house are located at Lake Park, a short distance from the Mahoning River, between Alliance and Sebring, almost in the center of the system. At this point the company purchased nearly 200 acres of land. Half of it was laid for a park and the balance for buildings and yards, with an allotment adjoining the park where a number of employees have erected homes. By making a fill about 1000 ft. long, averaging 200 ft. wide and 8 ft. to 10 ft. deep, the company brought its yards and tracks above high water and formed a pond of about 20 acres in the park. This is fed by a small stream and by two mineral springs which are famous in that district and form part of the park attractions. The water is pure and soft and is ideal for boiler feed. There is also a line to the river giving a double water supply. There is a large natural grove in the park, in addition to which over 1200 trees have been set out, and a considerable amount has been spent in beautifying the grounds. The lake has been stocked with fish, and thirty pressed-steel non-sinkable rowboats, built by the Mullens Company, of Salem, Ohio, have been installed. Adjoining the lake is a large pavilion, with restaurant, while in the grove is a dance pavilion and shelter house. A circle swing, built by the Traver Circle Swing Company, of New York, proved immensely popular the past season. Next summer the company will install a large merry-go-round and a "Katzenjammer Castle," combining seven different amusements. The park is patronized by an excellent class of people from towns

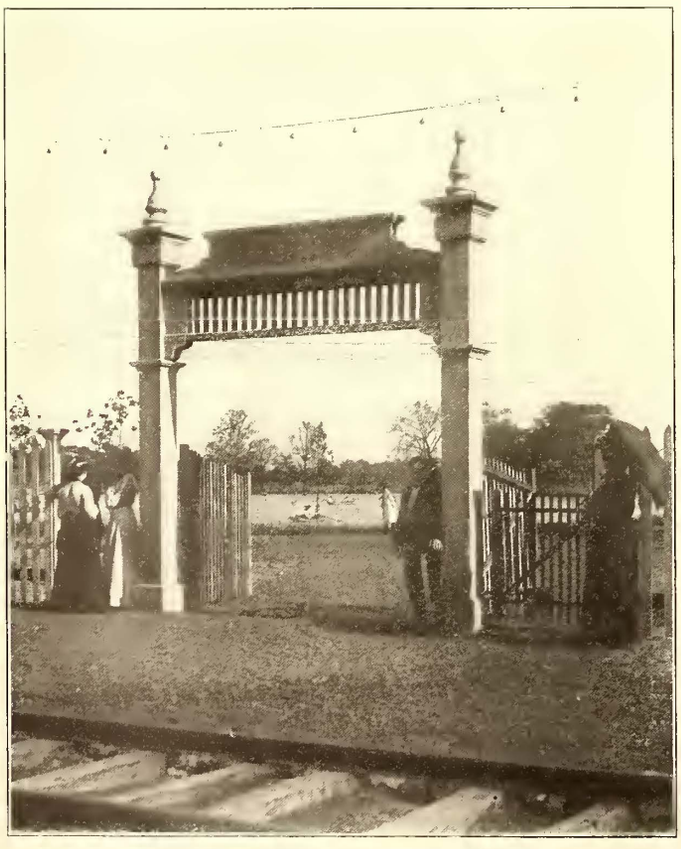
PART OF PANORAMIC VIEW OF LAKE, SHOWING THE POWER HOUSE AND PAVILION

all along the road, and with the baseball park gives the company a very satisfactory summer traffic. The two parks and all except one or two attractions are operated by the company.



THE CIRCLE SWING AT LAKE PARK

C. W. Goodwin, of Cleveland, has secured the boating and skating privilege for this park. He will keep the ice in condition and operate the lunch room and pavilion. Next spring he will install on the lake a steam launch having a capacity of forty passengers. A panoramic view of the lake and all the buildings is shown herewith.



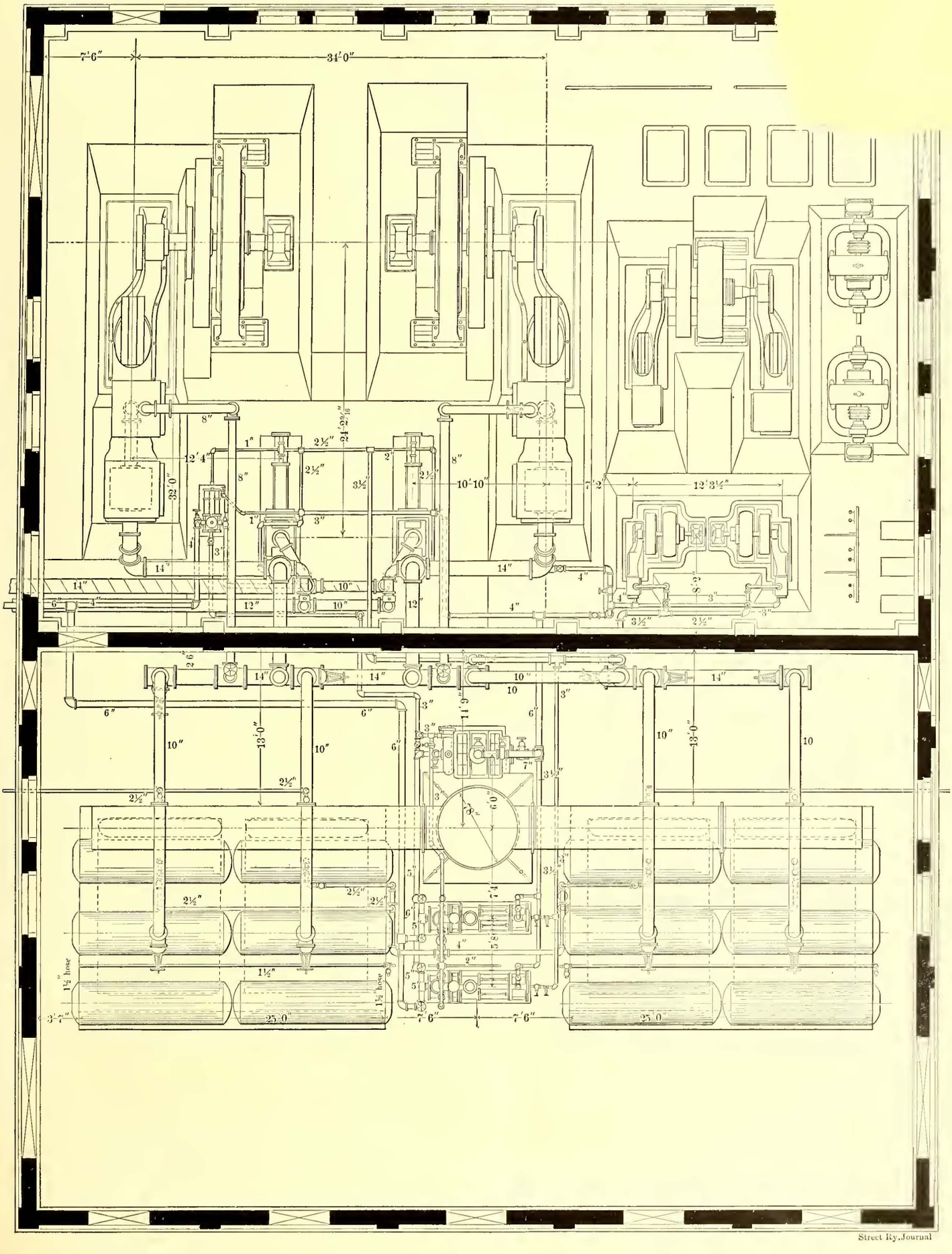
ENTRANCE TO LAKE PARK

The power station is of attractive design, built of hard burned brick, with stone trimmings, and laid with black mortar. The boiler room is 72 ft. x 46 ft., and the engine rooms, 75 ft. x 50 ft., inside dimensions. The boiler room floor is 7 ft. below that of the engine room floor. The condenser pit below the engine room is large and roomy, being 14 ft. deep. The outer walls are 13 ins. thick, with heavy pilasters, while the center wall is 17 ins. thick, reaching to cone of roof. The trusses are of light steel, designed for a large margin of strength and supported from the outer walls only, the center wall acting as a fire wall. The roof is slate. The floors are concrete; that in the engine room is built in arches and supported on structural steel. The engine room is covered by a 10-ton traveling crane. The building is designed for extensions in either direction without changing any of the present equipment. The boilers and building were designed for the installation of coal handling devices and stokers, but it was not considered economical to install them for the present equipment.

There are three boilers, with space for a fourth. They are of the Sterling water-tube type F, and are set 1 ft. higher than usual to permit the installation of chain-grate stokers at some later time. The heating surface in each is 3500 sq. ft., and the battery is rated at 1050 hp. The horizontal seams of the drums are double-butt strapped, triple-riveted and constructed for a continuous working pressure of 160 lbs. per square inch. Under a 25 per cent overload test the boilers showed less than 1 per cent moisture in the steam at boilers. Natural draft is used, the stack being of steel, 150 ft. tall and 78 ins. inside diameter. It has an ornamental top of galvanized iron and is guyed with eight stranded cables. The stack is riveted to a heavy cast-iron base and anchored to a heavy foundation. The stack shows 1.01 in. draft with one boiler working to rating with temperature of 525 degs. in intake.

EXTERIOR OF POWER HOUSE

The main generators are two alternating-current 500-kw Westinghouse, delivering 360 volts, 25 cycles, three-phase current. Each generator is direct connected to a 22-in. and 40-in.

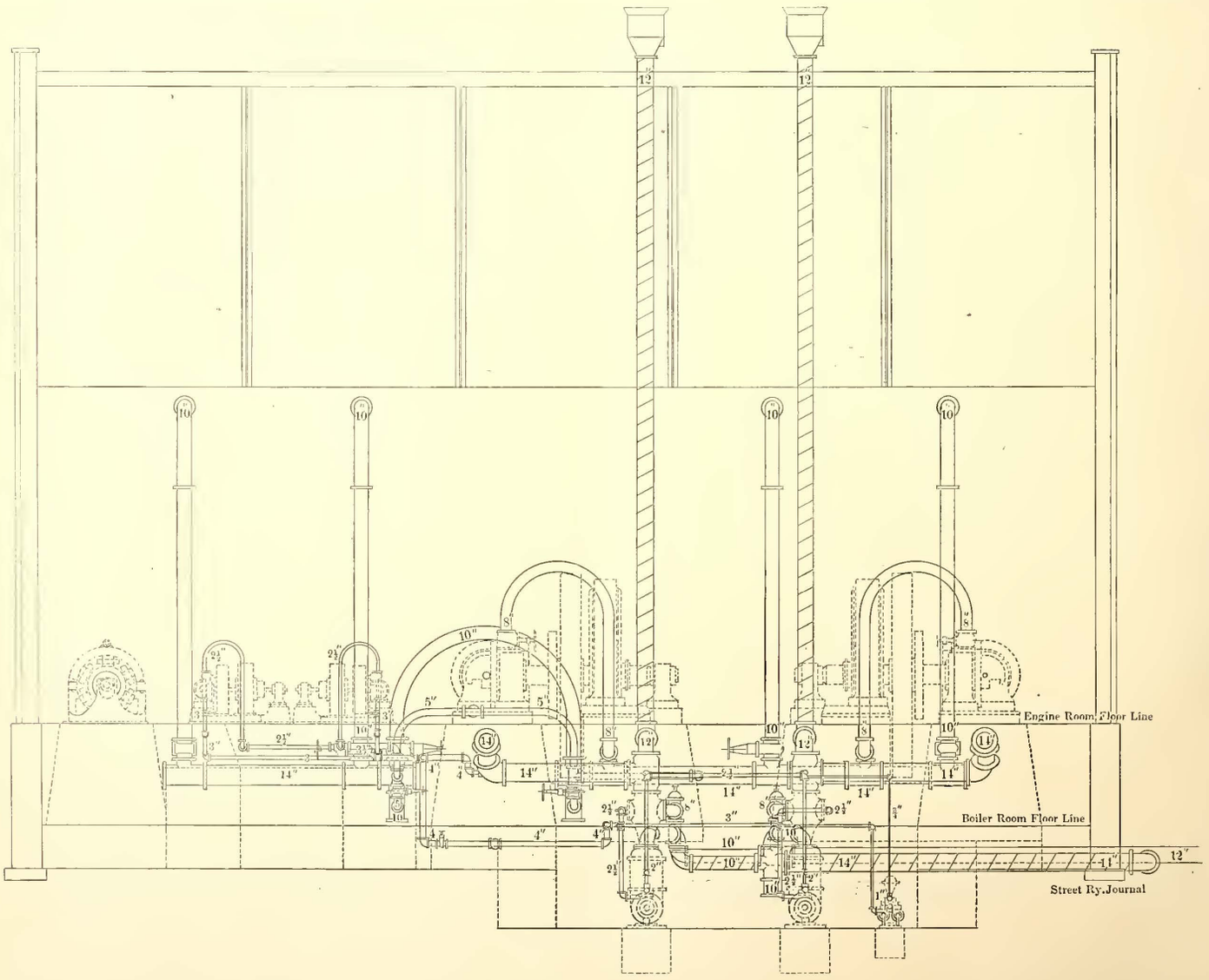


GROUND PLAN OF POWER PLANT OF THE STARK ELECTRIC RAILWAY COMPANY

l four-valve Russell engine, with Cor-
·s run at 125 r. p. m., making a piston
.r minute, which is considered a slow speed for engines of this size. The engines are without superheaters or steam jackets, and have cast-iron sole-plates covering the entire top of the engine bed and outer bearing foundation. They rest on brick foundations laid in Portland cement. The engines are designed for 150 lbs. working pressure, and all parts subject to severe strains are of cast steel. The exciter units for the main generators are two 30-kw 110-volt direct-current machines, direct connected to 7-in. x 10-in. Russell single-valve engines, designed for 150 lbs. working pressure. They operate at 325 r. p. m., and are equipped with a sub-base and central oiling device. There is space in the engine room for a 13-in. and 26-in. x 20-in. cross-compound four-valve engine to be direct connected to a 200-kw 60-cycle Westinghouse alternator, which may be installed later for lighting the neighboring cities of Alliance and Sebring.

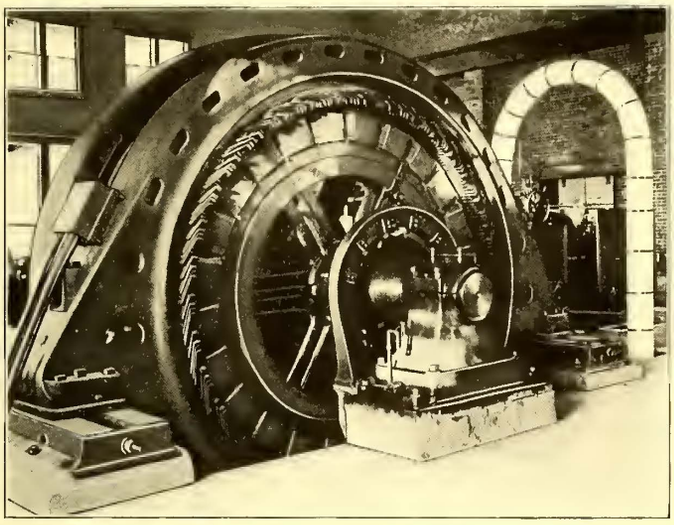
DANCING PAVILION IN LAKE PARK WITH SPRING NEARBY

In the boiler room is a 1250-hp Cochrane open feed-water heater which is supplied with water at 100 degs. from a hot-well by a 4½-in. x 6-in. Laidlaw-Dunn-Gordon low-pressure pump. This pump is located in the condenser pit, and its supply comes by gravity from the hot-well just outside of the building. The heater is designed to take the exhausts of the boiler feed-pumps, low-pressure pumps, condensers and exciter engines, but under normal

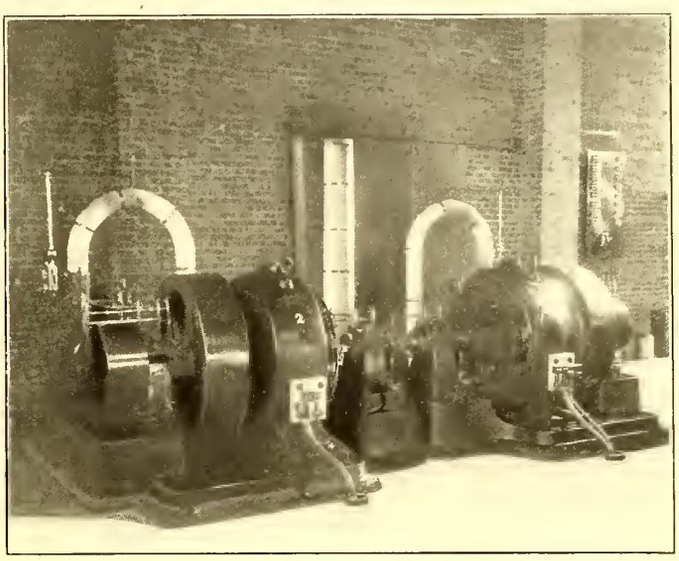


LONGITUDINAL SECTIONAL ELEVATION OF PIPING VIEWED FROM THE WEST

conditions there is more exhaust steam than is required, and the condensers and exciter engines are arranged to run condensing at will. However, when the entire plant is working up to its rating, it will require the exhaust from all these auxiliaries to maintain a feed temperature of 200 degs. A test of 15,000 lbs. of water passing through heater with the exhaust steam from one boiler feed-pump, one condenser and one exciter-engine, raised the water from 100 degs. in the hot-well to 210 degs. at the boilers.

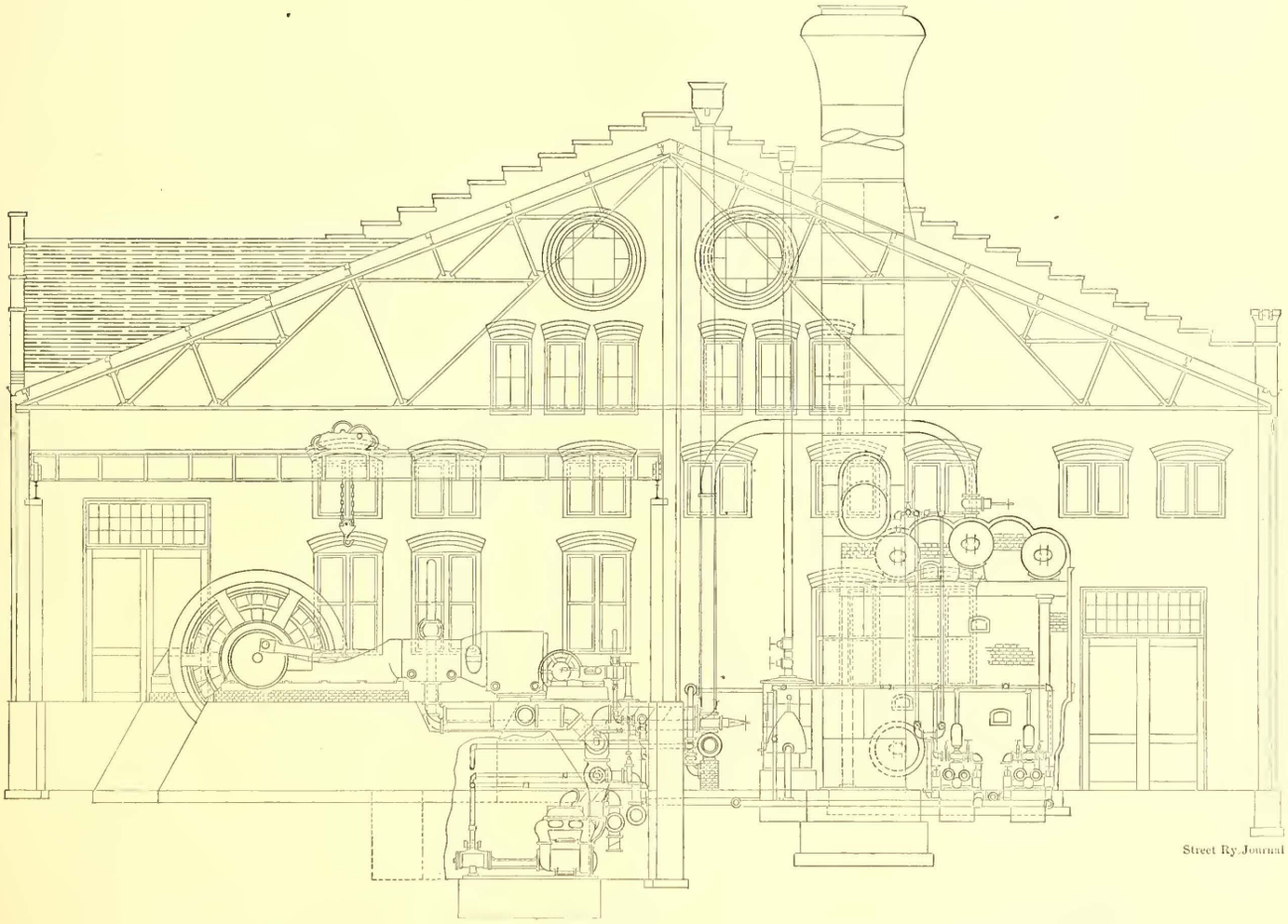


ONE OF THE GENERATORS



THE EXCITER UNITS IN THE POWER STATION

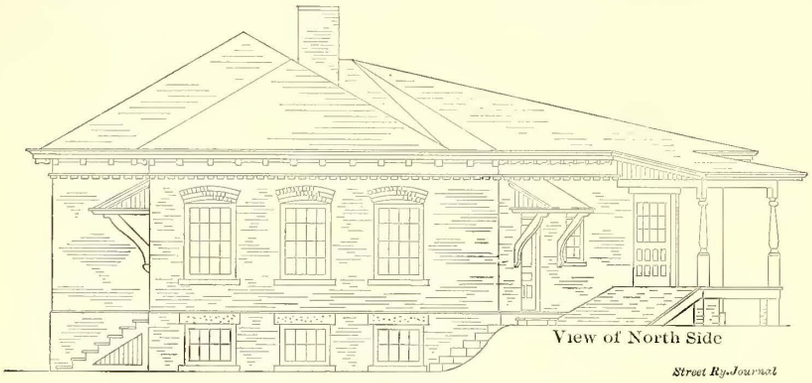
The steam from each large engine is condensed by a 14-in. x 18-in. x 24-in. single double-acting Laidlaw-Dunn-Gordon air pump and jet condenser in the condenser pit. The suction is taken from a cold well outside the building, which is supplied by gravity from the park lake through a line 1000 ft. long. The discharge is delivered to a hot-well outside the building, and the overflow returns to the lake by gravity. The spraying attachment of the condenser is permanent, and the vacuum is controlled by a throttle valve in the suction line operated from the engine-room floor. Above the condenser chamber is a three-way automatic valve which will throw the exhaust to the atmosphere in case of loss of vacuum, closing the opening into the condenser chamber. When the condenser has regained its vacuum, the valve is automatically thrown in the opposite direction, and the engine will again operate condensing. In a test



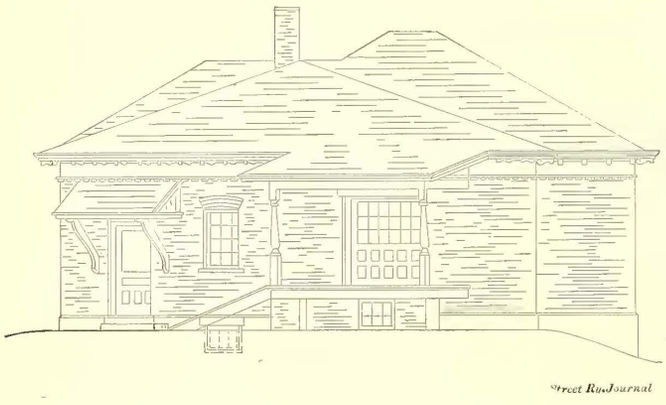
CROSS-SECTIONAL ELEVATION OF POWER PLANT OF STARK ELECTRIC RAILWAY COMPANY

under ordinary load, the engine was operated from condensing to atmosphere and back to condensing in less than one minute.

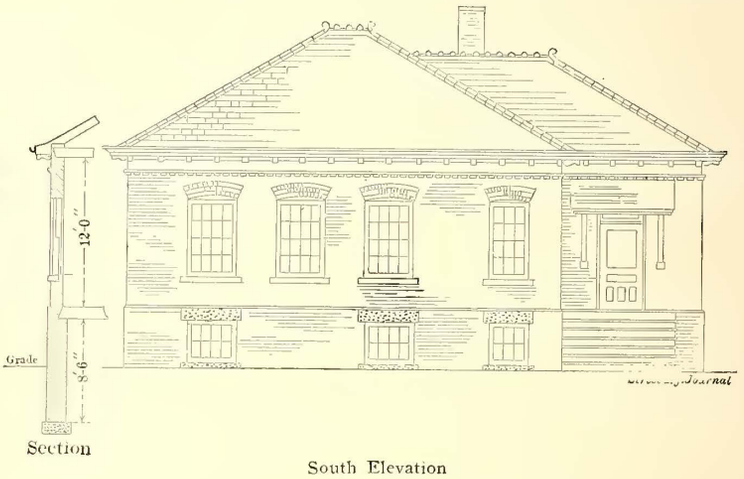
boilers. The suction is cross-connected so that one can draw from the heater while the other takes from the hot-well or the cold-well, or vice versa. The piping was all designed to provide for drainage, expansion and accessibility. The main header is near the floor line of the boiler room and below the floor line of the engine room. It is 14 ins. in diameter and is in two sections. The connections between the boilers and header are of extra heavy 10-in. pipe with long radius bends. The engine connections are 8 ins. in diameter and are below the floor line of the engine room; the bends to the engines above the floor line have long radius goose-neck bends. The valves are outside screw and yoke type, built for 250 lbs. pressure. The header is drained by two 2-in. steam traps, discharging into a Worthington egg-shaped receiver, with a 3-in. x 2-in. x 3-in. automatic pump



East Elevation

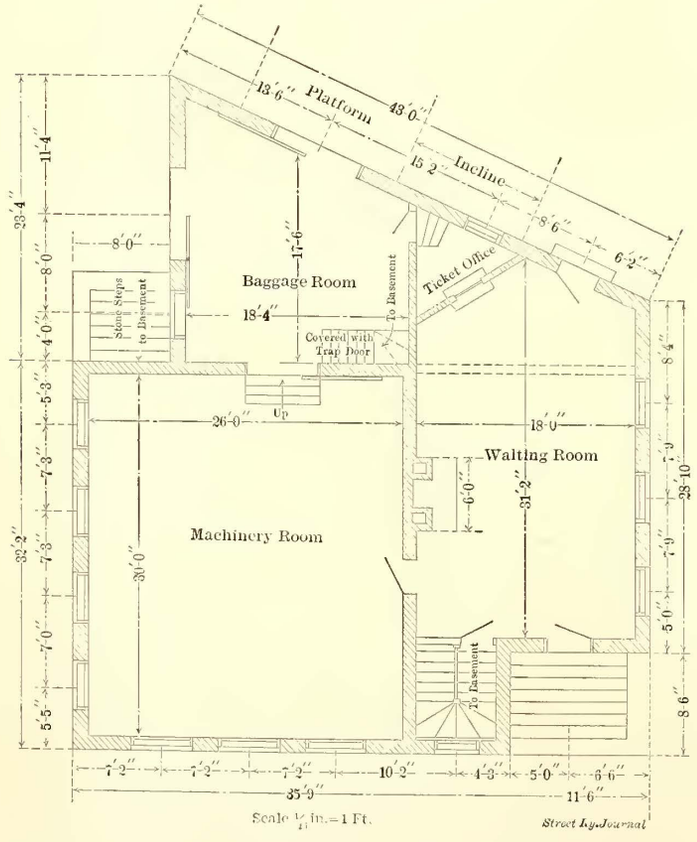


North Elevation

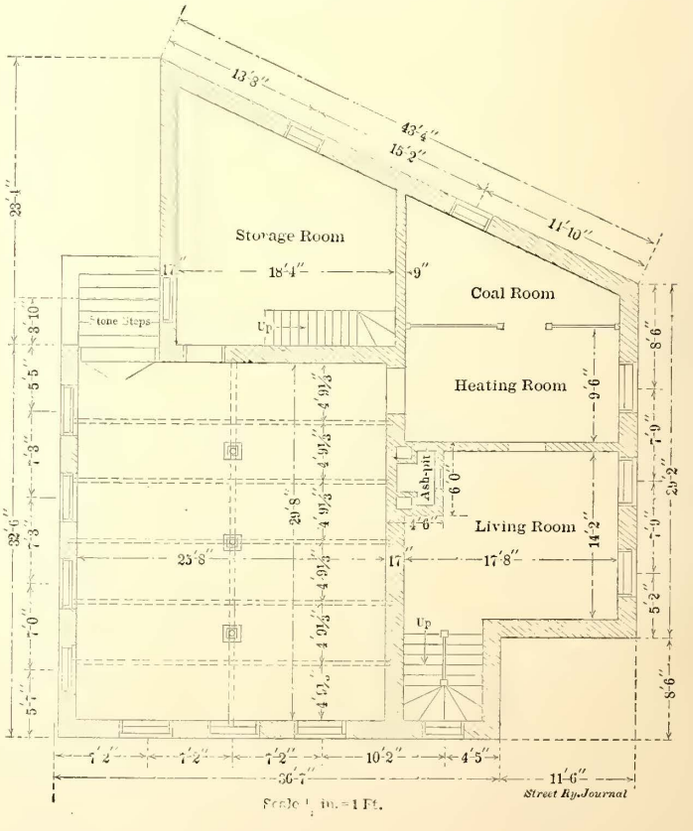


Section

South Elevation



Plan of Basement



Floor Plan

PLANS AND ELEVATIONS OF DAMASCUS SUB-STATION

The boiler feed-pumps are 10 ins. x 6 ins. x 10 ins., outside center packed, of Laidlaw-Dunn-Gordon manufacture. They are cross-connected so that either will deliver to one or both attached, which in turn discharges direct to the boiler feed-line or heater.

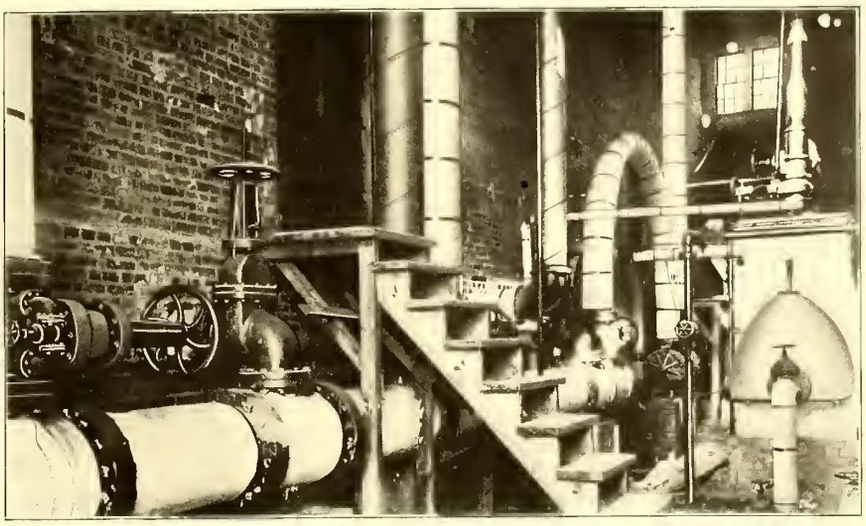
The station has a gravity oiling system with 50-gal. tanks,

elevated 20 ft. in boiler room, and piped direct to a central oiling device on each engine. The refuse oil passes to a filter in the condenser pit, from which it is pumped by a small steam pump back to the supply tank. The fresh oil required does not exceed 25 per cent of that which would be required without this arrangement.

In the station is a sub-station equipment consisting of two 250-kw Westinghouse rotaries. The step-up transformer, high-tension circuit breakers and switchboards were installed by the Westinghouse Company, and are of its latest design. In addition to the sub-station in the main house, there are sub-stations at Louisville and Damascus. The Louisville station has two 250-kw rotaries, while those at Damascus are 300 kw. The sub-station buildings are of unusually attractive design, and are fitted with waiting room, ticket office, freight and baggage room platform, together with living room for attendant. The machinery room floor has arched concrete construction resting on structural steel. On the extended shafts of the rotaries, type C induction motors are placed for starting. Three 200-kw oil-cooled transformers are in the basement, while directly above them are static interrupters and frame work containing the lightning arresters and high-tension circuit breakers of the long-arm type. A five-panel blue marble switchboard with modern Westinghouse instruments adjoins this. The station is designed for outgoing as well as incoming lines, with a view to a possible easterly extension of the road. Views of the exterior and interior of the Damascus station are given.

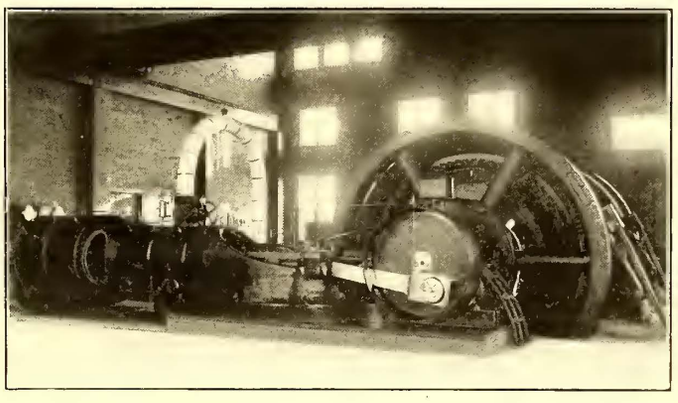
A large car house of sufficient capacity to accommodate all the motor cars is located adjoining the power station. At present only the lighter class of repair work is taken care of here, and the company is preparing to erect another building to be fitted up with modern repair shop equipment.

On Main Street, in the heart of Alliance, and within 200 ft. of the passenger station of the steam roads, the company is erecting a neat two-story brick building, 140 ft. x 75 ft., for use as a passenger station, express and freight station and general offices for its own use. There will be a siding for a freight car and every convenience for a station of this kind.



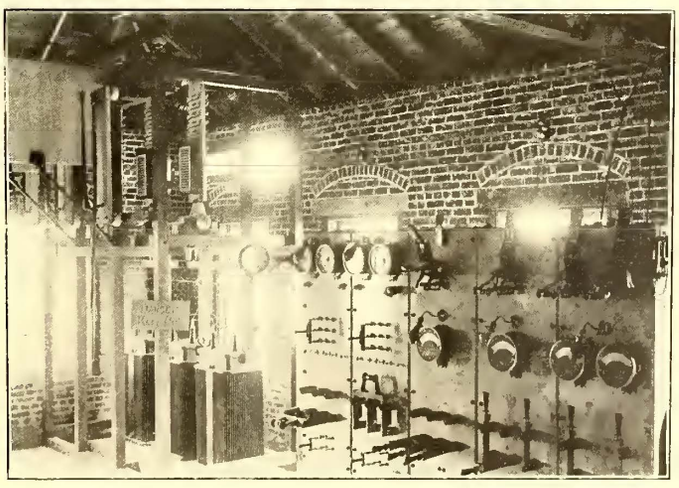
STEAM HEADER AND FEED-WATER HEATER IN THE BOILER ROOM

In operating, the company has adopted the rather unusual practice of giving each crew its own car and keeping the men on that car without change unless the car is disabled. Four cars are used for the regular schedule. Each runs half a day and then goes into the shop for cleaning and inspection. The motorman makes a report of any trouble, and it is his duty to inspect the car when he takes it again, to see that the work has been done to his satisfaction. Likewise the conductor is ex-



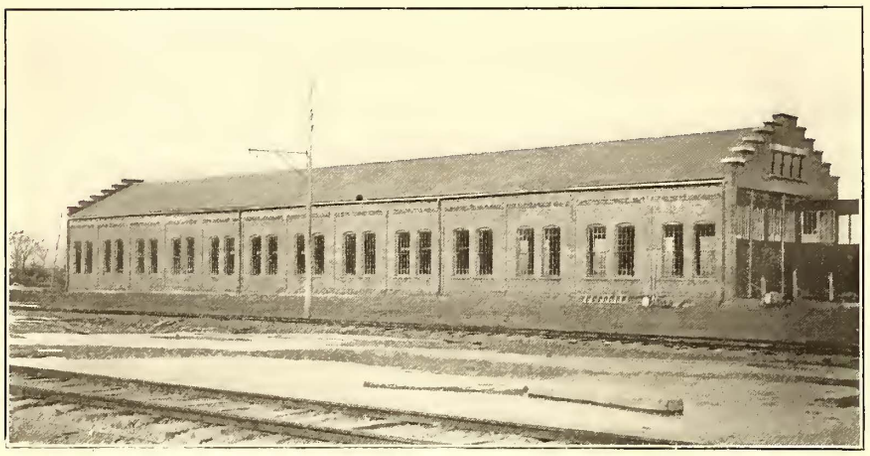
MAIN GENERATOR AND ENGINE IN POWER STATION

A VIEW IN THE BOILER ROOM



SWITCHBOARD IN THE DAMASCUS SUB-STATION

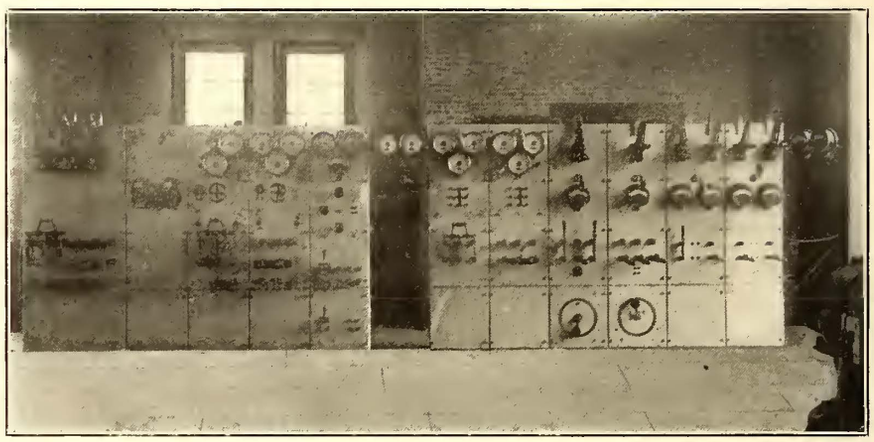
pected to see that the car is properly cleaned and in shape for service. By this plan each crew acquires personal interest in its car. The motorman is expected to study thoroughly and take care of the mechanism. A record is kept of the repairs made on each car, and the motorman who causes the company the least expense in repairs and accidents is given a prize. If one car costs more to maintain than others, the motorman is called upon for an explanation.



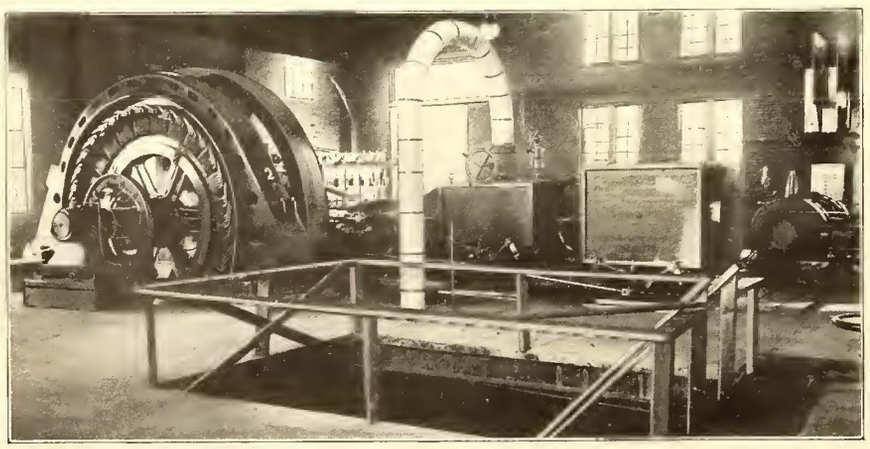
CAR HOUSE OF THE STARK ELECTRIC RAILWAY COMPANY

Great care is taken to insure safe operation. Construction trains, express cars, as well as passenger trains, run on orders, the former being kept on a regular schedule the same as passenger cars. If the despatcher's system is out of order, the motorman must remain on the siding and go to the nearest telephone to call up the despatcher for orders.

The Stark Electric Railroad Company has an authorized capital stock of $1,000,000, of which $850,000 is issued. The bonded indebtedness is $1,000,000, with $750,000 issued. The bonds have never been placed on the market, but are held in a pool by the men who promoted and built the road. These gentlemen comprise an independent syndicate, the majority of them Cleveland men, who have gone into the proposition as a permanent investment. They formed the Interurban Construction Company, for construction purposes, but the road was built without a construction profit other than a portion of the stock. C. R. Morley, Cleveland, president of the company, personally supervised the entire construction work, and the only contracts that were let out were for the building of the power house and the grading for the last 10 miles, this being done to hurry the work. Other officers are: D. Morison, Cleveland, vice-president; E. W. Weibenson, Cleveland, secretary-treasurer; W. J. Berry, Alliance, superintendent; B. M. French, civil engineer; G. W. Knox, Chicago, consulting engineer. The power plant was designed and built by the Arbuckle-Ryan Company, of Toledo, to whom this paper is indebted for the drawings and many of the details presented herewith. The road was completed to Sebring in June, 1903, and to Salem in August, 1904.



ONE SIX-PANEL AND ONE FIVE-PANEL SWITCHBOARD IN THE POWER STATION



PART OF THE ENGINE ROOM, SHOWING GENERATING UNIT AND PIPING TO ENGINE

C. R. Morley, president of the Stark Electric Railway of Ohio, expects to sail for Europe from Boston on Jan. 7. Fittingly to celebrate Mr. Morley's departure and to show their kindly appreciation of the man, the employees of the company tendered him a banquet at the Hotel Alliance on Dec. 20. All the officers of the company participated, also the employees of the legal and operating departments and a few invited guests. These toasts were responded to: "The Honorable City Councils," "The Stark Electric in Quakerdom," "They Builded Better Than They Knew," "The President's Work—Personal Supervision." The toasts were full of good cheer and good fellowship, indicative of the cordial relations of all departments of the road and the respect and esteem of all for Mr. Morley. After the toasts had been drunk, Attorney Thomas F. Turner, of Canton, on behalf of the different departments of the company, presented Mr. Morley with a gold watch, as a token of esteem. Mr. Morley expects to spend four months in Europe.

After two years of controversy between the city, the Richmond Street Railway Company and the C., C. & I. Railway Company as to which should bear the cost of arranging for the passage of interurban cars under the railway company's bridge in Main Street, in Richmond, Ind., the local company, a few days ago, quietly lowered the grade of the street 12 ins. and relaid the track. This makes it possible for the interurban cars from Indianapolis and Dayton to pass under the bridge. It is announced that the Dayton & Western and the Indianapolis & Eastern have arranged for through service between Dayton, Ohio, and Indianapolis, Ind. The plan is to have certain of the Dayton cars go through to Indianapolis and certain of the Indianapolis cars go through to Dayton.

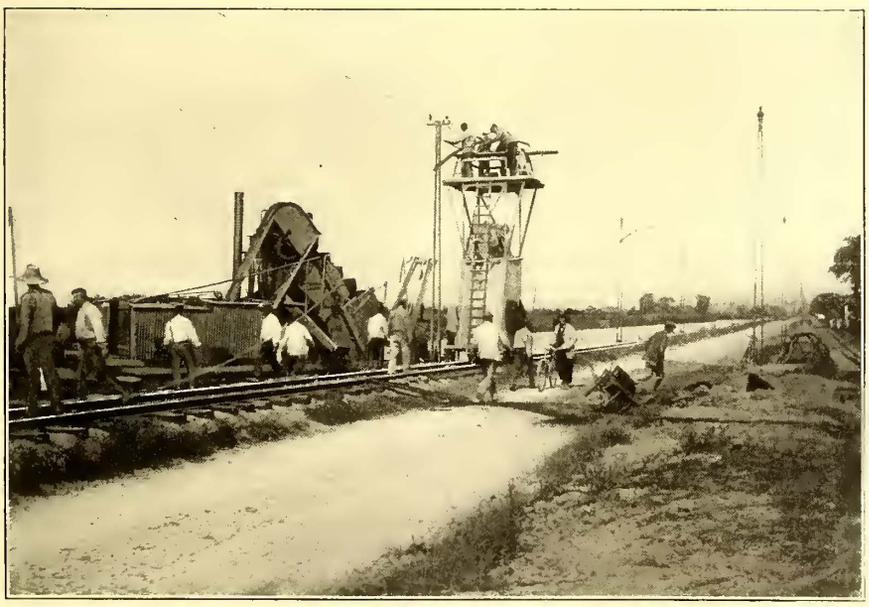
THE AMSTERDAM-HAARLEM TRAMWAYS SYSTEM

About five years ago there was constructed in the city of Haarlem, by a local Dutch company, an electric tramway system—the first in Holland. This road included a belt line about the city of Haarlem, with two suburban branches, one running north to Bloemendal, a thriving residential suburb, and another west about 5 miles to Zandvoort, an important seaside resort for the people both of Haarlem and of Amsterdam.

Haarlem itself is a city of 65,000 inhabitants and a very pleasant residential place, where many of the business men of Amsterdam live. The distance between the city limits of the two cities is 10 miles. It appeared to a number of people that an electric line connecting the two should be a paying enterprise, and several years ago a concession was granted for such a line, but the route was rather roundabout, and finally the Holland Steam Railway Company secured control and prevented the construction of the line. In 1901, however, Messrs. Anderhagen & Neumeyer, of Amsterdam, took the preliminary steps toward securing a new concession over the direct Government High Road connecting the two cities and running parallel with the steam railroad.

CONDITIONS OF FRANCHISE

The essential conditions of this concession for the construction of a double-track line on each side of the Government High Road were: (1) That the concessionaire was required to sheet pile the sides of the road (which is bordered by a canal on one side and a ditch on the other), in order to secure the necessary width and stability, and to carry out the whole of the work with the least possible interference with the regular use of the road. (2) The period of the concession was for fifty years from Dec. 31, 1902. (3) All construction plans of every nature were required to be submitted for the Government



ERECTING FEEDERS AND DREDGING ON GOVERNMENT ROAD

approval. (4) The period allowed for the construction was two years. (5) The speed allowed for the cars was to be regulated by the Secretary of State, and the speed actually permitted was 35 km per hour. The Secretary of State is also empowered to fix the maximum fares, but it was generally understood that the maximum fares allowed should be equal to those of the steam road. (6) At the expiration of the concession the Government takes over, without compensation, all the property of the company located on Government lands. There is a large number of minor provisions regarding protection of workingmen as to hours of labor, accident insurance, pensions, and so forth, as well as in regard to the protection of the various water boards, drainage boards, telegraph companies, railways, etc.

In addition to this concession for the use of the Government High Road, it was necessary to obtain an entrance into Amsterdam, and to do this satisfactorily the concessionaires ob-

VIEW ALONG GOVERNMENT ROAD NEAR HAARLEM

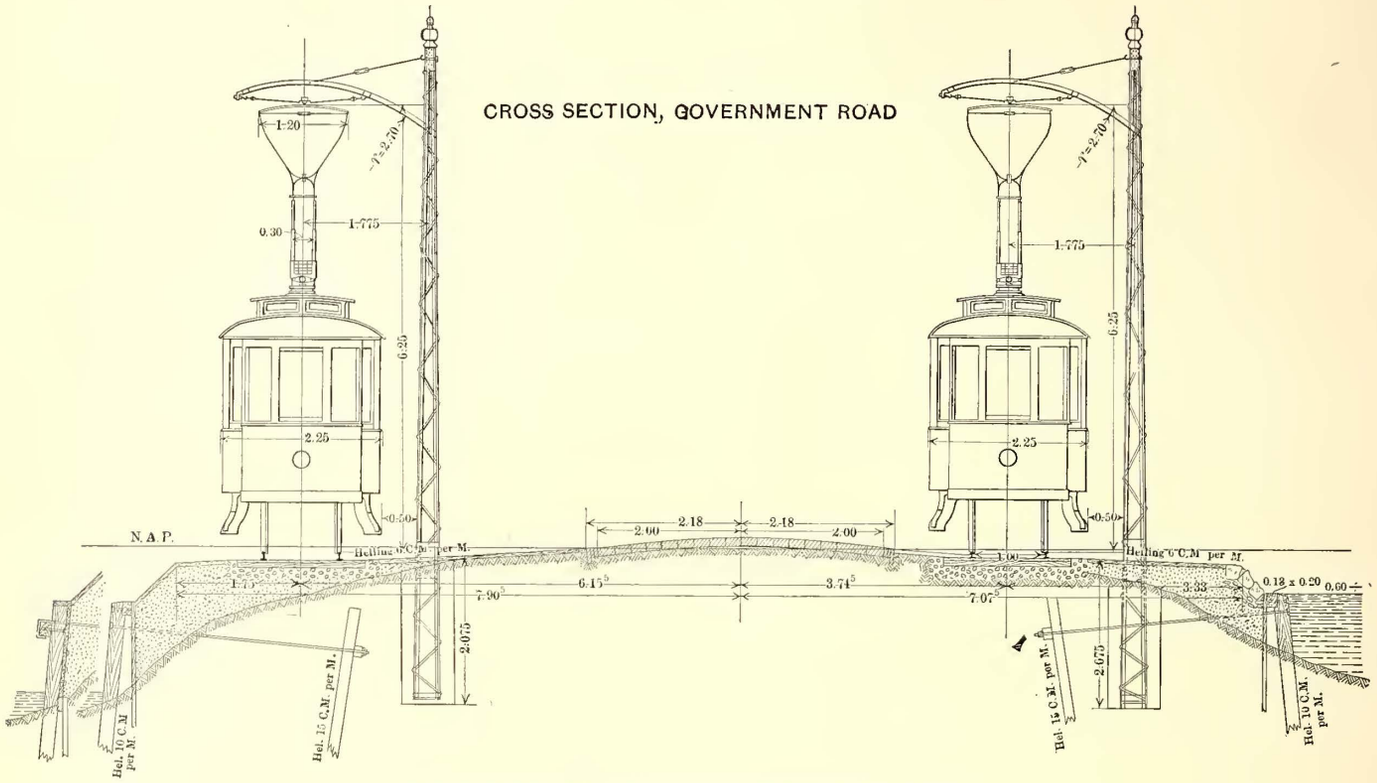
tained options on a private right of way for about 2 miles from the Government Road to the Amsterdam city limits, at a point near the terminus of one of the Amsterdam Corporation Tramway lines. In obtaining this private right of way, the option was made to include a strip of land for the whole distance, wide enough to permit of a row of building lots on each side of the road being laid out and sold. On this section the tramway is built on a purely private right of way in the center of the road, with a paved driveway on each side, and outside of this driveway the usual footpath and building lots are arranged.

Running powers were then secured over the tramways of Amsterdam, then in process of electrification, for a distance of about 1 mile from the city limits to the corner of the Spui and the Kalverstraat, the center of the office and retail business districts of Amsterdam. The gage of the Amsterdam city lines being standard and the gage called for by the new concession being 1 m, it was necessary to lay a third rail for the greater part of this distance, where the lines are common, to permit through running of cars over the corporation route, this work being carried out by the corporation at cost and a percentage. This was made more expensive by the fact that a large swing bridge had to be constructed to permit the through running of the cars, and this work was done principally at the expense of the concessionaires. In addition to paying for this bridge and construction, the concessionaires agreed to pay 40 per cent of the fare which the town would have charged within the city limits on the basis of its own rates, and also to repay the actual cost plus 10 per cent expended by the corporation for repairs and maintenance of the tracks used by the concessionaires. It further agreed to pay for power within the city and taken from the city's trolley wire, at a rate of not less than 0.9 pence (1.8 cents) per car-mile. The period of this contract is the same as that of the concession on the Government Road.

It will be noted that the conditions are most stringent and

that a net profit on the running in the city of Amsterdam could not be looked for. On the other hand, the distance within the city was a very short one (1.4 miles in a total run of 12 miles), and to secure the satisfactory terminal facilities, these concessions were necessary.

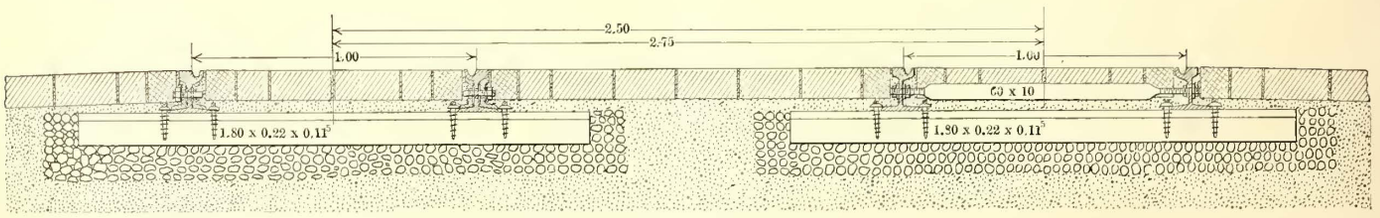
Messrs. Anderhagen & Neumeyer then secured an agreement with the corporation of Haarlem permitting the construction of about 1½ miles of lines within that city, to give the company a satisfactory terminus at its eastern end. The Haarlem concession is also for a period of fifty years, and is without unusual features, except that the concessionaires are required to pay large amounts for the renewal of bridges and similar works in the city of Haarlem.



CROSS SECTION OF TRACK ON GOVERNMENT ROAD

When all the concession arrangements above outlined were completed, local permits obtained, etc., the matter was presented to an American syndicate, headed by H. J. Pierce, of Buffalo, who, after full investigation, decided to take the matter up and build and operate the proposed line. The Electric Railway Company of Amsterdam—a Dutch corporation—was then organized to take over the concessions and build the line. All the shares of this company were subscribed and fully paid for in cash by the Netherlands Tramways Company of New Jersey, the American syndicate above mentioned, and among the American directors of the company elected were W. Caryl Ely, William B. Rankine, N. W. Halsey, J. G. White and James M. Edwards. Debentures of an amount equal to the amount of shares, viz., 3,000,000 guilders, were purchased outright by the well-known Amsterdam banking firm of H. Oyens & Sons.

In order to secure more satisfactory terminal facilities in Haarlem, as well as more desirable through running arrangements between Amsterdam and Zandvoort, the seaside resort above mentioned, the Netherlands Tramway Company decided to purchase outright the local Haarlem Tramway Company, which had been in operation then for two years, and which is known as the First Netherlands Electric Tramways, generally abbreviated to E. N. E. T. This was carried out, and practically all of the shares of the E. N. E. T. passed into the hands of the Netherlands Tramways Company of New Jersey, and for all practical purposes of operation they are consolidated and to be considered as a single system.



SECTION OF TRACK IN CITIES

CONTRACTS

Contracts were then entered into with J. G. White & Company, Ltd., of London, for the complete design and construction of all the work required, including the track and overhead construction, power station, car house, shops, office buildings, bridges, etc., for the Amsterdam-Haarlem interurban line and the reconstruction and additions required by the E. N. E. T. This reconstruction included the double tracking of the line running to Zandvoort, an increase of offices and car houses, and an increase in capacity of power station. This contract was entered into Jan. 1, 1903. The operation of the completed system was commenced in October, 1904. It was the intention to commence operation in the spring of 1904, but the work was delayed, due to the failure of the corporation of Amsterdam to complete bridges and the delay in getting the approval of the municipality of Haarlem.

ROUTE, PAVING, ETC.

The track and bridge construction within the city of Am-

sterdam and upon the Government High Road presents a number of very novel features which cannot be entered into here fully, but to which a brief reference is certainly desirable. The bascule bridge across the Kostverloren Vaart has already been mentioned and is operated electrically. As this type of bridge was not easily adaptable for overhead construction, the cars are run by momentum across the bridge. There is no difficulty in this, notwithstanding there is a considerable ascending grade and a sharp curve on the Amsterdam approach. The current for working this bridge is furnished by the city of Amsterdam, although there is a cable connection under the canal so that the current furnished by the railway company to the west side of the bridge can be switched on in case of the failure of the Amsterdam current.

From the bridge toward Haarlem the line runs over its own private right of way for a distance of 2444 m. The cross section of the road for the greater portion of its route is 23 m from building line to building line, and in the center a strip of 8 m wide is left for the tramway tracks with center pole construction. In making this fill, 280,000 cu. m of sand were required. This sand was brought in scows for a distance of 20 km from the work, and was unloaded from the canal by means of elevators into trucks and hauled by engines on the work. On this section there are two steel bridges and one wooden bridge which had to be built.

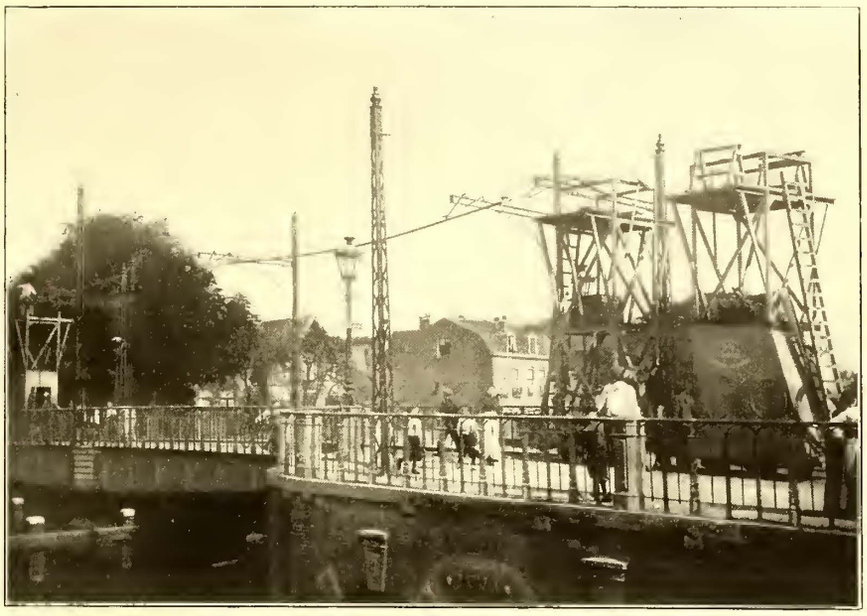
At the village of Slotedyk the line joins what is known as "The Government High Road," between Amsterdam and Haarlem. On the north side of this road is a canal running the entire length except through the village of Halfweg. On the south side of the High Road is a ditch. The ground over this distance is what is known in Holland as "Polder land," and is below the canal level. It is divided by ditches, generally running in a northeasterly and southwesterly direction. These

DOUBLE-TRACK ROAD ON NARROW STREET—HAARLEM

ditches lead to various points where wind mills are placed to pump water from the low levels up into the canals.

The paving of the High Road was practically relaid the entire length to the stipulated datum level of Amsterdam. The amount of work involved on the Government High Road may be seen from the following list of material required:

20,500 uncreosoted and 23,000 creosoted piles.
2,700 cubic meters uncreosoted and 1900 cubic meters creosoted timber.
160 tons of iron for tie-rods.
5,000 tons of basalt for protecting slopes.
75,200 cubic meters sand filling.
31,600 square meters of brick paving.
9,600 cubic meters of dredging.
1,700 meters of fencing, and 74 gateways and approaches to farms and houses on the south side.



SWING BRIDGE—HAARLEM

When the work was at its height on the entire line, there were in use 2360 laborers, two steam locomotives, one electric locomotive, thirty-one steam pile drivers, three steam spouters, one steam crane, sixty hand pile drivers, one steam bucket rigger and 165 flatboats and scows.

TRACK CONSTRUCTION

The permanent way along the Government High Road, and also along the private right of way, is practically a steam railway construction. The rails are what is known as the Vignole (or T) section, weighing 70 lbs. per yard. The section is the standard of the American Society of Civil Engineers for that weight. The rails rest directly on ties spaced 76 cm center to center, except at the joints, where they are 50 cm. The joints are

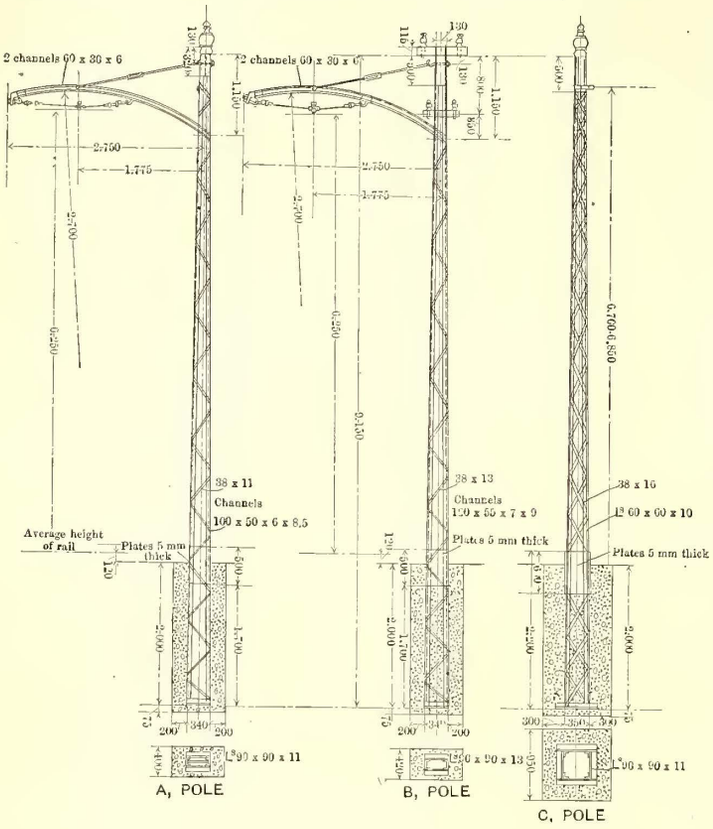
CAR HOUSE—HAARLEM

staggered. The ties are creosoted Norway pine, 23 cm x 11.5 cm, the upper edges being beveled. The rails are fastened to the ties by screw bolts. Double concealed bonds are placed at each joint. The length of route along the canal is 13.417 km.

At the village of Halfweg, which, as its name indicates, is situated approximately half-way between Amsterdam and Haarlem, the line crosses two canals. Over these, bridges were built specially for the purposes of the tramway. One bridge has four spans, each 15 m, and the other two spans of the same

length. There were used in the construction of these bridges 295 piles of 15 m average length, and 295 cu. m of other timber, 280 cu. m of brick work, 25 cu. m of granite, 150 tons of steel.

Through the village of Halfweg there are two sections of single line. These short sections are controlled by an automatic electric signaling device of the Siemens-Schuckert Company, particulars of which are given later in this article.

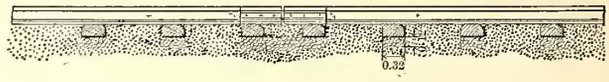


STANDARD POLES

The line enters the city of Haarlem at what is called the "Amsterdam Gate." The construction in Haarlem is all with 84-lb. grooved girder rails. They rest directly on the ties, which are spaced 74 cm center to center, except at the joints, where they are spaced 56 cm. The dimensions of the ties is the same as for the Vignole track.

CAR HOUSE

A new car house was constructed alongside the existing power station of the E. N. E. T. The pit construction in the car house is provided by the use of cast-iron columns to carry the rails. These columns at the other end have flanged bases resting on the pile foundations. The length of the columns is 2.20 m, and the depth of the pit in the clear is 1.40 m. The distance from center to center of the columns is 2 m. The rail bridges this distance without any additional support. This construction gives the minimum obstruction in the pits, and is simplicity itself.



LONGITUDINAL SECTION OF TRACK

CARS

The thirty-four cars were made by La Metallurgique, at Nivelles, Belgium. They are divided into two compartments, the larger for seating twenty-two passengers, and the other, twelve. The smaller compartment is for smoking. The cars are vestibuled. Besides the hand brakes, the cars are equipped with the Christensen air brake, with motor compressors, supplied by R. W. Blackwell & Company, Ltd., London.

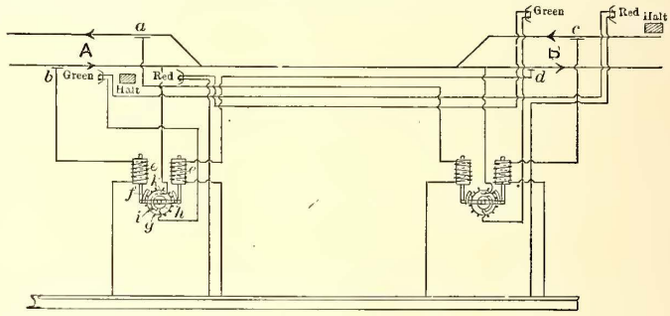
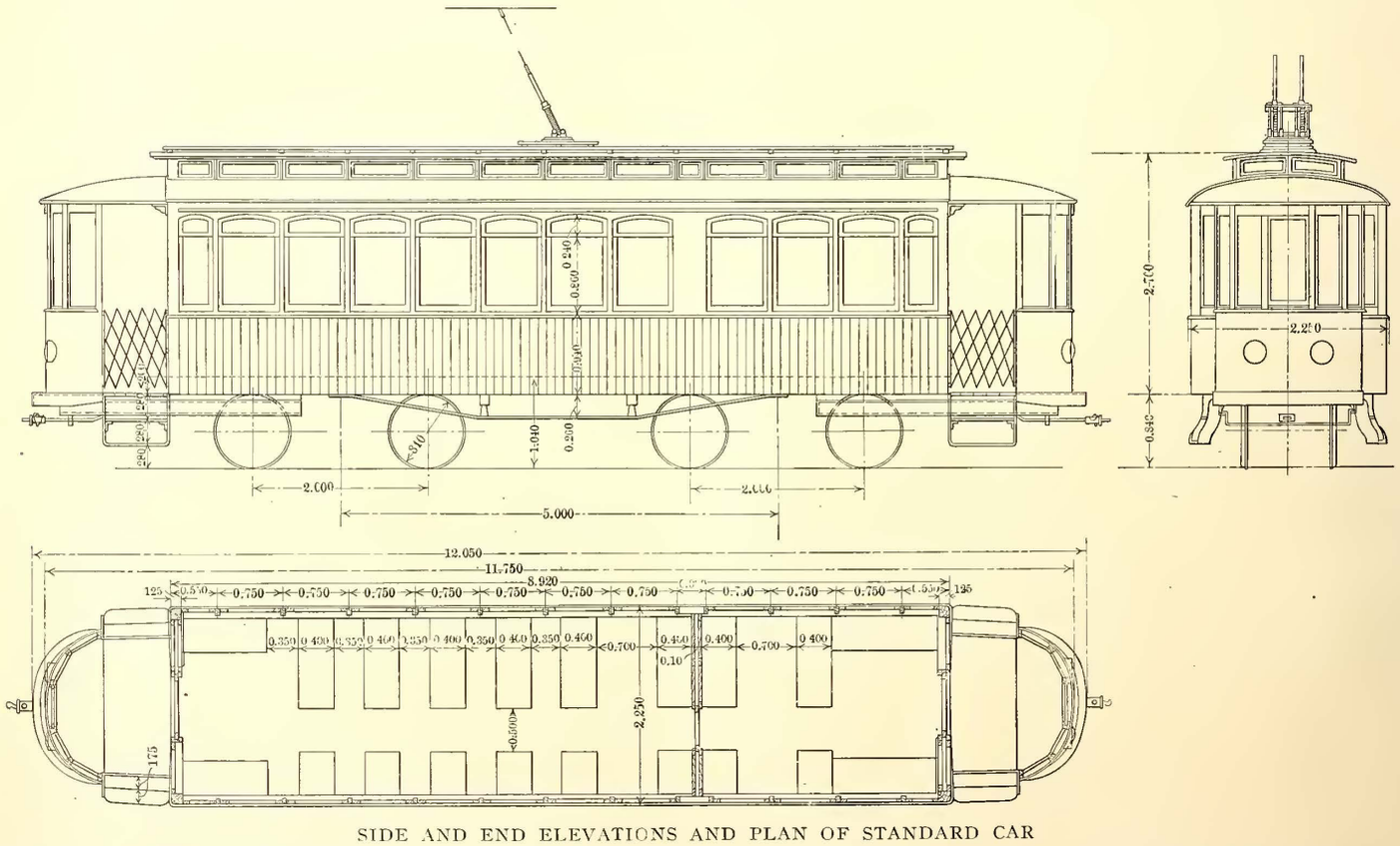


DIAGRAM SHOWING CONNECTIONS OF BLOCK SIGNAL SYSTEM



SIDE AND END ELEVATIONS AND PLAN OF STANDARD CAR

The trucks were also furnished by La Metallurgique. The special feature of these trucks is that the swing links are pivoted on the outside of the truck frame. The trucks are very easy riding, even at the higher speeds of 35 to 40 m.p.h. The motors are of 50 hp, and were furnished by the Union Elektricitäts Gesellschaft, now incorporated with the Allgemeine Elektricitäts Gesellschaft.

OVERHEAD CONSTRUCTION

The overhead equipment is on the bow system, with a pressure of 500 volts to 575 volts. The poles are of the lattice girder type, of three different weights, viz.: "A," 250 kg (550 lbs.); "B," 317 kg (700 lbs.), and "C," 590 kg (1300 lbs.). "A" and "B" are constructed of two channel sections bolted together, and "C" with angles. The poles are provided with heel plates and are set 2 m in concrete. The bracket arms consist of two channel sections bolted together. Bracket-arm construction is used throughout, except in Haarlem, and the poles carry both the feeder cables and telephone wires. The feeder cables consist of two bare copper conductors, each 194 sq. mm section. The trolley wire is 68 sq. mm in section.

On that part of the route from Haarlem to Vandvoort bow contact is made with two wires simultaneously. The trolley wire is zig-zagged in order to equalize the wear on the bow. The height of the wire from the ground varies from 7 m in Amsterdam to 6.25 m on the Government Road and 5.5 m on the E. N. E. T. section. This variation in height caused at first considerable trouble with the bows, but at present the bow base is so arranged as to keep an equal tension on the bow at the respective heights. The wire is held up by screwed mechanical clips, which, with the bow, give noiseless running.

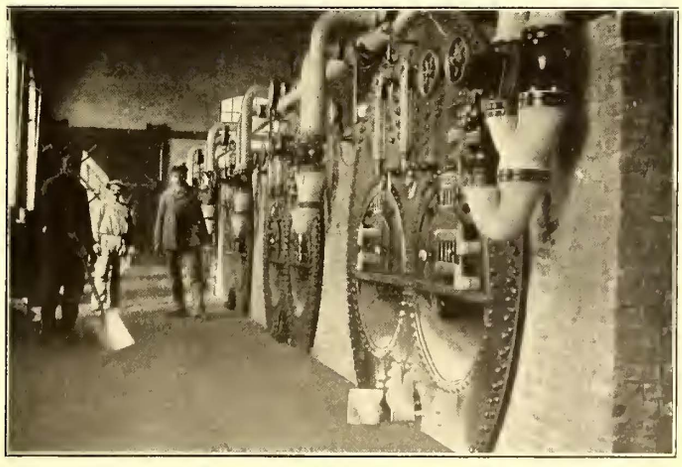
VIEW SHOWING METHOD OF LAYING TRACK

POWER STATION

The power house is situated in a central position at Halfweg, midway between Amsterdam and Haarlem. It is in practically the best position for distributing power to the line, being located on the banks of the Ringvaart Canal, which will afford cheap carriage for coal and other supplies, and has an abundance of water for feed to boilers and jet condensation. Owing to the nature of the country and the poor condition of ground at the site of the power station, an elaborate arrangement of piling was necessary for the foundations.

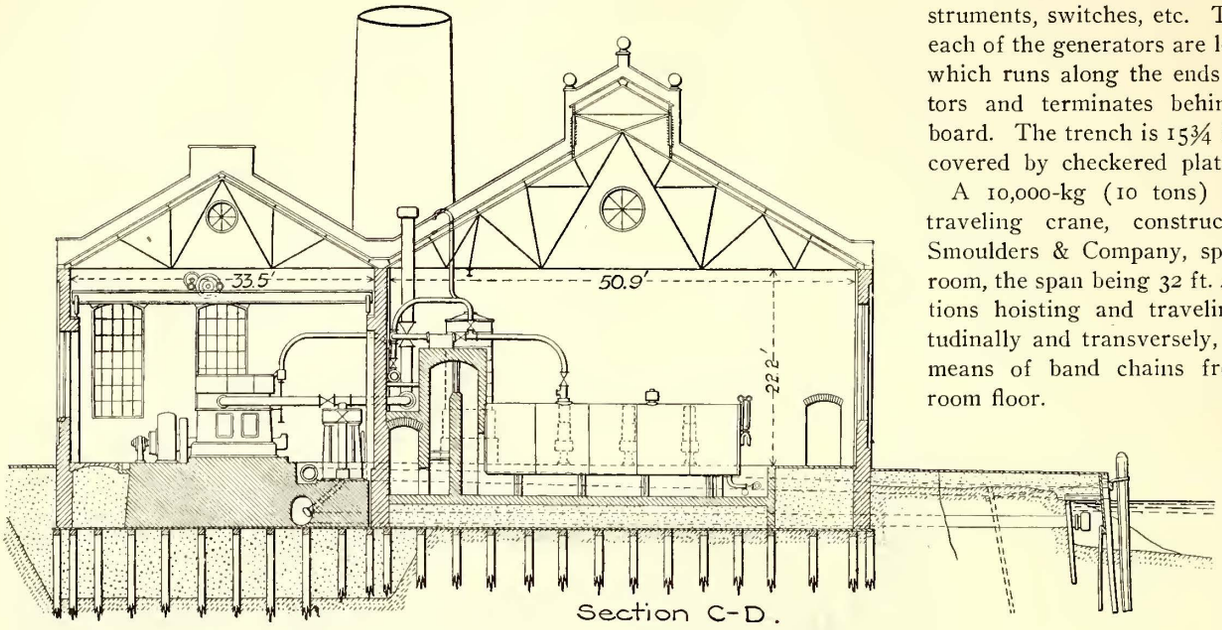
EXTERIOR OF POWER STATION—HAARLEM

The buildings, which include the station and car house, are of brick, substantially and neatly finished with stone trimmings. The ground area occupied by the power station site itself is about 9150 sq. ft., with sufficient ground for future extensions. A wharf is erected 26 ft. 3 ins. wide, and immediately adjoining is the boiler house, which is 88 ft. 7 ins. x 52 ft. 6 ins. A division wall separates the boiler and engine rooms. The engine room is 59 ft. x 34 ft. 7½ ins., and is 21 ft. 4 ins. high from engine room floor to top of wall. Situated at the end of the boiler



BOILER ROOM

room is a coal storage room, which is 50 ft. 8 ins. x 35 ft. 4 ins., with storage capacity for 400 tons. An outhouse for offices communicates with the engine room, and is 12 ft. 9 ins. x 12 ft. 9½ ins. The walls of buildings are 14 ins. thick above and 21 ins. thick below the ground line, the walls being supported by pilasters 14 ft. 9 ins. apart and 21 ins. thick, which are carried to the top of walls for supporting the roof principals. Good light is obtained throughout the entire building by large glass windows with iron frames. Ample door space is provided for bringing the machinery into the building, also communicating doors to the different rooms. A traveling crane works over an area of the engine room at a height of 15 ft.



CROSS SECTION OF POWER STATION

ENGINES AND BOILERS

The main engine plant consists of three Belliss patent self-lubricating, three-crank, triple-expansion engines, each of 430 hp at economical cut-off, and having a steam consumption of 13½ lbs. with superheated and 17 lbs. with saturated steam, with 26-in. vacuum. The speed is 375 r. p. m., and the regulation is within 3 per cent, even with sudden variations from full to no load. The engines are of the enclosed type, supported on a heavy cast-iron frame and secured by nine foundation bolts. The cylinders are 12-in., 17-in. and 26-in. x 13-in. stroke.

The boiler house contains six Lancashire steel boilers, by Stork, of Hengelo, Holland, the heating surface of each boiler being 926 sq. ft.; grate area, 35 sq. ft.; steam pressure, 160 lbs. per square inch.

SUPERHEATERS

There are six superheaters, by Stork, of Hengelo, Holland, which are placed in flues directly behind boilers, and are arranged to work at a temperature of 500 degs. F. By means of flue doors the superheaters can be cut out and engines worked by saturated steam. The heating surface of each superheater is 330 sq. ft. Each superheater consists of ten rows of coils, the ends of which terminate in two cast-steel headers, 8 ft. 11½ ins. apart, the coils being bound by steel straps bolted together. The steam enters the one header, passes through the tubes and discharges at the other. Fixed to the discharge steel header is a 1½-in. safety valve, a 1-in. blow-off cock and two small holes for testing purposes.

GENERATORS, SWITCHBOARD, ETC.

The generators, made by the Société Anonyme Westinghouse, are three in number, coupled to the engine shafts. The output of each d. c. compound 6-pole machine is 300 kw, at 525-575 volts, when running at a speed of 375 r. p. m. The switchboard, which was also supplied by the Société Anonyme Westinghouse, consists of five panels (three generating, two feeder panels), and is situated on the floor at the end of the engine room. The panels are of marble fitted to a steel frame, and having the usual standard forms of instruments, switches, etc. The cables from each of the generators are led into a trench which runs along the ends of the generators and terminates behind the switchboard. The trench is 15¾ ins. wide and is covered by checkered plates.

A 10,000-kg (10 tons) overhead hand traveling crane, constructed by Louis Smoulders & Company, spans the engine room, the span being 32 ft. 4 ins. The motions hoisting and traveling, both longitudinally and transversely, are worked by means of band chains from the engine room floor.

CHIMNEY

A round brick chimney is situated free from the building at the end of the boiler house. This chimney is 131 ft. high, and has an internal diameter of 5 ft. 5 ins.

CONDENSING PLANT

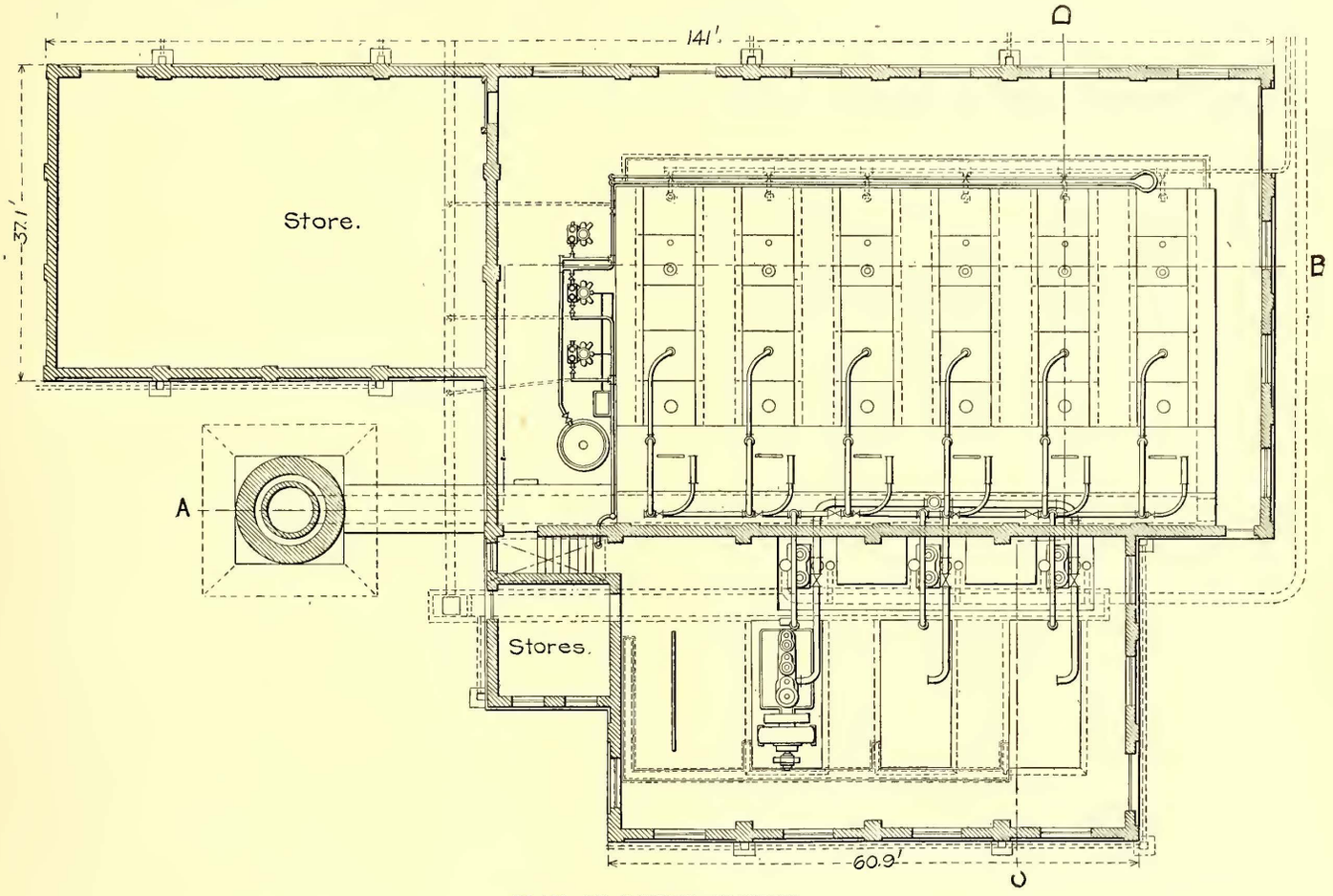
The condensing plant for the main engine, made by the Nederlandsche Fabrick, Amsterdam, consists of three jet condensers, each capable of condensing 9000 lbs. of steam per hour. The pumps are of the vertical type, the cylinders being placed side by side, supported by a cast-iron frame. Directly below are the pumps, of the Edwards type, each set being secured by six foundation bolts. The condenser and injection water inlets are situated behind the pumps, the pumps discharging into a large air vessel placed in front of the pumps.

STANDARD TRUCK

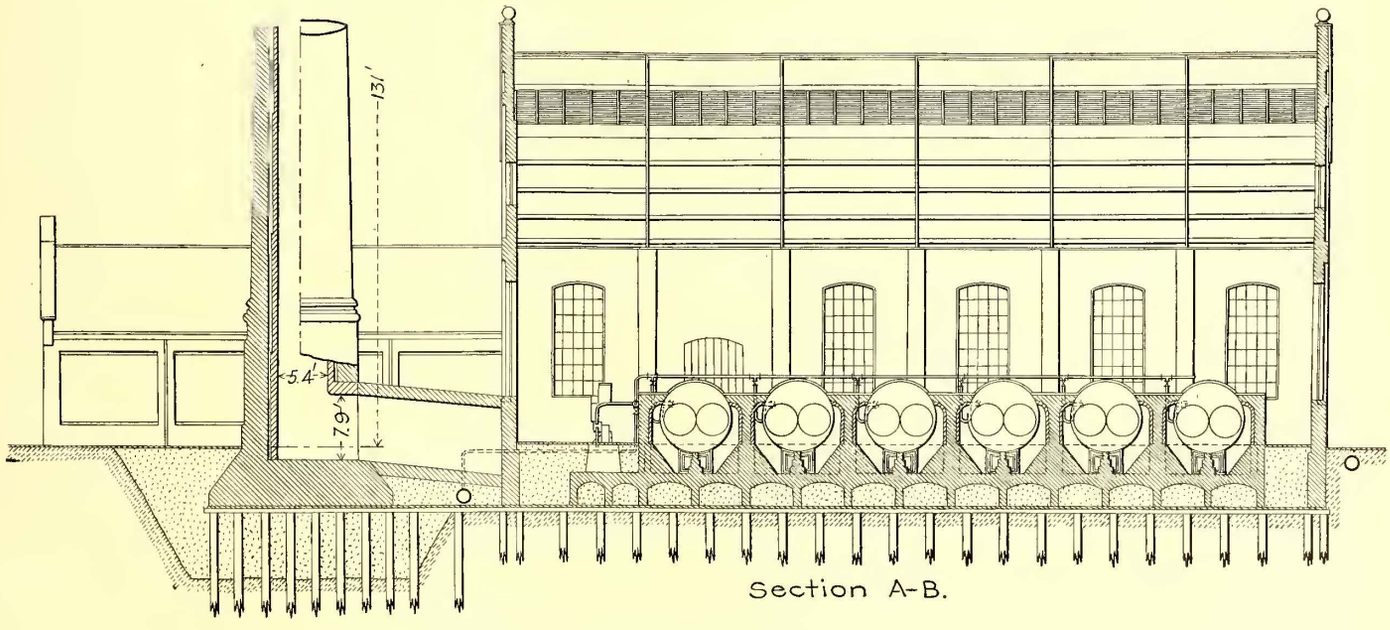
FILTERING TANKS

The feed-water to the boilers is taken from the adjoining canal, which contains an average amount of suspended matter, necessitating the filtering of the water. Under the boiler room floor, in front of the boilers, a duplicate arrangement of tanks is situated, built of brick. Each arrangement consists of a filter tank with reservoir, the filtering medium consisting of sand and clinkers, and is supported on a wooden floor perforated with holes, thus allowing the water to percolate through the medium to the reservoir. A branch pipe connecting both

reservoirs leads to a hot-well. Inside of the hot-well and fixed to the side of the tank is a ball float valve, with connecting pipe to the water inlet supply to the condensers, the latter being used as an automatic emergency water supply in the event of the



PLAN OF POWER STATION



LONGITUDINAL SECTION OF POWER STATION

filtering tanks failing to supply the hot-well. The area occupied by the filter tanks is about 710 sq. ft.

FEED-WATER HEATER AND PUMPS

A vertical exhaust feed-water tube heater 9 ft. 7 ins. high x 24⅝ ins. diameter, made by the Buffalo Pump Company, is placed directly behind the feed-pumps, the feed-water entering at the bottom and leaving at the top, the exhaust steam vice versa.

Two sets of direct-driven horizontal duplex end packed feed-pumps, 6 ins. x 3½ ins. x 6 ins., made by T. A. Lewis, New York, are installed, each capable of delivering 2400 gals. per hour against 300 lbs. per square inch, the working steam pressure being 160 lbs. per square inch, each unit being capable of supplying the total amount of feed-water to the boilers.

MAIN STEAM PIPING

From the angle stop valves on the boilers 6-in. pipes join the cast-steel header of the superheater, and then branch into the main header, from which the engines take their supply of steam. The piping, which is extra heavy throughout, is arranged by closing valves in the main header, to permit the

operation of this plant as three independent units. Owing to the high temperature of steam, ample allowance has been made for expansion and contraction, and the piping is designed in such a way that any condensation of steam in pipes connecting the main header terminates in the main header, and is drawn off by three drains of large size, one in each section, so as not to permit of any accumulation of water in the pipe. The three drains being coupled to two steam traps, which can be worked independently, discharge into a drip main which runs along the division wall to the hot-well. A standpipe from the drip main is placed in a prominent position in the boiler house, with end open, so that any excessive discharge of steam will show at once a defective trap.

From each of the angle stop valves on the boilers, a drain is connected to a drip main which discharges into the hot-well. This drain will only be used in case any of the boilers is shut down, so as to prevent any water from accumulating in the valve.

FEED PIPING TO BOILERS

The feed-water piping to boilers, is arranged in duplicate. The discharge from the pumps passes through the heater into one of two mains, which run along the side on to the top of the boilers and branch off to a Y piece into the feed-check valve in front of the boilers. By an arrangement of valves, the heater can be cut out and the water pumped direct to the boilers. The piping is arranged so that one or more boilers can supply any one engine independently of the others, and allow the consumption of steam in the engine to be determined at any time. There are three feed-pumps, each one being capable of supplying the total amount of feed-water to the boilers, and each pump having a separate suction pipe with strainer.

MAIN EXHAUST PIPING

From each of the three engines an exhaust pipe is carried across the engine room at a height of 6 ft. 6¾ ins., and through the division wall into the boiler room, where it is supported on the main flue, the three pipes connecting up at a central position, when the pipe is increased, and an automatic relief valve is situated in the vertical pipe leading to the atmosphere, on which there is an exhaust header. A branch pipe is taken from each exhaust pipe from engine into an independent jet condenser by valves situated conveniently in the piping. The arrangement will permit the operation of any engine working in conjunction with any condenser. Any condensation in the pipes will drain back into the condensers.

AUXILIARY STEAM PIPING

The auxiliary units (feed-pumps and jet condensers) are worked with saturated steam taken from branches off the main steam pipe, between stop valves and superheaters, and is designed on the loop system, alternate boilers connecting one side of loop. From the loop a main is taken, in which a separator is fixed, before entering the engine room, where it branches off to the three condensers. Other branches are taken to supply the three feed-pumps.

SIGNALS FOR SINGLE-TRACK SECTIONS

Wherever cars going in both directions use the same single track, automatic block signals have been installed. The signal system includes contact switches, *a*, *b*, *c*, *d*, supported in the overhead line near the entrance and exit of each turn-out, designed to be operated by the trolley wheels of passing cars. There is also a counting device which automatically counts cars in and out of the block, whereby, if it is desired, two or more cars going in the same direction can follow into the block, and the signals will not return to clear until all the cars have passed out.

When the overhead contact switch is actuated by a passing car, contact is made with the trolley wire and current flows for a brief period through the signal system. This current, if the car is going from A to B, passes through the windings of an electromagnet, *e*, whereby the armature of the magnet is drawn up, and a ratchet is engaged with a toothed wheel, and at the same time this wheel turns through one section of its circumference. Attached to the toothed wheel is a spring contact device which permits current to flow to the green and red lights at both ends of the block. If more than one car enters the block from the same direction, the wheel is advanced one tooth for each car and the signal lights remain burning. As each car leaves the section the operation is reversed through switch *d*, the toothed wheel going back one tooth for each car, but the lights remain burning until the last car has left the block, when the light current is broken and the signals return to clear.

LONG ISLAND CITY POWER HOUSE OF THE PENNSYLVANIA RAILROAD

The initial installation of generating units in the new Long Island City power house of the Pennsylvania Railroad is nearing completion, and it is expected the first unit will be ready for operation early in January. This power house is located between Third and Fourth Streets, Long Island City, near the East River water front, and opposite Thirty-Eighth Street, Manhattan. It is designed to supply power ultimately for the operation of trains through the East River tunnel, and also for the lines now being equipped with electricity by the Long Island Railroad Company. The property acquired at this location is roughly 200 ft. x 500 ft., but the present power house building occupies only half of this area, namely, 200 ft. x 265 ft. The station as laid out has room for six 5500-kw turbo-generator units for traction purposes and two 2500-kw turbo sets for furnishing lights in the tunnels and terminal buildings.

The present installation consists of three of the 5500-kw turbo sets which will be used for supplying power to the Atlantic Avenue and Rockaway divisions of the Long Island Railroad, these lines having been selected as the first to be electrified. The early completion of the Atlantic Avenue improvement necessitates its electrical operation long in advance of the completion of the New York terminal project. The plans for the electrification of the Long Island Railroad between now and the early part of June calls for the equipment of the lines shown in the accompanying map, and which include the following: The Atlantic Avenue line from Flatbush Avenue to Jamaica, and thence to Belmont Park, 14.12 miles; the Rockaway division from Woodhaven Junction to Rockaway Park, 8.53 miles; the line from Jamaica to the Metropolitan race track, 2.6 miles. The total line thus to be electrically equipped is about 86 miles, when measured as single track. In addition, the road between Rockaway Park and Far Rockaway, known as the Ocean Avenue line, should also be included in the electrified lines of the Long Island Railroad Company. This line has been in operation by electricity for some time, but its capacity will be increased by a loop which has been built over the Boulevard on the beach. The present power station will amply care for these present plans. Additional units will be added as fast as the tunnel equipment and electrification of the steam lines progress.

As announced in the Street Railway Journal for Oct. 3, 1903, the order for the 5500-kw turbo-units was placed in July, 1903, with the Westinghouse Machine Company by Westinghouse, Church, Kerr & Company, acting as engineers and constructors for the Pennsylvania Railroad. The turbines are of the Westinghouse-Parsons horizontal type, each having an overload capacity of over 11,000 hp. Each generator is direct connected to the turbine shaft through a flexible coupling. The generators will deliver three-phase alternating current at 25 cycles and 11,000 volts. The machines will be separately excited, and each turbo-unit will be capable of delivering 8250 kw for short periods, and considerably in excess of this load during momentary peaks.

For distribution, current will pass directly from the three-phase windings of the generators to the transmission lines at the initial pressure, 11,000 volts, no step-up transformers being used. For feeding the reconstructed lines of the Long Island Railroad, the high-tension current will be carried partly by overhead and partly by underground transmission lines to sub-stations for transformation and conversion into direct current at 625 volts.

Ultimately there will be eight of these sub-stations located at advantageous points over the Long Island system. For the present, however, but five of the sub-stations will be equipped, these to serve the mileage of the divisions now in process of electrification. The location of the five initial sub-stations, with the equipment of each, is as follows:

No. 1, near Grand Avenue, three 1000-kw rotary converters and nine 375-kw transformers.

No. 2, at East New York, three 1000-kw rotary converters and nine 375-kw transformers.

No. 3, at Woodhaven Junction, three 1500-kw rotary converters and nine 550-kw transformers.

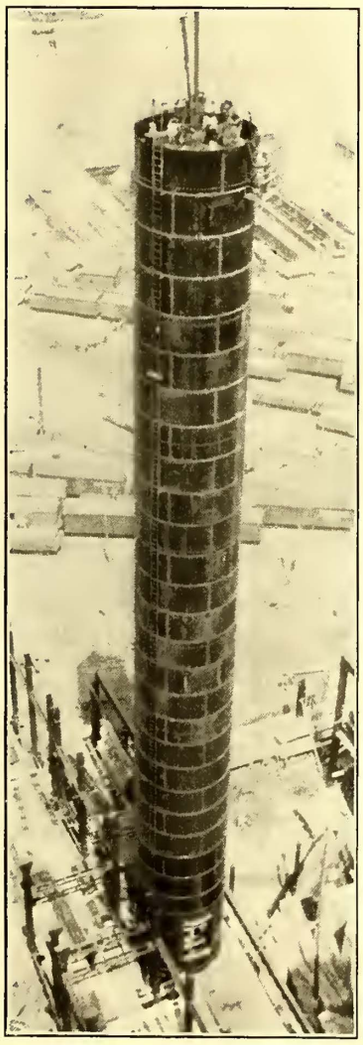
No. 4, at Rockaway Junction, two 1000-kw rotary converters and six 375-kw transformers.

No. 5, at Hammel, near Arverne, two 1000-kw rotary converters, six 375-kw transformers and one 3200-amp.-hour storage battery.

All the rotary converters and transformers were built by the Westinghouse Electric & Manufacturing Company, and are of that company's standard railway type for changing 11,000-volt three-phase 25-cycle alternating current to 625-volt direct current.

In addition to the five permanent sub-stations, an interesting feature will be two portable sub-stations mounted on cars, and designed to be shifted to various parts of the system as load conditions may require. Each of the portable outfits will consist of a 1000-kw rotary converter, with all the step-down transformers, oil switches, switchboard, etc., necessary to make up a sub-station complete in every detail, all compactly mounted on a car of regulation dimensions. These movable equipments will find their particular application during the horse racing season, when racing interest shifts at frequent intervals to the several race tracks scattered over Long Island. The heavy shifting loads created by these race tracks introduce serious problems in designing an efficient power distributing layout, as the trend of travel to any one of the tracks is not of sufficient duration to justify permanent investments in sub-station equipment at each of the points, but it is believed these portable sub-stations will give a satisfactory solution to the difficulties. During a meet at any one of the race tracks, one of the portable stations will be housed in a terminal building near the track and connected up to take care of the load at that point. At the close of the meet the car will be taken to some other point where it may be needed. It has also been decided to build side tracks at each of the permanent sub-stations, and in the event of break-down or mishap to the equipment at any sub-station, the portable equipment can be sent to take its place while repairs are being made.

The general layout of the Long Island power house includes a division wall down the center, one-half of the building comprising the boiler room, and the other the engine room. The main steam header is carried along this division wall, the steam



VIEW OF STACK DURING ERECTION

VIEW OF POWER STATION OF LONG ISLAND RAILROAD COMPANY FROM FREIGHT YARDS

piping from each set of boilers leading into the header by long bends. The steam connections for each turbo-unit are taken from the header and lead through the wall directly to each turbine. Each turbo-unit has its own surface condenser mounted at the exhaust end of the turbine, the condensers being of the Alberger surface condensing type. Each condenser has a separate steam engine-driven circulating pump and dry vacuum pump, the condensers taking the circulating water from a horizontal flue or sewer, 10 ft. in diameter, extending under the central line of the generating-units, and returning the water to a second flue located just above the intake sewer. Both the intake and outlet sewers are embedded in the concrete foundation. The hot water from the condensers is carried to a set of storage tanks, which acts as a hot-well for boiler feeding.

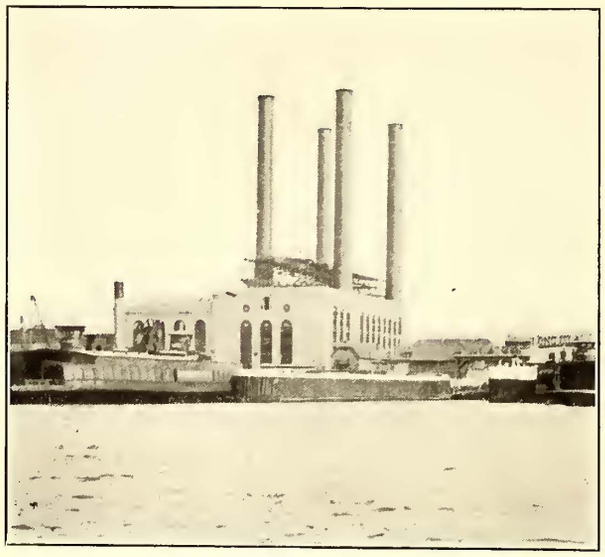
The plant is provided with one large open feed-water heater of the Cochrane type, furnished by the Harrison Safety Boiler Works. This heater is 8 ft. in diameter and 15 ft. long, inside measurements, and receives the exhaust from all the auxiliaries.

Steam for the present installation of turbines will be generated in thirty-two B. & W. boilers, rated at 600 hp each, arranged in two tiers along each side of an aisle, making eight boilers to each bank. The boilers are fitted with internal superheaters of the B. & W. type, designed to give about 175 degs. F. of superheat. The boiler room equipment includes Roney stokers and Green fuel economizers.

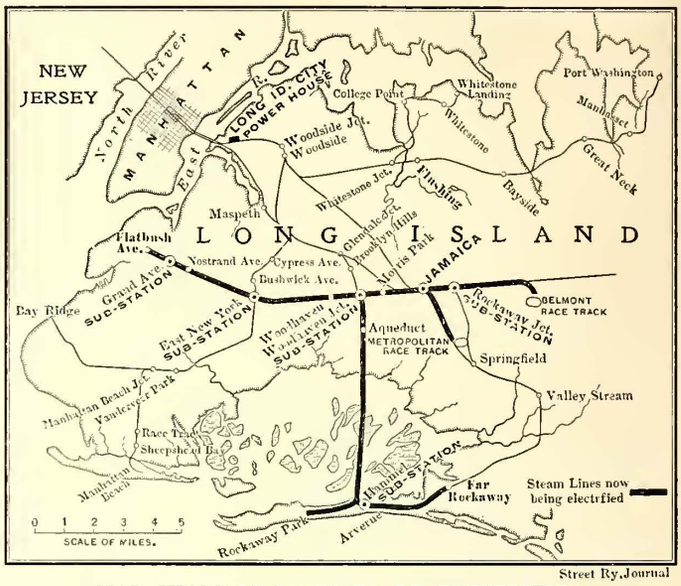
There are four stacks, each 275 ft. high and 23 ft. in diameter at the base. The stacks are of self-supporting steel construction, lined throughout with fire brick, the brick lining being 2 ft. 8 ins. at the base.

The power house foundations rest on piles ranging from 25 ft. to 30 ft. in length, driven over the entire area at distances ranging from 24 ins. to 40 ins. each way in centers. Under the stack foundations, the piles were placed nearer together. About 9500 piles in all were used in the work.

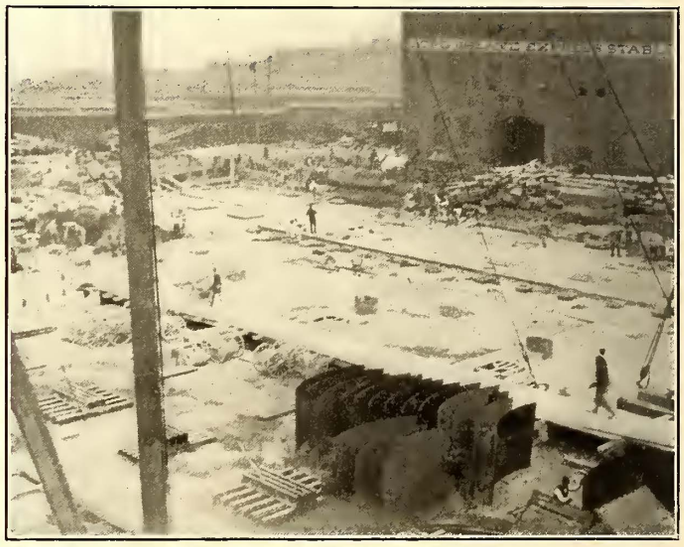
After the piles were in place a monolithic layer of concrete was laid on the pile ends to a depth averaging 6 ft. over the entire area covered by the power house building. The concrete employed was a 1:2½:5 mixture with Dragon Portland cement. This mass of concrete is thoroughly drained internally by means of mains and cross drains consisting of 10-in. and 12-in. vitrified pipe embedded in the work. This precaution was taken to preclude the possibility of trouble due to the concentration and possible freezing of moisture within the mixture. The



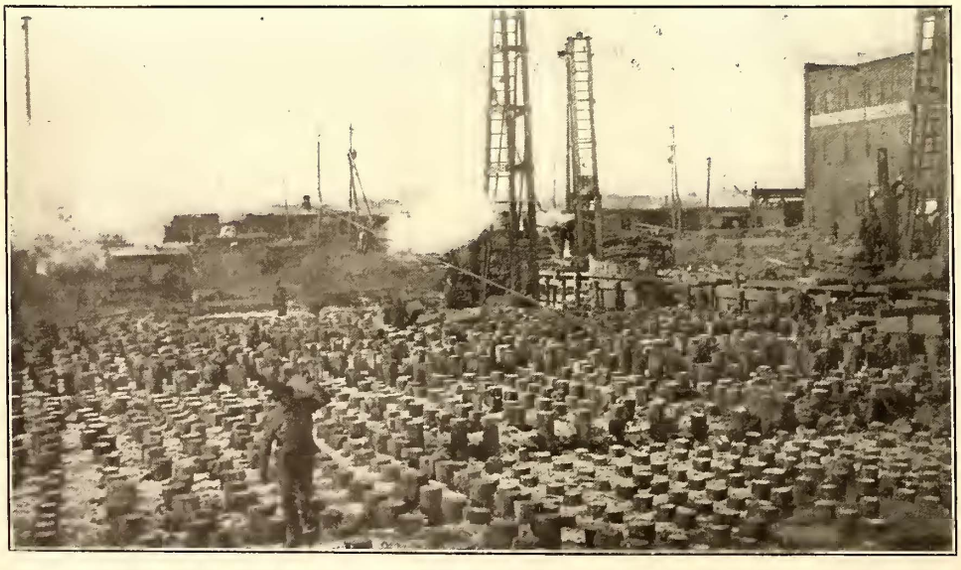
POWER STATION FROM RIVER



MAP SHOWING LINES TO BE ELECTRIFIED



LAYING THE CONCRETE FOR THE STATION FOUNDATION



PILE FOUNDATION FOR STATION

walls of the building, as well as the brick foundations of the turbo-units and the supporting columns of the frames for the boilers, rest on this concrete bed. In order to obtain a sure footing for the supporting columns, the following method was adopted: A number of 12-in. I-beams, from 6 ft. to 8 ft. long, were embedded in the concrete, on edge and close together. To these beams were bolted 12-in. cross I-beams, laid at right angles with reference to the lower layer. The bases of the supporting columns rest directly on these cross beams, and are bolted to them.

A special feature of the power station building is the extensive use of wire glass in both the windows and skylight. This material gives plenty of light in the station and, owing to its fire-protective qualities, is extremely desirable, especially on the Fourth Street side, where the power station is flanked for its entire length by the great Smith Varnish Works. Altogether there are about 30,000 sq. ft. of Mississippi wire glass, in angle-iron frames, used in the windows, and about 5000 sq. ft., also in angle-iron frames, are employed in the skylights. The various transformer stations, already mentioned, are also fitted with this material.

The coal storage has a capacity of 10,000 tons, and is located over the boiler rooms. The bunkers will be served by a coal conveyor which will take the coal from the barges, and will cross Front Street at a height of 175 ft. above the street level. The coal will then be discharged through a coal breaker into the hoppers. The ashes will be removed by a second line of conveyors which will take the coal from under the boilers and dump it into the cars of the Long Island Railroad.

In addition to the power station, three new car houses and inspection shops are being built, one at Rockaway Park, 100 ft. x 30 ft.; another at Dunton, 50 ft. x 200 ft., and a third at Morris Park shop, 75 ft. x 200 ft. The transmission line poles are also being erected. These poles are being set in concrete.

It is believed this power house has been erected in record breaking time. Ground was broken on the site Oct. 26, 1903.

FIG. 2.—ORDINARY MOLDS AND MOLD FOR DUTCHMAN JOINT

The first pile was driven about a month later. The work of laying the concrete bed was commenced in January, 1904. The first brick in engine room walls was laid in May, 1904, and the first steel column was placed in position the same month. The building structure is now partially completed. The first generating-unit is in place, and most of the remaining machinery is either on the ground or is en transit.

All of the engineering and construction for this power station has been carried out by Westinghouse, Church, Kerr & Company.

J. R. Harrigan, general manager of the Columbus Buckeye Lake & Newark Traction Company, and of the Columbus, Newark & Zanesville Traction Company, presented each of the one hundred and eighty-five employes of the roads with baskets containing a chicken and provisions for a Christmas dinner. Harrie P. Clegg, general manager of the Dayton & Troy Electric Railway Company, made a simlar contribution to the employes of his system; and also tendered a fine turkey dinner to the heads of departments constituting the "Officers' Club" of this property.

CAST-WELDING ON THE CALUMET SYSTEM AT CHICAGO

By the courtesy of H. M. Sloan, general manager of the Calumet Electric Street Railway Company, of Chicago, the STREET RAILWAY JOURNAL is enabled to give a number of interesting details as to the way cast-welding of rail-joints is carried on by that company. It has been claimed by some track men that the heating of the rail ends by the cast-welding process causes softening of the metal, which results in the wearing of the rail faster at the joints than at other parts, and finally results in a hammer blow effect which soon batters the joint down. While Mr. Sloan does not believe this is the case, and thinks that such battering is usually due to a low joint at the time the cast-weld is made, he, nevertheless, provides as far as possible against heating of the wearing surface of the rail by putting the greater part of the metal in the cast-welded joint around the base of the rail, leaving only enough around the upper part of the web to make the joint solid.

FIG. 1.—SHAPE OF CAST-WELDED JOINT USED ON CALUMET ROAD

Fig. 1 shows the shape of joint used on the Calumet system. In this joint it is seen that there is but little metal about the head of the rail and that the joint is tapered so that it is longest around the base. The joint covers only one bolt hole of the original angle-bar joint. At the bottom of the mold, as can be seen by this joint in Fig. 1, there is a pit which will contain from 10 lbs. to 12 lbs. of iron. Instead of heating the molds in a fire in the old-fashioned way, they are heated by having 10 lbs. or 12 lbs. of iron poured into them just before the joint is cast. The iron in the bottom, of course, afterward becomes a part of the finished joint as soon as the balance of the iron forming the joint is poured on top of it. The weight of joints on 83-lb. 7-in. girder rails is 100 lbs., and on 72-lb. 6-in. girder rails is 85 lbs. On the latter rail it is 13 ins. long at the rail base.

Cast-welding is done in cool weather before the ground is frozen. Rails are cast-welded into 300-ft. lengths. Every 300 ft. an open joint is left, which, as the weather becomes colder, opens wider and wider until, in the coldest winter weather, the track men go over the road and fill these open places with "Dutchmen," these "Dutchmen" consisting of rails of the same section as the track, sawed to the proper length to fill the gap. A supply of these "Dutchmen" of various lengths is kept on hand, so that there will be always one to approximately fit the opening. The open joints into which the "Dutchmen" have been placed are then cast-welded in the spring and the job is

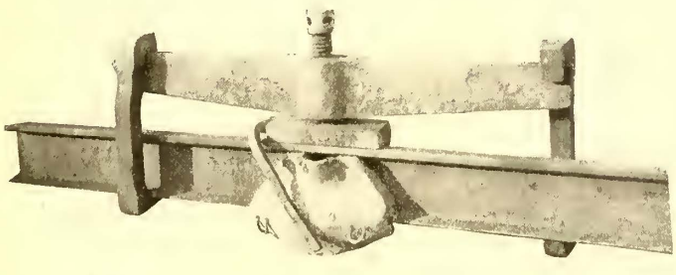


FIG. 3.—MOLDS AND CLAMPS READY TO WELD, POURING SIDE

complete. Extra long molds are used for casting these joints. Views of the ordinary molds and also one-half of a mold for a "Dutchman" joint are shown in Fig. 2. The molds as applied to the rail are seen in Figs. 3 and 4, Fig. 3 being the outer side of the rail, and Fig. 4 the inner side. The long bar through which the jack screw is placed and the hooks at the ends of it are of cast steel. These clamps are, of course, to keep the rail ends from rising during the cast-welding process, as experience has proved they are likely to do. The molds are held on the joint by a single U-shaped forging, which is slipped over the molds after they are placed against the rails.

The molds are coated inside with a mixture of graphite and kerosene. About three joints can be poured in a pair of molds with one coat of graphite, after which another coat of graphite is applied and two more joints are run in the molds before it is necessary to renew the clay coating. As to the life of the molds, the company has welded about 40 miles of track, and its stock of 125 molds has not needed replenishing and appears to be in fairly good condition. Some molds are cracked, but any ordinary cracks can be filled with clay, so that cracks do not interfere with the work. The molds are, of course, of cast iron.

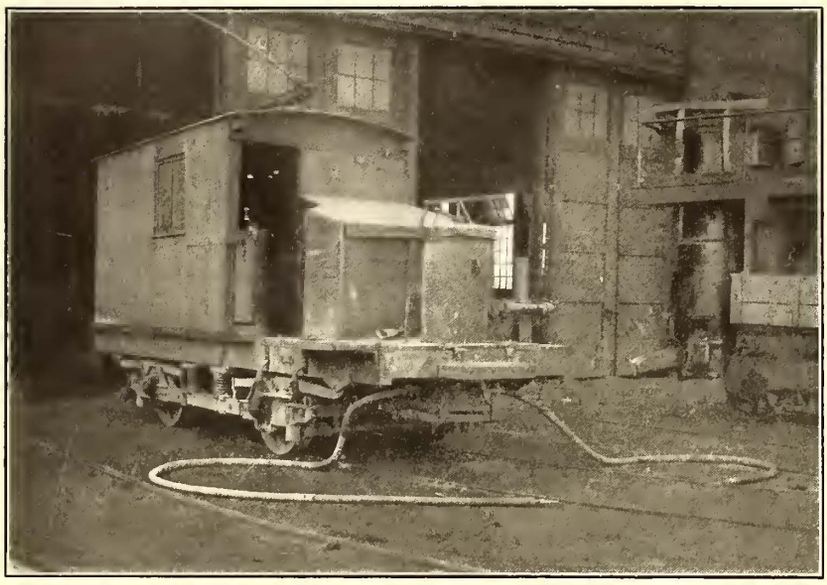


FIG. 5.—SAND BLAST CAR

The base of the rail is well cleaned with a sand blast before casting. Fig. 5 shows the sand blast car. Fig. 6 shows the cupola car. The cupola is flexibly supported on springs, so that there will be as little damage to the lining as possible in going over special work. The piece of sheet steel over the cupola is raised to protect the trolley wire from the heat of the blast when the cupola is in operation. If building this cupola car again, Mr. Sloan says he would make a double cupola.

The iron used in casting joints is 50 per cent No. 1 soft Ensley and 50 per cent soft machinery scrap. This No. 1 soft Ensley has an analysis as follows:

Silicon, 2.75 to 3.25 per cent.
Phosphorous, .70 to .85 per cent.
Sulphur, less than .05 per cent.
Manganese, .30 to .45 per cent.

All iron is poured very hot. This is very essential. The foremen are particular that the iron be sparkling hot before it is poured. The sand blast is used to clean both sides and base of rail. The shape of the joint is such that there is not iron enough to cause adhesion to the rail above the bolt hole of any joint. No joints made in this way can be knocked off, as they become a part of the rail.

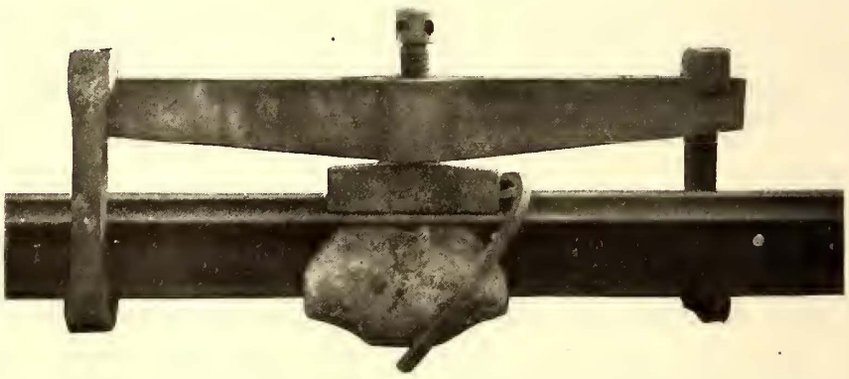


FIG. 4.—MOLDS AND CLAMPS READY TO CAST-WELD, RISER SIDE

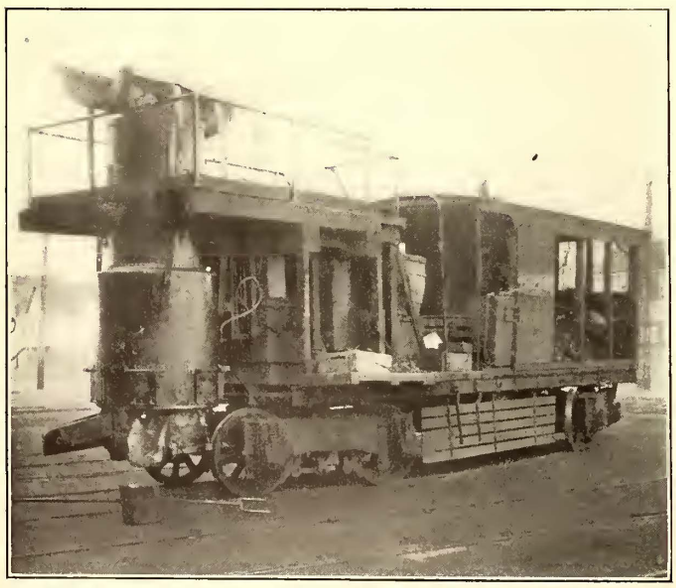


FIG. 6.—CUPOLA CAR

By measuring all coke and weighing all iron, it is possible to operate the cupola continuously. To do this, of course, the man in charge of the cupola must understand his business and there must be no guess work as to the quantities of fuel and iron put into the cupola from time to time. The largest day's work ever done by this cupola is 196 joints. This was under exceptionally favorable conditions, and if it could be done regularly would bring the cost per joint very low. On the Calumet system considerable old track which had been in use for some time before cast-welding had the joints cast-welded, with the result that the life of the track has been much increased. For example, on Cottage Grove Avenue some track laid in 1892 was cast-welded in 1902. The joints were low at the time of the cast-welding, and even since they were cast-welded they are barely perceptible, but the life of the track has been considerably prolonged beyond the possibility of a doubt. By cutting off the battered ends it would have been possible to make this track practically as good as new, except for the wear on the rail head between joints.

At the January meeting of the New York Railroad Club, W. B. Potter, chief engineer of the railway department of the General Electric Company, will present a paper entitled "The Latest Developments in Electric Traction."

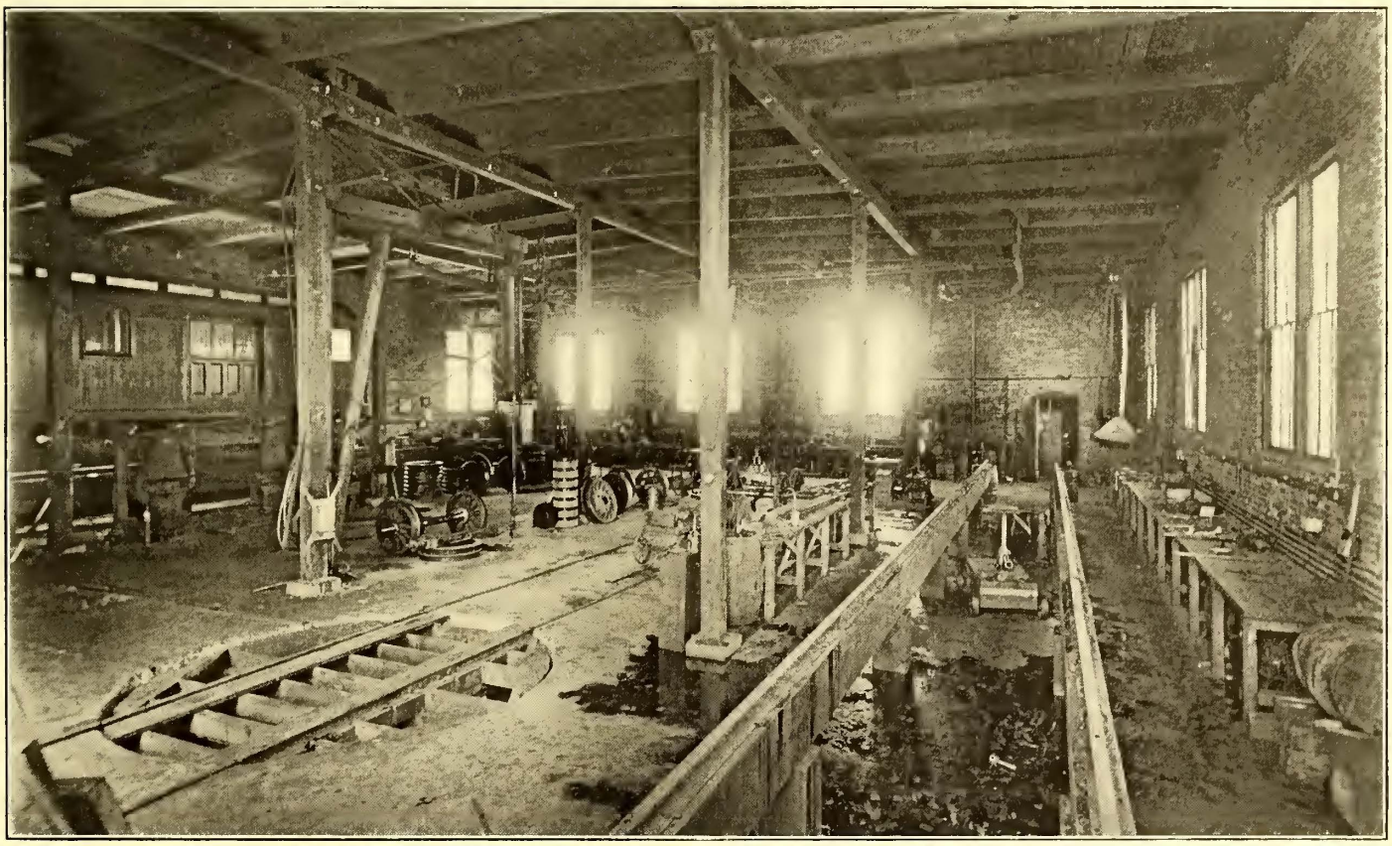
REPAIR SHOP PRACTICE ON THE JACKSON & BATTLE CREEK THIRD-RAIL SYSTEM

Many interesting developments have resulted from the rapid and extensive introduction of electric railway systems in this country during the past few years, but perhaps in no other way have departures been so radical and pronounced as in regard to repair shop methods and practice. The conditions imposed upon the mechanical department of an electric railway system operating heavy cars at high-speed schedules have proven to be difficult in the extreme and entirely beyond the expectations of the pioneers in this work. On the interurban roads operating over private rights of way with high-speed schedules, which are rivaled only by those of the most up-to-date and progressive steam lines, the question of maintenance of rolling-stock equipment, both electrically and mechanically, has proven a very serious matter, and has required special study in all details; it has come to rival, if not surpass, as regards exacting and detail nature of work, the similar problems met in steam railroad operation.

The Jackson & Battle Creek Traction Company, owing to the many radical and progressive methods of operation adopted, met with this problem in a serious manner from the outset. But in the endeavor of the management to build up an economical and paying traffic, the question of maintenance and repairs has received more than usual attention, and in many ways the results have shown the remarkable grasp of the principles essential to successful operation under conditions of heavy railroading. Few roads have, indeed, attempted to operate cars having total weights of 40 tons, and it has been universally found in such cases that conditions resembling those met in steam railroad practice are incurred. The officials of this road have attacked the problems from the standpoint of the steam railroad operating man, and have brought out many important innovations in electric railway practice which are worthy of careful study on account of the new methods involved.

An article descriptive of the new third-rail system of this company was presented in the Jan. 2, 1904, issue of the STREET RAILWAY JOURNAL, in which many of the interesting new features were referred to, but at that time only a brief mention could be made of the repair shop facilities which had been developed in anticipation of the work necessary to maintain properly the electrical and mechanical features of the equipment in running order. In this article the shop installation and repair methods will be referred to more fully and in detail.

This shop was intended to provide for, in addition to the periodical washings and cleanings, adequate facilities for making both electrical and mechanical repairs of all kinds to the rolling-stock equipment. In this connection a plan of the shop layout is presented, to indicate the arrangement of buildings that was provided to care for this work, and a study of the same is merited on account of the many features of convenience and other advantages which it imposes for a system operating a similar number of cars, namely, sixteen. It is, of course, evident that upon a system operating a larger number of cars, advantages of equal value in other directions might be gained by separating the machine shop from the erecting shop, but taking into consideration the size and operating conditions of this system, unusual advantages are gained by the combination arrangement here noted.

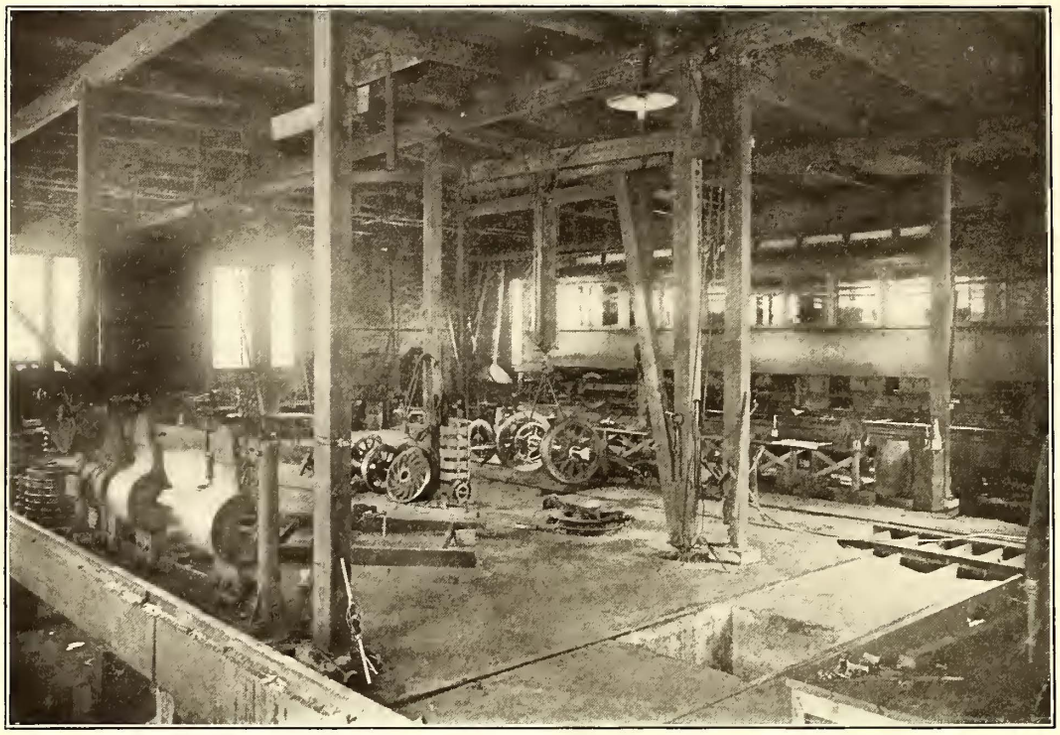


GENERAL VIEW OF THE REPAIR SHOP OF THE JACKSON & BATTLE CREEK TRACTION COMPANY, SHOWING ARRANGEMENT OF ELEVATED TRACKS, TURNTABLE, ETC.

Perhaps the most important of the advantages gained is to be noted in the elimination of the necessity of transporting material to and from a separated machine shop, as in this particular case the machine shop is adjacent to the erecting tracks and work. Furthermore, as all of the daily inspections of equipment are made upon the elevated tracks in the machine shop room, running repairs of even the slightest nature can be made with the greatest facility, and, as is well known, this is a factor which will cause many matters to be attended to at inspection times, which, if left to a more convenient time, might possibly develop and result in serious trouble—this is, unquestionably, one of the most important factors in repair shop work. Inasmuch as not more than one car is liable to be in the repair

shop room at any one time for heavy repairs, the facilities that have been thus provided may be seen to be entirely ample for the equipment of the road, so that on account of the convenience of the arrangement the installation has many features to commend it.

As may be noted from the shop plan on page 31, the layout consists of a combined erecting and repair shop, 71 ft. x 79 ft. in size, and a wash-room extension, 37½ ft. x 71½ ft., the latter being practically a half extension of the main shop. The extension, while used in the main for car washing, is equally adaptable to repair work of various kinds when the main shop is crowded with other work, and also is suitable for car painting. It will be noted that the floor arrangement of tracks and machinery is especially well selected for good lighting conditions, as well as for convenience of access to the various classes of work. The side-window lighting is particularly important here on account of the daily inspection work upon cars which is carried out upon the elevated tracks in the main shop room.



VIEW IN WHEEL SECTION OF THE REPAIR SHOP, SHOWING WHEEL PRESS, JIB CRANE AND AIR-HOIST RUNWAY

THE BUILDINGS

The building construction is, in general, of the well-known mill type, with wooden roof beams and brick side walls. The roof, which has a slope of ½ in. in 12 ft., is carried upon three rows of 8-in. x 10-in. posts, spaced 18 ft. to 20 ft. apart, in addition to the side walls. The minimum clearance under roof beams in the erecting shop is 19½ ft., while in the wash room there is a clearance of 16 ft. The roof beams are of 4-in. x 12-in. yellow pine, spaced 6 ft. apart, and the roofing carried consists of a base of 2-in. hemlock planking, upon which the tar and gravel covering is laid. This style of construction is of interest to operating officials, in view of the recent recommendations of the fire underwriters in favor of this "slow-burning" type of construction in preference to the use of steel roof trusses.

The side walls are of brick, 13 ins. thick, with the exception of the east ends of both the wash and paint shop, and a portion of the erecting shop, which have been faced temporarily with wood sheathing for facilitating further extension when found necessary. The wall and post foundations are all of concrete, extending in general from 4 ft. to 4½ ft. below grade; the side wall foundations have a bearing 24 ins. wide at the base, and taper to a width of 16 ins. at the top, while the post foundations are correspondingly lighter. The floors are of concrete, 7½ ins. thick, thus providing a very firm and strong flooring for heavy shop work, and one which will be the least affected by hard usage. The floor in the wash room is drained for re-

THE ARRANGEMENT OF STORAGE AND REPAIR TRACKS IN THE SHOP YARD AT ALBION, SHOWING SHOP BUILDINGS IN BACKGROUND

moval of water in washing the cars. A store room is also provided, but this is located in one end of the office building adjacent to the shops. This removes the stores from the fire risk of the shops and still keeps them within easy access of the shops on account of a convenient arrangement of tracks.

TRACK ARRANGEMENT

Three tracks are carried into the erecting shop, as shown in the shop plan. The two outside tracks, which are used for the daily inspections, are elevated 3 ft. 4 ins. above the floor, while the middle track enters at the shop floor level. This arrangement was conveniently worked out by the depression of the shop floor to a level 3 ft. 4 ins. below the rail level of the adjoining yard and trackage, which permits these outside tracks to be continued into the shop at yard rail level and still come at the desired height of 3 ft. 4 ins. above the floor; the middle track, which enters at floor level, enters, of course, by means of an incline depression, as shown in the cross section of the building in the drawing. The elevated tracks in the erecting shop are carried upon 12-in. x 12-in. wooden posts, located 9 ft. center to center, upon which are laid 8-in. x 16-in. stringers carrying the rails. The middle track at floor level, as well as those in the wash house, is embedded in the concrete flooring so as to come flush with the surface—an important factor in shop flooring.

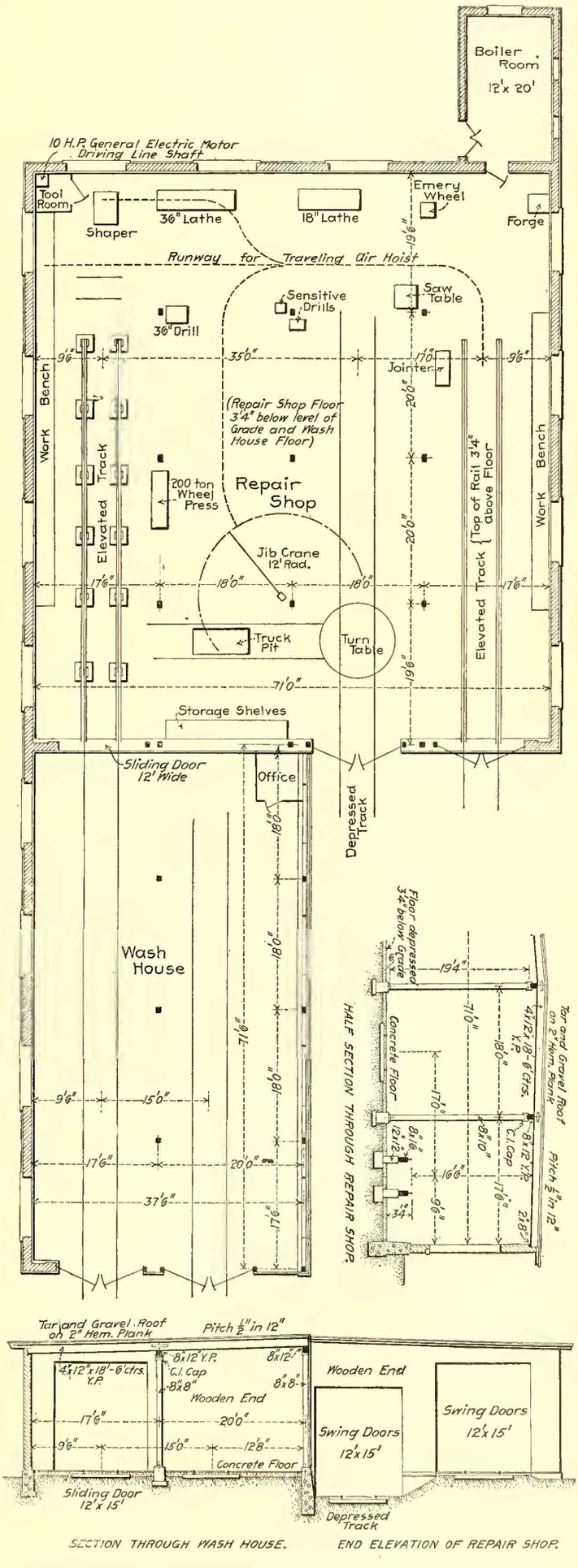
A very convenient track arrangement was installed in connection with the middle track in the erecting shop, in the form of a turntable near the entrance door. This table connects with a short cross track, about 30 ft. long, which provides for work upon trucks. It has a pit, about 8 ft. long, near the middle of the shop, for convenient access to the lower sides of trucks; this serves as a most effective and practical arrangement for truck and motor repairs, as, on account of this portion of the floor being covered by the 3½-ton jib crane, a maximum economy of time will result in both stripping and assembling work. In bringing a car in for truck work it is merely stopped with one truck upon the turntable and then jacked up to clear the truck, after which the latter is run off upon the cross track for repairs. With this arrangement, also a track needing repairs may be replaced by a similar one with utmost facility.

MACHINE SHOP EQUIPMENT

A liberal machine tool equipment was provided to care for the heavy repair work as well as the light-running repair work, as revealed in the inspections. The desire was to equip the shop so that any emergency work of the most exacting character could be readily and efficiently handled, and yet not to have the shop overequipped for the amount of work to be expected. In addition, a very complete traveling hoist equipment, in connection with the jib crane, was provided for facilitating transporting the material. A car hoist is not used here, as there is not enough of this class of work to make the jacking-up process of raising car bodies burdensome.

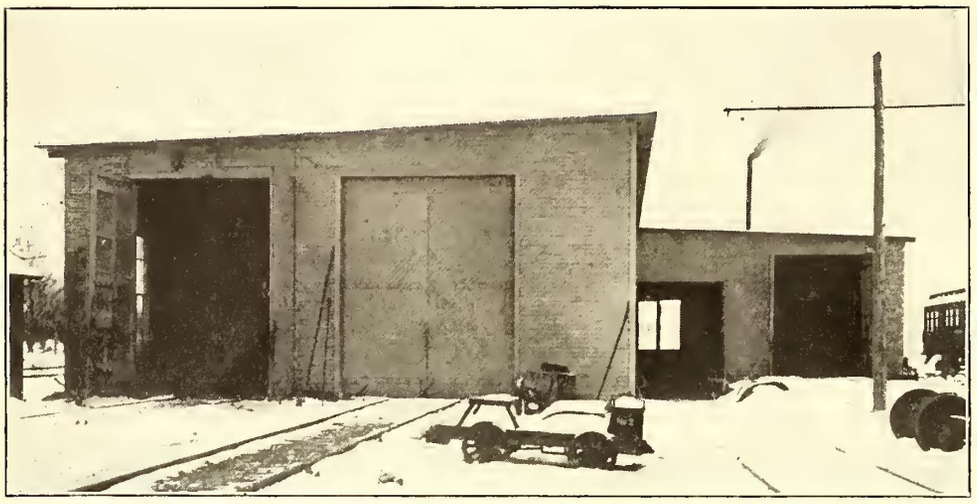
The machine tool equipment consists of two lathes, a shaper, a drill press, a sensitive drill, a wheel press and an emery grinder; this is supplemented by two woodworking tools—a saw table and a jointer. The lathes were selected in two very comprehensive sizes, one an 18-in. and the other a 36-in. lathe, both of which were supplied by George D. Walcott & Son, Jackson, Mich.; these sizes permit a wide range of diameters to be turned, and on account of the lengths of beds provided, 12 ft. on the 18-in. and 14 ft. on the 36-in. lathe, work of all ordinary lengths may be handled. For all plane surface work a shaper of 34-in. stroke is used, which will cover all ordinary requirements met in this service; this tool was also furnished by Walcott & Son. The wheel press is the standard 200-ton capacity Niles hydro-static press, having a capacity for car wheels up to 48 ins. in diamcter; this tool is very conveniently located for wheel work, being near the truck repair track.

The drilling equipment consists of a 36-in. Barnes drill press and a No. 0 sensitive drill, also built by W. F. & J. Barnes



PLAN AND SECTIONS OF THE REPAIR SHOP BUILDING

Company, Rockford, Ill. These tools provide for a large range of machining work, and will cover all requirements of a shop of this scope. The above equipment is supplemented by an emery wheel stand with two 12-in. emery wheels, for general grinding work in the shop; this emery stand was supplied by the Diamond Machine Company, Providence, R. I. The usual and necessary blacksmith equipment consists of a No. 005 forge,



EXTERIOR VIEW OF THE SHOP BUILDINGS, SHOWING DEPRESSED TRACK LEADING TO FLOOR-LEVEL TRACK IN THE SHOP

built by the Buffalo Forge Company, Buffalo, N. Y., which is operated by an individual blower, belt-driven from the line shaft.

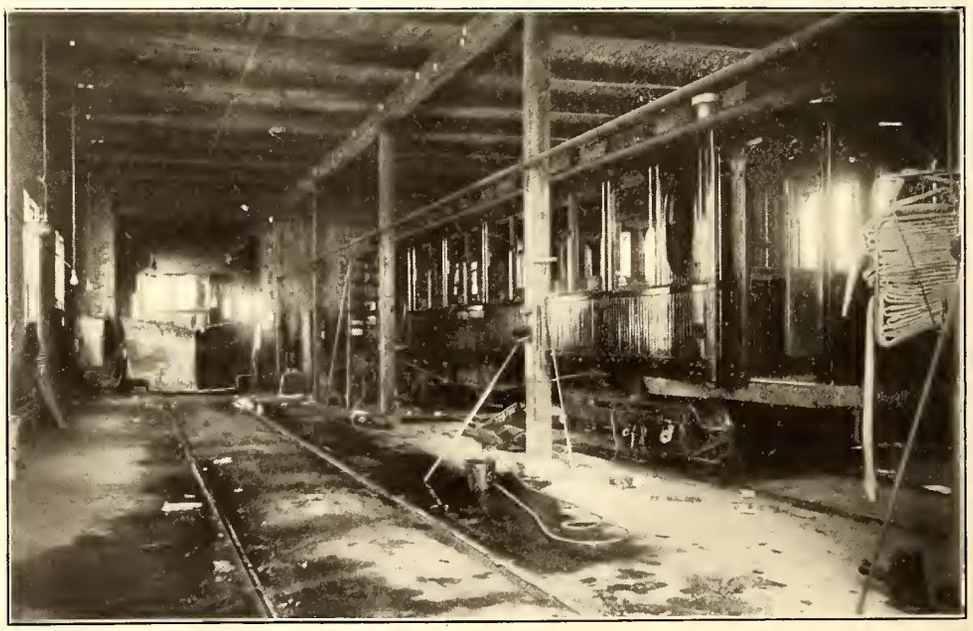
The locations of the tools above mentioned are clearly shown in the plan of the shop. They are conveniently distributed for convenience of access to the work, and also for daylight lighting, the majority of them being in close proximity to windows. For delivering work to and from the tools, an overhead track is provided for a traveling air hoist, which is thus easily moved to any part of the shop. The overhead track consists of a 6-in. I-beam, suspended upon hangers to about 4 ft. beneath the roof beams, and is arranged to cover all important parts of the shop, as shown in the floor plan drawing, the runway being shown in dotted lines; from over the north elevated track it swings around and divides into three branches, one covering the lathes and shaper, the middle one leading to the work bench and the other to the wheel press, and thence to the jib crane. The jib crane, which has a radius of 12 ft. and a capacity of 3½ tons, has a continuation of the air hoist runway, and may thus swing the hoist over the truck pit or over the middle track. The air hoist is of the cylinder type and has a lift of 6 ft.

The woodworking tool equipment embraces a Dennes Machine Company saw bench, a Jarvis jointer and a Goodell & Waters band saw, which are located as shown in the shop plan. They are convenient to the point of entrance for lumber and timber work to the shop, and are arranged for economical handling. This is not a complete equipment for general woodworking, but the requirements in the line of car body repairs, it is expected, will not make severe demands upon the shop. The amount of car sill and frame work that will arise would not be sufficient to warrant the installation of the number of tools necessary to handle it, yet the present woodworking equipment will enable all light repairs in this department to be taken care of independent of outside sources.

STEEL-TIRED WHEEL PRACTICE

It has been the experience of this system that the steel-tired wheel is an absolute necessity for the weights of cars used and the speeds operated under. When the road was opened for service, the lighter cars for the local service (32 tons) were equipped with chilled-iron wheels, while, of course, the heavier limited cars (43 tons each) for the high-speed limited service were at the outset equipped with steel-tired wheels, 34-in. wheels being used, with 3-in. treads and ⅞-in. flanges, as noted in the above-mentioned article descriptive of the rolling-stock equipment for the system. But the experience with the chilled-iron wheel under the severe conditions of operation, even in the local car service, soon revealed its entire unadaptability for use under heavy cars operating at high speeds; in several cases serious breakages occurred in the flanges or treads of the chilled-iron wheels, and in all cases they soon became chipped to such an extent that their removal from service was made necessary after a comparatively short time in service.

Recently it was decided to replace the chilled wheels upon the lighter local and express cars, as fast as they were removed from service, by steel-tired wheels, which would place these cars upon a par, as regards the wheels, with the heavier cars operating in the high-speed limited service. For this purpose a new style of wheel center was designed, which is of interest on account of its neatness and strength for a spoked wheel. As will be noted by reference to the drawing on page 33, of the new wheel center, it is of the spoked type, having twelve spokes, and is provided with a shoulder upon the inner edge of the rim, which obviates the necessity of a retaining ring for the tire upon that side. This shoulder, which, it may be stated, is now standard for all the steel-tired wheels of this company,



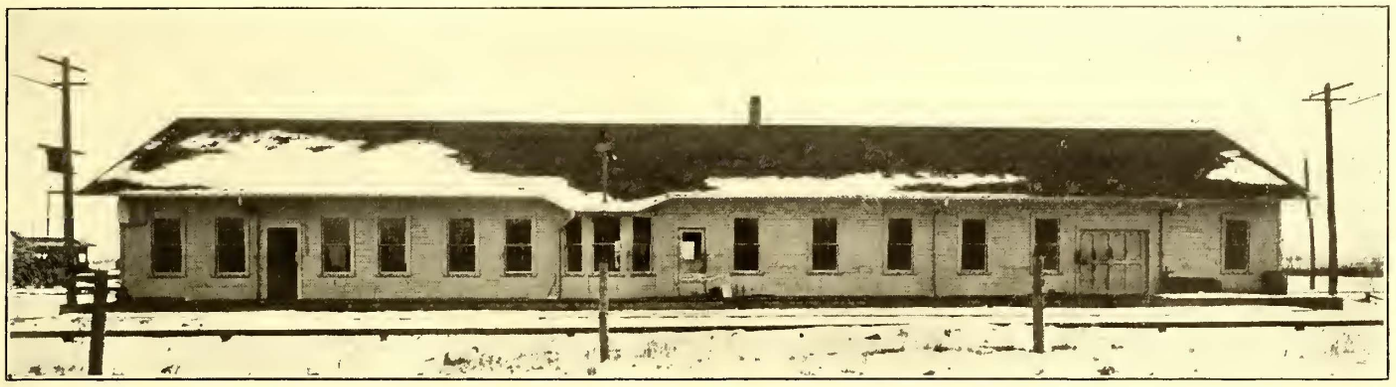
VIEW IN THE WASH HOUSE, SHOWING ENTRANCE AT LEFT TO REPAIR SHOP

is raised ¾ in. above the face of the rim, appearing very much like the ordinary flange of a chilled wheel; it serves as a very strong backing for the tire, and on account of being on the inside edge, is unquestionably very much superior to the usual style of retaining ring.

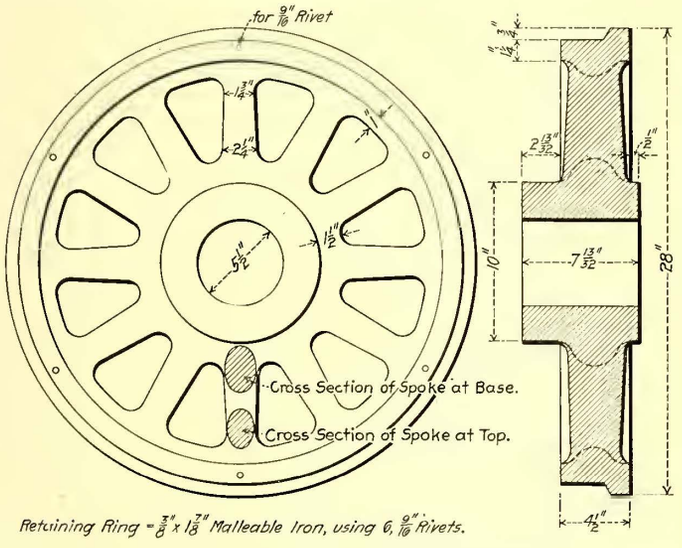
The general dimensions of the new wheel center are shown in the drawing. The local passenger and freight cars of this company are mounted upon the type No. 14AXX trucks of the Peckham Manufacturing Company, upon which the axles used have wheel seats 5½ ins. in diameter. The hub of the wheel center is 7¼ ins. x 10 ins. in size.

Upon the high-speed limited cars it is now the practice to use 3½-in. tires upon the standard 28-in. wheel centers, so as to give the wheel when newly tired a total outside diameter of 35 ins., and thus provide an entire additional inch of wear before removal of the tire is necessary. It will hereafter be the practice to keep these tires in service upon the limited cars until they have worn down to a thickness of 2 ins., giving thus a total wear of 3 ins. off of the diameter, or, in other words, down to a resultant wheel diameter of 32 ins. On account of the severity of the limited service, the tires will be removed at that point of wear and retained for service during the remainder of their usefulness beneath the local and freight cars. On account of the lower speeds and lighter weights of the latter cars, the wear will be much lighter there and a very long eventual life will be given to each tire. It is intended to make the thickness of 1¼ ins. the limit of wear for tires upon the local and freight cars, this being equivalent, in other words, to a total wear of 1½ ins. off of the diameter from the average size when put in this service.

The conditions of operation upon this system are severe to the extreme; the average daily service of the cars operated is 400 miles each, and speeds as high as 70 m.p.h. are often reached by the limited cars. While no figures are as yet available as to the total mileage per tire that has resulted in the case of the steel-tired wheel, yet the indications go to show that a greatly increased life of wheels in service will be obtained over that of the chilled-iron wheel. One result which has come with the more extended use of the steel-tired wheel, and which, moreover, can be estimated as a valuable asset, is the absolute safety which is felt when a car is carried upon the steel-tired rather than the chilled-iron wheels.



THE MAIN OFFICE BUILDING AT THE SHOPS AT ALBION, IN WHICH IS LOCATED THE STOCK ROOM



DETAILS OF THE NEW DESIGN OF WHEEL CENTER ADOPTED FOR THE STEEL-TIRED WHEELS

It is the opinion of the officials of this road that, by the use of an extra heavy wheel center, this feature of the equipment need never be renewed, under ordinary conditions of service, and that its life will last as long as that of the truck; figuring upon this basis, and comparing the cost of the steel tire and its necessary truing up in the lathe from time to time with that of chilled-iron wheel renewals, it is estimated that the steel-tired wheel will compare very favorably as to cost in operation with that of the chilled-iron wheel.

THE CAR-INSPECTION SYSTEM

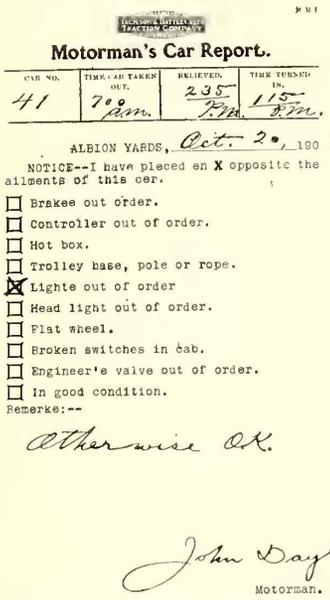
One of the commendable practices that has been introduced upon this road, as a result of studies of the steam railroad systems of operation, is the careful car inspections which are made a daily routine for every car in operation. The necessity of daily car inspection has, as is well known, been proven beyond a question of doubt by experience in steam railroad operation. While it has not been sufficiently thoroughly carried out in electric railway practice up to the present time, its necessity in this field is readily apparent when the delicate nature of the electrical mechanism and the ever-present danger of failure of insulation is considered.

The officials, after a careful study of the mechanical requirements of the service, have provided for an elaborate system of inspection, with corresponding report blanks for definite reports, which are to be made daily of every branch of the work. A number of blanks have been prepared, as illustrated herewith, with sample entries. These greatly facilitate not only the work of reporting upon the part of the workmen, but also the keeping of records in the offices of the master mechanic, and also they provide definitely arranged orders, or schedules, in regard to work to be done. The reports consist of a motorman's car report, a car inspection report, a shop work report, a daily time report and a car despatch report.

The object of the motorman's car report is to enable any motorman to report to the master mechanic any defect in the car, either mechanical or electrical, which he may discover during operation. As may be noted, it provides for the car number, time car was taken out, time relieved and time turned in; the sample entries upon the reproduced blank show the method of using the blank. One of these report blanks must be turned in by every motorman after every day's work so that there will be no excuse for any motorman not stating a trouble

which he may have discovered; if no trouble is found, the blank will appear clear and unmarked. This blank is a source of great assistance to the master mechanic in his study of troubles encountered, and it also serves as an excellent check upon the inspection department.

The car inspection report has to do with the work of daily inspection, which is made when the car is run to the machine shop after each day's run for a general going over by the shop



Motorman's Car Report.

CAR NO.	TIME CAR TAKEN OUT.	RELIEVED.	TIME TURNED IN.
41	7 00 a.m.	2 35 P.M.	11 5 P.M.

ALBION YARDS, Oct. 20, 1904.

NOTICE--I have placed an X opposite the ailments of this car.

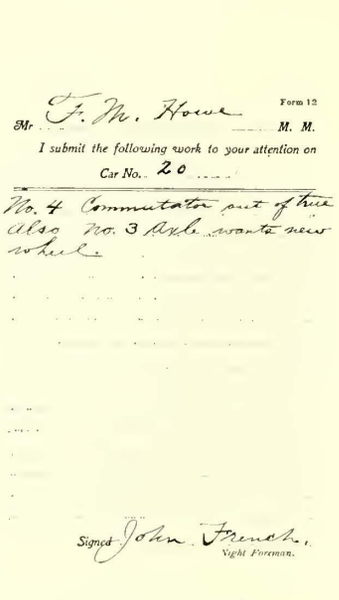
- ☐ Brakes out order.
- ☐ Controller out of order.
- ☐ Hot box.
- ☐ Trolley base, pole or rope.
- ☒ Lights out of order
- ☐ Head light out of order.
- ☐ Flat wheel.
- ☐ Broken switches in cab.
- ☐ Engineer's valve out of order.
- ☐ In good condition.

Remarks:--

Otherwise OK.

John Doyle
Motorman.

The Motorman's Car Report Blank



Form 12

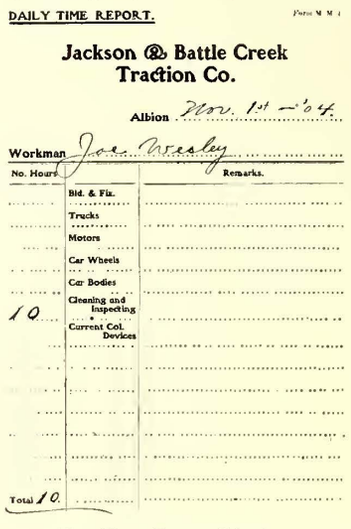
Mr. F. M. Howe M. M.

I submit the following work to your attention on Car No. 20

No. 4 Commutator out of true also No. 3 Axle wants new wheel

Signed John French.
Night Foreman.

The Work Report Blank



DAILY TIME REPORT.

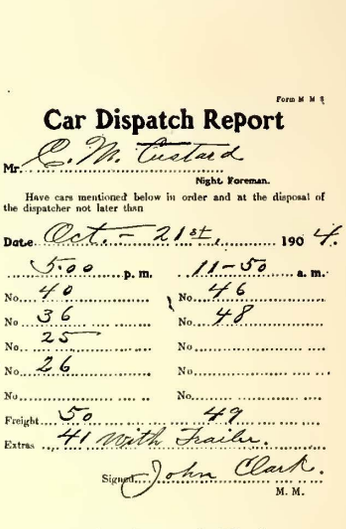
Jackson & Battle Creek Traction Co.

Albion Nov. 1st 1904.

Workman Joe Weasley

No. Hours		Remarks.
	Bld. & Fix.	
	Trucks	
	Motors	
	Car Wheels	
	Car Bodies	
	Cleaning and Inspecting	
10	Current Col. Devices	
Total 10		

The Time Report Blank



Car Dispatch Report

Mr. C. M. Custard
Night Foreman.

Have cars mentioned below in order and at the disposal of the dispatcher not later than

Date Oct. 21st 1904.

5.00 p. m. 11-50 a. m.

No. 40	No. 46
No. 36	No. 48
No. 25	
No. 26	
Freight 50	49
Extras 41 With Trailer.	

Signed John Clark.
M. M.

The Car Despatch Blank

THE REPORT BLANKS USED IN MECHANICAL DEPARTMENT OF THE JACKSON & BATTLE CREEK TRACTION COMPANY

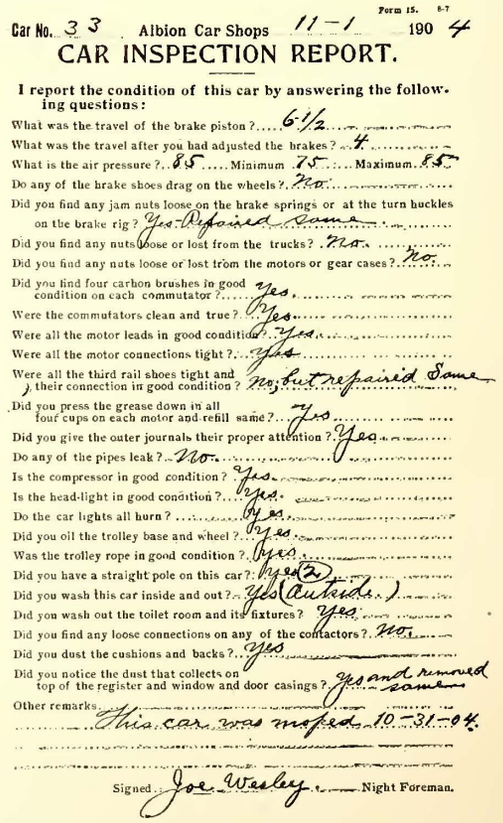
men. Two shifts of inspectors, of two men each, are kept in this service, who are thus enabled to carefully go over every detail of the equipment and provide for its being kept in perfect order. In this class of inspection work, the cars are run in upon the elevated tracks in the erecting shop, which gives better access to the motor equipment beneath the car, as well as also to all portions of the trucks and the apparatus beneath the car body.

The car inspection report used in this work is provided with twenty-six statements, which in effect amount to questions asked of the inspectors as to the conditions of all parts where trouble may be expected. The ground covered by the questions is very complete, embracing the entire range of mechanical troubles liable to be met in car operation, as dictated by experience in service. A glance at the report blank will show readily the comprehensive nature of the questions. The practice of the inspectors in making out the blank is to go over all of the points noted upon the same in order, and to answer them as they are determined upon examination of the car. This will, as indicated in the blank of the sample entries, enable many repair items to be attended to at inception, which, if left to a more convenient time, as is usually the case in car service, would amount to serious troubles; the questions, in fact, suggest in many cases the tightening of bolts and parts which may possibly become loose.

The shop work report is a blank upon which the inspection foreman may report to the master mechanic as to work needed upon any portion of the car or its equipment; the sample entry upon this blank well indicates its use. In this case, it is shown that upon car No. 20, a commutator needs truing up, and also a new wheel is necessary. These blanks are made out and submitted to the master mechanic only when the work is found necessary, separate reports being made out for different cars.

The daily time report is a form of report which is made out for each workman and submitted to the master mechanic as a method of time keeping; the sample entries in the blank shown will indicate clearly its use. The classes of work in the shop are divided into seven subdivisions, as indicated, and the time spent in each of these particular classes is recorded for facilitating the charging of labor cost to each individual department of work.

The last report shown, the car despatch report, is the requisition of the master mechanic upon the night foreman to prepare certain cars for service on the following day, as called for by the train despatcher. This is in accordance with steam railroad practice, and is a very successful method of keeping the mechanical department in touch with the requirements of the operating department, so that cars will at all times be in readiness for operation as required. It enables the night foreman to know definitely what cars will be needed for service on the following day, and upon which ones to devote the most effort.



Car No. 33 Albion Car Shops 11-1 190 4

Form 15. 8-7

CAR INSPECTION REPORT.

I report the condition of this car by answering the following questions:

What was the travel of the brake piston? 6 1/2
What was the travel after you had adjusted the brakes? 4
What is the air pressure? 85 Minimum 75 Maximum 85
Do any of the brake shoes drag on the wheels? No.
Did you find any jam nuts loose on the brake springs or at the turn buckles on the brake rig? Yes-Repaired Same
Did you find any nuts loose or lost from the trucks? No.
Did you find any nuts loose or lost from the motors or gear cases? No.
Did you find four carbon brushes in good condition on each commutator? Yes.
Were the commutators clean and true? Yes
Were all the motor leads in good condition? Yes
Were all the motor connections tight? Yes
Were all the third rail shoes tight and their connection in good condition? No, but repaired Same
Did you press the grease down in all four cups on each motor and refill same? Yes
Did you give the outer journals their proper attention? Yes
Do any of the pipes leak? No.
Is the compressor in good condition? Yes.
Is the head-light in good condition? Yes.
Do the car lights all burn? Yes.
Did you oil the trolley base and wheel? Yes.
Was the trolley rope in good condition? Yes.
Did you have a straight pole on this car? Yes (2)
Did you wash this car inside and out? Yes (outside.)
Did you wash out the toilet room and its fixtures? Yes
Did you find any loose connections on any of the contactors? No.
Did you dust the cushions and backs? Yes
Did you notice the dust that collects on top of the register and window and door casings? Yes and removed same.
Other remarks. This car was moped 10-31-04.

Signed Joe Weasley Night Foreman.

METHOD OF HANDLING THE CAR INSPECTION REPORT

The force employed in the repair shop work for both the maintenance work and cleaning of the cars, embraces the following workmen: Two day inspectors, two night inspectors, one machinist, one blacksmith, one electrician, one carpenter,

one painter and two car cleaners. One of the latter serves also as janitor of the shop building in keeping fires for heating the plant in winter time, etc. By an ingenious arrangement also, the day inspectors are enabled to do the daily routine inspection work of cars passing the despatcher's office at the shops, which is done upon this system in accordance with the very best steam railroad practice. As the cars pass the offices at regular intervals, the day inspectors meet them in passing and give them a brief inspection, including tapping all wheels for soundness, general examination of the third-rail shoes and other general features of the electrical equipment which can be done without serious delay to the car. They are given notice of the approach of a car by the automatic ringing of a bell as the car passes a contact clip upon the third rail at a distance of about half a mile from the station. In this way they are enabled to keep at work in the shop up to the last moment and still have ample time to get out to the station by the time the car arrives and comes to a stop. This is a very efficient method of providing for this work, and merits careful attention by those using car inspections.

Much credit is due E. S. Loomis, superintendent, for the introduction of many ideas of value as acquired from his former experience in steam railroad operation. The shops and work of inspections are in charge of George Stecker, master mechanic, to whom credit is due for this interesting information.

THE SURFACE CAR CONTROLLER—ITS PERFORMANCE, INSPECTION AND EFFICIENCY

BY EDWARD TAYLOR

If the management of a street railway company were to inquire of their claim or legal department as to what particular piece of car apparatus in use was causing them the most work, the answer in three out of four cases would be "the motor box," meaning the controller. When a certain item of a car's equipment is continually demanding the attention of the above-mentioned departments, it is usually a sufficient indication that the apparatus is either not suitable for the work in which it is used or that more than reasonably severe conditions of handling or maintenance are being imposed upon it. The manufacturers of electrical apparatus naturally lean toward the latter view in the case of the controller, and in support of their claim will present a series of conditions that would strongly impress any one not familiar with the details of the situation. But on the other hand, there are a number of facts that may be pertinently stated before entering into a discussion of the manufacturers' claims.

At the time the series-multiple rheostatic controller was designed, street railway appliances were in their infancy. The cars at this time were light, their speed was low and the equipment was in an undeveloped condition. Under these circumstances the controller gave as satisfactory results on the average as any other piece of apparatus on the car. But with the development of street railway cars and the increase in speed schedules, the faults in the several pieces of equipment received consideration. The motors were enlarged and improved upon, and the trucks were changed in design, strength, capacity, etc., to accommodate the heavier weights and higher speeds. Heavier resistances of improved type, with more radiating surface, were brought out for the larger motors. The car wiring, the circuit breakers, the fuses, the lightning arresters, and indeed nearly every part of the car equipment, electrical or mechanical, was redesigned, improved upon and brought to a higher state of efficiency. The controller, however, to-day stands in its essential details as it was at the time it was first designed, although it was and is recognized as being not altogether satisfactory.

The cause for this condition is not hard to find. At the time the car controller first appeared on the market, its general features and design were covered by such sweeping patent rights as to exclude the idea of successful competition, except by some one who could place a radically different design before the public. In the absence, therefore, of any effective competition, the manufacturers have assumed that their apparatus was giving satisfactory service, and have taken no vigorous steps toward its improvement. Naturally there has been but little incentive for them to undergo the expense attendant upon a more progressive policy; but the expiration of the patent rights, coming as it does in the immediate future, should cause a greater activity among the present manufacturers. Improvements should be sought for and worked out, so that the competition undoubtedly awaiting them in the future may be successfully met.

It is, however, no light task to construct a satisfactory railway controller. It undeniably has peculiarly severe conditions to meet, having to open a circuit carrying from 50 amps. to 200 amps. a great many times per hour. As this is especially hard on any type of switch, it was difficult to decide upon the most suitable way of accomplishing this object. Of the two chief methods employed, however, one is to break the circuit in a great many places simultaneously, thus reducing the severity of the arc at any one point; the other is to break the circuit in comparatively few places, and to rely upon a magnetic "blow-out" to do away with excessive arcing. Of the two, the latter method is generally preferred, as the former, by its multiplicity of parts, necessitated a considerably larger controller than did the latter style. This was detrimental to its success, as the chief idea in car equipment is to economize space to as large an extent as practicable. Partly on this account, and also because it was found that the magnetic blow-out gave more generally successful results, controllers of the second type, known as the K controllers, came into more general use, and it is of the K type that this article will treat.

CONTROLLER EXPLOSIONS

The most expensive and dangerous fault with controllers in operation is undoubtedly their "blowing up," and street railway men have long sought for an explanation of and a remedy for this trouble. But the variety of the theories of the cause of such "blow ups" is remarkable; according to statements made by men in a position to know, the trouble may be due to any one of the following causes:

Too low resistance in the grids;

Improper handling of the controller by motormen;

The arc shields or chimneys improperly arranged;

Too much oil used upon the controller fingers and drum;

The inspection and renewal of the wearing parts not properly attended to;

Handles too loose, allowing half-positions to be made;

The controllers too small for the motors;

The severe inductive kick of certain types of motors when their circuit is opened;

Or the reversing of the car to obtain a quick stop.

While the writer agrees that all these points are important, and that each in special cases has a bearing on the situation, consequently deserving a certain consideration, yet no one alone appears to get at the root of the trouble. But before entering into a discussion of what the primary cause of trouble is, we will consider the several theories enumerated above.

It can be readily understood that too low resistance may cause trouble at the controller for the following reasons: Where the resistance is high, the current is reduced to a minimum before being thrown off, as it is stepped down by cutting in the resistance from R-5 to R-1, inclusive, before the trolley contact is broken. This will, of course, reduce the severity of the arc formed by the opening of the circuit. But where the resistance is low, sufficient current may still be passed on No.

1 position, immediately before dropping off, to cause severe arcing.

In regard to the improper handling of controllers by motormen, it is well known that cars are often run with brakes applied, forcing the current to an excessive point, and thereby causing the controller to break heavier currents than it should ordinarily. Cases are of frequent occurrence where motormen throw off so slowly as to drag severe arcs at the fingers; and in other cases care is not taken to make full positions, whereupon the same trouble occurs. These conditions naturally do not tend to increase the life or efficiency of the controller, and will be touched upon at more length in a succeeding paragraph.

It has been found that certain arrangements of the arc shields tend to confine the arcing more closely within the magnetic field, and that in some cases a considerable decrease of trouble can be secured by rearranging this part of the controller.

If too much oil or grease is used on the interior of the controller it will add to the danger of severe arcs forming, as oil or grease appears to feed or maintain any arc in contact with it. In other words, more severe arcing occurs across greasy or oily surfaces than between dry plates.

Inspection is necessarily an important feature, as careless inspection may leave the controller in very poor condition, with carbonized boards or layers of copper scrapings ready to carry current across insulated portions, or with chafed or worn leads ready to short-circuit or break while car is operating. Or the fingers may be poorly adjusted and not breaking contact at the proper place. In any of the above cases, controller trouble is almost certain to occur.

If the handles are too loose the motorman may have difficulty in making full positions, while half-positions will cause a certain arcing in the controller, with a blistering or "titting" of plates and fingers. Moreover, with a loose handle the motorman cannot have the proper control of the drum, either in notching up or in dropping off the power.

The contention as to the controller being too small for the motor is, of course, true only on certain sizes of controller. For instance, when using a K-11 controller with two 60-hp motors, in certain classes of work, it would seem that there are grounds for the belief. The K-10 controller is designed for two 40-hp motors, while the K-11 is merely a modification of the K-10, with heavier wires and blow-coil windings. It is quite likely that in some cases the operation of the heavier equipment upon this control is attended with danger.

It is a well-known fact that the inductive kick of certain types of motors, when their circuit is opened, is much higher than that of motors designed with dampers to reduce this effect. This momentary high voltage may set up a vicious arcing at the controller under certain circumstances.

The practice of reversing to obtain a quick stop may in some instances cause a controller to blow up, but scarcely as a general rule. But it is, nevertheless, a practice that is highly injurious to equipment, and on four-motor cars will invariaby result in a burning and arcing at the reverser fingers. This arcing does not take place when the car is moving forward and the reverse switch is thrown back; but when the reverser is again thrown forward, with the car still in forward motion, it has been known to blow up the controller, due to the current generated in the motors.

The above action appears to be as follows: A small arc at a reverser finger, having no blow-out at this point, maintains itself, increasing in volume, and communicates with the trolley finger and the case, affording a path to ground for the full potential current. Heavy arcing then ensues, and the controller blows up. For this reason the reversing of four-motor equipments should not be countenanced save in the most extreme emergency. Otherwise permission to reverse will be abused, and there will be bent or broken armature shafts, flashing of the motors, carbonizing of brush holders, and controller flashing or blow-ups as a result.

In each of the above instances it will be noted that the trouble caused is due to an arc being set up in the controller, although these conditions do not of themselves act directly upon the controller—they inaugurate conditions that tend to increase the severity of arcing. But a certain amount of arcing must occur in every case of opening a circuit, and the correction of the above points cannot do more than alleviate or remove what may be called the immediate cause of trouble. The real cause and remedy, as before mentioned, must go beyond any points of this character, and be sought for in another direction.

THE REMEDY

It is generally admitted by all, that in order to "blow up" a controller, arcing must, of necessity, be started at some point on its interior, and that this must be continued and brought into contact with some point of opposite polarity, whereupon the arc will increase in severity and be limited only by the resistance of the circuit, plus the resistance of the arc. That this arc resistance may be considerable is well understood, and by this fact may be explained why in some cases the circuit breaker or fuse does not "go out" during a short-circuit in the controller.

If the resistance of the arc is great enough, sufficient current will not be carried to blow either device, yet considerable damage may be done; and any flash at the controller, even if harmless in its effects, may start a panic among the passengers of the car, with resultant damage suits. The reason for this fear and panic among the passengers is usually the alarming appearance of the flame that issues from the controller. The size of this flame, and the distance to which it reaches, seems often utterly disproportional to the amount of damage done in the controller. But it must be remembered that the controller with covers closed is nearly an air-tight box. A small arc formed on its interior, with its consequent heat and volatilized metal, tends to generate a considerable pressure, and often sets free unconsumed gases ready to ignite upon exposure to the air. These gases pour from an opening with great velocity, and on coming into contact with the oxygen of the atmosphere, produce flames of considerable length and volume.

It can be seen, therefore, that in order to do away with the most serious fault of the controller, either no arc must be formed, which is impossible, or the arc must be immediately dissipated or broken before attaining serious proportions. One means of destroying the arc in case of short-circuiting in the controller may be suggested, namely, to place a 10-amp. fuse in the controller ground. We have noted in an earlier paragraph that short-circuits may be maintained without blowing the circuit breaker or car fuse until either the metals burn away or the trolley pole is pulled down. A 10-amp. fuse in the ground circuit of the controller would obviate this condition, by cutting short the duration of any severe arcing from a finger to the controller cover.

The chief objections to this step is that if the fuse were out, or blown, the motorman would be exposed to the risk of a serious shock in case the controller short-circuited. For this reason a tell-tale device of some sort conspicuously located would be needed to indicate whether the ground circuit was open. The idea of a fuse in this circuit is not advised by the writer, but merely mentioned as deserving of some consideration.

The plan of directly attacking the arc itself would seem to offer the most satisfactory solution of a difficult problem. It is a well-known fact that an electric arc cannot be maintained in a strong magnetic field, as this appears to dissipate or disrupt it; so we now come to the question as to whether the magnetic field of these controllers is sufficiently strong for the work it has to perform, and whether the lines of force are properly distributed to obtain the maximum effect. By the use of a magnetometer on K-11 controllers which are in general service, it

has been found that with a given amperage, the magnetic effect is variable at different places where arcs are broken.

For instance, it was found that the lines of force were much stronger across fingers 15 and 19 than at the trolley finger, and that the distance of a finger from the blow-out coil was a measure of the strength of the magnetic circuit at that point. For example, with a certain amperage, there were 180 lines of force per square centimeter at the point where finger No. 15 breaks contact, and but 70 lines per square centimeter in the space where the trolley finger leaves the drum. In other words, there was over 150 per cent higher efficiency of the blow-out at the lower part of the controller than at the point where it is evident the blow-out is most constantly needed, and where observations and experiments have proven conclusively that by far the greater number of cases of trouble originate.

In addition to the comparative weakness of the magnetic circuit at the upper part of the controller, it was found that the closing of the iron hood short-circuited a large portion of the flux. For instance, with a current giving 80 lines of force per square centimeter at the break of finger R-1, with the hood open, there were but 45 lines per square centimeter when hood was closed, as in service. In other words, the iron hood short-circuited the magnetic field so as to reduce its efficiency by 45 per cent.

The cause for this action can be seen when it is understood that the magnetic circuit of the blow-out coil is carried across an arrangement very similar to a horse-shoe magnet, the frame of the deflector boards being one pole and the back frame of the controller the other. The fingers are located in the air gap of this circuit. When the hood is closed, however, it acts as an armature across this air gap, and short-circuits a large portion of the lines of force that would otherwise cross it. The substitution of some other substance than iron, such as aluminum, wood or an alloy, for the hood would do away with this short-circuiting, and should increase the blow-out efficiency.

In regard to the first point noted, namely, the weakness of the magnetic field at the upper part of the controller as compared with that across fingers Nos. 15 or 19, a more difficult problem is presented. A controller such as the K-10, intended for use with two 40-hp motors, will have a certain number of ampere turns in the blow-out coil per ampere of current to be broken in the controller. But the only difference between the K-10 and the K-11 is the heavier wiring of the K-11 and the larger conductors in its blow-out coil, to compensate for the heavier currents used by two 60-hp motors, for which the controller is rated. The space available for the blow-out coil is not increased, however, so the coil must necessarily contain a fewer number of turns. It is apparent therefore that the K-11 controller will not have as many ampere turns in its magnet per unit current to be broken as the K-10 controller; in other words, will be less efficient in dissipating arcs formed at any point in the controller. And this condition cannot be done away with except by materially enlarging the controller and keeping the blow-out coil at a point of the highest efficiency.

EFFECT OF OPERATING CONDITIONS

It is undoubtedly true, to return to the point of view of the manufacturers, that the handling of controllers is to blame for a large amount of the trouble. Motormen will, under certain circumstances, run with brakes set throughout considerable distances; they will throw off too slowly, dragging arcs; they will often hold on half-positions; they will often notch up the controller too quickly, and in many cases they will throw the handle to multiple positions, immediately dropping off, when full series would give a more even motion and a faster schedule. It will be found as a general rule that the men operating cars in this manner are those who have been the shortest time at the controller handle, and statistics showing cases of controller trouble with the length of time of service of the men operating the cars when trouble occurred, prove this point clearly.

For instance, one road, on compiling statistics of controller "blow ups" through a period of several months, found the following figures:

PERCENTAGE OF TOTAL TROUBLE EXPERIENCED IN RELATION TO LENGTH OF SERVICE OF MOTORMEN OPERATING CARS

Motormen in service	Per cent cases of trouble
Less than one year	50
More than one year and less than two years	10
More than two years and less than three years	7
More than three years and less than four years	5
Over four years	28

If the operating departments of all electric railway companies could be brought to realize the faults of the average motorman, a great saving might be effected. In the earlier days of street railways, more care, proportionally, was given to the instruction and selection of motormen than is now the case. The comparatively small number of employees at that time rendered their individual instruction a much easier task, and made it possible to exercise a greater degree of care in the selection of competent men. But, nevertheless, it would be quite possible for railway companies to-day to devote considerably more time and effort to the schooling and instruction of their motormen, and it would unquestionably prove a measure of economy.

If the motormen were familiar with the electrical apparatus of the car, and properly understood its handling, a great saving would be effected in power consumption, and a decrease secured in the cost of repairs, maintenance and damage suits. A system whereby a motorman would be compelled to furnish a complete report of every case of controller or electric equipment trouble, and a proper tabulation and filing of the same, should serve as a check on careless or incompetent men, and would exert a good moral effect. The inclusion in such a report of the conditions under which the trouble occurred would also facilitate the investigation and determination of the real cause or causes of any trouble with electric equipment, whereupon a remedy could be applied to same.

The inspection and maintenance of a controller may also have an important bearing upon the question of its efficiency. The correct standards of controller inspection will vary in different localities, but a few general rules and suggestions may be made:

Each car should be looked after at least once a week.

Burnt or worn fingers should be replaced.

The tension and position of all fingers should be tested by application, and all fingers ascertained to break contact at the proper time and place.

Any badly fused or blistered plates should be filed down or removed.

The entire drum and contact plates should be wiped off and put in good condition, and lightly lubricated with vaseline.

The leads to connecting board should be examined and left securely fastened, and not chafing. The interior of the controller should be carefully wiped out and kept clean, and all copper scrapings, caused by rubbing, removed.

Carbonized or smoked boards or fingers should be scraped or wiped off thoroughly, and shellac should not be applied till the parts are thoroughly cleaned.

Care should be taken not to use too much oil in lubricating the star wheel and cam, as when the controller heats up, any excess of oil will drop down upon the blow-out coil, setting up conditions which will eventually short-circuit it.

The reverser fingers should be tried and left with the proper tension, and the same precautions as to carefully wiping off the parts should be observed as in the main controller.

Controllers should be so constructed as to permit the use of tips for the plates and fingers. Tips could be more freely used

than where there is a fear of wasting copper by placing whole new fingers or plates on the controller. The tendency in such a case is to overdo the economy of making parts last as long as possible, and to decrease efficiency by retaining fingers or plates that have been worn or burnt beyond usefulness.

The efficiency of inspection could be greatly increased by raising the standard of the employees. It is customary to engage so-called "electricians" to attend to the important duty of keeping the controllers in good condition, and these men have far too often little education or experience in this line. Much better results could be secured by employing competent mechanics, who would be at the outset better fitted for this particular work, and who with a little schooling and instruction could be developed into most efficient workmen in this particular branch. The ordinary workman takes no particular pride in his work, and seeks only to get over a certain number of controllers in a day, in the easiest and usually the most slipshod manner. A good mechanic, on the contrary, prides himself on the thoroughness and carefulness of his work, and will go to great trouble to keep any apparatus in his care in the best possible condition.

In summing up the controller situation, it seems to be the consensus of opinion among men who are best informed upon the subject that the surface car controller is not entirely satisfactory in its performance under the unusually severe conditions to meet which it is installed, and that when trouble occurs it is manifested to the passengers in a manner conducive to excitement and dangerous panics, causing thereby considerable loss to the operating company. It would appear to men connected with street railways that the engineering staff of the controller manufacturers might, with profit to themselves and to their customers, bend their energies toward a solution of the difficulties.

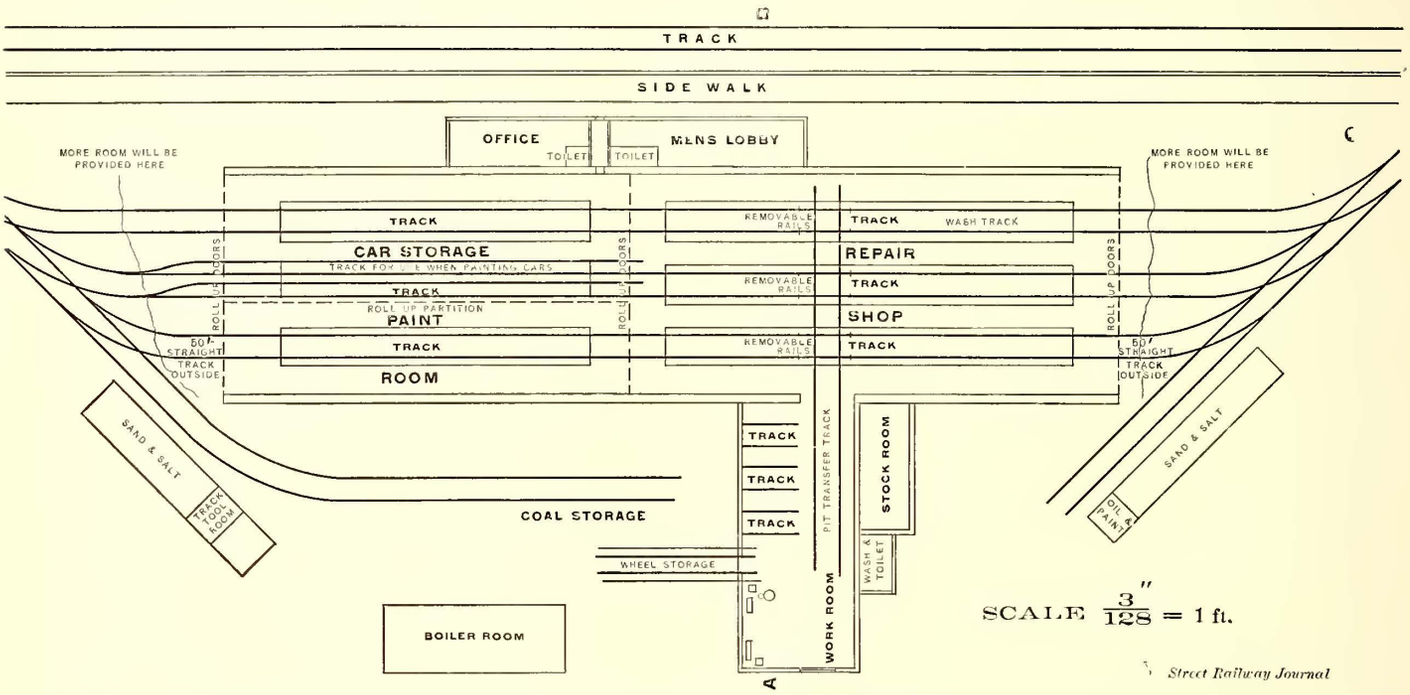
The writer is of the opinion that within the next few years radical changes will be made in railway motor control apparatus. Improvements which of necessity had to be worked out for the heavier elevated cars will no doubt be applied to the lighter surface equipment. The eminently satisfactory results obtained from the use of the automatically accelerating contactor controllers on elevated equipment should be sufficient reason for their being designed and operated on surface cars.

REPAIR SHOP FOR MEDIUM SIZE RAILWAY

BY E. W. GOSS

The car house illustrated in the accompanying sketches was designed for an interurban road using 50-ft. high-speed cars with 6-ft. wheel base trucks and four-motor equipment, and with all trucks and equipment alike so as to be interchangeable. The building is planned for storage as well as for general repairs, and cars may be placed on the storage tracks without running them out on to the main track.

The first point in the construction of a car house is to secure a suitable location, which in the design considered is an area a few feet below the street or main track, comparatively level and with good drainage. To have plenty of room between tracks without having too wide a truss for the roof, it seems best to make use of three tracks with 14 ft. centers and a clearance of 8 ft. from the outside rails to the walls, which should be about 2 ft. thick. The tracks instead of being laid at the ground level should be elevated so as to form the pits, or a basement, under the entire main building. Pit openings are left between the tracks, as shown, and it will be noticed additional openings are left outside of the tracks to allow the repair men to get around the trucks in renewing brake-shoes and brasses.

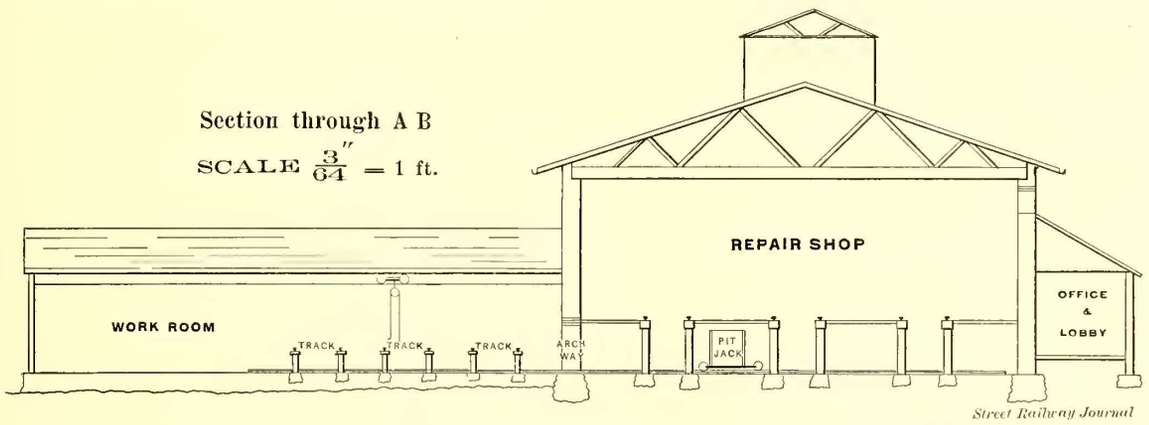


SUGGESTED TRACK ARRANGEMENT IN CONNECTION WITH MODEL REPAIR SHOP

Near the center of the repair shop end will be noticed a cross track which is on the pit levels and extends out into the work and machine room, the floor of which is on the same level as the pit floors. On this track a transfer car with raising and lowering equipment runs. This jack should be arranged to take a truck out from under a car and transfer it to the work room, where it can be stored on one of the spare tracks. One of the spare trucks is then run on to the transfer car and quickly put in the place of the one to be repaired and the car is ready to go into service again. The injured truck or motor can then be repaired while the car is out on the road earning something instead of being tied up in the shop several hours or perhaps days.

In the work room should be placed the lathe, drill press and such other tools as are required in making repairs. Attached to the work room is a stock room, where all supplies should be kept and accounted for. This is convenient to both the main building and the work room.

The repair shop, 110 ft. long, is shown separated from the storage tracks by roll-up doors. One track of the storage room is also separated from the others by a roll-up partition, to serve as a paint room. Extra heating pipes should be placed around this track so as to keep it warm enough for varnishing. Two cars at a time can be accommodated on this track. On the front of the building next to the main track are located the office and lobby for the conductors and motormen. At both ends of the car house, with tracks for loading, are located buildings for storing sand and salt, tools and also paint and oils. The oils can be piped direct to the stock room. One of these tracks may also be used for delivering coal to the boiler house. While this plan is laid out for a comparatively small road, there is no reason why it cannot be worked out to advantage for the larger properties.



CROSS SECTION OF MODEL REPAIR SHOP FOR MEDIUM-SIZE RAILWAY

The writer has used for several years the plan described for removing motors and wheels from under trucks, and has found it to work very satisfactorily, doing away with much of the annoyance of getting grease around in the interior of the cars, and handling the equipments more quickly and more economically than by the old methods.

ELECTRIC RAILWAY PUBLICITY IN CALIFORNIA

There are soon to be applied to electric railway work by the Pacific Electric Railway in California the methods of publicity that have made for so much in the successful management of steam railroads. The plan is simply that of creating an industrial bureau to supplement the present transportation department. The work of the bureau will be to advertise the advantages of Southern California for residential and commercial purposes and otherwise to further the interests of the company by giving publicity to its plans. This work will be carried out on a scale equally as pretentious as that of the steam roads, whose methods will be followed except where peculiar local conditions demand that they be varied. The bureau will, as previously stated, cover not only the growing lines of the Pacific Electric Railway, but also the whole of the southern section of California. It will exploit the material advantages of the towns on, and the country contiguous to, the lines of the company; disseminate accurate information as to the adaptability of the soil of the particular localities to certain lines of agriculture or horticulture, and the advantages of localities for manufacturing or other industries. It is also to aid settlers or investors in making judicious selections. In this way the Eastern visitors can be kept in constant touch with all the land in Southern California, while as an information bureau the new department can give prospective residents accurate information in helping them to establish a home or business. H. S. Kneedler, advertising manager of the company, who is thoroughly acquainted with the conditions in the southern section of the State, has been selected to manage the bureau.

PROCEEDINGS OF THE FIRST CONVENTION OF THE CANADIAN STREET RAILWAY ASSOCIATION

As announced in the STREET RAILWAY JOURNAL of Dec. 31, 1904, several prominent electric railway men of Canada have organized the Canadian Street Railway Association, which promises to be of as much value to Canadian railway interests as the American Street Railway Association has proved in the United States.

At the inaugural meeting, held in the Windsor Hotel, Montreal, on Tuesday morning, Dec. 20, 1904, W. G. Ross, managing director of the Montreal Street Railway Company, was elected chairman by the following gentleman present:

D. McDonald, manager, Montreal Street Railway Company. Col. H. H. McLean, K. C., director; M. Neilson, C. E., director, and W. Z. Earle, secretary - treasurer and manager, of the St. John Railway, St. John, N. B. E. A. Evans, manager, Quebec Railway, Light & Power Company, Quebec, Que. A. Royce, vice-president, Toronto Suburban Railway, Toronto, Ont. C. E. A. Carr, general manager and secretary-treasurer, London Street Railway, London, Ont. Dr. S. Ritter Ickes, treasurer, Grand Valley Railway, Brantford, Ont.

The opening session, which lasted from 10:30 a. m. to 1 p. m., was occupied in studying the draft of the constitution and by-laws, as submitted by Messrs. Moore and Ross, the committee appointed at the preliminary meeting to draw up the same. After considerable discussion and amendments, the amended draft was referred to the next day's meeting for final revision and approval. It was decided that the fees until June 1, 1905, should be $50.

During the afternoon session, which opened at 3 p. m. and continued until 5 p. m., E. A. Evans, manager of the Quebec Railway, Light & Power Company, read a paper on "Handling of Express by Electric Suburban Railways," followed by a discussion participated in by all present. A vote of thanks was then tendered to Mr. Evans for his very valuable and instructive paper.

C. E. A. Carr, general manager and secretary-treasurer of the London Street Railway, was to have presented a paper on "Transportation of Mail and Letter Carriers," but as he had not finished it he promised to have the paper ready for the next meeting. There was, however, an informal discussion on the subject by all present.

The members then held a general discussion on the "Use and Abuse of Passes," and it was suggested that at some future meeting a paper on this subject might be of interest. Prior to the close of the meeting the chairman invited all present to dine as the guests of the Montreal Street Railway Company at the St. James Club, Montreal, at 7:30 p. m. This invitation was cordially accepted.

The next day, Wednesday, Dec. 21, the morning session was called to order at 10:30 a. m. and was continued until 2 p. m. In addition to the gentlemen who attended the first meeting, the following were present:

W. H. Moore, assistant to the president, and R. J. Fleming, general manager, of the Toronto Railway Company, Toronto, Ont. L. Trudeau, superintendent; R. M. Hannaford, chief

engineer; Nelson Graburn, master mechanic; D. E. Blair, superintendent of rolling stock; P. Dubee, secretary, and H. E. Smith, accountant, all of the Montreal Street Railway Company. W. B. Brockway, formerly secretary-treasurer of the Street Railway Accountants' Association of America, of Yonkers, N. Y., and Elmer M. White, cashier Hartford Street Railway, Hartford, Conn., who is Mr. Brockway's successor.

The new proofs of the constitution and by-laws were read by the acting secretary, and after some alterations had been made, they were adopted.

Short addresses then were made by Messrs. Ross, Brockway, White and Fleming. D. McDonald, manager of the Montreal Street Railway Company, then read a paper on "Relieving Congested Traffic at Rush Hours," after which a discussion followed, taken part in by the members, who also gave Mr. McDonald a hearty vote of thanks.

Col. McLean asked the chairman if he would kindly prepare a paper in connection with mutual benefit associations for the next quarterly meeting, which he promised to do. It was also resolved that the electric railways of British Columbia be not urged to joint the association at present.

A GROUP OF MEMBERS AND FRIENDS OF THE CANADIAN STREET RAILWAY ASSOCIATION AT THE INAUGURAL MEETING

The election of officers was then proceeded with, resulting as follows: W. G. Ross, president; 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 Street 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.

Some discussion took place with reference to the publishing of the transactions of the association. It was decided that this matter be left in the hands of the executive committee. A vote of thanks was then tendered to the Montreal Street Railway Company for the kind and hospitable manner in which it had entertained the members of the association, and a motion was carried that the names of the gentlemen who had suggested the formation of the association, W. H. Moore and W. G. Ross, be entered in the minutes. After adjournment the members visited the extensive repair shops and power stations of the Montreal Street Railway Company at the invitation of President Ross.

MR. PARSONS' TUNNEL RECOMMENDATIONS

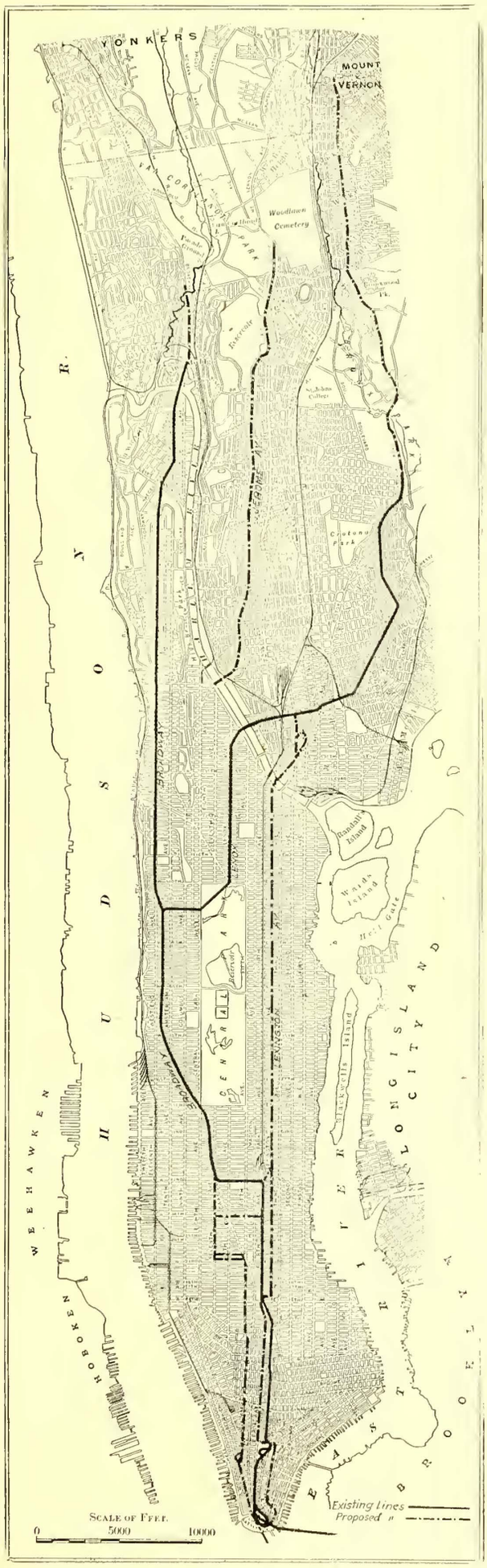
At the meeting of the New York Rapid Transit Board, on Thursday, Dec. 29, Chief Engineer Parsons read his report of proposed new transit facilities. He divided these plans into three parts, namely, new lines, the extension of subways and the extensions of elevated structures. One plan included a new route from the Battery to the Bronx, already proposed, mainly along Lexington Avenue. Another line was from the lower end of the city, up West Broadway to Forty-Second Street. Besides these there were three lines in the Bronx and one in Brooklyn which he suggested. Mr. Parsons also presented a report setting forth plans for the Subway in Fourth Avenue, Brooklyn, out to Fort Hamilton. He favors an Eastern Parkway tunnel extension from Flatbush Avenue, and has a tentative plan for a tunnel from the Battery under Governor's Island to connect with the Fourth Avenue Subway. The Fourth Avenue Subway will accommodate an immense stretch of territory. It will pass through the most populous sections of South Brooklyn, and, in addition, will serve Bay Ridge and Fort Hamilton and the contiguous sections.

Accompanying the report were maps of the proposed lines in Manhattan, Brooklyn and The Bronx. The estimated cost of the work outlined for Manhattan is $40,000,000. The extension in Brooklyn and the work laid out for The Bronx will cost about $9,000,000. One new line proposed for Brooklyn is so complicated and likely to prove so expensive that Mr. Parsons made no estimate of its cost.

Pamphlets containing these maps and a description of the routes will be printed for public distribution, and on Thursday, January 12, the Rapid Transit Commission will take up the plans for discussion, and will listen to any criticisms of them.

The plans for the new subways in Manhattan are a composite or an adjustment of the tentative plans offered by the Interborough Rapid Transit Company and the New York City Railway Company. The route is laid out so that the new part could be operated in connection with the present subway, or, by omitting one or two links in the chain, could be an independent East Side subway, with a connection at the Battery with a West Side line running to Forty-second Street. The route is such that the Interborough Company, which operates the present elevated and subway lines, the New York City Railway Company, which operates the surface lines, or any independent interests can bid on the contract.

The route extends on the East Side from South Ferry, along South Street, across Coenties Slip to Front Street, thence along William Street, under the Brooklyn Bridge, under Park Row to Chambers Street, to Broadway, and under Broadway to Union Square, thence passing beneath the subway, under Fifteenth Street to Lexington Avenue, and under Lexington Avenue and the Harlem River and private property to a terminal loop, under Third Avenue to East 142d Street and Morris Avenue, with a branch continuing under Morris Avenue to connect with the subway at East 149th Street. A West Side line, beginning on the East Side line at Battery Park, will run under Battery Park and Greenwich Street, West Broadway, Fifth Avenue, Broadway, Twenty-fourth and Twenty-fifth Streets to Seventh Avenue and under Seventh Avenue to a connection with the present subway, between Forty-second and Forty-fifth Streets. It will have a crosstown connection between Seventh and Lexington Avenues at Thirty-fourth Street,



MAP OF MANHATTAN ISLAND AND SUBURBAN TERRITORY TO THE NORTH, SHOWING THE PRESENT AND PROPOSED RAPID TRANSIT LINES

and connection with the present subway at Park Avenue, south of Forty-second Street, under the intervening streets and private property to Lexington Avenue at about Forty-fourth Street and at Battery Park.

The West Side line would connect with the new Pennsylvania station. In case the Interborough Company obtained the contract and did not build the Thirty-fourth Street cross-town line, this street could be used for the moving platform subway. The plans proposed by the New York City Railway Company included a line under Chambers Street from Broadway to West Broadway, which has not been put into Mr. Parson's plans because it would involve much expense and serious engineering problems for the junctions with other lines at Broadway and West Broadway.

As previously stated, Mr. Parsons outlines two new routes for Brooklyn. One of these is to run to Fort Hamilton under Fourth Avenue from its junction with Flatbush; the other is to run from the Battery across Governor's Island and Buttermilk Channel, along the shore to Fort Hamilton.

CORRESPONDENCE

SWEEPERS FOR THE REMOVAL OF SNOW

McGUIRE-CUMMINGS MANUFACTURING COMPANY

Chicago, Ill., Dec. 31, 1904.

EDITORS STREET RAILWAY JOURNAL:

In reading over your editorial in the STREET RAILWAY JOURNAL of Dec. 17, entitled "The Season of Snow", I am moved to call attention to some of the points in snow fighting that are not generally appreciated by street railway men. The principal erroneous idea in connection with snow fighting that I wish to upset is that a snow-sweeper is suited only to clearing light snows from tracks in city streets; that it has no place in heavy drifts either on city or interurban lines. To be sure, there are plenty of managers who have found this idea to be erroneoue within the past two or three years, but the old impression still previals to such an extent that it is worth calling attention to its error here and show the reasons why such ideas exist.

To make my point clear, it must be explained at the outset that there are two general types of snow-sweepers on the market which differ radically from each other. The oldest and most common type of sweeper has one broom at an angle of 45 degs. in advance of the left-hand side of the sweeper-truck, and another revolving broom at an angle of 45 degs in the rear of the right-hand side of the truck, both being underneath the car body. In other words, the right-hand wheels of the sweeper had nothing to clear the snow in advance of them save a shear board. The revolving broom on the left-hand side, while it cleared the left-hand rail, would, if anything, place more snow on the right-hand rail than was there before, and this snow on the right-hand rail would have to be taken care of by the shear board until after the right-hand wheels of the truck had passed through or over it, and the broom in the rear of the sweeper on the right-hand side had been given a chance to clear the right-hand rail. The arrangement is glaringly defective on the face of it, because it clears only one rail in advance of the sweeper, but it was thought to be necessary for structural reasons, as there was not room on the light sweepers of the early days to place a revolving broom at an angle of 45 degs., the full width of the track in advance of the sweeper. The same general plan of sweeper was used in horse car days, and when electric traction came in the design was made slightly heavier and fitted with motor-driven brushes. The unsatisfactory results with such sweepers in deep snow (which are all that one could expect with such a construction) are largely responsible for the prejudice in the minds of some

electric railway men against sweepers. One frequently hears it said that a plow is the only thing for heavy snow, and that a sweeper will simply "ball itself up" and churn the snow around without getting it off the track, if the snow is deep.

The other type of sweeper to which I refer belongs in an entirely different class both in construction and performance. In this sweeper a set of revolving brooms is carried at an angle of 45 degs., the full width of the track in advance of the sweeper truck. To do this, of course, necessitates a very heavy sweeper construction, which is of itself desirable; otherwise, an overhang great enough to accommodate brooms the full width of the track in advance of the truck would not be feasible and would result in derailment. By cleaning the entire track in advance of the sweeper instead of only half the track, the sweeper cannot get stalled in a drift as must necessarily happen if only half the track is cleaned. A sweeper of this type properly operated can do more than a rotary snow plow costing two and a half times as much and with less than one-third the power. The brooms revolving at a high rate of speed in advance of the plow can be made to cut through any drift that is formed, provided only the operator does not attempt to run the car into heavy drifts faster than it can cut the snow away. With the broom revolving at 400 r. p. m., the snow is thrown clear of the track as effectually as a rotary snow plow would do it; and what is still more important, the track is cleaned down to the rails so that there is no wedging of snow under the trucks and wheels, no interference with traction, no stalling, no derailment and no failure of electrical contact with the rails.

I send you herewith a photograph of a plow of the latter

ELECTRIC SWEEPER FOR HEAVY DRIFTS

class, showing the principles of construction I have described. The steel underframe of this plow, which carries the revolving brooms, is constructed with diagonal ends at 45 degs. to the rail. After trying revolving broom sweepers of this type, numerous companies have recently found that they answered the purpose better than snow-plows, even on interurban work in the heaviest drifts.

B. F. Stewart.

The Northern Ohio Traction & Light Company, and the Canton-Akron Railway Company have completed arrangements for instituting limited service between Cleveland and Canton by way of Akron. There will be three limited runs each way a day and cars will stop only at Cuyahoga Falls and Akron. The through run will be made in two and a half hours, in place of three and a quarter hours required at present.

The Montreal Street Railway Company repeated its method of Christmas giving to its employees, inaugurated in 1903, by handing a check for $3,000 over to the Mutual Benefit Association existing for the employees, instead of presenting each man with a turkey.

THE CLEVELAND AIR-BRAKE ORDER

The decision of the Cleveland Electric Railway Company, announced in the Street Railway Journal for Dec. 17, to install air brakes with independent motor compressors upon all of its cars, and the order for 700 equipments given to the National Electric Company for this number of Christensen brakes, have attracted a great deal of attention, and will undoubtedly greatly stimulate general interest in the use of air brakes. Cleveland is one of the few large cities in this country in which heavy high-speed cars are run, and in which power brakes are not in general use. This has been due not so much to any hesitancy as to the value of the air brakes as to a desire to determine the best type of brake before placing an order which would involve such a large investment as that for the equipment of all of the company's cars. For this reason the Cleveland Electric Railway Company has been conducting a series of experiments extending over more than two years, with practically every type of power brake manufactured.

The National Electric Company has already shipped six carloads of air brake equipments on this order, and the balance of the equipments required to fill this contract will be finished in about two months. It will require a total of thirty carloads of air brake apparatus to complete the order, not including the pipe and pipe fittings, which will be purchased in Cleveland. Another interesting fact, which will well illustrate the size of this order, is a comparison with an order for air brake apparatus for steam railroad cars. Thirty carloads of air brake material for steam railroad cars would mean about 3000 steam railroad air brake equipments. Another item of interest to show the magnitude of this order is that it will require 18½ miles of air pipe to equip the cars, as each car requires about 140 ft. of miscellaneous sized pipe, and 60,200 pipe elbows, unions and fillings will be required for joining the pipe.

The air compressor used on these cars is the Christensen B-2 type, which has a capacity of 20 cu. ft. of free air per minute. The reason that this large size compressor is used is on account of the fact that the Cleveland Electric Railway Company intends in the near future to adopt the trailer system, i. e., each of the city cars, during the summer rush season, will handle one or two trailers, and a compressor of about 20 cu. ft. is required, therefore, to handle the increased load.

The type of motor compressor adopted is the standard form of the National Electric Company, consisting of a series wound motor with duplex single-acting compressor with double helical gear and pinion, automatic governor, air whistle, etc. A new type of engineers' slide valve, however, will be used. The equipments are for single end operation. The weight of the complete air brake equipment, including the compressor, is about 1100 lbs. The net weight of the compressor is 725 lbs. The equipment is similar to the motor-driven air brake equipment in use on cars of the Public Service Corporation in Jersey City.

That the importance of the order is attracting considerable attention in Cleveland is evinced by the space devoted to it by the local papers, all of which commend the decision of the company to install power brakes. Among them the Cleveland "Plain Dealer" calls attention to the extended experiments carried on by the company with different kinds of power brakes, and which included a careful investigation into the relative merits of the independent motor compressor and the storage systems. The use of the latter in St. Louis and in the neighboring city of Detroit caused the company to give special attention to this method of operation, but the "Plain Dealer" indorses the decision of the company, and particularly the fact

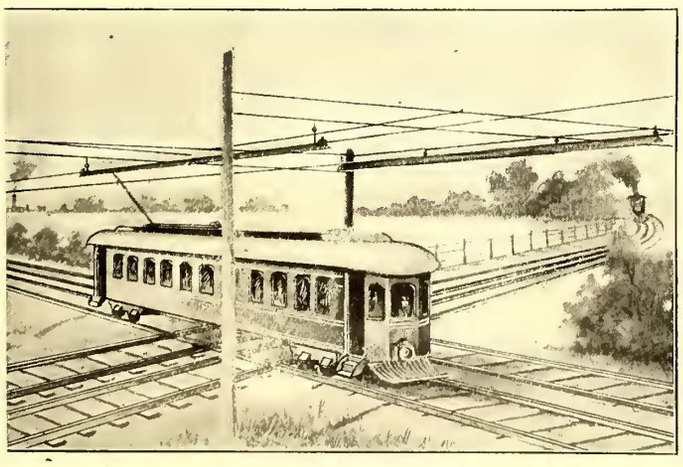
that it "not only adopted the more expensive system of the motor and compressor under each car but decided upon a machine larger in capacity than any of the suburban lines in this vicinity are using." It also refers to the decision as one adopted "after an unparalleled test in the history of electric railroading."

HOSPITAL TROLLEY CARS

Mrs. Caroline B. Alexander, her brother, Richard Stevens, of Castle Point, Hoboken, and Dr. M. F. De Hart, ex-president of the Jersey City Women's Club, representing a committee of the New Jersey State Charities Aid Association, have devised a plan for the establishment of a trolley car settlement for pauper consumption patients at Snake Hill, on the Hackensack Meadows, New Jersey. The suggestion has been approved by many physicians in Hudson County, and it is believed that the Board of Chosen Freeholders, which has charge of the county institutions at Secaucus, will provide for the tuberculosis colony on the highest point on the hill. President Thomas McCarter, of the Public Service Corporation, has promised to place at the disposal of the committee several trolley cars whose days of usefulness are over. The cars will be taken to Snake Hill and placed on foundations at a considerable distance from the penitentiary, almshouse and lunatic asylums. The first patients to be admitted to the trolley car settlement will be consumptive men and women inmates of the almshouse. There are about twenty of each. It is believed that one car of the jigger type will accommodate two persons. Four or more will be made comfortable in the larger cars. The improvised fresh air hospitals will be fitted up comfortably.

SAFETY TROLLEY GUARD

It is a recognized fact that trolley lines crossing steam railroad tracks should have some safety device to prevent a car



SAFETY TROLLEY GUARD

from becoming stalled or delayed on the crossing, and to meet these requirements the Niagara safety trolley guard has been devised and is now being sold by the Recording Fare Register Company, of New Haven, Conn.

As shown in the illustration, the guard is suspended over the track, and should the trolley leave the wire, it forms a contact, insuring the car clearing the steam track without accident or delay. This device has been installed with success in Buffalo, Brooklyn and in many other places, and has been approved by the Railroad Commissioners of the States of New York and New Jersey.

HANDSOME CARS FOR THE HARTFORD & SPRINGFIELD STREET RAILWAY COMPANY

The Hartford & Springfield Street Railway Company has placed in service recently a number of handsome 25-ft. and 30-ft. vestibule cars built for it by the Laconia Car Company Works, of Boston, Mass. One of these cars is shown in the accompanying illustration.

The 30-ft. cars have a seating capacity for forty-four people; they have straight sides, sheathed; steam car type of roof, with

ONE OF THE NEW CARS FOR THE HARTFORD & SPRINGFIELD STREET RAILWAY COMPANY, COMPLETELY EQUIPPED FOR SERVICE

monitor extending the full length of the car. Seven windows on a side have glass 24 ins. wide, while the two end windows are 29 ins. wide. All of the glass for the windows and doors is of polished plate. The monitor glass is of chipped pattern with plain border. The curtains are of the Curtain Supply Company style of gold star pantasote.

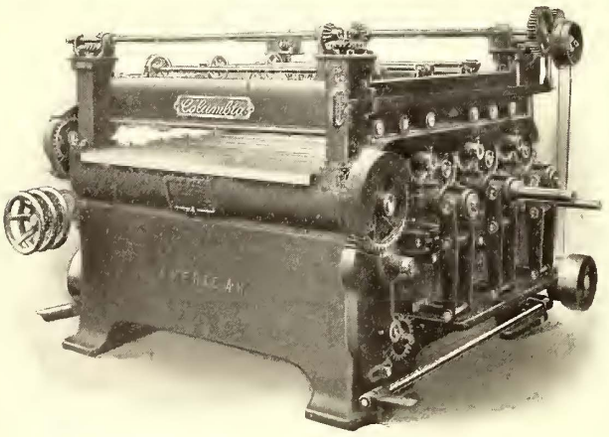
The inside finish of the car is of the Laconia standard design in selected mahogany, and the ceilings are painted and decorated. The seats, which were manufactured by Heywood Brothers & Wakefield, are upholstered in olive plush, with bronze grab handles on the backs. The Laconia high-speed double trucks, on which the car bodies are mounted, are fitted with 34-in. steel-tired wheels. The cars are also equipped with Christensen air brakes, made by the National Electric Company; Climax combination headlights, Murphy sand boxes, Consolidated heaters, Pfingst fenders, one New Haven and one Hartford register, and Wilson trolley catchers.

The 25-ft. cars are finished the same as the 30-ft. cars described above, and are mounted on similar high-speed double trucks fitted with Laconia double-plate wheels.

While the interests concerned have been discussing the question of the disfigurement of the New York subway through the display of advertising signs at all vantage points at stations along the line, there has quietly made its way into the tunnel the walking advertisement with which all are familiar. Here the transit commission, which has lodged a complaint against the present signs, seems to have been eluded, while the man whose advertisement is lost in the present maze of signs must surely lament his haste in arranging for his display. Of course, the walking advertisement will not be permitted to loiter at the stations. The man behind the advertisement can, however, enter at City Hall and display his sign at every station and to as many carloads of passengers as he takes trains in going by slow stages from one end of the line to the other

A MODERN SANDPAPERING MACHINE FOR RAILWAY WOOD-WORKING SHOPS

In the early days of electric railroading, when there were few large systems, little need existed for elaborately furnished shops for the maintenance of either the car or the electrical equipment. A few carpenters or cabinet makers equipped with some simple hand-power tools sufficed for carrying out all necessary repairs to the woodwork of the rolling stock, and such repairs to the operating equipment as could not be made by a local machinist were turned over to the manufacturer of the apparatus or some out-of-town machine shop. But the rapid growth of electric transportation lines, combined with their consolidation into great systems, is quickly changing the



GENERAL VIEW OF SANDPAPERING MACHINE, SHOWING CONTROLLING GEAR

old state of affairs, because the care of the more extensive equipment now required makes it good policy to install a well-furnished machine tool and woodworking department capable of coping with every phase of the maintenance problem. It is undeniable that the possession of such facilities secures many economies in operation by avoiding the time and expense of transporting injured equipment to distant points and by giving the management every opportunity to see that the repairs are carried out properly from beginning to end.

The maintenance of the rolling stock of a railway naturally involves the installation of a number of woodworking tools, and since much of the woodwork on cars requires a good finish, the value of having a sandpapering machine should not be overlooked. The "Columbia" sander, built by the American Woodworking Machinery Company, is a typical machine for this work, answering in its construction all the demands made for a tool to put a uniform and high-grade finish on a flat surface of wood. Although numerous types of single and multiple-drum sandpapering machines were manufactured for many years by various concerns, it was not until 1894, when the first "Milwaukee" sander was built, that a machine was offered containing an automatic device for taking up the slack in the paper while the drum was in motion. This feature enabled the accomplishment of work never before attempted on machines of this class, and resulted, in 1897, in the introduction of the present "Columbia" sander, a heavier machine with many new features. In 1901 the designer of both of these sanders conceived the idea of an entirely new method for gripping and clamping the ends of the paper in the drum, as well as to fasten the drum coverings securely, which, in connection with the automatic elastic take-up device, has given this sander every facility for doing first-class work.

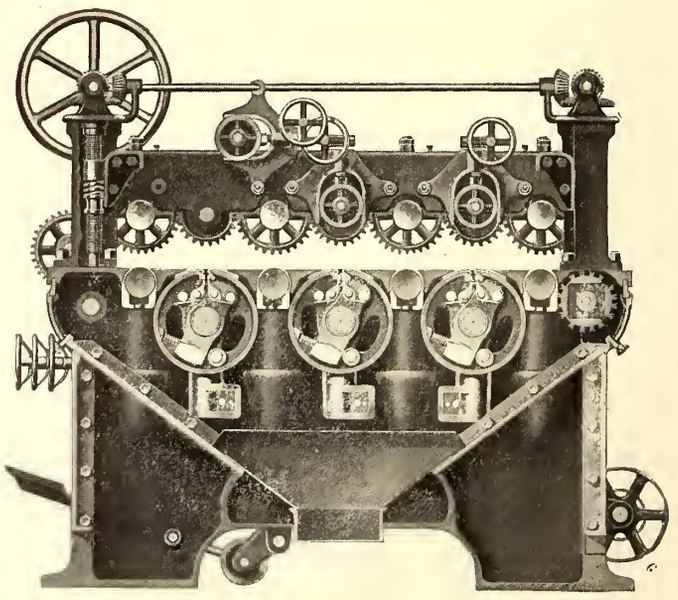
Among the essential features of this machine are the drum cylinders, which are very simply and durably constructed, as they are cast entire and are not made up of a series of narrow sections set-screwed to the shaft, or a series of webs on which a sheet-iron shell is riveted or bolted. It is the only sander provided with mechanism for automatically tightening the paper while doing its work, in consequence of which no time is lost in stopping the machine to take up the stretch in the paper, hence there can be no wrinkling or breaking caused by loose or flappy paper. This machine requires 36-in. paper, but one roll of 50 yds. will furnish paper to cover fifty drums; while 24-in. paper, if used spirally, would cover but thirty drums; a gain of 66 per cent in quantity of covers, and a saving of 3½ per cent in the actual cost of paper. The "Columbia" drum takes wider paper, while the spiral drum takes longer paper.

The paper is utilized the full width of the drum, there being no clamps to cover any part of it at either end, and the gripping device requires no more paper than if lapped and applied spirally. As loose or flappy paper is avoided by the automatic take-up, the paper wears evenly and therefore lasts longer. There is no opening in this drum to allow dust to enter.

It can be recovered with felt or canvas in one hour, without being taken out or disturbing a screw or any other part of the machine; spiral drums have to be taken out.

One of the most delicate yet most important organs of the sander, is the oscillator, which, on account of being perfectly regular in its movement, avoids defects in the work. It is provided with simple and easy means for taking up the wear caused by the weight of the cylinder and the rapidity of its movements. This oscillator follows with perfect freedom the raising and lowering of the cylinders for changing the cut.

The arrangement for raising and lowering the cylinders by means of a wedge gives the same result as if the boxes were perfectly rigid and required no adjustment. No raising screws or nuts are employed in this construction, hence there is no lost motion to disturb the parallelism of the drum and cause trouble. The cylinder box stems fit accurately reamed holes in the frame, and have a deep diagonal slot in which the heavy



TYPICAL SECTION, SHOWING ARRANGEMENT OF SANDPAPER DRUMS AND FEED-ROLL MECHANISM

wedge block is engaged, which slides in a transverse housing in the frame, holding the cylinders perfectly rigid and permitting them to be belted in any direction. The wedge blocks on both sides are connected and are adjusted by hand wheels at the front of the machine. This ingenious solution of the problem gives the cylinders an absolutely firm rest and enables them to be raised and lowered with the greatest ease and convenience.

The upper feed works frame is supported by four corner posts with four short screws, with bearings at both top and bottom, which enhance the rigidity of the frame, no matter how high the frame may be located, and it always remains in its true relative position to the lower rolls. A second nut and coiled

spring is provided to take up back-lash in screws, preventing swaying of the top frame when feeding thick stock.

By varying the exposed gear, this machine can feed slowly or fast to suit the finish required. Four rates of feed are provided, viz.: 12 ft., 15 ft., 18 ft. and 21 ft. per minute.

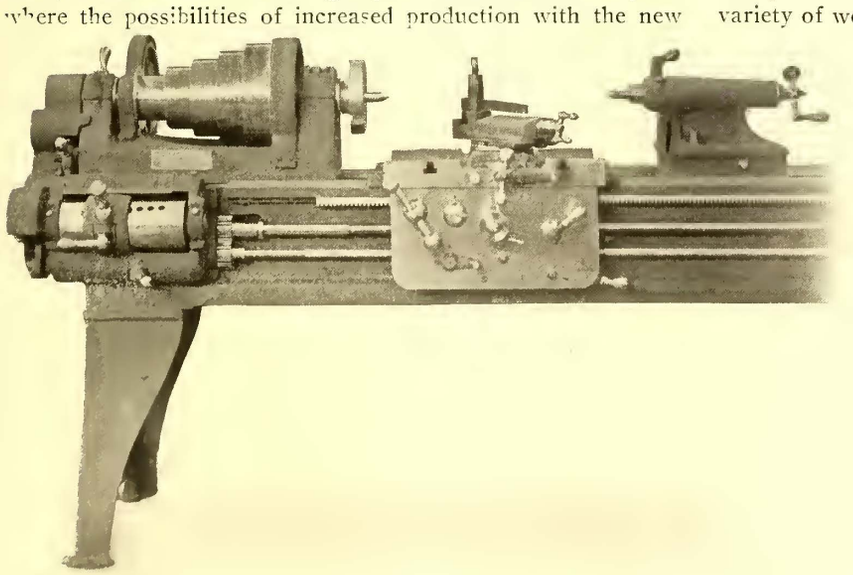
On the right-hand back corner post of this machine there is a compact but strong arrangement of gears for raising and lowering the top feed works by power. This is easily manipulated by the operator without changing his position.

Besides the necessary end girts there is a pair of inside girts laid obliquely in the frame, forming the solid sides of the dust pan, to which only a short spout has to be attached, making the pan practically dust-proof; at the same time these inside girts add strength to the form where it is most needed. An examination of the sectional cut will show that no single movable part besides the cylinders and brush is placed inside of the frame. All devices for the purpose of motion or adjustment are placed outside on the frame in plain view of the operator and out of danger of being clogged up with dust. The belt tightener used eliminates all danger of a belt slipping, and prevents irregular motion of the feed. A strong, constant and uniform feed is thereby insured. Connected with the belt-tightener is an instantaneous feed stop. It is only necessary to move the foot-treadle, which releases the tightener, to stop the feed in emergencies.

All boxes for cylinder shafts, oscillators and countershafts are self-oiling, having oil receptacles and drain plugs; the loose pulley is also similarly arranged.

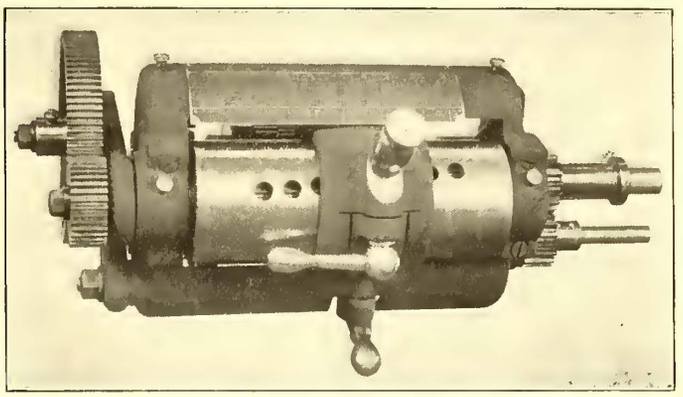
AN IMPROVED ENGINE-LATHE WITH QUICK-CHANGE FEED DEVICE

One of the most important of the many improvements that have been made in the design and equipment of machine tools during the past few years has been the addition of the rapid-change feed-gear device, which has in fact greatly changed the operative methods in machine shop work. Not only has this important time saver made advantageous changes in labor costs upon many classes of work, but also, by virtue of its all-gear drive, it has increased feeding capacities of lathes to a point where the possibilities of increased production with the new high-speed tool steels are within reach.



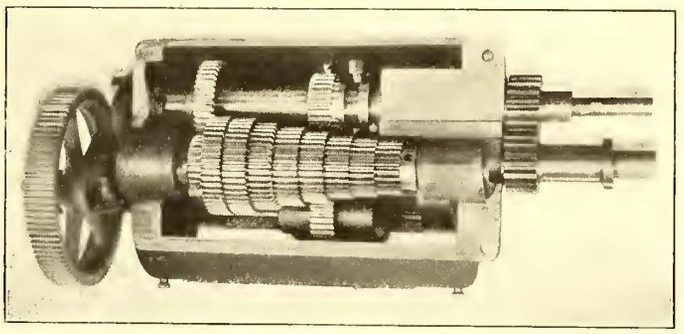
THE NEW LEBLONDE ENGINE LATHE, WITH QUICK-CHANGE MECHANISM FOR OPERATION OF THE FEEDS

The improved lathe of the R. K. LeBlonde Machine Tool Company, Cincinnati, Ohio, illustrated above, which embodies an interesting adaptation of the rapid-change feed mechanism, will indicate the trend of progress in this direction. The LeBlonde Company some time ago equipped its milling machine with a quick-change feed mechanism, and this application to the engine lathe is worthy of note for its many advantages.



DETAIL VIEW OF THE NEW FEED GEAR BOX USED UPON THE LEBLONDE LATHE

The engraving presented herewith illustrates the 16-in. size



REAR VIEW OF THE LEBLONDE GEAR BOX, SHOWING DETAILS OF CONSTRUCTION

of the new LeBlonde line of quick-change lathes, of which all sizes from 12-in. to 30-in. swing are built. These were brought out to supply the demand for lathes on which a large variety of work must be done that requires continual changing of feeds. Care was exercised in the design to enable the operator to obtain the quick-feed changes in the simplest possible manner so there would be no undue friction; the device contains the minimum amount of parts, thus requiring the least amount of care, and assures long life to the lathe, and, in addition, the mechanism is provided with ample oiling facilities and bearings of good proportion, and the entire range of feeds can be obtained without stopping the lathe or removing or changing a single gear.

The "quick-change" feed-box itself consists of a long, solid pinion, covered by a sleeve or barrel, as shown in the rear detail view of the box. This barrel has a slot cut in it, in which travels a gear so as to be in mesh at all times with the long pinion. The traveling gear is carried by a bush which has both a longitudinal and circular movement on the barrel, keeping the two pinions in proper mesh at all times, and at the same time allowing the upper one to be thrown into mesh with any one of the cone of gears which is mounted in the box, as shown. This cone of gears is then multiplied by the slip gear which is shown at the bottom in the rear view of the box; this is arranged so it can be thrown in a central position, stopping the entire feed

works in the apron of the lathe, thus also allowing any changes to be made at high speed without interfering with the box. This slip gear is directly on the feed-rod, on which is placed a spur gear which can be thrown in mesh with the gear on lead screw. By this method the lead screw can remain stationary, and is not intended to be used except for chasing.

A glance at the foregoing engravings will indicate that the new change-gear mechanism has no overhanging parts or outrageously large projections, the whole arrangement being compact and simple. It is also found that the mechanism does not consume more power than the usual type of change-gear arrangement upon the old style lathes. The arrangement of drive to the feeds from the spindle to the gear box is the same as is generally used upon the regular lathes of this company. One increase is obtained by the use of a telescopic gear on the stud; in this way the compounding generally used can be done away with, and wherever there are coarse feeds or heavy threads, the increase comes direct from the reverse stud, speeding the box up in exact proportion to the work, so that the mechanism is under a minimum strain at all times.

There are many advantages claimed for this particular style of feed mechanism, some of the more important of which may be referred to to advantage. On account of the absence of splined shafts, it is stated that there are no key-wayed gears sliding or running on the shaft, and, furthermore, that neither the head nor bed is weakened by slots cast or cut in them. The power being transmitted entirely by the gears, it is evident that there are no shafts in torsion, the shafts simply acting as bearings and not for transmission. The locking pin is arranged so it does not overhang, but connects the sleeve directly to the case, and when additional friction is necessary the whole can be locked together. The box is made so that it is impossible to mesh the gears on the corners; in other words, the gears cannot be thrown into mesh until exactly in proper position longitudinally. The handle at the bottom, when placed in a central position, allows the feed works from that point to remain idle, so that the gears can be changed at highest speed without injury; the lower handle can then be thrown in, thereby connecting the feed works to the box.

EXTRA PAY FOR INSTRUCTORS IN NEW YORK

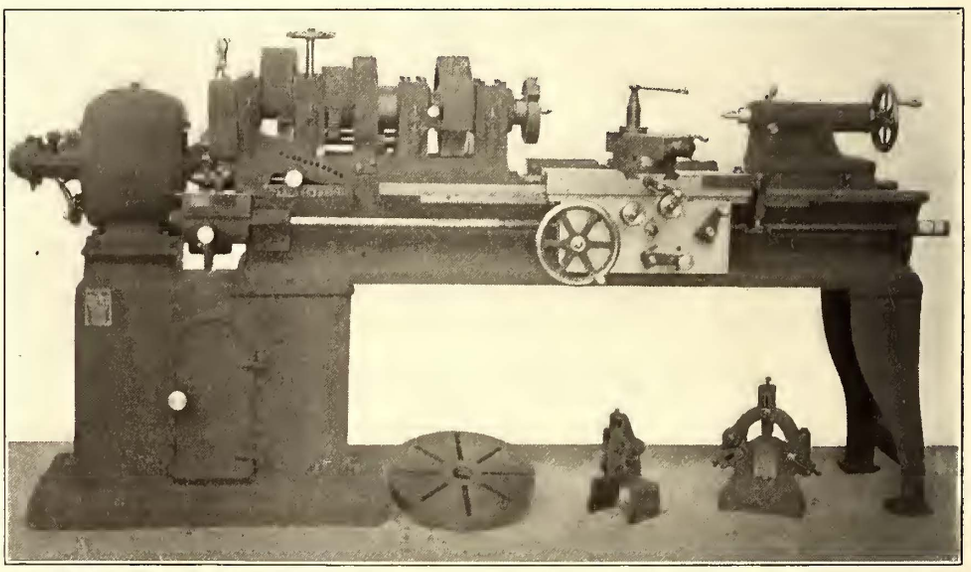
The New York City Railway Company announced last week that beginning with Jan. 1, 1905, those motormen who are engaged in breaking in new men will receive 15 cents a day in addition to their regular pay. The New York City Railway Company employs between 125 and 150 instructors of this kind, who are selected from the regular staff, and who carry on the instruction in the less crowded streets in the outer sections of the city.

A bill has been prepared providing for a railroad commission for Indiana. The Shippers' Association is opposing the proposition to incorporate in the bill a provision giving the commission power to deal with the question of protection for grade crossings. Such a provision will, they think, endanger the bill's passage. They urge a separate bill to deal with the grade crossing question of steam and interurban railroads.

A NEW DESIGN OF ENGINE LATHE

With the many improvements that have of late been made upon all classes of machine tools, in order to bring their capacities up to the standards required by the advent of the new high-speed tool steels, has come also the question of driving the tools for the best possible results. The motor drive has, of course, been most advantageous to the greatly increased productions that have obtained in machine tool practice, but the motor has never proven itself harmoniously adaptable to driving in connection with the old and well-known belt and cone-pulley method. Accordingly, the very interesting and successful new solution of this problem by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, is of special interest to machine shop officials, and should have a beneficial effect upon future practice in all lines of shop work.

The new Lodge & Shipley lathe has been modified to meet these requirements in the form of an entire change in headstock design. The new headstock which is now their standard combines many important advantages. The aim in the design of this head has been to provide a lathe head that will not only maintain its life and accuracy, but also stand the hard abuse that a machine of this class is subjected to with the use of high-speed steels.



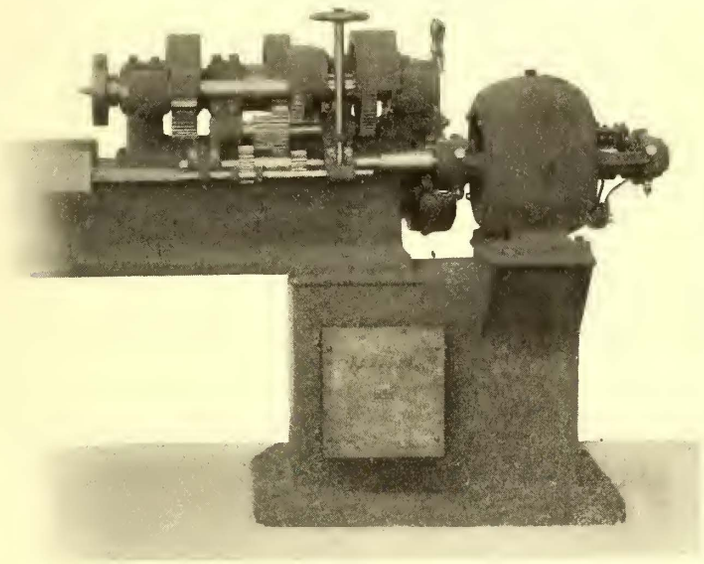
THE NEW LODGE & SHIPLEY SPECIAL GEARED HEADSTOCK LATHE, SHOWING A NOVEL METHOD OF MOTOR MOUNTING FOR INDIVIDUAL DRIVING

The construction of the driving pulley and sleeve is such that there is no belt strain whatever on the spindle, this being taken care of by two bearings that support the pulley sleeve, independent of the spindle bearings. The sleeve has a hole through its center, which is one-eighth larger in diameter than the lathe spindle, so that there is no point of contact between the sleeve and spindle. By this means the necessary high speeds are available through the back gears without running the pulley on the spindle, thus eliminating nearly all friction from this source. The usual style of engine lathe is short-lived and troublesome in this respect when using high speeds, and is also impossible to oil.

The end of the pulley sleeve facing toward the middle of the lathe has a positive jaw clutch, so that it can be engaged with one which slides on the inside hub of the face gear; this is operated by a lever handy to the operator for engaging the spindle or the back gears. On the pulley sleeve are keyed two gears of different diameters into which either of a pair of sliding gears on the back-gear shaft can be engaged, thus providing two changes of speed from this source. The pulley on the sleeve is of a large diameter and made to take a much wider belt than formerly used on the standard cone-pulley engine

lathes of this company. Inasmuch as the headstock spindle is mounted in separate bearings, but passing through the pulley sleeve with ⅛ in. clearance, it can readily be understood that when the head is at work there is no pull of the belt on the spindle. The belt pull is taken entirely by the bearings that support the pulley sleeve, as is also the pressure of the driving gears. This feature will add greatly to the life of the spindle bearings and enable the spindle to maintain its perfect alignment many times longer than with the old construction. The back gearing now revolves as one piece on its own journals and in self-oiling bearings, with a novel means of engaging and disengaging; this will be recognized at once as a much-desired improvement.

To equip this lathe as a motor-driven tool, a gear is merely mounted on the sleeve in place of the driving pulley, and is driven by a train of gears having two ranges of speed between the driving shaft and spindle, thereby giving six geared changes of speeds to the lathe. Any type of motor can be used, but a motor giving a 2:1 variation in speeds is greatly preferred, and will give to the spindle a multiplicity of speeds ranging from the maximum in a progression dependent upon the number of points on the controller used. With the motor connected up with a 20-point controller, 120 changes of speed are secured.

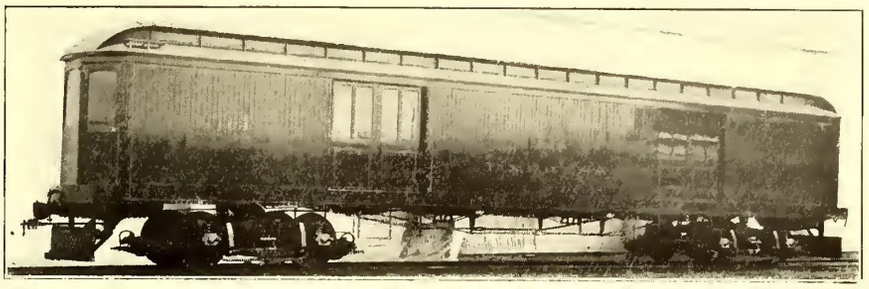


REAR VIEW OF THE NEW LODGE & SHIPLEY LATHE, TO SHOW DETAILS OF HEADSTOCK AND OF MOTOR SUPPORT

The lathe as illustrated in the accompanying engravings is arranged for motor driving. The motor is mounted upon a bracket extending from the enlarged cabinet leg of the lathe, where easy access to the running parts is secured, and the armature shaft is direct connected by coupling to the driving shaft of the lathe without intervening gears or chain; while the gear or silent chain drive is far from undesirable, still this arrangement is obviously infinitely better. The motor used in this case is a variable-speed motor, built by the Northern Electric Manufacturing Company, Madison, Wis., which provides a speed range of 2 to 1 by field control. The rheostat is mounted on the cabinet leg at the rear, and is easily operated from the front by a conveniently arranged handle, so that all speed changes may be made with the utmost facility, proving thus a very complete and economical arrangement.

A LARGE BAGGAGE AND EXPRESS CAR FOR THE UTICA & MOHAWK VALLEY RAILWAY

What is probably the largest baggage and express car ever built for electric service has lately been delivered to the Utica & Mohawk Valley Railway Company by the J. G. Brill Company. As the illustration shows, the car has two double sliding doors on each side and doors that swing outwardly at diagonally opposite corners. It is for use also as a locomotive, and is equipped with radial draw-bars for hauling electric cars, and also has heavy couplers for handling freight cars from steam roads. The car is mounted on the builders' high-speed trucks, No. 27-E-3, and has a four-motor equipment aggregating 220 hp. These trucks are capable of 70 m.p.h.

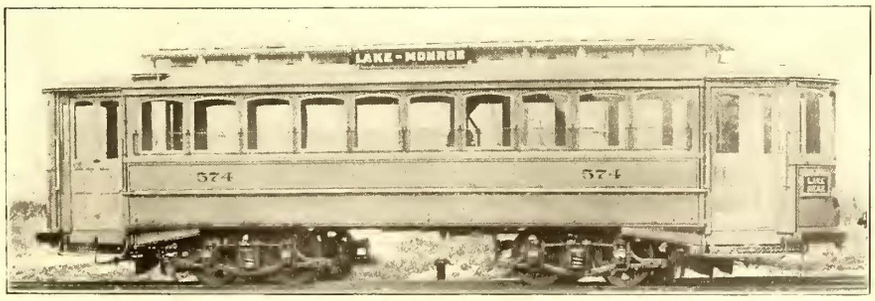


THE NEW 56-FT. EXPRESS AND BAGGAGE CAR FOR THE UTICA & MOHAWK VALLEY RAILWAY

The length of the car over the crown pieces is 56 ft., and the width over the sheathing, 8 ft. The side sills are of long leaf yellow pine, 5¾ ins. x 7⅞ ins., with 8-in. x ¾-in. sill plates. The cross joists are 4½ ins. x 5½ ins. A slatted partition with door forms a motorman's compartment at each end of the car. The trucks have a wheel base of 6 ft. 6 ins. The wheels are steel-tired and 36 ins. in diameter, and the diameter of axle is 6 ins. The weight of the car and trucks without the motors is 51,060 lbs.

NEW EQUIPMENT FOR THE ROCHESTER RAILWAY COMPANY

The Rochester Railway Company has just received forty cars from the G. C. Kuhlman Car Company, twenty of which are semi-convertible, built under the patents of the J. G. Brill Company. They are mounted on that company's No. 27-G trucks, and twenty, like the one illustrated, have windows which drop into pockets in the sides, and are mounted on Brill No. 34 trucks. The cars are intended for various divisions of the company's extensive system in and about Rochester. The lines are so arranged that all the divisions start from the business center of the city and run into the suburbs in every direction. One of the lines transverses a very picturesque country for a distance of 40 miles to Sodus Bay, on Lake Ontario, where the company owns a large and popular amusement resort. The company owns several other large parks which are famous



THE LATEST TYPE OF SUBURBAN CAR FOR THE ROCHESTER RAILWAY COMPANY

throughout the country. A large number of towns and villages are connected with the city by the lines, and as the neighborhoods in every direction are populous, all the lines do good business.

The cars are seated for thirty-eight passengers. The seats are upholstered in spring cane and have step-over backs. The interiors of the type of car shown are finished in white ash, with ceilings of bird's-eye maple. The bottom framing is very substantial, and includes 4¾-in. x 7¾-in. side and end sills. The sill plates are 6 ins. x ⅝ in., and are on the inside of the sills. The thickness of the corner posts is 3¾ ins., and of the side posts, 2¾ ins. The sweep of the posts is 1¾ ins. The length of the cars over the end panels is 28 ft., and over the crown pieces, 39 ft. The width over the sills is 7 ft. 6½ ins., and over the posts at the belt, 7 ft. 9 ins. The angle-iron bumpers, track scrapers, "Dedenda" gongs, "Dumpit" sand boxes, ratchet brake handles and Retriever conductors' bells, all of Brill manufacture, are included in the furnishings.

GASOLINE MOTOR CAR FOR THE GREAT NORTHERN RAILWAY, ENGLAND

As readers of this paper know, a good deal of experimental work has been carried on for some time past by various trunk line railways in Great Britain to determine the commercial value of the various types of independent motor cars to suburban traffic conditions. While some railways have been carrying out tests with steam motor cars, others have adopted gasoline cars, and in one case a combined gasoline and electric car has been employed. Certain of these cars were described in an article in the Street Railway Journal for Nov. 3 by Philip Dawson, and it is the intention to present herewith later particulars of the Great Northern car which was under construction at the time of publishing Mr. Dawson's article. The car, which is now in use, will be utilized, in all probability, on one of the branch lines running from Hatfield. The seating capacity is thirty-two passengers, but it is obvious that this can be considerably increased, and a larger type of car is being constructed, which will not only carry considerably more passengers, but will also provide a certain amount of space for baggage.

In its design the manufacturers, Dick, Kerr & Company, utilized to a considerable extent well-known electrical principles. Thus the whole of the machinery is assembled upon a frame, which is directly supported from the axles. It is thus entirely isolated from the body of the coach, so that even while standing at a station the noise vibration from the engine is quite imperceptible to the passengers.

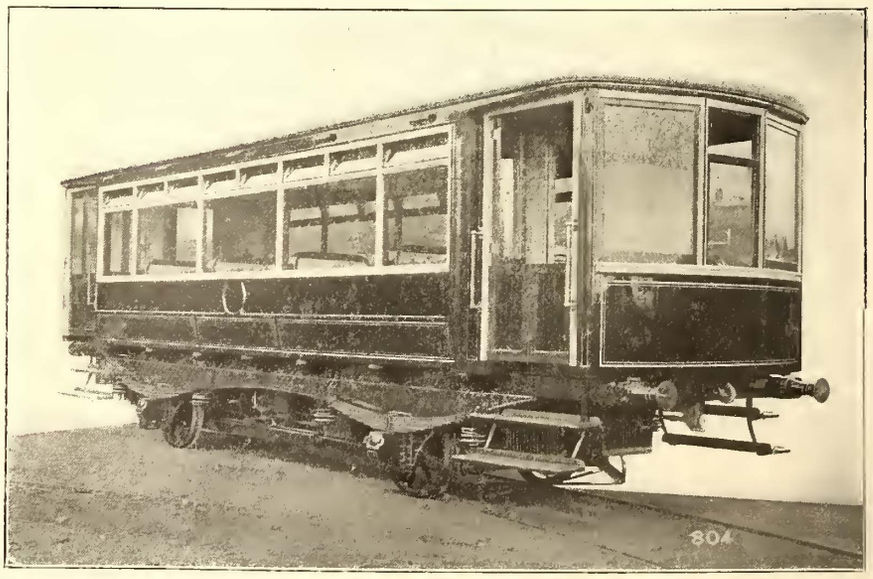
Another feature successfully adapted from electrically-driven cars was in dividing motive power into two engines, which not only minimizes the risk of break-down, but gives a better distribution of weight. The engines are not connected independently to the axles, but under normal conditions drive on to a common longitudinal shaft, which is connected to the axles by beveled gearing. To overcome the difficulty of one axle overrunning the other, owing to any possible inequality in the diameter of the wheels, a special form of differential gear is introduced, and combined with this special gear is the reversing mechanism. The engines are connected through independent clutches to a common change-speed box from which the power is transmitted, by means of the longitudinal driving shaft referred to above, into gear boxes suspended on each axle, and at this point the engine speed is reduced as required on the axles by means of single reduction gearing, very similar to that used in the electrical railway motors.

The engines are of the standard Daimler type, each capable of developing 36 hp, running at full speed. A separate petrol

END VIEW OF MOTOR CAR

tank is provided for each engine, and the combined capacity of these is equal to 400 car-miles.

The complete car weighs something under 16 tons, including its full complement of passengers, and although the normal speed for which it is designed is 30 m.p.h., it has on several occasions attained a speed considerably over 50 miles. The car is lighted by electricity obtained from storage batteries,



SIDE VIEW OF MOTOR CAR

which also supply current for the ignition and magnetic clutches. The design of the complete car is such that by jacking up the body the truck and motors can be run out in the same manner that a truck can be taken from beneath a standard electric car. But, in addition, the frame containing the machinery can be dropped from its bearings on the axles without removing the truck from underneath the car body, so that

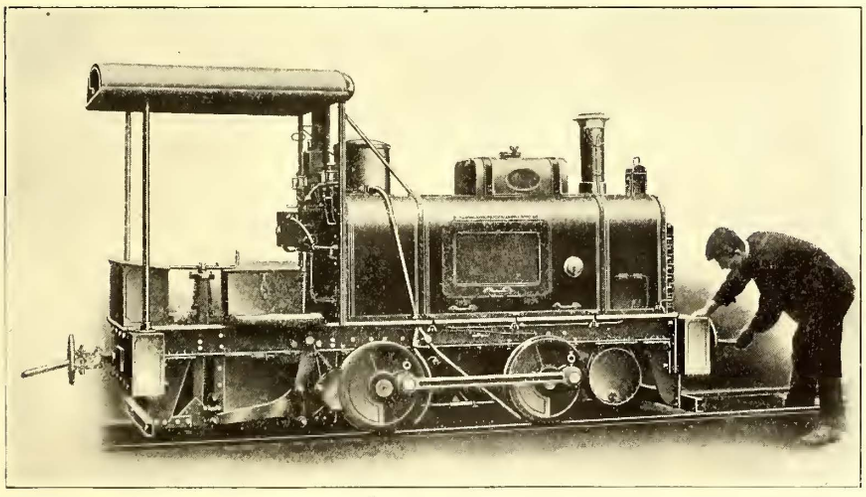
it will be seen that the flexibility and facilities for overhauling and repairs are everything that can be desired. The patents covering this arrangement are controlled by Dick, Kerr & Company.

The design of the car and its experimental operation have been under the personal supervision of Oliver Bury, the general manager of the Great Northern Railway Company.

SOME RECENT DEVELOPMENTS IN GASOLINE CARS AND LOCOMOTIVES

The Wolseley Tool & Motor Car Company, Ltd., Adderley Park, Birmingham, England, has also been giving very considerable attention during the past year to the development of the gasoline motor with reference to its use on street tramways and railways. The company's first actual order was received from the North-Eastern Railway Company for a pair of 80-hp four-cylinder horizontal engines, to replace the vertical ones, which had given trouble. The new engines have now been running on the North-Eastern Company's gasoline-electric railway motor cars for nearly six months, and are reported to have given every satisfaction, the two cars running with every regularity during the whole of the summer season on the Scarborough & Filey line. They have carried very heavy traffic, frequently accomplishing as much as 180 miles in one day, and have run every day in the week. An illustrated description of these cars was published in the STREET RAILWAY JOURNAL of Nov. 5 ,1904.

The Wolseley Company is quoting various of its clients for cars similar to the North-Eastern Company's cars, which have now, in the opinion of many experts, proved themselves superior for certain classes of traffic to the steam motor car. It is claimed for the gasoline-electric car that it is peculiarly adaptable to small lines where the car may have to stand frequently in a shed for two or three hours during the day. Immediately the car has finished work, the whole of the machinery is shut down, and nothing is being expended for fuel and wear and tear of machinery.

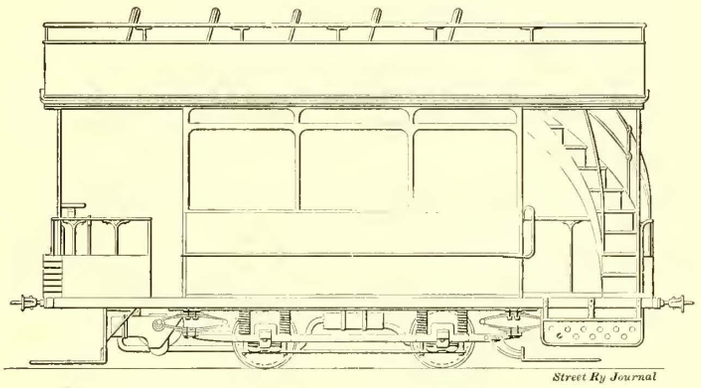


GASOLINE LOCOMOTIVE WEIGHING ABOUT 3 TONS, AND HAVING A DRAW-BAR PULL OF OVER 1100 LBS.

The car is designed solely as an independent unit, and no attempt is made whatever to haul another car, as, in the opinion of those responsible for the design, when it becomes necessary to construct motor cars of such power that they can haul other vehicles, the advantage of such independent units over a locomotive with its two or three trailers is not apparent.

Another important point to be remembered in comparing the two types of motor cars now being utilized, is that the North-Eastern type can be run for 180 or 200 miles without replenishing its fuel tanks. This, of course, is quite an impossibility with any form of steam coach as yet put into service. The need for replenishing its fuel supply so frequently is one of the drawbacks of the steam-driven motor car.

It is the company's belief that the electrical method of transmission is undoubtedly the correct one for coaches of the weight necessary for main line traffic, that is to say, 35 tons to 40 tons. When, however, railway authorities can be persuaded to utilize somewhat smaller vehicles constructed on very much lighter lines, then probably they will begin to see the advantage of smaller engine power and a direct geared type of transmission,



CAR SEATING THIRTY-TWO PASSENGERS, OPERATING WITH 20-HP GASOLINE ENGINE

without the intervention of electrical apparatus and its necessary complications.

The Wolseley Company is building small double-deck cars of the type illustrated, to accommodate fourteen inside and eighteen outside passengers and considerable baggage or mail, to be propelled by a 20-hp engine, constructed as simply as possible, driving through an ordinary change-speed gear device to the wheels.

Simplicity and reliability is the keynote of the design, and the total weight of the complete vehicle loaded, it is estimated, will not be above 10 tons. This vehicle, of course, will not withstand the severe shocks due to being shunted and hauled in conjunction with other rolling stock, but is provided with buffers and draw-gear, that it may be towed in the event of any unforeseen circumstances arising.

It is driven from one end only, and all controlling and propelling mechanism is mounted so as to be accessible to the motorman. The wheel base is 5 ft. 6 in., and the over-all length of the vehicle is 19 ft. The gage and the over-all width can be modified to suit requirements. The body is suspended on a standard type four-wheeled truck, the front leading wheels only being driven. Efficient guards are fixed at both ends.

The engine is a 20-hp horizontal, having two cylinders side by side, each 6-in. bore and 7-in. stroke, running normally at 600 r. p. m. It is situated under the motorman's platform, as shown in the illustration.

The gear box is mounted on the axle, and is driven from the engine by a "Renold" silent chain. The gearing gives three speeds forward of 4, 8 and 13 m.p.h., respectively, and a reverse of 4 m.p.h. The friction clutch is mounted on the gear box, and is of a type suitable for heavy traction work. Powerful screw-on block brakes act on all four wheels, one block on each wheel. These are compensated, and are actuated by a hand wheel conveniently situated.

The radiators for cooling the circulating water are placed in front of the vehicle, and the water is circulated by a rotary

pump. A sufficient reserve of water is also carried in a tank. The fuel tank is carried above the driver's head to give a sufficient fall to the engine. The fuel consumption is about 2½ gals. per hour on full load.

The idea of employing an internal combustion engine of simple design in conjunction with a direct-change speed gear device for propelling rail vehicles, has been applied by the company to tramways for ordinary tramway systems, and at the present moment it has on hand designs for two distinct types of tramways in England and abroad.

The larger style of tram car will be fitted with an engine developing 60 hp, and will be capable of a speed of 15 m.p.h. when necessary. The appearance of the car will correspond very closely to that of the familiar electric car, and its behavior no doubt will be watched with very great interest by all those who are interested in this new form of rail vehicle.

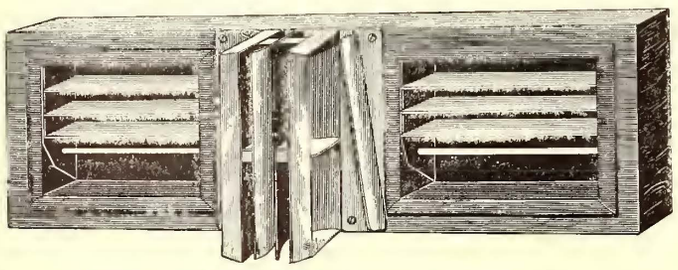
The company has just delivered to clients in Lancashire a small gasoline locomotive of the type shown, to haul 15 tons on their works tramways. On the official trials at Adderley Park, the locomotive showed a draw-bar pull of 1100 lbs. with ease. Its total weight is just over 3 tons, and it is geared to a speed of 8 m.p.h. only. It is provided with a 20-hp two-cylinder engine, and a simple form of change-speed gear box hangs in much the same way as an electric car motor on one of the axles. The four wheels (of 18-in. diameter) are coupled by the usual type of side rod. The engine is reported to be giving great satisfaction to the purchasers.

It is proposed to place on the market another type in the immediate future provided with a 12-hp engine and weighing about 3500 lbs.

A NEW VENTILATOR

Not the least perplexing problem in railway operation that has awaited a satisfactory solution is that of car ventilation, especially on long lines where the cars frequently are crowded far beyond hygienic limits. Of course, during mild, dry weather plenty of ventilation can be secured by opening the doors and windows, but when cold or stormy weather arrives the management finds it impossible to satisfy the opposing wishes of its patrons, some of whom are willing to brave anything to get a breath of fresh air, while the others prefer to have all drafts excluded. Many ventilators are so poorly constructed that during snow storms the flakes blow into the cars on the disgusted passengers who vow that only dire necessity can compel them to travel again under such conditions.

The steam railroads, on account of their longer runs and smoke nuisance, have been led to give special consideration to this problem, and as a result several large English lines, like the



VENTILATOR FOR STEAM AND ELECTRIC CARS

Midland Railway, the London & North-Western Railway and the South-Eastern Railway, have chosen ventilators of the type illustrated. Among electric railways, the British Electric Traction Company, which controls a large number of electric railways, has placed this ventilator in service on many of its cars with entire success, and as the consequence of careful tests all new cars for the Liverpool Corporation Tramways will also be equipped therewith.

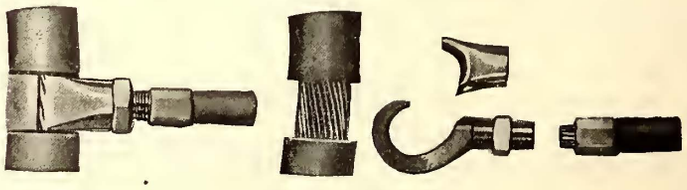
This ventilator is made by the American Ventilating Company, of New York, which manufactures it of chilled steel in any desired finish and of types suited for various kinds of cars. The apparatus, as illustrated, comprises a double deflector and two airways. When the train is in motion the deflector intercepts the air and injects it through the forward airway, first depriving it of cinders, dust and smoke. Behind the deflector a partial vacuum is maintained, which withdraws foul air through the rear airway, entirely changing the air in thirty to ninety seconds in steam railroad service, and in from two to three minutes in electric service, according to speed, literally without drafts, the windows being closed. The airways are always under easy control. Cars in service are equipped in the deck sash, without damage to their appearance.

A SIMPLE TAP JOINT

Since the introduction of the Dossert type-B joint, described in the Street Railway Journal of Sept. 24, 1904, and the use of the connectors, a demand has arisen for a mechanical joint which can be applied without cutting the cable. The T-joint has been greatly appreciated by its users, for when the work is completed it is as satisfactory as if the cable had not been cut. Very frequently, however, the cable is in service when the tap is to be made, and in that case it might cause serious troubles if the service were interrupted. In high tension work it is desirable to make tap joints when the service is live. In such cases the live contact should be handled as little as possible, so that quick application is particularly valuable. To meet this demand Dossert & Company, of New York, have developed the tap joint illustrated in Figs. 1 and 2, which show respectively the assembly and the various parts. A glance at the two cuts indicates immediately the simplicity of the entire construction.

A massive cast copper hook carefully machined to fit the cable forms the main member of the joint. The shank of this hook is threaded and drilled so as to form a nipple for the standard Dossert joint of the desired size. Upon this shank is secured also a heavy compression nut, which presses upon a suitably shaped casting fitting in the space between the cable and the base of the hook, forcing it against the cable with great pressure. The contact area of the hook contact is a carefully machined surface of many times the area of the cable that it surrounds, the portions being adjusted to fit the size of the tap. In mechanical strength and electrical conductivity, this joint is superior to the tap wire which it serves to connect.

The application of this tap joint is very simple. The tap wire may be fastened to the hook by the regulation Dossert coupler provided for that purpose. The main cable is then



FIGS. 1 AND 2.—ASSEMBLY AND PARTS OF TAP JOINT

bared exactly the width of the hook and scraped clean. The hook is then fastened over the wire and the lower casting is slipped into place. This lower casting is so shaped that it is impossible to adjust it in any but the correct position. The tightening of the compression nut finishes the work, which may then be taped up. It will be found to be less bulky and of better conductivity than any equivalent soldered joint. While the makers of this joint realize that this claim is a very radical

one, they have become convinced of its truth by testing their product in competition with soldered joints.

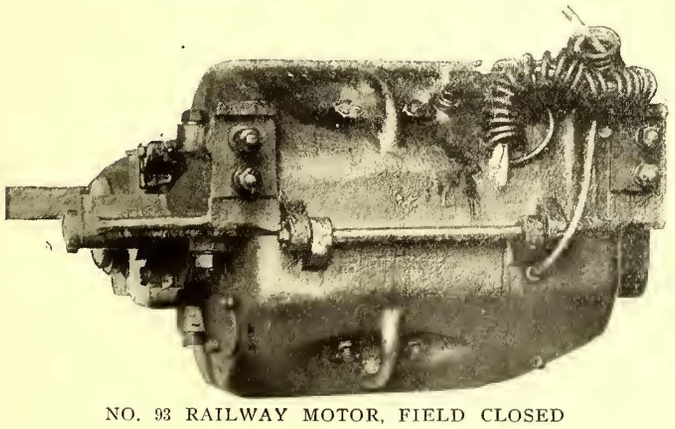
In railway work and in outside work where it is not necessary to install a fuse when a smaller wire is tapped off, the Dossert hook joint is made with taps of any size between 00 and 2,000,000 cm. In this work the tap connector will be much appreciated. Feeders for trolley mains or branch feeders present a very large field of usefulness for such a joint, and the facility with which work may be extended from operating construction should particularly appeal to railway and central station men, for, by the use of this joint, taps and mains can be jointed while both are under load.

In ordering it is necessary to give the number of strands and the diameter of each strand of the tap cable, and the outside diameter of the main cable. This is very important. The secret of the conductivity of this joint is accuracy of mechanical fit, and unless this can be secured the result will not be as satisfactory as would otherwise be the case.

THE WESTINGHOUSE NO. 93 RAILWAY MOTOR

The Westinghouse No. 93 railway motor, which supersedes the No. 56 motor, retains the features which have made that motor so successful, but also has a number of improvements as the result of further experience and study in the development of railway motors. It is designed to meet successfully the increasingly rigid demands of the city, suburban and interurban service to which it is adapted.

In city service a double equipment of these motors is suitable for operating single or double-truck cars of almost any size ordinarily used—that is, cars not exceeding 35 ft. to 40 ft. over-all, and weighing, without equipment or load, from 23,000 lbs. to 30,000 lbs. In this service, with runs from ⅛ mile to ¼ mile in length, a two-motor equipment with a gear ratio of 16 to 71 will produce a schedule speed of 10 m.p.h. to 13 m.p.h., assuming a pressure of 500 volts and a straight level track. In suburban service a four-motor equipment will operate cars from 40 ft. to 45 ft. over-all, and weighing from 30,000 lbs. to 35,000 lbs. without equipment or load. In this work, the average load being from ¼ mile to ¾ mile, the four-motor equipment will maintain an average speed of approximately 17.5 m.p.h. with gear ratios of 19 to 68 under the conditions previously stated. In interurban service, with an average run of from ¾ mile to 1½ miles in length, and with equipment and



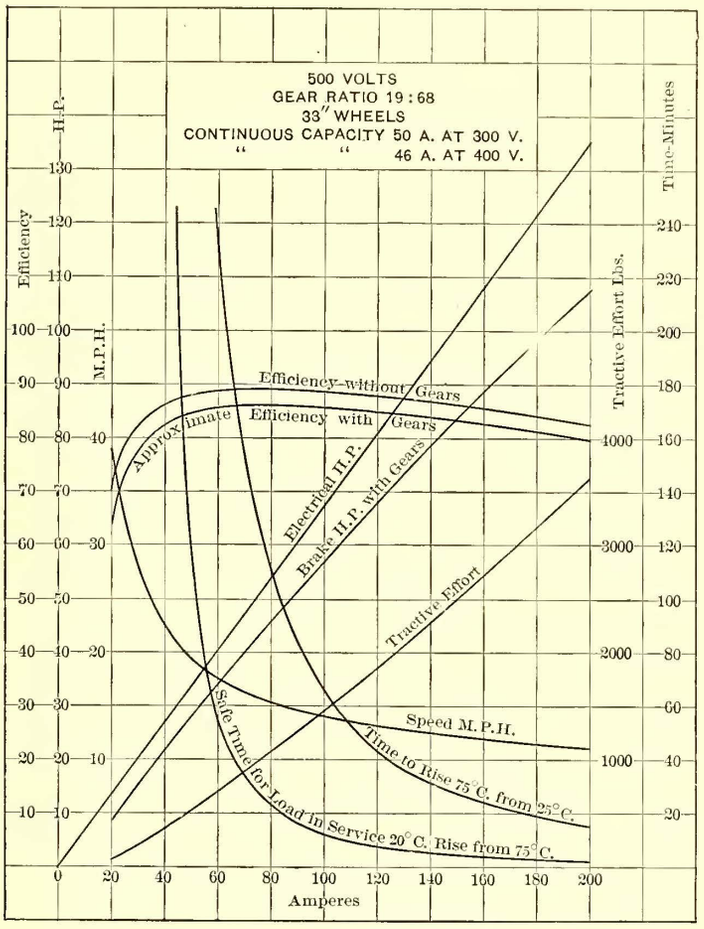
NO. 93 RAILWAY MOTOR, FIELD CLOSED

weight of car as above, schedule speeds of 23.5 m.p.h. to 28.5 m.p.h. may be attained.

The general performance of this motor is shown by the curves herewith. The motor has a nominal capacity of 50 hp at 500 volts for one hour. The curve sheets show the speed, tractive effort and the brake horse-power which it will develop with currents of from 0 amp. to 200 amps. at 500 volts, also a time-temperature curve.

The motor has a continuous capacity of 50 amps. at 300 volts, or 46 amps. at 400 volts. Under the usual conditions of railway service, it will carry safely any loads within the range shown on the curve sheets, provided that the integrated heating effect does not exceed the heating effect caused by the continuous application of the above currents at the corresponding voltage.

In a shop test at either of these loads, the rise in temperature

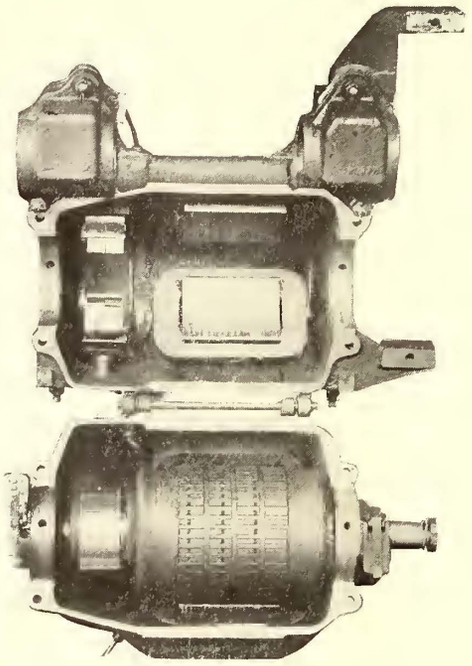


PERFORMANCE CURVES

of the windings of the motor during an all-day run will not exceed 75 degs. C., as measured by thermometers. With the motors mounted under a moving car, much better ventilation is obtained than in a shop test, and thus the temperature rise in service with the equivalent of these loads should be considerably less, and will usually not exceed 55 degs. C. For short periods, such as the rush hours of service, the motor may be operated with loads in excess of its continuous capacity, and under these conditions it will reach a temperature higher than the above, though still within safe limits. The time-temperature curve shows the allowable amount and duration of such loads. The curve is based upon a rise in temperature of 20 degs. C. in the interior of the coils under service conditions, after the motor is already heated to its ordinary running temperature. Thus, if the motor has been working for ten or twelve hours at a load equivalent to 47 amps. at 300 volts, and has attained a temperature of 55 degs. C. above the air, it may then, as shown by the time-temperature curve, carry loads equivalent to a continuous current of 110 amps. for ten minutes, with a further increase of not more than 20 degs. C. If at the end of this period the load is again reduced to the equivalent of 50 amps., the temperature will then gradually fall off to its former value of 55 degs. C. above the air. The time-temperature curve thus shows what may be termed the safe overload capacity of the motor.

The frame of the motor is of cast steel in two parts; it is roughly cylindrical in shape, and is divided in a plane through the axis of armature shaft and car axle. The two halves of

the frame are hinged together on one side, and are further held together by four bolts. The edges of the castings are carefully milled, so that a good joint between them is secured. All the working parts of the motor are enclosed by the field castings, and so are entirely protected. The hinges are placed on the side furthest from the axle, and the lower frame may be swung downward, to allow of inspection or repair of the field. If desired, the armature may be swung down with the lower frame, or retained in the upper part. This arrangement makes every part of the interior of the motor perfectly accessible. To give access to brushes and brush holders, there is a large opening in the upper casting over the commutator. This opening is closed by a malleable iron lid, which is made dust-proof by a felt washer riveted to its edge, and is held in place by a cam-locking device at each side. This cover may be removed when the conditions permit and the motor run open, with better ventilation and consequent increase of capacity. For cleaning and inspecting the lower field there is a hand hole in the lower frame under the commutator, and at the pinion end a peep hole for observing the wear of the bearing by noting the clearance between armature and pole piece. These openings are covered and made moisture-proof by malleable iron covers and rubber gaskets.



FIELD OPEN, SHOWING ARMATURE

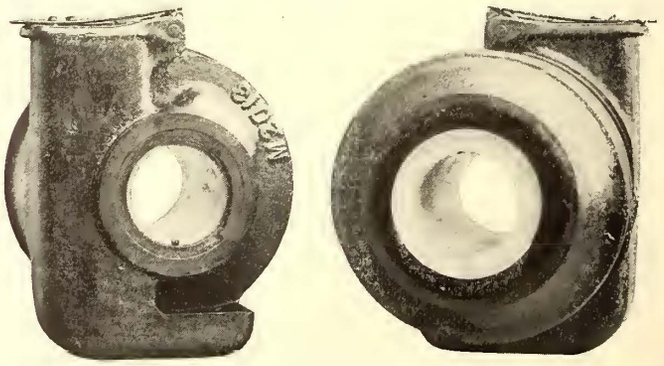
The four pole pieces are built up of soft steel punchings riveted together between wrought-iron end plates. They project radially inward, at angles of 45 degs. with the horizontal, and each is fastened to the frame by two bolts secured by lock washers. These bolts penetrate well into the stampings, but do not pass entirely through, thus leaving a smooth, unbroken pole face. The poles have projecting tips, which serve the double purpose of giving a proper distribution of magnetic field and retaining the field coils. The latter are held rigidly in place and all vibration is prevented by flat steel springs placed between the coils and the frame. The coils are formed of copper strap wound on the flat, the turns and sections being insulated from each other by treated asbestos sheets. The coils are heavily taped and repeatedly dipped and dried, and impregnated with special insulating compounds, which makes the entire coil moisture-proof and practically indestructible.

The armature core is made up of soft steel punchings, built up on a cast-iron spider. Air ducts are provided between the punchings, which connect with ventilating spaces in the spider; this arrangement provides an excellent circulation of air, resulting in a uniform temperature, which is the best condition for the radiation of heat. The armature is wound with machine-formed coils, carefully insulated and embedded in the slots. They are held in place by fish-paper wedges forced in between V-shaped grooves near the top of each slot, and also by band wires. Canvas caps are fitted over the front and rear ends of the coils, so that the entire winding is absolutely protected from any dust or dirt from the street or other sources. On the pinion end of the armature spider is a bell-shaped flange, upon which the windings rest. The entire winding is especially well protected from dirt, moisture or mechanical injury. Wiper rings pressed on the shaft outside of the armature revolve in spaces inside the bearing boxes and prevent oil from working along the shaft to the commutator or winding.

The commutator is of the straight bar type, without neck. The wearing surface is 10¼ ins. in diameter x 4 11-16 ins. long, and the wearing depth is about ⅞ in. There are 135 bars of hard-drawn copper, insulated with specially prepared soft mica, and built up and clamped on a cast-steel bushing.. The commutator bushing is then forced on the armature spider and securely keyed to it. This arrangement prevents any vibration between the commutator and armature core, which so often causes broken leads and short-circuits; it also allows the shaft to be removed if necessary without disturbing the connections or relative position of armature core and commutator.

The brush holders are of the sliding type with shunts. Two cast brass arms, well insulated with treated fullerboard are fastened by insulated bolts to the upper frame. The arms are arranged for radial adjustment to allow for commutator wear. Each arm carries two spiral phosphor-bronze brush springs, each of which bears upon a brush; the two brushes are placed side by side in the slot, each extending half way across the commutator. This arrangement reduces the inertia of each moving element and allows it to follow the surface of the commutator very closely, avoiding any sparking due to "chattering." The brushes are of copper-plated carbon, and each is connected to the holder by a shunt of braided copper, thus preventing any heating of the springs and consequent variation in pressure, such as would occur if the current passed through the spring. The brushes are ½ in. x 2 ins. in section and 2¼ ins. long. The leads are of flexible rubber insulated cable, and are brought out through insulating bushings of semi-soft rubber, set in the frame. All outside connections are made with knuckle joints.

The bearings for the armature shaft consist of solid cast-iron shells lined with babbitt metal. They are carried in cylindrical housings of cast iron, held between the halves of the frame. The housings have finished flanges on their inner ends, which are clamped between finished surfaces on the field frames; they are held from turning by tap bolts in both the upper and lower frames.

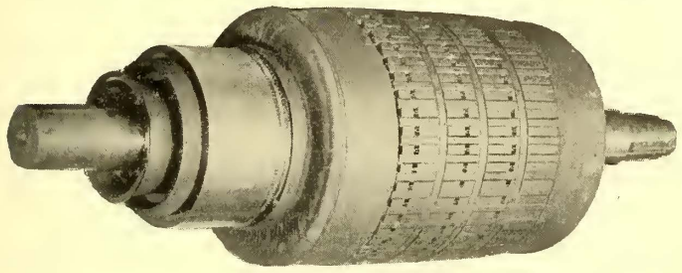


BEARINGS AND BEARING HOUSINGS OF NO. 93 RAILWAY MOTOR

Lubrication is obtained by oil and waste. The bearing housings contain oil and waste reservoirs which extend around one side and below the armature shaft, and allow the saturated waste to come in contact with the shaft through large openings in the low-pressure side of the bearings. Separate oil wells are provided, so that oil can be added in quantities to the bottom of the waste. The free oil can also be gaged. This method of lubrication is similar to that used in car-journal boxes in interurban and steam roads; the bearings are thoroughly

lubricated and the amount of oil used is extremely small. The inner ends of the housings are extended to include the wiper rings, so that oil thrown off by these rings is drained directly into separate wells at the bottom of the housings. The armature bearing at the commutator end is 6 11-16 ins. long, with a 3½-in. bore, and at the pinion end 8 7-16 ins. long, bored for a 3¾-in. shaft.

The armature shaft is made of medium grade open-hearth steel, and is unusually strong and heavy. The axle bearings consist of cast-iron bushings in halves, lined with babbitt metal. They are 11 ins. long, and may be made for a shaft of any diameter not exceeding 5½ ins. These bearings are held between projections from the upper frame and caps of cast steel bolted to these projections. These caps may be taken off, and axle and wheels easily removed. Lubrication of the axle bearings is by oil and waste, as in the armature bearings. A large reservoir with an opening through the upper frame is located in each axle cap, and feeds the axle through an opening in the lower half of the bearing.



ARMATURE OF NO. 93 RAILWAY MOTOR

A rectagular suspension bar supported on the truck frame is belted to special lugs on the front corners of the upper field frame. The pinion is of forged steel, with machine-cut teeth, and is taper-bored to fit the shaft. It is held in place on a tapered seat by a 2½-in. nut and lock washer, and is secured by a steel key. The pinion is countersunk to receive the lock washer, so that the end is flush. The gear is of cast steel, in two parts, which are bolted together and keyed to the axle. The face is 5 ins. wide. Gear ratios of 16:71 to 30:57 may be used; 16:71, 19:18, 24:63 and 30:57 are standard.

The gear case is made of malleable iron in two castings, divided in a plane passing through the axis of armature shaft and axle. The two parts are fastened together by lugs and bolts, and at front and rear ends to extension lugs in the upper field frame. This arrangement is particularly good, as no strains can be thrown on the gear case by vibration between upper and lower castings, the case being fastened to only one half. The supporting lugs are especially strong and heavy. The gears may be run in oil if desired.

Every part of this motor is rigidly tested while in process of manufacture, and after being assembled, a run under full load is made on every motor, in addition to a "break-down" test of the insulation, at an alternating potential of 3000 volts.

The approximate weights are as follows: Motor, without gears and gear case, 2975 lbs.; motor, complete with gears and gear case, 3335 lbs.; armature, complete, with a commutator and shaft, 1005 lbs. The approximate weight of a two-motor equipment with two controllers and the usual details is 7870 lbs. A corresponding equipment of four motors, controllers, etc., will weigh approximately 15,940 lbs.

Beginning Feb. 15, eight evening lectures on electric traction will be given about every two weeks by Professor Louis Duncan at the Polytechnic Institute, Brooklyn, N. Y. The first lecture will cover general considerations of load and cost factors.

AUTOMATIC SPRINKLERS FOR CAR-HOUSES

Recent car house fire tests at Cleveland, Ohio, and Newark, N. J., again have demonstrated the fact that the use of properly distributed automatic sprinklers will not only prevent destructive fires, but will also effect a very great saving in insurance rates. Similar results of other tests within recent years have made sprinkling devices more and more popular. A prominent type of this kind of apparatus is the Grinnell automatic sprinkler, made by the General Fire Extinguisher Company, Providence, R. I. The special purpose of this sprinkler is to arrest a fire in its incipiency through the agency of the heat of the fire itself.

The arrangement of the system consists of lines of pipes carried through the building, near the ceilings, from 8 ft. to 10 ft. apart, all connected with a larger pipe leading from any source of supply that will keep the water in the pipes under pressure. To each of the lines of pipe, and about 8 ft. apart, the automatic sprinklers are attached. Should a fire start at any point, the heat at once rises to the ceiling, where the temperature is very soon raised sufficiently to melt the fusible solder. The valve of the sprinkler is then released and the water is profusely distributed on the fire. The arrangement of the piping can readily be made to suit buildings of different plans of construction.

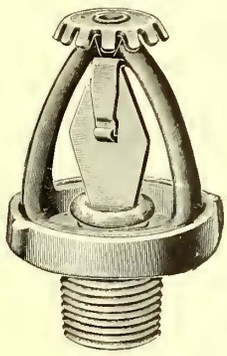


FIG. 1.

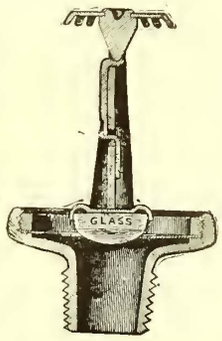


FIG. 2.

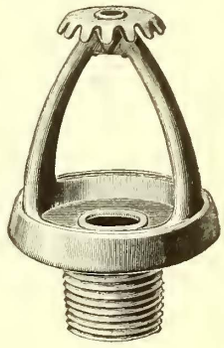


FIG. 3.

Fig. 1 is a view of the sprinkler closed. Fig. 2 gives a sectional view. Fig. 3 represents the sprinkler open for the discharge of water. A solid ½-in. stream impinging upon the deflector spreads in a profuse shower in all directions. Each figure is one-half the actual size.

The peculiar and distinctive feature of this sprinkler is that the valve is seated on a flexible diaphragm, and is so securely and ingeniously held in position as to relieve the low-fusing solder of nearly all strain. The valve seat is forced against the valve by the water pressure, and by reason of this construction the pressure of the water tends to tighten the valve. The further purpose of the flexible diaphragm is to cause the valve and its seat to move simultaneously outward until the solder joint is completely severed. Were not this opening kept closed until the solder joint is entirely broken, a slight escape of water would cool and reset the fusible solder when the valve is but slightly open, and thus defeat the working of the sprinkler. The hard metal key in the solder joint prevents the gradual yielding and accidental rupture of the fusible solder. These three important features, viz., tightness, certainty of action and security against water damage by the breaking of the solder joint, are stated to be embodied only in the Grinnell.

The valve proper is a hemispherical disc of glass, with a perfectly smooth fire glazed surface; it is at once non-corrodible, non-adhesive and impenetrable. Seated on the edge of a flexible aluminum bronze diaphragm and, moreover, being held in a state of tension, it is made to exert a constant and positive force, which severs the valve from its seat when the solder melts, and thus overcomes the acknowledged danger of failure by the sticking of the valve to its seat.

The valve of the sprinkler is held to its seat by a strut composed of three pieces, joined together by fusible solder. These are the only parts of the sprinkler required to move to liberate the valve. It is plain that no corrosion can take place to prevent their movement and that the solder actually lubricates them when it melts. To retard the fusible solder and the valve-holding strut from being destroyed by corrosion, the entire sprinkler may be protected with an acid-proof coating. The company's "corroproof" is offered for this purpose.

When the solder which joins together the three pieces composing the strut is softened by the heat of a fire (melting point usually 155 degs. F.), the strut falls apart, and the glass valve no longer held to its seat is thrown off by the spring of the diaphragm, aided, of course, by whatever water pressure there may be within the sprinkler. The escaping water impinges upon the deflector and is scattered in all directions in the form of spray.

Early forms of the sprinkler were roseheads, or hollow, perforated, spherical-shaped bodies, through which the water was

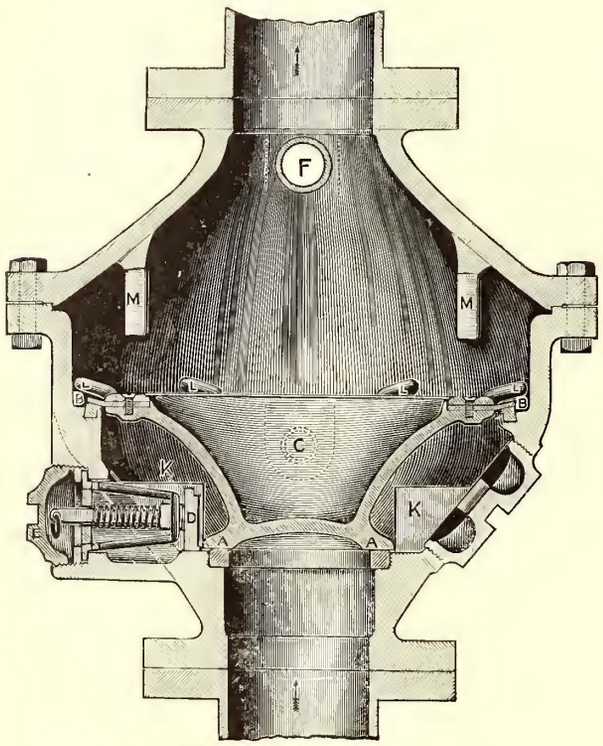


FIG. 4.—SECTION OF DRY PIPE VALVE

sprinkled upon the fire, but experience soon disclosed the fact that such small openings would be stopped up by the dust in the rooms, or when discharging by the sediment in the pipes. The construction in the Grinnell type consists of an open outlet ½ in. in diameter, and a deflector or splash-plate by which the stream of water is broken into spray and effectively distributed on the ceiling above and on the floor below each sprinkler.

The company also manufactures a dry pipe automatic sprinkler system and fire alarm, for the protection of buildings where water in the pipes would freeze.

In this system, the Grinnell valve intervenes between the outside water supply beyond the reach of frost, and the system of sprinkler pipes within the building. Air under moderate pressure within the sprinkler pipes keeps this valve closed and thus excludes the water. The opening of one or more sprinklers in case of fire lets the air out of the sprinkler pipes, and the valve is at once opened by the outside water pressure; an alarm is rung, and the water instantly fills the sprinkler pipes and is discharged upon the fire in a profuse shower from every unsealed sprinkler. It is entirely free from the complications caused by having secondary automatic apparatus, such as electric circuits, systems of wires with fusible links, or systems of small pipes provided with fusible openings, all of which are liable to get out of order.

The operation of the dry-pipe valve and alarm will be readily understood by referring to Fig. 4, showing a cross section, in which *A* is the valve closing the water inlet; *B* the air valve, consisting of a rubber ring on a block tin seat, and a check valve so constructed that it allows any slight leakage of water past the valve *A* to flow out through a drip pipe, and is automatically closed by the pressure of water in the intermediate chamber between valves *A* and *B*, when the valve *A* opens. *D* is a latch which prevents the valve *A* from closing by its own weight, or by the water column in the sprinkler pipes after it has once opened. *E* is a plug for access to latch *D*. There is also a draw-off valve and pipe for emptying the entire system of sprinklers and piping, and a valve used for the purpose of ascertaining that the system of sprinklers and piping is free of water down to the level of the draw-off pipe. A pressure gage is used to indicate the pressure of air in the sprinkler system. This gage is attached to a pipe which connects the intermediate chamber between the water valve *A* and the air valve *B* to an electric alarm attachment. When the valve *A* opens, the full water pressure enters through the pipe to the electric alarm attachment, and the pressure upon a flexible diaphragm closes a circuit and sounds a continuous electric alarm. Or, the pipe may be connected to a water motor alarm and made to sound a continuous mechanical alarm. *J* is a hand hole plug for access to the valves *A* and *B*. *KK* are guides for the valve *A*. *LLLL* are guides for the valve *B*. *MM* are stops to limit the movement of the valve.

In the opinion of the manufacturers, a dry-pipe system should not be filled with water during warm weather. By alternately filling and emptying the pipes and sprinklers, it is certain that more or less sediment will be carried into them and, further, the pipes will be rusted by the fresh supply of water. Moreover, there is a liability of unintentional neglect of the system by changing it at the end of each season; whereas, if the air pressure is constantly maintained in the pipes and sprinklers, it is absolutely impossible for anything to occur which can interfere with its action in case of fire.

This matter, however, has always been left for decision to the underwriters. The Stock Insurance Companies, as represented by the National Fire Protection Associaton, require that dry-pipe systems shall not be filled in warm weather, while the Associated Factory Mutual Fire Insurance Companies require that they shall be filled, relying upon frequent special inspections to guard against any trouble that may come from alternately changing the system.

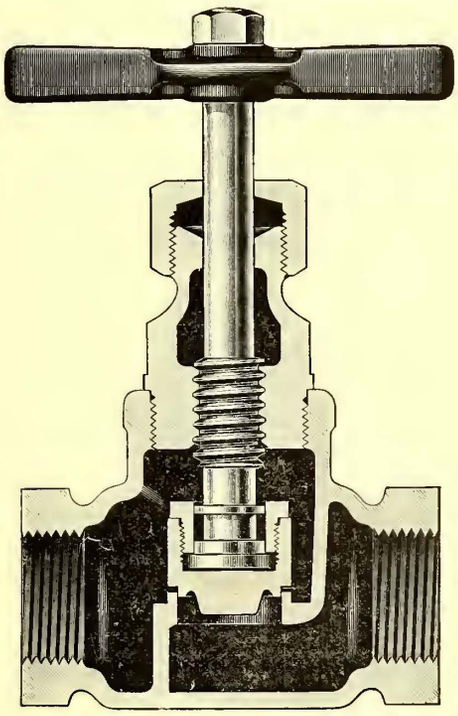
BLIZZARD TIES UP TRAFFIC IN NEW YORK

The new year came in like a lion for the street railway companies in the East. Jan. 2, the legal holiday, saw the volume of traffic reduced by a most disagreeable rain storm, which, in the vicinity of New York, was followed by a heavy fog. This fog lifted before Tuesday morning, but all along the Atlantic a storm threatened. It came, too, early on Tuesday in the shape of hail. The temperature fell rapidly, the wind increased, and early in the afternoon it was apparent that traffic would suffer. Little was it thought, however, at that time that transportation, both land and water, would in a few hours be practically at a standstill. But this proved to be the case. The snow was whirled in great drifts, and before midnight on Tuesday efforts were abandoned in some places to keep lines in operation. This was the case with both city and suburban companies. For more than two days not a car was operated on some of the old horse car lines in New York, and in Brooklyn and other cities it was noon on Wednesday before all the lines were in regular operation. The fall of snow was fully 9 ins.

THE HANCOCK VALVES

The globe, angle 60-deg. and cross valves, manufactured by the Hancock Inspirator Company, New York, are made screwed and flanged in sizes up to 3 ins., of special composition, giving great strength and resistance to wear. They are made one standard only, for all pressures. Under actual test, the bodies of these valves are said to stand a pressure of 4000 lbs. per square inch without breaking, are tight, with a water pressure of more than 1000 lbs. per square inch, and are guaranteed for 500 lbs. steam pressure. That the valve seat may be hard and durable, the body is made of a specially hard and tough mixture. The discs are of a composition which does not contain any zinc. The spindles are all made of Tobin bronze, as the manufacturer's experience has demonstrated that a Tobin bronze spindle working in a special composition bonnet will not cut under the highest steam pressures.

These valves are made after the same general design as the Hancock main steam valves, used on locomotives for a number of years, and found to give perfect satisfaction with the high steam pressures carried. From the sketch shown herewith of



SECTION OF GLOBE VALVE

a 1-in. globe valve, it will be seen that the area of the most contracted part of the valve is ample and of full size. All valves sent out have tee handles.

The metal is distributed to give uniform strength throughout, and no areas have been reduced or contracted to reduce weight. Two collars are placed upon the stem to guide the disc nut, thereby compelling the disc to always seat squarely and absolutely preventing the disc from cocking. The valve seat is flat, as that form has many advantages over any other used in valves of this character. The valve disc has a projection on it which serves two purposes; it acts as a guide when the seat is ground, and the lip or projection on the disc prevents the cutting of the seat by the wire drawing of the steam when the valve is cracked or slightly open.

When the valve is slightly raised from its seat, with the lip entering slightly, it allows the escaping steam to clean the seat, so that when the valve is seated all dirt and foreign matter has been washed or blown completely off the seat. This is a most important feature, as experience has fully demonstrated that when the Hancock valve begins to leak it requires a very little regrinding to make it tight. The bonnets of these valves are made with a long thread engaging the body of the valve, and the shoulder on the bonnet is made narrow. By means of this narrow seat on the shoulder it is possible to keep the bonnet tight, and when it is desired to unscrew the bonnet it can be easily done. This is considered an improvement over the form of bonnets having a wide shoulder bearing upon a wide surface on the top of the body of the valve. When it is necessary to regrind the valve to its seat, the bonnet is removed, the disc nut unscrewed from the disc and a piece of wood can be inserted in the disc, enabling it to be ground perfectly as the projection on the disc guides it, it being unnecessary to have any special regrinding tools for this purpose.

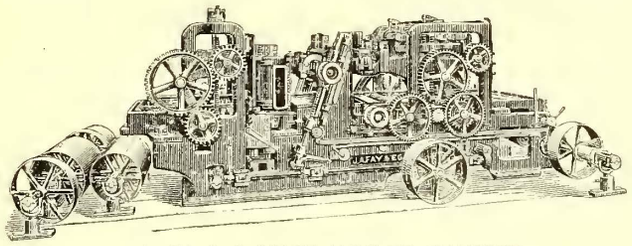
TRACK SCRAPERS IN GRAND RAPIDS

Since the subject of snow and sleet removal is a very important one at this season, it may be interesting to railway men to report that the Grand Rapids (Mich.) Railway Company equipped thirty of its cars last winter with track scrapers manufactured by the Root Scraper Company, Kalamazoo, Mich. The company had many occasions to put them to severe tests, but they proved entirely satisfactory, and as a result the management ordered twenty scrapers more for this season. It believes that these scrapers are first-class in every respect.

DOUBLE-CYLINDER TIMBER DRESSER

The J. A. Fay & Egan Company, of Cincinnati, Ohio, has been giving special attention toward the development of woodworking machinery for car shops, and has designed, among other machines, the double-cylinder timber dresser shown herewith. This is a powerful machine with roll feed, able to plane and joint dimension timbers on four sides at once. It is also serviceable for every variety of heavy planing.

The machine is solidly constructed to prevent vibration when working to its full capacity. It will plane timbers on two or



DOUBLE-CYLINDER TIMBER DRESSER

four sides to 30 ins. wide and 20 ins. thick, or two sides and one edge of two timbers, each 13 ins. wide and 20 ins. thick. The feeding mechanism consists of six rolls, the two in front being divided and center geared, insuring a very powerful drive, and allowing two pieces of uneven thickness to be planed at once. The rolls easily raise and lower; all upper rolls are driven down, to insure a powerful drive, and the feeding out one is geared on both ends. The lower feeding-in rolls are mounted on inclines, and can be lowered 1 in. below line of bed for dividing an extra heavy cut between top and the bottom heads. The lower cylinder is placed between the top cylinder and feed rolls; has independent vertical adjustment, draws out for sharpening or changing knives, and is belted from the feeding-out end. The pressure over the lower cylinder is by four large rolls, each having an independent lift. The upper cylinder is raised and lowered by hand or power. The hoisting mechanism operates from the feeding-in end, and all parts are arranged to operate together, or the upper cylinder and feeding-out rolls can be disconnected and parts raised by hand. The feed is controlled from the side or front.

This machine is also made a size smaller to plane 20 ins. wide or 30 ins. wide x 16 ins. thick, and is called No. 125.

LONDON LETTER

(From Our Regular Correspondent.)

One of the most interesting decisions that has recently been arrived at in London is that which the directors of the London, Brighton & South Coast Railway Company have come to in respect to their electrification scheme, which they have now been considering for about two years. This is the railway of which Mr. Philip Dawson was appointed consulting electrical engineer some years ago, and we understand that a most elaborate report on the subject of the electrification of a part of its intricate system in the vicinity of London has been prepared by him and presented to the directors. It has now been decided that about 4 miles of the line between Battersea Park and Peckham Rye will be electrified in the immediate future, and tenders will be invited from some of the best known electrical manufacturing companies for the necessary apparatus, equipment and construction. As is well known, Mr. Dawson has been strongly advocating for some time the high-tension, single-phase system for railway electrification, and this is the system which will be adopted on the section of the railway referred to above. As we have said, the decision has not been a hasty one. The scheme has been under consideration for over two years, and every possible contingency has been carefully investigated, and the details of construction have been thoroughly gone into and developed. Most elaborate calculations have been made regarding the traffic conditions, expense of construction, comparison of conditions of this single-phase system with the three-phase and direct-current third-rail systems, and it is a matter of the greatest interest to find that the directors have decided in favor of the high-tension single-phase system. As very little railway work has been done on this method, it has involved an immense amount of labor in developing the details of construction, and as the voltage will be 6000 volts, not only on the trolley wire, but also in the cars, it will at once be seen that the details in perfection of a system of this kind have involved many new features. It should be understood, however, that this line will be an experimental one, and though an important line in many respects, it is, at the same time, an inter-connecting link between main lines, so that should accidents occur it will not have a serious effect in dislocating the regular traffic of the Brighton Railway. It is not a necessary track either for goods traffic, so that the section to be electrified is extremely suitable for this experiment. After a reasonable time, and when its success has been proved, extensions will be made to Victoria Station on the one hand and to London Bridge on the other hand, so that the usual circle trains from London Bridge to Victoria would be operated by electricity throughout. In the meantime, shuttle trains from both stations would communicate with the electric trains until the time of experimentation is completed.

At the invitation of Messrs. J. G. White & Company a week or two ago a party of journalists representing the electrical and engineering technical papers in London, were invited to go to Amsterdam to see the electric railway which this firm have recently completed between Amsterdam and Haarlem. The party left on Friday evening by way of Harwich, and the Hook of Holland, arriving in Amsterdam on Saturday morning. They were accompanied by Mr. Murphy, of J. G. White & Company, and met at Amsterdam A. N. Connett, their chief engineer, who personally conducted the party over the whole line. The company operating the line has made arrangements with the Amsterdam Municipal Tramways, so that the Amsterdam-Haarlem Tramways start from the center of the city of Amsterdam and run along the military road about 10 miles to Haarlem, where they have also made arrangements with the Haarlem tramways to run over their system. The line continues beyond Haarlem to the second most important seaside place in Holland, Zandport, so that it is anticipated that in the summer time a large business will be done carrying the residents of both cities to this charming old seaside resort. A full description of the system will be found in another column, so that it simply remains for me to say here that the arrangements for the trip of the journalists were everything that could be desired, and one and all agreed that they had had not only a most interesting but also a most agreeable trip as the guests of Messrs. White & Company, and the cordial thanks of the party were extended to Mr. Connett and to Mr. Murphy for their great kindness.

It is interesting to note in this first issue of the year, that the electrification of the old underground railways of London, namely, the Metropolitan and the Metropolitan District Railway, is within measurable distance. For more than a year gangs of men have been at work all over the Inner Circle, and the laying of the third rail and the return rail over both the Metropolitan and the District portion of the Inner Circle is practically completed. The laying of the feeders, and much of the necessary work in connection with the electrification scheme is also in a very advanced state, and it would be quite possible within a few weeks now to run experimental trains on the Inner Circle. It will, however, probably be a few months yet before any electrical service is offered to the public as certain connecting links have yet to be completed between the power house and the sub-stations, though it is moderately certain that before the summer is reached electric trains will have entirely displaced the steam trains now in service, and the old underground railway will take on a complete new lease of life, the old regime of smoke, dirt and discomfort being entirely banished. The District Railway has had electric trains in service on the outer branches of its system for some time. The Metropolitan Railway has also had electric trains running on the Harrow and Uxbridge line, and recently completed the work from Harrow to Baker Street, so that the managers were enabled to invite a party of friends to travel by electric trains from Baker Street Station to Uxbridge on a brand new electric corridor train provided with all the modern comforts which travelers are rapidly coming to associate with electric railways. The guests were received by Sir Charles McLaren, M. P., the chairman of the Metropolitan Railway Company, and Sir William Birt, Lieutenant-Colonel Probyn, and Mr. Light, directors of the railways, together with Mr. A. C. Ellis, the general manager, and Mr. Thomas Parker, the electrical engineer to the railway and many other of the chief officers of the company were in attendance. In the course of a few remarks after luncheon, Sir C. McLaren expressed his regret that on this particualr occasion it would not be possible to show them the generating station at Neasden which had been equipped by the British Westinghouse Company, but stated that the cars on which they were to make their first public trip had all been built by the Metropolitan Amalgamated Railway Carriage & Wagon Company of Oldbury. He expressed great hope that when the old tunnels of the Metropolitan track were thoroughly cleaned up, and when the electric system was put into actual service, a greatly increased traffic would result. The trip in the train from Baker Street to Uxbridge, a distance of 18 miles, was accomplished in about 40 minutes, though no attempt was made to cover the distance at any high rate of speed. The guests were highly delighted with what they saw, and it is perfectly evident to any one that with the completion of the electrification scheme both the Metropolitan Railway Company and the Metropolitan District Company will once more enter into the transportation problem of London as extremely strong factors. In connection with this electrification scheme questions have frequently been asked as to what arrangements will be made for the running of the trains which other railway companies operate over the tracks of the underground railways, such, for instance, as the North Western Railway trains which run one about every half-hour between Broad Street in the city, and Mansion House, also in the city, making the circle by way of Willesden Junction. It appears that the Metropolitan Railway and the Metropolitan District Railway have made very satisfactory arrangements with these different railways which have running powers over the system. In the case of the North Western Railway Company its trains will remain as before, but at Earl's Court, where these trains first enter the tunnel, the steam locomotive will be detached and an electric locomotive attached to draw the train the remainder of its journey. It is extremely probable that the other railways with similar powers will make somewhat similar arrangements, so that when the regular service of the Inner Circle comes into effect no steam locomotive will be permitted in the tunnels when they have once been thoroughly cleansed from the fumes and smoke which have been polluting them for the past quarter of a century.

Perhaps the largest single contract which has ever been given out in Great Britain has just been placed by the Belfast Corporation for the electrification of its tramways, the exclusive contractors being Messrs. J. G. White & Company, Ltd., of London. The whole work amounts to about £543,000, and the contract is divided into five sections. Section No. 1 consists of the permanent way, which amounts to 28½ miles of double track, and 2 miles of single track, together with about 8 miles of double track repairing and bonding only. The rails are B. S. Nos. 4 and 4C, and will be laid on a concrete bed 7 inches thick, and all the paving in connection with the work will consist of granite sets. Section No. 2 consists of 37 miles overhead construction, mostly span wire, the trolley wire being No. 0000 S. W. G. Section No. 3 consists of cables comprising feeders, telephone and test cables, all of which will be laid on the solid system in earthenware troughs, filled in with bitumen, the insulation to be made of vulcanized bitumen. Section No. 4 consists of the engines, dynamos, switchboard, condensing plant, etc., and will comprise three engines and dynamos direct current of 1000 kw each, at 180 r. p. m. There will be in addition two 125-kw and two 250-kw 3-phase motor generators, besides a 25-ton crane, and all the usual equipments for a power house. Section No. 5 consists of a boiler house, containing superheaters, mechanical stokers, condensers, coal and ash conveying plant, and the

usual piping. The boilers, which are four in number, will work at a pressure of 170 lbs. There has been long and contracted discussion over this contract, considerable pressure having been brought to bear on the tramway committee to divide the contract up among various contractors, but after a full consideration of the matter it was voted to have only one contractor responsible for the whole works, so that Messrs. J. G. White & Company are the sole contractors to be employed in this vast electrification scheme. It is understood, however, that the sub-contractors for the engines will be the local firm of Combe, Barbour & Company, and the British Westinghouse Company has received a sub-contract for the engines, dynamos and equipment, while the cars will be manufactured by the Brush Electrical Engineering Company Messrs. J. G. White & Company hase also just concluded a contract in Montevideo, South America, of 51 miles of permanent way with the accompaniment of overhead construction, and 100 cars for installation on this system. The power station will contain generating sets to the extent of 2000 kw, and the value of the contract, of which Messrs. J. G. White & Company are engineers and contractors, exceeds £400,000. They have also recently secured the contract for the Mansfield & District Light Railways, amounting to about £48,000, the consulting engineers for this work being Messrs. Bramwell & Harris. It will thus be seen that Messrs. J. G. White & Company have closed quite recently work amounting to about £1,000,000.

It is announced that The American Car & Foundry Company has acquired a site in Trafford Park, Manchester, for the purpose of erecting large works for the manufacture of railway cars. This company already possess fifteen large works in the United States, and its daily "output" is more than three hundred cars. The company has just undertaken a contract for the supply of the railway cars for the Baker Street & Waterloo Underground Railway in London. All these cars will be built and finished at the new establishment in Trafford Park. The only portion of the work which will be imported will be the steel work, which will be received in a finished state. The remainder of the work will be done in England, and will necessitate the employment of local labor to the extent of £15,000 to £20,000. Although the land at Trafford Park was only acquired recently from the Trafford Park Estate, limited, the company expects to have the workshops erected and the necessary equipment installed so as to commence delivering the finished cars early in March.

The improvements committee of the London County Council has given notice that it will ask the Council to approve of estimates amounting to £314,550 in respect of improvements for tramways in the neighborhoods of Forest Hill, Catford, Lewisham and Greenwich.

There appears to be some prospect that in the next session of Parliament there will be a renewal of the struggle on the question of granting to a tramway company compulsory powers over lines owned and worked by a municipality. It will be remembered that during last session after a long fight, the Newcastle Corporation were obliged to grant running powers to the Tyneside Tramways Company. The arrangement is now in force, and is working excellently. It has brought a great increase of traffic both to the company and to the Corporation. The Blackpool, St. Annes and Lytham Tramways Company, encouraged by this example, is seeking compulsory running powers over the tramways of the Blackpool Corporation. The company offers the Town Council similar facilities over its line to Lytham. The remarkable thing is that some local authorities should still adhere to an absurd spirit of exclusiveness which necessitates companies bringing forward Parliamentary bills to obtain running powers. In numerous cases such powers have been arranged by amicable agreement, but where local authorities are pig-headed the convenience of the public, as well as the interests of the tramway companies concerned call for some simpler and cheaper method of obtaining compulsory powers than that of promoting private bills in Parliament.

The Bradford Tramway Committee has opened out a parcel express department for the convenience of traders, shopkeepers, and the public generally, the intention of this new department being to collect and deliver parcels within half a mile of any of the tram routes in Bradford. The railway companies (Midland, Lancashire and Yorkshire, London and North-Western, Great Northern, and Great Central) have appointed the department their accredited agents, and parcels are collected and delivered on their behalf. Parcels for the towns which have inaugurated a similar parcel express department, viz., Manchester, Edinburgh, Dublin, The Potteries, Halifax, can be dealt with satisfactorily. Passengers' luggage in advance will be collected on receipt of intimation with full particulars at the central or any of the sub-offices.

The Bury Corporation Tramway has also inaugurated a new departure in Corporation trading, namely, the collection and delivery of parcels throughout the system covered by the tramways. There was no formal inauguration, but tradespeople and others have already patronized the cars for the carriage of parcels. Briefly, the scheme provides for the collection and delivery of parcels up to 28 lbs. weight, the minimum charge up to 7 lbs. being 2d, with 3d for 14 lbs. and 4d for 28 lbs. Conductors of cars traveling into Bury are authorized to receive parcels at any stopping place, and these are conveyed to the central office for delivery or for forwarding by parcels, post or train, the railway charges being charged forward. The parcels will be delivered within half a mile of any part of the system, and will also be collected within half a mile for an extra 1d., and within a mile for an extra 2d.

In the Parliamentary Private Bill Office there was recently published the list of plans deposited in connection with private bills and provisional orders, which will come before Parliament next session. Compared with the 1904 session, the number shows a decrease of 48. Several tube railway bills will be promoted. The Central London Railway is bringing forward a scheme for new lines, and the other bills are promoted by the Baker Street & Waterloo Railway; Charing Cross, Euston & Hampstead Railway; Edgware & Hampstead Railway; Great Northern, Piccadilly & Brompton Railway (two bills); the Hammersmith City Railway, and North-East London Railway. Of the nine tramway bills, those affecting the Metropolis are the L. C. C.'s tramway bill, London Southern Tramways bill and the Metropolitan Electric Tramways bill. The L. C. C. is also promoting a general powers bill.

Lord Balfour, of Burleigh, has issued his award as arbiter in the question between the Corporation of Glasgow and the Paisley & District Tramways Company as to the amounts payable to and by the Corporation in connection with the running of tramway cars between Hawkhead and Paisley Cross. His findings are: (1) The Tramways Company to receive £250 from Glasgow Corporation on Dec. 1, 1904, for constructing the siding; (2) Corporation to pay the company whole fare received from local passengers, and two-thirds of a penny for each "through" passenger; (3) Corporation to receive from company 3 1-3d. per car mile for working expenses; (4) extra expense of checking tickets, etc., to be borne equally; (5) award to last till Dec. 31, 1914; (6) expenses incidental to the arbitration (i. e., arbiter's and clerk's fees, etc.), to be borne equally, and quoad ultra each party to pay its own expenses.

A scheme for an overhead electric railway from east to west above the Regent's Canal has been mooted. The canal runs for 10¾ miles through a populous commercial district from the East of London to Paddington. One of the leading officials of the Regent's Canal & Dock Company has stated that, although the canal company is not a promoter of it, it is aware of the details, and not averse to such a development of its property. As the route of the proposed line is open, it is pointed out that the cost of construction will be light.

The Metropolitan Electric Tramways, Limited, have opened for public traffic another extension of their electric tramways. The new line, which is about 5 miles long, and has double track throughout, runs from Cricklewood to Edgware. The electricity for working this line is supplied from the large generating station of the North Metropolitan Electric Power Supply Company, at Willesden.

We referred rather hastily last month to the formation of the Hastings & District Electric Tramways Company, which has recently been formed with a capital of £500,000 for the purpose of equipping Hastings & District with a first-class system of electric tramways. The system will also extend to St. Leonards and Bexhill in the immediate vicinity of Hastings, and will comprise about 20 miles of route. One of the most important features of this system will be that it has secured power to construct a line along the "front" of Hastings and St. Leonards throughout the whole length from Robertson Street to West Marina. As has already been stated, the company has entered into a contract with Messrs. Dick, Kerr & Company to install the whole undertaking, the total cost being in the vicinity of about £328,000. The whole work has got to be completed by July 30, 1905, so that work is being commenced at once. The consulting engineers for the work are Messrs. Kincaid, Waller, Manville & Dawson, and it will be remembered that this is a scheme in which Mr. William Murphy, of Dublin, has been interested in for some years. The want of electric tramways in Hastings has been felt for some time, as it is a municipal borough of over 65,000 people, and Bexhill, in the immediate vicinity, has a population of over 12,000. The provision for constructing a tramway line along the "front" of Hastings and St. Leonards is a valuable one, and this is the first time that power for a line of tramways along the "front" of any of the south coast watering-places has been granted. Dick, Kerr & Company are to be congratulated upon the receipt of this extensive contract, and as we understand that the work is to be done on a percentage basis it should prove not only satisfactory to the company, but to the contractors and engineers.

A. C. S.

PARIS LETTER.

Some months ago the Paris municipality addressed some enquiries to certain prominent electrical authorities concerning the adoption of a settled electrical policy for the town. The reason for this was that the many concessions for lighting granted by the municipality are approaching an end, having been granted for a limited term, and in view of the granting of future concessions for lighting, and also for traction, the need of a definite policy was strongly felt, and steps were necessary to ensure that the matter would not be dealt with from a niggardly standpoint. In addition, a technical commission, as already announced, has proceeded to the chief European and American centers to study transportation problems on the spot.

The municipality addressed themselves to the following well-known European authorities, apparently overlooking French concerns, a fact which did not fail to provoke protests from representatives of the latter: Siemens-Schuckert Company, Brown, Boveri & Company, Allegemeine Elektricitäts-Gesellschaft, Eric Gerard, and S. P. Thomson.

Replies from some of these have now been published. That of the Allegemeine Elektricitats-Gesellschaft includes a long and detailed study of the existing conditions, and among other things proposes that a large central station, sufficient for all the present and immediate future needs of Paris, be established by the municipality, who should then control the sale of current for lighting, traction and power required within the boundaries. A conservative estimate of the size of the station places it at 300,000 hp.

The French and German authorities have, in at least one locality, managed to agree sufficiently well to arrange for a joint tramway service over the frontier. The district is close to the Vosges, and at Schlucht the French part of the tramway installation is already in service. The grades are very heavy and the rack and pinion only just failed to be adopted. Over the German frontier at Gerardmer the line is now being installed, and the rack and pinion has been deemed necessary. The trams will run as far as the frontier in each case and the service on either side will be timed accordingly.

Marseilles is about to receive a rather extensive addition to its large traction system, and among other installations may be cited the towns of Blois and Ryes-Caen. Certain of the tramway concessions partake of the nature of light railways and allow for the carriage of passengers, parcels and goods, not at all a common arrangement on European tramways.

In Italy, the Adriatic Railway Company has applied for an authorization for the extension of its three-phase system on the Milan-Valtellina lines to Lecco and Usmate-Bergame. The new locomotives ordered of Ganz & Company and Brown, Boveri & Company for use on this line have already been mentioned in these columns.

The shareholders of the Spanish Thomson-Houston Company and the Allgemeine Elektricitats-Gessellschaft have recently met to discuss a scheme of fusion of their interests in the Peninsula. The former concern has recently obtained a prolongation of the concession for the Cadiz-Fernando tramway and will immediately start the installation. The rolling stock and equipments will probably be ordered in America.

At the recent Paris automobile fair no very novel applications were shown. A few firms, like the Hotchkiss, Westinghouse and Mercedes exhibited ball bearings for their new models, and some progress has been made in the direction of heavy delivery vans. In the electrical line, accumulator carriages claim a better efficiency, and the Kriéger Company exhibited some of its machines with electrical transmission consisting of engine, dynamo and motors, similar to that used on the omnibus recently developed by the General Electric Company, described in this journal, Oct. 29, 1904.

At Nivelles (Nord) where a line of 20 kilometers is to be installed, proposals have been asked for a single-phase system. Various proposals for a three-phase installation have been refused by reason of the complexities of such a system. In the meantime a part of the line has been put into operation with steam locomotives.

There are now several propositions for light railways between French and Spanish towns, crossing the frontier. The one recently put forward for Bagnères (Haute Garonne) is receiving the support of Spanish financiers and includes transport of goods and minerals as well as that of passengers between the several French and Spanish health resorts.

The Renard train consisting of leading motor-car with several trailers, which was described in the Street Railway Journal of Jan. 23, 1904, is now being tested on the roads between Dieppe and Rouen.

The New York City Railway Company ran its first car into Brooklyn over the Williamsburg bridge a few days ago, as an experiment to test the equipment.

THE LEASING OF THE CINCINNATI, DAYTON & TOLEDO TRACTION

Stockholders of the Cincinnati, Dayton & Toledo Traction Company will meet at Hamilton, Ohio, on Jan. 26 for the purpose of ratifying the lease of the property to a new company to be known as the Cincinnati Northern Traction Company, headed by Randall Morgan, T. J. Dolan, of Philadelphia; W. Kesley Schoepf, George B. Cox, J. B. Foraker and others of Cincinnati. The leasing company has agreed to pay interest on bonds, including $1,500,000 of bonds now in the treasury. In addition it agrees to pay a rental of $25,000 the first year, $37,500 the second, $50,000 the third and fourth years, $62,500 the fifth, $75,000 the sixth, $87,500 the seventh, and $100,000 the eighth year, and the additional sum of $12,500 per year when the gross earnings shall amount to $1,200,000, and increasing at the rate of $12,500 per year with each $100,000 of increase. The leasing company agrees to spend $1,500,000 on the property the first two years. The leasing company agrees to pay an assessment of $5 per share on the $1,500,000 of stock which it takes over, while the old stockholders are asked to pay a similar assessment of $5 a share on the outstanding stock. This assessment is to pay off the floating debt of $250,000 together with probable liabilities from litigation. If all the stockholders do not pay the assessment, 6 per cent. preferred redeemable notes will be issued. The improvements contemplated include the erection of a large central power station, placing of much of the road on private right of way, double tracking a considerable portion, eliminating curves and grades and extending the line into the heart of Cincinnati.

OPENING OF THE EAST BOSTON TUNNEL

The East Boston Tunnel was opened for traffic on the morning of Dec. 30 at 5.30 o'clock. The first car to carry paying passengers was run over the new route from the Maverick Square portal, and throughout the day a heavy business was done, the regular traffic being greatly increased by the number of riders who took the journey from motives of curiosity. The business was handled expeditiously and smoothly by the Boston Elevated Railway Company, and the improvement in transit facilities between the island wards of the city and the mainland was marked. The operating company's preparations to facilitate the movement of passengers at stations and cars through the tunnel reaped a well-deserved reward. Transfers were easily made between the various subway and surface cars and the tunnel, and large numbers of passengers from Winthrop, Chelsea and East Boston availed themselves of the new route to and from their work in the city proper. The smoothness of the roadbed and track was especially noteworthy, as was the excellent illumination throughout the tunnel.

On Dec. 29 a number of cars with invited guests on board were run through the tunnel. The first one of these carried Governor Bates, the Boston Transit Commission, the Massachusetts Railroad Commission, President Bancroft, of the Boston Elevated Railway Company, officials of the Boston city government and other prominent citizens. In the evening a reception and banquet was held at Masonic Hall, East Boston, about 700 guests being present. The arrangements were made by the East Boston Citizens' Association. Congratulatory speeches were made by Governor Bates, Lieutenant-Governor Guild, Hon. Joseph A. Corry, Chairman George G. Crocker of the Transit Commission, Hon. Albert E. Pillsbury, President Wm. A. Bancroft of the Boston Elevated Railway Company, Rev. Hugh O'Donnell, Rev. H. A. Manchester and Senator-elect Taylor. Joseph B. MacCabe was toastmaster.

Papers have been passed by which the East Boston tunnel has been formally leased to the Boston Elevated Railway Company for 25 years, beginning June 10, 1897, and ending June 10, 1922. Three-eighths of 1 per cent. of the gross receipts of the company from lines owned, leased or operated is specified as the rental, in addition to which the company agrees to act as agent to collect the tunnel toll of 1 cent, or such other amounts as may be fixed from time to time. The proceeds of the rental and toll will be used by the city of Boston as a sinking fund to redeem and pay the interest on the tunnel bonds. Use of the tunnel is to begin Dec. 30, 1904.

The Gould interests are said to plan important extensions to their street railway and lighting properties in Richmond and Petersburg, Va. An electric railway from Richmond to Ashland, and thence to the north coast, stretching to the Chesapeake, is one of the projects contemplated.

ST. LOUIS CAR COMPANY GETS LARGE ORDER TO BUILD STEAM CARS—ANNUAL BANQUET TO EMPLOYEES

George J. Kobusch, president of the St. Louis Car Company, has just received one of the largest single contracts for steam railroad coaches ever placed with any car building company. The order is for 137 cars for the Harriman lines in the West. The St. Louis company has heretofore devoted itself almost entirely to the building of electric railway cars and its entrance into the steam railroad car building field with a large order has naturally created quite a sensation in both steam and electric railway circles. As a matter of fact, the order may be taken as somewhat typical of the advance of the electric railway art that a company which has previously been identified almost entirely with electric railway work should secure such a large order at the very beginning of its entrance into steam railroad work. This all goes to show how close these two kinds of railroading are coming to each other.

Of the order, 10 coaches, 8 chair cars, 10 baggage cars, and 8 postal cars are to go to the San Piedro, Los Angeles & Salt Lake Railroad. The Southern Pacific Railroad is to get 26 coaches and 50 chair cars; the Oregon Railway & Navigation Company 8 coaches, and the Kansas City Southern Railway Company 5 coaches, 4 chair cars, 4 baggage and 4 postal cars. The railroad company also has an option on 27 additional baggage and express cars which can be taken up within four weeks. Besides this order from the Harriman lines, the St. Louis Car Company has an order for 10 coaches for the Pennsylvania Company, and 2 from the St. Joseph & Grand Island Railroad.

Mr. Kobusch is receiving congratulations from his friends both on having built up a plant able to supply such work and on his success in securing the orders, although, to be sure, orders for cars for surface and elevated roads calling for greater manufacturing facilities than these have been filled by the company within the past two years.

The capture of twenty-one prizes at the World's Fair by the company, was celebrated Friday evening, Dec. 30, at the fourth annual banquet given by the company to the heads of departments in the banquet hall of the company's works at 8,000 North Broadway, St. Louis. Seventy-five guests were present, including president George J. Kobusch and vice-president and general manager H. F. Vogel, who acted as toastmaster. The hall was prettily decorated, and the table was arranged in the form of a K in honor of the president. Colored shades and cut flowers completed the decorations. A large illuminated K, inclosed in a diamond represented the automobile department. The opportunity afforded by the banquet for the heads of departments to suggest without restriction reforms they deem fit resulted in the making of valuable suggestions. Elaborate souvenirs of the same design and one-fourth the size of the award diplomas were distributed. Semi-humorous toasts were responded to as follows:

President George J. Kobusch, "The General Prosperity of the Company, and Encouraging the Individual Efforts of Every Employee."

G. A. H. Mills, secretary-treasurer, "How to Write Three Thousand Pay Checks in Three Thousand Seconds."

L. Rubenbauer, superintendent, "How to Hustle Out and Ship More Cars in 1905 Than in the Preceding Year."

Walter Miller, superintendent machinery and tools, "How Easy it is to Maintain Machinery, Buy New Machines and Plan New Factories."

W. S. McCall, general sales agent, "Why it's Easy to Sell Cars Away From Home."

William S. Sutton, assistant superintendent, "What it Requires to Be in the Lead."

Frank McCoy, Pittsburg representative, "Why I was Proud of My Exhibit at the Louisiana Purchase Exposition."

E. J. Robinson, vice-president Laclede Branch, "A Few Words About the Women."

Henry Luedinghaus, "Why I'm Glad to be Invited."

C. W. Prosser, "What I know About Selling Steam Cars."

C. W. Swingley, "Why I Like to See Good Shipments of Cars."

Nick Le Grand, "What Fun it is to Fill Shipping Orders."

Tom Benisch, "How Easy it is to Be a Blacksmith."

Fred Langshenning, "What Married Life Means to a Draftsman."

Wm. Roeling, "What Ought to Be Done for the Cabinet Shop."

George Meyers, "What the Builders Need."

Herman Jensen, "What the Finishers are Going to Do Next Year."

A. T. Winchell, "How I am Going to Slap on Paint Next Year."

M. Weber, "Why I Like Roosters."

THE WASHINGTON, BALTIMORE & ANNAPOLIS TO BE COMPLETED

Arrangements have been perfected for the sale of the property of the Washington, Baltimore & Annapolis Railway to Cleveland parties. It will be remembered that this road was designed to use the Westinghouse single-phase system and that it went into the hands of a receiver some time ago. The Cleveland interests have paid the claims against the property, and it is probable that steps will be taken before long to complete the line. About $1,500,000 has been invested in the property thus far. The power station is partly up, and much of the grading between Washington and Balitmore is completed. The property also includes the Washington, Berwyn & Laurel Railway, an electric line which is in operation, and a short steam line also in operation. It is understood that the people who will take over the property comprise practically the same interests that financed the Northern Texas Traction Company. The financial plan has not been definitely announced, but it is believed that the original underwriters will be paid in underlying securities of the new company.

FRANCHISE MATTERS IN CLEVELAND

Through the efforts of the Cleveland press, Mayor Tom L. Johnson was induced last week to withdraw from the position he has long held in demanding 3-cent fare in return for an extension of the franchises of the Cleveland Electric Railway, and in an open letter to the street railway company he appealed for a trial of his 3-cent idea on one or more lines, or within a radius that would take in the most densely populated sections of the city. He also acceded to the proposal for a test as advantageous to the public as 4-cent straight fare. The most important statement made by the Mayor in his letter was this: "If it can be shown by a public test that an immediate settlement of the question of a higher rate of fare than 3 cents is generally demanded by the people, I will work for the passage of the ordinance."

Following a special meeting of the directors of the Cleveland Electric Railway, President Andrews of the company issued a reply to the mayor's letter. He stated that the company was absolutely satisfied that it would be impossible to operate 220 miles of road affording rides from 12 to 18 miles for one fare on a 3-cent basis, and that the company is unwilling to incur the loss that would necessarily follow the experiment of operating the entire system on this basis. Referring to the claim that the reduction of fare would increase traffic, President Andrews stated that during the eight months in which the company sold six tickets for 25 cents and gave universal transfers, it suffered a loss of $220,000 in gross earnings, and that the company estimated that while the stimulation of fare-paying traffic was somewhat over 1 per cent, the reduction in fare was about 9 per cent., taking into consideration the increased number of tickets sold. He said the company was very much in doubt whether the suggestion of straight 3-cent fare lines with cars running from the Public Square through the most densely settled sections of the city and operated in connection with the present lines so as not to disturb the existing rates of fare or transfers, could be put into practical operation with fair returns to the company and adequate service to the public. He stated that the scheme of running low-fare cars from the center of the city only through the most densely populated districts is new in street railway operation, but that if the company were assured that public sentiment favored such an experiment, and the City Council would authorize or request that this be done so that the company might be protected against charges of violating its present contracts, it would be willing to meet the suggestion.

Immediately following the company's statement, Mayor Johnson arranged for a special meeting of the City Council to lay before it a plan for making the experiment, and asking for its sanction. The councilmen were all brought in by policemen. The meeting was a sensational one, the Council being equally divided on the proposition of authorizing the experiment. After several hours of wrangling, the session adjourned without taking any action.

Mayor Johnson will place the proposition before the new Council, which takes its seat this week.

The remaining ten of the intramural cars used at the St. Louis Purchase Exposition have been purchased by the Chicago & Milwaukee Electric Railroad Company. Several changes will be made in them before delivery. The monitor type hood will be replaced by one of the steam coach pattern, and steps will be added.

COPENHAGEN TRAMWAYS STATISTICS

The following is the report for 1903 of the tramway systems of Copenhagen, Denmark. This city consists, politically, of two separate municipalities, Copenhagen and Frederiksberg, each having an electric railway system under private ownership. The results are reported separately, but a third column, giving the total figures, is added. The high cost for power is due to the fact that the systems are obliged by the municipalities to purchase power from the city lighting stations at the rate of 4 cents per kilowatt-hour.

When electricity was introduced in 1901 very little new mileage was added, but considerable single track was changed to double track and connecting links were built. A uniform fare of 2.6 cents is now being charged, which enables a passenger to transfer from one route to another; the longest distance which can be traversed for this fare is 7 miles. No transfers are issued between the two companies.

	Copenhagen Tramway	Frederiksberg Tramway	Total
Year ended	1903	1903	.....
Electric Traction inaugurated	1901	1900	.....
Length of line, single track (miles)	50	12.2	62
Total capital	$2,666,666	$853,334	$3.519,998
Funded debt	1,599,999	106,776	1,706.775
Depreciation, etc.	224,750	98,318	323,068
INCOME			
Traffic	$1,241,006	$268,430	$1,509,436
Other	15,283	3,322	18,605
Totals	$1,256,289	$271,752	$1,528,041
OPERATING EXPENSES			
Power	$260,938	$57,134	$318,072
Traffic	306,182	66,067	372,249
General	83,846	16,147	99,993
Maintenance	205,286	35,141	240,427
Totals	$856,253	$174,489	$1,030,742
Net income	400,037	97,262	497,299
Additions to net income	17,712	302	180,144
DEDUCTIONS FROM NET INCOME			
Interest	$94,618	$6,398	$101,016
Sinking fund	26,669	8,529	35,198
Depreciation and renewal	39,998	17,059	57,057
Sundries	51,571	9,907	61,478
Totals	$212,856	$41,894	$254,750
Net surplus	204,893	55,670	$260,563
APPROPRIATION OF NET SURPLUS			
Reserve	$38	.....	$38
Taxes, licenses, etc	71,520	8,001	79,521
Sundries	133,334	47,669	181,003
Population	414,600	80,000	495,000
Car mileage	6,807,549	1,337,622	8,145,171
Passengers carried	51,118,398	10,794,422	61,912,820
Passengers carried, per car-mile	7.5	7.8	.....
Average fare per passenger (cents)	2.44	2.54	.....
Traffic receipts per car-mile (cents)	18.4	20	.....
Traffic receipts per car-mile of S. T.	$24,820	$22,366	.....
Percentage of operating expenses to income	68	64	.....
Operating expenses per passenger (cents).	1.68	1.62	.....
OPERATING EXPENSES PER CAR-MILE (CENTS)			
Power	3.8	4.26	.....
Traffic	4.52	4.94	.....
General	1.24	1.20	.....
Maintenance	3.0	2.46	.....
Totals	12.6	12.8	.....
Kw-hours used	5,457,078	938,037	6,395,115
Price charged per kw-hour (cents)	4	4	4
Kw-hours used per car-mile	0.82	0.70	.....

A BOOK OF REVIEWS

The McGraw Publishing Company has just issued, in pamphlet form, the reviews which appeared in six different papers of W. C. Gotshall's "Electric Railway Economics." The extremely favorable reception which this book received in the "new publication" columns of the engineering, financial and daily papers indicates its value in the field of which it treats. The papers whose reviews are quoted are London "Engineering," "Commercial and Financial Chronicle," Street Railway Journal, "Electrical World and Engineer," "Boston Transcript" and "New York Tribune."

A "TRACTION" DINNER OF THE A. I. E. E.

The annual dinner of the American Institute of Electrical Engineers will be given in the ballroom of the Waldorf Astoria, New York City, on February 8, and promises to be a most interesting occasion. In view of the recent opening of the subway, thus adding underground traction in America to the domain of electricity; the adoption of electric locomotives for their great Manhattan terminal divisions by the New York Central and Pennsylvania Railroads; the equipment of the Long Island Railroad with electricity, and other signal events, the Institute has decided to devote this dinner to emphasizing the triumph of electric traction. A number of pioneers and leaders will be present, an original menu has been designed, and some novel features will be introduced; while the list of speakers includes men of national and international reputation. The dinner will be served for $5 per cover without wine or cigars, and as is usual on these occasions, ladies will be present. The participation of the ladies was a feature that elicited Mr. Carnegie's enthusiastic commendation at the famous Institute Library dinner, which he made forever memorable by his million-dollar gift for the United Engineering Building. Notices will be sent to the members forthwith, and it is requested that an early response be made, in order that proper care can be taken of all applications. More than 400 had to be seated at the Edison dinner last year, and the attendance in February promises to be equally large.

ILLINOIS COMMISSION HAS RIGHTS OVER ALL ELECTRIC RAILWAY AND STEAM AND ELECTRIC CROSSINGS

An opinion of importance, relative to the jurisdiction of the Illinois Railroad & Warehouse Commission, was given last month by Attorney-General Hamlin. Under the construction placed on the statutes by the attorney-general, the commission has jurisdiction over the crossings of two street railway lines in a city as well as the crossings of electric and steam roads in the country. The street railway and interurban companies throughout the State have contended that they were not within the jurisdiction of the railroad and warehouse commission. The commission recently notified all common carriers within the State that no more grade crossings will be permitted to be constructed, and it was this announcement that led to the request for the attorney-general's opinion regarding the power of the commission.

The opinion is a lengthy one which, after extended arguments in support of the interpretation given the statutes, concludes as follows:

One other argument in favor of the power of the Commission is offered, and it is one which greatly adds to the position taken above. The act of 1889 requires the Commission, after the hearing, to decide "with due regard to safety of life and property." The act of 1891 requires the decision to be such a decision as "the public good requires." These words make the question of the power of the Commission over crossings, a question involving public interest, and where public interest is involved a statute is liberally construed so as to carry out the best interests of the public.

If these statutes are to be liberally construed, then they cover all crossings of all roads whenever the crossing is dangerous to life or property. If a public interest is involved, the jurisdiction of the Commission is presumed unless the street railways can make it appear that the Legislature by affirmative words exempted them from the operation of the statutes, for, in that case it would not be a question of extending the meaning of the statute by implication, but by limiting it by implication and to place the limitation would require evidence of such an intent of the Legislature. This principle plainly gives the Railroad and Warehouse Commission authority over all crossings for the purpose of protecting life and property and the protection of the same.

In his opinion Attorney-General Hamlin takes up the acts of 1887, 1889 and 1891 separately and interprets them. The first of these he decides applied only to so-called steam railroads, but the act of 1889, he construes to apply to both steam and street railroads. In support of this interpretation as pointed out that where the legislature desired to except street railroads from any act it had done so expressly. The act of 1891 "to protect property and persons from danger at the crossings and junctions of railroads," he contends is further substantiation of the intent of the legislature to make the act applicable to steam railroads and street railways alike.

The distinction between street and commercial railroads in the incorporation laws of the state, which has been relied upon in the contention that the State commission has no power over street railways or electric lines, the attorney-general interprets as solely with reference to the powers of the companies and not with reference to the police power of the state exercised for the protection of life and property.

CHICAGO STREET RAILWAY STOCKHOLDERS URGED TO ALLOW EASTERN CONTROL

H. B. Hollins & Company, of New York, have sent to the stockholders of the North and West Chicago Street Railroad Companies a circular urging them to join the firm in giving to the committee representing the Eastern interests full power and opportunity for the election of boards of directors. The circular continues:

The necessity for the action we are taking in the matter of proxies arises from the fact that the two protective committees already existing have turned aside from the purposes for which they were formed and to which substantially the entire body of stockholders once stood pledged, and have been led into the pursuit of imaginary grievances and the invention of supposed remedies which, if put in practice, would be as destructive to your interests as they would be to ours.

Accompanying the circular is a letter from Alfred Skitt, who has been making an examination of the Chicago traction situation. Mr. Skitt says, in part:

The best results can be secured only if the properties be held together and improved as a whole. This, of course, involves not only a large new investment for reconstruction, but the provision of an amount sufficient to discharge the floating debt of the several properties and the receivers' certificates which have been issued during the administration of the property for its improvement by the court.

Your plan of seeking to have the City Railway Company made part of the combined properties must be regarded as wise. Even if this should involve the estimated outlay of between $30,000,000 and $40,000,000, I believe your policy would be justified—of course, under the condition always that the other properties are kept together and that a satisfactory arrangement is made with the city.

YOKOHAMA ELECTRIC RAILWAY CONTRACTS

The Yokohama (Japan) Electric Railway Company is in the market for rails, etc., to be used in the construction of its initial line, about five miles long, from Yokohama to Kanagawa. The company has decided to build on to Tokio, which will make the entire system about 20 miles in length.

The contract for the overhead equipment of the Yokohama-Kanagawa section is in the hands of the British electrical engineering and contracting firm of L. J. Healing & Company, of Yokohama, whose American representative is Francis A. Cundill, of 90-96 Wall Street, New York. Messrs. Healing & Company represent the Japanese interests of the Albert & J. M. Anderson Manufacturing Company, the Okonite Company, the Elmer P. Morris Company, and the National India Rubber Company.

ANNUAL MEETING OF THE BOSTON ELEVATED STOCKHOLDERS

The annual meeting of the stockholders of the Boston Elevated Railway Company was held in Boston on Jan. 2. Last year's board of directors was re-elected, as follows: Frederick Ayer, Wm. A. Bancroft, John J. Bright, Samuel Carr, T. Jefferson Coolidge, Jr., Francis H. Peabody, James Phillips, Jr., Jas. M. Pendergrast, Nehemiah W. Rice, Quincy A. Shaw, Jr., Wm. S. Spaulding, Walter S. Swan and Robert Winsor. President Bancroft's seventh annual report was submitted, showing that on Oct. 1, 1904, the total number of stockholders was 2922, holding 133,000 shares. About 83 per cent. of these are held in Massachusetts.

Touching upon the year's operation, Gen. Bancroft pointed out that plans for the extension of the elevated structure from the present Guild Street terminus to Forest Hills are being prepared, and 9,000 tons of steel have been purchased for this work. The East Boston Tunnel has been duly leased and placed in operation. Work has begun upon the tunnel for elevated trains under Washington Street by the Boston Transit Commission. The revision of wages which was set forth in the last annual report has now been in operation for a full fiscal year, the payroll having been increased nearly $174,000 from this cause during the year. The total number of revenue passengers increased 3½ per cent.; the number of free transfer passengers was 139,000,000, which is over 57 per cent. of the revenue passengers. The transfer traffic increased 7 per cent.

The receipts of the main line elevated stations, exclusive of the subway, increased 9.1 per cent., and the Atlantic Avenue stations 17 per cent. The total mileage of surface, elevated and subway tracks controlled by the company is 444,826. During the year 61 surface cars and 24 elevated cars were added to the equipment. The total revenue passengers carried were 241,681,945; the gross earnings were $12,391,353.07, and the operating expenses $8,631,553.08.

NEW YORK & STAMFORD RAILWAY COMPANY AND THE GREENWICH TRAMWAY COMPANY REPORTED SOLD TO THE CONSOLIDATED RAILWAY COMPANY

The announcement has just been made by special telegraph despatch from Greenwich, Conn., to New York papers, that the Consolidated Railway Company has effected a purchase of the New York & Stamford Railway Company and the Greenwich Tramway Company for an amount which is said to have been $1,400,000, or $150 per share. This sale, which is reported as having taken effect on Jan. 1, includes the entire system which is now operated by the New York & Stamford Railway Company, which comprises the old Port Chester Street Railroad, the Larchmont Horse Railway and the Greenwich Tramway. The organization of the Consolidated Railway Company, and a list of the other trolley lines owned by it, was published in the STREET RAILWAY JOURNAL for Dec. 24. It is owned by the New York, New Haven & Hartford Railroad Company, which latter company has for some time owned the Stamford Street Railway. The companies which have just been bought give the Consolidated Railway Company a connecting link between its present lines in Connecticut and the suburban branches of the Metropolitan Street Railway of New York City.

The New York & Stamford Railway Company is the result of a consolidation of its two constituent companies, the Port Chester Street Railroad and the Larchmont Horse Railway, which was affected in August, 1901. In that same month an agreement was consummated whereby this new company also took over the Greenwich Tramway, which, however, always remained a separate corporation, organized under an old charter. Since that time the Greenwich Tramway system has been materially extended, but it is still operated by the New York & Stamford Railway Company, the same interests being identified with both.

The system which the Consolidated Railway Company will take over is in most parts single track, having an extreme length of about 20 miles extending from Larchmont at the West to Stamford at the East and passing through the townships of Mamaroneck, Harrison and Rye, and the villages of Larchmont, Mamaroneck, Harrison, Rye and Port Chester, all in the county of Westchester, New York. In the State of Connecticut it traverses the townships of Fairfield and connects the villages of East Port Chester, Greenwich, Cos Cob, Riverside and Sound Beach.

In many places the road touches the Old Post Road to Boston and passes through a section of the country which abounds with landmarks of historic interest. Some of the mile posts which served as a basis of reckoning for the drivers of the old-time road coaches which followed much this same route a century or more ago, are still to be seen from the car windows. The total trackage of the road, including branches, sidings and double-tracked portions, is about 50 miles, laid to standard gage. The rails are 70-lb. T and 101-lb. girder.

From Port Chester to Rye Beach the line is double tracked, and at the terminus of the road at Rye Beach ample provisions have been made to take care of the excursion crowds, which in summer throng to this pleasant resort. The total rolling stock of the two lines which have been bought amounts to about sixty or seventy cars.

In the power station, which is situated in the village of Port Chester, there are at present four generating units, with a total rated capacity of 1525 kw, all directly driven by slow-speed steam engines. The boiler plant, which is practically a separate building from the engine and dynamo room, is equipped with a battery of nine water-tube boilers of 145 rated hp each. The electrical equipment throughout was supplied by the General Electric Company. The engines, however, are of different makes, viz.: Rice & Sargent 1400 hp, Buckeye 700 hp, Green 350 hp and Armington & Sims 25 hp. The boilers were all made and installed by the Pacific Iron Works, of Bridgeport, Conn. From a siding connecting with the tracks of the New Haven Railroad Company, all coal and heavy freight may be brought directly to the power station.

An office building, two car houses, and a repair shop are adjacent to the power station, and are all heated by means of exhaust steam from the engines. Not one of the buildings is more than five years old.

Milton J. Foreman, chairman of the Chicago Council transportation committee, and George W. Jackson, chief engineer for the Illinois Tunnel Company and chief consulting engineer for the transportation committee, are on a visit in the East, to inspect the subways of New York and Boston. They purpose to study the operation of subways now constructed and in operation and gather any new details available on their visit in order to make a report to the committee on the traction question, rerouting of cars and other topics before the Chicago Council.

REPAIR SHOP OF THE CHICAGO UNION TRACTION COMPANY BURNED

Fire completely destroyed the repair shop of the Chicago Union Traction Company on Dec 30. The building was a one-story brick structure measuring 125 ft. x 332 ft., and was located on Washington Boulevard, near Fortieth Avenue. Several old single-truck cars were destroyed together with three of the new double-truck cars recently purchased. The loss on cars is estimated at $25,000 to $35,000, on tools $5,000 to $10,000; the building was valued at about $40,000. The origin of the fire is unknown. During the conflagration two firemen lost their lives by being buried under the south wall of the building, which fell without warning.

SPRINGFIELD & XENIA PROPERTY SOLD

The Springfield & Xenia Traction Company's line was sold at receiver's sale, Dec. 23, by F. J. Green to the Cleveland bondholders for $225,600. The appraised value of the road is $200,000, and the bonded indebtedness is $500,000. Of this amount $425,000 in bonds have been floated, and $75,000 have been posted as collateral to secure a floating indebtedness of $60,000 against the road.

This is the third time the road has been offered for sale. Heretofore no bids were received, as the appraisement was said to be too high. The bidding was spirited, J. S. M. Goodlow, of Columbus, representing Patterson, Steele & Dennis, of Cincinnati, and Columbus men, started the bidding by offering $134,000 for the road. His bid had scarcely been announced when H. B. McGraw, of Cleveland, representing the bondholders, raised the sum $500. F. W. Adams, of the Toledo, Fostoria & Findlay Railway Company, increased the bid $500. The bidding narrowed down between McGraw and Adams until the road was finally sold to Arthur C. Hanson, clerk of the bondholders' committee.

It is understood that the road will be operated in connection with the Bushnell syndicate, which did not make a bid. John L. Bushnell, who holds bonds, was represented by Mr. McGraw.

MORE COMPANIES ADOPT OHIO TRAFFIC BOOKS

The coupon transportation book of the Ohio Interurban Railway Association has been adopted by the Toledo & Indiana Railway, the Detroit, Monroe & Toledo Short Line, the Fort Wayne, Van Wert & Lima Traction Company, and the Dayton & Muncie Traction Company, making 19 roads now using it. It is expected that several other roads will take action in the matter at the Canton meeting this week. The officers of the Ohio Interurban Railway Association are negotiating with the Indiana Electric Railway Association with a view to making the transportation books adopted by the two associations interchangable on the roads in both states.

FINAL DISPOSITIONS IN ST. LOUIS SUIT

Final depositions in the suit of J. Brooks Johnson to set aside the merger of the St. Louis Transit Company and the United Railways were taken Dec. 29, in the office of John A. Gilliam. During the hearing Judge Gilliam, counsel for the plaintiff, introduced many witnesses to prove that $614,015.25 worth of transit company assets was turned over to the United Railways Company. He has been unable to get satisfactory evidence in regard to this transaction. On Dec. 29, Judge Henry S. Priest, who is attorney for the defendants and is also named as one of the defendants in the suit, furnished the information, in the form of stipulations, which is to be filed in evidence. He submitted a statement from Treasurer Atkins showing that the United Railways Company had received on the night of Oct. 31, the sum of $614,015.25 from the Transit Company. The statement explains that the sum was in addition to any credit which may have been turned over on account of special deposits for the payment of coupons on bonds. An article of the stipulation also gives an account of the meeting of Oct. 19, when, it is said, the tripartite agreement between Brown, Bros. & Company, the Transit Company and the United Railways Company was made for the management of the street railway system of St. Louis for the next five years. This account shows that the number of shares voted in favor of the agreement was 162,175, all represented by their owners or proxies, and that there were no opposing votes. The remaining 10,438 shares were unrepresented. As soon as the dispositions are signed they will be filed in the circuit court. No date has been fixed for the trial.

NORTH AMERICAN COMPANY REPORTED AFTER ST. LOUIS LINES

At the meeting of the directors of the North American Company, to be held in Milwaukee next week, it is expected that John I. Beggs, general manager of the Milwaukee Electric Railway & Light Company, general manager of the Union Electric Light & Power Company, of St. Louis, and a director of the North American Company, will submit a proposition looking toward the purchase, by the North American Company, of the United Railways and the St. Louis & Suburban Railway, controlling all the street railway lines in St. Louis.

The North American Company owns the Union Electric Light & Power Company, the Laclede Gas Light Company, and the Missouri-Edison Company, all of St. Louis, and by purchasing the street railway lines would control practically all the public service interests of the city.

SUCCESSFUL TESTS OF A NEW FUEL

The testing department of the Brooklyn Heights Railroad has recently obtained very remarkable results in power-house tests with Brillium. The fuel used was locomotive cinders from the Lackawanna Railway, such as are ordinarily used for ballast, with about 10 6-10 per cent of No. 3 buckwheat coal.

Forty-four pounds of Brillium were used to each ton of cinders, and the boiler was run at about 15 per cent above its rating, with air pressure of ¼ inch under the grate bars. The flue gas temperature averaged 504 degs. and percentage of carbonic acid gas ran from 8.6 per cent to 12.2 per cent.

A net evaporation of 6.12 lbs. of water from and at 212 degs. was obtained from each pound of fuel. This buckwheat coal by itself gives about 6.75 lbs. evaporation.

A recent inspection of the boiler by A. H. Pitchford, representing the Fidelity & Casualty Company, shows that it and the grate bars are in good condition after using this fuel for over eighteen months. Brillium is the result of experiments conducted by Harold P. Brown, of New York, during the past two years; it is said to be reasonable in cost and produces a chemical reaction in combustion which is analogous to that discovered by Dr. Goldschmidt in obtaining high temperatures from metallic oxides for welding purposes.

DECISION AGAINST PASSENGER TAX IN ST. LOUIS

Judge Adams of the United States Circuit Court has granted applications for a preliminary injunction to the St. Louis & Suburban Railway Company, and the St. Louis & Meramec Railroad Company, to restrain the city from forcing the companies to pay a tax of 1 mill on each passenger carried. This question was practically settled Monday, Dec. 19, when Judge Adams rendered his opinion on the application of the St. Louis Transit Company for an injunction against the city.

In a sense, the decision establishes that a municipality cannot change the original, essential features of a contract, although the ordinance which specifies the terms expressly declares that the provisions may be altered, amended or repealed at any time, so says the "St. Louis Republic."

A resumé of the case is of interest:

The city of St. Louis formerly imposed on the St. Louis Transit Company an annual license tax of $25 a car. It repealed this law and prescribed, instead, a license tax of 1 mill on each 5-cent fare. The new law, which became effective the first day of this year, contemplated an increase in the city's revenue, from this company, of about $135,000 a year. However, the object of the bill was not so much to increase the revenue as to cause the running of enough cars to accommodate the public; it was supposed that, if the tax were removed from the cars and assessed on 5-cent fares, there would be no inclination to operate too few cars.

Not willing to submit to an enlargement of fixed expense, the company declined to respect the law, and, when the city demanded payment, applied to the federal court for an injunction. The court held that the original tax was in the nature of a contract, which the city has no right to break, even though the franchise ordinance specifically declares that a municipality retains the power to alter, amend or repeal it any time.

The gross earnings of the Auburn & Syracuse Electric Railway, in New York, opened for traffic a year ago last June, were more than $240,000 for the first fiscal year. Improvements made by the company since July involve an expenditure by the company and its allied interests of from $150,000 to $200,000.

NEW PUBLICATIONS

Report of the Eighth Annual Convention of the Street Railway Accountants' Association of America, with Appendix. 190 pages. Published by W. B. Brockway, secretary of the association, Park Hill, Yonkers, N. Y.

The complete report of the 1904 meeting of the Accountants' Association, which was held at St. Louis, like preceding reports, has been prepared with the secretary's characteristic promptness and attention to details. In addition to the verbatim proceedings of the sessions held in St. Louis, the book contains the reports of various committees, including the committee on blanks and forms, the joint committee on blanks for shop records, and the committees on a standard system of electric railway accounting, and a standard form of report for electric railways. The reports of the two latter committees are presented in full in the form in which they have been finally approved by the association. The book also contains the complete Question Box, including the answers submitted in writing and those given during the discussion at the St. Louis meeting. A fine engraved portrait of President F. E. Smith appears as a frontispiece.

PERSONAL MENTION

MR. A. N. CONNETT, chief engineer of J. G. White & Company, Ltd., of London, Eng., is now on a short visit to this side.

MR. L. K. BURGE, superintendent of the Eastern division of the Lake Shore Electric Railway, has been appointed superintendent of transportation. The office of division superintendent has been abolished.

MR. W. G. WOOLFOLK has resigned as superintendent of the Knoxville Traction Company, of Knoxville, Tenn., to become superintendent of the Philadelphia & West Chester Traction Company, of West Chester, Pa.

MR. ARTHUR C. RALPH, formerly general superintendent of the Boston & Worcester Street Railway, is in charge of construction work for the Old Colony Railway Company. He has established his headquarters at Taunton.

MR. CHARLES A. MUDGE, oberingenieur of the Allgemeine Elektricitäts Gesellschaft, of Berlin, is making a visit in this country. Mr. Mudge had charge of the Berlin-Zossen high-speed tests of last year for the Allgemeine Company.

MR. H. O. HAZZARD has been made a division superintendent of the Public Service Corporation, with headquarters at Millar Street car house, Newark, N. J. He was formerly an assistant in the employment bureau of the same company.

MR. L. O. WILLIAMS, superintendent of the Fort Wayne & Wabash Valley Traction Company, of Fort Wayne, Ind., has resigned, to take effect at once. He will be succeeded by Mr. Kem Smith, of Wabash, who has been with the Fort Wayne & Wabash Valley Company for some time. Mr. Williams goes with the McKinley Syndicate.

MR. W. A. HEINDEL, of the engineering staff of J. G. White & Company, Ltd., of London, Eng., is to become associated with J. G. White & Company, Inc., of New York. Mr. Heindel was at one time connected with the Washington electric traction system. He superintended the construction of the Lille (Belgium) electric traction system on behalf of the London White interests.

MR. W. L. STRETLOW, formerly division superintendent of the Lake Shore Electric Railway, has been appointed superintendent of the Springfield & Xenia Traction Company, which was bought in by the bondholders last week. Mr. J. W. Parker, formerly superintendent of the Springfield & Xenia Company, has been appointed superintendent of the Springfield, Troy & Piqua Traction Company.

MR. FRANK S. GANNON, vice-president of the New York City Railway Company, has just been elected vice-president of the Howland Improvement Company, which has the lease of the Atlantic & North Carolina Railroad, a steam line. This office is outside of that in connection with the New York City Railway Company, and will not interfere with Mr. Gannon's active duties in connection with the latter property.

MR. E. H. KEATING has resigned as general manager of the Toronto Railway Company, of Toronto, Ont., to become consulting engineer for several important projects in which the Mackenzie-Mann syndicated is interested. In this connection he will act as chief consulting engineer of the Toronto Railway, a newly created position. Mr. Robert J. Fleming, lately city assessment commissioner of Toronto, has been appointed to succeed Mr. Keating as general manager of the Toronto Company.

MR. HUGH BROOKS, superintendent of trucking for the Public Service Corporation of New Jersey, died Jan. 1. Mr. Brooks was one of the oldest officials on the Public Service system, and was engaged in street railway work almost all his life. He held the office of division superintendent on the Jersey City, Hoboken & Paterson Street Railway when that company was first organized, and when the property was taken over by the Public Service Corporation he was made superintendent of trucking for the consolidated system, having charge of horses, trucks and stables.

MR. H. V. SANGER has reigned as general superintendent of the Wheeling Traction Company, of Wheeling, W. Va. Mr. Sanger occupied the position four years. He entered the employ of the company eleven years ago as a conductor, and was advanced to starter, and then to assistant superintendent. He will be succeeded by Mr. John Marsh, who is superintendent of the company's lines on the Ohio side of the river.

MR. J. K. PUNDERFORD, general manager of the Consolidated Railway Company, of New Haven, Conn., has issued an order taking effect on Jan. 1, which places the entire system under Mr. J. B. Judge as superintendent, vice Mr. T. R. Hull, resigned. The same order also appoints Mr. M. W. Gaffney and Mr. F. P. Landey as official despatchers. Mr. T. F. Kays is made barn superintendent in charge of sending out the details for the various cars.

MR. J. A. HANNA, of Cleveland, Ohio, has accepted the position of sales manager of the Niles Car & Manufacturing Company. The general sales office of the company will hereafter be located in the Electric Building, Cleveland. As is well known, the Niles Car & Manufacturing Company has built cars for several of the leading city and interurban railway systems, and is now prepared to build promptly all styles of rolling stock for electric railway companies.

SIR WEETMAN D. PEARSON, BART. M. P., chairman of the British contracting firm of S. Pearson & Son, Limited, who is also president of the Ferrocarril, Urbano de Vera Cruz, Mexico, is now in New York en route for the Southern republic. The Vera Cruz system is at present operated as a mule road, but it is to be electrically converted. Contracts will be given out very shortly, it is expected. The equipment, etc., will be of United States manufacture. Sir Weetman and party are guests at the Waldorf-Astoria.

MR. RICHARD BARRATT has been appointed superintendent of the Montoursville Passenger Railway Company and the Montoursville Electric Light Company, of Montoursville, Pa., to succeed Mr. John P. Coonan, deceased. Mr. Barratt began his railway career six years ago as conductor of the Montoursville Passenger Railway. Later he became a motorman. He was then advanced to assistant superintendent, and upon the death of Mr. Coonan was appointed superintendent of the company, the duties of which office he has already assumed.

MR. E. D. CLIFFORD, assistant auditor of the Illinois Central Traction Company, has been appointed superintendent of the St. Louis & Springfield division of the Company. Mr. Clifford has been identified with the interests of the interurban company since last May, and during this time has held the position of cashier and assistant auditor. He is well known as the general superintendent of the Pawnee Railroad, which position he held for three years. Later he was with the Quincy, Carrollton & St. Louis Railroad for four years. He was general agent of the St. Louis, Peoria & Northern for three years, until it was merged into the Chicago & Alton and the Illinois Central, when he accepted his present position with the Illinois Traction system.

RECENT ADDITIONS TO THE ALLIS-CHALMERS STAFF.—Mr. J. U. Jones, of Dallas, Texas, one of the best known salesmen in the Southwest, has joined this company and will hereafter represent it in Texas and tributary territory. Mr. W. L. Loveland, the newly appointed head of the mining and crushing machinery department, is widely known among mining men, and has at command all the benefits which come from both a technical and practical training, and his acquaintance extends from city men to those who operate plants in the wilds of the mining countries. Mr. H. Schifflin has recently been made assistant manager of the mining and crushing machinery department, with headquarters in the New York Life Building, Chicago.

MR. WILLIAM H. BALDWIN, JR., president of the Long Island Railroad Company, died at his home at Locust Valley, L. I., on Monday, Jan. 2. Mr. Baldwin was born in Boston, and was graduated from Harvard in 1889. He entered railroading in the Union Pacific offices at Omaha, and later became general manager of the Pere Marquette Railroad. In 1896 he succeeded Mr. Austin Corbin as president of the Long Island Railroad. Mr. Baldwin was one of the first of steam railroad managers to devote themselves to the study of electric traction. Mainly to his foresight must be credited the extensive plans for electrification now being carried out by the Long Island Company. The several electric auxiliaries that are such an important part of the Long Island system also show that he was one of the first to appreciate the value of the electric railway as an adjunct to the steam railroad.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.	1 m., Nov. '04	71,388	38 920	32,468	23,024	9,444
Northern Ohio Tr. & Light Co	1 " " '03	69,049	38,021	31,028	22,755	8,273
	11 " " '04	819,115	445,442	373,673	249,149	124,524
	11 " " '03	810,623	441,285	369,338	244,867	124,471
AURORA, ILL.	1 m., Nov. '04	36 380	21,872	14,508	9,333	5,175
Elgin, Aurora & Southern Tr. Co	1 " " '03	34,616	22,297	12,319	9,173	3,146
	5 " " '04	201,586	107,800	94,786	46,506	47,280
	5 " " '03	206,678	116,887	89,791	45,863	43,928
BINGHAMTON, N. Y.	1 m., Nov. '04	18,434	10,695	7,740	------	------
Binghamton Ry. Co.	1 " " '03	16,909	9,938	6,971	------	------
	5 " " '04	116,682	59,458	57,224	------	------
	5 " " '03	109,029	54,522	54,508	------	------
BUFFALO, N. Y.	1 m., Nov. '04	328,346	185,541	142,805	134,758	8,047
International Tr. Co.	1 " " '03	314,006	183,067	130,939	128,495	2,444
	5 " " '04	1,907,742	952,704	955 038	691,492	263,546
	5 " " '03	1,849,300	974,704	874,596	662,079	212,517
CHICAGO, ILL.						
Aurora, Elgin & Chicago Ry. Co	1 m., Nov. '04	35,454	19,154	16,300	------	------
	5 " " '04	237,024	116,485	120,539	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Nov. '04	45,326	17,961	27,365	------	------
	1 " " '03	30,219	10,627	19,592	------	------
	11 " " '04	425,328	161,518	263,711	------	------
	11 " " '03	268,162	88,309	179,853	------	------
CINCINNATI, O.	1 m., Nov. '04	38,668	24,037	14,631	16,315	†1,684
Cincinnati, Dayton & Toledo Tr. Co	1 " " '03	39,695	24,237	15.458	15,958	†500
	6 " " '04	284,013	154,614	129,399	98,645	30,753
	6 " " '03	291,023	148,069	142,953	96,179	46,774
CLEVELAND, O.	1 m., Nov. '04	16,710	11,327	5,383	------	------
Cleveland Painesville & Eastern, R. R. Co.	1 " " '03	15,791	11,272	4,519	------	------
	11 " " '04	208,658	125,329	83,329	73,612	9 717
	11 " " '03	199,010	116,977	82,034	71,439	10.595
Cleveland & Southwestern Traction Co	1 m., Nov. '04	41,048	24,289	16,759	------	------
	1 " " '03	37 86:	22,909	14,952	------	------
	11 " " '04	438.291	272,577	165,713	------	------
	11 " " '03	411,750	242,523	169,227	------	------
COVINGTON, KY.	1 m., Oct. '04	88,974	49,920	39,054	17,219	21,835
Cincinnati, Newport & Covington St. & Tr. Co	1 " " 03	85,016	49.851	34,165	16,482	17,683
	10 " " '04	844,890	508,616	336,274	168,259	168,015
	10 " " '03	824,266	485,058	339,208	164,751	174,457
DETROIT, MICH.	1 m., Nov. '04	372,534	*212,611	159,923	90,511	69,412
Detroit United Ry.	1 " " '03	347,813	*204,627	143,216	84,007	59.209
	11 " " '04	4,191,824	*2524402	1 667,422	982,167	685,255
	11 " " '03	4,068,806	*2386345	1,682,461	912,890	769,571
DULUTH, MINN.	1 m., Nov. '04	51,925	25,553	26,372	16,521	9,851
Duluth St. Ry. Co	1 " " '03	51,684	28,558	23,126	15,832	7,294
	11 " " '04	565,461	297,931	267,530	181,505	86,025
	11 " " '03	570,577	314,609	255,968	170,755	85,213
EATON, IND.						
Muncie, Hartford & Ft. Wayne Ry. Co	1 m., Nov. '04	15,683	*6,657	9.026	4,000	5,026
	11 " " '04	167,069	*77,482	89,587	48,000	401,587
FORT WORTH, TEX.	1 m., Nov. '04	47,634	29,371	18,263	10,359	7,913
Northern Texas Traction Co	1 " " '03	40,358	24,478	15,880	9 673	6,207
	11 " " '04	509,546	285 946	223,599	111,472	112,127
	11 " " '03	423,224	230,104	193,120	101,886	91,233

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
HANCOCK, MICH.	1 m., Oct. '04	17,965	10 821	7,144	3,561	3,583
Houghton County St. Ry. Co	1 " " '03	15,452	8,813	6,639	2,123	4,516
	12 " " '04	194,592	133,538	61 053	39.312	21,741
	12 " " '03	187,594	120 781	66,813	34,616	32,196
HOUSTON, TEX.	1 m., Oct., '04	38,639	21,680	16,959	8,277	8,682
Houston Elec. Co	1 " " '03	36,313	25,604	10,710	8,081	2,628
	3 " " '04	96,943	64,043	32,899	24,911	7,988
	3 " " '03	115,736	70,802	44,934	21,924	23,010
MILWAUKEE, WIS.	1 m., Nov. '04	275 590	132,844	142,746	77,654	65,092
Milwaukee El. Ry. & Lt. Co.	1 " " '03	259,228	126,583	132,645	72,805	59 840
	11 " " '04	2,932,071	1,456,150	1,475,920	834 388	641,532
	11 " " '03	2,769,177	1,392,954	1,376,223	796,309	579,914
Milwaukee Lt., Ht & Tr. Co	1 m., Nov. '04	36,524	16,821	19,703	17,766	1,938
	1 " " '03	33 566	17,037	16.530	14 863	1,667
	11 " " '04	423,986	199,862	224,124	185,782	38,342
	11 " " '03	390,347	194,921	195,425	154,256	41,170
MINNEAPOLIS, MINN.	1 m., Nov. '04	354,202	162,704	191,497	97,308	94,189
Twin City Rapid Transit Co	1 " " '03	335,266	160,057	175,209	78,446	96,763
	11 " " '04	3,930,430	1,843,111	2,087,320	1,011,749	1,075,571
	11 " " '03	3,704,755	1,720,395	1,984,360	862,520	1,121,840
MONTREAL, QUE.	1 m., Nov. '04	204,555	133,849	70,706	18,871	51,835
Moatreal St. Ry. Co.	1 " " '03	189,561	116,609	72,952	17,903	55,049
	2 " " '04	426 831	255,486	171,345	37 818	133,527
	2 " " '03	396,162	227,318	168,844	36,825	132,019
OLEAN, N. Y.	1 m., Nov. '04	8,894	4,611	4,283	2,631	1,651
Olean St. Ry	1 " " '03	8 854	4,478	4.377	2,452	1,925
	5 " " '04	50,163	25,606	24,557	13,156	11,401
	5 " " '03	46,789	21,049	25,741	12,260	13,480
PHILADELPHIA, PA.	1 m., Nov. '04	110,666	------	------	------	------
American Rys. Co	1 " " '03	103,984	------	------	------	------
	5 " " '04	657,490	------	------	------	------
	5 " " '03	642,980	------	------	------	------
ROCHESTER, N. Y.	1 m., Nov. '04	119,288	69,982	49,306	26 890	22,416
Rochester Ry. Co	1 " " '03	105,212	54,121	51,091	25,914	25,177
	11 " " '04	1,354,369	748 954	605,415	------	------
	11 " " '03	1,160,424	592,609	567,816	------	------
SAN FRANCISCO, CAL.						
United Railroads of San Francisco	1 m., Nov. '04	567.673	------	------	------	------
	1 " " '03	533,56.	------	------	------	------
SAVANNAH, GA.	1 m., Oct. '04	48,171	26,814	21 358	10,694	10.664
Savannah Electric Co.	1 " " '03	43,697	26 264	17,433	10,449	6,984
	12 " " '04	540,053	304,291	235 762	125,924	109,839
	12 " " '03	513,207	306,276	206,931	117,587	89,344
SEATTLE, WASH.	1 m., Oct. '04	203,232	136.195	67,037	25,411	41,626
Seattle Electric Co	1 " " '03	186,501	138 616	47,885	22,906	24,979
	12 " " '04	2,283,516	1,580,506	703,011	2 4,399	418,612
	12 " " '03	2,080,914	1,492,522	588,393	288,509	299,884
SYRACUSE, N. Y.	1 m., Oct. '04	71,828	41,133	30,695	20,338	10,357
Syracuse R. T. Co	1 " " '03	70,016	39 6~6	30,330	20,170	10,160
	4 " " '04	291,233	162,641	128,592	81,129	47,462
	4 " " '03	282,609	157,145	125,464	81,053	44,411
TERRE HAUTE, IND.	1 m., Oct. '04	47,405	30,128	17,277	9,319	7,958
Terre Haute Tr. & Lt. Co	1 " " '03	44,410	28,145	16,274	8,400	7,875
	12 " " '04	555,065	369,129	185 937	113,459	72,478
	12 " " '03	456,534	300,384	156,150	82,241	73,909
TOLEDO, O.	1 m., Nov. '04	146,759	*77,037	69,722	41,626	28,096
Toledo Rys. & Lt. Co.	1 " " '03	140,718	*75,210	65,508	40,811	24,697
	11 " " '04	1,586,904	*845,372	741 532	458,181	283,351
	11 " " '03	1,509,299	*781,189	728.110	448,907	279,203