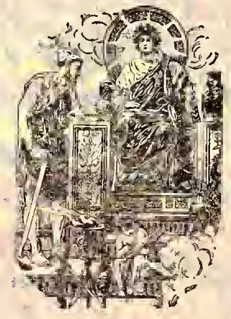

THE

The Street Railway Journal.

INDEX TO VOLUME XXV.

January to June, 1905.

McGraw Publishing Co.,
114 Liberty Street,
New York.

INDEX TO VOLUME XXV.

(Abbreviations: * Illustrated. *c* Correspondence.)

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AUTHORS' INDEX

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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 demonstrated 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

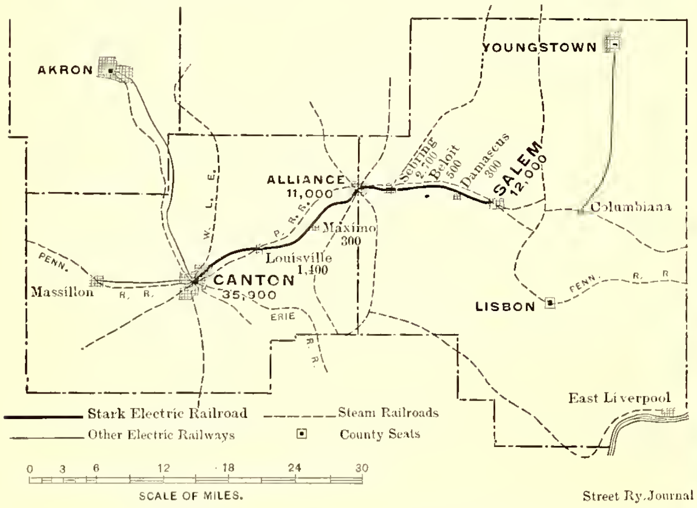
At the last meeting of the American Institute of Electrical Engineers a very interesting and suggestive paper was presented by Mr. Mershon dealing with the economic features of long distance power transmission, and especially with the extensions to which we may look forward in the near future. Such computations 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.

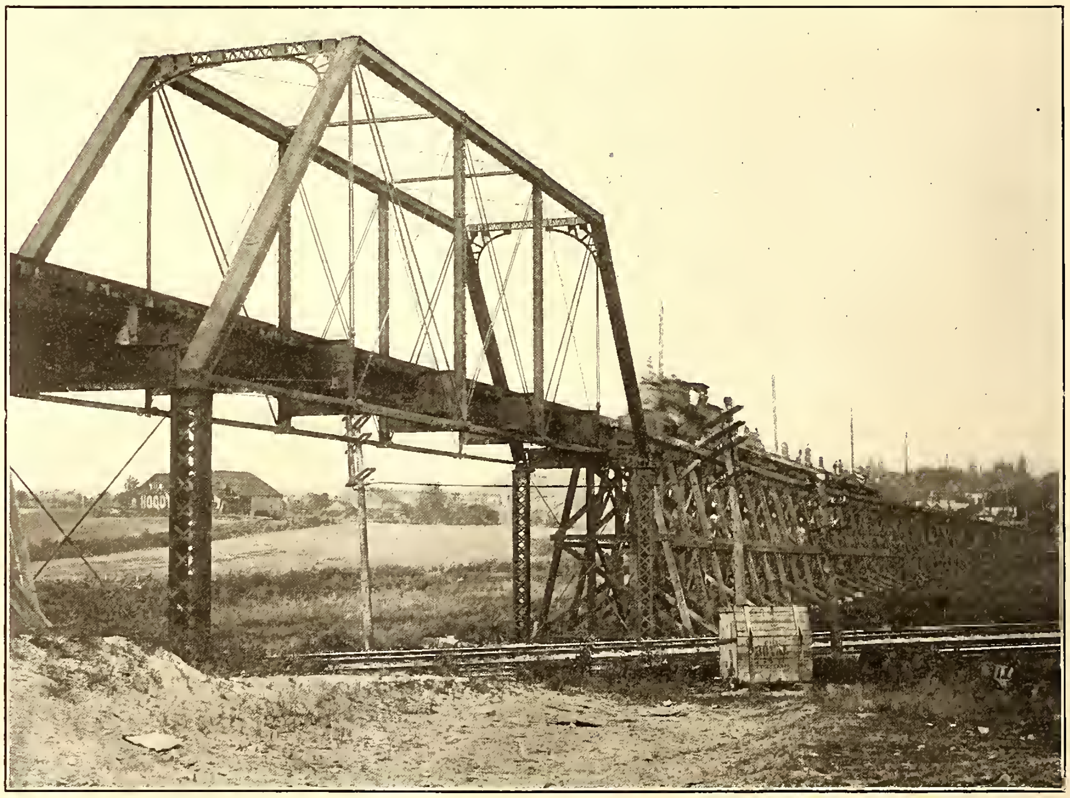
THE SYSTEM OF THE STARK ELECTRIC RAILROAD COMPANY

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

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.

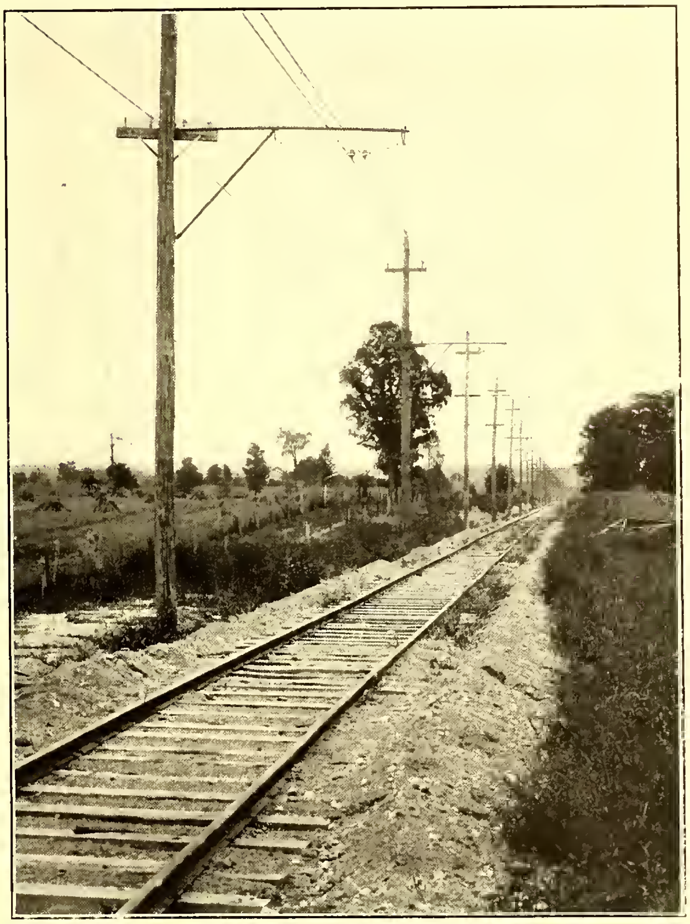


OVERHEAD CROSSING APPROACHING SALEM. A 5 PER CENT GRADE INTO CITY ON PRIVATE RIGHT OF WAY

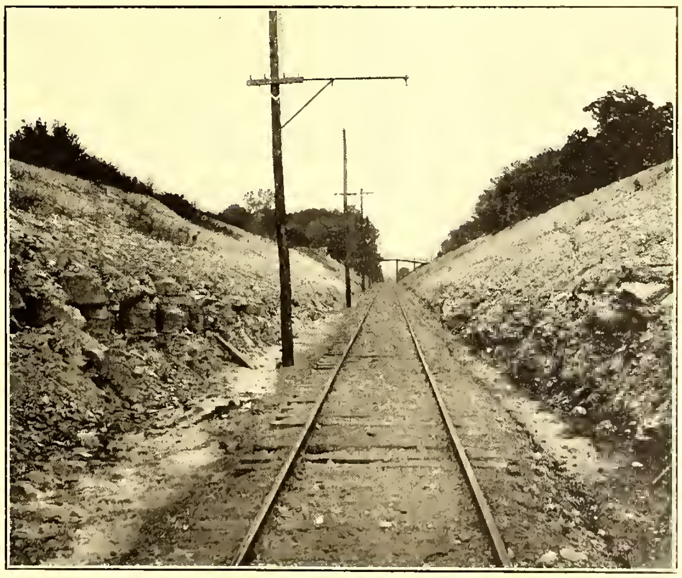
The line traverses one of the most populous districts of Ohio. The population in the towns and other territory tributary to the road is about 70,000, which gives an average of not far from 2000 per mile for the interurban line. The route, connecting steam lines and the population of the towns are shown 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-

CROSSING ABOVE THE PENNSYLVANIA RAILROAD AT LOUISVILLE 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 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 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 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 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


STEAM SHOVEL WORKING IN GRAVEL PIT


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


A HEAVY FILL ON THE STARK ELECTRIC RAILWAY


AN EXAMPLE OF THE OVERHEAD WORK

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

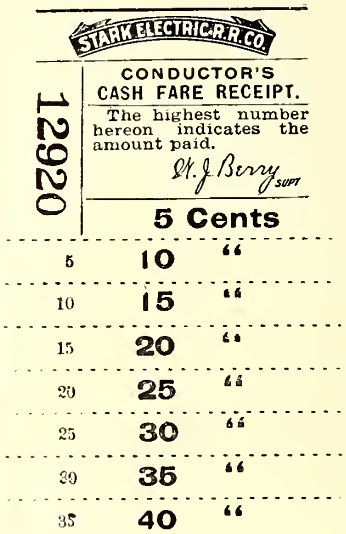
It is the home of the Buckeye Engine Company, one of the oldest and best known manufacturers of steam engines in this country; the Deming Company, pump manufacturers; Silver Manufacturing Company, castings; and one of the largest nail plants of the American Steel & Wire Company. Going into Salem, the 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,

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


STARK ELECTRIC R.R. CO.
12920
CONDUCTOR'S CASH FARE RECEIPT.
The highest number hereon indicates the amount paid.
M. J. Berry, Supt.
5 Cents
5 10 "
10 15 "
15 20 "
20 25 "
25 30 "
30 35 "
35 40 "

CASH RECEIPT

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

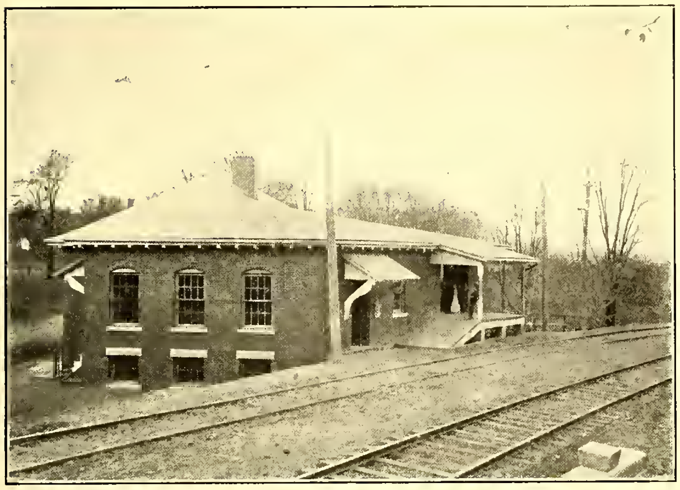
connection with the business it already handles over the Canton-Akron line from Canton. Through shipments are at present possible, but the goods have to be reshipped at Canton. Goods from Louisville, Maximo, Sebring and Salem are frequently taken to Alliance and shipped to Cleveland over the Pennsylvania, 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:

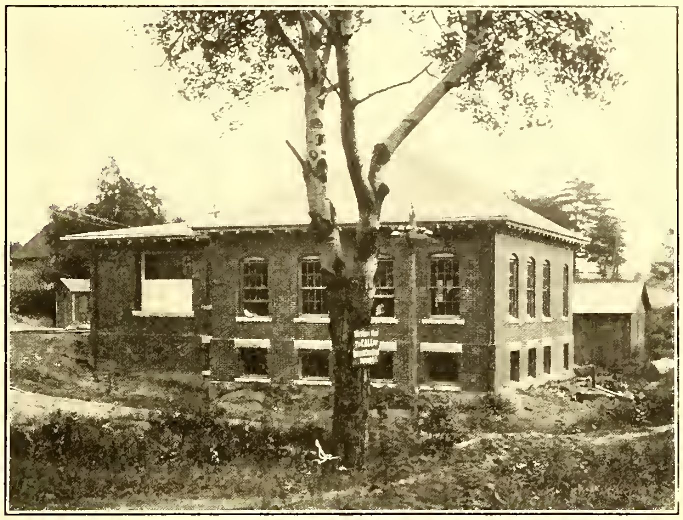
Miles	Town	Ticket Fare	Cash Fare	Round Trip
..	Canton	....	$0.05	....
7	Louisville	$0.10	15	$0.20
14	Maximo	25	25	50
19	Alliance	35	40	70
24	Sebring	40	45	80
25	Beloit	45	50	90
33	Salem	60	70	1.20

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

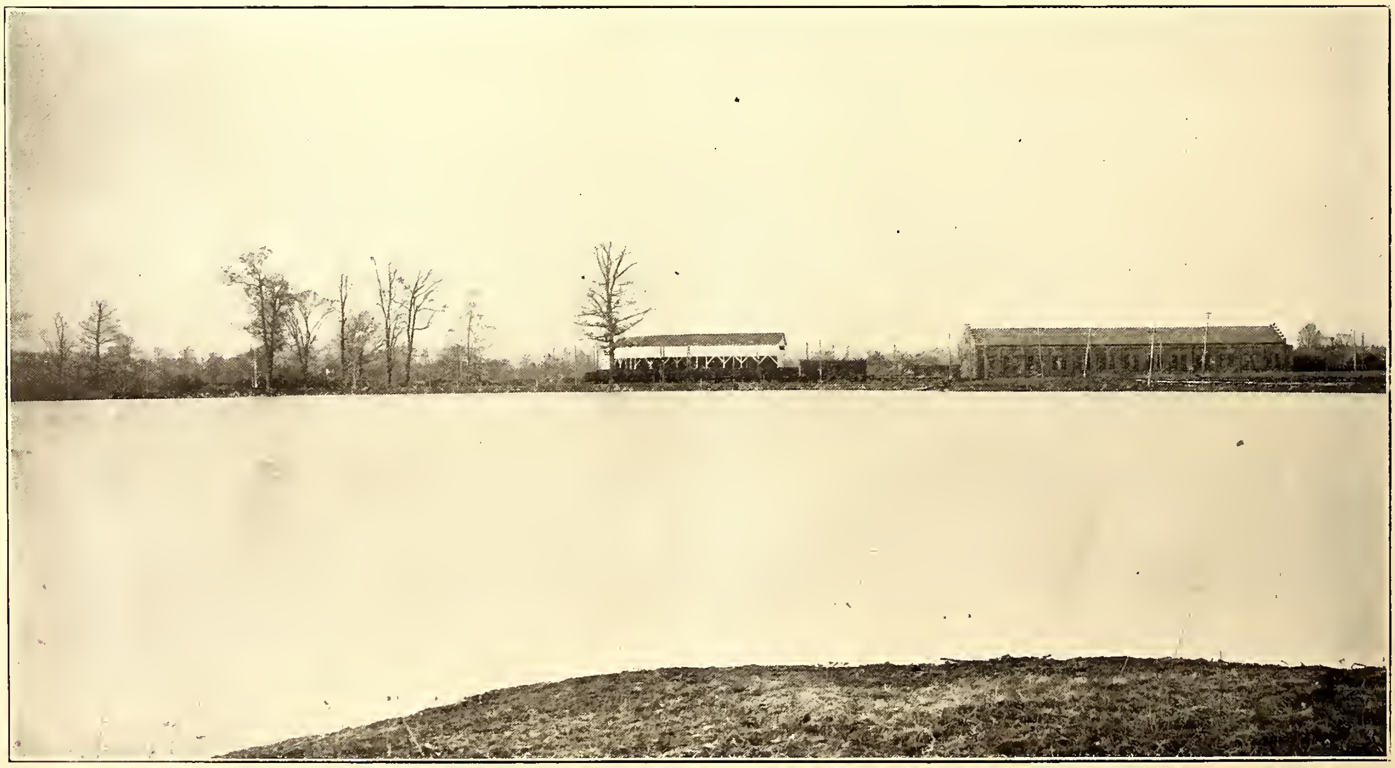
HANDLING THE CROWDS IN TRAINS ON A BASEBALL DAY fill and a 19-ft. cut, its grade being .5 of 1 per cent, while that of the steam road is .9 of 1 per cent. In doing this work the engineers uncovered what is believed to be Stark County's only gravel bank, which has been of immense value in ballasting. 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.

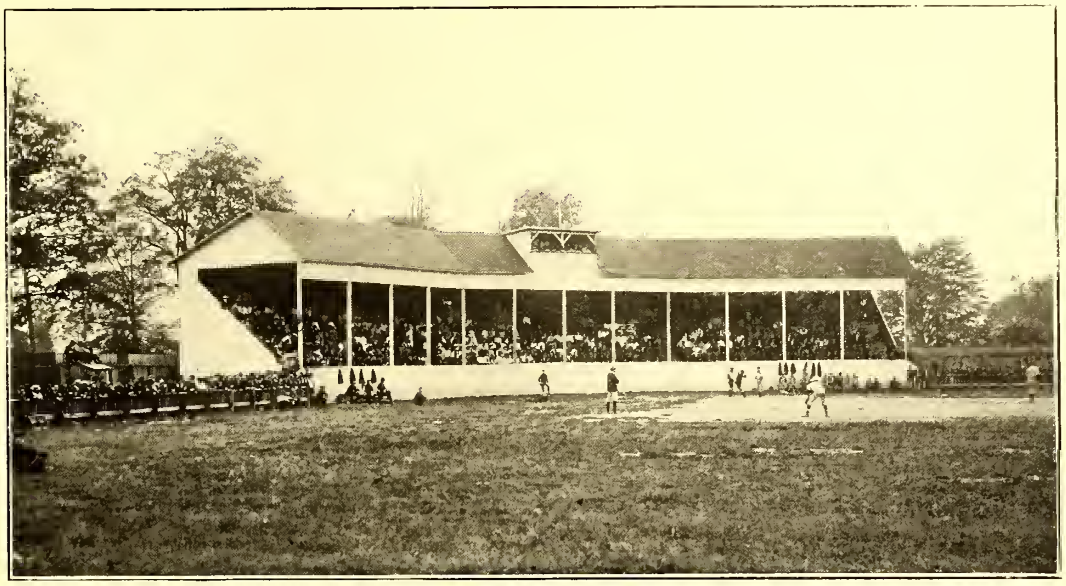


PART OF PANORAMIC VIEW OF LAKE, SHOWING CAR HOUSE AND BACK OF BASEBALL GRANDSTAND

The company operates a baseball park between Alliance and

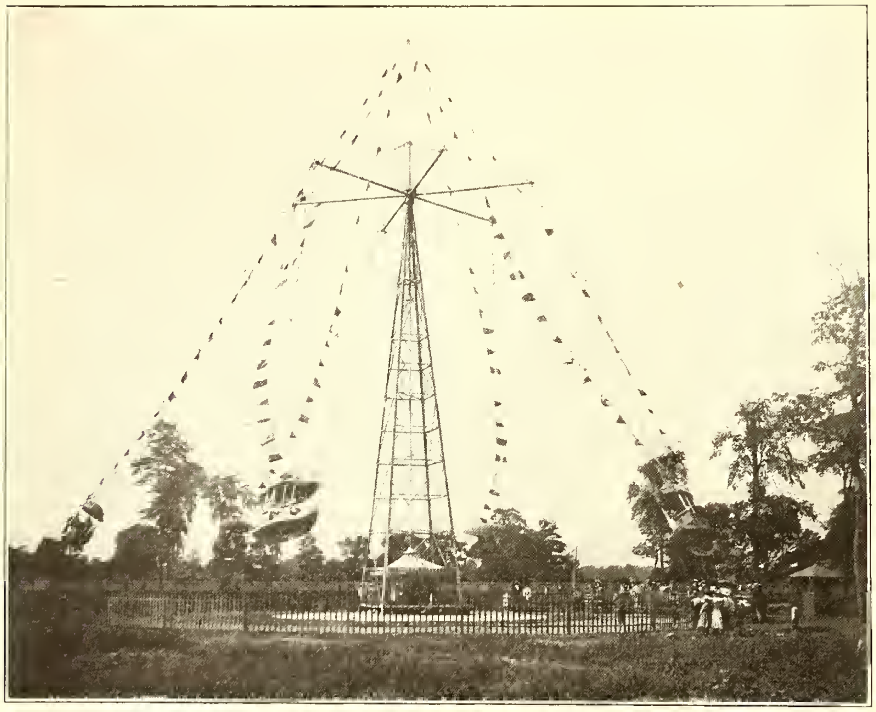
Sebring, and regular games have been played there all summer. For the large crowds thus attracted, unusual transportation facilities was required at times. It was deemed undesirable to purchase additional motor cars for this service, so the company took advantage of an opportunity to buy eight of the 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.

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



BALL PARK AND STAND

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

ENTRANCE TO LAKE PARK

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.

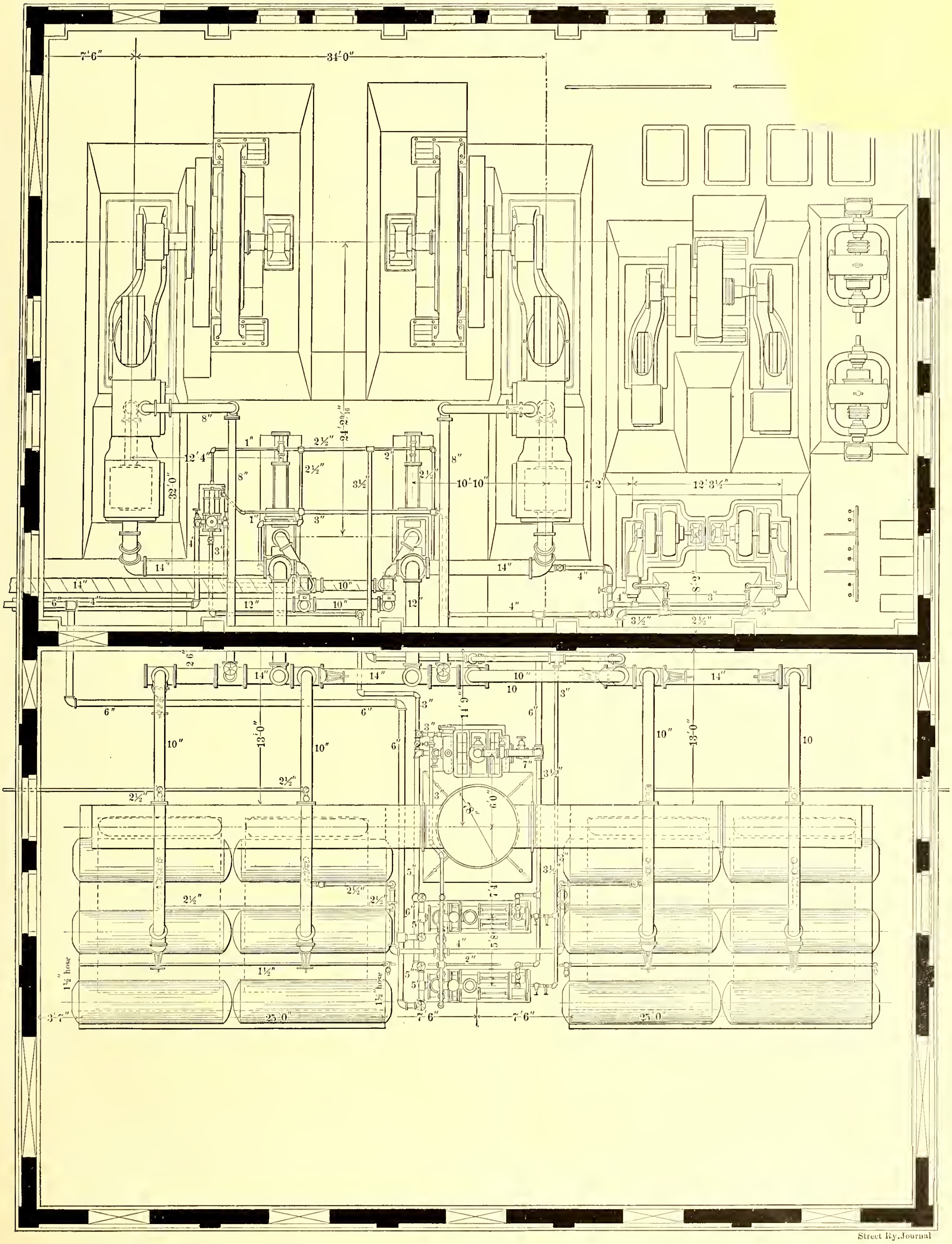
The power station is of attractive design, built of hard burned brick, with stone trimmings, and laid with black mortar. The boiler room is 72 ft. x 46 ft., and the engine rooms, 75 ft. x 50 ft., inside dimensions. The boiler room floor is 7 ft. below that of the engine room floor. The condenser pit 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

EXTERIOR OF POWER HOUSE

a heavy foundation. The stack shows 1.01 in. draft with one boiler working to rating with temperature of 525 degs. in intake.

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.

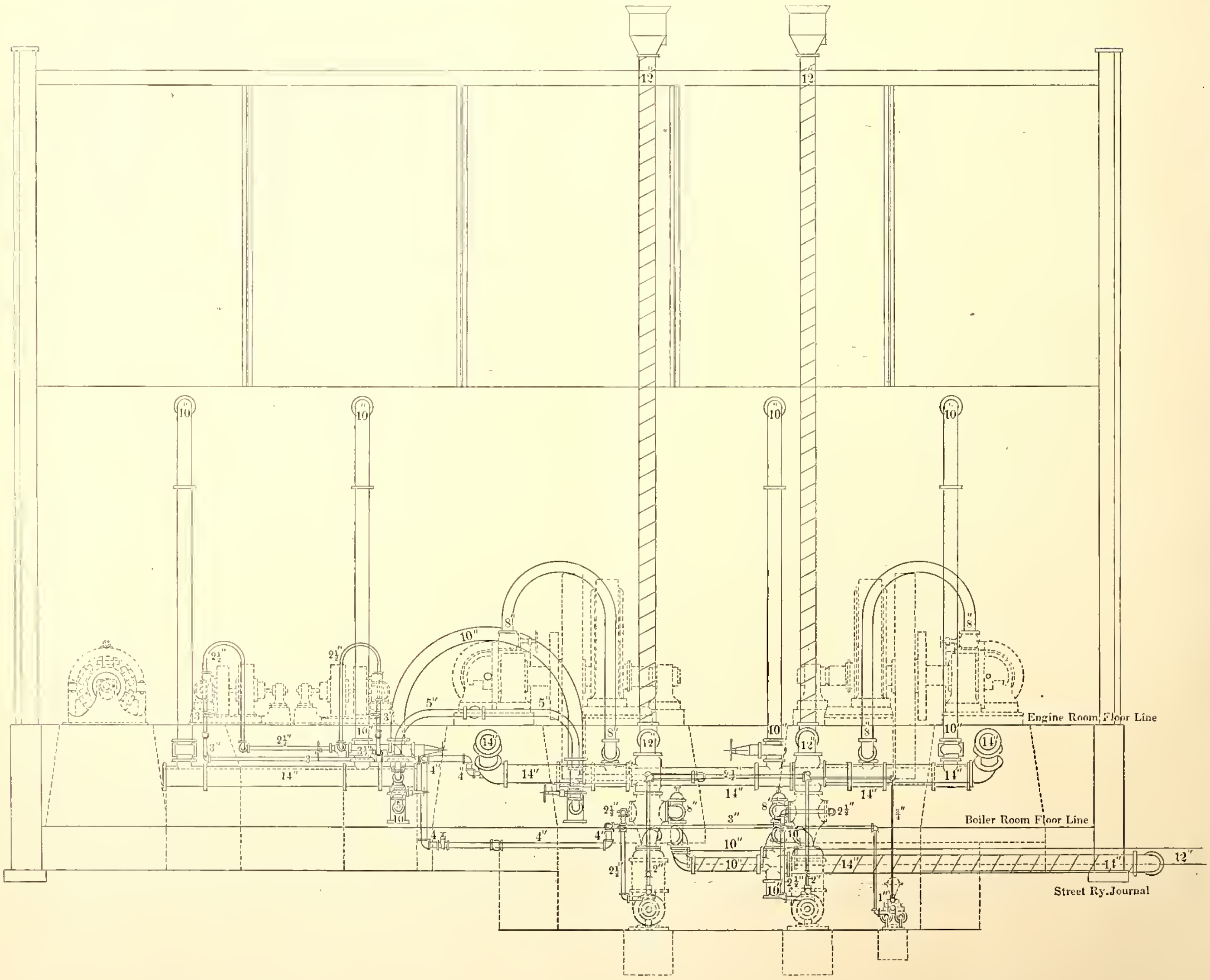


GROUND PLAN OF POWER PLANT OF THE STARK ELECTRIC RAILWAY COMPANY

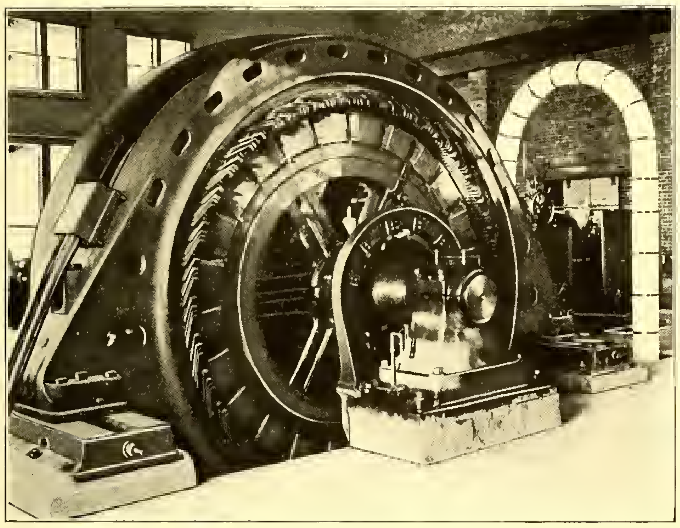
l four-valve Russell engine, with Cor-
·s run at 125 r. p. m., making a piston
.r minute, which is considered a slow speed for engines of this size. The engines are without superheaters or steam jackets, and have cast-iron sole-plates covering the entire top of the engine bed and outer bearing foundation. 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

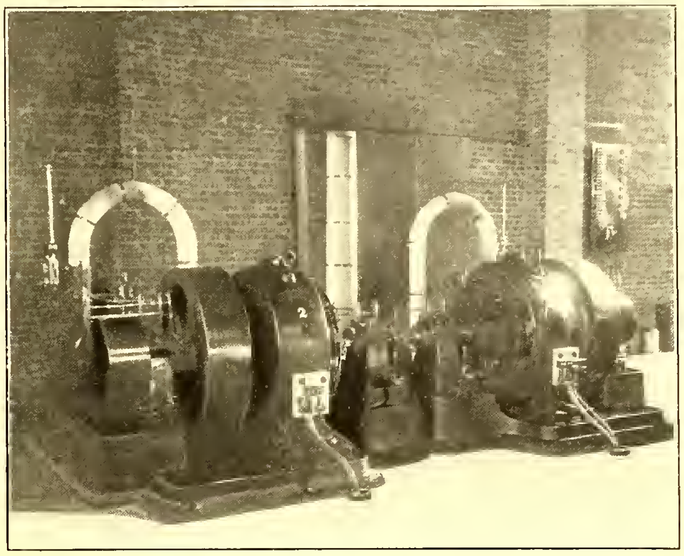
In the boiler room is a 1250-hp Cochrane open feed-water heater which is supplied with water at 100 degs. from a hot-well by a 4½-in. x 6-in. Laidlaw-Dunn-Gordon low-pressure pump. This pump is located in the condenser pit, and its supply comes by gravity from the hot-well just outside of the building.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

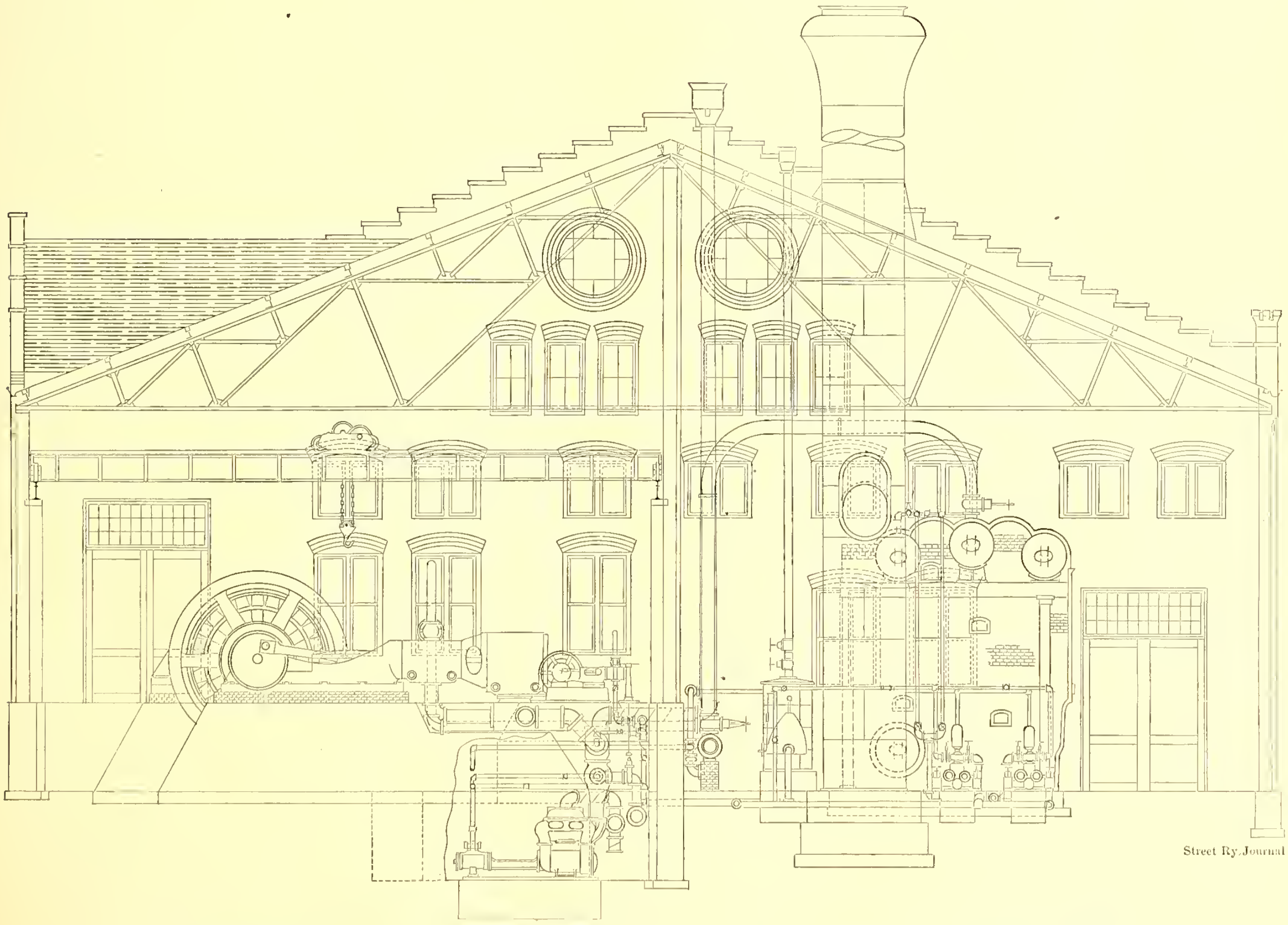


ONE OF THE GENERATORS

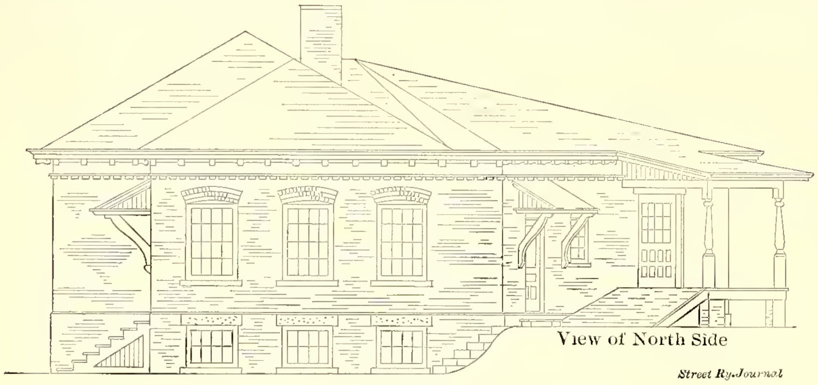


THE EXCITER UNITS IN THE POWER STATION

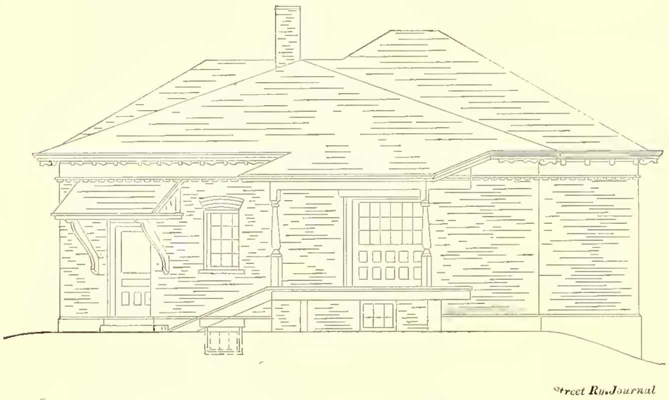
The steam from each large engine is condensed by a 14-in. x 18-in. x 24-in. single double-acting Laidlaw-Dunn-Gordon air pump and jet condenser in the condenser pit. The suction is taken from a cold well outside the building, which is supplied by gravity from the park lake through a line 1000 ft. long. 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



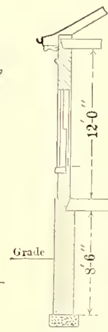
CROSS-SECTIONAL ELEVATION OF POWER PLANT OF STARK ELECTRIC RAILWAY COMPANY under ordinary load, the engine was operated from condensing to atmosphere and back to condensing in less than one minute.



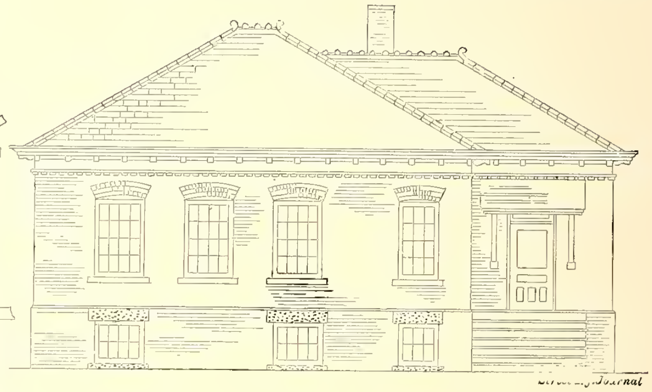
East Elevation



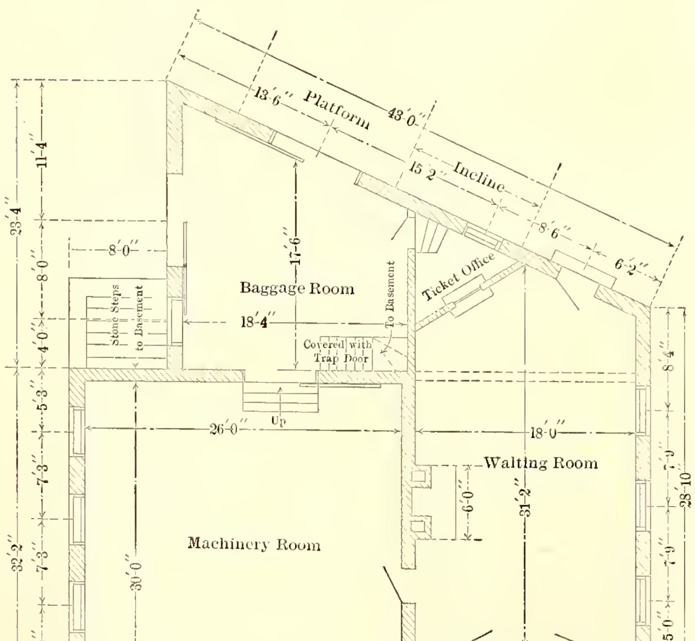
North Elevation



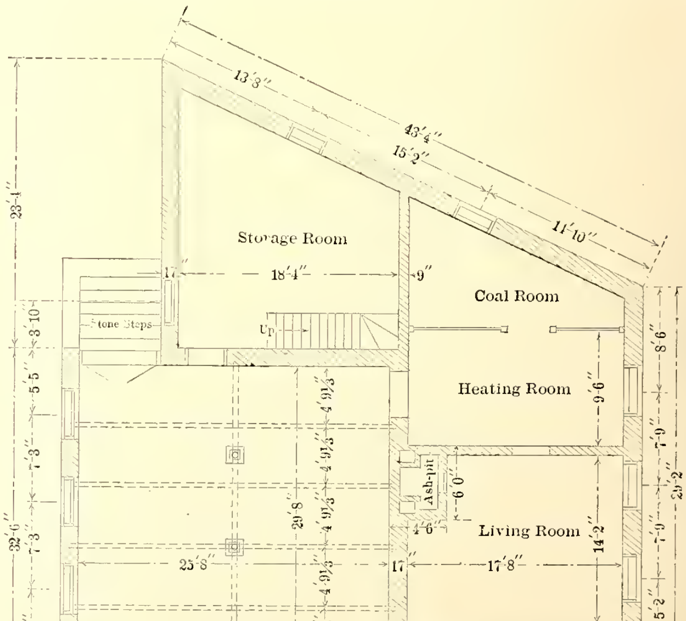
Section



South Elevation



Plan of Basement



Floor Plan

PLANS AND ELEVATIONS OF DAMASCUS SUB-STATION

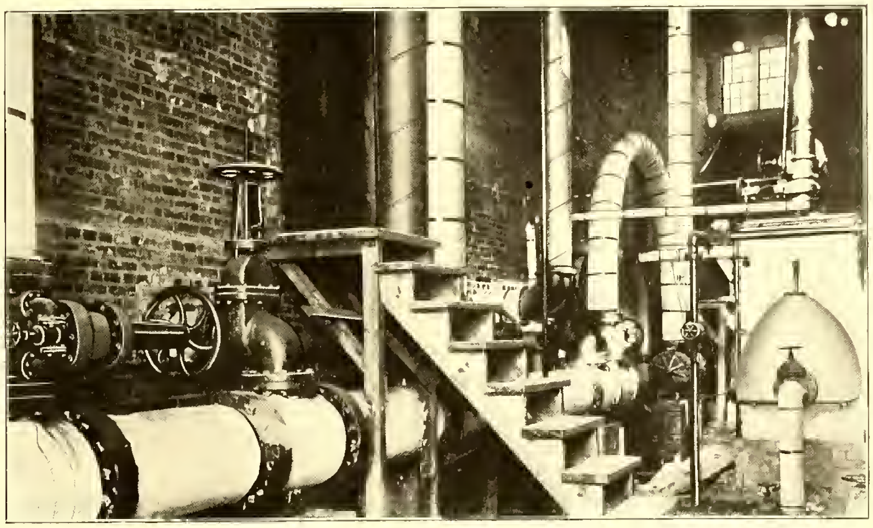
The boiler feed-pumps are 10 ins. x 6 ins. x 10 ins., outside center packed, of Laidlaw-Dunn-Gordon manufacture. They are cross-connected so that either will deliver to one or both boilers. The suction is cross-connected so that one can draw from the heater while the other takes from the hot-well or 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 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.

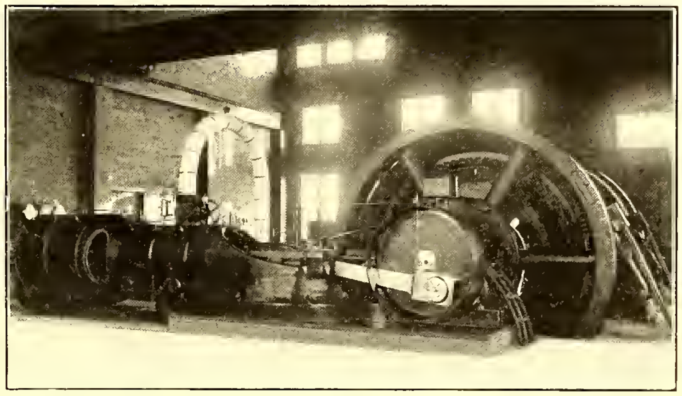
A large car house of sufficient capacity to accommodate all the motor cars is located adjoining the power station. At present only the lighter class of repair work is taken care of here, and the company is preparing to erect another building to be fitted up with modern repair shop equipment.

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.



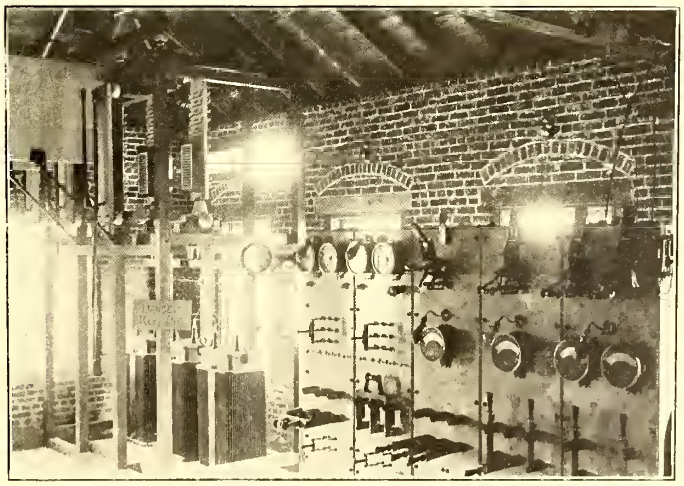
STEAM HEADER AND FEED-WATER HEATER IN THE BOILER ROOM

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

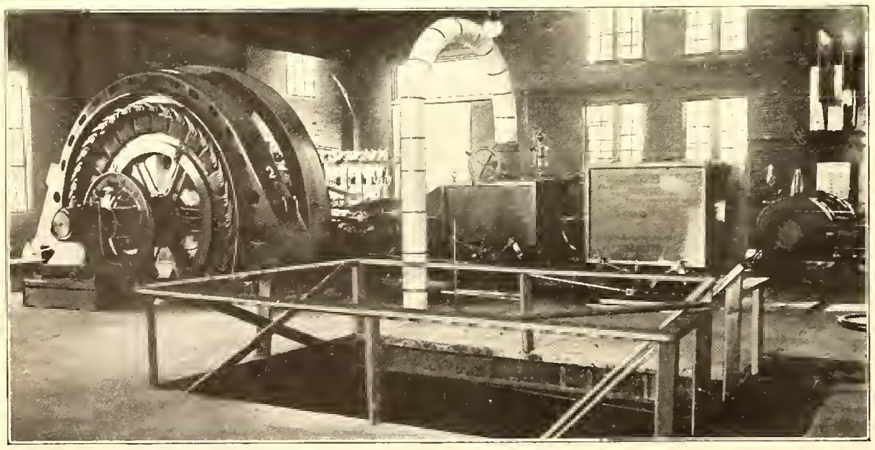
pected to see that the car is properly cleaned and in shape for service. By this plan each crew acquires personal interest in its car. The motorman is expected to study thoroughly and

CAR HOUSE OF THE STARK ELECTRIC RAILWAY COMPANY

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.

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.

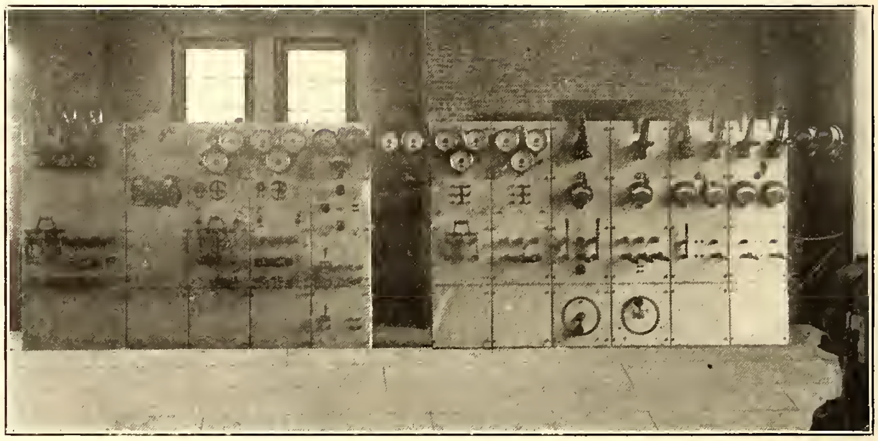
The Stark Electric Railroad Company has an authorized capital stock of $1,000,000, of which $850,000 is issued. The bonded indebtedness is $1,000,000, with $750,000 issued. The bonds have never been placed on the market, but are held in a pool by the men who promoted and built the road. These gentlemen comprise an independent syndicate, the majority of them Cleveland men, who have gone into the proposition as a permanent investment. They formed the Interurban Con-



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

struction 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.

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 Super-



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

vision." 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.

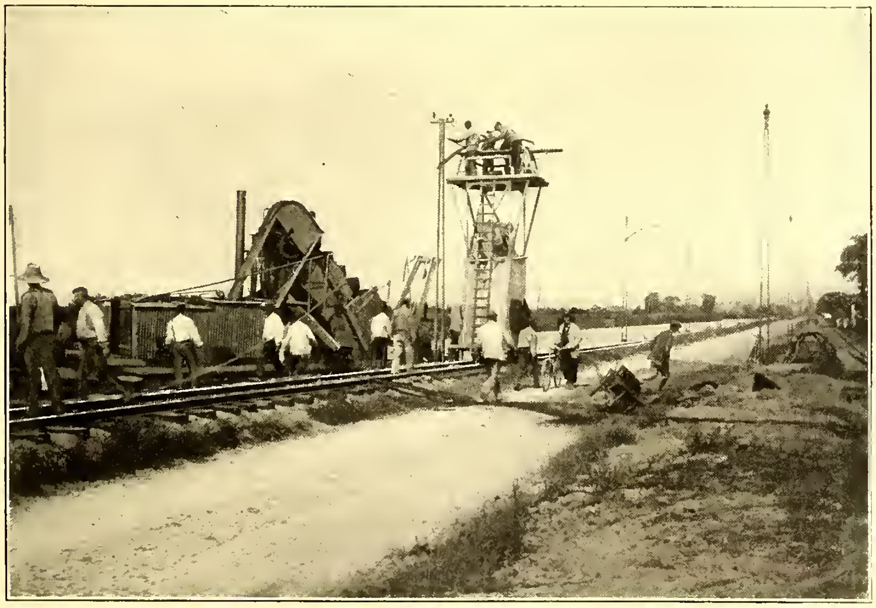
THE AMSTERDAM-HAARLEM TRAMWAYS SYSTEM

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 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.



ERECTING FEEDERS AND DREDGING ON GOVERNMENT ROAD

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 obtained 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.

VIEW ALONG GOVERNMENT ROAD NEAR HAARLEM

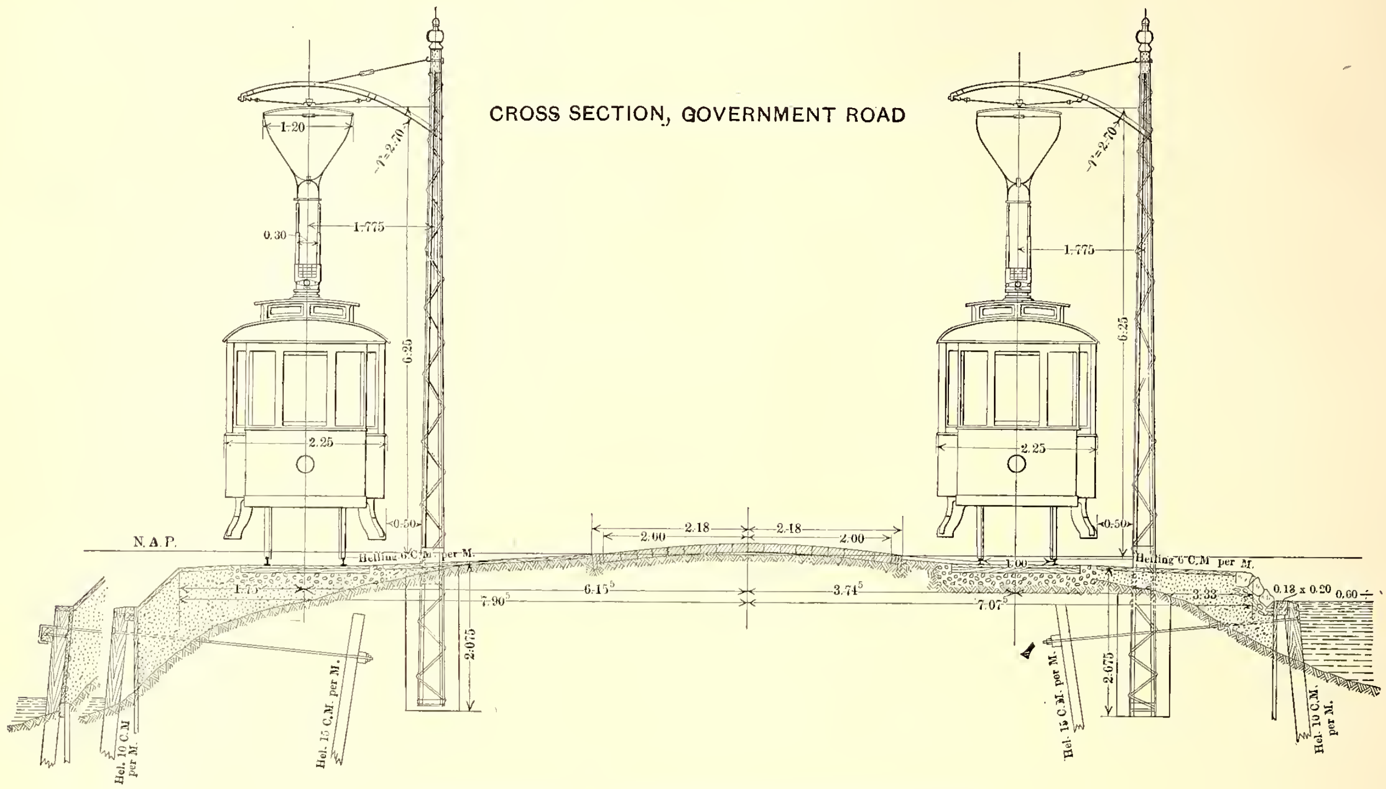
Running powers were then secured over the tramways of Amsterdam, then in process of electrification, for a distance of about 1 mile from the city limits to the corner of the Spui and the Kalverstraat, the center of the office and retail business districts of Amsterdam. The gage of the Amsterdam city 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.

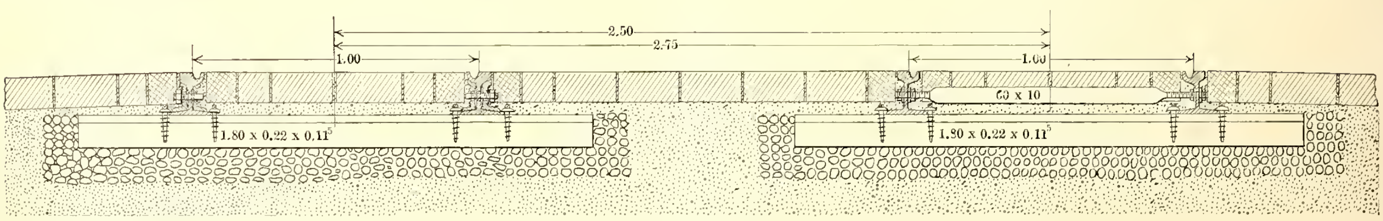
Messrs. Anderhagen & Neumeyer then secured an agreement with the corporation of Haarlem permitting the construction of about 1½ miles of lines within that city, to give the company a satisfactory terminus at its eastern end. The Haarlem concession is also for a period of fifty years, and is without unusual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

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.



CROSS SECTION OF TRACK ON GOVERNMENT ROAD



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 Amsterdam 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.

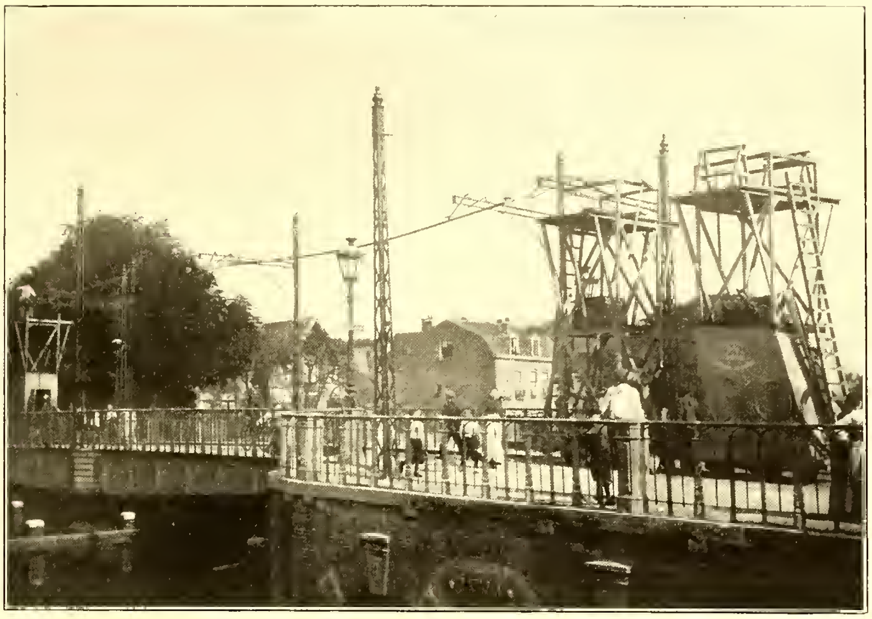
At the village of Slotedyk the line joins what is known as "The Government High Road," between Amsterdam and Haarlem. On the north side of this road is a canal running the entire length except through the village of Halfweg. On the south side of the High Road is a ditch. The ground over this distance 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.

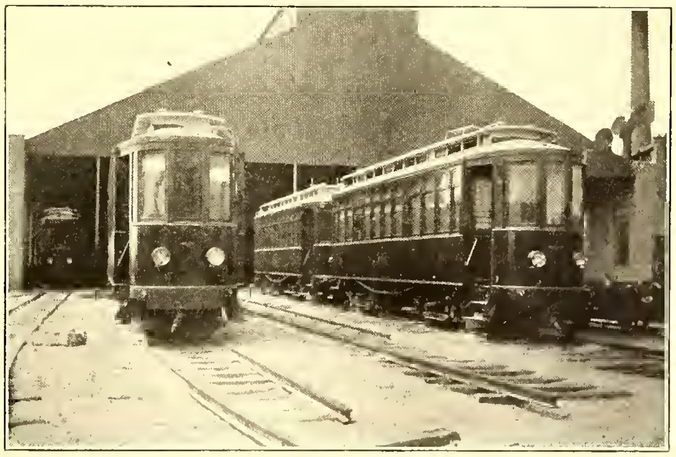


SWING BRIDGE—HAARLEM

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

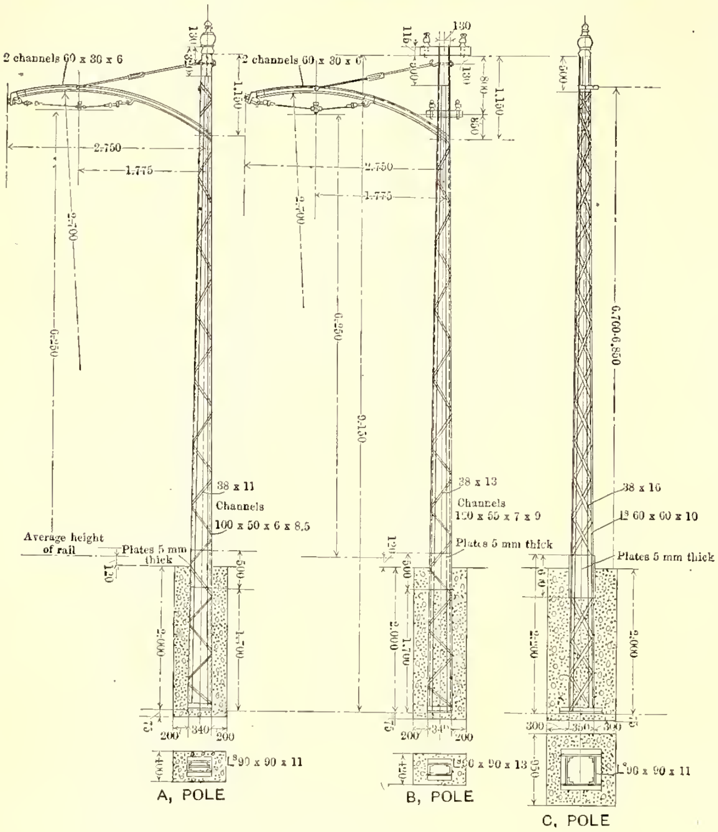


CAR HOUSE—HAARLEM

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.

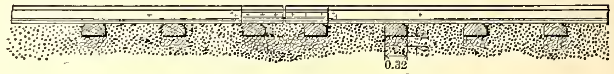


STANDARD POLES

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.

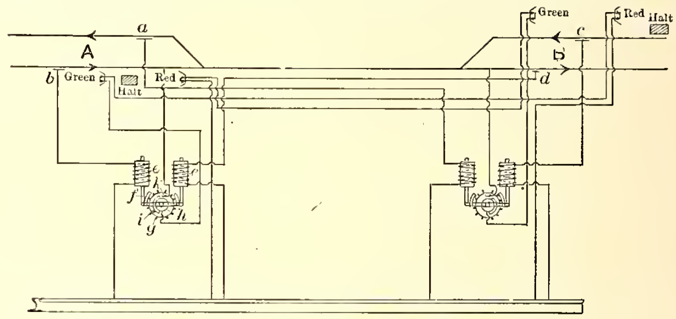
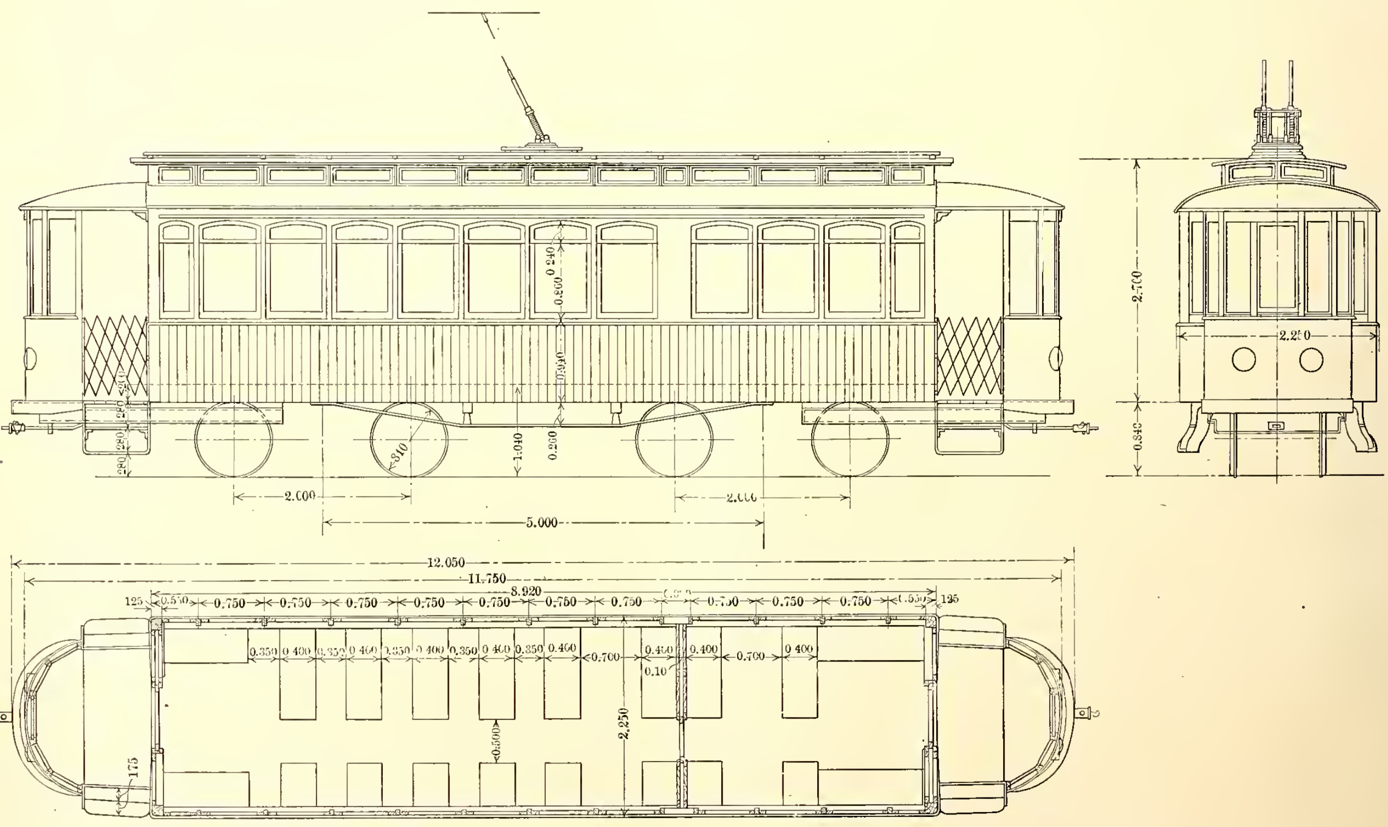


DIAGRAM SHOWING CONNECTIONS OF BLOCK SIGNAL SYSTEM



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.

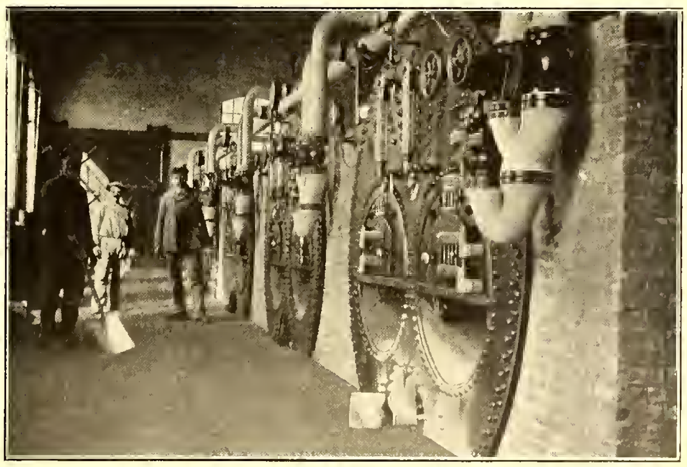
VIEW SHOWING METHOD OF LAYING TRACK

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.

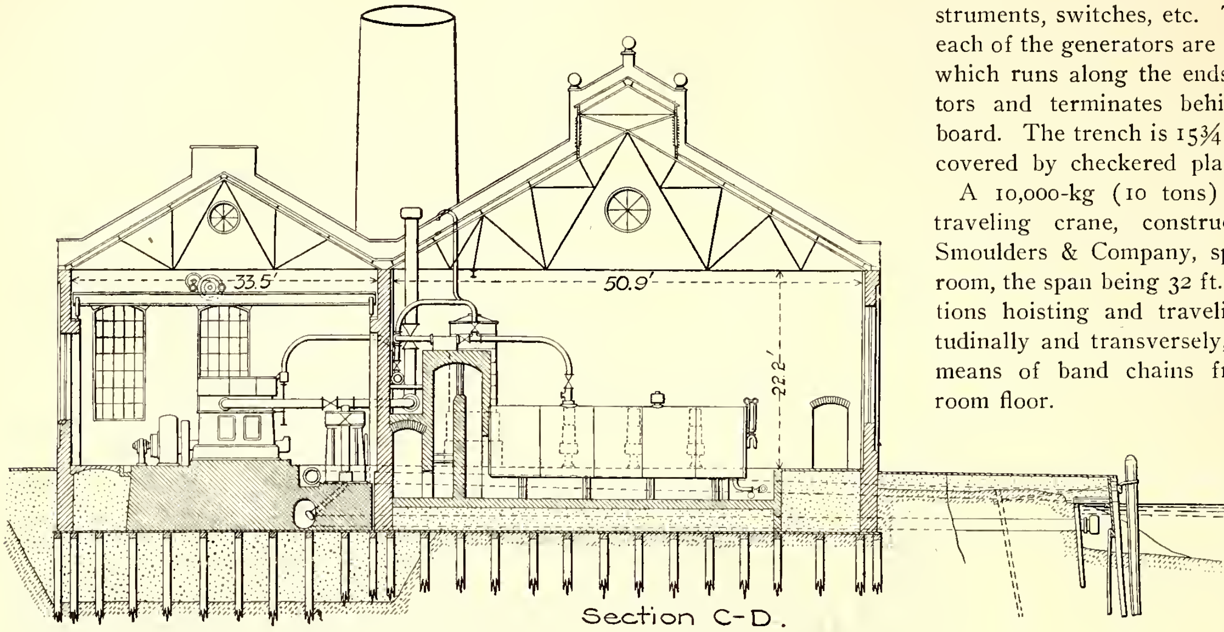
EXTERIOR OF POWER STATION—HAARLEM

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.

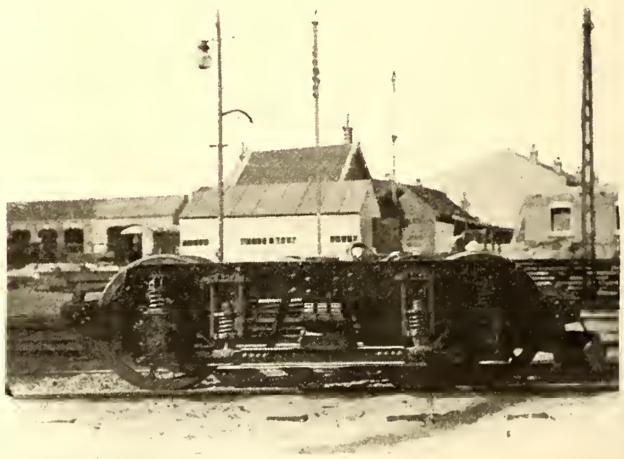
A 10,000-kg (10 tons) overhead hand traveling crane, constructed by Louis Smoulders & Company, spans the engine room, the span being 32 ft. 4 ins. The motions hoisting and traveling, both longitudinally and transversely, are worked by means of band chains from the engine room floor.

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

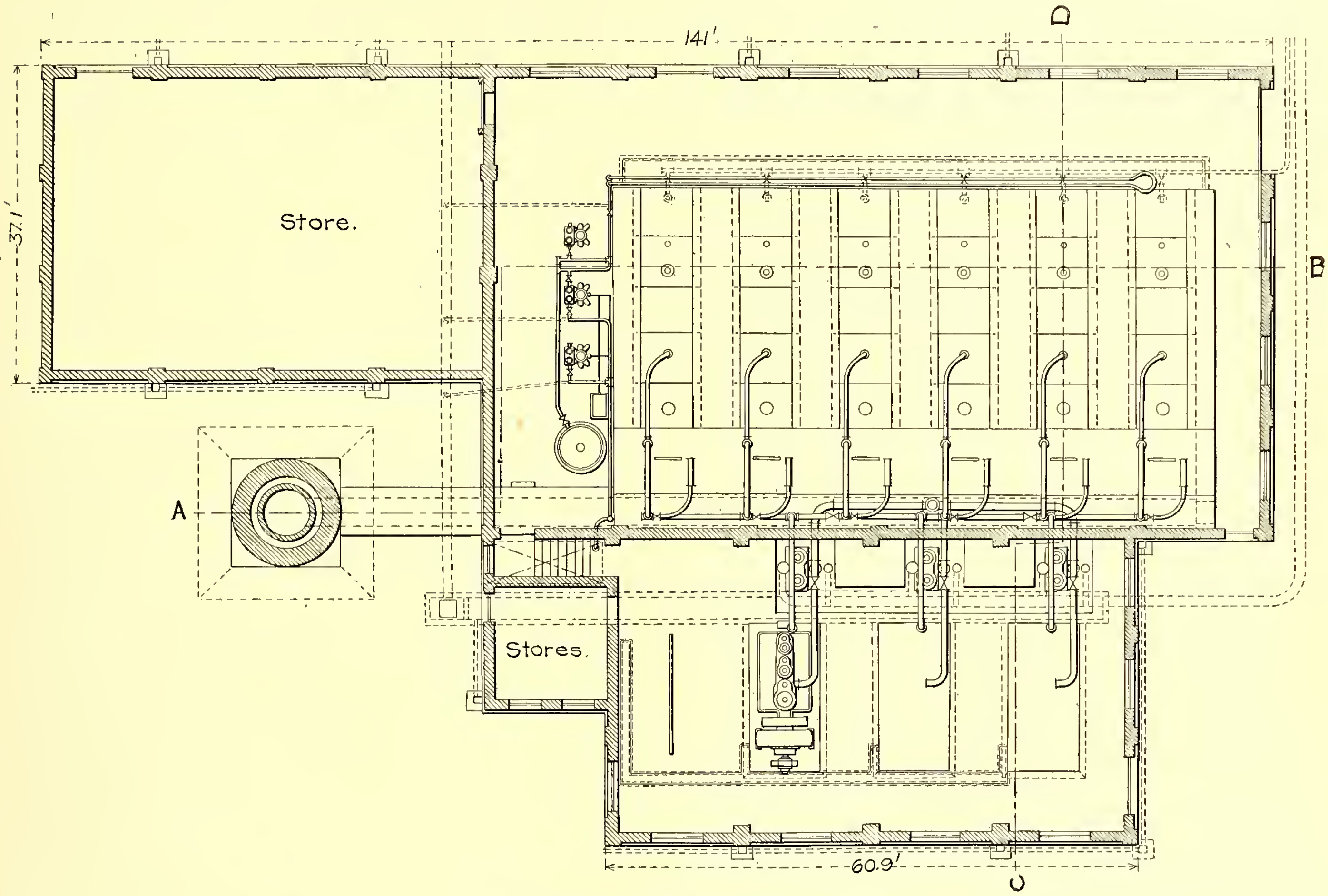
The condensing plant for the main engine, made by the Nederlandsche Fabrick, Amsterdam, consists of three jet condensers, each capable of condensing 9000 lbs. of steam per hour. The pumps are of the vertical type, the cylinders being placed side by side, supported by a cast-iron frame. Directly below 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

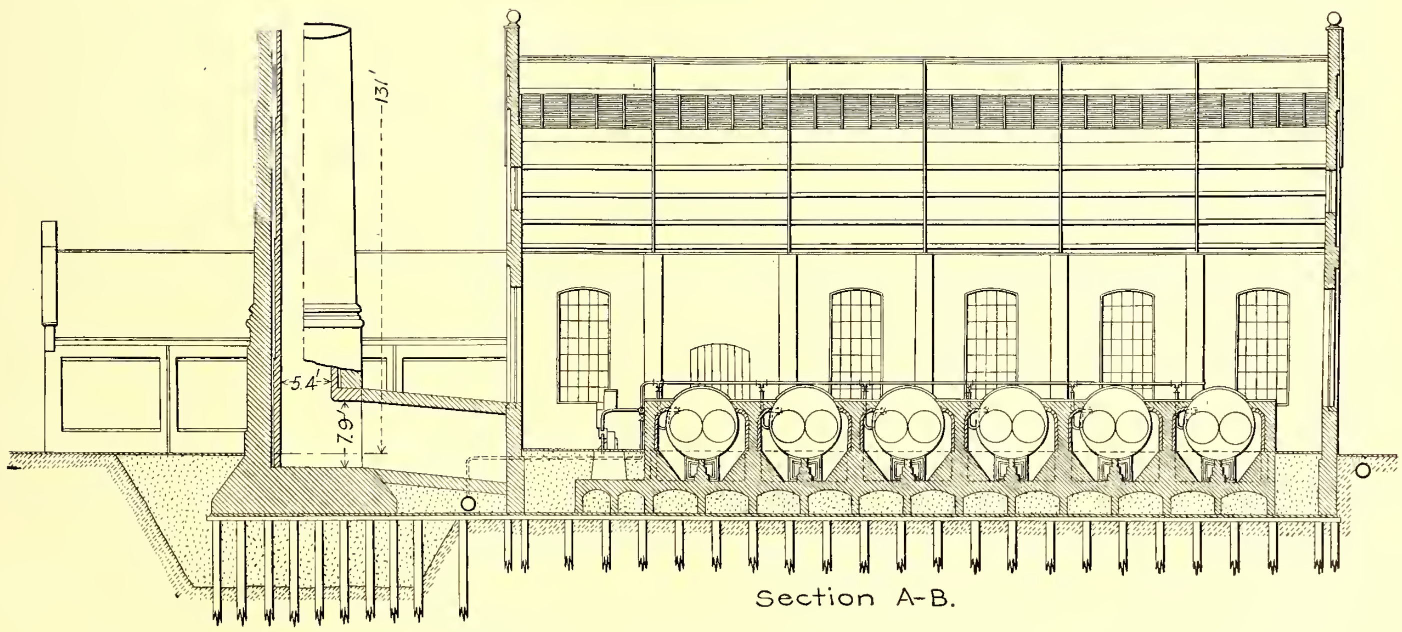
FILTERING TANKS

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

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 pres-



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.

sure 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.

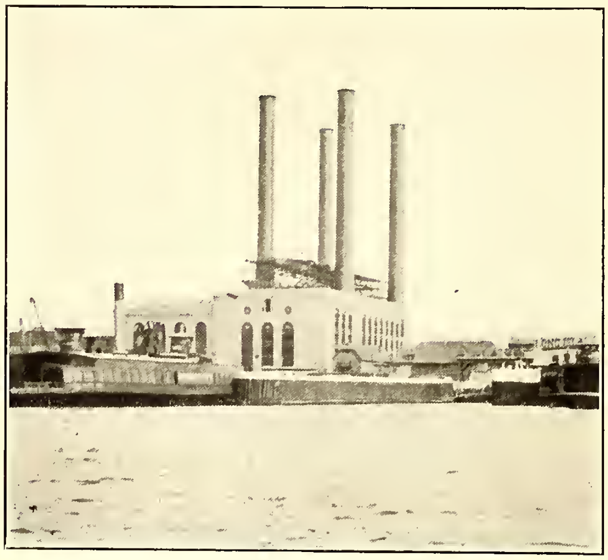
All the rotary converters and transformers were built by the Westinghouse Electric & Manufacturing Company, and are of that company's standard railway type for changing 11,000-volt three-phase 25-cycle alternating current to 625-volt direct current.

VIEW OF STACK DURING ERECTION

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

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 piping from each set of boilers leading into the header by long bends. The steam connections for each turbo-unit are taken

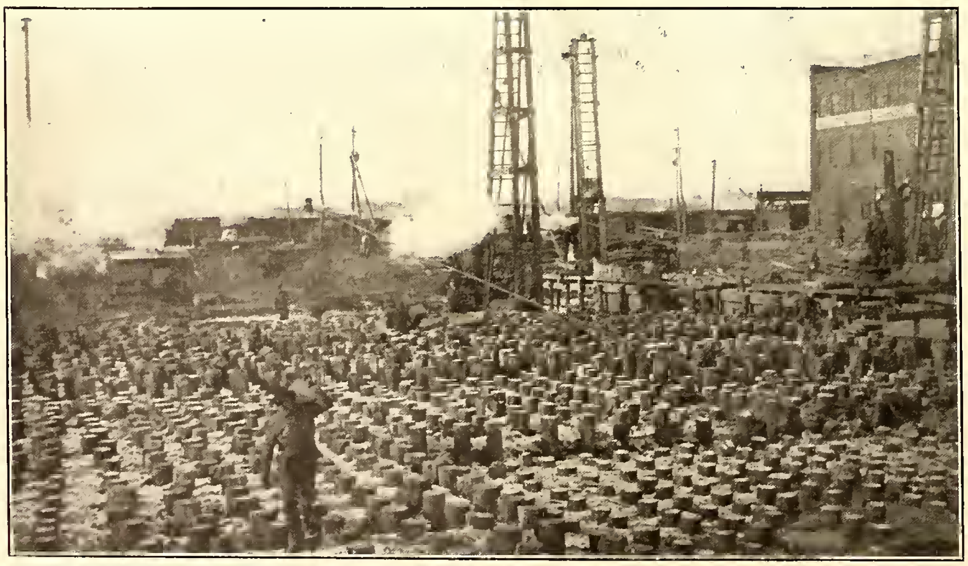


POWER STATION FROM RIVER

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.

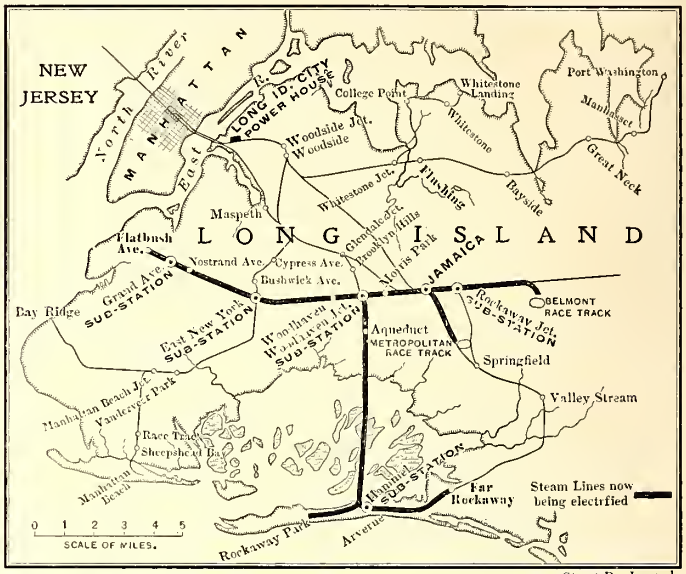
Steam for the present installation of turbines will be generated in thirty-two B. & W. boilers, rated at 600 hp each, arranged in two tiers along each side of an aisle, making eight boilers to each bank. The boilers are fitted with internal super-



PILE FOUNDATION FOR STATION

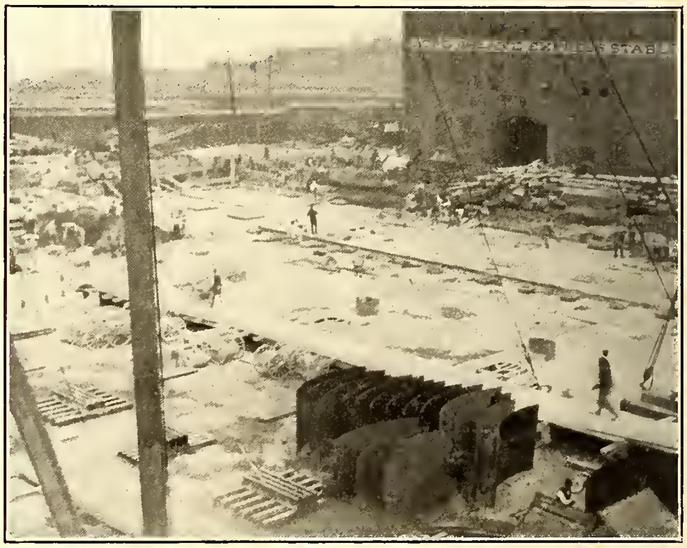
heaters of the B. & W. type, designed to give about 175 degs. F. of superheat. The boiler room equipment includes Roney stokers and Green fuel economizers.

There are four stacks, each 275 ft. high and 23 ft. in diameter at the base. The stacks are of self-supporting steel construc-



Street Ry.Journal

MAP SHOWING LINES TO BE ELECTRIFIED



LAYING THE CONCRETE FOR THE STATION FOUNDATION

tion, 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 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. 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 similar 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.

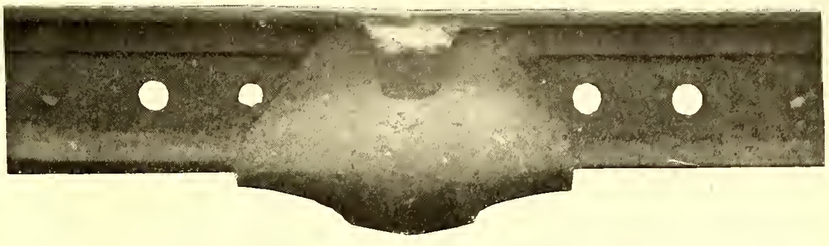


FIG. 1.—SHAPE OF CAST-WELDED JOINT USED ON CALUMET ROAD

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.

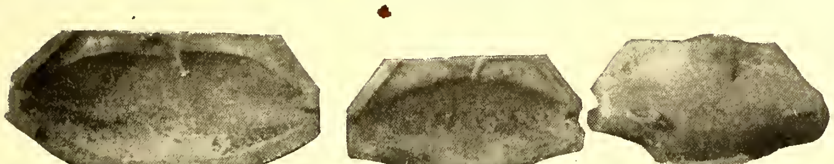


FIG. 2.—ORDINARY MOLDS AND MOLD FOR DUTCHMAN JOINT

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

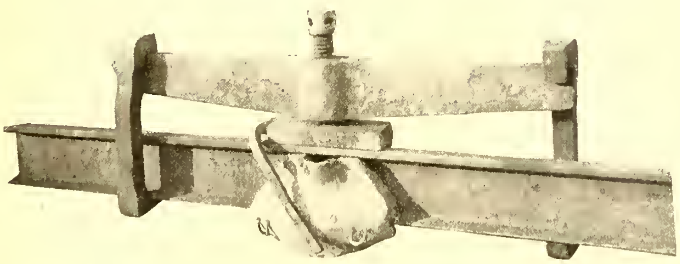


FIG. 3.—MOLDS AND CLAMPS READY TO WELD, POURING SIDE

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.

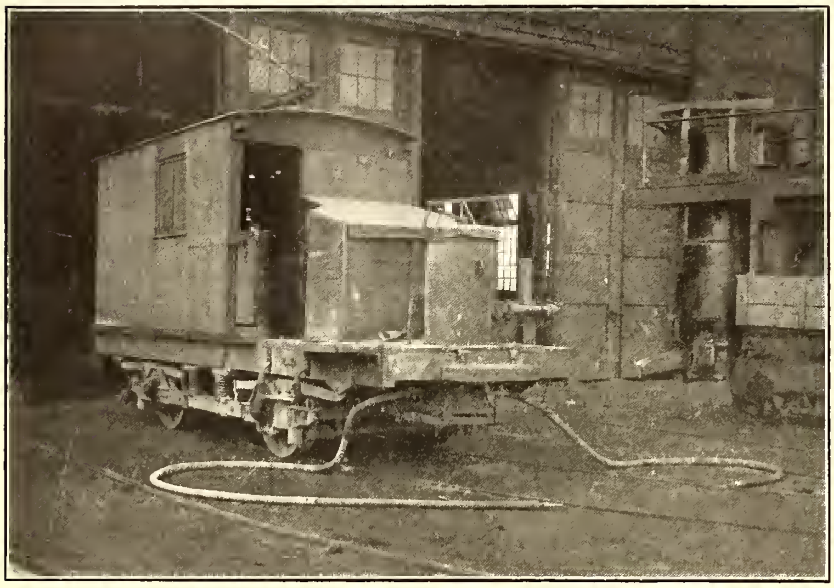


FIG. 5.—SAND BLAST CAR

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.

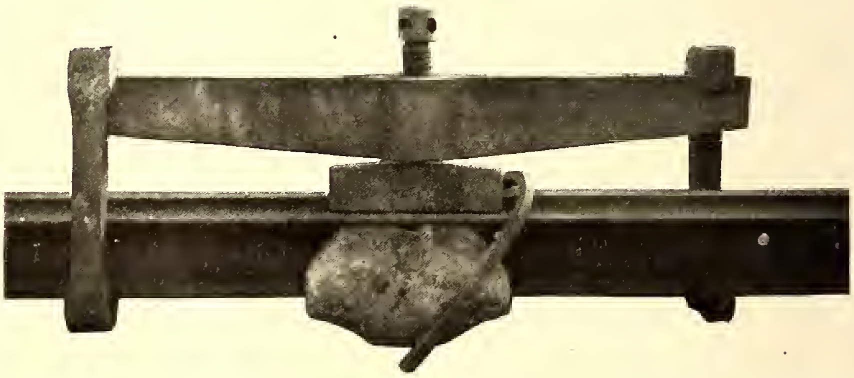


FIG. 4.—MOLDS AND CLAMPS READY TO CAST-WELD, RISER SIDE

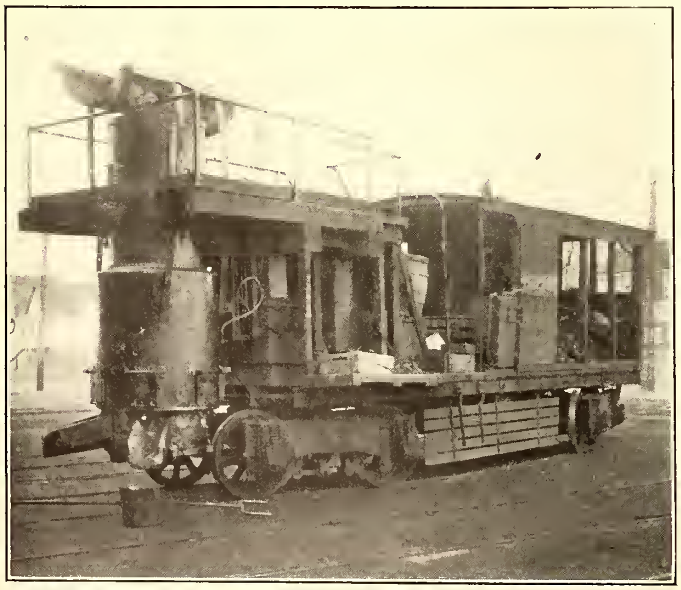


FIG. 6.—CUPOLA CAR

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.

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."

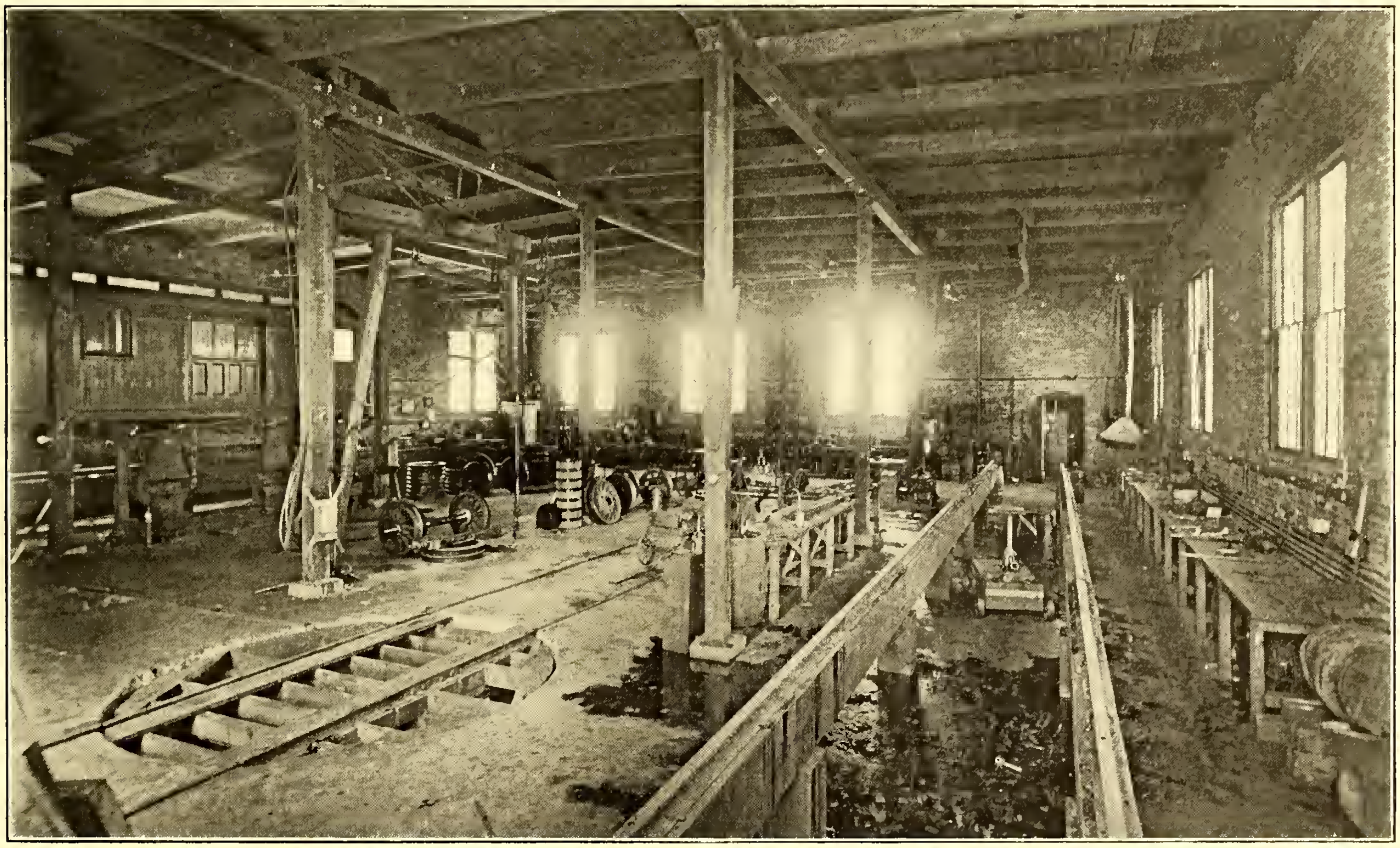
REPAIR SHOP PRACTICE ON THE JACKSON & BATTLE CREEK THIRD-RAIL SYSTEM

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.

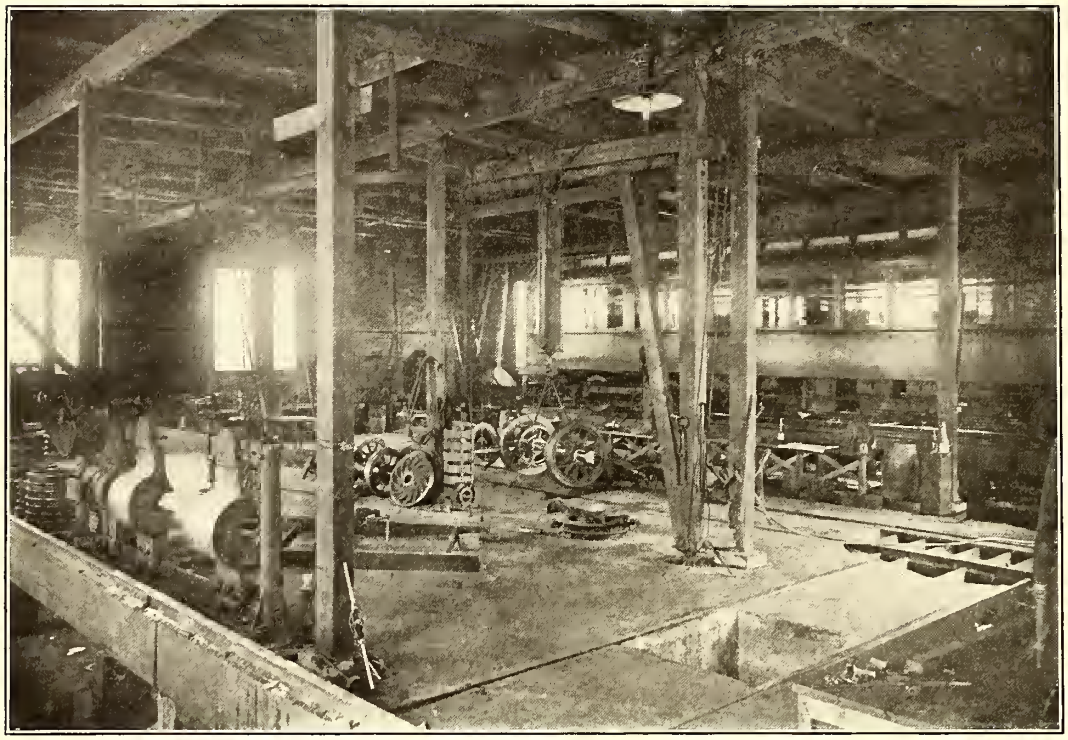
This shop was intended to provide for, in addition to the periodical washings and cleanings, adequate facilities for making both electrical and mechanical repairs of all kinds to the rolling-stock equipment. In this connection a plan of the shop layout is presented, to indicate the arrangement of buildings 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.

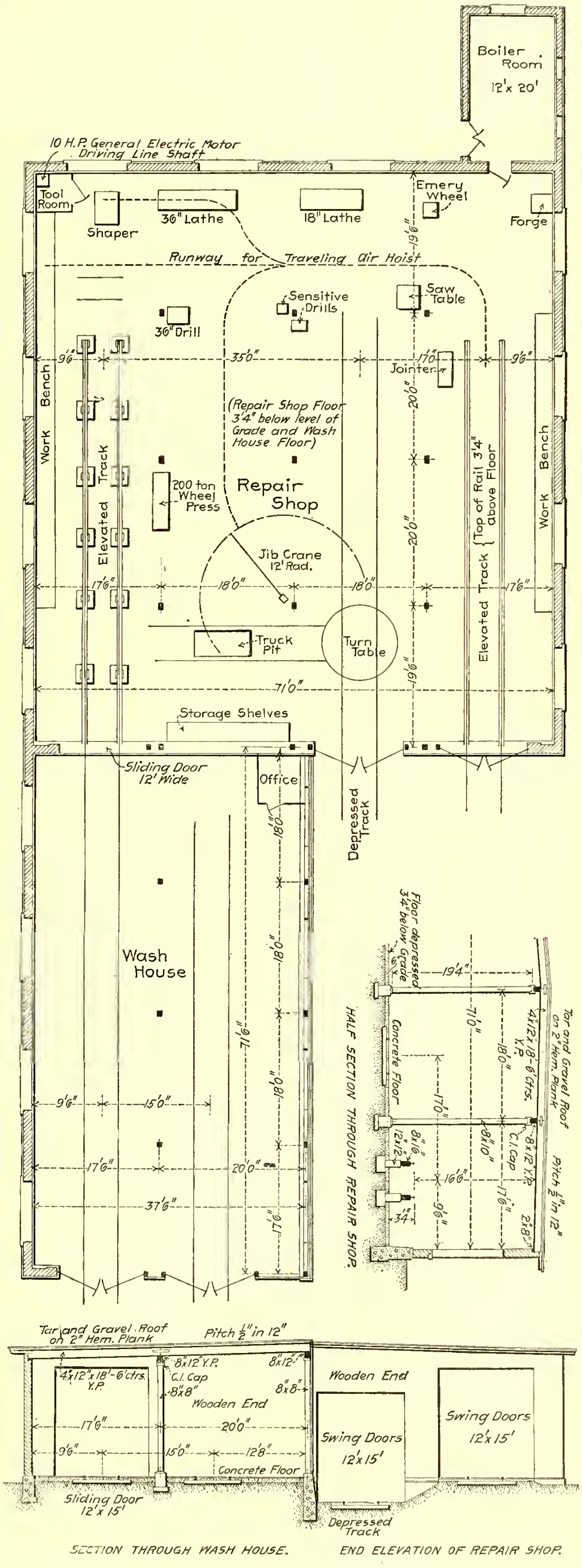
A very convenient track arrangement was installed in connection with the middle track in the erecting shop, in the form of a turntable near the entrance door. This table connects with a short cross track, about 30 ft. long, which provides for work upon trucks. It has a pit, about 8 ft. long, near the 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.

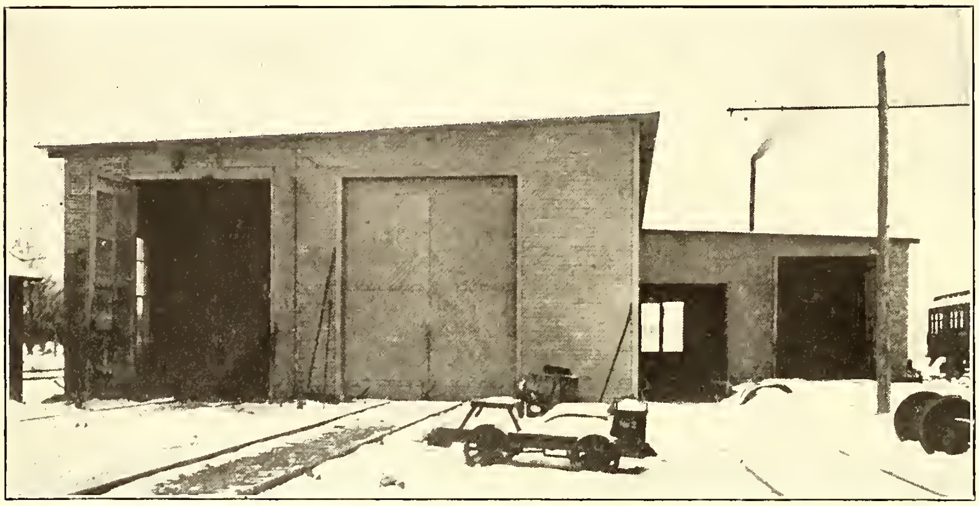
The machine tool equipment consists of two lathes, a shaper, a drill press, a sensitive drill, a wheel press and an emery grinder; this is supplemented by two woodworking tools—a saw table and a jointer. The lathes were selected in two very comprehensive sizes, one an 18-in. and the other a 36-in. lathe, 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 diameter; 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



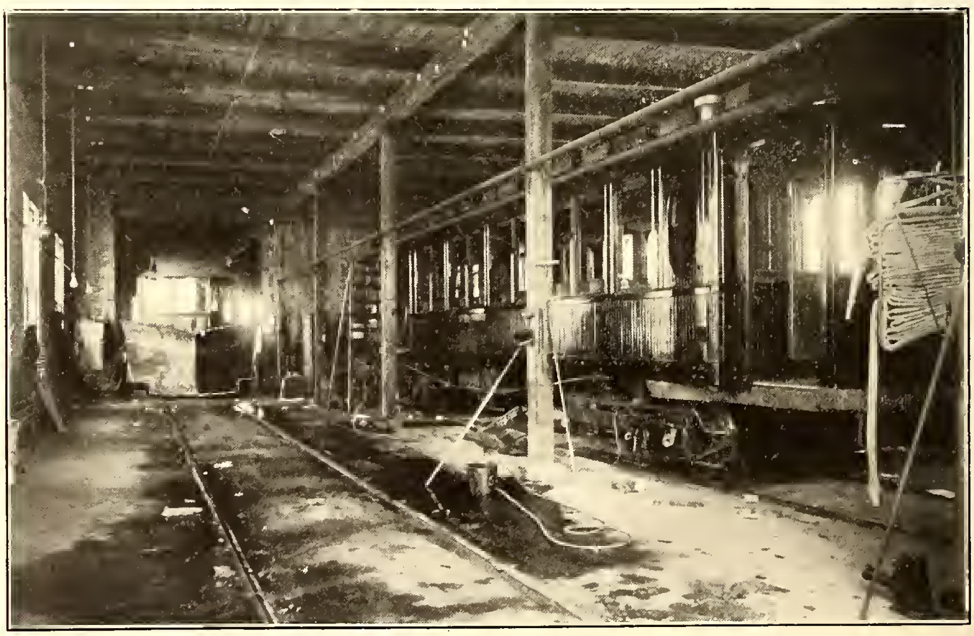
PLAN AND SECTIONS OF THE REPAIR SHOP BUILDING

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



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

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.



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

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

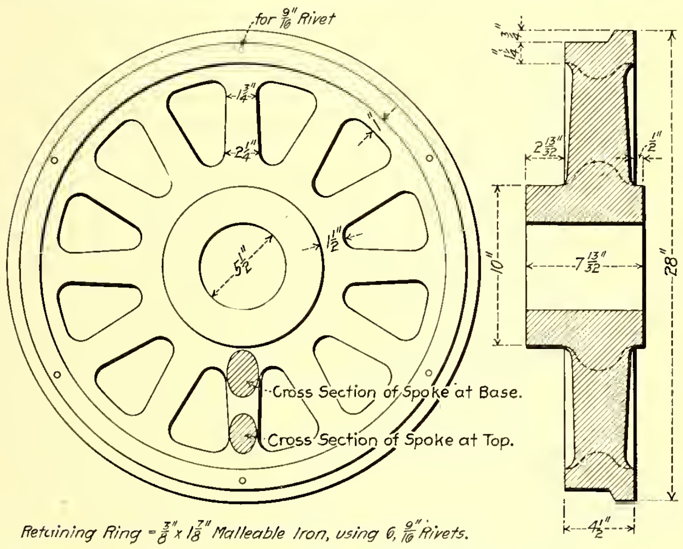
It has been the experience of this system that the steel-tired wheel is an absolute necessity for the weights of cars used and the speeds operated under. When the road was opened for service, the lighter cars for the local service (32 tons) were equipped with chilled-iron wheels, while, of course, the 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, 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 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

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.

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 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.

M M 1

JACKSON & BATTLE CREEK TRACTION COMPANY

Motorman's Car Report.

CAR NO.	TIME CAR TAKEN OUT.	RELIEVED.	TIME TURNED IN.
41	7 00 am.	2 35 P.M.	1 15 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.
- [x] 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 O.K.

John Dayle
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. Form M M 4

Jackson & Battle Creek Traction Co.

Albion Nov. 1st –'04.

Workman Joe Wesley

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

The Time Report Blank

Form M M 3

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.
No. 26	No.
No.	No.

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

Form 15. 8-7

Car No. 33 Albion Car Shops 11–1 1904

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 Wesley 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.

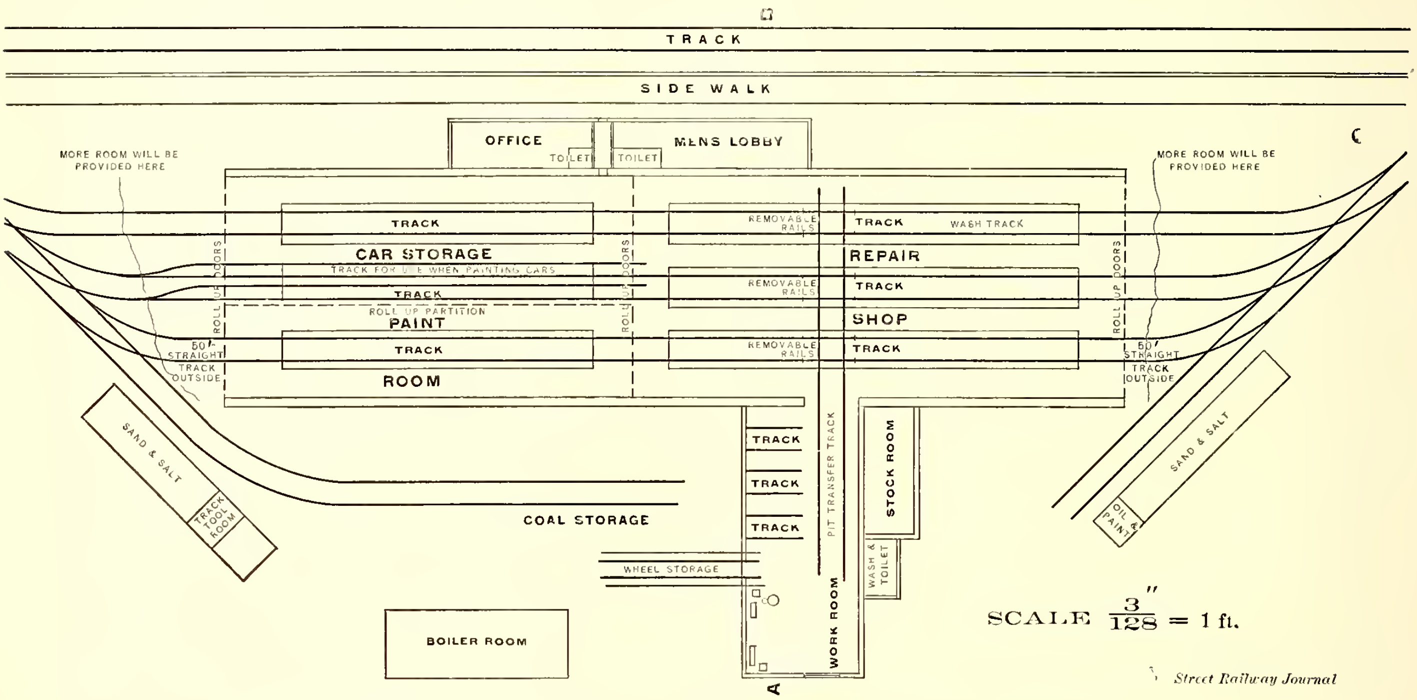
The writer is of the opinion that within the next few years radical changes will be made in railway motor control apparatus. Improvements which of necessity had to be worked out for the heavier elevated cars will no doubt be applied to the lighter surface equipment. The eminently satisfactory results 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.

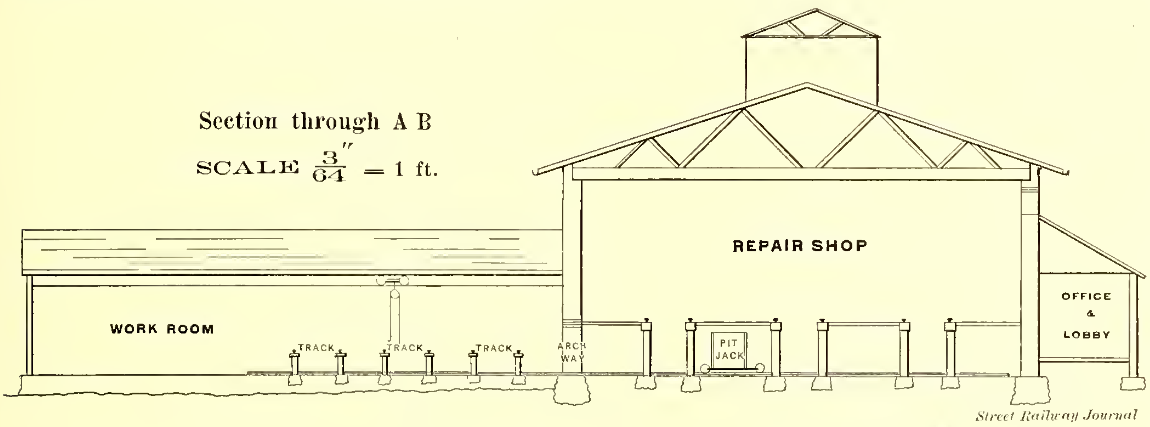


SUGGESTED TRACK ARRANGEMENT IN CONNECTION WITH MODEL REPAIR SHOP

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

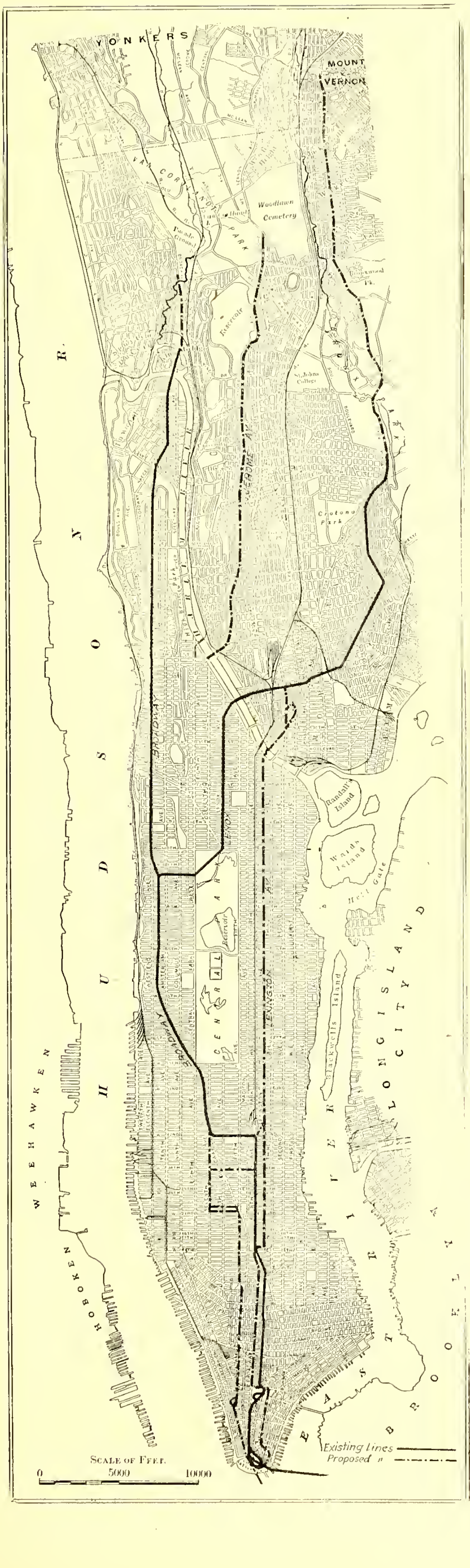
At the meeting of the New York Rapid Transit Board, on Thursday, Dec. 29, Chief Engineer Parsons read his report of proposed new transit facilities. He divided these plans into three parts, namely, new lines, the extension of subways and the extensions of elevated structures. One plan included a new 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 crosstown 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.

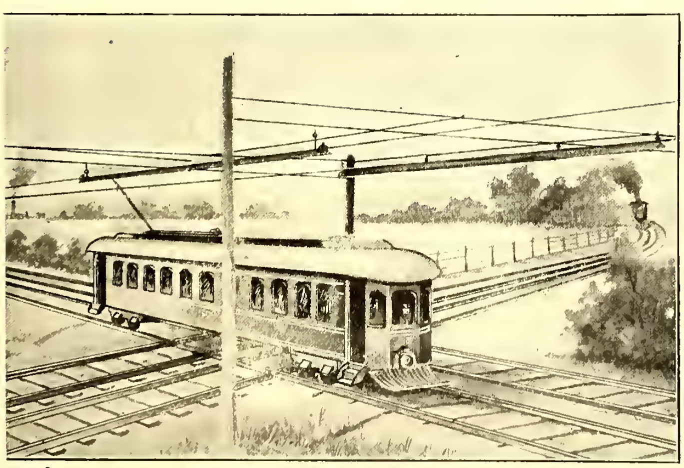
That the importance of the order is attracting considerable attention in Cleveland is evinced by the space devoted to it by the local papers, all of which commend the decision of the company to install power brakes. Among them the Cleveland "Plain Dealer" calls attention to the extended experiments carried 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

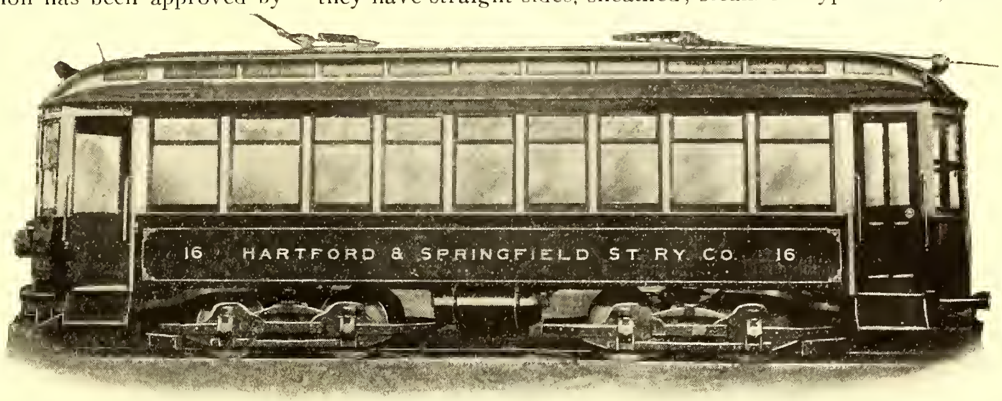
from becoming stalled or delayed on the crossing, and to meet these requirements the Niagara safety trolley guard has been devised and is now being sold by the Recording Fare Register Company, of New Haven, Conn.

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 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.



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

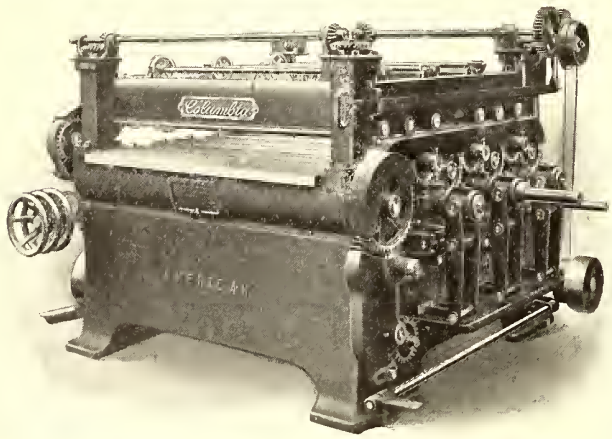
The inside finish of the car is of the Laconia standard design in selected mahogany, and the ceilings are painted and decorated. The seats, which were manufactured by Heywood Brothers & Wakefield, are upholstered in olive plush, with bronze grab handles on the backs. The Laconia high-speed double trucks, 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 WOODWORKING 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.

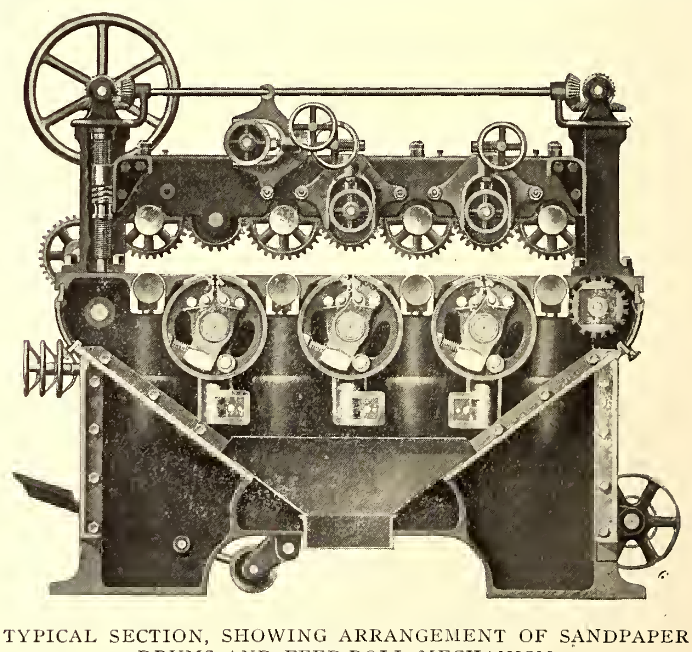
Among the essential features of this machine are the drum cylinders, which are very simply and durably constructed, as they are cast entire and are not made up of a series of narrow sections set-screwed to the shaft, or a series of webs on which a sheet-iron shell is riveted or bolted. It is the only 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.

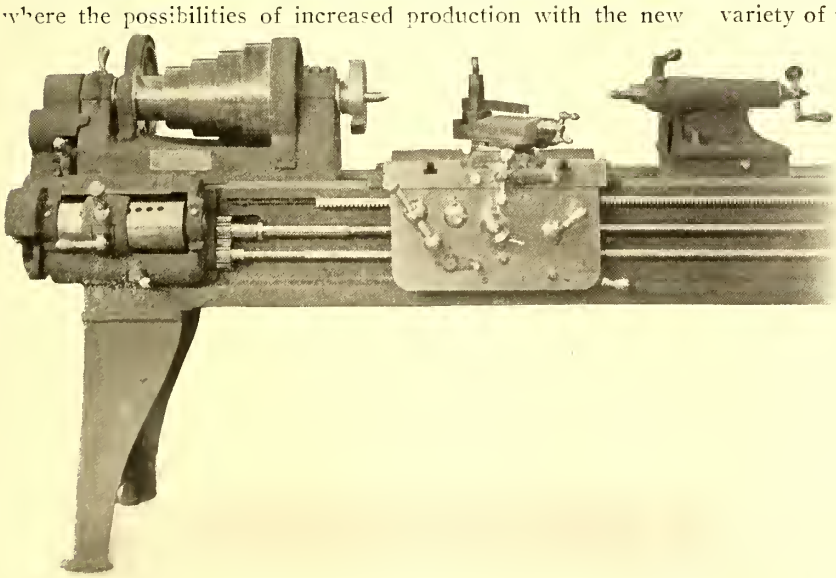
On the right-hand back corner post of this machine there is a compact but strong arrangement of gears for raising and lowering the top feed works by power. This is easily manipulated by the operator without changing his position.

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

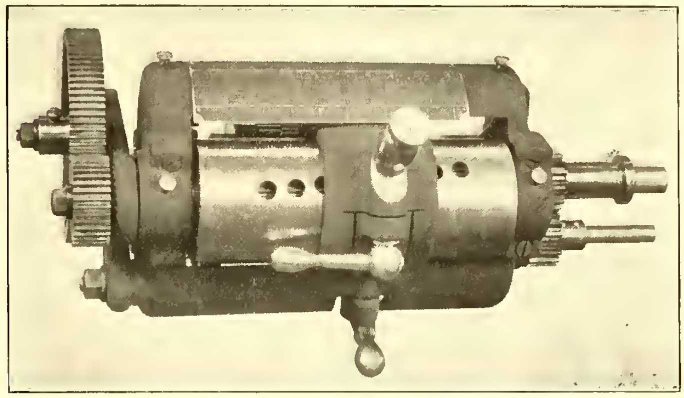
One of the most important of the many improvements that have been made in the design and equipment of machine tools during the past few years has been the addition of the rapid-change feed-gear device, which has in fact greatly changed the operative methods in machine shop work. Not only has this important 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



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

high-speed tool steels are within reach.

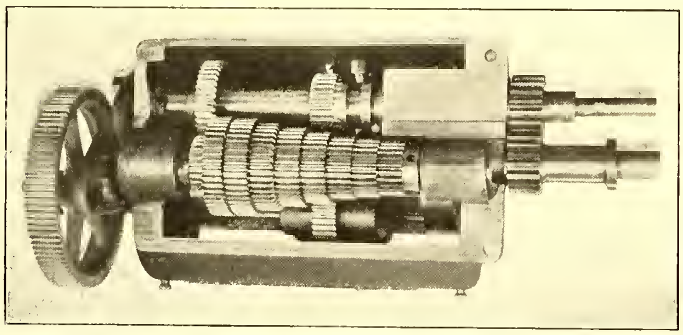
The improved lathe of the R. K. LeBlonde Machine Tool Company, Cincinnati, Ohio, illustrated above, which embodies an interesting adaptation of the rapid-change feed mechanism, will indicate the trend of progress in this direction. The LeBlonde Company some time ago equipped its milling machine with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



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

tion to the engine lathe is worthy of note for its many advantages.

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

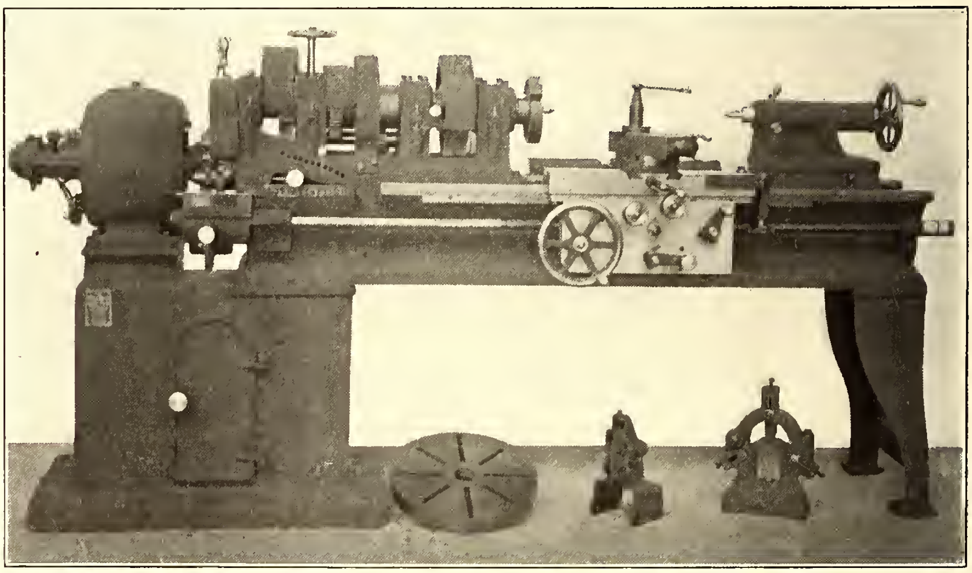
The New York City Railway Company announced last week that beginning with Jan. 1, 1905, those motormen who are engaged in breaking in new men will receive 15 cents a day in addition to their regular pay. The New York City Railway Company employs between 125 and 150 instructors of this kind, who are selected 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



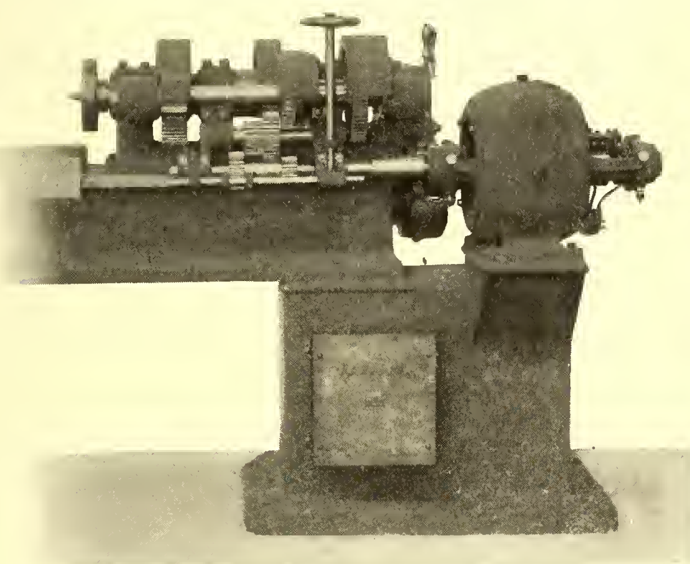
THE NEW LODGE & SHIPLEY SPECIAL GEARED HEADSTOCK LATHE, SHOWING A NOVEL METHOD OF MOTOR MOUNTING FOR INDIVIDUAL DRIVING

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 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 1/8 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.

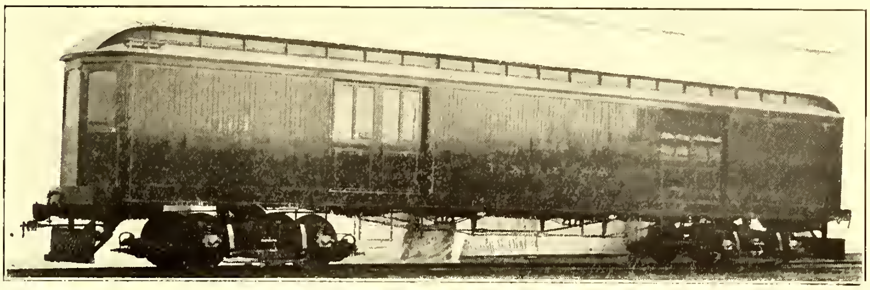


REAR VIEW OF THE NEW LODGE & SHIPLEY LATHE, TO SHOW DETAILS OF HEADSTOCK AND OF MOTOR SUPPORT

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.

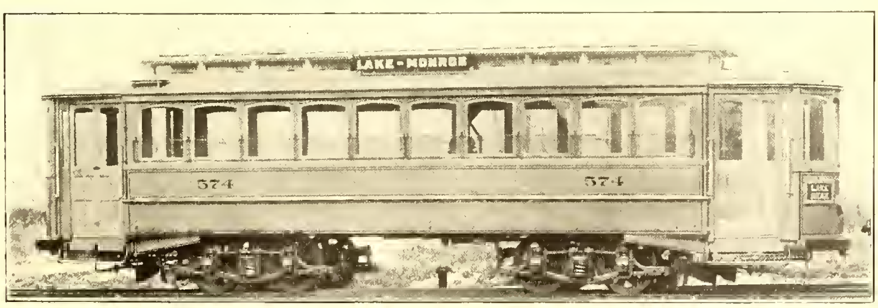


THE NEW 56-FT. EXPRESS AND BAGGAGE CAR FOR THE UTICA & MOHAWK VALLEY RAILWAY

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.

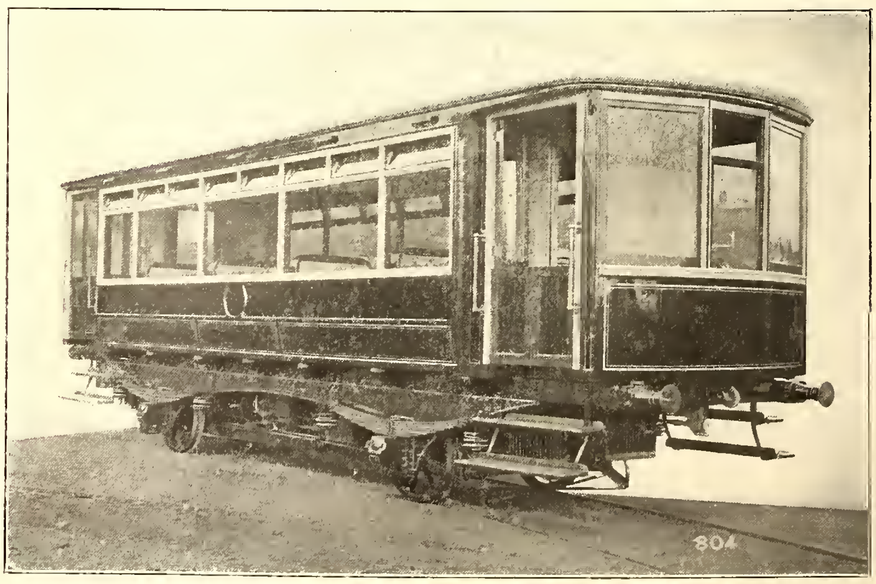
Another feature successfully adapted from electrically-driven cars was in dividing motive power into two engines, which not only minimizes the risk of break-down, but gives a better distribution of weight. The engines are not connected independently to the axles, but under normal conditions drive on 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

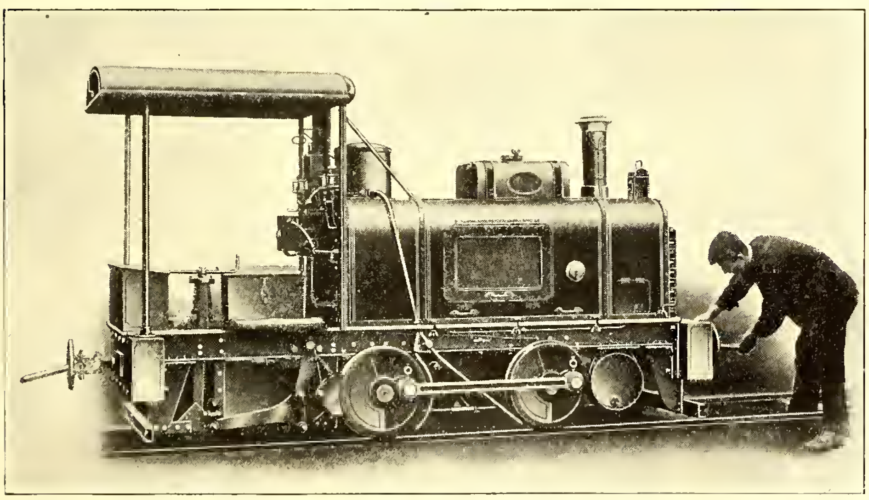
which also supply current for the ignition and magnetic clutches. The design of the complete car is such that by jacking up the body the truck and motors can be run out in the same manner that a truck can be taken from beneath a standard electric car. But, in addition, the frame containing the machinery 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.

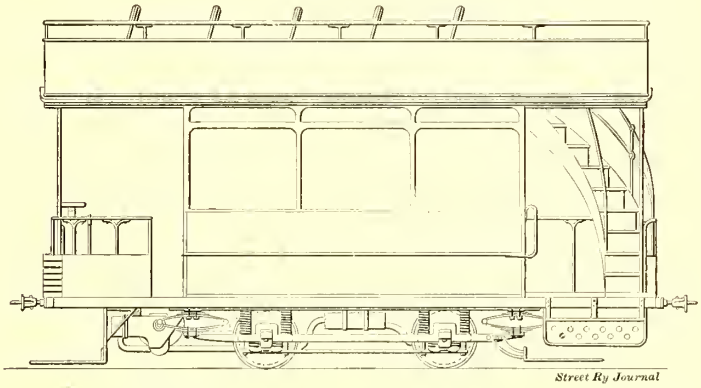


GASOLINE LOCOMOTIVE WEIGHING ABOUT 3 TONS, AND HAVING A DRAW-BAR PULL OF OVER 1100 LBS.

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, without the intervention of electrical apparatus and its necessary complications.



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

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.

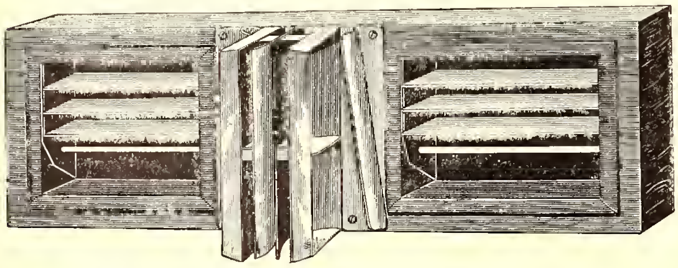
The company has just delivered to clients in Lancashire a small gasoline locomotive of the type shown, to haul 15 tons on their works tramways. On the official trials at Adderley Park, the locomotive showed a draw-bar pull of 1100 lbs. with ease. Its total weight is just over 3 tons, and it is geared 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.

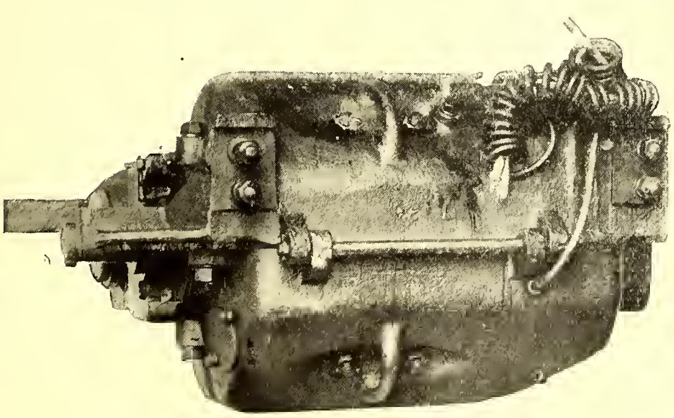
In railway work and in outside work where it is not necessary to install a fuse when a smaller wire is tapped off, the Dossert hook joint is made with taps of any size between 00 and 2,000,000 cm. In this work the tap connector will be much appreciated. Feeders for trolley mains or branch feeders present 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



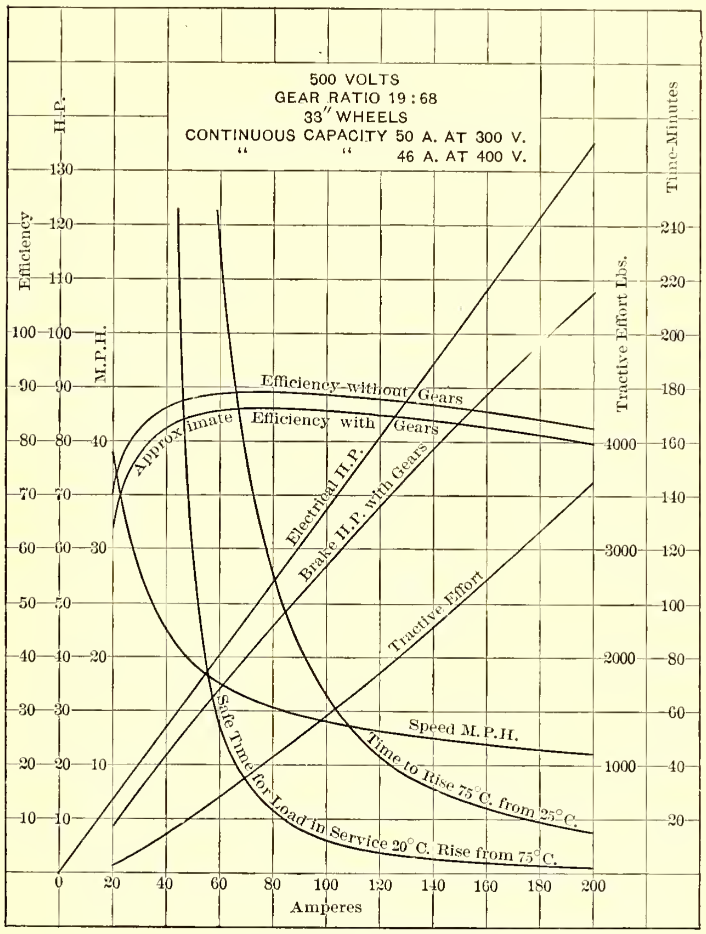
NO. 93 RAILWAY MOTOR, FIELD CLOSED

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.

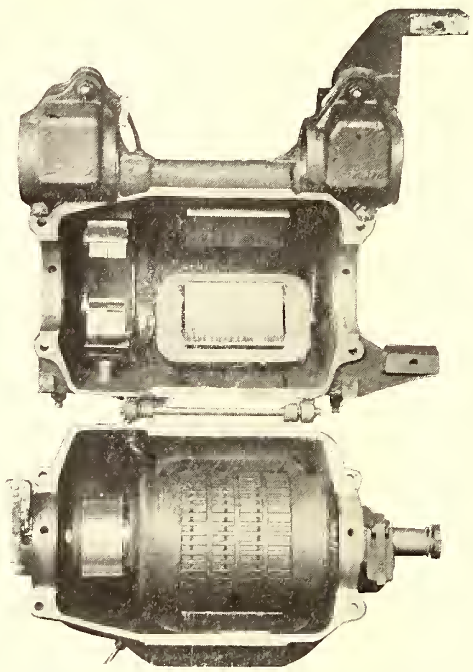
In a shop test at either of these loads, the rise in temperature



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

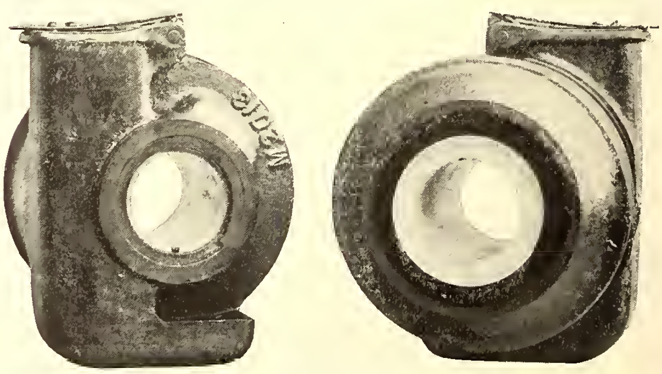
The four pole pieces are built up of soft steel punchings riveted together between wrought-iron end plates. They project radially inward, at angles of 45 degs. with the horizontal, and each is fastened to the frame by two bolts secured by lock washers. These bolts penetrate well into the stampings, but 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.

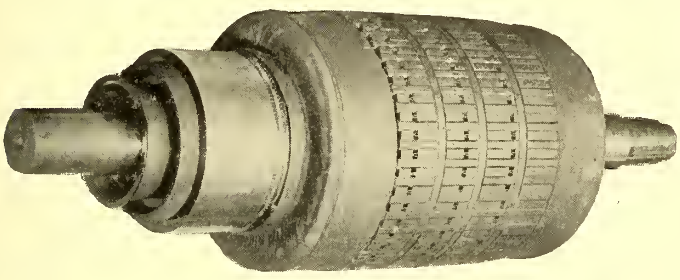
The bearings for the armature shaft consist of solid cast-iron shells lined with babbitt metal. They are carried in cylindrical housings of cast iron, held between the halves of the frame. The housings have finished flanges on their inner ends, which are clamped between finished surfaces on the field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


BEARINGS AND BEARING HOUSINGS OF NO. 93 RAILWAY MOTOR

are held from turning by tap bolts in both the upper and lower frames.

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.

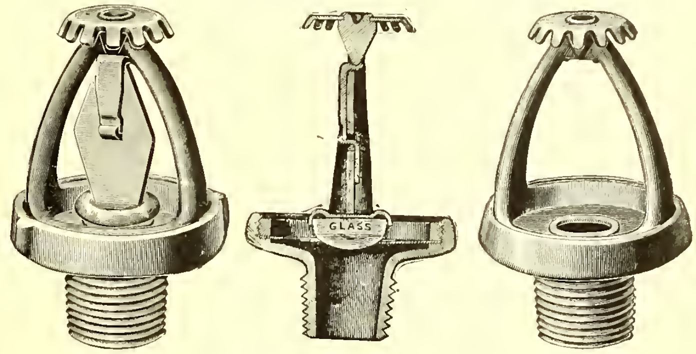


FIG. 1. FIG. 2. FIG. 3.

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

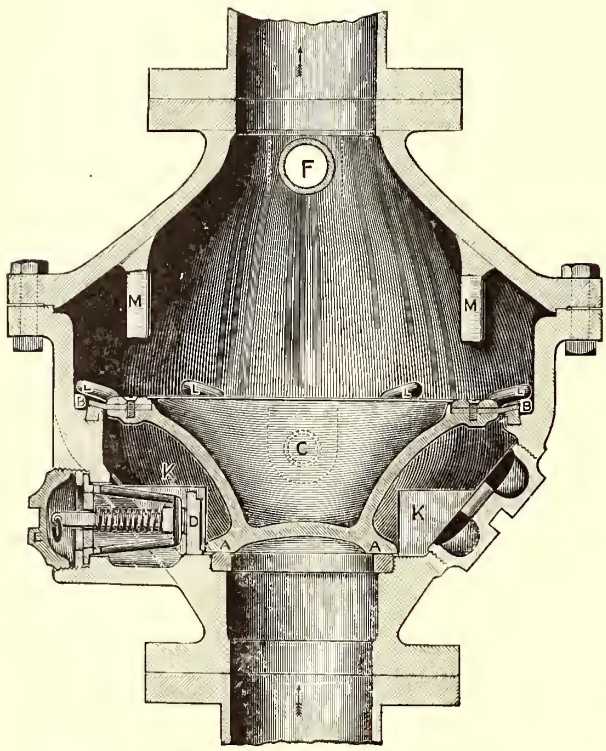


FIG. 4.—SECTION OF DRY PIPE VALVE

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.

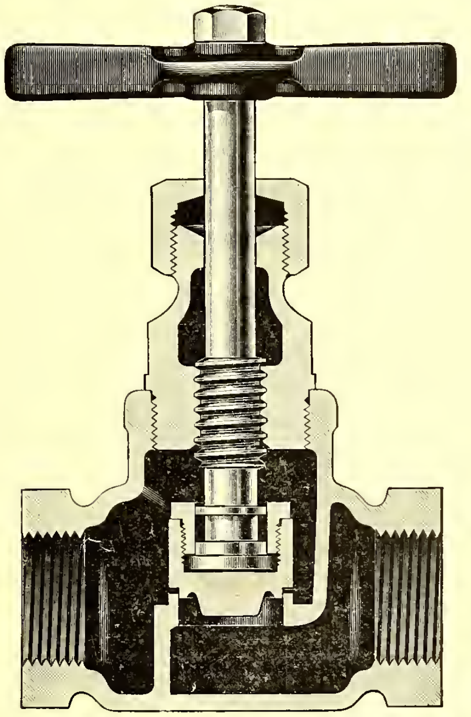
BLIZZARD TIES UP TRAFFIC IN NEW YORK

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.

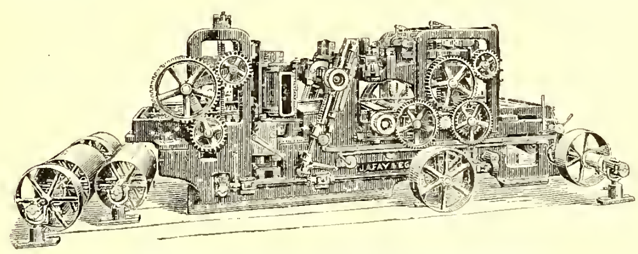
TRACK SCRAPERS IN GRAND RAPIDS

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. Thomscn.

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. Northern Ohio Tr. & Light Co	1 m., Nov. '04	71,388	38,920	32,468	23,024	9,444
	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. Elgin, Aurora & Southern Tr. Co	1 m., Nov. '04	36,380	21,872	14,508	9,333	5,175
	1 " " '03	34,616	22,297	12,319	9,173	3,146
	5 " " '04	201,586	107,800	93,786	46,506	47,280
	5 " " '03	206,678	116,887	89,791	45,863	43,928
BINGHAMTON, N. Y. Binghamton Ry. Co	1 m., Nov. '04	18,434	10,695	7,740	......	......
	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. International Tr. Co	1 m., Nov. '04	328,316	185,511	142,805	134,758	8,047
	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	425,228	161,518	263,711	......	......
	11 " " '03	268,162	88,309	179,853	......	......
CINCINNATI, O. Cincinnati, Dayton & Toledo Tr. Co	1 m., Nov. '04	38,668	24,037	14,631	16,315	†1,684
	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. Cleveland Painesville & Eastern, R. R. Co.	1 m., Nov. '04	16,710	11,327	5,383	......	......
	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	37,861	22,909	14,952	......	......
	11 " " '04	438,291	272,577	165,713	......	......
	11 " " '03	411,750	242,523	169,227	......	......
COVINGTON, KY. Cincinnati, Newport & Covington St. & Tr. Co	1 m., Oct. '04	88,974	49,920	39,054	17,219	21,835
	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. Detroit United Ry	1 m., Nov. '04	372,534	*212,611	159,923	90,511	69,412
	1 " " '03	347,843	*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. Duluth St. Ry. Co	1 m., Nov. '04	51,925	25,553	26,372	16,521	9,851
	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. Northern Texas Traction Co	1 m., Nov. '04	47,634	29,371	18,263	10,350	7,913
	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
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Oct. '04	17,965	10,821	7,144	3,561	3,583
	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. Houston Elec. Co	1 m., Oct. '04	38,639	21,680	16,959	8,277	8,682
	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. Milwaukee El. Ry. & Lt. Co	1 m., Nov. '04	275,590	132,844	142,746	77,654	65,092
	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. Twin City Rapid Transit Co	1 m., Nov. '04	354,202	162,704	191,497	97,308	94,189
	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. Moatreal St. Ry. Co	1 m., Nov. '04	204,555	133,849	70,706	18,871	51,835
	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. Olean St. Ry	1 m., Nov. '04	8,894	4,611	4,283	2,631	1,651
	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. American Rys. Co	1 m., Nov. '04	110,666	......	......	......	......
	1 " " '03	103,984	......	......	......	......
	5 " " '04	657,490	......	......	......	......
	5 " " '03	642,980	......	......	......	......
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Nov. '04	119,288	69,982	49,306	26,890	22,416
	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. Savannah Electric Co.	1 m., Oct. '04	48,171	26,814	21,358	10,694	10,664
	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. Seattle Electric Co	1 m., Oct. '04	203,232	136,195	67,037	25,411	41,626
	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. Syracuse R. T. Co	1 m., Oct. '04	71,828	41,133	30,695	20,338	10,357
	1 " " '03	70,016	39,686	30,330	20,170	10,160
	4 " " '04	291,233	162,641	128,592	81,129	47,463
	4 " " '03	282,609	157,145	125,464	81,053	44,411
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Oct. '04	47,405	30,128	17,277	9,319	7,958
	1 " " '03	44,410	28,135	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. Toledo Rys. & Lt. Co.	1 m., Nov. '04	146,759	*77,037	69,722	41,626	28,096
	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

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Through Service on Interurban Lines

We hear much in these days of the completion of through interurban electric railway routes between important cities, such routes being frequently made up of a long chain of interurban roads owned and operated by different companies. The completion of such routes is frequently heralded as an important event, as it often is, but it is doubtful whether either the public or electric railway men in general have analyzed the matter sufficiently to know just what bearing the fact that these through routes exist may have on the transportation business. It is frequently forgotten that the most important thing about a long continuous interurban route is not so much the facilities it offers for travel from one end of the route to the other as the possibilities for local business between various links of the chain. For example, there are now interurban lines by which one can travel from Indianapolis, the capital of Indiana, to Columbus, the capital of Ohio. Now, to our minds, the thing of most present importance in such a chain of interurban roads as this is that there is a chance for local travel by means of the interurban road between various points intermediate between Indianapolis and Columbus. On account of the length of the journey and the great amount of time consumed in traveling the whole distance from Columbus to Indianapolis by interurban cars, it is hardly safe to assume that any great amount of day traffic will be diverted from the steam railroads, but it is of importance to every interurban road in that chain that at its terminals are interurban lines connecting with the country beyond. It virtually adds a certain amount to the tributary population of each road. For distances of 60 miles to 80 miles, and possibly a little more, the limited service that is being inaugurated on many interurban lines is such a strong competitor of the steam railroad for local business that one might almost consider the steam railroad to be out of the race. For through passenger traffic between points over 80 miles apart, the interurban is considerably at a disadvantage, and from the nature of its service always will be unless something can be worked out in the way of sleeping car service which will enable traveling men to make a comfortable night's ride between towns 100 miles to 200 miles apart. As we have said before, we believe there is an opportunity for some such service, as it would fill a need of the transportation business that is not now supplied by steam railroads.

The Technical Graduate in the Repair Shop

A number of students in electrical engineering, after graduation from a university, find their way into street railway repair shops. A better place to get a general understanding of apparatus, a knowledge of men and a familiarity with handling current, could hardly be selected. If the young man enters into the work with the proper spirit, he will soon acquire such an understanding and knowledge of the electrical equipment of cars in particular and of electrical apparatus in general as can be gained in no other way. There is hardly a car shop where the work is limited simply to cleaning the cars and replacing worn parts. Trouble of some sort with the electrical apparatus is always present, and trouble is what the recent graduate is after. Its occurrence not only shows him the weak points of the apparatus, but it makes him do some hard thinking—first, to discover the trouble; second, to eliminate it, and lastly, to avoid its repetition. The weak points of the apparatus are brought forcibly before him, and if he has any ingenuity he will naturally attempt to improve the faulty apparatus.

The ability to handle current, too, is an acquisition of considerable value. The voltage carried by street railways, while not high enough to be regarded as fatal, is, nevertheless, sufficiently great to require caution in handling it. After a careless workman has gotten one or two good "jars" he will become cautious without any further instruction. After familiarizing himself with current at 600 volts, it is safe to say that the student will exercise the proper amount of care when handling higher voltages.

The opportunity to study the characteristic traits of workmen in a car shop is not to be overlooked. Street railway workmen seem to fraternize closer than men in other vocations, and this close relation, from which the student will not be debarred if he conducts himself properly, will give him chance to learn men in a manner that hardly any other position would admit. This fellowship feeling also aids the student in another manner. The workmen with years of experience are ever willing to give him any information they may possess. This information, of course, does not involve calculus, but it is that kind which can only be gotten by actual contact with apparatus, and is equal in value to the purely technical.

It may be hard for the technical graduate to find a dirtier job than that in the repair shop, but it is a question whether he can find anywhere else a place where he can learn so much in a practical way in so short a time.

The Multiple-Unit System for Suburban Service

A communication from one of our readers recently published in these columns inclined rather strongly to the use of electric locomotives instead of the multiple-unit system for the electrical equipment of the suburban service of steam railroads. The multiple-unit system has practically conquered the entire field of elevated railway service in the United States, and its fitness for this class of service is therefore hardly open to question at this time, when the change to the multiple-unit system is being made by the only elevated railway companies which have not heretofore employed it. The essential question then is, Are conditions of suburban service on steam railroads so essentially different from those on elevated railways as to call for a different plan of operation? Steam railroad suburban service, it is true, is different from elevated railway service in some particulars, but it appears to us that these differences are such that they constitute even stronger arguments in favor of the multiple-unit system as against individual locomotives in suburban service than can be advanced on elevated railways.

We are, of course, here considering suburban service pure and simple, without any relation to the hauling of through trains in and out of city terminals. Any tenable argument in favor of electric locomotives instead of the multiple-unit system for the ordinary run of steam suburban service in and out of large cities must be based on the assumption that the present service from steam locomotives is entirely satisfactory as regards speed and reliability. This assumption, however, is not by any means a safe one to make. It may be perfectly true that the present schedules of most suburban lines of steam railroads, as shown by the time-tables, are satisfactory, and there is no need of going to great expense to improve upon them, but that tells only a part of the story. The trouble is not with the schedules or the time-tables, but with the ability of the suburban trains to maintain these schedules during the rush-hour traffic.

During the past ten years the writer has had occasion to patronize regularly for daily transportation at various times some eight different steam railroad companies operating suburban service out of four of the largest American cities and one elevated railway operating steam locomotives. These daily experiences with suburban steam service demonstrate conclusively the fact that steam suburban service cannot maintain the same schedule speed during the rush hours as during the middle of the day, although the time-table almost invariably gives the same running time. What is supposed to take place and what actually does take place are two very different things. In steam railroad suburban service during the middle of the day, a few heavy locomotives are kept operating over the line with very light trains, and the maintenance of schedules is extremely easy; so easy, in fact, that the engineer almost loiters along the road. During the rush hour there is an enormous and sudden increase in traffic, greater if anything than is experienced by either elevated or street railways, because the steam suburban business is essentially commuter business and consists of taking people to their work in the morning and back at night. Owing to the infrequency of trains during the middle of the day, traffic seeks other means of transportation if it is available. This might be changed with the adoption of electric traction, but as conditions are at present, the morning and evening traffic peaks are enormously high compared with that during the day. Thus we see on a steam railroad operating three-car suburban trains at one-hour intervals during the day, that the evening traffic between 5:15 and 6:15 will take six, seven and eight-car trains on five or ten minutes' headway. Just at the time when the locomotive should be able to accelerate its trains the most rapidly and make the best time between stops in order to compensate for the long station stops during the rush hours, it is loaded down with a heavy train, which tends to make the case worse instead of better. The amount of motive power should, if anything, be increased during the rush hours rather than decreased. Even at best, there are enough chances for delay, if trains are being operated on very short headway, without adding to these chances by clinging to a system of motive power which gives slower schedules during the rush hours than at any other time.

The ultimate aim of any system of transportation is service rather than economy in motor repairs, and there are plenty who will even question the economy of electric locomotives as compared to smaller motors scattered through the train. The constant tendency in the rapid transit service is to increase the number of driving wheels, as is well shown by the present popularity of four-motor equipments as against two-motor equipments on double-truck cars a few years ago. Some master mechanics held up their hands in horror at the thought of four-motor equipments when they were first proposed, on the ground that double the number of motors under a car would greatly increase the maintenance expense. Experience, however, seems to have shown that the better ventilation of four small motors as against two large ones tends to keep repairs approximately the same, and, if anything, in favor of the four-motor equipment, while the service possible from four motors in the way of better acceleration and less delays on slippery tracks is such as to leave two-motor equipments out of the reckoning altogether in many cities. The same principles apply in a general way to heavier service where cars are operated in trains.

It is quite likely to be the case in steam road suburban service that the number of trains which can be operated out of a terminal during the rush hours in the evening cannot be greatly increased. This is due to a number of various local conditions, but it is the exception rather than the rule around our largest cities to find suburban service where there are not very great obstacles to overcome if the number of trains between 5 and 6 in the evening is to be increased. The number of passengers desiring to ride, however, is growing steadily, and is sure to continue to increase as long as comfortable transportation can be offered. Now, the only way to increase the carrying capacity if the number of trains is fixed is to increase the length of trains. This can be done indefinitely with the multiple-unit system. We admit there is opportunity for considerable argument on some of the fine points of locomotive vs. multiple-unit system; for instance, as regards comparative investment and cost of operation. But of more importance than these are the broad questions of service which we have just discussed and which appear to be altogether in favor of the multiple-unit system.

Concerning Stops

The question of car stops has been so frequently discussed in our columns that there would be little reason to refer to it again at this time were it not for the fact that there is still room for a vast amount of improvement in the matter on the part of various operating companies. Recent trips upon electric railways in widely separated parts of the country tend to confirm the impression that the inordinate number of stops occurring upon certain urban and suburban trolley systems constitutes the most adverse element of the many conditions which are interfering with rapid transit service.

There is little doubt that the bad effect of a large number of stops per mile upon fast schedules is appreciated by the great majority of street railway men, but in some quarters it seems next to impossible to improve the situation. The attitude of the public is the stumbling block in the way of the manager who desires to stretch the distance between stopping points, rather than any failure to grasp the relations existing between stops and schedule time. It is the old question of express vs. local service over again.

It is a simple fact, however, that real rapid transit cannot be given to a community which requires the stopping of cars at every point along the route where passengers may wish to enter or leave them. Nor can it be given when cars are obliged to stop at each street corner, unless the streets are further apart than is common in most cities. When motormen are required to come to a full stop at intersecting streets, even where no passengers desire to get off or on, the last hope of making a schedule much quicker than the horse car time-tables of the early eighties vanishes. From the standpoint of the passenger, it is difficult to name a more aggravating cause of delay than this. Certainly it is trying to travel 30 miles in ninety minutes on a high-speed interurban line and then spend three-quarters of an hour over the remaining 6 miles of the journey, which has to be taken in the cars of another company through purely suburban territory.

There is probably no specific limit as to the number of stops per mile above which a schedule will fall into disrepute from the viewpoint of good practice. In the business districts of cities it is the usual custom to stop at every corner, although we believe the foreign practice of stopping only at every second or third corner perfectly practicable here. Be this as it may, there can be no question as regards suburban regions or the residential portions of a community. Here it is safe to say that eight or ten stops per mile are about as many as the service can accommodate and maintain a reasonably fast schedule. Except in cities laid out upon the checkerboard plan, equidistant stops are, of course, seldom attained. At best they express a sort of average which gives a basis of comparison.

The function of a street railway is to carry passengers at a profit, and not the running of a certain schedule with specific energy consumption per ton-mile. It is easy to see that if stops are made so far apart as to be seriously inconvenient, the volume of traffic will be the first thing to suffer. For this reason it has paid street railway companies to spend large sums of money for motive power capable of producing acceleration far beyond that in effect upon steam railways, and for air-brake equipment of sufficient capacity to stop their cars more quickly than was ever possible with the older types of hand brakes. But the street railway motor cycle from stop to stop has been developed on the basis of such short runs that the full benefits of this expensive equipment are often lost with the heavy cars now found in suburban service. It is often asked, "What is the use of making a fast schedule if we carry the people anyway?" The answer is this: Good service attracts business which otherwise may be lost, and it is scarcely open to doubt that a reasonably fast schedule is absolutely necessary if the maximum number of people are to be regularly carried in the face of steam railway competition. A slow, funereal schedule means a large number of cars in service, with a corresponding increase in the expense of conducting transportation; it means that the motors must be constantly operated with the heavy currents demanded by the straight line portion of the acceleration curve; that traffic congestion is more likely to occur because of the larger number of cars operating under short headway, and, finally, it results in the loss of considerable good will on the part of the traveling public. Of course, there are extremes of speed to which even suburban and interurban cars may not profitably go, but the thing which is really needed in suburban schedules, and in residence district schedules for that matter, is a good average speed. There is a vast difference between slowing down to 6 m.p.h. at an important intersecting street and making a dead stop. Cases have occurred in which cars were stopped regularly on both sides of a street in the business district of a medium-sized city, but it is a satisfaction to state that this practice is exceptional.

The greatest good of the greatest number is a fundamental principle of transportation no less than of republican government. It is doubtless true that considerable opposition can easily be aroused on the part of the general public by suddenly putting into effect sweeping changes in regard to the spacing of stops. What is needed is a sort of educational campaign. A few succinct and clearly expressed placards placed in the cars ought to go a long way toward explaining how the entire service of a line can be improved by the elimination of certain stops. It is important to point out that even where designated stopping points are 800 ft. apart, the maximum distance that any passenger has to walk to get a car is 400 ft. Then, too, the public does not always realize that its willingness to walk even half a mile to the nearest station is a contributory factor of great importance in the fast schedules possible upon suburban steam railways. There is no doubt that the public wants real rapid transit, but the fact remains that it does not always know how to help secure it. In the elevated railway and subway lines of the largest cities an unconsiderable proportion of the passengers appear to realize that by entering and leaving the trains quickly they are actually assisting the companies to give quick service. Certainly the public of residential and suburban districts ought to be brought to appreciate the value of fewer stops in enabling the great majority of passengers to be transported more speedily. Given a favorable public sentiment, the way is at least partly cleared for improvement in the service, and this without resorting to higher maximum speeds than the laws permit.

CAR-TEST RECORDER OF THE BOSTON ELEVATED RAILWAY COMPANY

BY J. M. AYER AND H. S. KNOWLTON

The study of problems connected with train movement has occupied the attention of the management of the Boston Elevated Railway Company from the earliest days of the elevated division's design down to the present time. Long before the division was opened to handle traffic, and even before experimental trains began to operate, careful consideration was given to the questions of speed, running time, acceleration, coasting, braking and power consumption, which were unique in the history of Boston transportation. In fact, the problems encountered presented features of peculiar difficulty, thanks to the complications which the geography of the city imposed upon the alignment and grade available.

Useful and important as this study was in determining preliminary train schedules and movements, the results obtained were necessarily theoretical, being based on data largely speculative, until the time came where train tests were made in the subway in connection with the selection of equipment for the road. These tests gave the company information of great value in regard to the possibilities of the proposed equipment, but they required the services of a large number of observers, and were correspondingly expensive and complex. In order to take the two-second readings which were essential to the obtaining of good results, it was necessary to arrange a clock circuit and gong to give the requisite signals—a proceeding which at times involved no little confusion, possibility of error in the records, and difficulty in the ranks of the instrument observers and recorders. Then, too, a long time was used up in calculating the results and plotting the curves derived from the tests. Realizing these difficulties, Paul Winsor, assistant to the vice-president of the company, who then had charge of the elevated division, turned his attention to the problem of securing automatic test records with a minimum of manual supervision, and designed the apparatus which to-day represents the company's most advanced practice in the analysis of actual operating conditions. J. M. Ayer, assistant to Mr. Winsor, had general oversight of the construction of the test recorder and its operation. It is this apparatus which forms the basis of this article.

The train test recorder consists, in the main, of a double table of hard pine, to one end of which is attached a lower frame. Upon the table are mounted the indicating and recording mechanisms which produce the test diagrams desired. The lower frame carries a galvanized iron tank used in determining acceleration values. The instrument occupies approximately half the inside length of an elevated car. Its length over all is 15 ft. 1 in.; its width over all, 2 ft. 2 ins., and the height (see Fig. 1) from the floor of the car to the top of the table is 2 ft. 8 ins. Mounted on the top of the table is an instrument shelf 3 ft. 4 ins. above the floor, which is a convenient height for observation and manipulation. At the head of the table, and at the same level as the instrument shelf, is a platform upon which is mounted the recording apparatus. The general method of recording the values of the physical quantities observed consists in transmitting the instrument indications to pens bearing upon a moving sheet of paper, the transmission being accomplished by a system of steel piano wires connecting the pens with manually operated discs placed directly over the instruments. One of these discs is shown in Fig. 2.

Each disc is of cherry, 4½ ins. in diameter. A groove in the circumference receives the piano wire, which is fastened to a thumb screw at the end of its travel. Each instrument is mounted upon a wooden base, which is secured to the shelf shown in Fig. 1. A small brass upright post with a projecting arm carries the cherry disc directly over the center of the circle described by the instrument pointer, and the disc is pivoted and secured to this arm by an adjustable screw. A third thumb screw, movable in the curved slot shown in the disc, enables a brass pointer to be fastened tightly to the disc in the additional adjustment, which is made in bringing the recording pen and the pointer to zero. The indications of the instrument are followed by the observer, who turns the disc by the brass handle, in close accord with the fluctuations of the instrument needle. The ease with which even erratic variations in current, voltage, etc., can be followed is immeasurably greater than that of the old method of straining one's eyes to obtain a long series of two-second readings—a method which entirely failed to record the variations of the quantity observed during the interval between successive readings. Between each disc and its pen is a brass lever, giving an additional adjustment of the connecting wires. These levers are provided with small holes .1 in. apart, so that it is an easy matter to alter the ratio of wire movement by hooking into different holes. In operation, the systems of levers and wires are so adjusted that a pen deflection of 3 ins. from the zero line corresponds to the maximum scale reading of the attached instrument, which is chiefly determined by the diameter of the disc. Small pulleys are provided to change the direction of the steel wires when necessary.

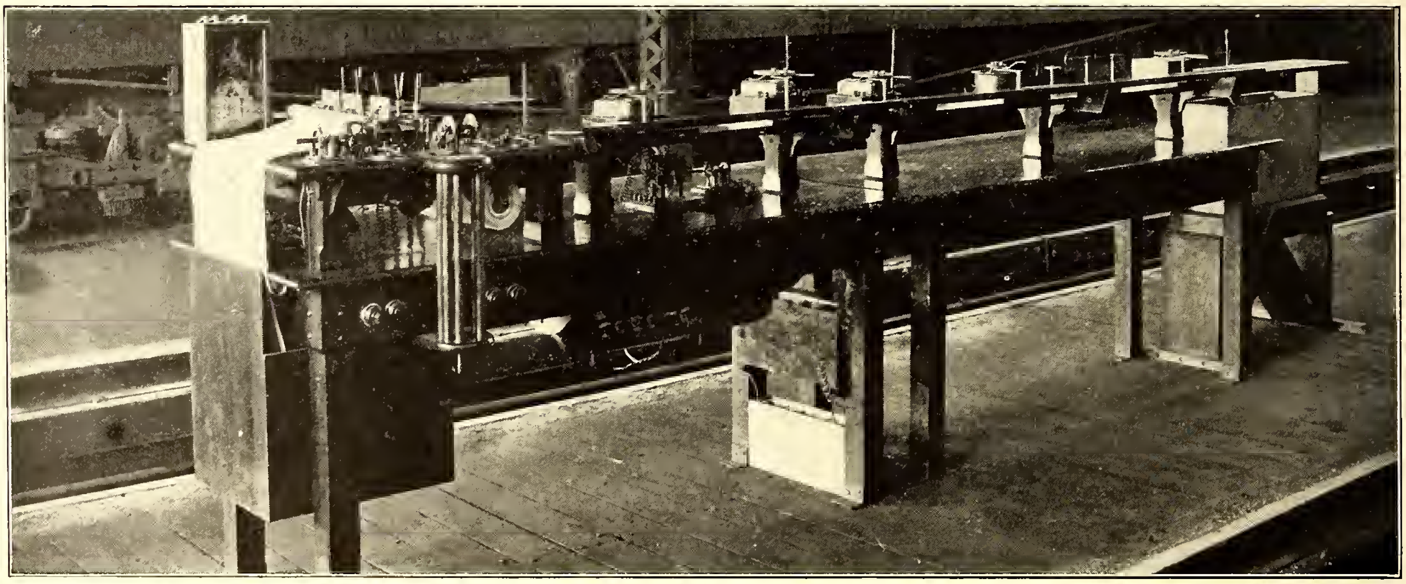


FIG. 1.—GENERAL VIEW OF RECORDER

Fig. 3 illustrates the arrangement of the record sheet as the curves of voltage, current, speed, air-brake pressures, etc., are drawn upon it as it is fed forward. The curves are drawn in ink by stylographic pens, the base lines being traced by the row of pencils shown in front of the pens. The pens are automatically returned to zero by small lead weights which move up and down in the brass tubes shown in the front of Fig. 4. The instrument shelf is equipped with positions for five observers, with an additional position for an acceleration operator above the tank.

Fig. 1 shows the roll of paper mounted on brackets beneath the table and the manner of its passing upward through the slot in the table. It is drawn over two brass writing tablets, one of which is used by the pens and the other by the base line pencils. Then the paper passes through the driving rolls and out, as shown in Fig. 3. Each end of the operating head of the recorder is mounted on solid brass brackets which are screwed to the table (see Fig. 1). These brackets carry the two driving cylinders and train of gears connecting them with the escapement; also a locking lever for throwing them in or out on the pinion of the lower cylinder. The writing tablets are fastened to these brackets, as are also three brass rods mounted above the tablets themselves. The forward rod carries the leads, which are set in three adjustable batteries of seven leads each, which mark the base lines ½ in. apart. Considerable experimenting was required to get leads of proper hardness to make distinct lines. These leads are weighted as shown in the accompanying cuts.

It will thus be seen that the diagram is transversely made up

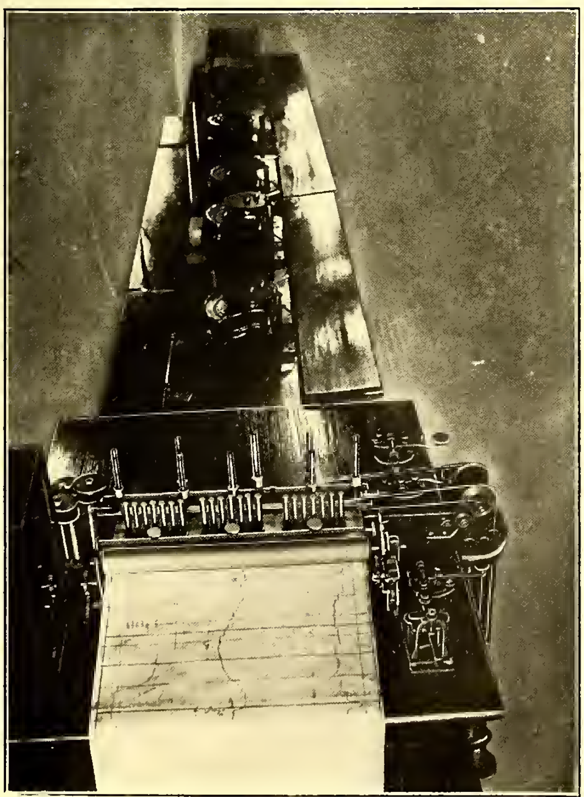


FIG. 3.—TOP VIEW OF RECORDER, SHOWING DIAGRAM AS IT COMES FROM THE APPARATUS

of three sections, each 3½ ins. wide. Outside of these are the station and distance records, which are made by pens mounted on the armatures of electromagnets, independently of the recorder head.

The other two rods carry the fountain pens which describe the curves of the diagram. These rods are fitted with adjustable stops which hold the pens at the base lines as they are drawn to zero by the wires and weights. Each rod carries three pens, making a total of six, or two pens to each of the three transverse sections of the diagram. These pens move freely upon the rods in responding to the pull of the wires given by the observers as they follow the deflections of the instrument needles. The rods carrying the pens are 2 ins. apart, and the pen holders consequently are set at an angle from the vertical, so that one pen can pass the other in the same section. This angle is such that the points of two adjacent pens on the paper are ⅛ in. apart. As the time scale of the diagram is 1 in. = 16 seconds, the two adjacent curves are two seconds apart, horizontally.

To Recording Pen.

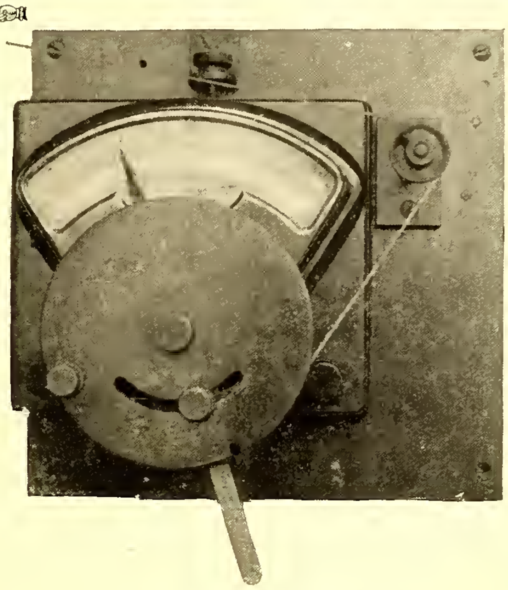


FIG. 2.—OPERATORS' DISC

The pens not standing vertically, had to be weighted to keep them in constant touch with the paper.

The wiring diagram of the apparatus is shown in Fig. 5. The moving strip of paper is driven by a powerful clock located beneath the table, through the medium of two solid brass cylinders, one of which is geared to the clock mechanism. The movement is controlled by a time clock operating through an electromagnetic escapement. Power for operating the various electromagnets, with the exception of those mounted in the time clock, is drawn from the third rail through suitable resistances. It was necessary to connect with the relay board on the car to secure continuous operation, regardless of whether a train is moving or standing still. In the diagram of Fig. 5 the connection of the car wiring with the third-rail shoe is shown through the main switch, main fuse, wattmeter terminals and reverser of the multiple-unit control system. From the main switch a tap leads to the voltmeter, the ground connection being made at point No. 13 on the bottom of the diagram. The wattmeter connections are shown in Fig. 6. These instruments are inserted when desired, as a check on the results calculated from the curves on the diagrams, and to determine the energy consumed by the motors which drive the air compressors throughout the train. The diagram in Fig. 6 represents the motors for driving the compressors of a four-car train. Returning to Fig. 5, the ammeter current is taken from a shunt in the main motor circuit between the reverser and the pilot-motor operated controller. The speed of the train is taken from a voltmeter operated by current generated by a magneto belted to a 6-in. wooden drum mounted on one of the axles of the trailer truck. The magneto is supported on a board with a felt cushion to take up the jar of the truck. Records of air pressure in the brake system are taken from a gage piped to the brake cylinder, or to the auxiliary reservoir, as may be desired.

On the same trailer axle is also mounted an interrupting device consisting of an 18-in. drum circumscribed by a brass contact ring. This ring is broken at two points, making an insulated section, covering about one-third the periphery. The other two-thirds section is grounded to the axle. At every revolution of the axle, therefore, the contact on the drum closes a circuit through an electromagnet, whose armature releases a wheel in a "speed clock" mounted on the table underneath the instrument shelf (see Fig. 1). This wheel advances one tooth for each movement of the armature, and is connected by a train of gears in the clock with a toothed contact wheel. Each revolution of this contact wheel corresponds to 132 revolutions of the trailer truck-axle, and therefore, with a 31-in. trailer wheel, represents a train movement of 1071.7 ft. When an 11-toothed contact wheel is used in the clock, the advance of one tooth corresponds to a distance of 97.3 ft. Each tooth of the contact wheel closes a circuit through an electromagnet at the bottom of the moving strip of paper, and the armature of the magnet moves a stylographic pen that makes a notch in the otherwise straight line which it describes upon the paper. The distance between each notch therefore represents 97.3 ft. travel of the train. The pen is held in a clamp at the end of a brass bar, which is in turn attached to the armature of the electromagnet.

because it gives the speed of the train in miles per hour directly when the running time in seconds is divided into 1000. This is readily shown by substituting 1466⅔ for D in the familiar equation

$$v = \frac{D}{t \times 1.466\frac{2}{3}} \qquad (1)$$

Where v = speed in miles per hour, D = distance covered in feet, t = time in seconds. The equation becomes

$$v = \frac{1000}{t} \qquad (2)$$

The straight and level track is chosen for this test as the speed of the elevated trains is practically constant throughout this particular distance on the structure.

When accurate checking is desired, the observer with the stop watch also holds a small push-button in his hand and

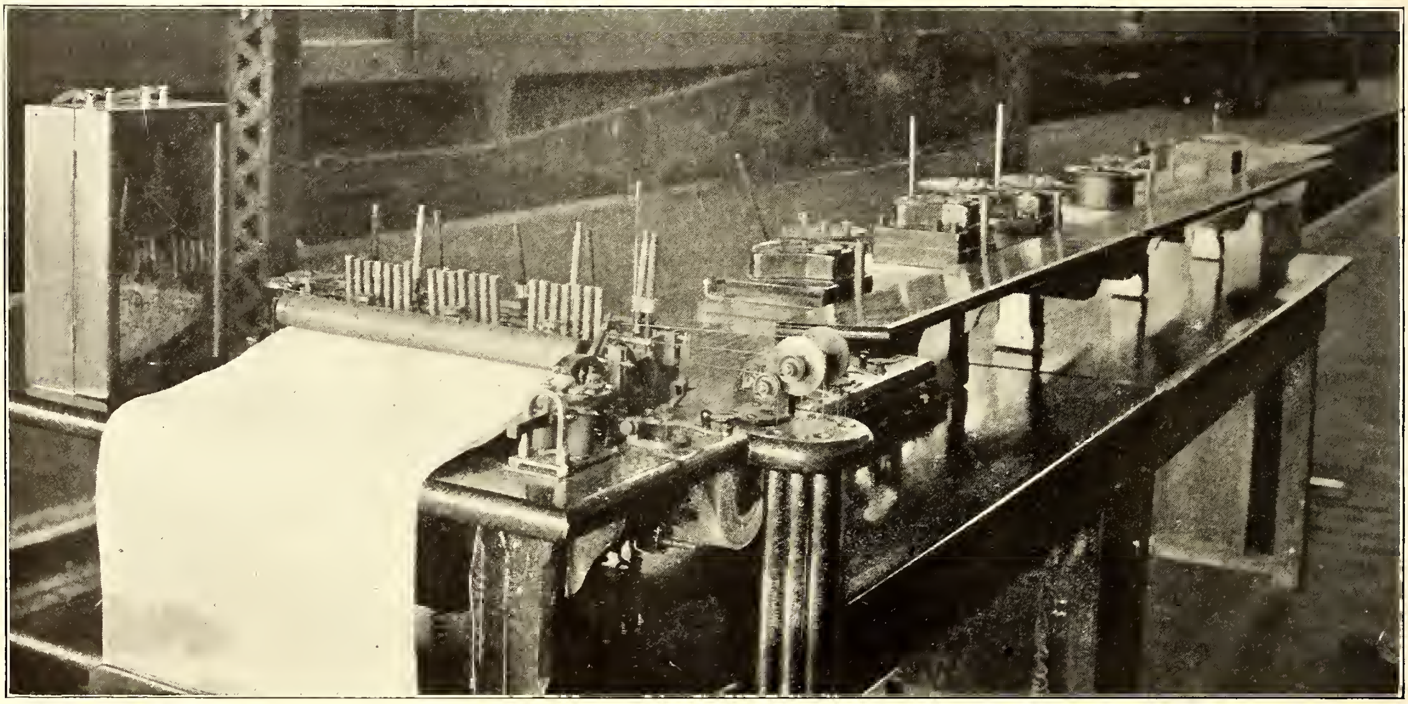


FIG. 4.—RECORDER, SHOWING DETAILS OF OPERATING HEAD

The resistances illustrated in Fig. 5 are mounted beneath the table. A single-pole knift switch cuts off the current when desired, and the resistances and wiring are protected by a 10-amp. Noark fuse. The potential required on the electromagnet circuits is derived from the drop in voltage existing across the smaller resistances shown in the right-hand portion of the diagram. A resistance of 600 ohms total is placed between the smaller resistances and the line connection, and a ½-cp pilot lamp is placed in series with the circuit to show quickly when the current is on. This pilot lamp is also mounted beneath the table.

For the determination of speed, the magneto-generator is calibrated with a speed indicator which is plugged into its shaft, the magneto being driven by a small 110-volt motor. A curve that is practically a straight line is then plotted to give the relation between the speed of the magneto and the voltmeter readings. The indication of the voltmeter is transmitted to the speed pen and recorded in a curve on the moving paper. It is checked by timing with a stop watch, the seconds required to cover a distance of 1466⅔ ft., set off on the elevated structure between the Sullivan Square terminal and the Thompson Square station. This distance is marked by horizontal white markers at its beginning and its end, and is included in a piece of track which is practically straight and level on each side of the markers, and also between them. This distance was chosen

presses it at the instant of passing each marker. The pen attached to the electromagnet A (Fig. 5), at the top of the moving paper, then records a corresponding notch in the otherwise straight line which it draws, at each pressing of the button. The record may then be taken into the office if desired, and perpendiculars dropped from the notches upon the base line so as to cut the speed curve drawn by the voltmeter pen, and enclose an area which represents the distance traveled, on the speed-time diagram. By checking up this area with a planimeter, the accuracy of the speed curve in terms of the speed scale selected is immediately made evident. This scale is always taken as 1 in. to 20 miles per hour. In case the observed speed deduced from the stop-watch measurement does not check with the average speed between the markers, as exhibited on the diagram, the ratio of the lever arms which regulate the movement of the steel wires connecting the voltmeter disc with the recording pen is altered in close proportion to the ratio of the two speeds. Thus, if the stop watch gave a speed of 40 miles per hour and the average shown on the paper was 45 miles per hour, and the wire from the voltmeter disc was hooked above the wire to the pen on the lever, the distance of the wires from the fulcrum of the lever being 3.5 ins. and 3 ins., respectively, the resulting ratio is $\frac{3.5}{3} = 1.17$. This ratio must be increased in order to give a smaller pen deflection with the same voltmeter deflection, and the effect of the increase is represented by $\frac{1.17 \times 45}{40} = 1.32$. Leaving the voltmeter wire in the same position (3.5 ins. above the fulcrum), the position at which the pen wire must be attached comes to 2.68 ins. above the fulcrum, the ratio between 3.5 and 2.68 being 1.32, approximately.

The horizontal scale of the test recorder is sixteen seconds per inch. This is obtained in the following manner: The moving sheet of paper is fed forward by the clock mechanism underneath the table, which is geared to a solid brass cylinder having milled raised bands parallel to the circumference. On top of this cylinder rests a second milled cylinder of brass, about 1¼ ins. in diameter, which serves as a weight to hold the paper in place as it is passed between the two after the manner of a clothes wringer. The top cylinder simply operates as an idler, and is not connected with any other mechanism by gearing. The circumference of the lower cylinder is 4 ins., and it is mounted upon a shaft which is geared to the driving clock and to an electromagnetic escapement in such a manner (gear ratio 4 to 1) that each time the escapement releases a 16-pin wheel, seen in Fig. 1, the cylinder rotates one-quarter as fast as the latter. The escapement releases one pin every second, and hence the cylinder requires sixty-four seconds to make a revolution. The armature of the electromagnet (Fig. 5, left-hand corner of cylinder) terminates in an open jaw, which allows the escapement pins on the pin wheel to pass through, one at a time; see also Fig. 1.

The armature of the escapement electromagnet is operated through a relay, which in turn is operated by a second relay in the time clock which stands upon the test table. The relay in the time clock is operated by a delicate sliding verge contact and local battery connection inside the clock, which completes the circuit once every second. The second relay is used simply to take all the strain possible off the time clock mechanism, which might become deranged if a powerful spring contact were connected with it mechanically. A key, shown at 1, Fig. 5, is connected in the circuit so that the paper may be fed forward by hand in case it is desired, either for adjustment or in case the clock fails during test operations.

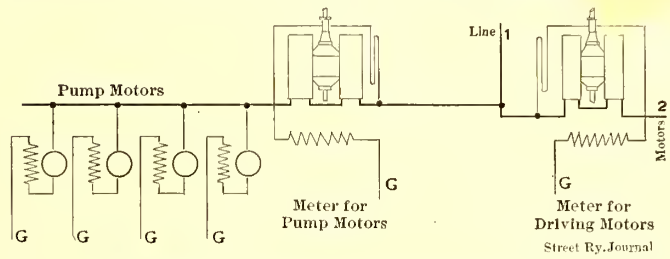


FIG. 6.—WATTMETER CONNECTIONS FOR POWER TEST OF CARS

In order to prevent sparking at the relay contact inside the clock, a non-inductive resistance coil is installed and connected across the magnet circuit. The magnet coils have a combined resistance of 125 ohms. The non-inductive resistance is composed of 54 ft. of No. 36 Climax wire, having a resistance of 21 ohms per foot, and furnished by the Driver-Harris Wire Company, of Harrison, N. J. The diameter of the wire is .005 in. The time clock was furnished by Blodgett Brothers, of Boston.

The accelerometer is one of the most interesting parts of the test recorder. It is designed to draw a curve of the rate of change in train speed as it increases or decreases during any run. It consists in the main of a galvanized iron tank, partly filled with water, carrying a wooden float to which is attached a vertical brass pointer. The tank is 18¼ ins. high, 8⅜ ins. wide and 26½ ins. long, in outside dimensions. The float is 25½ ins. long x 7 ins. wide x 3 ins. thick, and is secured to the tank by a rod about which it is free to revolve as an axis.

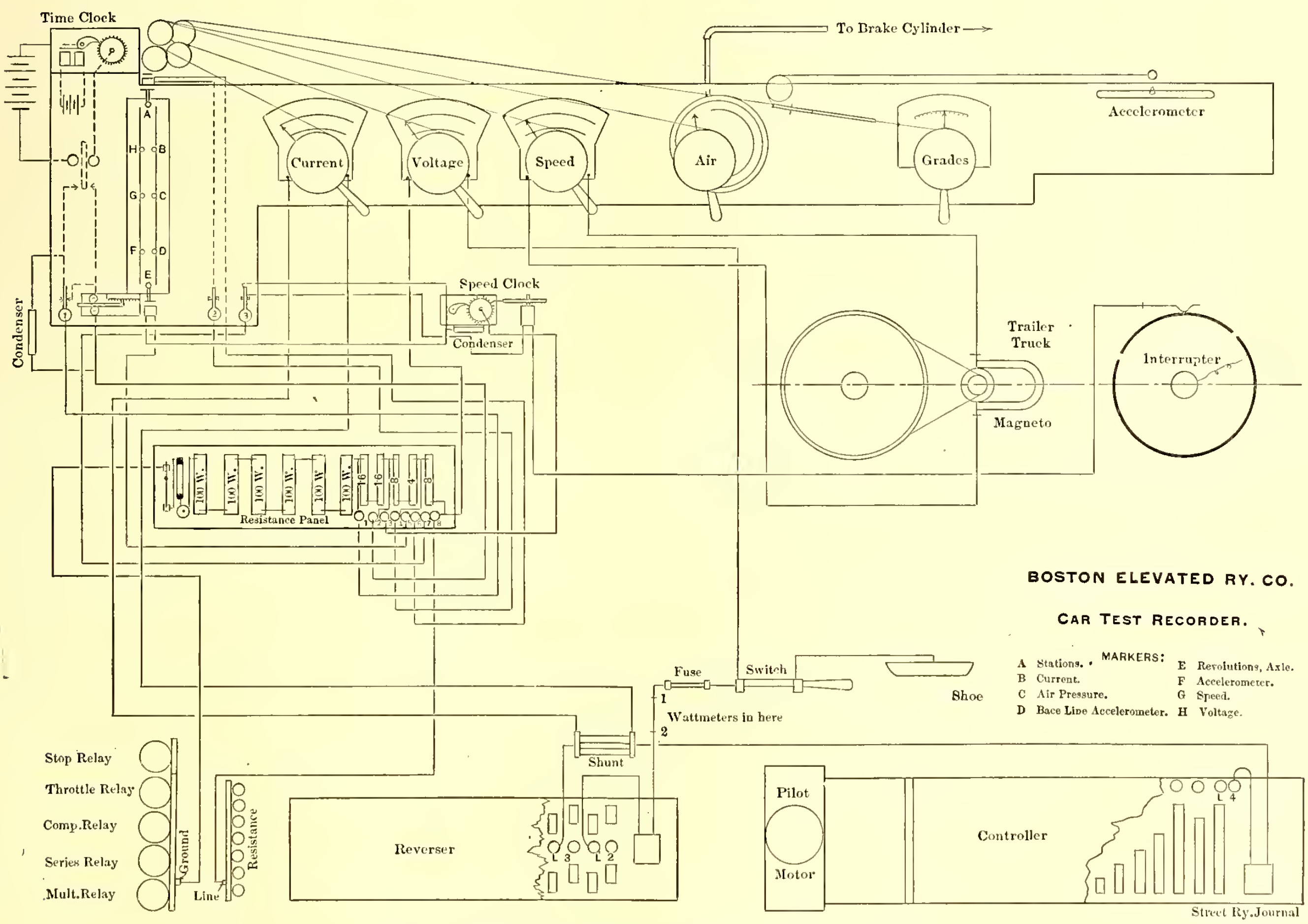


FIG. 5.—WIRING DIAGRAM OF CAR TEST RECORDER

Longitudinal motion is prevented by the suspension of this rod and its attachment to the sides of the tank. The acceleration of the car, positive or negative, piles up the water in the tank at one end or the other, according to the direction of motion, tilting the float forward or backward, as the case may be. The tank has a rigid connection with the car, as may be seen by Fig. 7. The pointer attached to the float moves to and fro from a zero position as the float swings up or down around the axis rod, and the motion of the pointer is followed by an observer with a pivoted pointer in much the same way that the indications of the other instruments are watched. Fig. 8 shows the general arrangement of the accelerometer and its connections as a car is standing upon a grade. A is the float, T the tank, B the brass pointer attached to the float, C the movable pointer,

FIG. 7.—RECORDER SET UP IN CAR

D a movable disc and pointer, and E a scale, which is used in connection with D to compensate for the effect of grades. F, G and S are pulleys, H an adjusting lever, and P the recording pen at the head of the table. The accelerometer pen is connected by a steel wire to the adjustable pointer C through the adjusting lever and pulleys. Pulley F is pivoted to a sliding arm which is wired to the compensating disc.

It is manifestly impossible to obtain correct indications of the acceleration values unless the effect of grades is overcome, on account of the tilting of the tank itself, which occurs at every change in grade. In operation, therefore, the apparatus is so adjusted that as each grade is reached, the operator handling the disc D corrects for the grade by simply moving the pointer to the scale E, in accordance with the exact value of the grade encountered while the observer follows the pointer of the float with the movable pointer. The pen then draws a correct curve of the accelerations and retardations of the train to a scale which is determined by the adjustment, the base line or zero of the scale coming in the center of the diagram.

The adjustment of the accelerometer is a matter of interest. The car containing the test recorder is first brought to a standstill upon level track. The water in the tank is level, and the float pointer stands in a vertical position at the zero point of its scale. The pen is placed at zero (on the base line), the pointer C being held at zero, and the slack in the wire is now all taken up, the compensating disc D being held with its pointer at zero on the scale E. The apparatus is now in shape to give acceleration readings on level track, but the scale of the pen diagram is unknown, the adjusting lever being set at some arbitrary ratio at this stage of the proceedings. The car therefore proceeds to the —8 per cent grade on the southbound track just beyond the Boylston Street subway station. Fig. 9 represents the position of the tank, float and pointer as the car stands upon this grade. The disc D is now fastened or held at zero; the pointer B has taken up a position due to the —8 per cent grade. The observer at the accelerometer tank then turns the movable pointer C to coincide with the position of B, which allows the pen P to move by means of the weight attached to it through a certain deflection on the diagrams. This deflection represents the effect of the —8 per cent grade, which effect corresponds to an acceleration of 1.76 miles per hour per second. This is derived from the well-known relation

$$\text{m.p.h.} = \frac{Tt}{91.2}$$

where m.p.h. = speed gained or lost in time t seconds with a tractive effort in pounds per ton of T. In this case, $T = 160$ lbs. per ton, the accelerating effort due to a —8 per cent grade, and $t = 1$ second. In other words, the effect of a —1 per cent grade is equivalent to an acceleration of .22 miles per hour per second. Now, in the test recorder of the Boston Elevated, a vertical scale of .5 ins. is taken, equal to 1 mile per hour per second of acceleration, positive or negative, on each side of the base line. When the pen deflection on the —8 per cent grade is measured on the diagram, therefore, if the resulting displacement from the base line is not .88 ins., the adjustment of the lever ratio must be altered until the correct deflection is obtained when the car comes to a standstill upon this grade. This ratio is 1.43, the pen wire hook being nearer the fulcrum.

It now remains to calibrate the scale E of grade corrections to be used in actual operation. This is done while standing upon the —8 per cent grade. The pointer C is held at the position it occupied before, when the scale determination was made, coinciding with the position of the pointer B in Fig. 9. The disc D is then turned so as to bring the pen P back to the base line. The indication of D's pointer on the scale E therefore gives the location of the compensating point for the —8 per cent grade. An equal arc is set off on the other side of the zero of scale E to give the + 8 per cent grade correction. Although in regular operation there is no movement of trains up an 8 per cent grade on the Boston Elevated system, the scale is completed for the purposes of symmetry. Intermediate points are now marked off in regular spacing and the apparatus is adjusted. Briefly stated, the object of the compensating disc D is to tighten up or loosen the pen wire just enough to offset the deflections which the grades themselves produce. In making tests with the accelerometer, one observer is required to manipulate the pointer C to coincide with pointer B, and another the pointer at D, on the scale E. The observer at D therefore has a table of grades before him, and he refers to these as the train passes over the line, setting his pointer on the grade of the scale corresponding to the track grade upon which he happens to be. In some parts of the subway the grades change rapidly, and considerable agility is necessary to follow the grades on the track, but the practice obtained in successive tests enables the work to be done with comparative ease.

The reader will note two arrows in the diagram (Fig. 8) which indicate the directions in which the train may be moving with reference to the accelerometer tank. These arrows are marked on the compensating scale. The + and — signs show which side of the grade scale is to be chosen, as the pointer is moved to follow any specific grade encountered on the line.

For example, let the train be considered as moving from left to right down the 8 per cent grade beyond Boylston Street station. The upper arrow indicates this motion, and the signs show that the left-hand side of the compensating scale is to be used for positive grades and the right-hand side for negative grades. Therefore, the observer at the compensating disc moves his pointer over the scale E to the right, until he reaches 8 per cent. This slacks up just enough on the movable arm attached to the pulley F to compensate for the effect of the grade upon the float, and consequently upon the pulleys, wires and, finally, the pen. On the diagram drawn by the pen, positive acceleration is shown above the base line, and negative acceleration or retardation below; which depends upon the direction of car movement.

Three keys are provided at the side of the table near the escapement which drives the recording sheet of paper. These are shown at 1, 2 and 3 in Fig. 5. Key 1 enables the paper to be manually fed forward in case the time-clock circuit is interrupted or special adjustment is wanted. Key 2 is used to mark the passing of stations, interlocking towers or other special points of interest on the line. This closes a circuit through the electromagnet A, which has a pen attached to its armature, so that every time the key is depressed a notch is marked in a line that is drawn continuously on the moving sheet of paper. Key 2 is pressed twice for stations and three times for interlocking towers. Key 3 is connected with the electromagnetic pen E at the bottom of the paper, and is used for special marks as may be required from time to time in testing. It is also connected so as to cut in the interrupter by means of a switch mounted on the key base. The batteries shown in the left-hand corner of the diagram are "Mesco" dry cells mounted in a box beneath the table. A condenser is placed across the

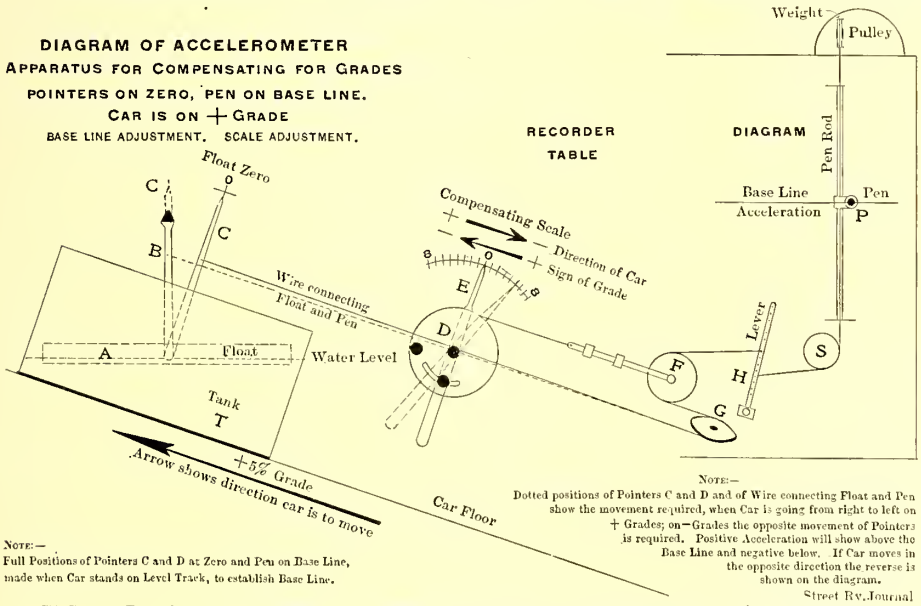


FIG. 8.—DIAGRAM, SHOWING APPARATUS FOR COMPENSATING FOR GRADES

relay contacts in the escapement circuit, and another in the speed-clock relay circuit to suppress sparking.

It will be observed in Fig. 5 that the brake cylinder is ordinarily piped to the pressure gage mounted on the test recorder. When it is desired, however, to obtain simultaneous records of the brake cylinder pressure and the auxiliary reservoir pressure, the former is obtained by a special automatic indicator which is mounted upon the table and connected to one of the pens. The latter is obtained by the usual method of following the gage readings with a disc and pointer.

Ordinarily the test recorder is kept in the shops of the Boston Elevated Railway Company in a place free from disturbance. Considerable care is, of course, necessary in order that the apparatus shall be properly set up in perfect working condition whenever a test is planned. The success of the tests is, to a noteworthy extent, thus dependent upon the oversight of the general foreman of elevated shops, John Lindall, and his assistant, Clark Doty.

The organization of tests on the elevated division requires the service of nine men, and frequently an extra man to check the diagrams by taking stop watch readings of the running

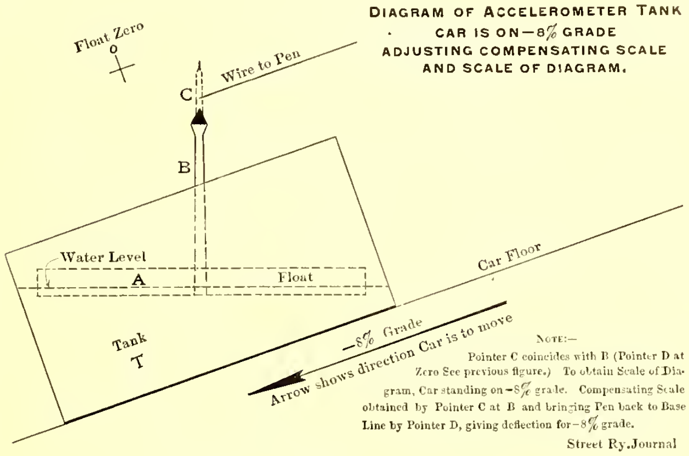


FIG. 9.—DIAGRAM OF ACCELEROMETER

times, stops, etc., between and at stations, towers, etc. These observers comprise the engineer in charge, John W. Corning; a key operator, diagram man, to write the names of stations, etc., on the chart; ammeter observer, voltmeter observer, speed observer and air-brake pressure observer. One man is also required to operate the compensator for grades, and another to follow the pointer which is attached to the accelerometer float.

The four quick-break snap switches, shown at the side of the table in Fig. 1, are for the purpose of connecting the dry batteries with the clock contacts and relays. Two of these are duplicates, so that an extra battery may be thrown into circuit in case anything goes wrong with those already in use. The roll of paper used with the apparatus is about 600 ft. long and 14 ins. wide. The running time of trains for the round trip from Sullivan Square to Dudley Street being forty-four minutes and the speed of the paper 1 in. in sixteen seconds, it follows that about 14 ft. of paper are used up in making a complete test over the route. About forty tests of this character can thus be made without replacing the roll of paper. As the paper is used up, it is fed forward over the end of the table into a wooden box, which keeps it clean and prevents its falling upon the floor. When a test is about to be started, the main switch located in the hood of the car is thrown in. This makes all the circuits alive down to the small knife switch, which is mounted on the resistance panel beneath the table. This switch is then thrown in, and all the apparatus except the battery circuits becomes alive. The time clock has previously been started and the driving clock beneath the table wound, but the paper does not begin to be fed forward until the two battery switches have been closed, which is the last operation before starting a test.

Summing up the foregoing and assuming that a test is now under way, we find the record showing the following, as the paper is fed forward: Stations, current, air, accelerometer, axle revolutions, speed and voltage. The scales on the diagrams drawn in the test are:

1 Space = 97 ft. (distance scale.)
1 in. = 200 amps.
1 in. = 200 volts.
1 in. = 20 m.p.h.
1 in. = 30 lbs. per square inch brake-cylinder pressure.
1 in. = 16 seconds time, on paper, horizontally.
1 in. = 2 m.p.h. per second acceleration and retardation.

The various scales are obtained by the adjustment of the wires at the levers.

Fig. 3 shows plainly a record coming from the machine as it looks during an actual test. Fig. 10 illustrates a record of a run from Beach Street station to Northampton Street station practically as it was taken from the paper roll on the recorder. Fig. 11 is the same record, properly labeled and marked with

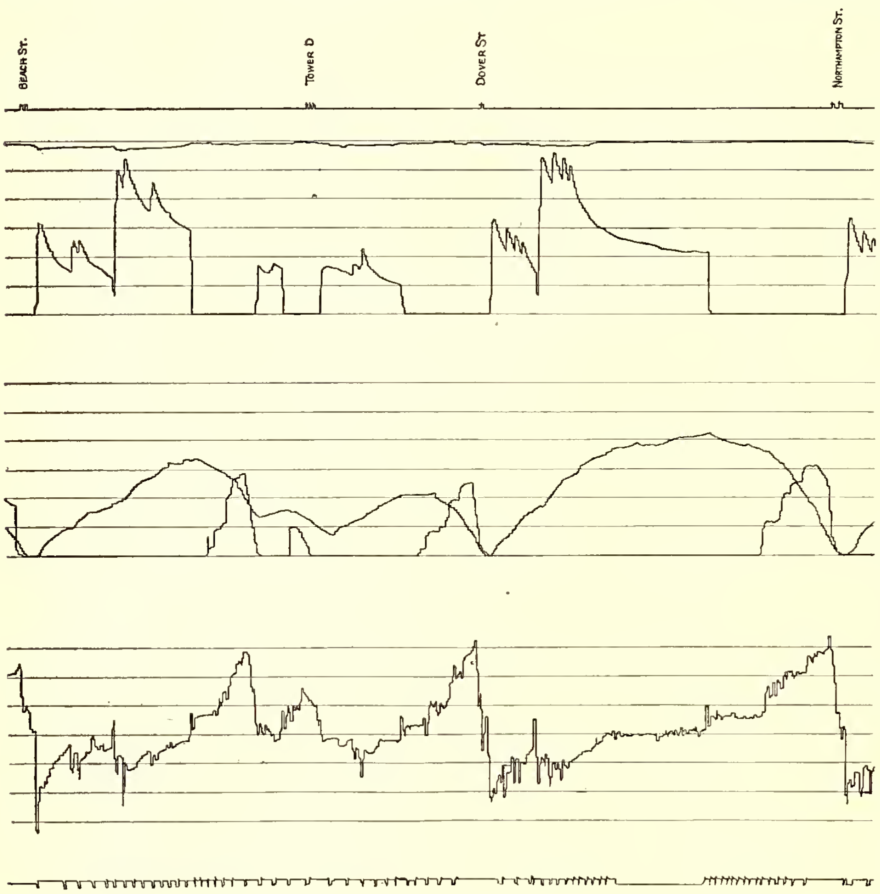


FIG. 10.—DIAGRAM JUST AS IT COMES FROM THE RECORDER

the scales used. This run was made in the current year with car No. 090 of the elevated division, equipped with two Westinghouse 50-C motors, gear ratio 50:21 = 2.38, 34-in. wheels and Christensen air-brake system. The weight of the car loaded was approximately 30 tons. In this test but one car was run in the train. Fig. 12 shows the alignment and grade of the track covered in the run, with a map of this section of the line.

All the curves are drawn upon the same horizontal time axis. Turning to Fig. 11, the "Location Record" is seen at the top of the diagram, two notches having been made as the train reached Beach Street station, and three as it passed Tower D at the Motte Street Y. Below this is the voltage curve, and then the current curve. The speed-time curve follows, then we have the diagram of brake cylinder pressure, followed by the acceleration curve and distance record. The slight fall in voltage as the current increases is plainly evident, and the "notching-up" of the control as the series and parallel resistance points are passed is also apparent. The train started from rest at Beach Street; accelerated to a maximum speed of about 33 miles per hour along Harrison Avenue; braked to a speed of 13 miles per hour at the Motte Street curve to the right (radius 144 ft.); accelerated to 16 miles on Motte Street; braked to 7.5 miles in rounding the 90-ft. radius curve at Tower D on Washington Street; accelerated to 21 miles approaching Dover Street station, and braked to a standstill, coming to rest at the station. After a two-second stop at Dover Street, the train accelerated on level track free from any curves of note to a maximum speed of about 42 miles per hour. Current was cut off about fourteen seconds before the brakes were applied in approaching Northampton Street station; the car coasted for about 700 ft., and then was braked to a stop. The record shows the longer time of remaining in series on leaving Beach Street as compared with the quicker getting away from Dover Street, this being due to the 105-ft. radius curve at the former station. The maximum current during the run was about 550 amps. The brake cylinder diagram shows that four applications were made in slowing down at the Motte Street curve, and three at Northampton Street. The effect of the heavier applications upon the speed-time and acceleration-time curves is noteworthy, as is the effect of the single application made in slowing down at Tower D.

Looking at the acceleration and speed-time curves upon leaving Beach Street, in conjunction with the current curve, an interesting point is observed. The falling off in current is clear, after the resistance is cut out and the counter electromotive force of the motors in series rises. The drop in current causes a corresponding fall in tractive effort, the speed does not increase as rapidly and the acceleration curve sags toward the zero line. Every change in the accelertion is instantly reflected in the curve. It is, of course, necessary to use average values in judging the variation of the acceleration. In the diagram shown in Fig. 11, positive acceleration is shown below the zero line and negative above.

In the run from Dover to Northampton Street, the gradual decrease in acceleration as the current falls off in the motor curve is well shown. The flattening of the speed-time curve in this run as the speed approaches a fairly constant value is also most evident in its effect upon the acceleration, which drops practically to zero at the points of high speed.

An interesting place in the acceleration diagram between Dover and Northampton Streets occurs where the car begins to coast before the brakes are applied for the Northampton Street stop. An examination of the speed-time diagram at this point shows that the speed curve slants downward at a practically uniform rate during this part of the run. The acceleration curve is, of course, negative here, and the constant rate of retardation appears plainly on the diagram between the time of shutting off current and the time of applying brakes. The value of train resistance under these conditions may easily be reduced from the speed-time curve, which drops from 42 to 36 miles per hour in about seventeen seconds. The application of the equation

$$t = \frac{\text{m.p.h.} \times 91.2}{T}, \text{ where } t = \text{seconds}, T = \text{pounds per ton,}$$

previously mentioned, gives a value of approximately 32 lbs. per ton for the friction and air resistance encountered by the single car used in the test. In making the Northampton Street stop, the motorman released the brakes slightly before the end of the run, so that the rate of braking was largely determined by the train resistance. The retardation therefore decreased very rapidly, as may be seen on examination of the acceleration diagram, which gave an easier stop than was made at Dover Street.

Considering the distance record, it will be noted that the space between notches grows shorter as the speed of the car increases, and that a corresponding elongation of the gaps between the indentations occurs as the speed slows down. Thus, about one and one-half seconds are required to cover the distance of 97 ft. indicated by the marks, at the maximum speed between Dover and Northampton Streets, while some ten seconds are required to cover the same distance in accelerating through the first part of the run after a speed of about 5 m.p.h. has been reached. This checks closely with the speed-time curve.

In the upper portion of the diagrams (Fig. 11) are two tabulated statements, which give the data bearing upon the energy consumption for the two runs. These are determined by integrating the current curve with a planimeter, obtaining the average amperes for the car by dividing the time of the run in inches, including the stop into the area (5.45 sq. ins. in this case, Dover-Northampton); this gives the average amperes per car derived from the mean height of the current curve in inches, multiplied by the scale. The average volts are obtained by measuring a considerable number of voltage ordinates and taking the mean of these. The product of the two gives the average power in watts, and this multiplied into the length of the run in hours gives the energy consumption in kw-hours, provided the factor .001 is properly used to convert watts into kilowatts. The distance in miles is either known from the engineer's tables or measured on the diagram in feet and converted. The division of this distance in miles into the energy consumption obtained in kw-hours gives the quotient of energy consumption in kw-hours per car-mile.

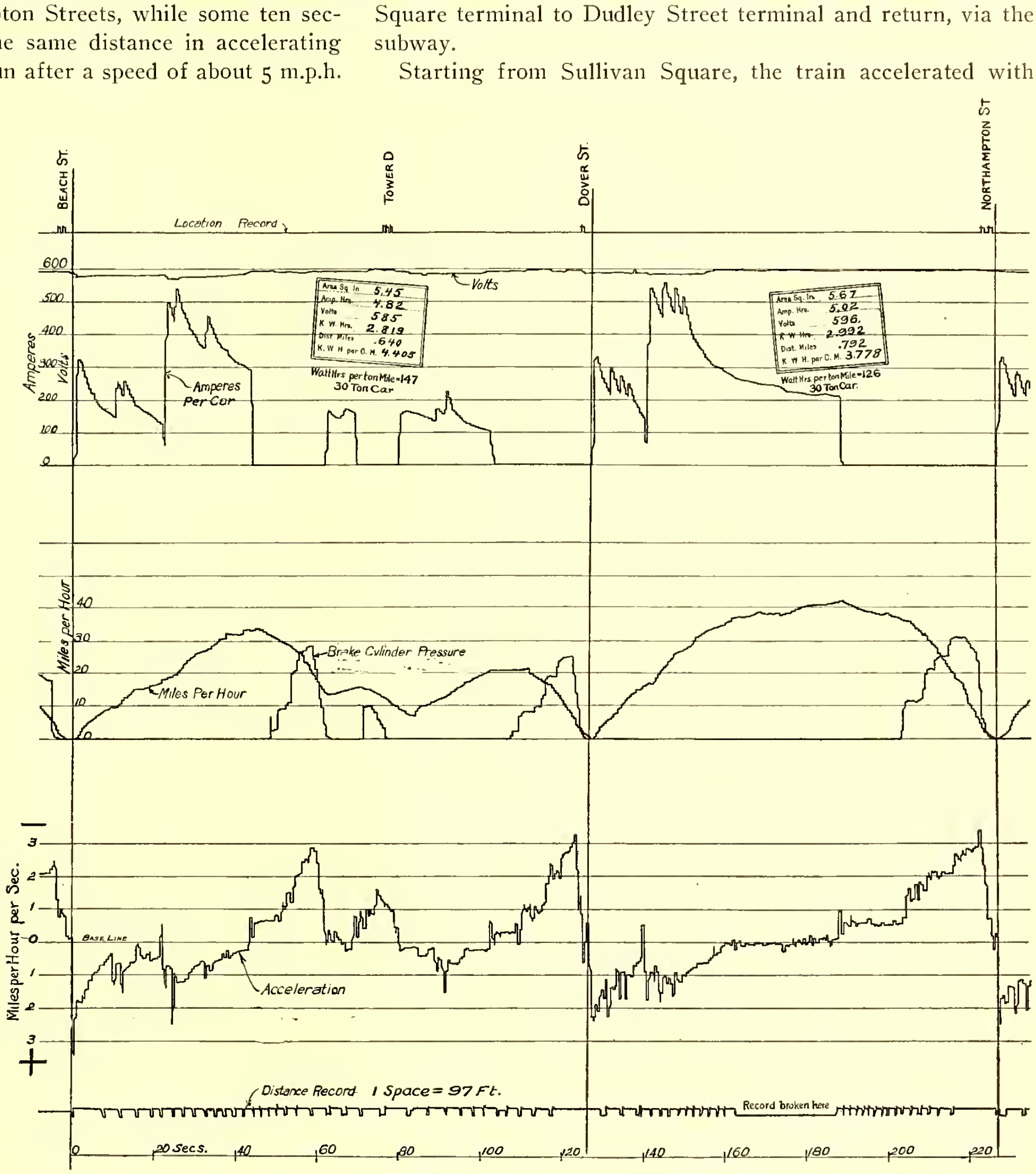


FIG. 11.—DIAGRAM WITH NOTATION ADDED

This comes to 4.405 in the case of the Beach Street to Dover Street run, and to 3.778 in the run from the latter station to Northampton Street. An interesting phase of this determination arises from its illustration in the present case of the point that a high-speed run with few stops can frequently be made at a less expenditure of energy than a low-speed run, where the stops and slow-downs are more frequent, necessitating repeated accelerations. In the two runs of Fig. 11, the watt-hours per ton-mile figure 147 for the Beach-Dover Street run, and 126 for the Dover-Northampton Street run.

Fig. 13 shows a round-trip run in a recent test in which the apparatus was set up to give the curves of brake cylinder and auxiliary reservoir pressures in addition to the regular curves.

The run was made with a four-car train between 2 and 3 a. m. on Nov. 13, and is identical with a regular service run with the exception of the length of station stops. Each car in the train was equipped with two GE 68-C motors, rated at 170 hp each, gear ratio 3.28. The driving wheels were 33 ins. in diameter, and the train was equipped with the Westinghouse automatic air brake and the Sprague-General Electric system of multiple-unit control. The recorder was mounted in the first car of the train, No. 0171, and the round trip was made from Sullivan Square terminal to Dudley Street terminal and return, via the subway.

Starting from Sullivan Square, the train accelerated with the motors in series until about sixty seconds had elasped, when the controller was thrown into multiple upon taking the so-called Bunker Hill Street curve. The gradual decrease in current per car on the "series-motor curve" is clearly shown, the maximum series current being approximately 240 amps., and the minimum, 50 amps., at a speed of 20 m.p.h. The low rate of acceleration when running in series through the Sullivan Square yard is also apparent, as is the instantaneous increase in the rate of acceleration upon going into multiple and taking 344 amps.

Full multiple running brought the train to a maximum speed of 40 m.p.h., the acceleration curve showing the gradual decrease in the rate of gaining speed as the motors took less and less current. At the point of maximum speed the current was 125 amps. During this acceleration the calibration points on the structure were passed, and the average speed determined by stop watch figured 36.6 m.p.h. This checks closely with the average speed determined from the speed-time curve between the two points shown. The train coasted for about eighteen seconds with the current off, of course, after reaching maximum speed. It then braked to a full stop at Thompson Square at an average rate of retardation of 1.6 m.p.h. per sec- Square at an average rate of retardation of 1.6 m.p.h. per second.

This is well shown by the average of the acceleration curve below the base line, about two minutes eighteen seconds from the point of starting from Sullivan Square. The advantages of coasting are apparent from a glance at the current curve, which encloses an area that is a proportional factor in the energy consumption of the run. It will be noted that the auxiliary reservoir pressure was maintained at about 70 lbs. during the major part of the run, until the braking point was reached, when it fell to about 66 lbs. The brake cylinder diagram shows that three applications of the brakes were made before release in stopping at Thompson Square, followed by a single light application. These applications produced brake-cylinder pressures of 30 lbs., 42 lbs., 46 lbs. and 12 lbs. per square inch, respectively. From the station record line at the top of the diagram it will be seen that the run from Sullivan run the average voltage was about 570. The alignment and grade was favorable to high-speed operation.

The foregoing analysis indicates the sort of information that the curves give, and similar studies can easily be made of the other runs in the round trip. It remains to touch upon the salient features of the record.

From Thompson to City Square the short run presents no special points of interest except the regular notching-up of the control as the train speed increased; the maximum current demand of about 450 amps., maximum speed of 26.3 m.p.h., maximum rate of acceleration of about 2 m.p.h. per second, and lower demand upon the brakes. An interesting point is shown in connection with the maximum current demand in the first two runs.

The current reaches a higher value between Thompson and City Squares, because the speed is lower when the control goes into multiple, and there is less counter electromotive force in the motor armatures than in the Sullivan-Thompson run, where multiple was reached at a speed of 20 m.p.h. Here

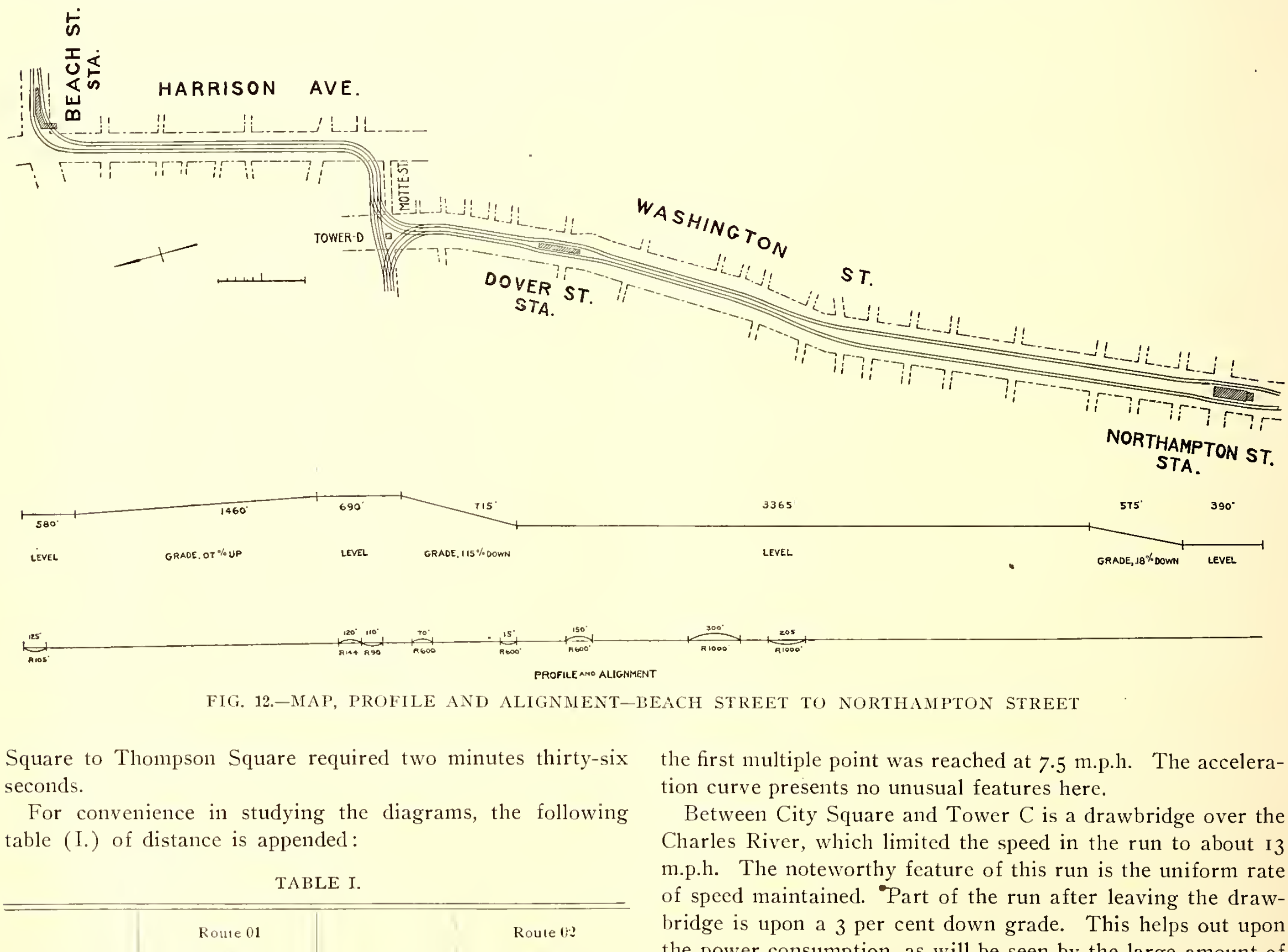


FIG. 12.—MAP, PROFILE AND ALIGNMENT—BEACH STREET TO NORTHAMPTON STREET

Square to Thompson Square required two minutes thirty-six seconds.

For convenience in studying the diagrams, the following table (I.) of distance is appended:

TABLE I.

Route 01			Route 02		
Sull. Sq	Feet	Miles	Dudley St..	Feet	Miles
Thomp. Sq ..	5,605	1.062	North. "	3,091	.585
City " ...	1,391	.263	Dover " ..	4,189	.793
No. Sta	2,911	.551	Pls. " ..	2,517	.477
Haykt Sq	1,029	.195	Byl. " ..	1,419	.269
Scy. " ...	1,500	.284	Park " .	1,335	.253
Park St......	1,580	.299	Scy. Sq..	1,440	.273
Byl. "	1,080	.204	Adams " ..	770	.146
Pls. "	1,730	.328	Haykt " ..	990	.188
Dover St.....	2,507	.475	No. Sta	1,072	.203
Nor. "	4,182	.792	City Sq..	2,887	.547
Dud. "	3,937	.746	Thomp." ..	1,390	.263
			Sull. " ..	4,654	.881

The voltage curve between Sullivan and Thompson Squares shows the drop in pressure at each moment of unusual current demand, and the rise as the current is thrown off. During the the first multiple point was reached at 7.5 m.p.h. The acceleration curve presents no unusual features here.

Between City Square and Tower C is a drawbridge over the Charles River, which limited the speed in the run to about 13 m.p.h. The noteworthy feature of this run is the uniform rate of speed maintained. Part of the run after leaving the drawbridge is upon a 3 per cent down grade. This helps out upon the power consumption, as will be seen by the large amount of coasting involved, the current being required for only brief impulses of short duration.

Leaving tower C, the speed was about 12½ m.p.h. as the train passed around the 125-ft. radius curve to the right, and the run to North Station was made without notable increase in speed. A single application of current was enough to carry the train around the 100-ft. radius curve at the North Station. An interesting point is noted in the voltage curve just after leaving Tower C. The train passed over a gap in the third rail at this point and the current supply of the head car was momentarily cut off, so that the voltage curve dropped to zero.

In the run from the North Station to Haymarket Square the track is carried down a 5 per cent incline into the subway. This run is consequently nearly all coasting, and only a brief application of current to the train was necessary. The control did not pass beyond the series running point. The brake cylinder diagram is of special interest here on account of the additional braking required by the down grade, to keep the train well under control at a maximum speed of 20 m.p.h. The gradual reduction in auxiliary reservoir pressure is interesting to note.

The negative acceleration appears well during the braking period. A glance at the speed-time curve shows why it was necessary to make an additional quick application of the brakes to prevent overrunning the station in coming to a full stop at Haymarket Square. The reader will note that the brakes were kept on at the North Station while the train was standing there, on a —1 per cent grade.

Between Haymarket Square and Scollay Square the effect of the alignment and grade upon the current and speed curves is especially apparent. The train barely had time to accelerate in series to 16 m.p.h. before it was necessary to brake on account of the 90-ft. radius curve, reached seven minutes after leaving Sullivan Square. After passing around this curve, the train accelerated through series to multiple up a 3 per cent and then a 5 per cent grade, until it was again necessary to cut off current, which was followed by coasting around part of the 90-ft. radius curve approaching Scollay Square. The train was still climbing a 2.7 per cent grade as it entered the station, so that a third application of the current was necessary in order to make a proper stop. It is easily apparent that this type of run is exceedingly expensive from the standpoint of power consumption. Even at Scollay Square it was necessary to keep the brakes on in order to hold the train at the platform, about 38 lbs. per square inch being required in the brake cylinder. It will be noted that the maximum series current taken by the car in the second period of acceleration is less than in the first period. This is because the speed and counter electromotive force of the motors was higher, as was explained previously in the run from Sullivan to Thompson Square. The acceleration curve is worth examining in this run.

The effect of the throttle in the control is noteworthy as one examines the current curves. It will be seen that this was set in the equipment to about 240 amps. for series running and 480 amps. in the multiple. In the Haymarket-Scollay run it was possible to run in multiple for about six seconds.

The first part of the run from Scollay Square to Park Street involves clear operation from series to multiple. A maximum speed of 23 m.p.h. was reached, followed by a brief coast. Then the train was braked to a speed of 10 m.p.h. for the 90-ft. and 82-ft. radius reversed curve entering Park Street. It was necessary to keep the current on for fourteen seconds in passing around the curve. At Park Street the train was held on a —2.8 per cent grade with the brakes on.

The effect of the sharp curves appears plainly in the run from Park to Boylston Street. Scarcely does the train leave Park Street before it has to be braked for a 90-ft. radius curve; speed is then gained until the train approaches a 90-ft. radius reversed curve on nearing Boylston Street, when the brakes are again applied; then two short applications of current are given, followed by braking to a stop. The curve of brake-cylinder pressure plainly shows the frequent demands upon the brakes in the subway, as does the recurring falling and rising of the auxiliary reservoir pressure. Coasting is relatively less frequent in the subway.

Upon leaving Boylston street the train passed down an 8 per cent grade with a single brief application of current. The maximum speed attained was 12.5 m.p.h. The rapid acceleration at first is plainly shown by the acceleration curve, which sags as the brakes are applied, although there is a slight positive acceleration all the way down. At the bottom of this grade the climax of the subway's intricacy is reached in a 90-ft. radius reversed curve, the latter part of which is on a 4.5 per cent up grade. Here current is applied for the run to Pleasant Street, which is reached without further incident.

The noteworthy features of the run from Pleasant Street to Tower D are: The heavy consumption of current and slower rate of acceleration in climbing the 5 per cent incline which leads out of the subway; the cutting off of current and ensuing series operation upon reaching the 200-ft. radius curve over the New York Central and New York, New Haven & Hartford Railroad tracks, and the maintenance of a speed of about 12 m.p.h. around the 125-ft. radius curve at the Y at Tower D. The 200-ft. radius curve over the railroad tracks is also upon a 3.85 per cent up grade.

From Tower D to Dover Street nothing unusual occurred. Sometimes a train goes into multiple for a few seconds between these points.

Between Dover and Northampton Streets the conditions are favorable for high-speed running and quick acceleration. On the run shown in Fig. 13 an emergency stop was made from a speed of 37.5 m.p.h. in eighteen seconds, the rate of retardation being 2.1 m.p.h. per second. The demand upon the brake cylinder and the auxiliary reservoir is well shown here. Thus, 60 lbs. was held in the former, and the latter dropped to about 60 lbs. also, in the emergency equalization. If this emergency stop had not been made, the energy consumption for the run would have been much less, as may be seen by the run northbound from Northampton to Dover Streets, in which no stop was made. The curves show very well that acceleration and not running at speed is what requires great power.

In the run from Northampton to Dudley Streets the effect of the curves in the line upon approaching the terminal is apparent. The shortest curve, on the loop, has a radius of 105 ft. Series running and brief applications of current characterize the latter part of this movement. Shortly before entering Dudley Street, the train passed over a gap in the third rail, and the effect on the voltage curve is shown as at Tower C. The running time from Sullivan Square was eighteen minutes eight seconds.

A stop of seventeen seconds was made at Dudley Street, after which the northbound run was begun. Some series running was required to clear the special work and curve just north of Dudley Street, after which a full-speed run without hindrance was made to Northampton Street. The approach to Northampton Street is in part a 1 per cent down grade, and the increased demand upon the brakes in coming to a stop is easily apparent.

Between Northampton and Dover Street an excellent run is possible, accelerating uniformly until the motor curve is reached, the maximum speed being 38 m.p.h. Nearly twenty seconds are used up in coasting. At the point of maximum speed the current is 125 amps. In this run the gradual decrease in acceleration as the current falls off upon the motor curve is extremely well shown, as is the gradual increase in retardation as the brakes are applied.

From Dover Street to Tower D the only notable feature is the reduction of speed to 10 m.p.h. in passing around the Y toward Pleasant Street. A short series application of current is then made, after which the train coasts down the 2.48 per cent and 3.85 per cent grades over the steam railroad tracks around the 200-ft. radius curve shown, and thence down the 5 per cent grade into Pleasant Street. In approaching the latter station, the brakes are on for about thirty-eight seconds. This run takes little energy after Tower D has been passed, as may be seen from the current curve.

At Pleasant Street the track enters the subway, northbound. From this point to Boylston Street the speed-time curve is more or less distorted by the alignment and grade. It will be seen that the current is necessarily kept on a considerable portion of the time, and that a third application of the current is needed in entering the station at Boylston Street, on account

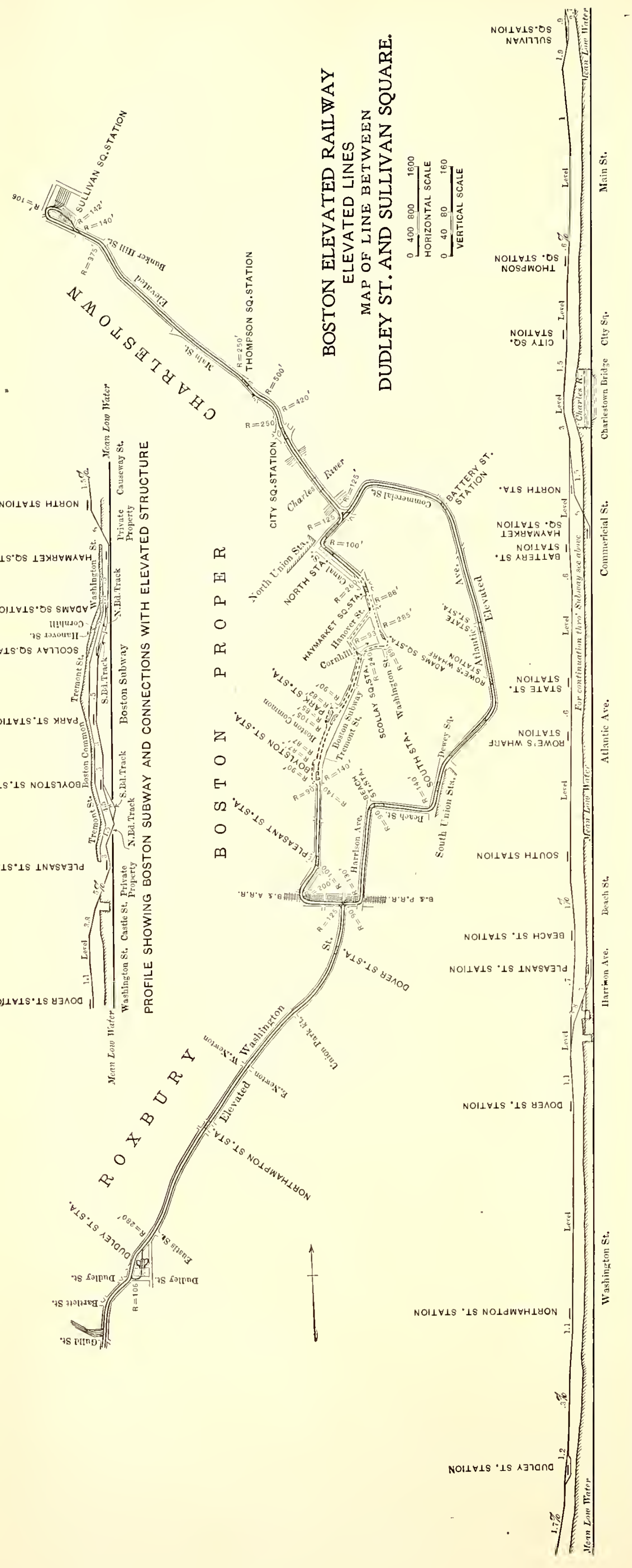


FIG. 14.—PLAN AND PROFILE, SHOWING ELEVATED STRUCTURE FROM DUDLEY STREET, ROXBURY, TO SULLIVAN SQUARE, CHARLESTOWN, VIA ATLANTIC AVENUE AND SUBWAY

of a 90-ft. radius curve and a 4.5 per cent grade encountered just south of the platform.

Between Boylston and Park Streets the acceleration curve is especially smooth and well balanced. There is no significance in obtaining equal maximum values, other than the fact that in such cases the acceleration and braking rates are equal, but the reader will note the close correspondence between the acceleration, current and speed curves here. The run between these two stations presents little difficulty from the track layout's standpoint, but it is so short that very little time is left for coasting between the moments of shutting off power and applying the brakes.

The run from Park Street to Scollay Square is still more economical of energy consumption in terms of distance. Nearly one-third of the time of run is spent in coasting, and yet the distance, 1440 ft., is covered in fifty-four seconds, which means an average speed of 18.2 m. p. h. The effect of the down grade of 3 per cent in stopping at Scollay Square is evident on the speed, brake cylinder and auxiliary reservoir curves.

The shortest run in the subway is from Scollay to Adams Square, 770 ft. Three per cent and 4 per cent down grades abound, with a 90-ft. radius curve approaching Adams Square. The conditions are favorable for a run that is largely made up of coasting, and as one would expect, the current curve is not prominent. The current is off during about 87 per cent of this run. An application of the brakes is necessary on approaching the 90-ft. radius curve, which is rounded at 10 m. p. h. to 12 m. p. h., after which the train makes its stop.

From Adams Square to Haymarket Square series running is the order of events, with a little judicious coasting. No serious curves or grades are found here. This run is a good example of the effect of holding the motors in series, then coasting and braking. The acceleration curve is seen to drop off with great rapidity as the current in the motors decreases, and the short period of straight acceleration as compared with the long motor curve is worthy of comment.

The advantages of going into multiple when possible, as far as the schedule is concerned, are plainly shown in the run up the 5 per cent incline between Haymarket and the North Station. In the preceding run thirty-eight seconds were required to accelerate to 17.5 m. p. h., while in this one but fifteen seconds are needed. This is, of course, not a perfectly fair comparison, as the alignment and grade upon leaving Adams Square is not quite similar to that at Haymarket Square, but it shows in a general way the advantages of multiple operation in saving time. In this run it will be noted that the current reaches a constant value, as does the speed (20 m. p. h.) in climbing the 5 per cent grade. This means that this is the highest speed that can be attained on this grade by the equipment, with the voltage at the point shown. The area of the current-time diagram is significant as an indication of the power consumption of such a car, weighing about 30 tons, in ascending a 5 per cent grade The run from North Station to Tower C does not differ in general character from the corresponding southbound run. Upon passing around the 125-ft. radius curve at Tower C, however, in the run to City Square, the motors are thrown into multiple, and the train accelerates up the 3 per cent grade which marks the Charlestown drawbridge approach. Power is shut off for a few seconds, and then the train accelerates across the bridge with the motors in series; this is kept up long enough to allow a brief period of coasting and subsequent braking into City Square. The reader will note that the train is taking but 47 amps. per car in this series running at 20 m.p.h.

The short run from City Square to Thompson Square requires no special comment, other than the second application of brakes needed to avoid overrunning the station platform.

The final run from Thompson Square to Sullivan Square illustrates the regular acceleration of the train to a maximum speed of about 36.3 m.p.h. Coasting is particularly evident as the train approached the curve near Bunker Hill Street. The calibration points on the structure were passed in 28.3 seconds, giving an average speed between points of 35.3 m.p.h., which checks exactly with the speed-time curve. The train coasted for forty-five seconds; braked to a speed of 11 m.p.h. at the 105-ft. radius reversed curve at the entrance to the terminal, and came to a stop in the Sullivan Square station, having made the round trip, 10.071 miles, in thirty-four minutes six seconds. A single application of current was required to round the last reversed curve satisfactorily. The momentary drop in voltage while the train was standing at Dudley Street, and also while standing at Pleasant Street, was due to feeder tests which are made nightly at the power houses.

BOSTON ELEVATED RAILWAY COMPANY
TABLE II.

Power test made on elevated cars, made in March, 1904.

Table of test, March 20, for maximum difference of power. Cars Nos. 0108 and 090.

Equipment, 2—50E—31 ins. and 2—50C—34 ins.

	Routes 03 and 02 K. W. Hrs. p. c. m.			Routes 01 and 04 K. W. Hrs. p. c. m.	
Equip.	50E—31″	50C—34″	Equip.	50E—31″	50C—34″
Sull.			Sull.		
Thmp	2.162	3.264	Thmp	1.978	3.283
City	4.030	5.502	City	4.055	6.300
To. C	2.806	4.082	To. C	2.860	4.338
Batt	3.404	5.370	N. S	0.757	0.911
State	2.733	4.500	Hykt	1.473	1.364
R. W	2.622	3 907	Scy	3.740	6.190
S. S	2.550	3.907	Park	3.700	4.490
B'ch	2.020	3.050	Byl	1.556	1.721
To. D	3.330	5.270	Pls	2.348	3 610
Dov	2.513	3.468	To. D	5.395	8.302
Nor	2.204	3.632	Dov	2.238	2.406
Dud	2.912	4.400	Nor	2.198	3.640
			Dud	2.432	3.875
Av	2.774	4.200	Av	2.672	3.880
Dud.			Dud.		
Nor	1.873	2 706	Nor	1.750	2 566
Dov	2.020	3.302	Dov	1.896	3.198
To. D	2.937	4.205	To. D	2.748	3.983
Pls	1.048	1.431	B'ch	2 220	3.370
Byl	3.456	6.615	S. S	2.162	3.280
P'k	2.476	3.220	R. W	2 505	4.038
Scy	2.143	2.853	State	2.565	3.372
Adams	1.540	1.083	Batt	2.732	4.410
Hyt	3.212	4.858	To. C	2 605	3.850
N. S	6.780	10.030	City	2.907	3.962
To. C	3 160	5.845	Thp	2.332	3 390
City	1.911	3.378	Sull	2.016	3.172
Thmp	4.210	6.440			
Sull	2.127	3.390			
Av	2.778	4.245	Av	2.370	3 549

Table II. illustrates the result of working up a test obtained by the recorder, comparing the energy consumption of two different gear ratios upon the elevated division. The 50-C motors were geared to 34-in. wheels, with a ratio of 2.38, and the 50-E motors were geared to 31-in. wheels, with a ratio of 3.18. The latter motors proved to be the most economical of energy. Some remarkable differences in energy consumption with the same equipment were brought out, over different portions of the line. Thus, under route 01 and equipment 50-E—31 ins., the long run at high speed from Sullivan Square to Thompson Square takes but 1.978 kw-hours per car-mile, against 4.055 kw-hours per car-mile in the short run between Thompson and City Square. The runs in the subway from Haymarket Square through to Park Street show plainly how much more power is used in overcoming the grades and curves, and in accelerating from the low speeds entailed, as compared with the freer runs at higher speed between Tower D and Dudley Street, for instance. The energy consumption runs up to 5.395 kw-hours per car-mile between Pleasant Street and Tower D, on account of the effect of the long climb out of the subway to the elevated structure. This latter figure rises to 8.302 kw-hours per car-mile for this run in the case of the 50-C—34-in. equipment, which accelerates more slowly to a higher maximum speed than the 50-E—31-in. The higher acceleration proves more economical in nearly every case, and this is particularly notable on up grades, as may be further seen in the extreme case of Haymarket-North Station, route 02. Here the higher speed equipment took 10.03 kw-hours per car-mile, and the lower speed and quicker acceleration equipment required but 6.78. The ratios and wheel diameters of Table II. were arranged to give the maximum difference in accelerating power and in capacity for maximum speed with the given equipments.

BOSTON ELEVATED RAILWAY COMPANY
TABLE III.

Power test on elevated cars, made in March, 1904, with car-test recorder.

Table of test, March 20, 1904. Two-car train, maximum difference in power from Dover Street to Northampton Street.

Car. Nos.	090	0108	Train
Equipment	2—50C—34″ wh.	2—50E— w.31″	
Gear ratios	2.38	3.18	
Run	Dov. to Nor.	Dov. to Nor.	
Distance, miles	0.792	0.792	
Weight, tons	29.5	29.5	59
Ton miles	23.76	23.76	47.52
Time motor			
Curve reached	30 sec.	22 sec.	
Time to make run	1 min. 49.5 sec.	1 min. 49.5 sec.	
Time current on	64 per cent.	64 per cent.	
Kw hours	2.879	1.749	4.628
Kw hours per c. m.	3.632	2.204	2.918
W. hours per t. m.	121.2	73.6	97.4
Average speed m. p. h.	26.0	26.0	
Max. " "	41.8	41.8	
Accel. " "			
Per S	1.00	1.00	
Coast do	0.30	0.30	
Brake "	2.02	2.02	

The detailed analysis of a run from Dover to Northampton Streets is shown in Table III., based upon the above recorder test. In the test two cars were used, and the performance of the motors on each car noted, one current curve being shown in red and the other in black ink. One car was geared differently from the other, as stated in both tables. The running time was, of course, identical with each equipment. It will be seen that the recorder enables the most detailed comparisons to be made between the motors in the different cars of a train after the connections are properly made with the instruments.

The figures of Table III. are significant in respect to the lower consumption of energy with the gear ratio which gives the quicker acceleration, between Dover and Northampton Streets. This works out as 73.6 watt-hours per ton-mile, against 121.2 watt-hours with the slower acceleration. The motor curve was reached in twenty-two seconds, against thirty seconds in favor of the 50-E—31 equipment. The coupling of the two differently geared cars together in the same train gave a test in which the running time, speed, acceleration, coasting and braking factors were identical with each, leaving only the power consumption to vary, between the two equipments.

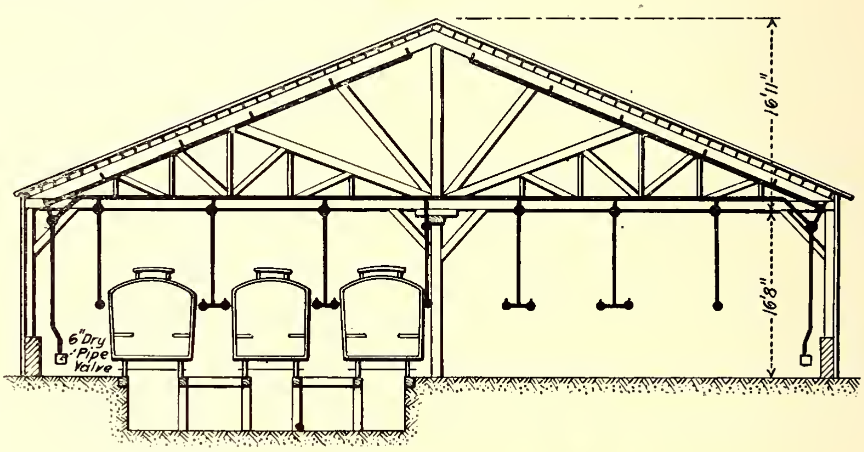
Fig. 14 shows a map and profile of the elevated division.

The importance of securing accurate information in regard to the behavior of the rolling stock and equipment is great upon any road, but it is especially so in the case of lines giving rapid transit in the congested districts of large cities. In the short runs which characterize elevated railway or subway service, the detailed analysis of acceleration, coasting, braking and energy consumption problems is well nigh absolutely necessary if a road is to be operated in a scientific manner. The interrelations of the complex factors which enter into a run with a modern high-powered train must be studied both singly and in toto if full control is to be had of the equipment's performance. In modern rapid transit, time is the vital point. Anything which will save time without undue additional expenditure of money is of momentous consequence. The seconds count in short runs as they cannot in long ones. Important as coasting is from the standpoint of energy consumption and motor heating, the acceleration and braking curves are the determining features of such runs as are found on elevated and subway routes in cities. The apparatus described in this article enables the slightest noticeable irregularity in train operation to be recorded for careful investigation; it furnishes a continuous story on the spot, of the manner in which different motormen operate the train; is adaptable to any car on the road, surface or elevated; enables both approximate and accurate information to be given to officials immediately, without recourse to long and tedious calculations; shows the economical and expensive sections of the line from the viewpoint of power consumption; indicates where it will pay to slacken up and where to increase the schedule speed; furnishes information as to the value of new appliances in multiple-unit control, air-brake systems, etc., and enables many physical quantities hitherto in doubt and more or less speculative to be determined by the engineering department of any company with sufficient accuracy for all commercial purposes.

The recorder described as in use in Boston can be used with equal facility on other electric railways, and in surface or interurban car work especially is it valuable in determining the characteristics of the track, acceleration and braking under adverse or favorable conditions of weather, the power required to operate heavy cars in snowy periods, etc. Used in connection with power-station load curves and feeder-system data, it provides information of the highest consequence in determining the actual losses between the station bus-bars and the wheels of the cars. Load curves may readily be predicted for any schedule from the characteristic runs made with the recorder, and the daily or monthly cost of operation closely estimated for both trains and the power-station equipment supplying them. In conjunction with data supplied by the manufacturers of car equipment, the copper and iron losses of the motors can be figured from the recorder diagrams at every point on the most tortuous alignment and variable profile. Thus, the data necessary for determining motor heating and capacity can be accurately obtained for any given transportation cycle. By a quick reference to a table of station distances, or the distance record on the diagram, and a moment's use of the slide rule, the engineer in charge of the test can determine for any official present the energy consumption actually being made by the train. Emergency stops can also be analyzed with despatch, and the effect of running past a danger signal fitted with an automatic stop can be studied on the spot. In short, the possibilities of investigation with the recorder appear limitless.

THE RECENT CAR-HOUSE FIRE TEST IN NEWARK, N. J.

The test conducted at Newark, Dec. 2, by the Underwriters' Electrical Bureau, of New York, to determine the practicability of protecting car houses by automatic sprinklers, has been previously mentioned in these columns, but further particulars are now available. The test was conducted at the Belleville Avenue car house of the Public Service Corporation, which generously placed this structure at the disposal of the underwriters, and also supplied a number of cars to be burned for the purpose of this test. The car house, a section of which is presented herewith, is a frame structure 80 ft. x 150 ft., with light wood, slate-covered roof, with heavy wood trusses spaced 16 ft. 8 ins. between centers, and with the lower chord of the trusses 16 ft. 8 ins. from the former. The peak of the roof is 33 ft. 7 ins. from the floor; the distance between tracks is extreme, being 6 ft. 1¾ ins. and 6 ft. 3¾ ins. With cars in position, the distance between car bodies on the first and second tracks is 41 ins., and between the second and third tracks is 44 ins. There are seven tracks in the car house, but for reasons of economy it was not considered advisable to sprinkle more than three of them.



SECTION OF CAR HOUSE, SHOWING ARRANGEMENT OF SPRINKLERS

The car house was fitted with the dry-pipe system of automatic sprinklers, with two different makes of sprinkler heads and two dry valves. Half of the sprinklers and one dry valve were furnished by the General Fire Extinguisher Company, of Providence, R. I., manufacturers of the Grinnell system, and the other half and the other dry valve by the Manufacturers' Automatic Sprinkler Company, of New York. There were altogether 192 sprinklers on the Grinnell dry valve and 193 on the Manufacturers' dry valve, making a total of 385. The sprinklers were upright and the two makes were alternated on all the lines.

In this connection it might be said that a "dry-pipe" system of sprinkler piping is one from which the water supply is held back by a "dry valve" located at some point in the supply pipe, as at the base of a riser. The sprinkler piping is filled with air under pressure. When a sprinkler opens it releases the air, which in turn releases the "dry valve." This allows the water to rush into the piping and discharge from the opened sprinkler. It can be seen that some time is taken by these operations, the interval being limited, however, by the rule that not over 200 heads shall be placed on one dry valve. The time is also dependent upon the releasing point of the particular type of dry valve and the air and water pressure which may chance to obtain at the time of the fire. Under average conditions, this period will vary from one to two minutes. The nearer the valve is located to the base of the riser, and the less the amount of piping under air pressure, the quicker will be the operation.

The sprinkler equipment of the Belleville Avenue car house was divided into two systems, with one 6-in. riser for each sys-

AMPERES
0
125
250
375
500
625
lbs per sq in
0
24
48
72

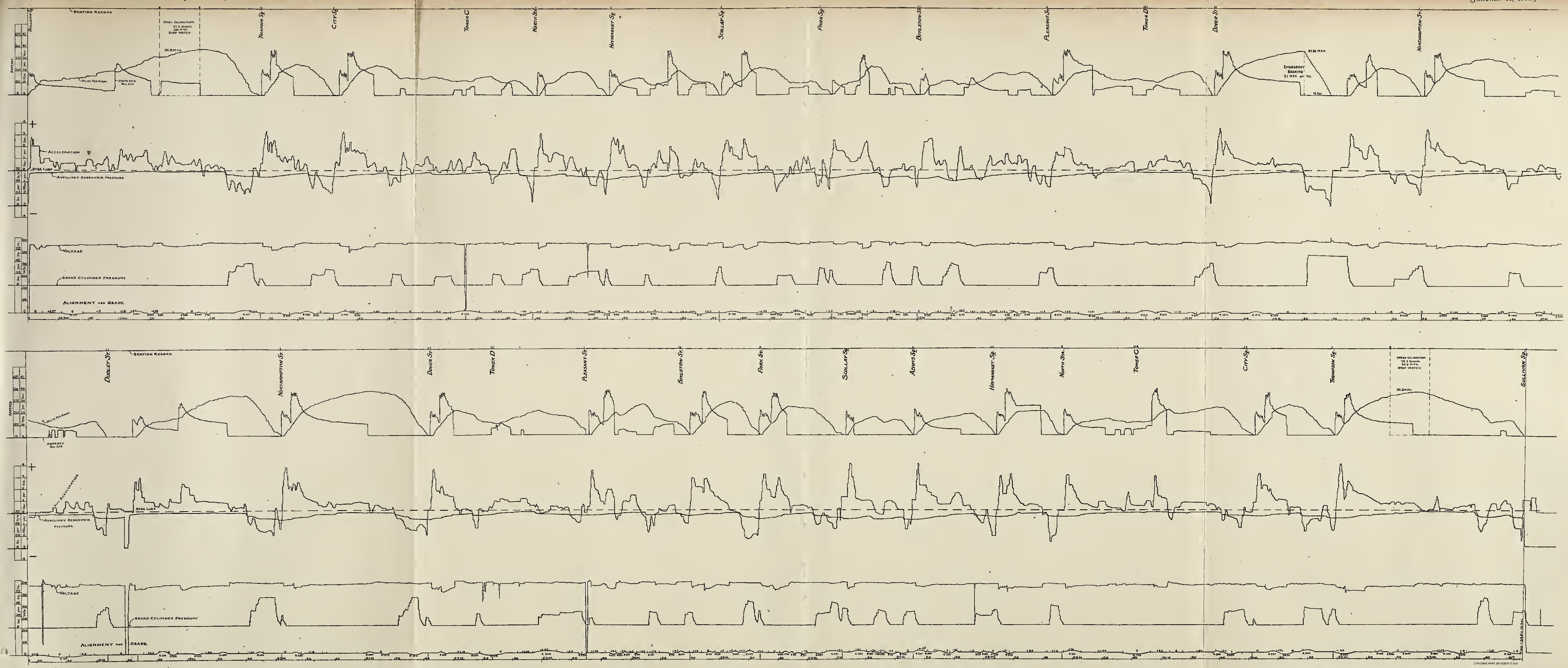
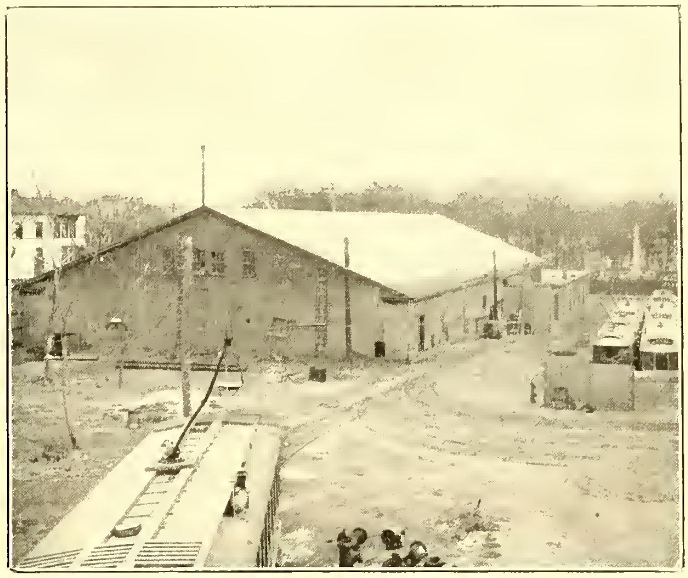


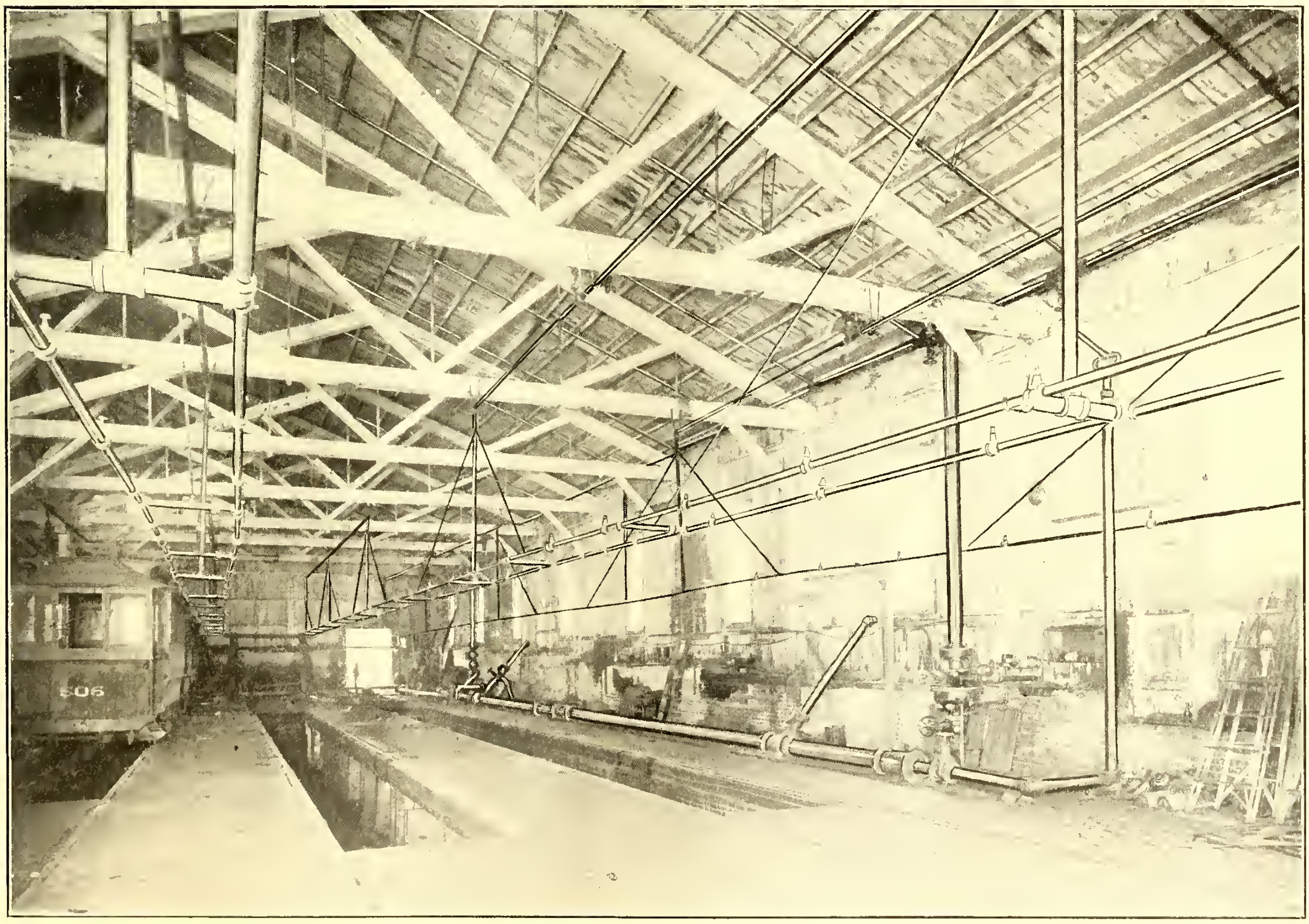
FIG. 13. DIAGRAM OF RUN FROM SULLIVAN SQ. TO DUDLEY ST. AND RETURN VIA SUBWAY, ON NOV. 13, 1904. 4 CAR TRAIN--ALL MOTOR CARS. WEIGHT PER CAR, 30 TONS. EQUIPMENT PER CAR, TWO G. E. 68 C MOTORS, 170 H. P. EACH. GEAR RATIO, 59:18=3.28. 33" DRIVING WHEELS. WESTINGHOUSE STANDARD AIR BRAKES.

tem, and both connected to a common 8-in. main. All the ceiling was sprinkled except the office, and the four aisles between the cars were protected with low-line heads, which, as shown in the section, were about even with the tops of the car windows. The highest line of ceiling sprinklers above the ground was 32 ft., and the pressure from the city supply was 20 lbs. to 30 lbs., but this pressure was capable of being increased from 40 lbs. to 64 lbs. by the fire pump to be described below. The ceiling sprinklers were spaced 7 ft. 11 ins. x 8 ft. to 9 ft. The low-line sprinklers were placed 5 ft. apart.

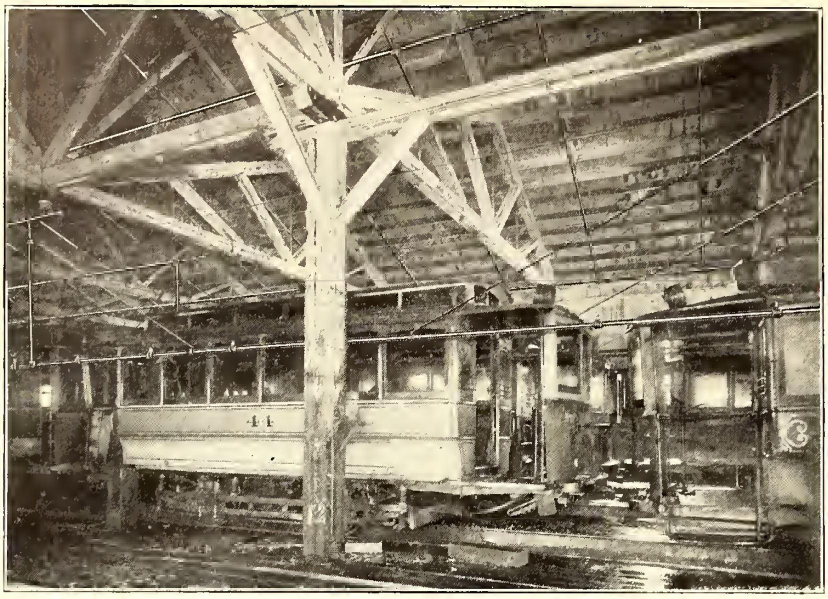
For mechanical reasons, the low line of piping was principally 1¼ ins. in diameter. There was a connection to the city main and, in addition, there was a 750-gal. Worthington two-stage centrifugal pump and a 500-gal. Gould rotary pump, each driven by a 50-hp railway motor. The air pressure for the dry-pipe system was supplied by a Christensen air-brake compressor, supplied by the National Electric Company. There were alarm connections on both dry valves, and the valves and piping were so installed that either system could be controlled independently of the other. The system was also provided with



BELLEVILLE AVENUE CAR HOUSE—FRONT AND REAR VIEWS



BELLEVILLE AVENUE CAR HOUSE—FRONT AND REAR VIEWS



CAR IN TEST NO. 3—BEFORE THE FIRE

and doors open, and with just enough paper and excelsior to start the car blazing. In this test the Worthington centrifugal pump was used, in which the water pressure was raised to from 75 lbs. to 80 lbs. The first sprinkler, which was one on the low line, opened just one minute and a half after the fire was started, and the fire was practically extinguished in two and a half minutes after the first sprinkler opened, or in four minutes after the fire was started. Eleven sprinklers opened.

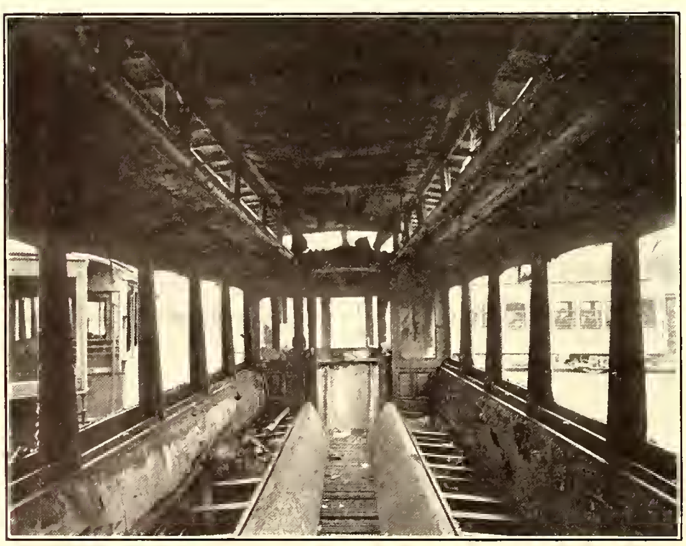
The third test, which was the most severe of all, was conducted on a car in the center of the last row. In previous tests, as stated, only enough paper and excelsior had been used to start the fire; in this test the entire interior of the car was saturated with kerosene oil. In addition, the windows were closed, while the doors were kept open. The automatic pump was connected to the water system as in the second test. In this case the first sprinkler opened in forty-five seconds after the fire was started, and the fire was practically out in four and a quarter minutes after the fire was started, ten sprinklers having opened. One no-

a Glazier nozzle attached to a standpipe 12 ft. above the ground, so arranged that it could be supplied with water from either or both pumps.

In the first test, a car in the center row in the front of the car house was fired, with all windows closed, doors open and just enough paper under the seats to start the car blazing. This was a severe test, because the fire naturally gained a great deal of headway before the glass in the windows broke and, hence, before the sprinklers could be operated by the heat. The car was set on fire at both ends, and the first sprinkler, which was one on the low line opposite the windows, opened four minutes after the fire was started. Altogether during the test, ten sprinklers opened and the fire was extinguished in eighteen minutes after the opening of the first sprinkler. Throughout the test the fire was confined to the car in which it originated. In this test the city water pressure, which was from 32 lbs. to 34 lbs., was used.

The second test was conducted with a car in the center row in the rear of the car house, and the car was set on fire, with the windows

CAR IN TEST NO. 3—DURING THE FIRE



CAR IN TEST NO. 3—AFTER THE FIRE

ticeable feature of this test was that, although it was the hottest of any, it proved to be the easiest to extinguish.

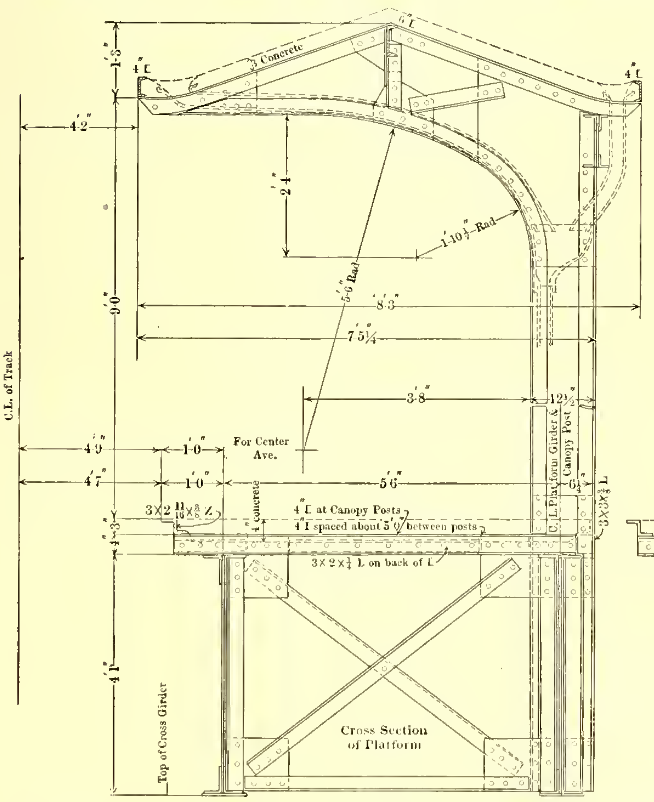
The three tests described were conducted for the fire underwriters under the direction of Bruce E. Loomis, chief of the Underwriters' Electrical Bureau, of New York. According to Mr. Loomis, a number of important points were demonstrated which amply justify the insurance companies going to the great expense and trouble to which they were put in conducting these tests. One of these was that a centrifugal or rotary pump, as used in these tests, is of considerable value, and that it is desirable to gear the motors so that the pump should run higher than its normal speed, in order to provide against fluctuations in voltage. The test also showed that two lines of the low sprinklers, where cars are far apart, are much more satisfactory than one line, although this is not a question of very great importance, because in most car houses the distance between tracks is considerably less than at the Belleville Avenue car house. The system of sprinkler pipes did not interfere with the operation of the car house, and trolleys can be turned easily. To guard against trouble in grounding from any accidental contact, an insulated joint was introduced into the sprinkler system by Mr. Loomis. A satisfactory insulated coupling of this kind can be made by the use of three boxwood discs, boiled in paraffine, coated with P. & B. compound, and held between the pipe flanges by bolts passing through insulating bushings. The fact that, although the adjoining tracks contained cars, the damage was confined entirely to the cars in which the fire was ignited, indicated absolutely to the underwriters that automatic sprinklers can be very successfully applied to car house properties.

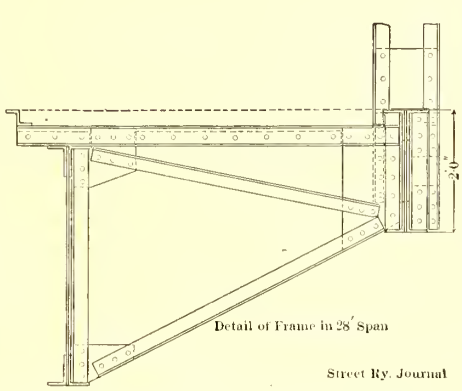
In view of the successful result of these tests, it is believed that the stock fire insurance companies are prepared to make material reductions in car house premiums where the railway companies are prepared to install approved sprinkler systems.

CONCRETE ELEVATED PLATFORMS AND CANOPIES IN CHICAGO

The Metropolitan West Side Elevated Railway Company has recently been replacing some of its wooden station platforms with concrete. The result has been a platform which is apparently much more durable and is certainly much neater in appearance than the wooden platforms. The wooden platforms on certain stations which had been down ten years were worn out.

The concrete construction is shown both by the accompanying photograph (which is of the Center Avenue station) and by the drawing. The concrete of the floor is 4 ins. thick with expanded metal reinforcement. The concrete is spread between a z bar at the outer edge of the platform and an angle bar at the inner edge. The real support of the concrete slabs consists of 4-in. I-beams placed about 5 ft. between centers.





CONSTRUCTION DETAILS OF STEEL WORK FOR REINFORCED CONCRETE PLATFORM AND ROOF

The concrete being 4 ins. thick, extends about 1 in. over the top of each I-beam, so as to give a firm hold on the I-beam. The concrete used was a mixture of one part Lehigh cement, three of sand and five of crushed limestone.

Besides the station floors, the roof and stairs are also of reinforced concrete. The concrete of the roof is 3 ins. thick, as shown by the drawing. On top of the concrete of the roof is a layer of asphalt cement on which was placed a layer of roof felt, which is covered with asphalt, after which the whole is entirely covered with gravel.

CONCRETE STATION PLATFORM AND ROOF, METROPOLITAN ELEVATED RAILWAY, CHICAGO

This work is under the charge of C. S. Menden, chief engineer of the Metropolitan West Side Elevated Railway Company.

PLANS FOR RE-INSULATING FEED WIRE AT ST. LOUIS

The United Railways Company, of St. Louis, at the close of the Exposition purchased of the Textile Machine Works, Reading, Pa., a machine for putting a waterproof braided insulation on feed wire. The braiding machine was one which was on exhibition at the World's Fair. The machine is capable of putting three braided coverings on a wire or cable. In ordinary practice, probably two coverings, one of jute and one of cotton, will be braided onto cables. The machine is being set up at Park and Vanderventer Avenues, in portion of a building devoted to the line department. After being run through the insulating machine, the wire or cable is to be passed through insulating compound, which will saturate the insulation. The company has considerable feed wire which has been up many years, and as the insulation is becoming frayed so that it looks badly, it is the intention to take this wire down and put a new braided covering on it. There is also a lot of lead-covered underground cable, the insulation of which was ruined in the big conduit burn-out last June, which was fully described in these columns. It has been found that the lead covering can be stripped off of these cables and a braided insulation put on top of the paper insulation of the cable so as to make very good overhead feed wire. The amount realized from the sale of the scrap lead in this case will be sufficient to pay for reinsulating the cable for overhead use.

Power from the Kern River plant, in California, is now being used to operate the Los Angeles, Pacific Electric and Redondo Railways, in Los Angeles, which is more than 125 miles from the source of generation. Power is transmitted into the city over two-pole lines of three wires each. The difference of potential is 65,000 volts. The plant was three years building.

"SPECIAL TRACK WORK" AT THE NEW ENGLAND STREET RAILWAY CLUB

A largely attended meeting of the New England Street Railway Club was held in Pierce Hall, Copley Square, Boston, on the evening of Dec. 29, President Neal being in the chair. A number of members of the New England Railway Club were also present. It was announced that the date of the annual banquet would be Jan. 26, 1905, the place selected being the Hotel Brunswick, Boston. The speaker of the evening was Victor Angerer, vice-president and general manager of Wm. Wharton, Jr., & Co., Inc., Philadelphia, his subject being "Special Track Work."

Mr. Angerer stated at the outset of his address, which was illustrated by a large number of admirable lantern slides, that, until the October meeting of the club, he had felt some doubt as to whether frogs and switches formed a sufficiently important part of the mechanism of street railways to enable a paper of general interest to be prepared upon the subject. His doubts were dispelled, however, by the papers of Messrs. Steward, Hodges and Curtin (abstracted in the STREET RAILWAY JOURNAL, Nov. 5).

The speaker then reviewed the history of rails and special work, which, he stated, should preferably be termed "special track work." As a result of the cable and early electric operation, five different types of special work were evolved, viz.: (1) Steel castings, made as closely as possible to join up to the rolled rails, somewhat improved in quality, but still softer than the rolled rail, and also more porous; (2) steel castings with pieces of the rolled rail electrically-welded to the ends of the first kind, and also to reduce the number of joints on a given lay-out; (3) chilled cast iron with rolled rails cast into the ends, with the joints, therefore, as good as in the rest of the track, but brittle; (4) rolled rails, planed and fitted similarly to the built-up work; (5) a combination of cast-iron and rolled rails, with the cast iron in parts exposed to wear. Some of these types are still in use in places where the traffic is so light that it does not pay to put down a more expensive kind of work. All have the common point of weakness in that the parts which receive the greatest wear, where the same surface has to bear the traffic of more than one line, or where a narrower surface than the width ot the wheel tread has to support the weight of the car, naturally wear down much faster than the rest of the work, and when the wear at these parts becomes objectionable, the entire piece has to be renewed. This weakness is inherent in all frogs, especially steam railroad frogs built up of ordinary rails, but it is immensely accentuated on street railways with the narrow wheel treads which are necessarily used. The width of the wheel tread cannot be wider than the width of the head of the rails, without danger of striking projecting paving stones on the outside of the rails, and again, the width of the rail head is in many cities restricted by ordinances, mostly dating back to the old horse-car times. This width of wheel tread is in most cases insufficient to span the groove of an intersecting track at the point of the frog, or of the main track in branching off at the point of the mate. It has therefore become almost necessary in street railway work to provide at intersecting grooves a riser or flange bearing—i. e., the groove is filled up at its bottom so that the flange of the wheel will run on this filler and the wheel run on its flange where it theoretically loses its tread bearing. In castings, the metal of the casting is carried up; in built-up work separate pieces of metal are inserted, or the work constructed from specially rolled rails with shallow grooves. The surface of a wheel flange presents a cutting edge rather than a bearing surface, hence these risers are soon cut down, and then the wheels begin to pound and quickly destroy the parts where they have this insufficient bearing or where they have to jump across the space of the intersecting grooves. The effort to protect these parts led to the adoption of what is called "hard center work," and from that time dates the battle royal between the special track work on the one side, and the wheels, increasing weight of cars and frequency of traffic on the other side, almost like the conflict between the armor plate and the gun in somewhat less peaceful pursuits.

Various metals have been tried, including Harveyized steel, manganese, chrome and tungsten steel, as well as various methods of holding the metal in the frog. The results of hard-steel center work can be pronounced satisfactory in general, and probably no street railway would consider the use of anything else in important and complicated layouts. Some steam railroads have also adopted hard center work for their tracks in streets and for sidings. The renewal of the centers has not always been an entire success. If both lines crossing the center are about equally worn, a good job can be made by the renewal, but when one line is worn much more than the other only one line can be made fairly good by the renewal, as the difference in wear can in no practical way be compensated for in the new center.

The idea of having the center remain serviceable as long as the surrounding parts, has been practically accomplished by the manganese steel center, except in cases where defects have developed. One curious result, however, appeared through the fact that it is impossible to construct the centers in exact proportion to the wear at each point of the surface. The parts of the center which carry the wheel on the full tread do not wear down as fast as either the point of the parts of ordinary steel beyond the center, so that after some service these places appear as hills in the track and make the cars ride a little roughly, apparently calling for a renewal of the center, although the center is not by any means worn out. A better way to remedy this trouble is to grind these high places off from time to time to re-establish the surface of the track.

The joints have given little trouble in special track work, due to the greater stability of the curves over straight rails and the great stability of the heavy special pieces. The ever increasing weight of the pieces, however, is a source of trouble to the trackman, and modern appliances, such as cranes, are now introduced to facilitate handling. The bugbear of special work is the compromise joint at the end of a layout where it joins up to the various sections of rail used in the straight track. No matter how carefully a compromise joint is fitted in the shop to pieces of rail available, the rail in the ground is likely to vary from these, producing an inferior joint. This difficulty has largely been overcome by the use of compromise rails—i. e., short pieces of the sections to be joined, connected by some welding process.

To-day the weakest part of special work is the pivot part and heel of the switch tongue. The tongue itself, made of hard forged steel or manganese steel, with a hard metal bed, wears well enough, but the pivots and supports at the heel end have to a great extent proved insufficient to withstand heavy service. A number of devices are now on trial, but it remains to be seen which best meets the case. Where the curve is comparatively little used, an unbroken main line switch can often be installed to advantage, obviating the great wear at the heel from the main line traffic.

Later improvements in special track work have mostly consisted in the strengthening of it to meet the ever increasing weight of cars and in the finer working out of the details. The lines of special work layouts, to insure the smooth running of cars on curves, have been greatly improved by the introduction of easements or spirals on the ends of curves, although this has to a large extent been overdone. Mr. Angerer here submitted an illustration of one of the simplest spirals, designed for curves of less than 62-ft. 6-in. central radius. It had changes of curvature every 3 ft. 6 ins. By simply dropping out the first few radii, a 100-ft. radius switch can be set into this spiral without disturbing the alignment of the balance. Spirals for curves of larger radii are derived from this base by multiplying the base functions by 1½, 2 and 3, respectively, and these four spirals cover the entire field up to curves of 500-ft. radius. There are several systems of spirals in use, prescribing ten or more different spirals to cover this range. Each manufacturer and many of the large street railways have systems of their own, requiring different calculations for each one in applying them to different layouts, while practically, when laid down alongside of each other, the lines of all these different spirals for a given curve vary less than ¼ in. at any one point. Some uniform standard in street railway spirals is badly needed.

It is impossible to state how long a piece of special work should last. It depends on the amount and condition of traffic, weight of cars and passengers, speed, weather conditions, tendency of the wheels to slide or turn at some points, and no uniform basis can be established. Mr. Angerer said that he had tried by careful measurements of impressions taken of track in the street, to average the wear of manganese steel centers per car, but he had to give it up. The results varied from .0012 in. to .0020 in. of vertical wear per 10,000 cars. Mr. Hadfield, of England, the originator of manganese steel, in working similar tests, observed a vertical wear of from .0008 in. to .0032 in. per 10,000 cars at different points of one layout. Variations of 100 per cent to 200 per cent admit of no conclusions. It is also difficult to state just when a piece of special work is worn out. (The speaker here showed a slide of a center which had carried 2,570,000 cars without showing very much wear.)

The next step in the future development of special track work for city streets is uncertain. Whether it will be made throughout or at least the entire surface of manganese steel seems doubtful. The points of greatest wear would then last no longer than they do now. For general use it would seem that the period of the hard center work is liable to be extended for many years to come.

When the street railways branched out into the country, where they were not restricted by the regulations of a city or bothered by the city pavement, the use of T-rails and the general practice of steam railroads naturally followed. Split switches are now commonly used on such track, as are spring rail frogs, which are the best kind to take care of traffic of different kinds of cars with large and small wheel flanges on the same track. Where team traffic on the country highways is liable to encroach upon the track, tongue switches, built up of T-rails and fixed frogs, have to be used.

Manganese steel rails have been used in the Boston Subway and on street and steam railroad tracks for curves in steam railroad frogs, and a test is now going on with split switches having manganese steel points to the rails.

The making of the working plan for each special track work layout involves intricate calculations and a careful consideration of all conditions. As it finally passes into the hands of the track layer it must contain data for properly locating the work in the street, as well as for fitting of the work in the shop. Each detail should be designed to suit the rolling stock in use at the particular place, and therein lies one of the greatest difficulties of the special work manufacturer. There seems to be no limit to the different sizes of wheels, wheel flanges and wheel bases of cars in use, and yet each of these factors, combined with the radii of the curves, calls for a different groove. The truck of a car on a curve stands on a chord to the circular line, and the wheels take a skewed position relative to the running line of the rails. This calls for a wider groove than would be required to pass the flanges of the wheels on straight track. Just how much wider for a given flange, radius, diameter of wheel and wheel base can easily be determined by the graphical development of the flange on the angle of the skew. A table worked out on this basis of the width of grooves called for by the combination of the more representative wheel flanges in use, and the prevalent wheel bases, together with the radii of curves—the wheel diameter being omitted, as a negligible factor—shows the great variety of the width of grooves necessary. Of late, the tendency of wheel makers has been to increase the thickness of the wheel flanges of a given depth, which has proved very troublesome in the making of special work. A piece of special work can only be made to suit one of these combinations, and other cars with different wheel bases and particularly different flanges run over the work will shorten the life of the work from what it would be if only one kind of cars and wheels wheel were used on it. It is the same case as a machine which wears too rapidly when the parts fit too closely.

THE QUESTION BOX

At the suggestion of a number of subscribers, the Street Railway Journal has decided to institute a question box on topics connected with street railway construction and operation. The popularity of this form of collecting and publishing information was demonstrated at the Utica convention of the New York State Street Railway Association, and at recent meetings of the Accountants and Master Mechanics' Associations. Other bodies which have successfully employed the question box are the Pennsylvania Street Railway Association and the National Electric Light Association. There are many reasons, however, why such a series of questions and answers can be published with more desirable results in a weekly periodical than at an annual meeting. One obvious advantage is that the answers printed to one question often call for a reply, which can be published in a succeeding issue of a weekly periodical. Again, a reply on one topic often suggests another worthy of discussion, and which can be presented for consideration in the following issue.

It is proposed to start the question box by printing in this and the next weeks' issues of this paper a series of questions which has been prepared to cover certain of the main divisions of street railway operation. Copies of these questions have also been mailed to a number of companies. Replies are requested, however, from any or all of the readers of this paper who have opinions to offer. The name of the contributor will be withheld from publication in any case where a request to this effect is made.

The questions have been divided into nine sections, entitled, respectively, A, general; B, employees; C, parks and pleasure resorts; D, the express and freight question; E, the master mechanic's department—cars and car parts; F, steam engineering; G, the engine room; H, the line department; I, the track department. While the questions in the aggregate may appear somewhat formidable, it has been considered desirable to commence with a fairly large number, so that those interested in any one section may omit the others from consideration. In replying, it is not necessary to repeat the questions, the key numbers are sufficient. Answers are requested in detail and with reasons, as "yes" and "no" are of slight value. Progress is made by each person giving to the other the benefit of his experience, and the co-operation of all is requested in this general exchange of information.

A. GENERAL.

A 1.—What various methods do you employ for advertising your road and its attractions?

A 2.—How much money do you spend annually for advertising?

A 3.—How much money can be spent profitably by an electric railway company for advertising?

A 4.—What are some of the ways by which an electric railway company can kindle and foster a more kindly feeling and a fairer treatment on the part of the public press of its community?

A 5.—What are some of the ways by which an electric railway company can kindle and foster a more kindly feeling toward it on the part of the public?

A 6.—Several electric railway companies are publishing regular leaflets or periodicals for public distribution, with the idea of bringing about a better relation between the company and the public. What do you think of this suggestion?

A 7.—Have you ever tried the suggestion of publishing such a periodical? What were the results?

A 8.—A company wishes to carry its own fire insurance, by setting aside a certain percentage of its gross receipts each year to cover fire losses. What would be a safe percentage to allow?

A 9.—Under what conditions can an electric railway company venture to carry its own fire insurance on its various properties?

A 10.—What percentage of your gross receipts are you paying out through the claim department?

A 11.—A company wishes to set aside a certain fund each year to cover all accident claims. Should this fund be based on a definite sum per car mile, or on a percentage of the total gross receipts? What would be a proper allowance?

A 12.—What is a proper basis on which to compute accident liability insurance?

A 13.—In the electric railway business, is an accident liability insurance company—mutual or otherwise—feasible? Why?

A 14.—Do you carry United States mail over your road? If so, please describe how you do it.

A 15.—Relative to carrying United States mail and mail carriers, what are the salient points of the contract between your company and the Government?

A 16.—What would be a proper basis on which to formulate contract with the Government for carrying United States mail on electric railways?

A 17.—At one time the use of trail cars was quite general on electric railways throughout the country. Then came a period when the running of trailers was looked upon with more or less disfavor. There seems to be a decided tendency at the present time to go back to trailers. Please give your ideas and experience relative to trailers. Under what conditions do trail cars properly find a place in the operation of a modern electric railway? Do trail cars cause a greater number of accidents? If they do, what can be done to make them safer? What is the economy in running trailers?

A 18.—Give suggestions based upon your experience for handling the extra traffic during the rush hours, and on special occasions, as ball games, fairs, etc.

A 19.—Has the running of so-called "sightseeing cars" been a popular and profitable experiment?

A 20.—When "sightseeing cars" are operated over an electric railway system by outside parties, what is the usual compensation paid by the "sightseeing" company to the railway for the use of the tracks?

A 21.—Is there any reason why an electric railway company should not operate its own "sightseeing cars"?

A 22.—Has the running of funeral cars been a popular and profitable experiment?

A 23.—What is the best form of funeral car? (Please give description with photographs and drawings.)

A 24.—The editor will appreciate receiving extracts from your franchises, setting forth what you consider particularly noteworthy features and provisions.

A 25.—What are the salient points that go to make up an "ideal electric railway franchise"; one that would be absolutely fair to the public as well as to the company?

A 26.—Is it not true that if the capital invested in electric railways should be exempted from all special taxation, the public would be benefited through increased electric railway facilities?

A 27.—It is commonly held that electric railway companies should make some return to the local municipality in exchange for the right to use the streets. What is the fairest basis upon which this compensation can be accomplished?

A 28.—Is a franchise tax a fair and just method of taxing electric railways? Give the reason for your opinion.

A 29.—What, in concise form, are the best arguments that can be brought to bear in favor of private ownership of electric railways when a community is being agitated with the municipal ownership theory?

A 30.—Is it true that a properly regulated monopoly of street railway interests in any community is conducive to the best service of the public? Please give your reasons for your answer.

A 31.—On a high-speed interurban electric railway, what precautions should be taken to protect crossings where the line cuts a public highway? Please describe the precautions you take at such points.

A 32.—Where an electric railway crosses a steam road, what is the usual arrangement between the electric road and the steam road for the maintaining of a flagman at such points?

A 33.—When grade crossings are to be abolished or avoided, what portion of the expense should be borne respectively by the electric railway company, the steam railroad and the municipal authorities?

A 34.—What have you done toward abolishing grade crossings on your system?

A 35.—What precautions do you take to avoid accident to persons getting on or off at points where it is necessary for conductors to go ahead to flag over crossings or other dangerous points?

A 36.—In making up a schedule of fares for an interurban road, is it better to base rates on mileage or with reference to municipal boundaries? What is your practice?

A 37.—What is the best method of collecting and checking fares on interurban roads?

A 38.—What are the underlying principles upon which a traffic agreement between a city road and an interurban road for joint use of city tracks should be made?

A 39.—Where an interurban company seeks the right to run cars over a city company's tracks, what compensation should be paid by the interurban company for this privilege, and what should be the basis upon which the compensation should be determined?

A 40.—When an interurban company uses city tracks jointly with a city company, what is the best agreement as to the handling of crews; as to the responsibility in case of accident; as to collection of fares within city limits; as to the various mechanical questions involved, including weight and type of cars, dimensions of wheels, power, etc.?

A 41.—What is the best method of keeping records of deeds to real estate, rights-of-way, etc.?

A 42.—Information is requested as to the best ways of handling the snow-removing problem. Please state in detail your snow-fighting methods. Please give all the steps taken from the time the first flurry of snow appears until the battle has been won and schedules restored.

A 43.—What is the most effective form of snow-plow?

A 44.—Do you use snow fences? Are they effective? What form of fence do you use? (Please give description with photographs or drawings.) Give particulars as to how and where fences are placed. What do you do with the fences in summer? How much do the fences cost to build?

A 45.—What arrangements does your company make with the municipalities for removing snow?

B. EMPLOYEES

B 1.—What are the requirements demanded of applicants for conductors and motormen on your road? The editor will appreciate receiving copies of all the blanks used in your employment department.

B 2.—How are the men employed on your road? Do you have an employment bureau, or are applicants examined and hired by the manager or superintendent? Under what conditions does it become advisable to establish a separate employment department?

B 3.—For conductors and motormen do you prefer married or single men and country bred or city men? Please give your reasons for your answer.

B 4.—Do you employ men who have had previous experience on other electric roads? Why?

B 5.—What process do you go through after an application has been filed in determining whether the applicant has told the truth?

B 6.—Do you consider it a good idea to make applicants swear to the statements in their application blanks? Why?

B 7.—Do you bond motormen? What is the process?

B 8.—Do you bond conductors? What is the process?

B 9.—What physical examination do you require of applicants?

B 10.—What is the method of testing for eye-sight and hearing?

B 11.—What methods do you employ for training new motormen and conductors as to their duties?

B 12.—If you have a regular school, please give full description of the apparatus used and the methods of teaching.

B 13.—Do you require accepted applicants to pass an oral or written examination before they are put to work? If so, please send list of questions asked.

B 14.—Please send copies of any special rules for the government of conductors and motormen which you think particularly desirable.

B 15.—What is your process for paying off motormen and conductors?

B 16.—Has the method of letting conductors and motormen take their day's wages from each day's receipts proven satisfactory?

B 17.—Have you any system of special rewards or prizes to conductors and motormen for meritorious service? Please give complete details of the system and the results secured.

B 18.—What is the best method of reprimanding and punishing employees?

B 19.—What do you think of requiring motormen to pay for damages caused by their carelessness?

B 20.—Do you require conductors to make good shortage in their accounts and do you pay back to them any overages?

B 21.—What are you doing to better the condition of electric railway employees and create among them a spirit of greater loyalty to the company's interest?

B 22.—Do you have a benefit association for the men? How is this association handled and what advantages does it offer? The editor will appreciate receiving copies of the constitution, by-laws and reports of association of this kind.

B 23.—What are the advantages in providing club rooms for the use of employees? What is your practice in this regard?

B 24.—What do you think of organizing employees' bands, ball clubs, bowling clubs, etc.? What is your practice in this regard, and what advantages have been gained?

B 25.—How do you handle your extra list?

C. PARKS AND PLEASURE RESORTS

C 1.—Give suggestions, based on your experience, as to the best method of handling park travel.

C 2.—Give some suggestions on how to make a pleasure park pay.

C 3.—Is it better for the railway company to operate a park and its attractions or to induce outsiders to operate them on a percentage basis?

C 4.—On what basis do you determine the percentage to be paid for lease of attraction privileges at your park?

C 5.—What are some of the methods of maintaining interest of the public in a pleasure park?

C 6.—What are the relative merits as drawing attractions of vaudeville and light opera?

C 7.—What is the best form of theater for ordinary electric railway park? Please discuss seating arrangements, methods of supporting roof, acoustic properties, arrangement of stage, etc.

C 8.—Please send rough sketch with description of general layout of your park theater.

C 9.—What do you think of the "new idea" in pleasure parks, i. e., having an enclosed area on the idea of "Dreamland" at Coney Island, where a small fee is charged for admission to the enclosure and where the attractions consist of a limited number of free shows, and a number of side shows or attractions to which additional admittance fee is charged?

C 10.—A company is thinking of establishing a pleasure park. Please give suggestions, ideas and pointers as to what should be done, and what should not be done.

C 11.—What is the best form of car terminal at a park, with reference to preventing congestion of cars and crowds? Please discuss the theorctical and practical questions involved.

C 12.—Please send rough sketch of the car terminal at your park.

C 13.—Based on the results of the past three seasons, has your park or attraction resort proved a profitable investment? Please give itemized statement of receipts and expenses in this connection

D. THE EXPRESS AND FREIGHT QUESTION

D 1.—What general advice and suggestions would you give to the manager of an interurban road who is thinking of starting an express and freight business—particularly on the subject of rates and classification?

D 2.—To what extent does an express or freight business assist the development of the passenger business?

D 3.—As far as the electric railway business is concerned, what is the difference between "express" and "freight" matter?—in other words, define each term. How do you classify various material?

D 4.—Do you recommend the adoption of regular official classification class rates, or special rates to meet circumstances?

D 5.—Is it advisable for an electric railway to compete with a steam railroad in carrying freight at or below the rate made by the steam road?

D 6.—Is it advisable to compete with a regular express company in carrying express matter at or below the rate made by such express company?

D 7.—Do the steam railroads and regular express companies interchange traffic with you? If not, why not? What can be done to bring about interchange relations between electric railway companies and steam railroads and old line express companies.

D 8.—An interurban electric railway wishes to make an agreement with a city road for the joint handling and exchange of express and freight matter. What is a fair basis upon which to form such an agreement? What arc the essential features of your agreement covering this matter?

D 9.—Does it pay to handle express matter by electric cars? Does it pay to handle freight by electric cars?

D 10.—As a broad proposition, can express or freight matter be hauled as cheaply per ton mile by electricity as by steam?

D 11.—What does it cost per ton mile to haul express or freight matter by electricity—including all items of expense properly chargeable to this department.?

D 12.—Will you please give the following information concerning your express business:

Gross receipts,
Operating expenses,
Cost of power,
Interest on investment,
Total expenses,
Net income,
Total tonnage,
Average rate per 100 lbs.,
Gross earnings per express car mile per day,
Dollars received per car hour?

In connection with above statistics, please give statement as to general character of express or freight business transacted.

D 13.—What has been your experience with handling heavy commodities or rough carload freight, such as ice, coal, wood, stone, etc.?

D 14.—What has been your experience with handling milk on electric cars? Please give details.

D 15.—Under what conditions can an electric road do a profitable business in hauling milk?

D 16.—What has been your experience with handling light packages? Please give details.

D 17.—What has been your experience with carrying baggage? What rates do you charge, and how is the baggage carried?

D 18.—Under what circumstances is it advisable to give wagon collections and deliveries?

D 19.—What methods do you employ for soliciting express and freight business?

D 20.—What arrangements do you make for local agents at different points on your line?

D 21.—Do you handle shipments destined to points at which you have no agents? If so, how?

D 22.—Is it better to pay local agents commission or salary?

D 23.—How often and how should local agents remit express receipt?

D 24.—Do you not find it advisable to make the accounting reports as simple as possible, combining as many as possible in one form? How do you accomplish this? The editor will appreciate receiving copies of blanks devised to simplify and concentrate express accounts and reports. Please add comments and explanations.

D 25.—How often should abstract reports be made of express matter received and forwarded?

D 26.—Who should audit the express accounts?

D 27.—What is the best form of shipper's receipt. The editor will appreciate receiving two copies of the receipt you use, with any comment or explanations you may care to make.

D 28.—What is the best form of way bill to use?

D 29.—How do you handle your unclaimed express or freight?

D 30.—What per cent of your gross receipts from express and freight do you pay out in settlement of loss and damage claims?

D 31.—What have you done to reduce amount of lost and damaged shipments?

D 32.—Is it advisable to handle express matter on combination passenger and express cars? Why?

D 33.—What is the best form of combination car for handling passengers and express matter? Please give description with photograph or sketch.

D 34.—Do you have your own warehouse at each station, or make other arrangements?

D 35.—Please give suggestions as to best arrangement for terminals in which to handle express and freight.

E. THE MASTER MECHANIC'S DEPARTMENT—CARS AND CAR PARTS

E 1.—What do you consider the essential features of a satisfactory set of car specifications?

E 2.—What can be done in the direction of adopting a standard form for car specifications?

E 3.—What is the best type of car for cities of less than 50,000 population? Why?

E 4.—What is the best type of car for cities with population between 50,000 and 250,000? Why?

E 5.—What is the best type of car for cities with population over 250,000? Why?

E 6.—What is the best type of car for a combined city and suburban service?

E 7.—What is the best type of car for moderately high-speed suburban service (suburban service as distinguished from interurban service)?

E 8.—What is the best type of car for high-speed interurban service?

E 9.—Under foregoing questions relating to best type of car, please discuss seating arrangements; length and form of platform; general dimensions; design and construction.

E 10.—What is the longest car that can be carried safely and economically on a single truck?

E 11.—What can the master mechanic of the average surface road do to render his cars more nearly fireproof?

E 12.—Have you had trouble from fires on cars attributable to the lighting or heating circuits? What have you done to eliminate these troubles?

E 13.—Have you had trouble from fires on cars attributable to the motor or controller circuits? What have you done to eliminate these troubles?

E 14.—What is the best form of flooring for the inside of cars?

E 15.—Have you had any trouble with car floor rotting out prematurely? If so, to what do you ascribe the cause and how can the trouble be remedied?

E 16.—What is the best form of handle for trap-door lifts in cars?

E 17.—What is the most satisfactory covering for car seats? Why? Please give relative costs.

E 18.—What are the arguments for an against heating cars by (a) electricity; (b) hot water; (c) stoves?

E 19.—What do you find is the cost of heating cars by electricity on your road?

E 20.—What has been your experience in the use of car fenders?

E 21.—Do you consider a projecting fender better than a wheel guard, and if so, why?

E 22.—If a projecting fender is used, how far should it project in front of dashboard, and how near the rail can it be safely carried at a fixed point?

E 23.—Can a projecting fender be used equally well on both a single and double-truck car?

E 24.—Without mentioning trade names, what form of projecting fender do you consider the least expensive to keep in repair, and at the same time do effective work in saving life?

E 25.—In the use of a projecting fender, do you consider it desirable to have the fender so arranged that it can be dropped to the track, and if so, do you favor an automatic drop, or one worked by the motorman?

E 26.—Is it practical to use the same kind of fender on city and interurban cars?

E 27.—In the use of fenders on suburban and interurban cars, does not the high speed of the car prohibit the use of a projecting "pick-up" fender? Do you consider the "pilot" better on this kind of car?

E 28.—With a car running at a high rate of speed, say, 40 or 50 miles per hour, has the use of a projecting fender been found practicable, and if so, on what roads?

E 29.—Does the oscillation of a single-truck car interfere with the use of a projecting fender?

E 30.—What have you to say on the question of first cost of car fenders? To what extent should the first cost be considered if the fender will do effective work?

E 31.—In your experience, have you found it less expensive to keep a cheap fender in repair than the more expensive ones?

E 32.—What are the relative advantage and disadvantages of two-motor and four-motor equipments?

E 33.—Is there any advantage of four motors over the same motor capacity combined in two motors?

E 34.—What are the relative advantages and disadvantages of outside and inside hung motors? Which method do you prefer?

E 35.—What is the best and most convenient method of connecting motor leads to the motor, especially on short city cars? (This question is suggested with the hope of bringing out some way of reducing the time necessary to disconnect motors when cars come into the shop.

E 36.—For armature bearings, which form of lining do you prefer, babbitt or brass? Please give your experience with either,

E 37.—What has been your experience with casting babbitt bearings in your own shops? Do you consider it profitable to do so? Please give statement of costs in this connection.

E 38.—What formula for babbitt metal do you consider satisfactory?

E 39.—What devices do you use for rebabbitting journals? Please give descriptions with photographs or drawings. (Rough sketches will do.)

E 40.—Do you consider it necessary to bore babbitt bearings after pouring? Why?

E 41.—Please describe your method for boring babbitt bearings.

E 42.—After the armature shaft has become worn, how do you insure good fit at the bearings?

E 43.—What is the best length for armature bearings?

E 44.—What is the best length for axle bearings?

E 45.—A road is having trouble with motors becoming hot on hills. What can be done to keep motors cool under these conditions?

E 46.—State experience with use of oil instead of grease for motor lubrication.

E 47.—Give description, with sketch of journal box, suitable for using oil for motor lubrication.

E 48.—How can the ordinary journal box designed for use with grease be changed to use with oil as a lubricant?

E 49.—In lubricating armature bearings, is there any advantage in using both grease and oil at the same time, feeding oil with a wick from below, and grease from cups above the bearings?

E 50.—Are you in favor of split or solid gears? Please give your experience with either. What are the relative advantages and disadvantages of each?

E 51.—If split gears are used, what do you do to prevent bolts and nuts from becoming loose?

E 52.—What can be done to prevent the gear case dropping into the street when the bolt breaks?

E 53.—Are you in favor of having the gear case cast as a part of the lower half of the motor frame? Why?

E 54.—Have you had any experience with wooden gear cases? If so, please describe the form of case used and the results secured.

E 55.—The question of cast-iron versus steel-tired wheels is receiving considerable attention. Please give us your contribution on this subject.

E 56.—What is the best method of re-tiring steel wheels?

E 57.—A road has had trouble with wheels becoming loose on axles. What is the probable cause and what the remedy?

E 58.—When pressing wheels on axles, what difference do you allow between diameter of axle and wheel bore?

E 59.—At what pressure should wheels be forced on axles?

E 60.—What play do you allow between gage of wheels and gage of track? State your experience along this line.

E 61.—What is the chief cause of flat wheels?

E 62.—What can be done to prevent flat wheels?

E 63.—Give details as to how you treat flat wheels. In regrinding flat wheels, what precautions should be observed?

E 64.—Is a 36-in. wheel desirable? If so, why? If not, why not?

E 65.—Have you given any special study to the question of brake rigging? Please give the results of your observations along this line.

E 66.—What can be done to prevent the brake rigging from knocking off motor lids?

E 67.—What composition do you use for trolley wheels, and why?

E 68.—What is the best size and shape of trolley wheel for high speeds?

E 69.—What is the best size and shape of trolley wheels for city service?

E 70.—A road has had trouble with trolley rope leaking current when very wet. How can this be remedied?

E 71.—What pressure do you maintain on the springs in trolley bases?

E 72.—How often do you thoroughly wash your cars?

E 73.—What kind of soap or cleansing compound do you use for cleaning cars?

E 74.—What has been your experience with cleaning cars with oil?

E 75.—What is the best kind and grade of oil to use for car cleaning?

E 76.—Many of the steam roads dry-wipe their cars without the use of any water. Do you think this method is applicable to electric cars?

E 77.—How many cars can one man thoroughly wash in a day? (State size of cars in answer.)

E 78.—Has any electric road employed women for cleaning cars? What were the results?

E 79.—Should the matter of cleaning and washing cars come under the transportation department or the master mechanic's department? What are the advantages and disadvantages of either system?

E 80.—Please describe a good arrangement of stand and room for washing cars.

E 81.—What is your method of washing car window glass?

E 82.—What can be done to prevent car windows from sticking or binding at the sides?

E 83.—Do you know of an improved form of table or rest for expediting the work of varnishing window sash? If so, please give description, with photograph or drawings. (Rough sketch will do.)

E 84.—Please give description with photograph or sketch of good form of rack for holding freshly varnished window sashes.

E 85.—What are good ways of heating the paint room?

E 86.—What can be done to prevent trouble from dust in the paint room?

E 87.—What is a good form of scaffolding for use when painting cars?

E 88.—What do you find to be the cost of painting cars? (This question has been made broad purposely. The idea is to start a comprehensive discussion on the subject of "cost of car painting." Itemized statements of labor, material and costs of car painting are particularly requested.)

E 89.—What are the relative advantages and disadvantages as regards cost, durability, etc., of the two general systems of painting cars, i. e., that known as the "knifing" process, using a foundation coat of pure lead and linseed oil, rubbed in with a putty-knife; and that known as the "rough-stuff" method?

E 90.—What can be done to reduce the cost of painting and varnishing cars without sacrificing durability?

E 91.—Please describe in detail your method of painting cars from start to finish.

E 92.—Do you favor the use of rubbing varnish on the exterior of cars? Why?

E 93.—Have you ever tried mixing varnish in body colors in order to make the body coats more elastic? What were the results secured?

E 94.—What is the best way to remove old varnish?

E 95.—What has been your experience with the use of ammonia for removing old varnish? What solution do you use?

E 96.—Do you know of any good varnish renovator?

E 97.—How do you "burn off" a car that needs repainting? Please describe the apparatus used. (Photograph or sketch will be very acceptable.)

E 98.—What have you done in the direction of eliminating beading, superfluous decoration and fancy work from your cars?

E 99.—What is the best method of treating car roofs to secure tight roofs?

E 100.—The suggestion is made that the regular daily inspection of cars should be made at the terminals of the lines, between regular trips. Is this feasible, and what are the advantages to be gained?

E 101.—Please describe in detail your system for inspecting cars.

E 102.—What is your system for inspecting trolley bases, poles, harps and wheels?

E 103.—Please state in detail the extent and exact nature of the nightly inspection of cars as practiced on your road.

E 104.—Please describe in detail your system for keeping records of cars, by which it is known when any given car should be sent to the shop for general inspection and overhauling.

E 105.—Should general inspection and general overhauling of cars be done on a mileage basis, say, after 20,000 miles, or on a time basis? What are the advantages and disadvantages of each system?

E 106.—If cars are overhauled on a time basis, what is the proper time limit; if on mileage, what is the proper mileage basis?

E 107.—If a car is sent out of the shop in good, all-round condition, what part of the equipment—accidents barred—will first require the return of the car to the shop?

E 108.—When a car is sent to the shop for some particular trouble—say low bearings—how much additional general inspecting and overhauling should be done at that time?

E 109.—For the average repair shop, what is the best method of driving the tools?

E 110.—What is the best method of keeping track of small tools, as drills, bits, etc.?

E 111.—When doing repair work on double-track cars, which method is preferable; lifting the bodies from trucks and doing the work from the top, or doing the work from the pit? Please state what you consider the advantages and disadvantages of each method.

E 112.—The master mechanic of a 20-car road has been told he can save money for the company by making all his own armature and field coils. Can he? What are the deciding factors in the case? Please give relative costs in this connection.

E 113.—As a general proposition, is it cheaper for a road to make its own armature and field coils than it is to buy them?

E 114.—What is a good and safe method of moving and handling armatures around the repair shops?

E 115.—Please describe your mode of procedure in rewinding an armature, outlining each step in the process. (Photographs illustrating the various processes will be very acceptable.)

E 116.—Do you consider it necessary to bake armatures after rewinding?

E 117.—How long and at what temperature do you bake armatures after rewinding?

E 118.—What is the nature of the compound you use for dipping new armature coils?

E 119.—Is there any satisfactory substitute for cotton tape as a covering for armature and field coils?

E 120.—Is there any economy in attempting to rewind and reinsulate motor field coils?

121.—What method or device do you use for scraping and straightening old field coil wire?

E 122.—What is the nature of the compound you use for dipping rewound field coils?

E 123.—How long and at what temperature do you bake field coils after rewinding?

E 124.—How do you locate faults in damaged armatures?

E 125.—How do you test repaired armatures at the shops?

E 126.—What is a good way of testing armatures and fields without removing the motors from the car during regular inspections, particularly on small and medium size roads?

E 127.—What is the best way of removing armatures and fields from cars, particularly on small and medium size roads?

E 128.—How do you test for low armature bearings?

E 129.—Have you found any scheme for securing better contact between motor commutators and carbon brushes?

E 130.—What improvements have been made in motor brush holders?

E 131.—What is the best method of turning down a motor commutator?

E 132.—To what various uses can compressed air be put in electric railway repair shops?

E 133.—What methods are available for securing compressed air in electric railway repair shops?

E 134.—If compressed air is used in repair shops, what pressure per square inch will best serve all purposes?

E 135.—An engineer wishes to install air compressing plants in several repair shops of different sizes. How will he go about it to determine size and capacity of compressing plant for each?

E 136.—In terms of per cubic foot capacity, what will be the cost of installing an air compressing plant?

E 137.—What is a fair estimate of repair and depreciation cost of an air compressing plant?

E 138.—A master mechanic wishes to use compressed air for various purposes in his repair shops. After the compressing plant has been installed, how much will the air cost per cubic foot at the point of application (air being used at, say, from 50 lbs. to 80 lbs. pressure)?

E 139.—Is it practicable and economical to use air brake compressors on cars for furnishing compressed air to clean cars and for other shop purposes?

E 140.—Do you attempt to rewind electric heater coils? If so, please describe your method of doing the work.

E 141.—Plans and descriptions of a "home-made" sand drier are requested. How do you dry sand on your road?

E 142.—Do you know of any satisfactory machine for taping coils? Please give sketches or photographs and descriptions, together with statement of results secured.

E 143.—What kind of rack or support do you use for holding armatures while they are being repaired or rewound? Please give description with photograph of drawings. (Rough sketches will do.)

E 144.—Please describe any of the labor-saving devices you use in the work of repairing armatures, winding armature coils, field coils, etc.

E 145.—Please describe the oven you use for baking armatures, etc. (Photographs or sketches will be very acceptable.)

E 146.—Do you know of any cheap and convenient form of small gas or electric furnace for heating soldering irons, etc.? If so, please give description, with photograph or drawings. (Rough sketches will do.)

E 147.—Do you know of any satisfactory "home-made" air or electric crane for general shop purposes? If so, please give descriptions with photographs and drawings. (Rough sketches will do.)

E 148.—What apparatus do you use for removing and replacing wheels and axles under cars? Please give descriptions, with photograph or drawings. (Rough sketches will do.)

E 149.—What form of hoist do you use for lifting car bodies? If the hoist was made from your own plans, please give details and drawings. What do you consider the best form of car hoist for repair shops?

E 150.—What is a good way of moving car trucks around the shops?

E 151.—How do you straighten a bent axle?

E 152.—How do you straighten a bent trolley pole?

E 153.—What is the best method of cutting circular holes in car dashers for headlights?

E 154.—What is the best method of cutting circular discs of glass for headlights?

E 155.—Do you use the sand blast for any purpose in your shops? If so, please describe the apparatus used and the results secured.

E 156.—If you are using any device or labor-saving scheme around your shops not brought out in the foregoing questions, please send description and photographs or drawing. Progress in the business is made by giving others the benefit of your experience and by your taking the benefit of theirs.

E 157.—What is a convenient and satisfactory method of unloading cars from flat cars?

E 158.—To what extent can the "piece system" of paying repair shop employees be used on small and medium size roads?

E 159.—On your road, what is the average life of the following:
Gears,
Pinions,
Babbitt linings in armature bearings,
Axle bearings,
Wheels (iron),
Wheels (steel),
Trolley wheels,
Trolley rope,
Bell rope?

E 160.—Computed on basis of first cost and total miles run during whole life, what do you find as the cost per mile run for the following:
Gears (split),
Gears (solid),
Pinions,
Armature bearings,
Axle bearings,
Wheels (iron),
Wheels (steel),
Trolley wheels?

E 161.—What can be done to reduce trouble from burned-out cables on snow-plows?

E 162.—State instances where automobiles have been used to advantage in carrying on any phase of electric railway work? Give details.

E 163.—Has the automobile tower repair wagon proven efficient or economical in electric railway work?

E 164.—Please state in detail what trouble you have had with lightning striking cars. Then please state in full what steps you have taken to prevent damage from lightning (with particular reference to protective precautions placed on the cars themselves).

E 165.—Is there any advantage in placing recording wattmeter on cars for the purpose of checking amount of current consumed by each motorman? Please give particulars of any instance where, to your knowledge, the placing of wattmeters on cars has resulted in saving of current through the more careful handling of the controller by the motorman.

E 166.—If it has been decided to place wattmeters on cars in order to determine the amount of current used, what is the best procedure, in detail, to secure the best results from their use?

E 167.—What are the relative advantages and disadvantages of running cars the same end on? Please discuss the effect on the bearings, motors, car framing, wheels, etc., and questions arising in relation to terminals.

E 168.—Does running cars the same end on insure better inspection of motor and controller parts?

E 169.—When do conditions justify the adoption of multiple-unit control on the average electric road? What are the deciding factors in the situation?

CAR HOUSES.

E 170.—Contributions are wanted on the subject of "The Ideal Car House." Please give your ideas, suggestions, etc., along this line.

E 171.—Please send in a description of your car house, together with drawings, sketches or photographs, that will show general layout and construction.

E 172.—What are the relative merits of slow-burning mill construction and other available types of construction for car houses?

E 173.—What is the best form of roof for car houses?

E 174.—Please give details and cost of "saw-tooth" roof for car houses. What are the advantages of this form?

E 175.—Have you had any experience with using old T or girder rails as supporting columns for buildings? If so, please describe the method followed in detail.

E 176.—What is the best layout for entrance tracks to car houses?

E 177.—What is the best material for car house floors? How should floors be laid?

E 178.—What is the best form of pit for car houses?

E 179.—What are good ways of lighting pits?

E 180.—What are good ways of heating pits?

E 181.—What specific acts or precautions instituted by your company have resulted in securing low fire insurance rates? Give details and results secured.

E 182.—Please describe the sprinkler system at your car house. How is the pressure maintained? How do you prevent the sprinkler system from freezing up?

E 183.—Are the interest and maintenance charges on an effective sprinkler system greater than the saving in insurance?

PAPERS AT THE MEETINGS OF THE CANADIAN STREET RAILWAY ASSOCIATION

An account was published in the last issue of this paper of the first meeting of the Canadian Street Railway Association. Below will be found abstracts of the two papers presented on that occasion. The authors were E. A. Evans, manager of the Quebec Railway, Light & Power Company, and D. McDonald, manager of the Montreal Street Railway Company:

HANDLING EXPRESS BY ELECTRIC SUBURBAN RAILWAYS
BY E. A. EVANS

The writer had the honor of submitting a paper to the members of the Canadian Electrical Association in 1902 upon electrical suburban railways, in which he took the ground that, in the near future, steam railroads will handle their suburban and short distance interurban passenger traffic and mail, express, baggage and light local freight by electric motive power. In this paper the writer submitted statements showing the results from passenger traffic, of carrying out this theory upon the existing steam railway running between Quebec, Ste. Anne and St. Joachim, a distance of 25½ miles. These results showed that during the year 1889-1890, the first year's operation, 95,563 passengers were carried, and in 1899-1900, 261,175 passengers were carried; this under the old regime of steam railroading. The next year, 1900-1901, with the electric system, 537,933 passengers were carried, and last year, 1903-1904, 877,310 passengers were carried; of this number, 155,980 passengers were carried by the steam trains. By way of explanation, it should be stated that the same number of steam trains, arriving and departing at the same hour, are being operated now as in 1899-1900. The passenger receipts, which averaged $38,246.47 a year during the eleven years of steam operation, last year amounted to $96,943.47. From this it will be noted that the average fare per passenger has decreased from 18.17 cents to 11.05 cents, showing that the more frequent service permits of and encourages the residents along the railway to visit from village to village. Under the old system this practice was not so general, and as there has been no apparent increase in population, this custom accounts for the large increase in travel.

In 1900, the writer issued instructions to all agents to make a report of all parcels, hand valises, baskets, canes, umbrellas, etc., which were handed in to them to be taken charge of and for which no charge was being made; in other words, the agents took charge of these parcels merely as an act of courtesy and without responsibility. The results showed that large numbers of parcels were being left, and an inspection of the reports showed that these parcels at the Quebec office consisted principally of groceries, meat, laundry, etc., whereas at the wayside stations, they were made up largely of vegetables, cut and uncut flowers, fowl, laundry, etc. Consequently, in the spring of 1901, parcel offices were opened at each station, and agents were instructed not to accept the care of any package without making a charge of 5 cents for each article for the first twenty-four hours, and a similar charge for each additional day. A supply of parcel checks was issued at the same time. This change created considerable opposition on the part of the regular passengers, who, having had this privilege for over eleven years, now claimed it as a right. As a consequence, receipts which were anticipated from agents' reports to amount to several hundred dollars a year, did not aggregate $100. A careful watch, conducted at the different stations at this time, revealed the fact that residents would bring their parcels to the station, wait the arrival of some friend who was traveling, and then request this friend to take charge of the package and bring it either to or from town. Grocers in town would be telephoned to from say Mrs. B. to meet a certain train and hand her parcel to Mr. H., who would take charge of it, Mrs. B. sometimes, and generally, meeting Mr. H. at destination to take the parcel from him. This condition naturally led to the establishment of an express, baggage and light local freight department earlier than was anticipated.

Under steam railway rules, the freight charges are determined according to the classification of the Canadian Freight Association. The different railways, of course, have their own rates, but abide by the classification made by the association. Rule 30 of this association provides for such articles as the Quebec Railway, Light & Power Company is now carrying under its express baggage and light local freight department, as follows: "Small consignments of one class, or including articles of several classes, will be charged at actual weight, according to the classification of each article, but no single shipment will be taken for less than 100 lbs., first-class, exclusive of cartage, minimum charge, 35 cents, with an additional charge of 10 cents for each cartage performed by the railway company's cartage agents." It will be seen that under this tariff the company would have been unable to carry any parcel, no matter how small, for a less charge than 35 cents—in many cases more than the value of the package of rhubarb or other vegetables that were being sent to town. It was therefore necessary not only to make new rates suitable to the special requirements of the district, but also to adopt new rules and regulations regarding this class of traffic. These rules and regulations went into effect on Dec. 1, 1902, the tariff being as follows:

Any station to any station:
For all parcels, small boxes, etc., from 0 to 10 lbs. 5 cents.
For all parcels over 10 lbs. to 20 lbs., 10 cents
For all parcels over 20 lbs. to 30 lbs., 15 cents.
For all parcels over 30 lbs. to 50 lbs., 20 cents.
For all parcels over 50 lbs., and not over 100 lbs., 25 cents.

The rules governing these goods are as follows:

Express Freight.—All goods weighing less than 100 lbs. and offered for shipment, will be carried on any regular passenger or electric train, with all despatch possible.

Each parcel, box, etc., must be properly packed and addressed in full before a receipt (Form B 32) is given to the sender. Fresh fish, fresh meat and any other perishable articles must be prepaid. Any dangerous articles will not be accepted except on special orders from the superintendent.

Agents will use form B 33 when way-billing, which must be made in duplicate, one copy of the way-bill to be given to the driver of the electric train or the baggageman of the steam train, and the goods must be forwarded by the first train due to leave after the goods have been accepted for shipment; the other copy of the way-bill will be kept by the agent and accounted for in the same manner as regular freight.

Agents receiving express freight will issue Form B 34, and notify consignee as quickly as possible, and when goods are delivered a receipt must be taken on Form B 33, opposite article for which receipt is required. Way-bills received will be accounted for in the same manner as regular freight.

Conductors of all regular trains may accept goods for shipment at any flag station, using form B 31 for billing express freight.

Any article weighing over 100 lbs. to be carried by the regular freight trains only and under Canadian Freight Classification rules. These regular freight trains are operated by steam in the usual manner.

Agents were instructed to despatch all parcels under the above regulations by the first passenger car at any time of the day or night, and to give them in charge of the motorman on electric cars and the baggageman on steam trains. They were also informed that no excuse would be accepted for not despatching these parcels by the first train.

The public immediately took advantage of the facilities thus offered, and the parcel office, while still open for the accommodation of travelers, is practically unused. The receipts from this source of revenue the first year amounted to $300, and last year practically doubled, and is still meeting the approbation of the public. Passengers in the villages along the line, instead of purchasing from small stores near their residences, travel to town to purchase goods from different stores. They usually have their purchases made into one parcel, which is sent to the station to be forwarded by express to destination, instead of having it deposited in the parcel office and having the trouble to call for it and transport it themselves. Again, vegetables of all kinds, cut flowers, etc., are being daily expressed to town during the summer from the villages to supply the hotels, boarding houses, etc., in the city. In conclusion, it is pleasing to be able to state that during the two years in which this business has been in operation, only three complaints of delays have been received and not one single package has been lost or gone astray.

Of course, it will be noted that the conditions mentioned are different from those on most suburban electric railways because of their having no agents at the different stopping places. This difficulty, however, can be overcome in most cases. There is usually some responsible man or woman residing close to the stopping place or flag station, with whom arrangements can be made to take charge of the packages for a small consideration or commission.

RELIEVING CONGESTED TRAFFIC AT RUSH HOURS.
BY D. McDONALD

Of the 1000 operating electric railway companies on this continent probably less than 100 have to deal with the overcrowding problem. If we take the existing conditions in towns of 300,000 to 400,000, we will frequently find that a quarter of this number, or say 100,000, work in a business or downtown section about 1 mile in length and ¼ mile or ⅓ mile in width. Seventy-five thousand of these people wish to get home quickly and a large part of them want to board cars in ten or fifteen minutes, about 6 o'clock. If each car has a capacity (seated or standing) of fifty to sixty passengers, 1300 cars would be required to transport this crowd, in addition to those needed elsewhere on the system. It is not only financially impracticable for an operating company to furnish such a number of cars to be used for a small fraction of the day, but the element of "time" contributes an even greater difficulty. A business center, such as that under consideration, is generally provided at most with two streets where the greater part of this traffic must be carried on. The closest headway that may be run by cars, at 5 m.p.h. or 6 m.p.h. speed, is about 20 seconds. Hence we must find a means of running 1300 cars over four tracks in 15 minutes or 900 seconds; that is to say, we must run 325 cars over each track in 900 seconds, which means that the interval between cars must be less than 3 seconds. This is a material impossibility, and if each car must have a headway of 20 seconds we arrive at a total time space of ($325 \times 20 = 6500$ seconds $= 108$ minutes) or 1 hour and 48 minutes to let the procession go by.

It is evident from the above figures that the possibility of relieving congestion with an unlimited number of cars, even if it were approved as a commercial venture, cannot be done without sacrificing time and speed, which would probably entail a larger general loss than that mentioned above, and would also give rise to greater recrimination than the disagreeable quicker ride that passengers must endure under present conditions. There is a maximum in all calculations, and the limiting number of cars that a city street may accommodate is pretty nearly covered by the service that most companies are at present giving in the heart of busy cities.

The European plan of numbering and limiting passengers, which, by the way, is generally disregarded in most European countries during Sunday and holiday rushes (for they do business calmly and amuse themselves rapidly), would not suit our speedier temperament. It might be desirable from the standpoint of the companies, as it would reduce the actual loss caused by missing fares, but it yet remains to be seen with what public favor such a limitation would meet in this busy country. We are forced, consequently, to the following conclusions:

(1) That congestion at rush hours cannot be avoided.

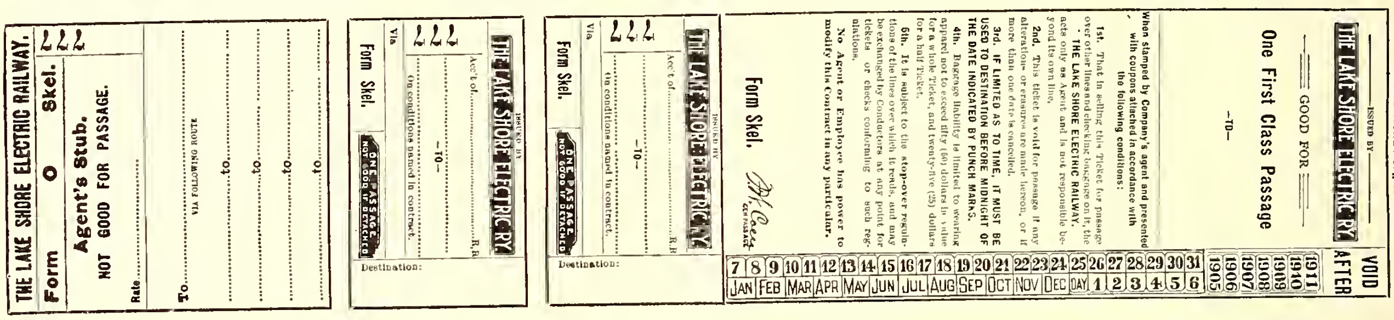
(2) That it may be possible to relieve the crush by the addi-

tion of a reasonable number of cars to a limit where speed must not be sacrificed.

(3) That with a view to further increasing the maximum number of cars that may be run without loss of time, most cities should consider the advisability of increasing the speed and giving clearer right of way to allow space for more cars, and thereby afford greater and better accommodation to the public.

INTERLINE TICKETS ADOPTED BY OHIO ASSOCIATION

At a meeting of the Ohio Interurban Railway Association, held at the McKinley Hotel, Canton, Dec. 29, a standard form of interline ticket was adopted. For some time a number of the Ohio roads have been selling tickets to points on other lines, but there has been no uniformity of ideas either as to the form of tickets, limitations or methods of accounting. The result is that some roads have had one method for doing business with one connecting line and another for another connecting line, and there has been much confusion. A wide range of ideas as to details was brought out in the discussions, and while the subject was thoroughly thrashed out and a uniform ticket was adopted by those present, it is unfortunate that this action does not insure that the standard form will become absolutely uniform on all Ohio roads, or even with the roads represented at the meeting. Before the discussion opened, President Harrie P. Clegg, of the association, brought out the point that any



FORM OF INTERLINE TICKET ADOPTED BY THE OHIO ASSOCIATION

action taken at the meeting would not bind a road to accept or use the ticket, but that it was the desire to secure and put together the best ideas and experiences of those interested in order to devise a form that would be satisfactory to the largest number of roads. He said that some roads undoubtedly had arrangements with roads outside the association, and it would be necessary to agree to some of the requirements of these roads, but he urged that members of the association doing business with each other should at least follow the principles of the agreement, even though they departed from it in certain details as might better suit their own requirements.

F. J. J. Sloat, chairman of a committee appointed at a previous meeting to investigate the subject, presented a form of interline ticket that embodied a large number of ideas presented to him by traction managers as well as by steam passenger men. He admitted that the form was a trifle cumbersome and contained clauses that could doubtless be eliminated, and he suggested that the ticket be taken up section by section, discussed and voted upon.

It was agreed that safety paper should be used for all interline tickets. The form of agent's stub was agreed upon, but some roads wanted an auditor's stub, others a general passenger agent's stub as well as auditor's stub, while others did not want either. It was agreed that those roads that desired them could have an auditor's or general passenger agent's stub, to be identical with the agent's stub, and to contain the initial point, the destination, the route and the rate. It was also agreed that the agent's and auditor's stubs should be placed at the bottom of the ticket rather than at the top, so that in case an agent found it necessary to use a ticket containing a number of coupons for a shorter trip, he could return the remaining coupons to the auditor, with his stub, thus preventing blank coupons from remaining in the agent's hands.

The form contract proposed by Mr. Sloat contained twelve clauses, but before the session was over these had been simplified and boiled down to five clauses. The form of the contract is shown in the accompanying illustration.

There was much discussion over the advisability of requiring a passenger to sign a first-class, one-way or round-trip ticket, for which regular fare was paid, but it was the general sentiment that it was undesirable and unreasonable to place such a restriction upon a first-class ticket. The limitation upon responsibility for damage to baggage was placed at $50, although a number of roads had heretofore allowed a greater amount, while others had said nothing about it in their contracts.

The question of limiting a first-class ticket also brought out much discussion.

E. S. Dimmock, general manager of the Canton-Akron Company, said he thought it was placing a hardship upon a passenger who paid a full fare to require him to use a ticket within thirty days, as proposed, and said that he should hesitate to attempt to collect fare from a man who presented a ticket that had expired.

President Clegg, of the association, emphasized the point that the electric roads ought to be liberal on that point, especially on a first-class ticket. He said that the steam roads were showing a tendency to reduce their efforts to circumvent scalpers, as it was found that it cost more money to fight them than was gained in the long run. He said that the interurban lines had made a very favorable impression with the general public through their liberality, and he did not want to see restrictions placed on the use of tickets until it had been demonstrated that such restrictions were necessary.

Vice-President Will Christy, of the Northern Ohio Traction & Light Company; Secretary F. W. Coen, of the Lake Shore Electric Railway, and several other prominent managers voiced similar opinions.

General Manager Sloat, of the Cincinnati, Dayton & Toledo, said that his company willingly refunded money on tickets after they had expired, but urged that for the convenience of the auditing departments that the thirty-day limit be placed on the ticket.

General Passenger Agent Morrell, of the Dayton & Western, stated that they placed the thirty-day limit on all tickets they used, for the benefit of the auditing department, but that they did not refuse local tickets if presented after the limit had expired. He thought it would be well to use the same policy in the case of the interline ticket, although he would be inclined to refuse to honor the round-trip portion of an interline ticket if presented after the thirty days; however, he favored refunding the money or extending the limit in such a case.

Another manager said his conductor had instructions to take an expired ticket if the passenger said nothing about it, but if a passenger asked if the ticket was good, the conductor was advised to refuse it and to inform the passenger that the money would be refunded at the office. On a rising vote, it was decided to insert a clause providing that if the ticket was limited as to time, it must be used to destination before midnight of the date indicated by the punch marks, and providing the ticket with spaces for the year, month and date, to be punched in case the ticket was limited. It was also understood that agents were to be instructed to limit the ticket to thirty days.

Mr. Sloat proposed that each road should be given a distinguishing number, and that each coupon should contain the number of the issuing road and that of the road over which the coupon was good. It was thought that this would add to the complication of making out the ticket, and it was decided that each coupon should contain the name of the issuing road in heavy type, with space for the initials of the collecting road.

The question of suitable colors for tickets brought out an immense amount of discussion, more time being spent on this than any other subject. One manager wanted a different color for each road, so that an auditor would know at a glance what road had issued a certain ticket. Another manager advised that each road be permitted to select different colors or combinations of colors for all the different combinations of routes over which he would be likely to sell tickets, arguing that this would prove a safeguard against alteration of tickets, and would also facilitate the handling of tickets by agents, as each agent would become familiar with the kind of ticket required for a certain route. A Dayton manager stated that at the Dayton station, which was used by several roads, they had sixty to seventy different varieties of tickets, each possible destination point being designated by a ticket of a certain color or combination of colors. He thought that with the immense variety of possible combinations of colors, it would be possible to have a different ticket for any interline ticket that might be required.

A ticket manufacturer who was called upon for his opinions, said that his people would be delighted to get up all the combinations that could be thought of, but he freely admitted that the cost of such an enormous variety of tickets would be prohibitive. He said that there were only four or five colors that were distinctive under artificial light, and the steam roads had found it advisable to reduce the number of colors to the smallest possible limit.

Mr. Sloat urged against permitting a conductor or agent to place any dependence upon the color of a ticket; he said a ticket should be carefully written out and read to guard against errors. On Mr. Sloat's motion, the number of colors for tickets was limited to four—half-fare single trip, half-fare round trip, full-fare single trip and full-fare round trip. This was afterward reduced to two; half-fare tickets to be made by printing "Half Fare" across the face of each coupon on a full-fare ticket. Single-trip tickets will be green, and round-trip, gray. The various ticket companies represented were asked to get up samples of the tickets and submit them to the various roads, and some orders for the tickets were placed on the spot, as a number of roads are experiencing demands for interline tickets, and some of them have been holding off until a standard could be adopted.

The matter of a standard form for a special excursion ticket and for a party ticket was left to a committee, which was authorized to act in the matter of preparing forms, which, however, are to follow as closely as possible the tickets already adopted.

The standard form for reporting tickets used by a number of steam roads, and also used by the Lake Shore Electric in its interline business with steam roads, was adopted. This is illustrated. Under this arrangement, each road will send each other road a monthly statement of tickets sold, and settlements will be upon this basis and not upon a basis of tickets collected by other roads, as it was pointed out that conductors frequently neglect to take up a ticket, and under this arrangement a road would receive pay for a ticket whether it was collected or not. Tickets returned for redemption would, of course, be charged to the foreign road and not to the road that sold the ticket, although either party will be authorized to make the redemption.

The basis of settlements resulted in a long wrangle, and came near tying up the entire proposition, as some of the managers wanted to leave the question to the decision of their directors. Some proposed that each road should settle with each other road on the point of whether settlements should be on a basis of balances or in full. Secretary Merrill pointed out that settlements on the interchangeable coupon books were made on balances, and that one form of report would do for both. He said that the various roads had been following this plan, and that thirty minutes a month was all the time required to make out all bills and mail checks for balances. General Manager Carpenter, of the Western Ohio, said that the interline ticket business had grown to be a very important factor in their business. They receive as high as $3,000 in a month from tickets sold by a connecting line over their road, and he felt assured that his directors would object to the plan of permitting another road to have that amount of their funds. He said it was a much simpler and safer plan for each road to make its monthly statement and settle on the balance.

F. J. J. Sloat thought settlements would be made more promptly and with greater safety to all concerned if each road sent its monthly statement of tickets sold over a road and authorized that road to draw a draft for the amount due in full. F. W. Coen argued along the same lines, and stated that his company had followed this plan in doing business with connecting steam and electric lines. A rising vote resulted in a tie, and finally Mr. Coen withdrew his objections, and the motion to settle on balances carried.

Owing to the absence of Edward Spring, chairman of a committee on interline checking of baggage, no attempt was made to settle on a standard form and method, and the matter will be taken up at the next meeting. This is a very important question, and it is one that will take much discussion to adjust. Many of the roads feel that rates are so low at present that they

FORM 51

The Lake Shore Electric Railway Company

ACCOUNTING DEPARTMENT

Norwalk, Ohio,............................190.......

REPORT OF COUPON TICKETS

Sold over the..R. R.

during the month of.............................., 190.......

N. B.—If any discrepancies are found in this report, please make no alterations, but advise by letter and corrections will be made in subsequent statements.

A. C. HENRY, AUDITOR

	FROM	TO	FORMS	Consecutive Nos.		No. Sold		Through Rate	Prop'n	AMOUNT
				Com. No.	Clos. No	R T	S T			

FORM FOR ACCOUNTING FOR INTERLINE TICKETS cannot afford to check baggage free of charge, while others hold that the plan of charging 25 cents or more for each trunk, frequently turns the business over to the steam road. F. W. Coen, of the Lake Shore Electric, stated that all baggage was checked free of charge and that it is carried on all their limited cars, and on the express cars where there are no baggage compartments on the regular local cars. Frequently it precedes the passenger. He felt satisfied that the plan brought them an immense amount of business that otherwise they would not secure. He said that if each road attempted to collect 25 cents a trunk, on a long interline trip, it would prove a tremendous drawback to the business. Mr. Morrell, of the Dayton & Western, said that they were checking baggage from Dayton to Indianapolis, and that each road received its regular charge. The amount is collected in advance and a coupon check is attached to the baggage, each road taking up its coupon and settling on this basis. He thought this a good plan.

A representative of the Central States Guide Publishing Company, of Norwalk, Ohio, stated that his company is now publishing the time-tables of all electric roads in connection with its official steam road guide, and pointed out the advantages of having these guides thoroughly circulated among all ticket agents, hotels, etc., and he quoted rates at which the books would be supplied to members of the Ohio Association.

President Harrie P. Clegg outlined the features of the trip recently made by Indiana managers over Ohio roads, reference to which was made in recent issues of this paper, and stated that the officers of the new Indiana Electric Railway Association had agreed to co-operate with the Ohio Association in all matters of common interest. He expressed the opinion that a merger of the two associations would result ultimately, and said that practically the only point which debarred such a step at present was the fact that the Indiana Association had in view certain legislative plans which, of course, could not be acted upon by an interstate association.

General Passenger Agent Morrell, of the Dayton & Western, announced that beginning this week limited service would be inaugurated between Dayton and Indianapolis. The buffet parlor cars owned by this company will make three trips each way a day. The running time for the 108 miles will be four hours and fifteen minutes; fare, including excess of 50 cents, will be $2.25.

The next meeting of the Ohio Association will be held at the Algonquin Hotel, Dayton, Jan. 26. This will be the annual meeting, and much interest is attached to the election of officers, as several men are understood to be in the field for the presidency of the association.

Nine new members were admitted to the association, including representatives of the Detroit, Flint & Saginaw Railway, the Springfield, Washington C. H. & Chillicothe Traction Company, Northern Ohio Traction & Light Company, Ft. Wayne, Van Wert & Lima Traction Company and the Detroit, Monroe & Toledo Short Line, none of which had been represented at previous meetings.

SEMI-CONVERTIBLE CARS FOR PHILADELPHIA SUBURBS

The illustration presented herewith shows one of five cars lately delivered to the Media, Middletown, Aston & Chester Electric Railway by the J. G. Brill Company, which are the first of this semi-convertible type to be used on this road. The company's lines extend in a westerly direction from the suburbs of Philadelphia, traversing a beautiful country which is thickly populated and contains several colleges and schools of national repute, country clubs and fine residences. In summer the cars carry many sightseers, for the country along the lines is noted for its beauty. Cars of this semi-convertible type are in use in other suburbs of Philadelphia, and everywhere meet with the hearty approval of the public. A car of this kind was recently placed on the lines of the Philadelphia Rapid Transit Company for trial, and was so well liked that the company has ordered sixty from the builders.

The cut shows a number of windows held at different heights, and gives an idea of the lowness of the window sill. The large windows and the light woodwork of the interiors make the appearance within very attractive, and the ability to raise all the sashes into the roof pockets at any time suits the car to all sorts of weather. The width over the posts at belt is 8 ft. 2 ins., and the interior width is 7 ft. 10 ins., allowing the seats to be 36 ins. long and the aisle 22 ins. wide. The seats

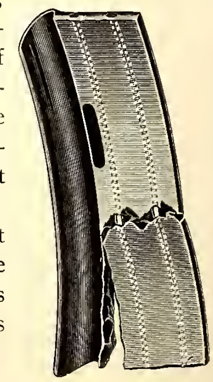
SEMI-CONVERTIBLE CAR USED IN THE VICINITY OF PHILADELPHIA

are of the builders' step-over type with arm rests on the window sills. The length of cars over the end panels is 25 ft. 4 ins., and over the vestibules, 34 ft. 9 ins. A device lately patented by the builders prevents the folding doors at the platform entrances from moving in any but the desired direction. The windows in the vestibules are arranged to drop into pockets in the wainscoting. Angle-iron platform center knees extend well back of the body bolster, relieving the ends of the car of much of the strain of the platform load. The side sills are 4 ins. x 6¾ ins., with 12-in. x ⅜-in. plates on the inside, to which the bases of the posts are attached. These wide plates take the place of inside trusses, and have the additional advantage of stiffening the posts. The end sills are 5¼ ins. x 6⅞ ins., the corner posts 3¾ ins., the side posts 3¼ ins., and the sweep of the posts 1¾ ins. The cars are mounted on the builders' No. 27-G type of truck, having a 4-ft. wheel base, 33-in. wheels and 4-in. axles. Four motors of 25 hp each are used per car, and the total weight of a car with trucks, motors, etc., is 34,140 lbs.

THE SAFETY BRAKE-SHOE

The accompanying illustration shows a new brake-shoe recently brought out by W. W. Whitcomb, the brake-shoe expert of Boston, and entitled by him the "Safety." The feature of this shoe is the fact that extending lengthwise through the casting are two pliable steel rods which will hold the parts together, in case of fracture, and prevent their falling beneath the car.

These rods are not cast into the shoe, but are forced through holes provided in the casting. In this way the inventor claims that strains are avoided and the shoe is more reliable.



SAFETY BRAKE-SHOE

The Old Colony Street Railway Company has increased the rate of fare on some of its lines. The fare from Brockton to New Bedford is 50 cents, as against 35 cents before Jan. 1, and the fare to Taunton from Brockton is 25 cents, as against 20 cents. General Manager Goff, of the company, says that street railways cannot be operated on a fare of less than 1½ cents a mile.

FINANCIAL INTELLIGENCE

Wall Street, Jan. 11, 1905.

The Money Market

The money market continues to show extreme ease in all its departments, and despite the unfavorable showing made by the banks on last Saturday, and the continued exports of gold to Europe and South America, rates for all maturities during the week have ruled at the lowest points attained for several months, and, according to some of the local bankers, there is nothing in the situation at the present time to warrant the expectation of any material improvement in the near future. It is pointed out that while the present strength of foreign exchange may develop into a considerably larger movement of gold to foreign countries, the losses sustained on this account would be more than offset by the heavy return movement of funds from the interior. Money on call and on time has been in abundant supply, while the demand from Wall Street houses and commercial sources has been practically at a standstill. At the opening demand money loaned at 2¾ per cent, but subsequently the heavy offerings of funds forced the rate to 2 per cent, the ruling rate for the week being about 2½ per cent. In the time loan department business has been practically at a standstill. The banks and individual lenders offered freely at extremely low rates, but borrowers have shown a disposition to await lower interest charges before entering the market. Sixty and ninety day funds were 2¾ bid, and offered at 3 per cent, while for periods extending from four to six months 3 per cent was bid, with offerings at 3¼ per cent. Mercantile paper, after ruling at 4 per cent for several months, declined to 3½ per cent for the choicest grades, to conform with the extreme ease in time money. There was no great change in the European discount rates during the past week. Considerable importance is attached, however, to the reduction in the Imperial Bank of Germany's rate from 5 to 4 per cent, indicating that the demand for gold there has slackened. France, however, continues in the market for the yellow metal, and it is not at all improbable that shipments to that point will be made in the shape of gold coin. At the present time the entire output of Assay Office bars is engaged ahead of time, and should the demand for remittance continue at the present rate, shipments of gold coin will be the only alternative.

The bank statement was very disappointing. The preliminary figures of the known movement of funds indicated a gain in cash of about $7,000,000, but instead, the local institutions sustained a loss of nearly $800,000. Loans increased over $3,000,000, and deposits increased $5,119,500. Reserve required increased $1,279,875 over the previous week. The surplus was $11,608,250, as against $14,686,975 in 1904, $14,810,300 in 1903, $12,958,450 in 1902, $22,398,050 in 1901 and $16,707,350 in 1900.

The Stock Market

There was a considerable falling off in the volume of business in the local securities market this week, but, although price movements displayed an irregular tendency, the general tone was firm. In the early dealings values generally showed strength, but the improvements were soon lost by selling induced by a decidedly poor bank statement, and the efforts made at Washington to put through at the present session of Congress, a bill looking to the adjustment of railway rates. Otherwise, the news of the week was of a decidedly favorable nature, but it had very little influence upon values, there being a general disposition on the part of the larger interest to hold off for the present. Money was extremely easy, rates for all classes of accommodation ruling at the lowest levels attained in several months. The reduction in the Imperial Bank of Germany's discount rate from 5 to 4 per cent, was generally expected, and indicates that the demand for gold at that center has been satisfied. Railway traffic returns continued to show substantial increases over the corresponding period of last year, and the improvement in the general business situation was reflected in increased dividend on the shares of several minor railway and industrial concerns. At the close the market strengthened materially, but the trading was confined largely to the speculative element.

The local traction issues were weak throughout, the declines being attributed to the falling off in traffic during the recent storms. Brooklyn Rapid Transit declined nearly 2 points to 60¼. Manhattan sold from 168 to 166, and Metropolitan Securities lost 3¾ to 75¼. Metropolitan Railway sold as low as 114½, but at the close there was a sharp rally to 115⅞.

Philadelphia

Very little interest was manifest in the local traction issues this week. Trading was extremely quiet, but prices generally ruled strong. United Gas & Improvement was the most animated of the group, about 2000 shares being traded in at prices ranging from 105¾ to 105⅛, the final transaction taking place at 105½. Philadelphia Traction advanced from 99 to 99¼ on the exchange of about 900 shares, and Philadelphia Rapid Transit brought 17⅞ and 17¾, for about 500 shares. Consolidated Traction of New Jersey showed decided strength, upward of 500 shares changing hands at from 79½ to 79¾, the closing transactions being made at 79⅝. Philadelphia Company common was traded in at 41½ and 41¼, while the preferred changed hands at 47. American Railways was quiet, about 400 shares selling at 48⅛ and 48. Upward of 500 Union Traction brought 59 to 58⅞.

Chicago

Developments in local traction affairs were of more than ordinary interest this week, and indications now point to a speedy settlement of the question at issue to the entire satisfaction of all concerned. John J. Mitchell, president of the Illinois Trust & Savings Bank, and John H. Eckels were in New York this week, conferring with J. P. Morgan and others on matters pertaining to the consolidation of the City Railway and the Union Traction Companies, and although official announcement is wanting, the belief prevails that the matter has been practically settled. It is said that a syndicate composed of Chicago and New York capitalists has been formed and has purchased control of the Chicago City Railway, at $200 per share. This is considered a very important step in the solution of the local traction problem, inasmuch as it is believed that by merging the two companies the whole situation will soon be cleared up.

Another important development was the settlement of the fight for control of the North and West Chicago Street Railway Companies by the contesting interests. At the annual election of both companies held on Tuesday last a compromise board of directors was elected in each instance, which is satisfactory to both the local and Eastern interests. It is stated that all litigation against the New York parties is to be stopped, and that the adjudication of further questions that may arise shall be brought about privately among the parties concerned, and that the dominant interests in the Union Traction Company are to finance the receivers' certificates of the Union Traction Company that are to be issued.

The city council committee on local transportation has made a move which ultimately may result in universal transfers on the street cars of this city. It has recommended for passage an ordinance compelling the exchange between the principal lines of the City Railway and the west division of the Union Traction Company. The ordinance, if passed, will depend for its enforcement upon the police powers of the city.

The local traction stocks were practically neglected during the greater part of the week, there being a general disposition on the part of traders to await developments in the local situation. Chicago City Railway at the opening sold at 180¾ and 184 for small amounts, but in the announcement that a "deal" had been consummated, the price advanced sharply to 194, a gain of over 14 points for the week. West Chicago stock was bought liberally at the same time around 60, while the consolidated 5s advanced to 82 on large transactions. The elevated railway stocks were practically neglected; Chicago & Oak Park sold at 7¾ for about 200 shares. Metropolitan preferred brought 60, while Northwestern common and preferred changed hands at 23 and 63, respectively.

Other Traction Securities

The feature of the Boston market was the active buying of Boston Elevated early in the week, unusually large amounts of the stock changing hands around 158¼. Subsequently, however, the price receded and closed at 157, the lowest for the week. Massachusetts Electric brought 13½, while the preferred declined from 60 to 58 and rallied at the close to 58½. West End common advanced from 94 to 95 on the purchase of small lots, while the preferred broke from 113½ to 112, and closed at 113. In the Baltimore market interest centered largely in the United Railway issues, and especially the incomes; about $100,000 worth sold at from 53 to 52¼. Of the 4 per cent bonds, about $40,000 sold at

93, while the stock brought 14½ and 14. City and Suburban 5s sold at 113¼. Lexington Street Railway 5s brought 103, and a fairly good business was transacted in Norfolk Railway & Light 5s at 91¼ and 91. On the New York curb, Interborough Rapid Transit scored a sensational rise on comparatively small transactions. From 168, the closing figure of a week ago, the price advanced to 187½, an extreme gain of 19½ points. About 35,000 shares were traded in. The advance was attributed to a steady accumulation of the stock by parties closely identified with the management of the company. There were also reports of phenominal earnings, some estimates placing the combined earnings of the Interborough and the Manhattan Railway Company at 20 per cent. Washington Railway & Electric common continued strong, with sales at 28. New Orleans Railway preferred was firmer, sales taking place at 10¼ to 11, while the 4½s sold at 75. Public Service Corporation sold at 140 for 200 shares, a gain of 5 points above the last previous sale. There were no dealings in the Buffalo companies securities during the week, but bid prices for both the consolidated 5s and the debenture 6s ruled decidedly strong. International collateral trust 4s, ex-January coupons are quoted at 78½ bid, 79½ asked. North Jersey Street Railway stock was unchanged at 24 bid, without sales, but $10,000 of the 4s brought 77½.

Interest in the Cincinnati, Dayton & Toledo leasing plan caused activity in the securities of that company at Cincinnati last week. About 500 shares of the stock sold at 22 to 23, while $73,000 worth of the 5 per cent. bonds sold at 84¾ to 85. Cincinnati, Newport & Covington common was quite active, about 3000 shares selling, most of it in one large lot; range from 31¾ to 32¼. Several lots of the preferred sold at 91 to 91¾. Cincinnati Street Railway was firm at 144½. Detroit United advanced to 78½. A block of Indianapolis Street Railway 4s sold at 87½, and a block of Columbus Railway 4s at 91.

Northern Ohio Traction & Light has been the active feature of the traction list in Cleveland of late. Sales reached about 1200 shares in the past week and the price advanced from 18½ to 20½, with sales at 60 days delivery as high as 21. There is no news to explain this activity except that the earnings of the road are showing good increase. About 400 shares of Cincinnati, Dayton & Toledo sold at 22½ to 23½. Northern Texas Traction made a new high mark of 44, with a deal at 45 for future delivery. The last statement of this road shows 23 per cent. increase in gross earnings. Western Ohio receipts advanced from 12 to 14 and are scarce at less than 20. Syracuse Rapid Transit made a high mark of 82½, due to the near approach of the time when the property will be included in the proposed New York Central merger. Aurora, Elgin & Chicago preferred sold up from 40 to 45 on small lots.

Security Quotations

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

	Dec. 31	Jan. 14
American Railways	47½	47½
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	156¾	156½
Brooklyn Rapid Transit	60¼	60¼
Chicago City	180¾	192
Chicago Union Traction (common)	9¾	12
Chicago Union Traction (preferred)	40	45¾
Cleveland Electric	74¼	74¼
Consolidated Traction of New Jersey	78½	78½
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	77½	77¾
Interborough Rapid Transit	168	186
Lake Street Elevated	—	—
Manhattan Railway	166	167¾
Massachusetts Electric Cos. (common)	13⅛	13½
Massachusetts Electric Cos. (preferred)	58½	58½
Metropolitan Elevated, Chicago (common)	22	22
Metropolitan Elevated, Chicago (preferred)	60	59
Metropolitan Street	118	115¾
Metropolitan Securities	77	75
New Orleans Railways (common)	2	2¾
New Orleans Railways (preferred)	10½	11
New Orleans Railways, 4½s	74	74½
North American	99	100¼
Northern Ohio Traction & Light	17	17
Philadelphia Company (common)	24	24
Philadelphia Rapid Transit	41	41
Philadelphia Traction	17½	17¾
South Side Elevated (Chicago)	96	96
Third Avenue	131	127
Twin City, Minneapolis (common)	104¾	105¼
Union Traction (Philadelphia)	58¾	58¾
West End (common)	94½	95
West End (preferred)	113	113

* Ex-div. a Asked.

Iron and Steel

The "Iron Age" says that the monthly blast furnace statistics are almost startling in the revelation they make of the enormous current consumption. December product of anthracite and coke iron was 1,614,000 gross tons. In spite of this large output, stocks of the merchant furnaces declined 121,000 tons, indicating a rate of consumption in a winter month of over 1,750,000 tons. The steel companies produced in December 1,019,841 tons of pig iron and more will be made in January. How enormous the requirements are is shown by the fact that the Carnegie Company has forty-eight out of fifty blast furnaces going. Yet it is short of pig iron, and is today closing purchase of 25,000 tons for January delivery. Pittsburg reports a good deal of activity in the steel market, with premiums over official prices on billets and steel bars. Further sales steel rails, about 32,000 tons, have been effected in the Chicago district, but otherwise the market is quiet. Up to Jan. 1 the associated mills had sold 650,000 tons.

HUDSON RIVER TUNNEL DEVELOPMENTS

The Hudson Companies, a construction company with a capital of $21,000,000, was incorporated at Albany on Monday, Jan. 9, to take over the work of completing the construction of the two tunnels under the Hudson River, from Hoboken to Christopher Street, in New York City, the proposed crosstown line under Ninth Street, and the extension from Greenwich Street north under Sixth Avenue, for which the Rapid Transit Board has already granted franchises. The tunnel work is now being done by the Hudson Improvement Company, which is now to be merged in the new company.

The Hudson Companies will also take up the work of building the two tunnels under the Hudson from the Jersey City station of the Pennsylvania Railroad to the corner of Cortlandt and Church streets, in New York, work which the Knickerbocker Improvement Company had previously been organized to undertake. The former scheme is that of the New York & New Jersey Company, of which William G. McAdoo is the president, and the latter the franchise of the Hudson & Manhattan Company, also known as a McAdoo enterprise.

More important, perhaps, than the mere announcement of the formation of the new company is the fact made public by Harvey Fisk & Sons, that they have succeeded in financing the company and that the capital stock of $21,000,000, of which $16,000,000 is 7 per cent. preferred, has all been subscribed for and allotted. The officers of the new company have not yet been announced, and the names of the incorporations and directors, made public at Albany, give no hint whatever as to the financial backers of the scheme.

So far, it is the expectation that the Hudson Companies will be only a construction company, the operating companies remaining as at present, the New York & New Jersey Company for the up-town tunnel, and the Hudson & Manhattan Company for the down-town tunnels, and the officers of these two companies will not be changed in the least by the appearance of the new company.

It is also announced that the Hudson Companies had secured a 500-year contract with the Pennsylvania Railroad Company for the transfer of its passengers from the Jersey City terminal of the road to this city through the tunnel to Cortlandt and Church streets, and thence by connection with the Subway at Dey Street, either to Brooklyn or up town, as the passenger may wish to go. The Hudson Companies has secured for the operating company the right to construct a terminal under the present Jersey City railroad station as its passenger and baggage room, and in return will give the Pennsylvania Railroad the use of the tunnel terminal in this city at Cortlandt Street as a down-town station.

From one source it is said that while details are not yet arranged, the Hudson Company expects to be able soon to announce that it has completed arrangements now pending by which it will connect from its Hoboken terminal, now building, by a spur track with the Delaware, Lackawana & Western Railroad on the north, and the Erie and the Central Railroad of New Jersey stations on the south, thus giving their passengers direct tunnel communications with this city over either the Christopher Street or the Cortlandt Street lines.

APPLEYARD PROPERTIES IN RECEIVERS' HANDS

Three of the Appleyard properties in Ohio have been placed in the hands of receivers. The companies are the Central Market Street Railway, the Columbus, London & Springfield Railway and the Dayton, Springfield & Urbana Railway. J. C. Schmidlapp, president of the Cincinnati Union Trust Company, Cincinnati, and Myron H. Wilson, treasurer of the Cleveland Trust Company, are the receivers. Preliminary to the application for receivers was the filing of suits against each of the roads and the entry of immediate judgment with the consent of representatives of the roads. The General Electric Company entered suit against the Columbus, London & Springfield for $5,982, and against the Central Market Street Railroad for $10,688, and Horace Power, an Eastern capitalist, brought suit against the Dayton, Springfield & Urbana for $10,140. The roads mentioned do not include all the so-called Appleyard properties in Ohio, although some of the other roads are under lease by these companies.

The Central Market Street Railway operates sixteen miles of city tracks in Columbus. It was built to provide entrance for interurban roads and it is now used by all the lines entering the city. The company has a capital stock issued of $1,250,000, and a bonded indebtedness of $500,000, and its earnings for the year ending April 30, 1904, were $51,582.

The Columbus, London & Springfield Railway operates 52 miles of interurban line between Columbus and Springfield. It has a capital stock of $2,500,000, bonded indebtedness of $1,500,000, and its earnings for the year ending April 30, 1904, were $157,200.

The Dayton, Springfield & Urbana Railway owns and operates 45 miles of interurban line between Dayton, Springfield and Urbana. It has a capital stock of $1,500,000, and bonded debt of $750,000. The company owns the capital stock of the Springfield & Western, $250,000, and guarantees the principal and interest on $155,000 of bonds and operates its 8 miles of track. It also leases and operates the Urbana, Bellefontaine & Northern Railway, 21 miles, guarantees principal and interest on its bonds, which amount to $500,000, and owns practically all the capital stock of the company, which amounts to $500,000. It also owns the capital stock of, and guarantees the principal and interest of the bonds of the Kenton & Southern Railway, which has not yet been built. The earnings of the entire property for the year ending April 30, 1904, were $231,145.

As originally laid out the Dayton, Springfield & Urbana was one of the best paying propositions in the Central West, but the saddling upon it of two new and weaker propositions depleted its surplus. Up to six months ago the road paid dividends on its preferred stock, but recently these were discontnued. An indignation meeting of stockholders, held two weeks ago, resulted from the action, and demand was made for an explanation.

The Columbus, London & Springfield Company ought to prove a very good property, as it is well built and connects two large cities with good territory between, besides being part of the through system from Columbus to Indianapolis.

According to Theodore Stebbins, general manager of the properties, the great trouble with all of these roads has been that their rates of fare have been too low for profit. On the interurban lines the passenger rates were based upon 1½ cents per mile, with 1¼ cents per mile for mileage books, and even lower rates for commuters. On the Central Market system, in Columbus, the company sells eight tickets for 25 cents, and also receives 2½ cents from each interurban passenger in and out of the city. Low fare advocates have claimed that short lines traversing the thickly populated sections of large cities could thrive on three-cent fare, but the claim does not seem to have been borne out in this case.

It has been known for a long time that the properties were in poor financial shape, and it is stated that the failures were due to large floating indebtedness rather than to excessive capitalization. The difficulty was undoubtedly precipitated by A. E. Appleyard's connection with recent bank failures in Boston and Buffalo.

It is stated that the receivers will arrange to secure funds sufficient to make some needed improvements, and it is understood that Theodore Stebbins will continue for the present in active charge of the properties.

As yet there is no intimation that the failure effects the Columbus, Grove City & Southwestern, the interurban line running south from Columbus, or the Dayton, Lebanon & Cincinnati, a steam road also controlled by Appleyard. A report from Zanesville states that at the recent annual meeting of stockholders of the Ohio River & Western Railway, another steam road purchased by Appleyard with a view to electrifying it, two sets of directors were elected; one representing Appleyard interests, and the other parties who formerly owned the road. It is claimed by the latter that Appleyard failed to pay for his stock, and that according to the terms of the contract his claim was forfeited Jan. 1.

The opinion is generally expressed in Ohio traction circles that the Appleyard properties will be taken over by some strong syndicate, as they occupy strategical positions in the much-talked-about through systems of Ohio and Indiana. It is known that recently Mr. Appleyard made a proposition to the so-called Elkins-Widener syndicate and that this proposition was turned down. It seems reasonable that if the properties are offered for sale the Philadelphia people would be interested in acquiring them.

HUDSON VALLEY RAILWAY COMPANY OBTAINS IMPORTANT DECISION FOR NEW YORK COMPANIES

A few years since the Hudson Valley Railway Company, at great expense, went through to the Court of Appeals on the question of the right of a street railway in New York State to force connection with steam railroads for the interchange of freight. The company eventually got a decision that unquestionably was a victory for every street railway in the State.

After enjoying for two or three years such benefits as naturally go with such connection, the Delaware & Hudson Company suddenly discovered that the decision of the highest court of the State, in the opinion of the legal department of that railroad, simply entitled the Hudson Valley Company connection without interchange of cars, and refused to deliver to the electric company cars from other roads consigned to the electric company's customers. The Delaware & Hudson Company also induced the Boston & Maine Railroad to take this position, and arbitrarily annulled such arrangements as had been entered into for the business, even declining to operate under contracts. The Hudson Valley Company took up the subject of its rights, not only to connection, but to such interchange of business, and on Jan. 3 obtained a favorable opinion by Justice John M. Kellogg, before whom the company proceeded, after having secured a temporary injunction. The company expects to carry this case through to the Court of Appeals, as it did the original subject of connection between electric and steam roads.

The decision is so lengthy as to preclude printing it in full here. The part of it that seems particularly pertinent is the review by Judge Kellogg of the action brought by a constituent company, going through to the Court of Appeals, which he says gives to a street railroad company the same right of connection as a steam railroad company, and says the court has not the right to force a physical connection that does not carry with it the right to interchange cars. Assuming if an interchange of cars is impracticable, or not to be had, then a physical connection cannot be required.

The Judge refers to the contention of the defendant in the case of the People ex rel, etc., as receiver of the Oneonta, etc., Railroad Company vs. the Delaware & Hudson Company, recently decided by the appellate division, as disposing of the question in suit. "In that case," he says, "the special term, without opinion, refused to compel the defendant by a mandamus to accept cars from the plaintiff road. The defendant in the appellate division contended that the decision of the court below was simply a denial of the remedy by mandamus. Upon the facts it appeared that the relator in that case was indebted to the defendant for similar services, was in the hands of a receiver and that its road was not suitable for freight traffic. There being no opinion, either at special term or in the appellate division, it is difficult to decide just what was determined in that case, and it is conceded by counsel on both sides that there are no other decisions in this State upon the question." "Therefore," he says, "it is fair to assume that the appellate division would not have decided that question without a statement of the reasons for such decision." He concludes: "Under all the circumstances it is fair to assume that the special term denied the writ in the Oneonta case as a matter of discretion, refusing the extraordinary remedy, and leaving the plaintiff to an equitable action to enforce its rights, and that the appellate division, viewing such decision as a matter of sound discretion, affirmed the order without opinion."

The lengthy review and argument made by Attorney Carr of cases similar to this in other states, notably Colorado and Kentucky, Judge Kellogg says, "furnish us but little aid. The question to be determined is, what are the rights under the New York statutes?"

It was suggested by the plaintiff's attorneys at the trial that the disposition of the action of one defendant should govern the other. Attorney Carr would not consent. The court has filed the following memorandum with reference to the Delaware & Hudson Company, defendant:

"The questions in this case, so far as they relate to receiving from or delivery to plaintiff's road of cars or freight, are disposed of by the decision in Hudson Valley Railway Company vs. The Boston & Maine Railroad Company at this term of court, and the injunction will cover the same points and also prevent a removal of the connection now existing at Lake George and Glens

Falls. The connections formerly existing as South Glens Falls and Saratoga were put in under special contract for the sole purpose of aiding the plaintiff in getting rails and material to be used in the construction of its road, and after such material was moved were to be removed whenever the plaintiff required. This court cannot prevent the removal or require the restoration of those connections in violation of the terms of the contract between the parties. This is not a proceeding to establish a physical connection. It may be that the temporary physical connection as established is at a place or is different in construction than the parties would require or desire for permanent use. If the order is not agreed upon it will be settled on ten days' notice."

THE RAPID TRANSIT WEEKLY

The "Rapid Transit Weekly" is the name of the new publication issued in the interests of several of the interurban electric railways in the vicinity of Chicago. It is a four-page sheet, newspaper size, and while the general make-up is similar to that of a daily, a better quality of paper is used, so that half-tones may be printed. The roads interested in the paper are the Aurora, Elgin & Chicago Railway Company, Elgin, Aurora & Southern Traction Company, and the Joliet, Plainfield & Aurora Railroad. Besides time tables, maps and views along the lines, the paper contains a summary of the amusements in Chicago for the current week, time tables of steam roads centering in Chicago, advertisements and miscellaneous matter. The publication office is at 126 Market Street, Chicago.

E. C. FOSTER RECEIVER OF NEW ORLEANS COMPANY

On application by Attorney-General Robert H. McCarter, as counsel representing the New York Security & Trust Company, United States District Court Judge William M. Lanning has re-appointed E. C. Foster, president of the New Orleans Railways Company, as receiver for that company. Mr. Foster had been appointed receiver by Judge Lanning, sitting in camera Saturday, Dec. 31, in anticipation of the company's default on Monday, Jan. 2, in the payment of interest on $2,500,000 mortgage bonds held by the Trust Company.

The appointment of Mr. Foster as receiver last Saturday was followed by the appointment by the United State District Court for the district of Louisiana, of Mr. Foster and Pearl Whyte, the latter being a large bondholder in the New Orleans Railways Company, as ancilliary receivers, and when the default in the payment of the interest due on Monday occurred, Mr. Foster was reappointed pursuant to foreclosure proceedings instituted by the New York Security & Trust Company.

The New Orleans Railways Company operates all the trolley lines in that city. The amount of interest in default is said to be $400,000.

ST. PETERSBURG TRACTION PROJECT

Murry A. Verner, of Pittsburg, Pa., returned on the North German Lloyd liner Kronprinz Wilhelm, Jan. 11, after a brief sojourn in St. Petersburg, where he went to confer with the authorities regarding the construction of a very extensive network of electric lines contemplated in and around the Muscovite capital.

When seen by a representative of the STREET RAILWAY JOURNAL, Mr. Verner was extremely reticent in giving information as to the possibility of his Pittsburg interests securing the contract for the building of the system which will involve an expenditure of some $20,000,000. He said that negotiations had got to such a pitch that it would be inpolitic to make any statement at the moment. Mr. Verner's visit to Russia was made at the special invitation of the St. Petersburg authorities.

The American syndicate of which Mr. Verner and Sellers McKee are the leading interests, has been after the St. Petersburg contract for fully two years past. While what is referred to in diplomatic circles as the sugar affair was at its height, there was an intense anti-American feeling in Russia and the municipal authorities of St. Petersburg refused to seriously consider the overtures of the syndicate regarding the electric traction project. Mr. Verner, however, took the matter up with the government and it was understood at the time that the Minister of the Interior would encourage the scheme. The Russian attitude toward Americans is at present, however, very friendly. The contract is expected to be fixed up within the next three months at latest.

The Russo-Japanese war will be no hindrance to the deal going through, as according to Mr. Verner the hostilities have affected St. Petersburg business interests little or none at all. As to the result of the war, Mr. Verner says, the utmost confidence is displayed by all classes that the Czar's forces will win in the long-run.

IMPORTANT TURN IN CHICAGO AFFAIRS

A special wire to the STREET RAILWAY JOURNAL from its Chicago office, on Wednesday, Jan. 11, at 11:15 a. m., announced the confirmation in Chicago by Mr. Govin of negotiations completed in New York which make possible the consolidation of the Union Traction Company and the Chicago City Railway Company. Messrs. J. P. Morgan & Company and H. B. Hollins & Company, of New York, and Marshall Field, John J. Mitchell and the Armour interests, of Chicago, have secured control of both properties, but actual consolidation is dependent on franchise matters. Details will, of course, all be decided later. Another announcement of interest is that the contest between the Union Traction Company and the underlying companies was compromised peacefully at the annual meeting on Tuesday.

In December Messrs. Hollis & Company sent to the stockholders of the North and West Chicago Companies a lengthy circular in which the statement was made that their holdings in these companies were so large that they would not be entrusted to any but the most experienced and able guardianship, and that they were prepared to enter upon the reconstruction of the properties. Accompanying the circular was a letter from Alfred Skitt, formerly of the Manhattan Elevated Railway, of New York, giving in brief his views concerning the Chicago traction properties and the situation in that city. In this letter, Mr. Skitt, who made a thorough study of the situation, says there is a bright future for the properties under just such arrangement as it now seems likely will be carried out.

THE STREET RAILWAYS OF NEW YORK IN 1904

A summary has just been issued of the reports made to the Railroad Commissioners of New York by the steam railroads and the street railway companies of the State. At this time there will be appended merely a few comparative totals, the plan being to publish an extended extract of the pamphlet in next week's issue.

The board reports the cost of street railway equipment for the year at $470,668,920, a gain of $16,000,000 over 1903. Net earnings from operation were $20,567,122 in 1904, and $20,715,127 in 1903. These roads still have in their equipment 4443 horses, but the number shows a decrease of over 600 since 1903. The report contains the following comparison:

	1903.	1904.
Number of passengers carried, including transfers	1,267,563,057	1,341,766,931
Number of transfers	305,548,230	312,860,257
Tons of freight carried	514,460	633,674
Passenger car mileage	192,583,102	199,767,097
Freight and express mileage	724,950	1,097,498
Mail car mileage	214,698	219,790

During the year 193 persons were killed on street surface roads and 878 injured.

A NEW SURFACE COMPANY TO BUILD IN NEW YORK

The New York City Interborough Railway Company, whose right to build surface street railway lines in Bronx Borough, New York, has been upheld by the Appellate Division of the Supreme Court, is to be operated in harmony with the Interborough Rapid Transit Company, controlling the subway and the elevated lines in New York. This announcement was made last week, after the election to the directorate of the New York City Interborough Company of W. G. Oakman, Andrew Freedman, George W. Young, Alfred Skitt and Walter Luttgen, all directors of the Interborough Rapid Transit Company. The other directors of the Interborough Railway Company are Robert C. Wood, Cornelius Vanderbilt, W. J. Fransioli and Arthur Turnbull.

In a statement to the public the Interborough Railway Company says its intention is to build a line from the One Hundred and Eighty-First Street station of the subway in Manhattan accross the Washington Bridge to Bronx Park, and also its other lines, five in number, this to be done as soon as a few minor legal details are adjusted. The definite statement is made that traffic arrangement has been made with the Interborough Rapid Transit Company whereby passengers will be carried over both systems for a reduced fare. The rate of this fare is not given, but it is generally assumed to be on the basis of eight cents for a transfer from one system to the other. The new company will become a competitor of the New York City Railway Company, which operates in the Bronx through its subsidiary the Union Railway Company.

APPOINTMENT OF COMMITTEE ON AN INTERNATIONAL FORM OF ACCOUNTING

President W. G. Ross, of the Street Railway Accountants' Association of America, has appointed a committee to take up the subject of an international form of street railway accounting. It will be remembered that in his presidential address at St. Louis, ex-President F. E. Smith, of the Accountants' Association, called attention to the fact that there are several different methods of street railway accounting in use abroad, and that these systems differed radically from that employed in this country. He recommended that a committee be appointed to take up the subject of a standard form of street railway accounting with the British and Continental street railway organizations, and others interested. It was his hope that a form could be adopted which would be international, and which would enable investors in street railway properties, no matter where situated, to compare the results of operations of companies in which they might be interested. The committee which will take up this subject for the Street Railway Accountants' Association of America, consists of W. G. Ross, of Montreal; C. Nesbitt Duffy, of Chicago, and W. B. Brockway, of New York.

ANNUAL MEETINGS OF THE OHIO INTERURBAN RAILWAY ASSOCIATION AND OF THE NEW ENGLAND STREET RAILWAY CLUB

The annual meetings of the Ohio Interurban Railway Association and of the New England Street Railway Club are to be held on Jan. 26, the former at the Algonquin Hotel, in Dayton, and the latter at the Hotel Brunswick, in Boston. The meeting of the New England Street Railway Club will commence with a business session, which will be held at 3 o'clock, and at which the officers for the ensuing year will be elected. The annual banquet will be held at 7 p. m., with a reception at 6:30; the charge for tickets is $2.50, and members are requested to make prompt application if they desire to secure seats in the main dining-room.

The meeting of the Ohio Interurban Railway Association will convene at 5 p. m.

NEW YORK, WESTCHESTER & BOSTON PERFECTING ORGANIZATION

The New York, Westchester & Boston Railway Company, which plans to build an electric railway from New York to White Plains and the Connecticut State line at Port Chester, is perfecting its organization. Last week the company announced that it had secured the services of William Barclay Parsons as chief consulting engineer, and that William A. Pratt will be retained as chief engineer of the company for a period of at least two years. The company informs the STREET RAILWAY JOURNAL that at the annual meeting, to be held shortly, a full board of directors will be elected. William L. Bull, senior member of Edward Sweet & Company, will continue as president of the company, and Samuel Hunt, who is connected officially with several roads in the West, will continue as vice-president. Mr. Hunt will have entire charge of the building of the line.

Mr. Parsons, who has been retained by the company as its chief consulting engineer, was chief engineer of the New York Rapid Transit Commission during the building of the subway and now acts as consulting engineer to the commission. All plans and material used by the Westchester Company will first have the approval of Mr. Parsons. The franchise of the company calls for the construction of a road practically similar in equipment to the present subway system of New York, and it is believed by the financial interests connected with the Westchester enterprise that Mr. Parsons' experience in building the subway, coupled with his executive and engineering ability, will make his services of inestimable value to the company, as well as insure the construction of the most improved type of railroad.

Mr. Pratt, who has been retained for a period of at least two years as chief engineer of the company, has just resigned as chief engineer of the Staten Island Rapid Transit Railroad Company, which is part of the Baltimore & Ohio Railroad system. He has had more than twenty-five years experience in the location, construction and maintenance of railroads, principally in the service of the Baltimore & Ohio and the Chesapeake & Ohio Railroads. He was for a number of years civil engineer of the Philadelphia division of the Baltimore & Ohio. Mr. Pratt and the staff that will work under him have just established themselves in offices at 30 Broad Street, New York, and will actively proceed with the completion of the work now necessary so that construction may begin as soon as the weather will permit. In the meantime, the company's right of way for a considerable portion of its route will have been purchased.

John Bogart, formerly State engineer, who, as engineer for the company, had mainly to do, up to the present time, with the preparation of its plans, will continue as a consulting engineer of the Westchester Company.

OTTAWA VOTES NOT TO BUY STREET RAILWAY

There was referendum at the municipal election in Ottawa, Ont., last week, on the question of the purchase by the city of the property of the Ottawa Electric Railway Company. The proposition was voted down. A price of $250 a share was placed by the company on its stock.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED DEC. 27, 1904

778,256. Electric Railway; Joseph Dela Mar, New York, N. Y. App. filed March 8, 1904. A protecting housing for the third rail, the roof of which is the contact surface for the car shoe, being sectional and connected with the rail by sliding bars actuated successively by the car.

778,356. Railway Signal; Frank L. Fuller and Charles S. Banghart, New York, N. Y. App. filed March 21, 1904. The car on entering a block runs over an insulated section of the rails and the signal is then closed through the car wheels and axles, the current used being entirely independent of the propelling current.

778,376. Trolley Harp and Guard; Stephen G. Reynolds, Easton, Pa. App. filed June 29, 1903. A trolley guard comprising a generally U-shaped yoke in the opposite inner faces of the trolley-harp and having its free ends bent inwardly and rearwardly to overlie the groove in the trolley wheel.

778,520. Trolley; John S. Weckman, Carnegie, Pa. App. filed Sept. 22, 1904. Details.

778,643. Controller; John P. Durkin, Philadelphia, Pa. App. filed Oct. 15, 1904. An automatic catch on the controller handle strikes a stop at each position of the handle, requiring slight backward movement of the handle to release the catch before it can be moved forward.

778,655. Crossing for Street Railways; Henry M. Gleason, Philadelphia, Pa. App. filed April 30, 1904. A pivoted oscillating grooved member between the ends of abutting transverse rails and automatic means operated by the wheel of the approaching car for shifting said grooved member so that the groove shall be in alignment with the grooves of the abutting rails in the direction of the travel of the car.

778,706. Metallic Street Car; Frederick H. Rapley, New York, N. Y. App. filed Dec. 26, 1903. Details of construction.

778,729. Brake Operated Signal or Tail Light; Samuel N. Wilcoxson, Collingwood, Ohio. App. filed June 7, 1904. A circuit closer is attached to the brake rigging of a car so that when the brakes are applied a tail lamp will be lighted.

778,806. Street Railway Switch Mover; Samuel C. Smith, Philadelphia, Pa. App. filed March 21, 1904. Relates to means for throwing the switch from a moving car.

778,832. Electric Traction; Henry B. Greenwood, Buenos-Aires, Argentina. App. filed July 16, 1904. A tube containing sheet metal links rests upon the main conductor, the links being successively lifted by a magnet carried by the car into contact with the top of the tube, so that the car may take current therefrom.

UNITED STATES PATENTS ISSUED JAN. 3, 1905

778,987. Trolley; William W. Mercer, Norfolk, Va. App. filed May 28, 1904. Details.

778,933. Trolley Catcher and Retriever; Charles F. Wilson, New York, N. Y. App. filed Aug. 19, 1903. A spring-drum and ratchet device for controlling the trolley.

779,150. Third Rail System; Giosue D'Esposito, Pittsburg, Pa. App. filed March 12, 1904. Relates to the mounting of the third rail and guard therefor.

779,199. Motor Controller; Charles E. Parry, Schenectady, N. Y. App. filed Sept. 24, 1903. By the initial movement of the controller handle the motorman can either throw the motors first into series or into parallel depending upon the conditions under which the train is to be started.

779,204. Electric Railway System; George L. Campbell, Nyack, N. Y. App. filed Oct. 11, 1902. Switch boxes in the road bed provided with covers built up of magnetic and non-magnetic laminations to thereby increase the effective pull of the magnet on the car, upon the switch-operating armature in the box.

779,213. Car Fender; George A. Fullipp and Charles Huszka, East McKeesport, Pa. App. filed July 20, 1904. Details of construction.

779,390. Signaling for Railways; William S. Berry, Pittsburg, Pa. App. filed May 25, 1903. In systems where the signal mechanism is operated by the trolley current, the automatic interposition of resistance protects the signal magnets against variations in the current.

779,401. Trolley Pole Controller; Arthur W. Harrison and Eugene H. Fostick, Los Angeles, Cal. App. filed June 2, 1904. The trolley base contains an air chamber and carries a solenoid by which the pole can be drawn downward and its motion controlled.

PERSONAL MENTION

MR. FRANCIS G. GILL, claim agent and adjuster of the street railway department of the Public Service Corporation of N. J., is dead, aged fifty-two years.

MR. ERNEST F. LEAMED, of Boston, has gone to Minneapolis in connection with power developments in the vicinity of the Twin Cities in which Stone & Webster are interested.

MR. LOUIS H. HAYNES has resigned as electrical engineer of the Boston Suburban Electric Companies to accept a position on the engineering staff of the New York, New Haven & Hartford Railroad.

MR. C. E. WARWICK has been appointed chief inspector of the Galveston City Railway Company to succeed Mr. Edward L. Lawson, who has become connected with the Fort Worth-Dallas Interurban Company.

MR. RUSSELL ROBB has been admitted into the partnership of Stone & Webster, of Boston. Mr. Robb is a graduate of the Massachusetts Institute of Technology in the class of 1888, and has been connected with Stone & Webster since 1892.

MR. ANTHONY J. BEMIS, formerly resident manager of the Brockton & Plymouth Street Railway at Plymouth, Mass., is now manager of the Cape Breton Electric Company, Ltd., at Snyder, C. B. Both of these properties are controlled by Stone & Webster, of Boston.

MR. B. J. ARNOLD has been retained as consulting engineer by the city of Chicago to make an exhaustive study and report on the possibility of deadening noise on the Union Loop in that city, and also on the practicability of the through routing of cars on the elevated lines.

MR. MILES LEWIS PECK has been elected president of the Bristol & Plainville Tramway Company, of Bristol, Conn., to succeed Mr. Charles S. Treadway, resigned. Mr. Peck has been treasurer of the Bristol Savings Bank since 1872, and is prominent in local affairs in that city.

MR. G. G. ROSE, of New Castle, Pa., has been appointed general freight and passenger agent of the Pennsylvania & Mahoning Valley Railway Company, succeeding the late Mr. Fred Carpenter, who was killed by accident a short time ago. Mr. Rose has been with the company some time.

MR. J. G. BANKAT, master mechanic of the Schenectady Railway Company, will act as chief engineer of the company in the future. Mr. C. C. Lewis, who resigned from that position, has, as previously mentioned in the Street Railway Journal, entered the employ of J. G. White & Company, Ltd., for whom he will superintend the electrification of the tramway system at Montevideo, Uruguay.

MR. NORMAN BERRY has just been appointed general manager of the Huntsville Railway, Light & Power Company, which operates the street railway system, and supplies the electric lighting in Huntsville, Ala. Mr. Berry has just returned from Soa Paulo, Brazil, where, for the past three and a half years he has been superintendent of car repairs of the electric railway system in that city.

MR. P. E. MITCHELL, who for several months past has been superintendent of the Knoxville Electric Light & Power Company, has been appointed to the position of general superintendent of the Knoxville Traction Company to succeed W. G. Woolfolk, who has become general superintendent of the Philadelphia & West Chester Traction Company. Mr. Mitchell will continue to act as superintendent of the Light & Power Company.

MR. WILLIAM BARCLAY PARSONS, consulting engineer to the New York Rapid Transit Commission, chief consulting engineer of the New York, Westchester & Boston Railway, and a member of the Panama Canal Commission, is expected to sail for the Isthmus next week to make an examination in behalf of the Government of the work that has been done by the engineers on the final surveys for presentation to the authorities at Washington.

MR. E. D. LEAVITT, of Cambridge, Mass., was presented with a handsome silver service on Jan. 2, by thirty-eight men who have been in his employ within the last thirty years, in appreciation of the sound engineering training given by him. Mr. Leavitt is well known to the engineering profession as consulting engineer of the Calumet & Hecla Mining Company, the Manhattan Elevated, the Metropolitan Water Board and other clients, and this tribute will be generally appreciated as a fitting recognition of his personal inspiration to his employees.

MR. C. E. D'ORNELLAS, of the French Thomson-Houston Company, of Paris, is spending a few months in this country. He is on a trip of inspection to study the latest developments in electrical engineering, but is devoting the greater part of his time to traction matters, particularly interurban roads and subways. He expects to return to France during February. Mr. d'Ornellas is a brother of Mr. T. V. d'Ornellas, whose appointment as electrical engineer of the Peruvian Government was mentioned in the Street Railway Journal for Dec. 31.

MR. JOHN P. COONAN, former superintendent of the Montoursville Passenger Railway Company and the Montoursville Electric Light Company, died at Montoursville Dec. 25, 1904, at the age of thirty-two years. Mr. Coonan began his railroad career with the Conestoga Traction Company, of Lancaster, Pa., in 1892, as conductor, and then took the position of general repair man. Leaving that company in 1898, he went to Montoursville as electrician. In 1901 he was appointed superintendent of the company, which position he held until his death.

MR. SOLOMON LE FEVRE DEYO, chief engineer of the Interborough Rapid Transit Company, operating the subway and elevated lines in New York, was the guest of honor at a banquet given by about 150 members of the engineering staff of the company to celebrate the completion of the engineering work on the subway. Practically all the officials of the company were present. As a token of appreciation there was presented to Mr. Deyo as coming from his associates a five-gallon silver punch-bowl, gold lined and suitably embellished. Mrs. Deyo and a number of the wives of members of the party participated in the dinner.

MR. W. B. GRIMSHAW has resigned as general freight agent of the Trenton, Lawrenceville & Princeton Railroad, the Yardley, Morrisville & Trenton and the Newtown & Yardley Street Railways, all controlled by the New Jersey & Pennsylvania Traction Company, of Trenton, N. J., and is succeeded by Mr. J. O. B. West, who has served the company in various capacities. Mr. Grimshaw built up an entirely new business on the Yardley and Newton lines. He was formerly general freight agent of the West Chester, Kennett & Wilmington Street Railway, operating between Kennett Square, Pa., and Brandywine Springs, Del. The Trenton, Lawrenceville & Princeton Railroad is the only electric railway operating under a steam charter in New Jersey that does a freight and express business. Mr. West, the new freight agent, is well acquainted in Trenton and along the respective lines.

MR. CHARLES N. BLACK, chief engineer of the Metropolitan Street Railway Company, of Kansas City, Mo., has been appointed general manager of the company, and hereafter will act in the dual capacities of chief engineer and general manager. Mr. Black will thus be responsible for the operation of the entire system, succeeding in these labors Mr. Bernard Corrigan, who heretofore has acted as president and general manager of the company. Aside from this change, the personnel of the company will remain unchanged. Mr. Satterlee will continue as assistant general manager and claim agent, and Mr. J. W. Carter will continue as general superintendent. The selection of Mr. Black to assume the new duties is an expression of appreciation of service that began with the reconstruction of the Metropolitan system and really made that reconstruction the success it has proved. Mr. Black came to Kansas City as chief engineer to Ford, Bacon & Davis, to whom was entrusted the work of rebuilding the system. In this capacity he was responsible for all the work done by the company, and when in September, 1903, this work was finished, he was induced by the Metropolitan Company to become chief engineer of the system. Mr. Black is by profession an electrical engineer. Princeton is his alma mater. In 1888 he was graduated from the regular course with the degree A. B. For the next two years he studied under Professor Brackett and secured the degree of E. E. Then began Mr. Black's commercial career. He was subsequently connected with the Brush Electric Company, the Short Electric Railway Company, the Walker Company and others.

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Do Electric Roads Pay?

The recent failure of two or three associated interurban lines in Ohio and certain remarks in the annual report of the Massachusetts Board of Railroad Commissioners, which is published in abstract in this issue, have led to a number of pessimistic utterances in the daily press and elsewhere as to the financial condition of electric railway companies. The Ohio event is generally recognized as being due to local conditions, but the broad statements made by the Massachusetts Commission have naturally attracted much wider attention, and, we are sorry to say, have been given more consideration than the actual facts properly deserve. Broadly recited, the charges are as follows: That of seventy-four operating companies, thirty failed to earn expenses and fixed charges, twenty-five companies paid dividends, of which number only fourteen earned them during the year, while five companies were actually in the hands of receivers. In addition, it was stated that very few roads made proper provision for depreciation, and that very many were virtually living from hand to mouth. Now, if these accusations are to be taken strictly at their face value, they would imply that the electric railways of Massachusetts are in a very bad way indeed and that the business is a very precarious one. The bare facts as stated can probably be substantiated, since the commissioners have access to the figures, but that they mean what many interpreters of this report would have us understand by them, we beg leave to doubt. To begin with, last year was conspicuously a lean year in the street railway business, owing to very unusually heavy expenses during the winter and light receipts during the summer. Some roads suffered more than others, but the difference from the average of a series of years was in many cases quite enough to make many a conservative board of directors think twice before declaring a dividend. The mere cost of removing snow, to which we alluded in a recent editorial, was abnormal enough to cause serious loss, and the cool summer was equally bad.

The commissioners state further in their report that in previous years many electric railways were recklessly built in a spasm of frantic promotion, and they are now paying the penalty of their temerity, and that roads were constructed which did not meet any public necessity, and upon which the receipts fell off as soon as the novelty wore away. Looking forward, they see either one of the following results: (a) the acceptance of an unsatisfactory service as better than nothing; (b) an increase of fares; or (c) abandonment of the railway. As regards the first count, nobody knows better than street railway men that an unsatisfactory service is the road to ruin. In some cases railways have, in overmuch enthusiasm, started out in interurban work at unremunerative rates of fare, which should be corrected whenever possible, which is rather seldom, for three nickels beat a dime, and when fares go up traffic usually goes down. Nevertheless, it is a cause of congratulation that this important subject is to be taken up by the Massachusetts Board, and if a satisfactory conclusion can be worked out in any particular case, we believe that such a result will be reached by this body. Finally, it is quite clear that no road is going to be abandoned. Some may fail and be sold out at a price that will enable the new owner to make them pay, but that is their misfortune, and in such case the service will often be improved.

In our opinion, the conditions described, when combined with the weather and temperature of the past twelve months, form a sufficient explanation for the Massachusetts situation. We do not believe that the street railway business in that State, or anywhere else for that matter, is half so bad as the statistics for the past year, when judged by themselves, would imply. There are occasionally roads which have been unwisely built, improperly capitalized and injudiciously administered. Let the

Massachusetts Commissioners, as well as those in other States, give such roads a helping hand if they can, and let them work out their own salvation. If the companies have to reorganize, let them do their own financiering as seems necessary. A good year ahead will help out many a struggling road and lighten the burden imposed last year. Certain it is that roads will not be abandoned, and more will be built every year in response to genuine needs. We are keenly alive to the mischief that over-capitalization and over-promotion have done in the past, and have steadily raised a warning voice against it. But both bring their own punishment, and at worst lead to reorganization on a more conservative basis and more caution in the future. Broadly, however, electric roads have been made to pay, even in some very unpromising places, and we believe that those in Massachusetts will prove to be no exception to the rule. Here's hoping for bigger receipts in the new year!

The Indiana Electric Railway Association

The Indiana Electric Railway Association, which held its first regular convention last week, might have followed the example of its sister association in Ohio and chosen the name "Interurban Railway Association," so large a percentage of the mileage in Indana is interurban. Indiana men are feeling strongly the necessity of frequent gatherings for the next year or two for the purpose of settling many questions pertaining to interchange of traffic and traffic agreements. It was proposed at one time to unite the associations of Indiana and Ohio, so closely are the two States being joined by their interurban connections; nevertheless, we think the decision to keep the two State's associations separate for the present is a wise one as long as such frequent meetings as once a month are proposed. The larger an association and the less acquainted its members are with each other, the less is the freedom of discussion, and there will be less formality about the State association meetings than there would be in a bi-State association meeting. The questions brought up at the first meeting of the Indiana Association, as can be seen by the report and by editorial discussion elsewhere, were mainly engineering subjects, but it is probable that questions of policy and traffic will take an equal, if not greater, share of the association's time in the future. The facility with which the recent Indiana convention drifted into the discussion of questions of policy and traffic, and the number of questions raised by such discussion, show how necessary it is to thrash out some of these things among interurban companies. As was fitting, the Indiana Association held its first meeting in the magnificent new interurban terminal station, of which Indianapolis can well be proud. This station, which is by far the most important of its kind in the country, is one of the strongest testimonials with which we are acquainted to the importance of the interurban electric railway to the world of to-day. The association's membership is distributed well among men of all departments of the Indiana companies. The election of Charles L. Henry to the presidency of this association was a fitting recognition of the important part Mr. Henry has played in the interurban railway development of this distinctly interurban railway State, Mr. Henry having been the organizer of the Union Traction Company of Indiana, which was, and (with its recent additions) still is, the largest interurban railway company in the country, and being now engaged in another important interurban railway enterprise, the Indianapolis & Cincinnati Traction Company, the new single-phase railway, whose important work is referred to on the opposite page.

The Preservation of Ties

In his paper before the Indiana Electric Railway Association last week, Thomas B. McMath, civil engineer of the Indianapolis Traction & Terminal Company, considers the subject from two standpoints, as shown by his paper which is published elsewhere in this issue. He considers first the possibility of increasing the life of timber ties by the creosoting process, and second, concrete beam construction, which partly does away with timber ties. Although creosoted ties have not been used to any great extent in street railway track construction, the increasing cost of timber is causing us to draw nearer and nearer to the time when processes for increasing the life of timber will be of more value. According to the case as made out by Mr. McMath, we are now about at the point where the use of creosoted timber is commercially feasible and advisable. Mr. McMath's remarks about concrete stringer construction are especially interesting because of his experience with concrete stringer construction in Indianapolis, where track construction of this kind was employed several years ago. This method was abandoned later, but is now being taken up again, and some of the streets approaching the new Interurban Terminal Building have had construction of this kind laid in them. The peculiarity of the latest concrete stringer construction, described in Mr. McMath's paper, is that the track is held down by anchor bolts and plates imbedded in concrete, with the idea of preventing the springing up of the rails, which seems to have been troublesome in previous concrete stringer work.

Railway Power Statistics in Indiana

The paper giving statistics on the cost of electric railway power production and transmission in the State of Indiana, as presented to the convention of the Indiana Electric Railway Association last week, is conceded by all who have read it to be a valuable contribution to our knowledge of power production, because it includes so great a per cent of the electric railway mileage of that State and because of the intelligent analysis Mr. Richey has given to the matter. There are several rather startling things about the figures Mr. Richey presents. Perhaps the most striking is that he should have been able to get figures on the cost of power from 85 per cent of the electric railway mileage in the State. This indicates that Indiana railway managers are wide awake on the power subject, and that there is not the ignorance on this subject which prevailed in some quarters, and which was the regular thing a few years ago. Another interesting feature is the statement that but 20 per cent of the railway power generated in the State outside of the city of Indianapolis is represented by the output of direct-current generators. This shows how large a percentage of the electric railway power of the State is supplied to interurban lines covering considerable territory and calling for alternating-current transmission. Another surprise is the low average cost of power at the power station bus-bars for the stations reporting—i. e., about ¾ cent per kw-hour. This low figure, however, is accounted for by the fact that two-thirds of the electric railway power of the State is generated in two large and economical power stations, namely, that of the Indiana Union Traction Company, at Anderson, and that of the Indianapolis Traction & Terminal Company, supplying all the city lines in Indianapolis. Even eliminating these large power stations, however, and taking the uneconomical balance, the cost of power on the remaining roads is rather lower than the majority of electric railway engineers would have surmised, being a trifle over 1 cent per kw-hour. These, however, are only a few of the interesting figures given in Mr. Richey's analysis, which is worth study, as it is a good indication of what is actually being done in the way of economical power generation for electric railways to-day. Coal is comparatively cheap in Indiana, but with the aid of the other figures given by Mr. Richey, any engineer can figure the probable effect of variations in price of fuel. The cost of labor reported is exceedingly low, even for the station reporting the highest cost, namely, .331 cent. This would indicate that all of the stations reporting must have been of fairly good size, and also that electric railways generally have reached sizes of units and sizes of stations which do not leave much room for cutting down labor cost. This fact was also indicated by figures from the Boston railway power stations, upon which we commented in our issue of Sept. 10, 1904.

Other Important Events in Indiana

A number of other things are happening in Indiana these days which make it a center of interest for electric railway men all over the country. Of most general and national interest probably is the starting of the Indianapolis & Cincinnati Traction Company's line, equipped with single-phase alternating-current motors. This will be the first road to try out the Westinghouse single-phase alternating-current railway motor on a large scale in every-day service. It is an important road aside from the fact that it is equipped with single-phase motors, and this fact adds still more to the interest attaching to its use of single-phase motors. Another event of great local importance to electric railway men of Indiana and the neighboring States was the inauguration of a limited parlor buffet car service between Indianapolis, Ind., and Dayton, Ohio, to be known as the "Interstate Limited."

The Indianapolis & Cincinnati Traction Company's single-phase road is now operated in the city of Rushville, and by the time this paper reaches its readers will very likely have in commercial service several miles of interurban line. Besides the question of the performance of the single-phase railway motor, various problems in high-tension trolley conductors will be thrashed out on this road. The voltage of the trolley wire being 3300, the engineers of this undertaking have taken great pains to prevent any accidents from the breaking of the high-tension trolley. The catenary form of construction has been adopted. The trolley wire is supported from the catenary every 10 ft., so that should the trolley wire break the loose end could not reach the ground or be within reach of a person standing on the ground. The catenary construction, of course, makes possible the use of a center-bearing high-tension insulator. There has been plenty of opportunity for the exercise of ingenuity in working out plans for this radically new type of overhead trolley construction. Then there is another new feature, the bow trolley, which is to be tried for the first time in this country on high-speed interurban work. It is agreed by most engineers that given the possibility of using a single-phase alternating-current supply at high tension, the next logical step is the use of some form of trolley which will give no trouble from leaving the wires at high speed, and which should have sufficient contact area for the comparatively small current required at high voltages. The wear will probably be great on the bow form of trolley at high speeds, and the pressure in order to keep this wear within reasonable bounds must be light. It is not expected that a successful form of bow trolley will be evolved without considerable experiment, but as one engineer remarked, there is plenty of opportunity to beat the present average trolley wheel on heavy high-speed service. Taken altogether, the work on this Indianapolis & Cincinnati line is of great importance to the interurban electric railway work of the future, and justifies the interest manifested in it all over the country, although, to be sure, with the large number of contracts for single-phase alternating-current motor equipments now under way, the Indianapolis & Cincinnati line will not long have the distinction of being the only purely single-phase electric railway in regular service in the country.

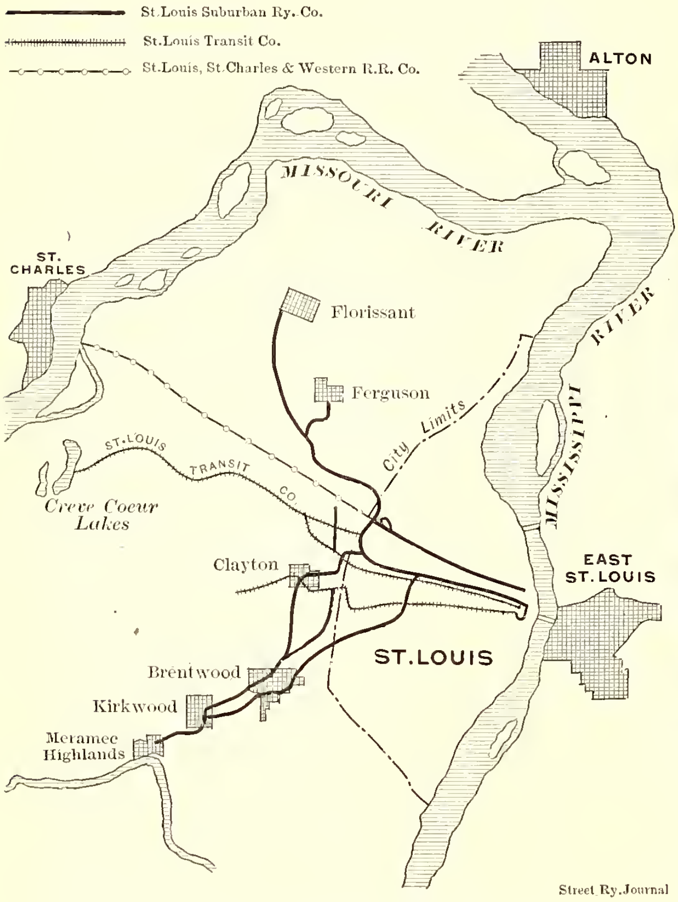
The "Interstate Limited," operating from the center of one State well over into an adjoining State, giving parlor buffet car service, is the first installation of this extent attempted by interurban roads, although shorter "limited" runs are being made, and may in future years be regarded as an event of considerable historical importance. Interurban railway companies have heretofore generally followed the practice of keeping their own cars on their own tracks, although on the route over which the "Interstate Limited" is to operate through car arrangements have been in vogue for some time for certain portions of the route. The "limited" feature of this service has been fairly well tried out and found profitable on other interurban lines. The buffet car service is an experiment, but there are many good reasons for thinking that it will prove profitable. The fact that these three companies have been able to agree on a traffic arrangement for through cars is encouraging, and shows that interurban managers are gradually realizing the point for which we have been contending for some time as to the increasing necessity of through traffic arrangements, or at least through connections at terminal points. Further particulars of this and other limited services will be found in an early issue.

Curves at the Foot of Grades

One of the most exasperating things in the layout of an interurban road is frequently the apparent necessity of locating sharp curves at the foot of long grades. Perhaps we should not say that this is necessary, because, with a sufficient expenditure, curves so located can frequently be eliminated and the curvature placed at some other less undesirable point. It nevertheless can be taken as an indication of the eternal "cussedness" of things that usually the very place it is hardest to avoid sharp curves is near the foot of long grades. The engineer of a company that is building an interurban line to operate rather than to sell, and who has in mind an investment which will not be endangered by the accidents which are sure to occur at some time where sharp curves are located at the bottom of grades, will use every possible means to avoid such curves. Where a curve is not a "blind curve"—that is, where the motormen coming from each direction can see a long distance beyond the curve—the curve adds practically no element of danger unless it is of such short radius that it cannot be taken at the speed likely to be attained by a car going down grade. Of course, there are locations which can truly be called mountain conditions, where grades and curves are the regular thing and where car speeds are correspondingly slow. On such roads sharp curves are not as dangerous as on the prairie roads, which occasionally take a dip into a river or creek bottom, with bluffs and cuts to shut off the view around curves. On the prairie road, high speed is the regular rule, and motormen being used to high-speed running, are less likely to run slow at dangerous points.

THE ST. LOUIS & SUBURBAN RAILWAY AND WORLD'S FAIR TRAFFIC

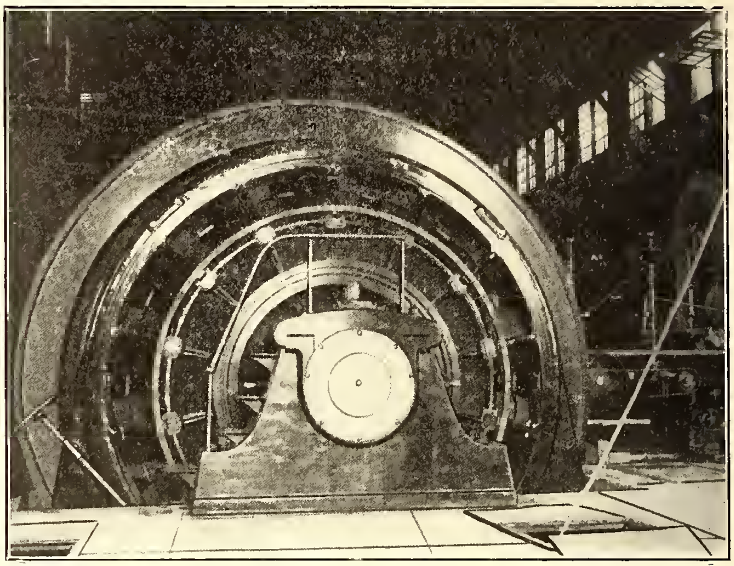
One of the important factors in the local transportation problem at the Louisiana Purchase Exposition the past season was the St. Louis & Suburban Railway. Although this company operates approximately only about one-tenth as many cars as the St. Louis Transit Company, it is a road which had much to do with transportation to and from the Exposition because of its location. A considerable proportion of the track is over a private right of way, which is due to the fact that part of it was originally a steam railroad operating west from the neighborhood of Vandeventer Avenue to Florissant. The downtown end of the line, which enters the business part of the city on Locust Street, was the first cable road to be constructed in St. Louis. The entire line was eventually changed to electric traction.



MAP OF SUBURBAN ELECTRIC LINES, ST. LOUIS

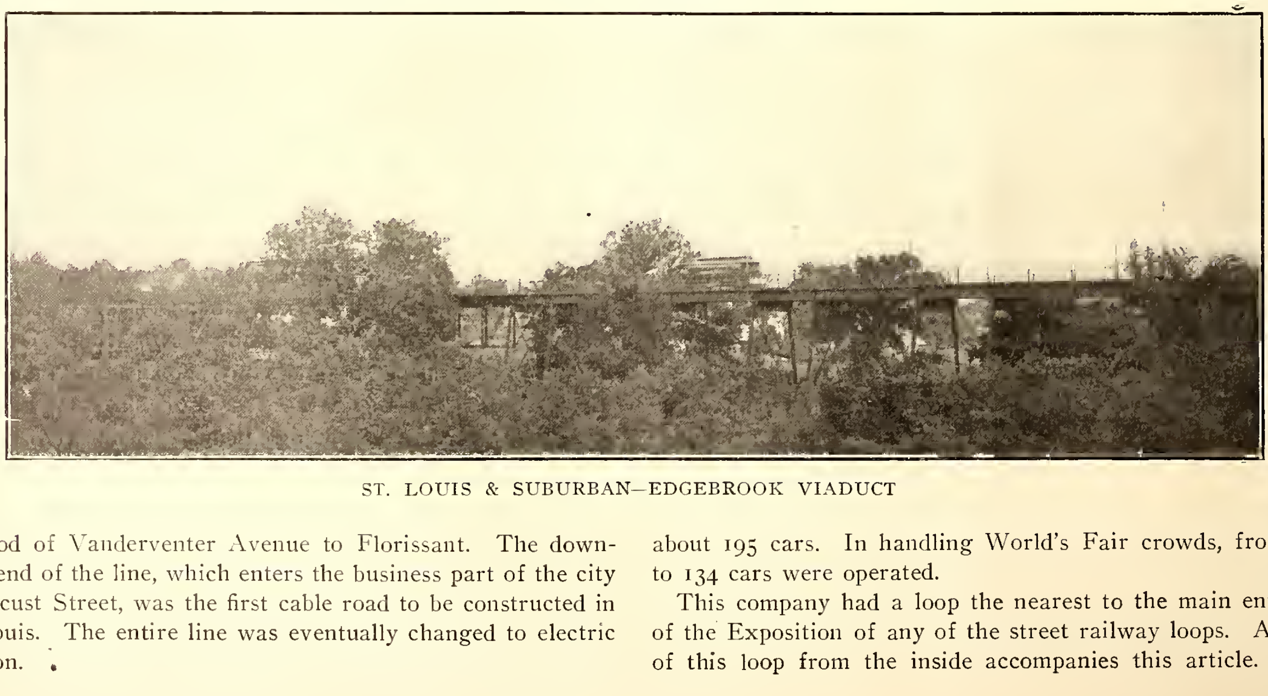
An opportunity is afforded, now that the Exposition has closed for some months, of reviewing the status of this line, which afforded the most direct route to the Fair grounds from certain sections of the city. During the Exposition so much attention was given to the Fair and to the larger system of the St. Louis Transit Company that little or nothing was printed of the system of the St. Louis & Suburban Railway Company.

One of the accompanying engravings shows a typical view along the company's private right of way. Heavy standard T-rails are used and the track is rock ballasted. Stopping platforms are placed at every street intersection. Operation over this private right of way being free from the dirt, dust and interruptions of a street, the highest class of service could be given consistent with stops on signal every block. The accompanying map shows all of the suburban lines radiating from St. Louis, and it will be noticed that the greater part of the mileage outside of the city limits is controlled by the St. Louis & Suburban Railway Company. The company maintained two loops at the World's Fair grounds, one at the Lindell or main entrance and one at the Skinker Road entrance. Cars were operated from the downtown loop to these two loops in addition to giving regular service over the suburban lines to Ferguson, Florissant and Meramec Highlands. The company owns about 195 cars. In handling World's Fair crowds, from 100 to 134 cars were operated.

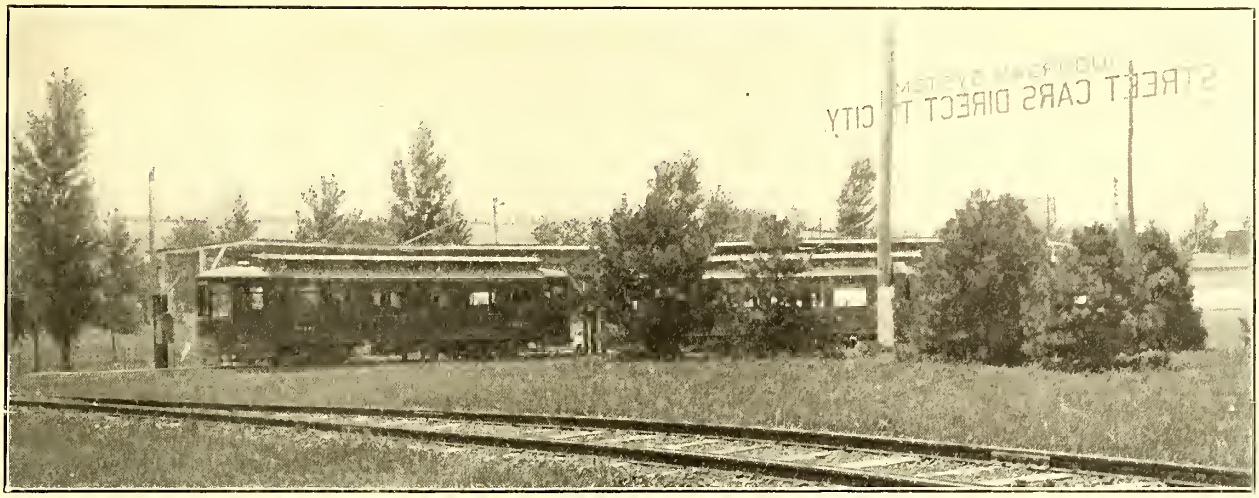


ONE OF THE NEW ALLIS-CHALMERS UNITS IN THE SUBURBAN POWER STATION

This company had a loop the nearest to the main entrance of the Exposition of any of the street railway loops. A view of this loop from the inside accompanies this article. This



ST. LOUIS & SUBURBAN—EDGEBROOK VIADUCT

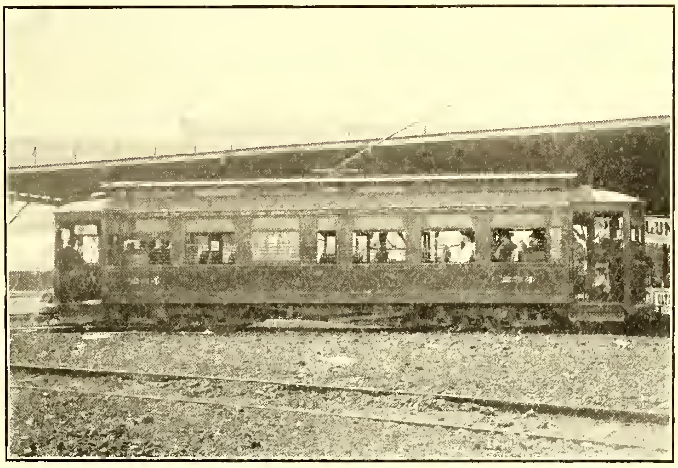


ST. LOUIS & SUBURBAN LOOP AT MAIN ENTRANCE TO THE EXPOSITION

method of operation was radically different from that of the other street railway loops at the Fair grounds, in that passengers were not allowed inside the loop except on the cars. In one corner of the loop was a roofed-over space, where passengers congregated and waited for the cars. The cars discharged passengers at an exit gate and then moved along to the loading gates. Cars were stopped so that front and back platforms were directly opposite these loading gates, and passengers stepped directly into the cars as they passed through the gates, so that there was no danger of crowds collecting inside the loop and getting injured in attempting to board moving cars. The arrangement was one which worked very smoothly. The electric sign over this loop which greeted the Exposition visitor as he went out of the main exit through the Fair grounds is shown in one of the engravings.

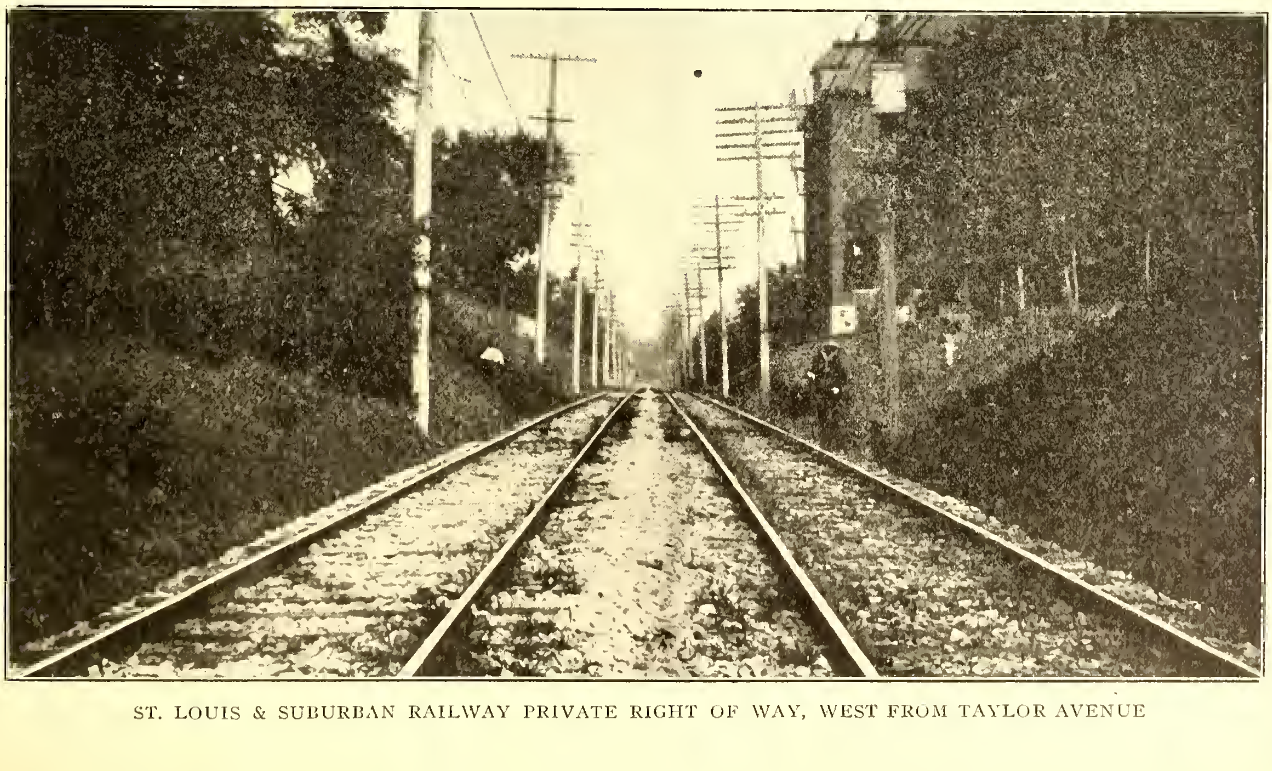
This company's standard cars are of a construction which has been frequently described in these columns. One of these cars is illustrated here. It has a seating capacity of fifty-two passengers. The body is 32 ft. long, and the length over all, 42 ft. It is mounted on St. Louis No. 47 short-wheel base truck, and has the patented steel-channel bottom, in which the strength is placed in the side sills, so that plenty of room is left for the swiveling of the trucks between the wheels, and the car body can be placed low. All cars have arc headlights.

Just before the Exposition, the company rebuilt its car house at DeHodiamont, which had been destroyed by fire. The new car house, a front view of which is shown, is practically fireproof. It has eleven entrance tracks and a capacity of 100 cars.

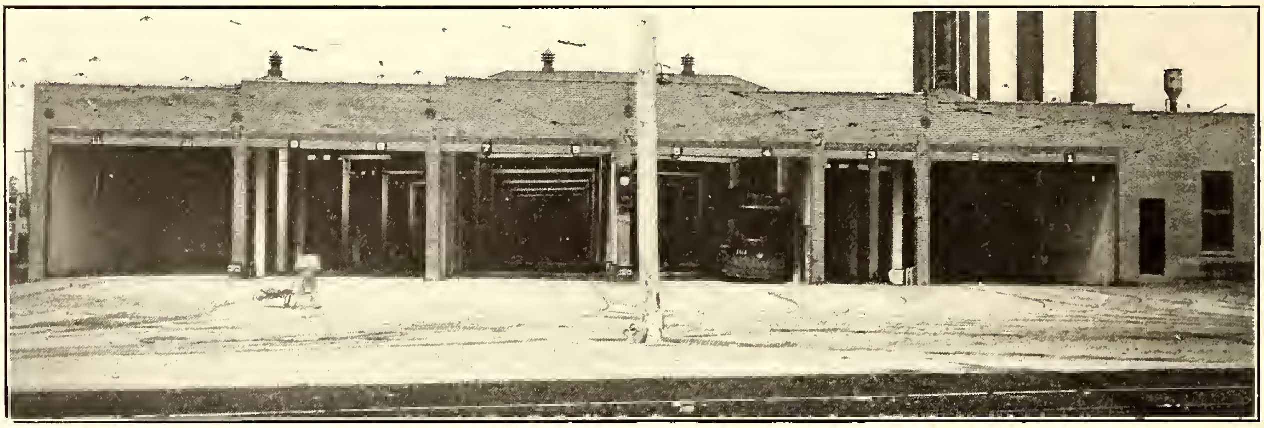


ONE OF THE ST. LOUIS & SUBURBAN STANDARD CARS

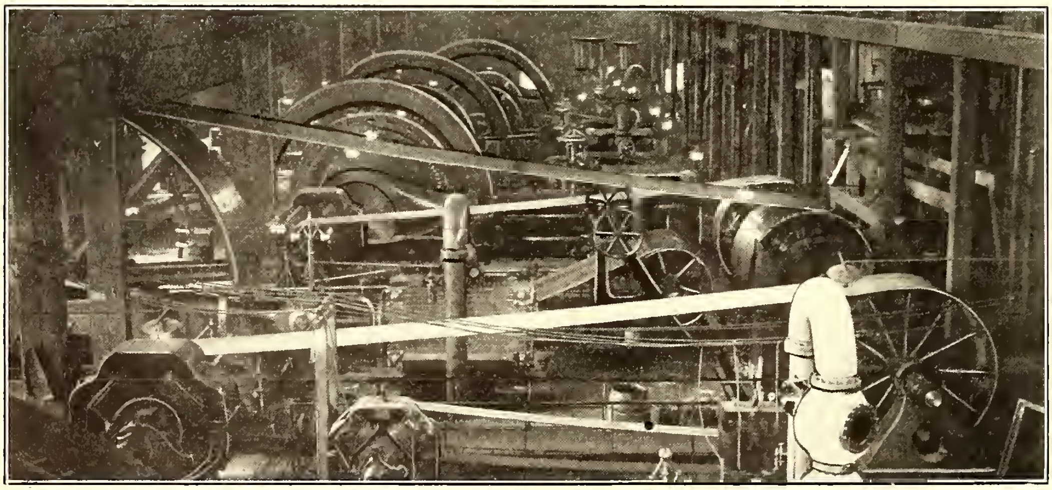
The power house, also at DeHodiamont, is one which was built early in the history of electric traction, and which has been added to and reconstructed from time to time, so that



ST. LOUIS & SUBURBAN RAILWAY PRIVATE RIGHT OF WAY, WEST FROM TAYLOR AVENUE a part of it is now well up to date. The latest addition consists of two GE 1200-kw 6600-volt alternating-current generators driven by Allis-Chalmers cross-compound Reynolds-Corliss engines. The engine room of this station is an interesting historical study, as in it can be found some of the earliest apparatus used in electric traction, and also some of the latest. The boilers and piping underwent a thorough reconstruction just previous to the World's Fair. The company has two substations to which 6600-volt alternating current is transmitted—one to supply the downtown end of the line and the other at Brentwood for the lines extending southwest. The system is under the management of John Mahoney, general superintendent, the president being J. S. Walsh, of St. Louis. These gentlemen are sharing with the St. Louis Transit Company management the many congratulations that have been offered to the street railway officials of St. Louis on the way the World's Fair crowds were transported during 1904.



ST. LOUIS & SUBURBAN NEW STORAGE SHEDS AT DE HODIAMONT



INTERIOR OF THE DE HODIAMONT STATION OF THE ST. LOUIS & SUBURBAN

A record of the traffic on the Brooklyn Bridge for the last twelve months, kept by Bridge Commissioner Best, shows that about 36,000 passengers now cross the bridge in the bridge trains in a single rush hour at night; this means that the cars, which seat about forty people, actually carry about three times that number during this one rush hour, from 5:30 to 6:30 p. m. In 1890 careful estimates were made of the probable future travel on the bridge, and the number of passengers now carried in the busiest hour of the day is 40 per cent greater than the maximum capacity then believed to be practicable with the length of train and number of trains now run, and it was estimated that the number of passengers now carried would not be reached until 1920.

EXPERIENCE WITH STORAGE AIR BRAKES AT ST. LOUIS

The storage air brake system has been in operation on most of the cars of the United Railways Company, of St. Louis, since before the opening of the World's Fair. This being the first large street railway to be equipped with the storage air brake system, considerable interest attaches to the performance of the storage air apparatus in actual service. It was thought by some that the compressing stations might be a source of trouble in cold weather, as they are expected to run without an attendant on duty all the time. No trouble has been experienced on this score. An attendant visits each station every two hours. The heat liberated by the compression of the air is not sufficient to heat the compressing station in the cold weather and stoves have been put in the stations, which are looked after by the attendant on his regular visits.

Almost the only difficulty experienced so far in the practical operation of the system is that the reducing valves on the cars have sometimes frozen up. The main storage tanks under a car carry air at 300-lb. pressure. Air is fed through a reducing valve to the service reservoir from which the brakes are operated. The latter reservoir is kept at 45-lb. pressure. If the reducing valve is frozen it may result in allowing an abnormal pressure in the small service reservoir and the blowing of the pop valve in this reservoir. A frozen reducing valve can be thawed out by burning a newspaper or something similar under the valve. On one line the reducing valves have been taken from under the car and put inside the car under a seat. This does away with the trouble.

Another improvement made has been in the introduction of blow-off cocks on both the high and low-pressure storage tanks on the car, by which the water can be blown out. The original plans called for these cocks, but in the hurry of equipping the cars before the opening of the World's Fair, the blow-off cocks were omitted in most cases and plugs were inserted. It is the intention to remove these plugs and put in blow-off cocks on all the cars, which will make it possible to drain off the moisture several times a day, if necessary. As with any compressed air apparatus, the most trouble from freezing comes when warm, moist weather is followed by a cold wave.

THE STEEL-TIRED WHEEL IN STREET RAILWAY SERVICE

BY NORMAN McD. CRAWFORD
General Manager, Hartford Street Railway Company

It is the growing opinion of street railway engineers that something stronger than the chilled cast-iron wheel should be used under cars operating on interurban lines, especially those operating under high-speed conditions and upon tracks that are not any too smooth or straight. Troubles from broken flanges with cast-iron wheels have been found to increase very materially when used under heavy cars operating under these conditions, and much interest is directed toward an economical solution of this difficulty. The steel-tired wheel affords the desired remedy and is being introduced in street railway service in many places, in spite of its supposed higher cost, and its use is expected by many to grow soon to such proportions that the chilled cast-iron wheel will be in the minority.

About four years ago the Hartford Street Railway Company decided to introduce steel-tired wheels upon the heavy double-truck cars used upon some of its principal suburban lines which are operated at high-speed schedules upon tracks having the combined disadvantages of sharp curves and heavy grades. It was realized that in case of a broken flange there was imminent danger, in many places, of a bad accident, resulting in precipitating the car down steep embankments, and the steel-tired wheel was introduced as a matter of precaution in view of the past troubles with broken flanges upon cast-iron wheels. The unquestionable sense of security obtained in the use of the steel-tired wheel, which cannot be had with the chilled cast-iron wheel, made the use of the former seem desirable at any cost, but the results of its introduction have been so far beyond expectations, not only as to safety, but also as to serviceability and economy, that steel-tired wheels are now being used upon many of the city cars of the Hartford Company, as well as its suburban lines. It will be of interest to those having to do with wheel problems to learn that the experience gained by the Hartford Company is such as to indicate that the use of the steel-tired wheel is attended by even less cost than is the case with the chilled-iron wheel.

The first cars equipped with steel-tired wheels were a lot of fourteen double-truck closed cars, nine of which were used in suburban service and the other five in city service; these cars were equipped Oct. 15, 1900, as shown in the accompanying table. The table shows the remarkable results which attended their use upon these cars. Cars No. 450 to 454 are operated over 200 miles per day upon the Rainbow suburban line, embracing a 28-mile round trip. These wheels had made mileages ranging between 100,000 miles and 200,000 miles each, in the time indicated upon the table. Their tires have, in many cases, required several turnings, but will permit several more before the tire requires to be removed from the wheel.

In October, 1901, eleven more double-truck closed cars were similarly equipped, which showed mileages ranging from 70,000 miles to 97,000 miles each at the time these records were taken. The last cars equipped with steel-tired wheels are four double-truck open cars, which were changed in May, 1902. These have similarly shown excellent results in service, as indicated in the accompanying table. Car No. 306 of this lot is now being operated 196 miles per day upon the New Britain interurban line, showing up to April 30, 1904, a total mileage of 39,942 miles. In all, thirty double-truck cars are now equipped with steel-tired wheels, making a total of 240 steel tires in service upon the Hartford lines.

Data as to how many turnings have been given the various tires are unfortunately not at hand, although it can be said that cars No. 402 to 408 have not required turning up to June 1, due to the minimized wear resulting from the long wheel base trucks upon which they are used.

The important feature of superiority of the steel-tired wheel over the cast-iron wheel is in the strength and stability of its flange. The chilled cast-iron wheel is very liable to chip at the flange, especially under the conditions of street railway service, with the frequent and heavy braking effects imposed upon the car wheels. Unequal heating is developed throughout the tread and flange of the wheel, and particularly is this dangerous with the cast-iron wheel when used in the wet and slushy season of

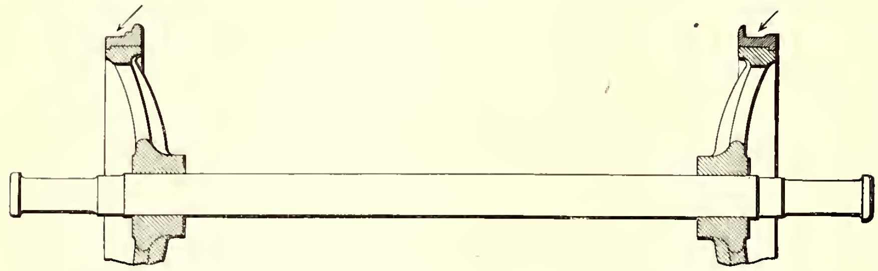
STEEL-TIRED WHEEL RECORD—HARTFORD STREET RAILWAY COMPANY

Car No.	Date Equipped	Mileage up to June 1st	Class of Service	Type of Car	Truck Wheel Base	Remarks
4 2	Oct. 15, '00	12,054	Sub'n, extra	Closed	5' 9"	These tires had not required truing up at time of this record
404	"	42,710	"	"	"	
406	"	100,282	Suburban	"	"	
408	"	64,015	"	"	"	
450	"	105,495	"	"	4 ft.	Each of these 5 cars oper 200 miles per day upon the Ra nbow line, a 28 mile r'nd trip with numerous hills and sharp curves
451	"	105,032	"	"	"	
452	"	110,296	"	"	"	
453	"	197,005	"	"	"	
454	"	104,999	"	"	"	
455	"	66,982	City	"	"	
456	"	83,061	"	"	"	
457	"	88,914	"	"	"	
458	"	64,451	"	"	"	Note.—All tires on wheels used upon the short wheel-base-trucks (4 ft.) had been turned up once or more times up to the latest date shown
459	"	89,699	"	"	"	
462	Oct. 4, '01	82,872	"	"	"	
464	" 6 "	88,835	"	"	"	
465	" 7 "	91,160	"	"	"	
466	" 6 "	97,416	"	"	"	
467	" 7 "	98,595	"	"	"	
468	" 7 "	70,575	"	"	"	
469	" 13 "	93,125	"	"	"	
470	" 19 "	86,063	"	"	"	
471	" 24 "	92,059	"	"	"	
472	" 25 "	96,992	"	"	"	
474	" 27 "	89,532	"	"	"	
302	May 17, '02	7,385	Sub'n extra	Open	"	
304	" 21 "	11,171	"	"	"	
306	" 17 "	39,942	Suburban	"	"	Car No. 306 oper 196 miles per day upon the New Britain interurban line
308	" 24 "	28,204	"	"	"	

the spring; in case of sudden heavy braking, with the resulting overheating of the flange, it is almost inevitable that unequal shrinkage strains should be set up as the flange meets the water or snow in the groove of the rail, and many breakages have been traced to this cause. Another danger that is met in the use of the cast-iron wheel through city streets is that of chipping the flange when passing through irregularly-worn special work; this latter trouble is unavoidable, but must be contended with in street railway service. Furthermore, there are the other well-known difficulties which are met in the manufacture of chilled-iron wheels which always involve the feature of uncertainty as to what may be expected from them. The result of these difficulties has been found by the Hartford Street Railway Company to be such that the cast-iron wheel can be depended upon for only one season, after which it is the custom there to renew them as a matter of safety.

These troubles are almost entirely avoided by the use of the steel-tired wheel. No chipping of the flange may be expected from sudden contacts with special work, or with the unequal heating effects of braking. They are capable of standing much more severe service upon curves, and, furthermore, are not so subject to the difficulty of "flatting," which is unavoidable with the cast-iron wheel; if the steel tire becomes flat by prolonged skidding, the flatness tends to roll out by the rolling action of the wheel upon the track. The unquestionably serious trouble met in the cast-iron wheel of unevenness of chill, which is thought to be, and unquestionably is, most favorable to the production of flats, is, of course, entirely absent in the steel tire.

A difficulty met in the use of the steel tire is the more rapid wear of flanges, but it has been found by the experience at Hartford that even this can be avoided by proper truck proportions. In this connection it is important to note that the experience at Hartford has been that the abnormal wear upon flanges is present only upon trucks whose wheel base is shorter than the gage of the track. It will be noticed from the accompanying table that two sizes of truck are used, those having a 4-ft. wheel base and a few having a 5¾-ft. wheel base. It was readily observed that the flange wear is very perceptibly less upon the tires used with the trucks having the long wheel base than upon the others. It was furthermore noted that upon short wheel base trucks the excessive flange wear took place upon two wheels located at diagonally opposite corners of the



SKETCH TO INDICATE TENDENCY TO SIDE WEAR WITH SHORT WHEEL-BASE TRUCKS

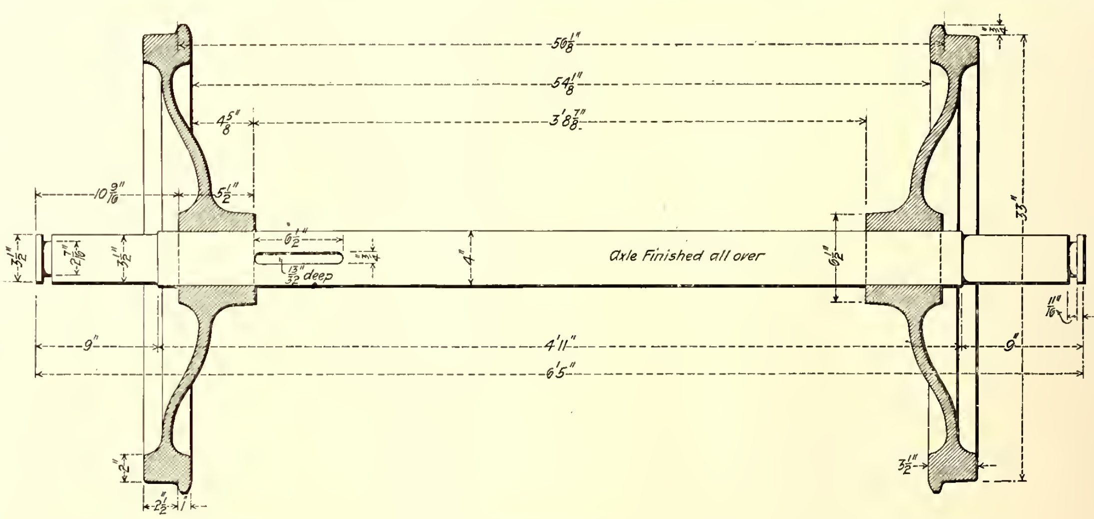
truck. This indicates a tendency toward a sidewise action of the truck, which is undoubtedly due to the wheel base length being shorter than the gage of the track; the action of a truck of such proportions may be likened to that of a single pair of wheels operated in a truck, which would, it is evident, have a tendency to turn sidewise in passing curves.

Another interesting fact was noted, in the case of the trucks with short wheel bases, that as the diagonally opposite wheels begin to wear thin at the flanges there is a tendency of a double wear upon the other sets of wheels which tends to crowd the thin flange even more tightly against the rail; the result of this action is indicated graphically in the accompanying sketch. No tendency of this kind whatever has been observed upon the trucks having a wheel base longer than the gage of the track, which is a strong indication that much of the difficulties met in the operation of steel-tired wheels rests in the proper proportioning of the truck. The Hartford Company expects to equip some of its single-truck cars having 6-ft. wheel bases with steel tires in order to ascertain if the still longer wheel base will further reduce its tendency to diagonal wear.

It is to be noted in this connection that steel-tired wheels have been operated at Hartford for mileages as high as 100,000 miles before turning. Our experience, however, would indicate that it is not advisable to allow the tires to wear to this extent, as in such case too much material must be cut off in truing the wheel tread up to the standard templet. We have also found that if the wheels are allowed to make only from 40,000 miles to 50,000 miles and are then turned up in the lathe, the cost of truing will be minimized, as the least possible amount of metal will have to be removed in order to strengthen the flange. This is the present practice, and with it much satisfaction is being experienced. About three truings are possible with the size of tire now used, which makes the total available mileage from each tire approximate 200,000 miles.

The most interesting phase of the problem of using steel-tired wheels is that of the cost, which is generally supposed to be higher than that attending the use of chilled wheels. The chilled cast-iron wheel as used at Hartford costs from $5 to $7 per wheel, according to the weight and nature of the service in which it is used; the total mileage that may be expected from the chilled wheels, however, is not over 30,000 miles, which, at an average cost of $6 per wheel, makes its cost amount to 20 cents for every thousand miles of service. A new steel tire, as used at Hartford, costs $12 each, but with the three truings after each 50,000 miles of service, will make the net cost $3 per 50,000 miles, or 6 cents per 1000 miles; adding to this a reasonable shop cost of $1 per wheel for the original application of the tire to the center, which also applies to each truing-up operation in the lathe, the gross cost per 50,000 miles is brought up to $4. Even this, however, only increases the gross cost per 1000 miles to 8 cents, which is very much less than half of that resulting from the use of the chilled cast-iron wheel.

The contention that the steel-tired wheel is outclassed by its first cost of from $30 to $40, is manifestly erroneously taken, as the center of the steel-tired wheel does not require renewing and should be considered as a permanent feature of the truck. Worn tires may be removed from it and replaced by new ones almost indefinitely. It is only fair to assume that the cost of the center should be charged up to the truck investment and only the renewable feature, the tire, be considered in comparison with the cast-iron wheel. The center is practically indestructible if made sufficiently strong for the service in the first place, and serves as a permanent investment. The only additional cost to be considered is that of removing a worn tire and replacing it by a new one, but this is easily covered in the above-mentioned allowance of $4 per tire per 50,000 miles, for this operation, and each of the three turnings in the lathe. Even if the expense of handling in the lathe and machining were double the above allowed amount, it may be seen that the cost of operating the steel tires would even then be far below that of using the chilled cast-iron wheel.



DETAILS OF NEW SOLID ROLLED AND FORGED STEEL WHEELS AS USED AT HARTFORD

The Hartford Company has recently introduced several of the new type of solid forged and rolled-steel wheels into service under some of its double-truck interurban cars in order to make a trial of this interesting departure in wheel building. This solid steel wheel has many advantages to offer over the steel-tired wheel, not only as to first cost, but also as to general simplicity and equal strength with less weight. On account of the very thorough and effective methods of forging and rolling in manufacture, it is thought that a maximum of density is secured in the rim which will result in even longer wear than is secured from the tires upon the steel-tired wheels. While these new wheels have not been in service long enough as yet to allow of intelligent comparison of their performance with the various types of steel-tired wheels, still they promise to prove very economical and very satisfactory results are expected.

The lower drawing on page 108 presents the principal details of the new solid steel wheels as applied to the standard axle of the Hartford Street Railway Company, ready for use. Special attention should be called to the lightness of the web as compared with that of a chilled-iron or steel-tired wheel, although from the nature of the construction it is said to be very much stronger. These wheels were furnished by the Standard Steel Works, Philadelphia, Pa.

FIGHTING SLEET ON THE AURORA, ELGIN & CHICAGO RAILWAY

One of the most serious problems with which the management of a third-rail electric road is compelled to deal is that of the removal of, or prevention of the formation of, sleet. This is more serious on lines through the open country, where the schedule does not require cars at intervals frequent enough to prevent the sleet forming again, after it is once removed. In such a case, about the only means of avoiding frequent tie-ups of the line, is to place on the rail some solution with a very low freezing point, which will not only melt the ice already formed, but will prevent the formation of additional sleet. After thorough and satisfactory tests last winter, the Aurora, Elgin & Chicago Railway has adopted this method. A solution of calcium chloride, which does not have the corroding effects of common salt solution, is employed. In fitting up the necessary apparatus for distributing the liquid over the rail, the fact has been kept constantly in mind that effective fighting of sleet necessitates it being attacked as soon as it begins to form, and the apparatus is therefore so arranged that it can

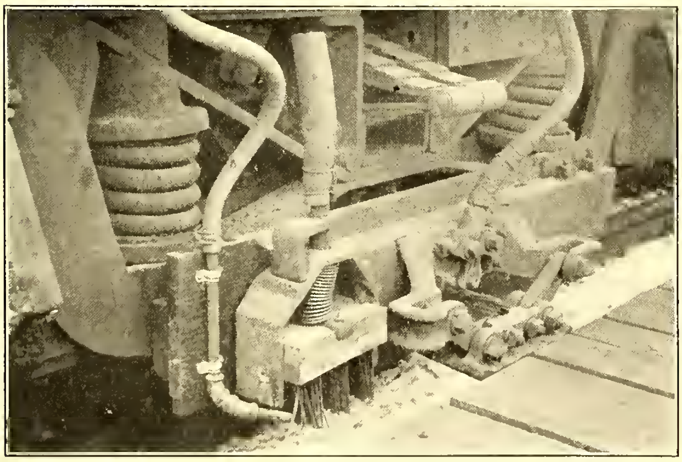


FIG. 1.—PIPE CARRYING SOLUTION TO THE RAIL

be put into service on very short notice. Another point aimed at was that the fighting of sleet should interfere as little as possible with the regular schedule.

The method of throwing the liquid on the rail is shown in Fig. 1. The small pipe shown in the illustration is connected to a rubber hose leading to the motorman's cab. Through this the solution is lead to the rail a few inches in front of the steel sleet brush. This brush, passing immediately afterward, spreads the solution uniformly over the film of ice before it has had time to run over the side of the rail. Each car is equipped with four such pipes, one in front of each of the four shoes, so that no matter on which track or in which direction the car may be traveling, one of the pipes may be put in service. The hose to which the pipes are attached are connected to the discharge pipes of a 40-gal can placed in the cab, and containing the solution of calcium chloride. As the solution is a conductor, it is necessary to ground the pipe on the truck frame to prevent the can in the cab becoming charged and becoming dangerous to the operators. This results, of course, in a current from the

FIG. 2.—PLATFORM AND CANS AT WHEATON

third rail to the truck by way of the stream of liquid, but the conductivity of the stream is not great enough to cause an excessive current.

That they may be placed in service quickly, the cans filled with the solution are distributed at several points along the road on platforms, one of which is shown in Fig. 2. In case of a sudden sleet storm, the several cars running on a regular schedule pick up the cans from the nearest platform, place them in the cab and connect them by means of the rubber hose to the pipes leading to the rail. When a can becomes empty it may be filled, without removing it from the cab, at one of the several stations similar to that at Wheaton, shown in Fig. 3. Several barrels are placed on a trestle sufficiently high to insure the cans being filled quickly. The end of the long hose, which may be seen in the engraving, leading from the barrels, is inserted in the can in the cab of the car.

The cans are originally filled at the shops from the large mixing tank shown in Fig. 4. In this tank the caustic chloride of calcium is mixed with warm water in the proportion of about 38 lbs. of the chemical to 1 cu. ft., or about 7½ gals. of warm water. The proper density of the mixture is obtained by the use of a hydrometer, the reading of which should show a specific gravity of from 1200 to 1250.

When running at full speed, the full flow from the ¼-in. pipe is thrown on the rail. On slowing down or at stops, the operator in the cab governs the flow to correspond with the speed by means of a globe valve in the discharge pipe of the can. About one gallon of solution is used per mile. This amount is sufficient to spread well over the top of the rail, yet is not enough to run down over the sides to be wasted or possibly to injure the bonds. The corroding effect of calcium chloride on the copper is somewhat in dispute, but by so distributing the solution that it does not reach the bond, any danger is, of course, avoided. In case of a very thin coating of sleet, the immediate effect of the liquid is to dissolve the ice so the contact is made direct with the rail. With thicker formations, however, the sleet is not melted at once, but it is rendered a conductor by the permeation of the fluid, and is so loosened that it is scraped off the rail after one or two sleet brushes have passed over it.

As long as any of the liquid remains on the rail, the formation of new ice is prevented, but it has been found that after about two hours, the effect of the passage of the shoes and brushes over the rail is to carry most of the solution off, and in case of a continued storm, another treatment is necessary.

As the expense of fitting each car with the necessary apparatus is very small, practically all of the motor cars have been so equipped. This prevents any delay in getting the apparatus in operation, as might occur if the front car of a train was not equipped. E. F. Gould, electrical engineer of the system, states that the apparatus was thoroughly tested last winter, and that the schedule was interfered with very little, although several serious sleet storms prevailed. The sleet is always attacked when it first begins to form. This is especially the case if the storm occurs early in the morning when no cars are being run over the line. At such a time cars are equipped with the cans at the barns and are kept in operation continuously as long as the storm continues. The expense of installing the apparatus, as may be seen, is comparatively small. After once installed, about the only additional expense is that of supplying the calcium chloride. As one gallon of the solution, containing 7½ lbs. of the chemical, is necessary per mile of treatment, the cost per mile at the usual market price of one dollar per 100 lbs. for the calcium chloride is only 7½ cents. This expense is negligibly small compared with the benefits obtained.

FIG. 3.—ELEVATED BARRELS AT WHEATON FOR FILLING TANKS IN CARS

FIG. 4.—MIXING TANK FOR CALCIUM CHLORIDE AT THE CAR HOUSE

THE STRENGTH OF TIMBER TREATED WITH PRESERVATIVES

With the increasing use of timber, preserved in one way or another against decay and fire, it is important to determine the effect which the preserving process has upon the strength of the preserved timber. Many engineers believe that creosoted timber is more brittle and less capable of withstanding strains than the same timber before being treated with creosote.

This question was made the subject of a careful study during the St. Louis Exposition by the Government Bureau of Forestry, under the direction of Doctors von Schrenk and Hatt, of the Bureau of Forestry, and it was found that such reduction in strength as resulted was due entirely to the steaming process required in the seasoning, and that it was very nearly in direct proportion to the length of time that any given steam pressure was applied. Thus, the diminution of strength was found to be 25 per cent after a pressure of 20 lbs. was applied for ten hours to green loblolly pine, and 10 per cent when a pressure of 20 lbs. was applied for four hours. This diminution of strength increased very rapidly when the pressure rose above 20 lbs., and amounted to about 25 per cent when a pressure of 50 lbs. was applied for four hours.

With relation to the effect of preservatives themselves, it may be said that the treatment with zinc chloride does not seem to further reduce the strength of timber beyond the effect of the steaming process. This might have been expected when it is considered that the strength of the zinc chloride solution ordinarily used does not exceed 2½ per cent. The strength of timber that had been treated with the 2½ per cent solution of zinc chloride after having been steamed four hours at 20 lbs. pressure was the same as that of timber which had been steamed without the subsequent application of zinc chloride. The same statement may be made of timber treated with an 8½ per cent solution of zinc chloride. It may be that subsequently the crystallization of the zinc chloride will weaken the wood fiber. This remains to be determined.

The effect of the creosote appears to be the same as that of an equal amount of water in weakening the fiber. That is to say, the strength of creosoted timber is that of green timber. The difference is that while green timber gains strength upon seasoning, the creosote oil remains in the wood, and, it appears from analysis of a pile thirty-five years old, that the oil remains in a liquid condition. Consequently, comparison between seasoned timber and creosoted timber will always result to the disadvantage of the latter as far as its strength is concerned. In the case of creosoted wood, it also remains to determine what changes in the wood fiber take place through lapse of time in the presence of creosote oil.

The preservative fluids investigated included only croesote and zinc chloride.

It is expected that a bulletin will be issued upon the results of these investigations when the tests are completed. This bulletin will also contain the results of the investigations to determine the best methods of preserving wood so that the maximum impregnation may be obtained with the least expenditure of oil per cubic foot of timber.

Provided the City Councils of Minneapolis and St. Paul make appropriations sufficient to repay the company for the expenditure entailed, the Twin City Rapid Transit Company, operating in and between these cities, will build two flat cars for the transportation of fire apparatus from one city to the other. One car will be kept in each city, and in thirty-five minutes after request has been made from either place for assistance, the apparatus would be ready for service in the other city. The value of this proposal to the cities concerned is inestimable.

STEAM-TURBINE POWER PLANT OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD AT WARREN, R. I.

A steam-turbine electric generating plant that is noteworthy from the directness of the steam lines and the absence of a multiplicity of pipes has been added to the power station at Warren, R. I., of the Fall River branch of the New York, New Haven & Hartford Railroad. It is substantial evidence of the rapid growth of the electric service instituted by that company, for in the brief period since 1900, when electric transportation was introduced between Providence and Fall River and Bristol, the company has, for the second time, found it necessary, owing to increased traffic conditions, to make additions to its power equipment.

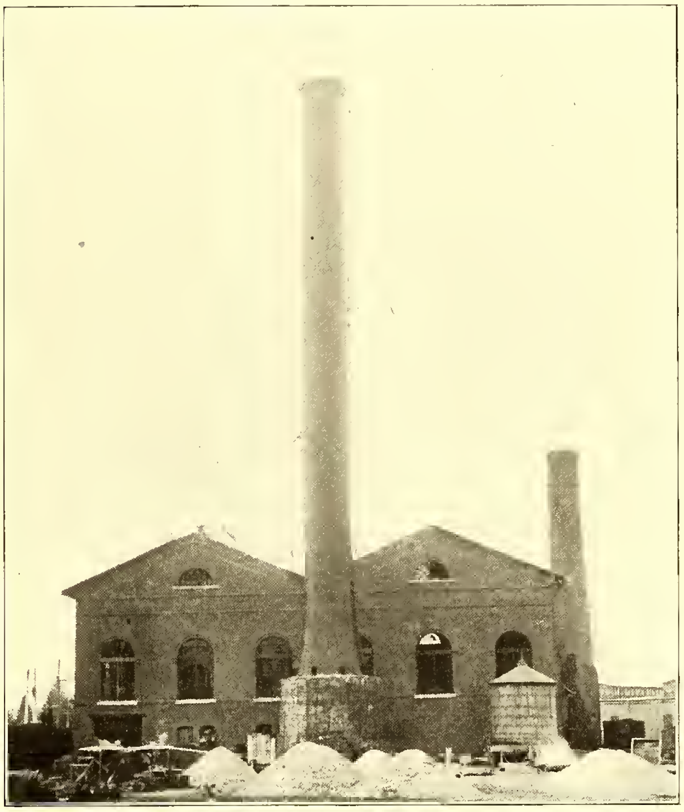
Warren is situated somewhat centrally with respect to the termini, the distances from the power station to Providence, Bristol and Fall River being 10 miles, 4 miles and 9 miles, respectively. Until this latest provision for additional power was made, direct current only was delivered from the plant, at 650 volts, and in connection with its transmission over the relatively long distance to the points of heavy demand, storage battery stations were maintained, one at East Providence and the other at Brayton, Mass., near Fall River. The direct-current machinery consisted largely of two 800-kw direct-connected steam-engine units.

To provide for the additional power for which, as stated, a need had developed, a contract was made with Westinghouse, Church, Kerr & Company, of New York. It was decided to employ alternators giving current directly at 13,200 volts, using Westinghouse-Parsons steam turbines for driving the alternators, to erect rotary sub-stations adjoining the storage battery plants and to connect the direct-current with the alternating-current system by means of a rotary converter in the power house, arranged to remain floating on the line, so that either system could assist the other according to the distribution of the load. The direct-current plant is, of course, planned to supply mainly the sections of the railway nearer the power station, so that the alternating-current machinery may be drawn upon when the load in that vicinity is unusually high, and vice versa, the direct current part of the station may, through the converter, serve the distant points. It is noteworthy that both the sub-stations and the power house building extension, which have accordingly been built, are of fireproof construction throughout, with brick walls, concrete floors and steel roof frames, the last carrying, in the case of the power station addition, a roof of Ludowici tiles, and in the case of the sub-stations, roofs of reinforced concrete.

The power station addition is practically 100 ft. in length and conforms to the general lines of the old building. It is divided into a boiler room, one story in height, housing the boilers and steam lines, and an engine room, two stories in height, containing on the second, or main floor, the steam turbines and electric generating apparatus, and on the basement floor the condensing apparatus, electric cables and transformers. Along the outer wall of the boiler room is a coal bunker, which is a continuation of that along the older section of the wall. Coal cars are run on an elevated track over the bunker, and the coal delivered from them into it passes by gravity through openings in the bottom of the building wall along the firing space in front of the boilers.

In the boiler room there are four Babcock & Wilcox water-tube boilers of 400-hp capacity each, arranged in two batteries, with space for a third battery. The boilers are connected with two mains, one of which supplies steam to the turbines, and the second, or auxiliary, steam main carries steam to the boiler feed-pumps, air pumps and an exciter engine. With this system of piping any derangement of the steam connections to the auxiliary apparatus in the station will not interfere with the operation of the steam turbines. The normal operating pressure is 150 lbs., and all the boilers are arranged for the installation of superheating apparatus when desired.

The products of combustion are carried through a brick duct immediately back of the boilers, leaving enough space below the duct for the blow-off connections. The top of the duct is flat and is built of brick, supported by T-bars spanning the duct. The smoke stack is outside the building, and is of the self-supporting steel class, 130 ft. high and 9 ft. in inside diameter. It was built by the Coatesville Boiler Works, of Coatesville, Pa., and rests on a masonry base 20 ft. high, through which the smoke duct reaches the steel shaft. The effective height of the chimney is 148 ft. above the grates. The base is octagonal in form, and is built of concrete, with outside and inside brick walls, which were made to serve as forms for the concrete filling.



POWER STATION AT WARREN

The water for the boilers is handled by two 12-in. x 7-in. x 12-in. Warren duplex horizontal outside packed pumps, which receive their supply either from the city mains or from a deep well located on the premises. They deliver ordinarily through a feed-water heater, which receives the exhaust from the pumps, condensers and exciter engines, but the heater may, of course, be by-passed when desired. It is of the closed type, with single steam connection, and was built by the Goubert Manufacturing Company. It is placed horizontally overhead between the two batteries of the boilers, and alongside it is the outboard exhaust for the excess steam from the auxiliaries.

The leading characteristics of the piping work have already been mentioned. Each end of the main steam header is closed with an elbow pointing downward and fitted with a blank flange to form a drainage pocket; and the high-pressure lines are all drained by means of the Holly system. The connection from each boiler is, as usual, provided with two valves, and one of these, over the boiler, is a Pearson automatic non-return stop valve. The auxiliary header, however, is carried in the engine house basement, and is supplied from opposite ends of the present auxiliary steam main that extends across the front of the boilers. The two connections for this purpose, 4 ins. in diameter, are joined at the station partition wall by a connection from the main steam header, so that the auxiliary header may also receive steam from the main source.

The generator room contains two 750-kw turbo-alternators, with space for a third unit of the same size. They operate at 1500 r. p. m., giving an alternating-current output at 13,200 volts, as stated, and they are guaranteed to develop an electrical hp-hour on about 16 lbs. of steam when exhausting into a vacuum of 26 ins. They are also rated with a capacity to carry 100 per cent overload. As usual with this type of generating unit, no foundation bolts have been employed, the machines simply resting on a concrete base.

Each turbine is connected to an independent condensing plant, with the usual arrangements for operating either condensing or non-condensing. Each condensing unit consists of a Warren vertical twin air pump and jet condenser located adjacent to the turbine, but on the engine house basement floor, there being an open hatchway over each machine, so that the operating attendant has a full view of all the apparatus. The condensing plant is supplied with sea water from the Warren River, and an intake well has been built outside the building for the suction ends of the injection pipes of both the old and the new parts of the station. It was first intended to lead the water from the river to the well through a flume, but an intake bay is now being dredged to bring the water to the well through a short canal. Entrance to the latter will take place through a 4-ft. x 4-ft. opening fitted with removable screens formed of maple frames and No. 8 galvanized iron wire on a ½-in. mesh.

The rotary converter is of the capacity of one of the turbo-generators, or 750 kw. The transformers used with it are located in the basement. The new equipment includes a motor-driven exciter, as well as a steam-driven exciter. Both are of 50-kw capacity at 125 volts, and the engine of the latter is a 9-in. and 15-in. x 9-in. Westinghouse compound engine.

The switchboard is of blue Tennessee marble, supported on a steel frame. High-tension switches are of the oil-bath type, and all uninsulated parts of the switchboard connections carrying high-pressure current are enclosed in the usual fireproof compartments, reducing the danger to the attendants. Cables and wires otherwise are run on insulated supports on the basement ceiling, leaving the engine room floor unobstructed.

Each of the sub-stations will contain triplicate units of 300 kw each, including both static transformers and rotary converters for supplying 500-volt direct current to the trolley lines. One, two or three of the converters can be placed in operation as required. The same care has been shown in arranging the electric apparatus and circuits in these stations as in the power station. In conclusion, it may be said that the station stands as an instance of rapid construction, the excavations for the stack foundations, which were first undertaken, not being started until Aug. 15, 1904, and the first turbine being turned over by Dec. 21. The first sub-station was started Dec. 28.

The Trenton Street Railway, of Trenton, N. J., has applied to the City Council for relief from the abuse of transfer privileges extended to passengers. It is expected that the company will require all transfers to be issued through a transfer agent at the corner of State and Broad Streets, for persons transferring at that point. The city of Trenton is peculiarly laid out, and while the lines run at right angles at State and Broad Streets, they again parallel at others. The Stanton Street cars (running on State Street) parallel the South Broad Street cars for many blocks in the southern part of the city; the Wilbur cars parallel the North Broad Street cars in East Trenton. The Hamilton Avenue cars meet the Wilbur cars at East State Street and Olden Avenue. The East Trenton cars are paralleled in East Trenton by the Brunswick Avenue and Princeton cars (running at right angles at State and Broad Streets), and the Prospect Street and Pennington Avenue cars are but a short distance apart in the northern part of the city.

TESTS OF THE NEW YORK CENTRAL ELECTRIC LOCOMOTIVE

Since the preliminary test conducted by the New York Central & Hudson River Railroad Company with its experimental electric locomotive on the Schenectady-Hoffmans section of its line, near Schenectady, N. Y., and described in the STREET RAILWAY JOURNAL for Nov. 19, a series of tests has been commenced to determine whether the locomotive meets the requirements of the specifications. These tests are now under way. Later it is proposed to conduct certain other tests on draw-bar pull, using the dynagraph car of the New York Central Railroad Company.

PROGRAMME OF TESTS

The programme adopted for the tests at the experimental track follows:

These tests are to be of eight kinds, viz.: (A) Adjusting resistances; (B) heat tests; (C) friction tests; (D) acceleration, traction and commutation tests; (E) speed tests; (F) accidental condition tests; (G) special tests; (H) service tests.

A.—ADJUSTING RESISTANCES

Acceleration curves will be taken with amperes plotted to time, and the resistances will be adjusted until a smooth curve is obtained.

B.—HEAT TESTS

The weights of trains, including the locomotive, should be 400 tons, 435 tons and 550 tons (2000 lbs. each ton); coaches will be weighed and proper combinations will be figured out to secure the exact weights of trains mentioned.

All controlling apparatus will be adjusted to take an average accelerating current while on resistance of 830 amps. per motor.

Ammeters will be placed in the circuit of each motor to see that all field coils are properly connected. All armatures should take approximately the same current when in multiple. A record of these amperes will be made and reported for inspection before the definite test is started.

The heat-run test at full voltage and full acceleration current will serve to give the whole locomotive a test, approximating the operating conditions in service. The temperature rise of armature, fields, commutators and all controlling apparatus will be taken. Thus a complete test will be gotten on commutation and general mechanical and electrical operation. The heat tests, approximating, as they will, service conditions, will therefore be the most important of all.

TESTS WITH A 550-TON TRAIN

The contract requires that a train of 550 tons total be handled from Forty-Second Street to Croton in one hour; there will then be a layover of twenty minutes; the return to Forty-Second Street with the 550-ton train must then be made in one hour, one stop being made in each straight trip. The motors will start at approximately the temperature of the surrounding air, and their rise in temperature will be measured by the thermometer, after the round trip. To approximate these conditions, the test on the experimental track will be made as follows:

Distance, 5½ miles.
Voltage at sub-station under all loads, 666 to 575.
Total weight of train, 550 tons.
Average accelerating current per motor, 830 amps.
Run going west to be made with motors accelerating at 830 amps., up into full multiple.
Run going east to be made with two motors in series for 1 mile, at which point the locomotive will be turned into full multiple.
At each end of straight trip, the locomotive will be shifted to the other end of train.

Run West:
Time, power on, 6 minutes 50 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 8 minutes 30 seconds.

Run East:
Time, power on, 7 minutes and 20 seconds.
Coasting, 50 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 9 minutes.

Two round trips will be made, with time consumed as follows:

	Minutes
Two round trips, train in motion, 17½ minutes	35
Time in motion, locomotive shiftings, 2 minutes each	6
Extra time allowed for coupling, 2 minutes each	6
Total	47
Time shifting locomotive once	4
Layover	29
Repeat above two round trips	47
Total time of test	127

At the end of the above run, the temperatures of the armature, field and controlling apparatus, as measured by their resistance and by the thermometer, will be taken.

TESTS WITH A 435-TON TRAIN

The contract requires that a train of 435 tons be handled from Forty-Second Street to Croton in forty-four minutes; there will then be a layover of sixty minutes at Croton. The return to Forty-Second Street must then be made in forty-four minutes with 435-ton train, then a layover of sixty minutes at Forty-Second Street. The locomotive must be prepared to keep up this service continuously.

To approximate these conditions, the test on the experimental track will be made as follows:

Distance, 5½ miles.
Voltage at sub-station under all loads, 666 to 575
Total weight of train, including locomotive, 435 tons.
Run going west, with motors in full multiple.
Run going east, two motors will be used in series for 1 mile and then the motors will be turned into multiple.

Run West:
Time, power on, 6 minutes and 20 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 7 minutes and 30 seconds.

Run East:
Time, power on, 7 minutes.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 8 minutes and 30 seconds.

Two round trips will be made, with time consumed as follows:

	Minutes
Two round trips train in motion, 16 minutes each	32
Time in motion, locomotive shifting 2 minutes each	6
Extra time allowed for coupling, etc., 2 minutes each	6
Total time	44
Shifting locomotive once	4
Layover	56
Total time of cycle	104

The foregoing will be repeated with a complete cycle every 104 minutes for twelve hours, or until continuous temperature rises are reached. A standard thermal characteristic test will be made, taking temperatures by thermometer, and by resistance during each layover and plotting them in a curve. At the end of the complete test, all temperatures by thermometer and resistance will be taken carefully, as in ordinary thermal characteristic runs.

TESTS WITH A 400-TON TRAIN

The contract requires that a train of 400 tons total weight be handled from Forty-Second Street to Croton in one hour, making three stops, and with a layover at each end of straight trip of sixty minutes; this cycle to be operated continuously.

To approximate these conditions, the tests on the experimental track will be as follows:

Distance, 5½ miles.
Voltage at sub-station under all loads, 666 to 575.
Total train weight, 400 tons.
Run west with motors in multiple.
Run east with motors in series for 1 mile and then in multiple.

Run West:
Time, power on, 6 minutes and 10 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 7 minutes and 30 seconds.

Run East:
Time, power on, 6 minutes and 50 seconds.
Coasting, 60 seconds.
Braking, 1.5 m.p.h. p.s.
Total time in motion, 8 minutes and 30 seconds.

Two and one-half round trips will be made, with time consumed as follows:

	Minutes
Average time train in motion, 2½ round trips	40
Shifting locomotive in motion, 2 minutes each	8
Extra time allowed for coupling, etc., 2 minutes each	8
Total time	56
Shifting locomotive once	4
Layover	60
Total time of cycle	120

The foregoing will be repeated with a complete cycle every two hours for twelve hours, or until continuous temperature rises are reached. A standard thermal characteristic test will be made, taking temperatures by thermometers, and by resistance during each layover and plotting them in curves. At the end of the complete test, all temperatures by thermometer and resistance will be taken carefully, as in ordinary thermal characteristic runs.

A coasting test will also be made with the locomotive pulling a 550-ton train, with the brushes removed and fields excited, at the approximate free running current value, in order to determine the effect of the magnetism upon the bearings.

In addition to the foregoing contract tests, other thermal characteristic runs will be made so as to complete a thorough thermal test of this locomotive equipment.

Distance, 5½ miles.
Acceleration per motor, 820 amps.
Minimum weight of train, 200 tons, including locomotive.
Maximum weight of train, 700 tons including locomotive.
Voltage at sub-station, 666 to 575.

There will be a sufficient number of tests, including the contract tests, to determine the degree rise per watt loss for as great a range of distribution of losses as would be gotten by operation with a 200-ton train minimum to a 700-ton train maximum. These will be as follows:

Run west to be made in full multiple.
Run east, 1 mile in series and then in multiple.
Time power on and coasting in each case to be determined by trial as in ordinary thermal characteristic runs.
With the lighter trains the layovers should be as small as consistent with operation during the test.
With the heavy trains a layover of approximately one-half the total time should be allowed.

All of these special runs, as well as the contract runs, will be calculated for losses as shown in thermal characteristic tests, and a report will be prepared therefrom.

C.—FRICTION TESTS

After getting the friction of the locomotive and train fairly constant and of average value, a series of friction test runs will be conducted. These runs will be made by allowing the train to coast in both directions over a portion of the track where the grades and curvatures are known, but a section of track will be selected having as long, straight and level portions as possible. Trains of 200 tons to 700 tons will be used. The locomotive will also be used alone. The average speed during coasting will be as low as 25 m.p.h., and also as high as possible. At least eight or ten good records will be obtained with average speeds within the above range. From the record of speeds to time thus obtained, the friction of various trains at various speeds will be determined.

From the heat-run records, the speed, amperes and volts can be gotten for various instants, and therefrom a speed or torque curve plotted to amperes will be deduced. In connection with the torque curves and the records of speed to time, the friction during acceleration at various speeds can be calculated and compared with the frictions determined from the coasting tests.

D.—ACCELERATION, TRACTION AND COMMUTATION TESTS

Acceleration, traction and commutation tests under control of the limit switch will be made as follows:

The controller will be adjusted to take varying average currents during acceleration on resistance of 600 amps., 800 amps., 1000 amps. and 1200 amps. per motor. Care will be taken to determine the slipping point of the wheels, and several tests with the proper current per motor will be made at or near this point.

Tests will be made with trains from 200 tons to 700 tons, also with the locomotive alone. The commutation of the motors and the general operation of the control will be noted and recorded. A record of amperes, volts and speed to time will also be taken. These tests will be taken at or near the substation, so as to get practically 600 volts across the motors.

The traction tests will be made with and without sand, and notes will be taken as to which wheels slip, with memoranda of weather conditions and conditions of rail.

E.—SPEED TESTS

Speed tests will be conducted with the locomotive pulling trains of from 200 tons to 700 tons weight to ascertain the maximum speed the locomotive can make when hauling these trains. The locomotive will also be tested running light and its maximum speed will be determined. The voltage at the substation may vary from the pressure previously given while these tests are being conducted, and if it does vary, allowances will be made and speed curves plotted to show what speeds the locomotive will make when supplied with a working pressure of 600 volts at the locomotive.

F.—ACCIDENTAL CONDITION TESTS

These tests are to be conducted to ascertain the hauling ca-

N.Y.C. & H. R. R.R. Electrical Department. Eq'p't Data Sheet No. ——

APPARATUS UNDER TEST ——

TESTS NUMBERS —— Date —— 190

EQUIPMENT:

Number of Motors

Armature Numbers

Frame Numbers

Type of Motors

Field Specifications

Armature Specifications

Gear Reduction

Size of Wheels

Weight on a Driving Axle

Total Wt. Loco. or Motor Car

Total Effective Wt. Loco. or Motor Car

REMARKS:

The Term Train, unless otherwise stated, includes Locomotive.

Temperatures taken by the resistance method will be followed by the letter "R."

Trailers											Total
Weight Each											
Effect. Tons Ea.											
Length, Ft.											
Total Cross-Sect. to Rail, Sq. Ft.											

BLANK 1, FOR APPARATUS UNDER TEST

N.Y.C. & H. R. R.R. Electrical Department. Test No. —— Eq'p't Data Sheet No. ——

STARTING RESISTANCES

Date —— 190

NOTCH	STEP	TOTAL	REMARKS

UPPER PART OF BLANK 2, FOR STARTING RESISTANCES

N.Y.C. & H. R. R.R. Electrical Department. Test No. —— Eq'p't Data Sheet No. ——

LOG OF RUN

Date —— 190

No. of Run											
No. of Cars Used											
Weight of Train											
Length of Train											
Distance Run											
Direction of Run											
Duration of Run											
Time	Motors, Series-Series										
	Motors, Series-Multiple										
	Accel'g on Resis.										
	Power on										
	Coasting										
	Brakes on										
Distance	Motors, Series-Series										
	Motors, Series-Multiple										
	Accel'g on Resis.										
	Power on										
	Coasting										
	Brakes on										
Accel.	Motors, Series-Series										
	Motors, Series Multiple										
	Motors, Multiple										
Speed	Maximum										
	Mean										
Energy	Train										
	Pumps, L'ts, &c.										
	Motors										
	Total by Sta. Wattmeter										
Current	Maximum										
	Mean										
	Accel'g per Motor										
Volts	Maximum										
	Minimum										
	Mean										
Track	Condition										
	Grade										
	Curvature										
Wind Vel. & Direction											
Train Resis. per Ton	Coasting										
	Braking										
Accel'g Force, per Ton											

BLANK 3, LOG OF RUN

N.Y.C. & H. R. R. R. Electrical Department. Test No. —— Eq'p't Data Sheet No. ——

LOG OF HEAT RUN I

Time Sheet Date —— 190

SCHEDULE	Time of Run			Elapsed Time		SCHEDULE	Time of Run			Elapsed Time	
	H.	M.	S.	Accn.	Current On		H.	M.	S.	Accn.	Current On
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					
Start						Start					
Stop						Stop					

UPPER PART OF BLANK 4, LOG OF HEAT RUN I.

pacity of the locomotive and how it will operate under various accidental conditions, of which the following are examples:

(1) One motor cut out of service, due either to loss of armature or field coil.

(2) Two motors cut out of service for similar reasons.

(3) Controller difficulties, such as one reverser failing to throw.

(4) Air Brake Failures—Tests will be made to indicate how

N. Y. C. & H. R. R.R. Electrical Department. Test No.——— Eq'p't Data Sheet No.———

LOG OF HEAT RUN II

Date————190

READINGS RECORDED AT INTERVALS OF————

Instrument No. Corr. Factors							TEMPERATURES					
Motor No.—— Time	Volts Arm.	Amps. Arm.	Partial Res. Arm.	Volts Field	Amps. Field	Res. Field	Arm. by Res.	Field by Res.	Spool	Spool	Frame	Air Temp.
Motor No.—— Time												

No. of Comm. Segments——— No. Between Current Leads——— No. Between Volt Leads———
Ratio: Total Resistance,/Partial Resistance, (1) From Test——— (2) From Calculation———

Resistances:	Number	Resistance	Number	Resistance	Number	Resistance	Number	Resistance
Armature 25° C.								
Armature Hot								
Field 25° C.								
Field Hot								

BLANK 5, LOG OF HEAT RUN II.

N.Y.C.&H.R.R.R. Electrical Department. Test No. ——— Eq'p't Data Sheet No. ———

LOG OF HEAT RUN III.

Date ————190

FINAL TEMPERATURES Taken at ————

MOTOR	No. 1	No. 2		No. 1	No. 2
Frame			Arm. Core Surface		
Spool			Arm. Conductors		
Spool			Commutator		

AIR TEMPERATURE At end of run————°C.

Remarks, Weather Conditions, etc.:

UPPER PART OF BLANK 6, LOG OF HEAT RUN III.

N. Y. C. & H. R. R.R. Electrical Department. Test No.——— Eq'p't Data Sheet No.———

RESISTANCE MEASUREMENTS

Date————190

Time———— Air Temperature————

Arm. No.	Volts	Amps.	Resis.	Temp.	Field No.	Volts	Amps.	Resis.	Temp.

UPPER PART OF BLANK 7, FOR RESISTANCE MEASUREMENTS

N. Y. C. & H. R. R.R. Electrical Department. Test No. ——— Eq'p't Date Sheet No. ———

SUMMARY OF HEAT TESTS

Date————190

FOR APPARATUS UNDER TEST SEE SHEET No.————

SCHEDULE: Speed————m. p. h., including———stops of————seconds each, for————feet distance. Power on————secs. Started every————secs. Coasting————secs. Braking————secs. Standing————secs. per run. Time occupied in taking resistances————mins. per hr. Power on————min. per hr.

ACCELERATION: Accelerating current called for————amps. Mean accelerating current from test————amps. Time of acceleration on resistance————secs.

VOLTAGE: Voltage called for————. Mean voltage on motor just before power is cut off————. Mean voltage during speed curve running————

CURRENT: Mean current, while power is on————amps. Root mean square current, while power is on————amps. Current just before cutting off power————amps. Free running current————amps.

SPEED: Maximum————m. p. h. Mean, while running————m. p. h. Mean, including stops————m. p. h. Free running speed————m. p. h.

FINAL TEMPERATURE RISE BY THERMOMETERS

MOTOR	No.	No.	No.	No.
Frame				
Spool No. 1				
Spool No. 2				
Armature Core				
Arm. Conductors				
Commutator				

LOSSES:		WATTS MEAN LOSSES WITH POWER ON		
	Armature No.			Mean
	C²R Armature			
	Core Loss			
	Total Arm. Loss			
	C²R Field			
	Total Loss			

Ratio of Distribution =————
Mean loss during run =———— = ———— Watts

REMARKS:

Tested by	Date of Test	Test approved by

BLANK 8, SUMMARY OF HEAT RUNS

N. Y. C & H R. R.R. Electrical Department. Test No.——— Eq'p't Data Sheet No.———

TRAIN RESISTANCES

Date————190

TRAIN RESISTANCE BY COASTING

No. of Locomo's or Motor Cars									
No. of Trailers									
Weight of Train									
Effective Tons per Train									
Length of Train									
Coasting Speed { Beginning / End									
Time Coasting									
Direction of Wind									
Velocity of Wind									
Grade + or −									
Curvature									
Average Speed									
Retard m. p. h. p. s.									
Retard. lbs. per Ton Tr. Wt.									
" due to Wind									
" " " Grade									
" " " Curv.									
" " " Friction									

TRAIN RESISTANCE BY FREE RUNNING

No. of Locomo's or Motor Cars									
No. of Trailers									
Weight of Train									
Length of Train									
Free constant Speed									
No. of Motors used									
Voltage on Motors									
Amps. per Motor									
Direction of Wind									
Velocity of Wind									
Grade + or −									
Curvature									
Total Friction per Ton									
Retard. due to Wind									
" " " Grade									
" " " Curv.									
" " " Friction									

BLANK 9, TRAIN RESISTANCES

the locomotive can be used as a brake to stop a train in case of a failure of the air brakes to work.

G.—SPECIAL TESTS

In order to ascertain whether or not certain changes in design may be advisable, tests will be made to ascertain what the effects would be in case changes were made, of which the following are examples:

(1) With brush holders mounted on supports attached to the yoke over the journal boxes, and also with the brush holders bolted directly to the magnetic frames.

(2) Tests with various types of third-rail and overhead current collecting devices on the locomotive.

(3) Fuse tests to determine the proper size and action when blown.

(4) Effect of magnetism in the motors upon metallic substances between or near the rails of the track.

(5) Competition tests with trains hauled by modern Atlantic and Pacific types of steam locomotives, including acceleration, speed and friction tests.

(6) What will happen if an armature is cut out, but has short-circuited coils.

(7) General operation of locomotive to be noted. This will include reliability of operation, riding qualities of locomotive, ease of taking curves, utility of motor screens under varying weather conditions of rain and snow, the action of various auxiliary devices, etc.

(8) Test for flashing over, when braking heavy currents.

(9) Tests under various conditions of snow, sleet, ice and rain, noting effect on shoes. Experiments to be made with various forms of snow-plows for cleaning the third rail, with and without protection; also with various methods of cleaning sleet and ice from the third rail; also heating tests of third rail for melting ice.

(10) Tests to be made with worn driving boxes. For these tests the boxes will be turned out to correspond to a worn journal.

H.—SERVICE TESTS

Service tests will be conducted of approximately 50,000 miles, of which the mileage made in performing the above tests shall constitute a part, to ascertain the results both on the locomotive and track. The 50,000 miles will be made up approximately as follows:

Preliminary running	500
Casual running	100
Heat test running	800
Other test running	4,100
Service mileage	44,500
Total	50,000

The service mileage will be made as follows:

(1) Eight hours running per day.

(2) Number of single trips per day, 68.

(3) Miles per day, 403.

(4) Days required for mileage test, 112.

In the 6 miles there are six frogs and one railroad crossing. Ten trips each day will be made through the passing sidings to get the wear and tear of going through the switches.

Before starting the mileage runs, a representative of the railroad company, to be appointed by the motive power department, will follow the tests, with the object of suggesting improvements to facilitate the handling of the locomotive, as well as to note mechanical defects.

RECORD BLANKS

A complete set of record blanks has been prepared by the Electrical Commission of the New York Central & Hudson River Railroad Company for systematically collecting and studying the test records. In using these blanks, all final records will be made out in duplicate and signed by regularly appointed representatives of the railroad company and the General Electric Company, and a copy of each official test will be furnished to each company. In view of the importance and novel character of these tests, reduced fac similes of the different forms employed are presented on the two preceding pages, showing the headings under which the entries will be made. The originals are all uniform in size, being 13½ ins. long and 7¾ ins. wide. There are nine forms, as follows:

(1) Apparatus under test;

(2) Starting resistances;

(3) Log of run;

(4) Log of heat run I. (time sheet);

(5) Log of heat run II.;

(6) Log of heat run III.;

(7) Resistance measurements;

(8) Summary of heat tests;

(9) Train resistances.

In addition to these reports, a progress report is to be submitted each week to the New York Central Electrical Commission, showing the results of the tests made during the previous week.

ANNUAL REPORT OF NEW YORK BOARD OF RAILROAD COMMISSIONERS

The Board of Railroad Commissioners of New York State has just rendered its annual report to the Legislature. In reference to elevated railroads, the report states that the total number of passengers carried on the Manhattan Railway during the year ending June 30, 1904, was 286,634,195; in 1903 it was 246,587,022, an increase in 1904 of 40,047,173. The average carried per day in 1904 (365 days) was 785,299; in 1903, 675,581. The Brooklyn statistics are included under surface railways. During the year the Brooklyn elevated roads killed 3 passengers and injured 48; the Manhattan killed 11 and injured 7. The board is still considering the question of the protection of the electric third rail in the operation of the elevated railroads in New York City.

The total gross earnings from operation of the surface street railway companies were $51,964,744.99, which is an increase of $2,989,996.22 over 1903. The operating expenses were $31,397,622.73, which is an increase of $3,137,901.45 over 1903. The percentage of dividends to capital stock is 3.71; in 1903 it was 3.66, an increase of .05 per cent. The total number of passengers carried (including "transfers") was 1,341,766,931; the total number carried in 1903 was 1,267,563,057; 74,203,874 more being carried in 1904 than in 1903. The miles operated increased 99.95 miles, but some of this was not operated during the entire year. The number of passengers carried in the boroughs of the Bronx and Manhattan, New York City (including "transfers"), was 618,760,058; an increase of 6,051,787 compared with 1903. The number of "transfers" in these boroughs increased 8,671,514. The number of passengers carried in the borough of Brooklyn (including "transfers"), including those carried in the borough of Queens by the Brooklyn roads and those carried in the borough of Queens by the Long Island Electric and the New York & Queens County (borough of Queens roads) railways, was 410,709,977, an increase of 30,957,755 over 1903. The number of "transfers" in these boroughs increased 4,714,503. The average carried per day (365 days) in these boroughs was 1,125,233.

Following will be found a table giving percentages of operating expenses to gross earnings for all the companies for the year ending June 30:

	1903.	1904.
Maintenance of way and structures	3.99	4.39
Maintenance of equipment	5.94	7.23
Operation of power plant	9.42	9.32
Operation of cars	28.13	28.30
General expenses	10.22	11.18
	57.70	60.42

The percentages of subdivisions of operating expenses to total operating expenses were as follows:

	1903.	1904.
Maintenance of way and structures	6.92	7.27
Maintenance of equipment	10.29	11.96
Operation of power plant	16.33	15.44
Operation of cars	48.74	46.83
General expenses	17.72	18.50
	100	100

The following table gives statistics relative to the operation of some of the more important companies in the State:

Street Surface Railway (principal companies) Receipts and Expenditures per passenger and cost of operating per car mile for year ending June 30, 1904
OPERATED WHOLLY OR IN PART BY MECHANICAL TRACTION

NAME OF ROAD	Number of passengers carried including transfers	Total car mileage	*Based upon Gross Earnings from Operation and Operating Expenses		*Based upon Receipts from all Sources and Total Expenditures, Including Fixed Charges		Per Car Mile		
			Average earnings per passenger	Average cost of operation per passenger	Average receipts per passenger	Average expenses per passenger	*Gross earnings	*Operating expenses	*Total expenses, including fixed charges
			Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Albany and Hudson	1,335,115	712,602	14.18	9.35	17.44	15.47	26.57	17.53	28.98
Auburn and Syracuse	2,737,954	904,822	8.72	5.84	8.77	8.19	26.39	17.66	24.77
Brooklyn Heights†	327,323,843	53,891,975	4.16	2.48	4.24	3.85	25.24	15.04	23.38
Binghamton	5,916,960	1,210,622	4.06	2.21	4.08	3.53	19.76	10.81	17.24
Central Crosstown (N. Y. City)‡§	15,969,152	1,426,824	2.56	1.69	2.73	2.36	30.59	18.93	26.47
Coney Island and Brooklyn	39,459,197	6,391,140	4.17	2.70	4.18	3.39	25.72	16.71	20.98
Crosstown Street (Buffalo)	16,404,286	2,614,577	3.30	1.99	3.33	3.05	20.73	12.48	19.14
Dry Dock East, Broadway and Battery (N. Y. City)	12,834,140	1,863,000	3.94	3.14	3.99	4.32	27.12	21.64	29.76
Geneva, Waterloo, Seneca Falls, and C. L.	1,708,859	437,984	4.57	2.93	4 59	4.15	17.85	11.43	16.21
Forty-second St. M. and St. N. Ave.(N.Y.City)§	20,355,905	3,232,145	4.13	2.89	4.61	4.85	26.04	18.24	30.53
Hudson Valley	5,717,679	2,265,130	8.13	6.56	8.55	11.19	20.54	16.55	27.36
International (Buffalo)	82,965,876	15,153,937	4.18	2.53	4.39	3.49	22.90	13.80	19.08
Jamestown	4,934,893	797,864	3.00	1.99	3.04	2.71	18.58	12.30	16.75
Kingston Consolidated	2,639,516	493,599	4.66	2.75	4.68	4.27	24.92	14 72	22.82
New York City¶	433,114,493	45,383,254	3.49	1.84	3.64	3.90	33.34	17.55	37.23
New York and Long Island	924,849	377,410	6.46	5.54	6.52	5.69	15.82	13.66	15.82
New York and Queens Co.	15,680,571	3,092,412	4.16	2.35	4.22	3.60	21.09	11.90	18.27
Rochester	47,338,639	6,138,030	3.14	1.79	3.19	2.55	24.23	13 86	19.70
Schenectady	10,102,677	2,755,036	6.48	4.91	8.21	6.81	23.77	18.04	24.98
Syracuse and Suburban	1,603,045	438,492	5.21	3.24	5.24	5.09	19.05	11.84	18.60
Syracuse Rapid Transit	21,451,500	3,869,887	3.89	2.28	3.91	3.42	21.57	12.67	18.97
Third Avenue (N. Y. City)**	45,867,289	6,336,829	3.92	2.07	5.25	5.22	28.37	14 99	37.78
United Traction (Albany and Troy)	33,454,182	8,297,632	5.05	3.29	5.09	4.22	20.37	13.28	17.01
Utica and Mohawk Valley	14,002,520	3,394,271	5.18	3.52	5.20	4.72	21.36	14.52	19.47
Union (N. Y. City)	48,766,028	7,670,457	2.65	2.03	2.68	2.58	16.86	12.93	16.29

*Includes earnings and expenses of freight, express, mail and all other business. †Includes all lines operated by Brooklyn Heights not making separate reports. ‡For nine months. §Includes portion operated by horses. ¶Includes all lines operated by New York City not making separate reports and also includes lines operated by horses. **For ten months

The following is a table of accidents occurring on street surface railways during the year ending June 30, 1904, as reported to the board in separate accident reports and as classified in its own office:

Table of Accidents on street surface railroads reported by separate reports to the Board of Railroad Commissioners, classified as to causes, for the year ending June 30, 1904.

CAUSE OF ACCIDENT	1904								1903							
	PASSENGERS		EMPLOYEES		OTHERS		TOTAL		PASSENGERS		EMPLOYEES		OTHERS		TOTAL	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Fell from car in motion	7	26	4	9	3	9	14	44	6	15	3	4	...	2	9	21
Getting on or off cars in motion	12	156	2	...	5	54	19	210	10	130	1	...	10	77	21	207
Walking or being on track	1	1	10	4	94	161	105	166	...	...	5	3	82	166	87	169
Putting head or arms out of windows, or missiles thrown in windows	...	1	...	...	...	...	...	...	2	...	...	...	...	...	...	2
Crossing tracks at street crossings	...	...	...	...	42	114	42	114	...	...	...	...	28	108	28	108
Derailments:																
Running at too high rate of speed	...	...	...	...	...	...	...	...	13	40	1	1	...	...	14	41
From obstruction on track	...	...	...	...	...	...	...	...	...	7	...	...	...	...	...	7
From unknown causes	...	34	1	2	...	...	1	36	2	54	...	2	2	1	4	57
Defective track	...	9	...	...	...	...	...	9	...	...	...	...	...	...	...	...
Collisions:																
Head on, by neglect of orders or signal	1	62	...	10	...	...	1	72	2	53	...	...	...	...	2	53
Rear, by neglect of orders or signal	...	110	...	10	...	1	...	121	...	44	3	20	...	...	3	64
By misplaced switch	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...
At grade crossings of railroad	...	5	...	...	...	...	...	5	...	7	...	...	...	...	...	7
Other causes	3	62	11	36	...	2	14	100	2	36	8	18	1	2	11	56
	24	466	28	71	144	341	196	878	35	388	22	48	123	356	180	792
From causes beyond their own control	1	223	2	23	...	2	3	248	17	224	5	24	1	1	23	249
By their own misconduct or incaution	23	241	26	48	143	336	192	625	17	161	16	24	113	346	146	531
Reported as caused by intoxication	...	2	...	...	1	3	1	5	1	3	...	...	9	9	10	12
Indeterminable as to want of caution or otherwise	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...
	24	466	28	71	144	341	196	878	35	388	22	48	123	356	180	792

The average number of persons, including officials, employed during the year ending June 30, 1904, on all the street surface railroads of the State (including horse railroads) was 32,646; in 1903, 30,028. The aggregate amount of salaries and wages paid them during the year was $19,812,227.43; in 1903, $17,841,895.49. The companies owned and operated on June 30, 1904, 5253 electric motor or cable box cars; 4136 electric motor or cable open cars; 659 electric motor combination box and open cars; 30 electric motor combination passenger and baggage cars; 10 electric motor mail cars; 428 electric motor express, freight and other cars; 376 electric motor snow-plows, sweepers and sprinklers, the total being 10,892; for the year ending June 30, 1903, the total was 10,364. Sixteen thousand and seventy-two fenders were reported in 1904 as in use on these cars. Some of these fenders are transferred from one end of the car to the other at terminals, and some f the devices reported as fenders are wheel-guards. Two .thousand and twenty-six other cars (being cars operated by horses, and box, open, freight, express, service cars and snow-plows not equipped with motors) were also owned and operated on June 30, 1904.

The number of tons of freight reported as carried on the street surface railroads of the State during the year ending June 30, 1904, was 633,674.

On some of the roads separate express companies operate, and in some of these cases the amount carried is not reported.

REPORT OF ELECTRICAL EXPERT

The electrical expert of the board reports generally on the physical condition of street surface railroads as follows:

The improvements in the physical conditions of electric railroads in this State, mentioned in the last report to the board on that subject, have been continued during the past year. This is especially true of the suburban and interurban roads. There are, however, some exceptions, and a few of the older and less important roads are not in proper condition. On some of these there is quite an excursion traffic during the summer season, and the safety of this traffic requires that these roads should be improved.

The board has made recommendations which, if complied with, would result in the necessary improvements. In some instances, the financial conditions of the companies are such that they have been unable to comply with all of the recommendations. In these cases, frequent inspections of the roads have been made, and compliance with the more important recommendations, affecting the immediate safety of operation insisted upon, and, in most instances, have been complied with.

The improvement in the construction of cars, noted in the last report, has been continued during the past year, and all of the new cars added to the suburban service in the State are of modern construction and properly provide for the comfort and convenience of passengers. As a result of the board's action, there has been a marked improvement in the maintenance of cars on nearly all of the city as well as suburban railroads; more attention has been given to the matter of caring for cars, including painting, varnishing and cleaning.

The increase in the use of power brakes on electric cars has been continued during the past year, and all of the additions to the rolling stock on interurban lines have been equipped with some form of power brake, and a number of cars on city lines have been so equipped.

The question of the danger of high-voltage transmission lines, located on street and highways, was the subject of investigation by a committee of the State Street Railway Association. This committee made a number of tests on a line especially constructed for that purpose. Your electrical expert took part in these tests. This committee presented a report to the association at its convention held in Utica, September, 1904. This report was to the effect that, under certain conditions, wooden poles supporting wires carrying high-voltage currents might become dangerous to persons coming in contact with them. They also suggested a practical and inexpensive method of preventing these possible dangers, but, even with pole lines equipped as suggested by the committee, they should not be placed on streets or highways where it is possible to avoid doing so.

One of the most serious defects in electric railroad operation, not only in this State, but throughout the country, exists in the methods of train despatching. This important matter was the subject of consideration by a committee of the State Street Railway Association. This committee has not completed a report on this subject. A uniform method of train despatching on interurban railroads must be adopted, to insure safety of operation.

During the past year, several accidents have occurred, which were caused by operating two or more cars in one train with one motor car, the others being trailers coupled to the motor car and to each other with draw-bar couplings. These trains are usually used for excursion purposes, and in most cases without a sufficient number of employees on them to insure control on heavy grades. Where traffic demands the operation of cars in trains, they should be equipped with modern couplings and air brakes, controlled by the motorman on the head car.

THE BOARD'S RECOMMENDATIONS

The board renews to railroad managers its general recommendations made in its annual reports for several years, as to the operation of street surface railroads, especially in the following particulars:

First—Every street car which crosses a steam railroad at grade shall be equipped with a red flag for use during the day and a red lantern for use at night. When approaching such crossings, the car shall come to a full stop at least 30 ft. from the crossing, and shall not proceed until the conductor has gone upon the steam railroad, carrying the flag or lantern, and after ascertaining that the way is clear, given the proper signal for the car to proceed. The board also recommends that at all grade crossings by overhead trolley railroads of steam railroads, a V-shaped trough of metal be constructed over the trolley wire or wires to insure the motor retaining the current while the crossing is being made.

Second—That where two or more street car lines cross, or where they merge, an agreement shall be made as to which line shall have the right of way. The car that has not the right of way shall come to a full stop before crossing the tracks of the other line, or entering on the joint track, and the car which has the right of way shall slow down before crossing the tracks of the other line, or entering on the joint track.

Third—That cars passing in opposite directions shall not meet on street crossings.

Fourth—That the speed of cars be reduced to the minimum on all curves where the view is obstructed.

Fifth—That passengers be prohibited from riding on the running boards or side steps of open cars.

Sixth—That passengers be not permitted to stand on the front platform of open cars, and that only as many passengers be permitted on such platforms as can be conveniently seated. In the case of open cars that have no seats on the front platforms, passengers shall not be permitted to ride on the platform, and the side gates shall at all times be kept closed. Under no circumstances should passengers be permitted to ride on the front platforms of closed cars.

These recommendations have been quite generally adopted by the companies. Beginning in January last, in New York City, the plan of stopping street surface railroad cars at intersecting streets, with the front platform at the crosswalk first reached, was tried, but afterward abandoned. The recommendation of this board as to providing oil tail-lights on cars operated on suburban lines has been quite generally adopted.

Attention is called to statements contained in this volume of investigations of complaints against street surface railroads.

The members of the Salt Lake Street Railway Mutual Aid Association, at its last meeting, elected the following officers and directors for the ensuing year: O. P. Arnold, Jr., president; George Manning, vice-president; J. R. Mathews, secretary; A. M. Rust, treasurer; Joseph J. Coles, T. C. Nuttal, E. H. Arnold, M. W. Wagstaff, J. M. Lindsey, directors; Walter Calder, J. G. Williams, George Eldredge, auditors; Dr. C. M. Benedict, physician. The reports of the secretary and treasurer show the association to be in a thriving condition, financially and otherwise. It now has a membership of 340, over 100 having joined during the past few months. Arrangement has been made with one of the retail drug stores of the city by which members of the association will get prescriptions compounded and drugs and medicines at special rates. It is expected that an arrangement will be made with one of the hospitals to care for the members of the association in the event of sickness or accident, at a reasonable rate.

ANNUAL REPORT OF THE MASSACHUSETTS BOARD OF RAILROAD COMMISSIONERS

The annual report of the Railroad Commissioners of the State of Massachusetts has just been published. The statistics presented are for the year ending Sept. 30, 1904, and the commissioners say that the total miles of main track (including trackage rights) operated in the State is 2,654.479, an increase of 33.517 over the previous year. The remarks on the general condition of the street railway properties of the State follow:

STREET RAILWAY CONDITIONS

The street railway returns of the year are suggestive. Of seventy-four operating companies, thirty failed to earn expenses and fixed charges; twenty-five paid dividends; of the twenty-five which paid dividends, fourteen earned them during the year. Five companies, as stated above, have been in the hands of receivers. Very few companies, beside keeping their railways in good repair, reserved for depreciation what prudent management would require. Generally present necessities only have been met, the future, with its inevitable expense of replacement and reconstruction, being allowed to look out for itself. The board prepares a yearly list of companies, which appear from their returns to have properly earned and paid a dividend of at least 5 per cent for the five years immediately preceding. Thirteen companies were found to be entitled to a place upon the list submitted in January, 1903; the list of January, 1904, contained the names of twelve companies; that submitted this year contains the names of ten companies.

Attention has been repeatedly called to the unusual expenses consequent upon the severity of last winter's weather and to the loss of receipts in the summer owing to the coolness of the season. But it is not safe to count upon mild winters and warm summers in this part of the country, and while it is agreed that the past year was an extraordinary one, it is plain that the weather did not drive five companies into insolvency and others perilously near it. The evil is more radical. In the early days of the change from horse to electric railway, promotion ran wild, with the idea that immense profits were to be realized in the extension of the old and in the construction of new railways as electric roads in any and every direction; that where no business was in sight, it would appear under the creative magic of the electric car. The test of this opinion, necessarily a test of years in which novelty disappears, is now practically complete. Experience has shown that with the more expensive roadbed and equipment, the heavier rail and larger cars, there has not been the corresponding and expected development of permanent business. Operating cost, too, in heating cars and in repair and renewal of plant, has proved larger than was expected. With the new accommodation and the nearer approach to railroad conditions, has come the increased demand of the public for expenditures in the interest of safety and comfort which had not been counted upon, as for example, in construction of double track, instalment of signal systems and establishment of waiting rooms. Hurried along by the natural enthusiasm for the new type of railway with its many most attractive features, capital, sometimes deliberately misled, has been invested in undertakings for which there was no sufficient demand, and which are now represented by roads run, not only without return upon the investment, but at an actual loss of capital. In such cases the future promises as possible events: the acceptance of an unsatisfactory service as better than nothing; an increase in fares, or the abandonment of the railway. It is a source of gratification that under our restrictive laws, while capital has taken its own risk as to the earning capacity of these enterprises, in no case has there been an issue of stock or bonds in excess of the fair cost of the railway property, to act as a contributing factor to the existing troubles.

Upon some railways fares have been raised, and with encouraging results, but this action is usually unpopular, and is often taken at the risk of lessening the volume of business. It is, moreover, at times complicated by agreements made between companies and town officials when locations and privileges in the streets were granted. If, however, this is the remedy, it is better that it be applied than that the public lose the benefits which the railways bring.

Another incident of the present situation has been the enforcement upon certain systems of a seemingly arbitrary distinction between the long and the short distance ride, to the provocation of the through traveler, who is loath to admit that there is any justification for it. The zone system has never been favored in this State. Instead there has been adopted the 5-cent fare within city and town limits, in some cases between centers of adjoining towns. As new grants of location have been sought, the 5-cent fare has been made good for greater and greater distances, frequently through the use of transfer checks. This low fare promotes a better distribution of population in large communities, and is conveniently paid and collected, while the company has been enabled to reap a profit in the frequency with which cars have been filled and refilled with persons taking short rides. In one notable and exceptional instance this fare covers five cities, which were deemed to be so closely connected as to make practically one continuous community, and so to give the company the advantage of continually changing patronage from point to point. The attempt, however, upon interurban lines to maintain these local concessions, and at the same time to establish a sort of mileage basis for through travel, with arbitrary fare limits, has naturally led to frequent complaints from those who think they are unjustly denied privileges which are given to others. The companies, as well as the traveling public, would be benefited by the establishment of a more satisfactory system of fares upon these railways. Much study has been and is being given to the matter, but as yet the problem remains unsolved.

ASSETS AND LIABILITIES

The gross assets of the companies on Sept. 30, 1904, were $140,843,739.79, an increase of $1,979,525. The gross liabilities at the same date, including capital stock, were $136,049,485.24, an increase of $2,928,075. That is, the aggregate surplus of the companies was reduced by $948,550.

DIVIDENDS

The total amount of dividends declared the last year was $3,214,496.24, a decrease of $371,752 over the preceding year. One company paid 11 per cent; one paid 10 per cent; five paid 8 per cent; one paid 8 per cent on preferred and 7 per cent on common; one paid 7.22 per cent; one paid 7.20 per cent; one paid 7 per cent; ten paid 6 per cent; one paid 5.5 per cent; six paid 5 per cent; two paid 4 per cent; one paid 3.75 per cent; two paid 3 per cent; one paid 2.5 per cent; one paid 2 per cent; one paid 1.5 per cent; two paid 1 per cent; sixty-four companies declared no dividend.

COST AND CAPITAL INVESTMENT PER MILE

The total capital investment (capital stock and net debt) of the street railway companies of the State advanced the last year from $122,666,365 to $129,494,748, an increase of $6,828,383.

The average cost of the street railways of the State, per mile of main track (including the cost, but not the length of side track), as it stood on the books of the companies Sept. 30, 1904, was $27,025.14 for construction; $10,176.73 for equipment, and $13,105.68 for lands, buildings (including power plants) and other permanent property, making a total average cost of $50,307.55 per mile of main track.

INCOME AND EXPENDITURES

The total income of the companies from all sources, for the year ending Sept. 30, 1904, was $27,759,334.51, and the total expenditures (including dividends) were $27,975,717.19, making a net loss of $216,382.68 to be deducted from the surplus of previous years.

The items of total expenditure, with the increase in each item over the previous year, are shown in the following table:

TOTAL EXPENDITURES, 1903 AND 1904

Expenditures.	1903.	1904.	Increase.
Expenses of operation	$17,519,367	$18,397,291	$877,924
Interest on debt and loans	2,350,391	2,670,989	320,598
Taxes	1,725,312	1,761,083	35,771
Rentals of leased railways	1,394,283	1,486,385	92,102
Other charges on income	435,382	445,473	10,091
Dividends paid	3,586,248	3,214,496	*371,752
Total expenditures	$27,010,983	$27,975,717	$964,734
Surplus for the year	16,668	†216,383	*233,051

* Decrease. † Deficit.

The gross earnings and expenses of operation the last year are classified and compared with those of the previous year, in the following table:

GROSS EARNINGS AND EXPENSES OF OPERATION, 1903 AND 1904

Earnings and Expenses.	1903.	1904.	Increase.
Revenue from passengers	$24,921,452	$25,619,597	$698,145
from mails and merchandise	82,837	93,344	10,507
from tolls, advertising, etc.	536,522	494,306	*42,216
Gross earnings from operation	$25,540,811	$26,207,247	$666,436
Operating expenses	17,519,367	18,397,291	877,924
Net earnings from operation	$8,021,444	$7,809,956	*$211,488

* Decrease.

VOLUME OF TRAFFIC

The total number of passengers carried during the last year on the railways of the 102 companies making returns to the board was 520,056,511, an increase of 15,394,268 passengers over the previous year.

The total number of miles run by street cars was 107,897,456, an increase of 390,644 miles over the previous year.

The following table gives for each of the last ten years the average gross earnings, operating expenses and net earnings from operation, per car-mile run and per passenger carried, thus showing more in detail the changes from year to year in the earnings, cost and net results of operation:

GROSS AND NET EARNINGS FROM OPERATION PER CAR-MILE RUN AND PER PASSENGER CARRIED, 1895-1904

Years.	Average per Car Mile.			Average per Passenger.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.	Gross Earnings.	Expenses of Operation.	Net Earnings.
	Cents	Cents	Cents	Cents	Cents	Cents
1895	30.20	20.82	9.38	5.07	3.50	1.57
1896	27.69	19.70	7.99	5.08	3.61	1.47
1897	25.68	17.71	7.97	5.12	3.53	1.59
1898	24.80	17.11	7.69	5.11	3.52	1.59
1899	24.74	16.87	7.87	5.09	3.47	1.62
1900	24.46	16.10	8.36	5.06	3.33	1.73
1901	23.40	15.66	7.74	5.02	3.36	1.66
1902	23.42	15.87	7.55	5.05	3.42	1.63
1903	23.76	16.30	7.46	5.06	3.47	1.59
1904	24.29	17.05	7.24	5.04	3.54	1.50

STREET RAILWAY ACCIDENTS

The whole number of persons injured in connection with street railway operation, as reported by the companies for the year ending Sept. 30, 1904, was 5078, of whom 92 received fatal injuries and 4986 injuries not fatal. The number of passengers injured was 3372, of whom 21 were injured fatally. The injuries to employees were 161 in all, 5 of which were fatal. The number of injuries to travelers and others on the street was 1545, of which 66 were fatal.

Altogether, there appear to have been injured, fatally and otherwise, 804 more passengers, and 300 more travelers and other persons—in all 1104 more—the last than the preceding year.

THE QUESTION BOX

In the last issue of this paper the first portion of a series of questions, forming the "Question Box" of the STREET RAILWAY JOURNAL, was published. The topics covered were: A, General; B, employees; C, parks and pleasure resorts; D, the express and freight service; E, the master mechanic's department. The following questions relate to F, steam engineering; G, the engine room; H, the line department; I, the track department.

For the benefit of those who did not see the previous number, it might be stated that the STREET RAILWAY JOURNAL has decided to institute a question box on topics connected with street railway construction and operation. The questions were published in this and the last issues of this paper. Copies of these questions have also been mailed to a number of companies. Replies are requested, however, from any or all of the readers of this paper who have opinions to offer. The name of the contributor will be withheld from publication in any case where a request to this effect is made. In replying, it is not necessary to repeat the questions, the key numbers are sufficient. Answers are requested in detail and with reasons, as "yes" and "no" are of slight value. Progress is made by each person giving to the other the benefit of his experience, and the co-operation of all is requested in this general exchange of information.

F. STEAM ENGINEERING.

F 1.—What is the standard method of rating boilers?

F 2.—When computing the overload capacity of a boiler plant, what percentage above rated capacity is it safe to rely on?

F 3.—With reference to the relation between average and peak loads on an electric railway power station, what is the best size and what the best arrangement of boiler units?

F 4.—What is the best method, all things considered, of supporting a boiler?

F 5.—What kind of brick have you found best for boiler settings?

F 6.—In setting boilers, is it advisable to leave air spaces in the division and side walls?

F 7.—How do you locate breaks in boiler setting?

F 8.—What do you do to reduce air leakage in the brick work settings of boilers?

F 9.—Without mentioning trade names, can you give any suggestions on best way of securing good boiler steam pressure regulation on railway loads?

F 10.—Is it possible to secure regulation of boiler steam pressure to within 2 per cent. or 3 per cent. of normal, under railway load conditions?

F 11.—Do you blow-off your boilers at regular intervals? If so, how frequently?

F 12.—Describe what you consider to be the proper method of blowing down a boiler.

F 13.—How should the blow-off pipes of a boiler be protected?

F 14.—What is a practical method of keeping a boiler in service when a leak develops in the tubes, either fire-tube or water-tube?

F 15.—How frequently should boilers be thoroughly inspected?

F 16.—How frequently should boilers be thoroughly cleaned?

F 17.—Have you discovered any schemes for simplifying the work of cleaning boilers? Please describe any of the little things which make the work easier. For instance, when necessary for a man to go inside the boiler, what kind of a light does he take with him?

F 18.—Are you in favor of taking out boiler insurance? Why?

F 19.—On what basis is boiler insurance usually determined? What premium do you pay?

F 20.—What is a cheap and simple method of determining amount of feed water used in boilers at a small or medium size plant?

F 21.—Where feed water is taken from city mains on meter basis, what is a fair charge for the water?

F 22.—Where two sources are available ,is it preferable to take feed water from city water mains or from open supply, as a pond or stream?

F 23.—Can a satisfactory "home-made" device be devised for automatically indicating high and low water in the boilers?

F 24.—What advantage or economy is obtained by the use of automatic boiler-feed devices?

F 25.—If you know of any satisfactory "home-made" automatic boiler-feeder devices, please give description, cost and sketch.

F 26.—Please state your experience with automatic boiler-feeding devices, and give information and suggestions as to conditions under which a device of this kind can be used to advantage. What is the direct advantage and economy secured by an automatic boiler-feeding device?

F 27.—What ingredients in feed water cause scale formation in the boilers? What are the neutralizers in each case?

F 28.—How can the engineer of a small power station, without consulting a chemist, determine the scale-forming ingredients of the feed water he is using, with a view of injecting neutralizing chemicals?

F 29.—Is it practicable to use soda ash for purifying boiler feed water? What are the objections? Under what conditions should soda ash be used, and in what quantities?

F 30.—Under what conditions can kerosene be used to advantage in boilers? What are the objections to the use of kerosene?

F 31.—Will zinc placed in a steam boiler prevent scale or corrosion? Under what conditions of feed water impurity should zinc be used?

F 32.—What is the best method of feeding purifying compounds into a boiler?

F 33.—What portions of all the piping in the boiler room should be of brass?

F 34.—What are the relative merits and what the relative cost of iron and brass for hot feed water piping?

F 35.—Do you know of any novel or unusual arrangement of valves or piping on boiler feed lines that has resulted in better regulation or other advantage in feeding water to boilers? If so, please give detailed description, with sketch if possible.

F 36.—The proposition is advanced that in striving for flexibility in operation of steam plant, we have overdone the matter of putting all steam pipes in duplicate and coupling them up to the engines and boilers by an interminable number of valves so that all manner of permutations and combinations might be made between the engines and boilers. What do you think about it?

F 37.—How long after the engine has been stopped should the air pump vacuum endure? In actual practice, how long does it endure?

F 38.—How do you test vacuum enclosing pipes and vessels for leakage?

F 39.—What is the minimum head of hot-water supply above pump suction for reliable pumping service?

F 40.—What is the best method of guarding against possible shortage of condensing water supply?

F 41.—Can superheating be applied to existing electric railway power houses? What changes in piping, valves, engines, etc., are necessary? What advantages will follow? Cite instances.

F 42.—What is the limit in size of station in which superheating can be used with economy?

F 43.—Do you recommend separately fired or boiler contained superheaters for moderate size plants?

F 44.—What do you do with the ashes from your boiler plant?

F 45.—What is the comparative economy, including operation and maintenance, of automatic stokers and hand firing?

F 46.—What is the smallest size of boiler plant, or minimum coal consumption, which warrants the use of automatic stokers?

F 47.—What is a quick and sufficiently accurate method of determining the comparative values of different grades and kinds of coal for boiler firing purposes?

F 48.—In a small or medium size station what is the best method of determining amount of coal consumed? Give details.

F. 49.—What should be done to prevent coal storage bins from taking fire by spontaneous combustion?

F 50.—An engineer of a small power station requests suggestions on reducing cost of handling coal from cars to boilers. He does not believe size of plant warrants chain bucket conveyors. Can you give him any pointers or "wrinkles" on reducing this cost?

F 51.—On your road, what is the cost of boiler room labor per ton of coal fired, including handling ashes. (State whether hand firing or automatic stoking is used.)

F 52.—How many tons of coal should a fireman and passer handle per day?

F 53.—Is it easier for the fireman to handle coal from the floor with a long-handled shovel or from a charging car with a short-handled shovel?

F 54.—What schemes are there for inducing firemen to take greater interest in their work? Give details and results secured.

F 55.—What is the smallest size station in which coal and ash conveyor systems can be installed profitably—first investment and running cost considered? Give details.

F 56.—An electric railway power house is located in a lumber mill district, where sawdust and mill scrap are very cheap. The engineer believes he can run his station entirely on this fuel and stop using coal. Can he do it? What changes will he have to make in his grates and fire boxes? What about obtaining better draft? Can anyone furnish data on electric railway power houses using wood for fuel?

F 57.—Can the efficiency of an ordinary hand-fired boiler be increased by the use of a fire-brick coking arch over the grates? Give results of experience.

F 58.—Have you ever used a fire-brick wall at the back of the furnace? Into what form did you build the brick and what were the results secured? Please send sketches.

F 59.—For what uses, if any, do you employ compressed air in the boiler room? What has been your experience with the air lift for raising water from wells?

F 60.—What is a cheap and simple method of testing flue gases in a small or medium size plant?

F 61.—After an engineer has secured an analysis of the flue gases, how should he use the data obtained in determining and increasing the efficiency of his boilers?

F 62.—If the boiler is working at good efficiency, what should be the temperature of the flue gases as they leave the boiler?

F 63.—What is the rule for determining size of flue for a given plant?

F 64.—What are some of the ways by which intensity of draft can be secured, exclusive of mechanical blower?

F 65.—Have you ever tried injecting a jet of steam under boilers to raise steam pressure at times of heavy demands? Give details of arrangement and result secured.

F 66.—In a small or medium size plant, what is the best method of increasing boiler capacity during heavy peak loads? Give details and results obtained.

F 67.—An engineer of a medium size plant has been urged to put in mechanical draft. Wanted, information and suggestions as to what to do and how to do it.

F 68.—When does it become profitable to put in forced or induced draft in a small or medium size plant?

F 69.—What is the standard of measurement in expressing draft of chimney? On what is the standard based?

F 70.—What is a simple method of determining roughly the draft of a chimney, where absolute accuracy is not required?

F 71.—Given a proposed power plant, how is the height and cross section of chimney determined?

F 72.—What are the relative advantages and disadvantages of self-supporting steel stacks and brick chimneys? What are the relative costs?

F 73.—Information is requested concerning foundations for chimneys. What is the best kind of foundation?

G. THE ENGINE ROOM

G 1.—Discussion is invited pertaining to comparisons of the various systems of power generation and distribution now available for electric railway purposes.

G 2.—What are your ideas, based on experience, regarding the use of several small generating units in place of one or two large units? Give details, cost and results secured.

G 3.—Is it possible to run a commercial lighting or power load from generating units that are supplying current for railway purposes? How can it be done? What is the best method of regulation in such case to prevent fluctuations in the lighting or power circuit?

G 4.—To what various uses do you employ compressed air in the engine room?

G 5.—How do you obtain compressed air for the various uses about the power house. At what pressure do you use the air?

G 6.—Please state in detail what trouble you have had with lightning at your power house. Then please state in full what steps you have taken to prevent damage from lightning.

G 7.—Do you know of any satisfactory schemes whereby all employees of a power plant can participate in a bonus when station is operated at especially good economy? Give details and results obtained.

G 8.—A young engineer, who has yet to win his spurs, has been given charge of the power house on a 20-car road. He has been asked by the manager to carry out a general efficiency test of the entire station. He wants suggestions from some of the older heads as to some of the things he should and should not do in carrying out these tests. He wants to know how to dispose his available forces so as to obtain the data without taking on additional help. If your manager should ask you to make tests and report on just what each department of the power house was doing and could do, how would you go about it to get the information? This is a matter especially worthy of discussion. Suggestions are particularly requested.

G 9.—To what extent have gas engines been used on electric railway loads, and what have been the results secured with gas-engine-driven units? Information and data relative to this application of the gas engine are especially requested.

H. THE LINE DEPARTMENT.

H 1.—Please state in detail what trouble you have had with lightning on any part of the transmission or distribution system. Then, please state in full, what steps you have taken to prevent damage from lightning.

H 2.—What special trouble, if any, have you had with lightning on high-tension transmission lines, and what precautions do you take to protect the high-tension line and high-tension apparatus?

H 3.—What is the most efficient method of protecting high-tension lines from contact with trees?

H 4.—What is the best form of cradle or other device for catching broken high-tension lines at highway crossings, or where the lines cross over or under other wires?

H 5.—Should iron trolley poles be painted? Please give reason for your answer.

H 6.—Should wooden trolley poles be painted? Please give reasons for your answer.

H 7.—Without giving trade names, what is the nature of the paint you prefer for painting trolley poles?

H 8.—What is the best way to paint trolley poles? Give sketch or photograph and description of apparatus used; also detailed cost of doing the work.

H 9.—What is the best way to raise and set trolley poles? Give sketch or photographs and description of method. also detailed cost of doing the work.

H 10.—What are the relative costs of various kinds of woods available for trolley poles? What are their relative length of life?

H 11.—What is the most efficient method of jointing copper feeder cables?

H 12.—What is the most efficient method of tapping trolley wire to feeders?

H 13.—What is the most efficient method of preventing short circuits by reason of low-tension feeders coming in contact with trees?

H 14.—Do you prefer a mechanical or soldered clip?

H 15.—It has been suggested that sleet can be prevented from forming on the trolley wire by greasing the wire. Have you ever tried it? With what results?

H 16.—What is the best method of overcoming trouble caused by sleet on the trolley wire?

H 17.—When you receive a report from a car crew that a trolley wheel has jumped the wire, what action is taken?

H 18.—Please describe the essential features of your "hurry-up" service for repairing breaks in overhead construction.

H 19.—What are the relative advantages and disadvantages of the tower wagon and the tower car for making repairs in overhead construction? Do you prefer the wagon or the car?

H 20.—Have automobile tower wagons for repair purposes been used to any extent? What advantages do they possess over horse-drawn wagons?

I. THE TRACK DEPARTMENT.

I 1.—In the construction of a suburban or interurban electric railway, what are the deciding factors in determining the weight and section of rail to be used? State what weight and section you prefer, and why.

I 2.—What is the best type of rail for city service in unimproved streets?

I 3.—What advantages, if any, does a 9-in. girder rail possess over a 7-in. girder?

I 4.—If the conditions require a girder rail, which type would you prefer, semi-groove, full-groove, tram, center-bearing or Trilby section? Please state your reasons in full for the preference.

I 5.—When laying tracks, what space should be left between the ends of the rails for construction and expansion?

I 6.—What are the determining factors in selecting ballast for a new suburban or interurban electric road?

I 7.—What is the best material for ballast on a suburban or interurban electric road?

I 8.—Please give comparative costs of ballasting track with different materials.

I 9.—What means, machines, devices, special rigged cars, etc., do you know of for expediting or cheapening the work of ballasting and laying track? Please give sketch or photograph and detailed description, including cost.

I 10.—How can good drainage be secured on suburban and interurban electric roads? Please answer this question in detail.

I 11.—How can good drainage be secured on city tracks? Please answer this question in detail.

I 12.—What is the best form of cover plate and design of openings for track drains, especially with reference to the prevention of horses' shoes getting caught in openings?

I 13.—What is the best way of keeping tracks to gage in unimproved streets? Give details.

I 14.—Have you had any experience with "creeping" rails, and how have you remedied this difficulty?

I 15.—Have you had any experience with "waves" developing in the top surface of rails? What is the cause of this phenomenon and how can it be remedied?

I 16.—Do you know of any electric road that has used crude oil on the roadbed to lay dust and kill weeds? What have been the results obtained?

I 17.—Is crude oil a satisfactory substitute for salt for preventing obstruction of switches and special work by ice and snow?

I 18.—Do you know of any satisfactory device to be attached to each car for cleaning the groove of girder rails? Please give description, with sketch or photograph.

I 19.—Is there any advantage in greasing curves?

I 20.—What are the relative costs of various kinds of woods available for ties? What are their relative length of life?

I 21.—Has any satisfactory substitute been found for wooden ties? What has been the experience with iron, steel, glass, concrete or other materials for ties?

I 22.—What has been the experience with concrete foundations under rails or roadbed? Please give details as to how concrete was laid, cost of canstruction and results secured.

I 23.—What methods are available for welding joints? Please give your experience with any of the methods of welding track, including detailed cost of doing the work, and the results secured.

I 24.—In sanding track, is it better to sand one rail or both? Why?

I 25.—When sanding track, is it better to sand from a special sand-car or to have sand on each car? Why?

I 26.—Is it a good idea to mix salt with the sand? Why?

I 27.—What can be done to overcome slippery rails, due to dead leaves on the track?

FIRST CONVENTION OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION

The Indiana Electric Railway Association held its first annual meeting at Indianapolis, Jan. 12. At a preliminary meeting of Indiana electric railway men held in Indianapolis on Dec. 9, 1904, the Indiana Electric Railway Association was formed and a constitution and by-laws were adopted. The by-laws provide for an annual meeting the second Thursday in January of each year. Regular meetings are provided for the second Thursday of each month, subject to change by the executive committee. At the preliminary organization meeting, held Dec. 9, a committee of nominations and arrangements was appointed, consisting of A. L. Drum, general manager of the Indiana Union Traction Company, chairman; Paul H. White, manager of the Indianapols & Martinsville Rapid Transit Company; J. W. Chipman, general manager of the Indianapolis & Eastern Railway Company; Gardner F. Wells, manager of the Terre Haute Traction & Light Company, and C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Company.

The convention was held on the fifth floor of the new Traction and Terminal Building, which is the new building recently completed to serve as an interurban terminal and traction headquarters in Indianapolis.

The meeting was called to order by A. L. Drum, chairman of the committee on arrangements. He presented the nominations for officers on behalf of the committee. The following officers were nominated and afterward elected: President, Charles L. Henry, president and general manager, Indianapolis & Cincinnati Traction Company; vice-president, J. W. Chipman, general manager, Indianapolis & Eastern Traction Company; secretary, Paul H. White, general manager, Indianapolis & Martinsville Rapid Transit Company; executive member (one year), A. L. Drum, general manager, Indiana Union Traction company; executive member (two years), C. C. Reynolds, general manager, Indianapolis & Northwestern Traction Company; executive member (three years), Gardner F. Wells, general manager, Terre Haute Traction & Light Company; member finance committee, Charles Murdock, president, Fort Wayne & Wabash Valley Traction Company; member finance committee, W. G. Irvin, general manager, Indianapolis, Columbus & Southern Traction Company. President Henry then took the chair.

A paper was presented by A. S. Richey, electrical engineer of the Indiana Union Traction Company, on the subject: "Cost of Electric Railway Power Production and Transmission in the State of Indiana." A very full abstract of this paper is printed elsewhere in this issue. The paper contains valuable statistics on the cost of power production for 85 per cent of electric railway mileage of the State from which he has collected statistics.

In the discussion of this paper, A. L. Drum emphasized the point brought out by Mr. Richey that frequently alternating-current transmission is employed where direct current would be better. He cited one case of a railway and light plant in a city where the change from an alternating-current distribution with 45 per cent loss was made to a direct-current underground distribution with 12 per cent loss, and the $15,000 saved on fuel paid the interest on the $300,000 invested in making the change to the underground system, and the requirements of the city for underground wires were complied with. He cited another amusing incident where a company having a 500-volt direct-current power distribution system in a city thought to save money by operating it as a three-wire system, with 1000 volts between the outer mains of the system, placing the motors on one side of the city, on one side of the three-wire system, and those on the other side of the city, on the opposite side of the three-wire system. Further calculation, however, revealed the fact that the only saving in copper would be from the power station to the center of distribution on the neutral main, and this point was only about 100 ft. from the power house, so that the only compensation the company would have had for improving the insulation to stand 1000 volts between the outer mains would be the saving in copper on 100 ft. of neutral main. He further called attention to the fact that direct-current feeder copper in the air sometimes appreciates in value, while the contrary is the case with rotary converters and sub-station apparatus. He had hung up copper on overhead lines costing 11 cents a pound and sold it later at 15 cents a pound. In the gas belt in Indiana, steam users had found that gas at 8 cents per 1000 cu. ft. was about equivalent to coal at $1.35 per ton.

L. J. Schlesinger, inquiring of Mr. Richey as to the reason for the greater efficiency of transmission on the new lines of the Indiana Union Traction Company, as cited in Mr. Richey's paper, asked whether Mr. Richey had made any tests on the rail-bonding on the older lines.

Mr. Richey replied that no doubt considerable of the greater loss on the older lines could be accounted for by inferior rail-bonding, as these lines included city track which had been down some time. The curves and grades were easier on the new division, and the sub-stations better located with reference to the loads.

President Henry called attention to the important part that cost of labor plays in the total cost. As had been intimated before in the discussion, wages could not be reduced. For this reason, if the cost of labor is to be reduced, the only way is to use appliances which will do away with as much labor as possible.

The convention then adjourned for lunch. After lunch, the Indianapolis Traction & Terminal Company took the members on a special car from the Terminal Building to its power house and shops on West Washington Street. The party returned to go into convention again at 2:30 p. m.

Thomas B. McMath, civil engineer of the Indianapolis Traction & Terminal Company, read a paper on "Track and Roadbed Construction and Maintenance," with particular reference to the life and chemical preservation of ties. This paper is published elsewhere in this issue. It takes up briefly the commercial economy of the creosoting process and concrete roadbed construction with and without ties in paved city streets.

Thomas Elliott, chief engineer of the Cincinnati Traction Company, was asked for his experience, and stated that some creosoted ties made in Cincinnati had been down eleven years and were apparently as good as new. Common pine ties could be furnished, including creosoting, for about 40 cents each, about half of which was cost of creosoting. Such ties would be as good or better than the best timbers untreated, costing no more. Some poles had also been creosoted. Such poles undoubtedly had a much better life than the untreated poles. Creosoted poles, however, were not as good insulators as untreated wood poles. It is sometimes necessary to respike creosoted ties. In this case the holes were left open without apparent detriment.

President Henry spoke of the difficulty of securing data on the life of treated timbers, because it takes so many years to make tests of any value. He had always taken the position that it did not pay to put in poor ties, and for this reason would never lay seconds or culls. The freight, handling and laying cost the same for the best ties as for the poor ones, and the poor ones would have to come up much sooner.

Leverett M. Clark, master mechanic of the Indianapolis & Northwestern Traction Company, then read a paper on the "Construction and Maintenance of Cars and Equipment." He outlined briefly various points which he considered should go into the specifications for high-speed interurban rolling stock. Among these points, he mentioned the necessity of great strength in the lower side frames, because they formed the foundation for the sides and roof, and also the necessity of strong draft rigging, especially if the cars are intended to operate in trains. He favored quarter-sawed oak finish in the smoking compartment, mahogony in the passenger, and ash in the baggage and rear vestibule. He recommended Pullman color for the exterior, extra storm sash for winter use, seats upholstered in leather in smoking compartment, and with plush for the passenger compartment. He favored steel-tired wheels, because of the greater factor of safety, quiet running and freedom from flattening. Solid axle gears were also recommended. The advantages of multiple-unit control were summarized. The capacity of air-brake storage reservoirs should be so proportioned that a full service application of brakes will cause a reduction of pressure of not more than 4 lbs. The capacity of compressors should be sufficient to supply all air required for the operation of brakes, whistles and sanders under normal conditions, and not operate in excess of 30 per cent of each hour that the car is in service. Ts, elbows and other sharp turns should be avoided whenever possible, as well as water pockets and leaks. The range of reservoir pressure should be from 12 lbs. to 15 lbs., the compressor being cut out at a point not exceeding 5 lbs. above the emergency brake-cylinder pressure.

The following system of inspection was outlined:

MAINTENANCE

After a car has been on the road twenty-four hours, or has run a given number of miles, say 200, it should be placed over a pit in car house and receive a thorough inspection by a car inspector, whose duty is not to repair, but to report the exact condition of every detail on an inspection card, which, when employed in connection with a motorman's defect card, should show the absolute condition of cars and their equipment at regular intervals. An O. K. should be placed opposite defects noted on the inspection card after having been repaired, and when entire car has been O. K'd. by foreman of repairs, the cards should be sent to the master mechanic's office, from which a record of body, truck, motor, controller and trolley troubles can be kept.

After a car has been thus inspected and repaired, it should be thoroughly cleaned inside and out. Trucks, wheels motors, compressors, etc., can be kept in good condition by frequent wiping with oily waste.

All bearings should be regularly lubricated with a good quality of oil of a consistency conforming to the season of year.

Long fibred wood mixed with Japanese fibre in the proportion of 5 to 1 forms a reliable and durable packing waste, we having records of journal and motor armature bearings which have run over 80,000 miles on the original waste placed in boxes.

For gear lubrication, a graphite grease mixed with a cushion of ground cork or fibre is recommended.

The air brake equipment should receive intelligent attention.

Operating valves and compressor governors should be regularly cleaned and oiled once each month. Compressors should be inspected, cleaned, and if necessary, oiled at least once a week, brake cylinders every twelve months, and at all times the governors should be watched to know that the proper reservoir pressures are maintained, that the reservoir gages are correct, and all cut-out cocks, joints, etc., free from leaks. Chime whistles should be kept clean and in tune. Sanding devices should be kept in operative condition, and hot water heating systems given proper care to guard against deposits of sediment and leaks.

Gardner F. Wells inquired as to the advantages of the unusually long cars used by the Indianapolis & Northwestern. Mr. Clark replied that these cars, which were from 62 ft. to 66 ft. long, sometimes did away with the necessity of putting on extra cars at times of unusually heavy traffic, and that was the principal advantage.

In answer to another question, Mr. Clark described a method of cushioning the trolley base used on the Indianapolis & Northwestern. The trolley base is bolted to oak planks, which have rubber cushions between them and the car roof. The object of this was to do away with part of the rumbling and hammering sound made by the trolley pole when running at high speed.

H. L. Swartz said that he had tried this plan and found it worthless as a preventive of noise.

Some questions were asked regarding the best way of fighting sleet on the trolley wire, the day previous to the convention having been one when considerable trouble was experienced by Indiana roads.

Mr. Elliott described the plan successfully used at Grand Rapids, which consisted of fastening a chain in the groove of the trolley wheel, the chain being renewed as fast as it wore out.

A. L. Drum, talking of desirable improvements in cars, favored making the toilet rooms larger and putting in water tanks to supply water for flushing purposes and prevent them from getting foul.

Frank D. Norviel, taking up again Mr. Wells' question as to the advantages of long cars, such as his company (Indianapolis & Northwestern) uses, said that the Indianapolis & Northwestern sometimes took out of Indianapolis on a single trip, in the baggage compartment of its regular passenger cars, express matter the gross revenue from which would be as much as $15. This was made possible by the fact that the cars were long enough, so that there could be a baggage and express compartment at the front end, in addition to the usual lengths of passenger compartments. That, he considered, was the real reason for using such long cars. He also brought up the question of charging for passengers' baggage. He opposed this policy and favored the free checking of baggage, as the steam roads do. He said that the interurbans were losing traffic by not doing this, because passengers with baggage, in many cases, have to pay more for passenger fare and baggage between two given points in Indiana on interurban roads than they would have to pay on steam roads, where baggage is checked free. A comparatively small number of passengers have baggage anyway, and he thought the interurban companies could afford to carry the baggage of such passengers free rather than lose the traffic altogether. To do this, of course, it was necessary to have a baggage compartment on each car. He urged strongly arrangements between interurban companies in Indiana whereby through tickets could be purchased, thereby insuring traffic to interurbans which might otherwise take steam roads for part of the distance.

After the discussion was closed on this subject, President Henry called on Dr. Louis Duncan, who was a casual visitor to the convention, to address the convention on any subject he might choose. Dr. Duncan, in responding to the invitation, called attention to the great interest attaching to the single-phase system with which the Indianapolis & Cincinnati Traction Company is equippng its lines. He questioned whether too great things were not anticipated for the single-phase system. It involved a great deal of complicated apparatus on each car, all of which involves certain losses. He did not think alternating-current motors would replace direct-current motors on city lines, and alternating-current interurban motors which were obliged to operate over direct-current city lines would always be at a disadvantage. He apparently considered that the advantages of the single-phase railway motors would be the most pronounced on interurban lines with heavy traffic and on electrically equipped steam roads. He would be very glad to learn what results had been obtained in the operation of the Indianapolis & Cincinnati line so far.

President Henry, of the Indianapolis & Cincinnati Traction Company, in answering Dr. Duncan's last question, explained that his company as yet was operating only one car, and that within the city of Rushville, to conform to the terms of the franchises. In another week, he hoped to have a number of miles of interurban line in operation, and it would probably be thirty days before the entire line from Indianapolis to Rushville would be in operation. The system was, of course, in an experimental stage, and no doubt some changes would have to be made in various details. He invited any electric railway men who were interested to visit the road and see what was being done. As regards the merits of the single-phase system, he wished to put himself on record as one of those who believe that the time will come when electric interurban roads "will handle heavy freight and lots of it." He believed that the single-phase system would make this possible. He emphasized the importance of getting rid of the large volume of current which must be handled in heavy railway work at 500 volts pressure. The Indianapolis & Cincinnati cars would be equipped with two trolleys, one trolley being of the ordinary wheel type for use in the city of Indianapolis, and the other being a new form of bow trolley for use on the high-speed, high-tension line outside of the city. He expected that the bow trolley would take considerable experimenting to perfect, but that it would ultimately be worked out. Power is to be transmitted from the power station to sub-stations at 33,000 volts, and at the sub-stations, static transformers will step-down the pressure to 3300 volts, at which voltage it will be supplied direct to the trolley line. The transformers carried on each car reduce the voltage to 250, for use in the motors. The sub-stations are fireproof structures, containing only static transformers, and are designed to operate without attendance. The only automatic circuit breakers in connection with the transmission and distribution system are to be located at the power station.

The convention then adjourned. Arrangements for the next regular meeting, according to the constitution, are left to the executive committee. The idea is to have meetings held in various places in the State.

The association starts out with a membership of over sixty electric railway men of Indiana.

In his message to the Legislature, Gov. Johnson, of Minnesota, recommended that the electric lines of the State be placed under the control of the Railway and Warehouse Commission.

In order that perfect protection against fire may be provided, especially in case of a wreck, the San Francisco, Oakland & San Jose Railway Company, operating the "Key Route," has installed the patent Stemple fire extinguishers on all its cars. The extinguishers, which are the large brass Babcock pattern, are placed in the front of each car in the right-hand corner.

CORRESPONDENCE

THE REMOVAL OF SNOW

UTICA & MOHAWK VALLEY RAILWAY COMPANY

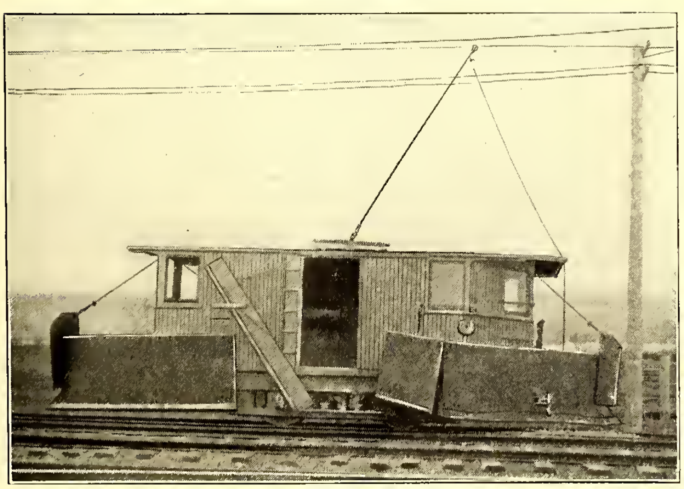
EDITORS STREET RAILWAY JOURNAL: Jan. 11, 1905.

Your recent editorial on snow fighting, and Mr. Stewart's letter in your issue of Jan. 7, discuss a topic which is of great importance to all street railway companies in Northern latitudes. It is one to which the Utica & Mohawk Valley Railway has necessarily devoted considerable attention, and your request to us to give some particulars of our methods of caring

SINGLE-TRUCK SWEEPER

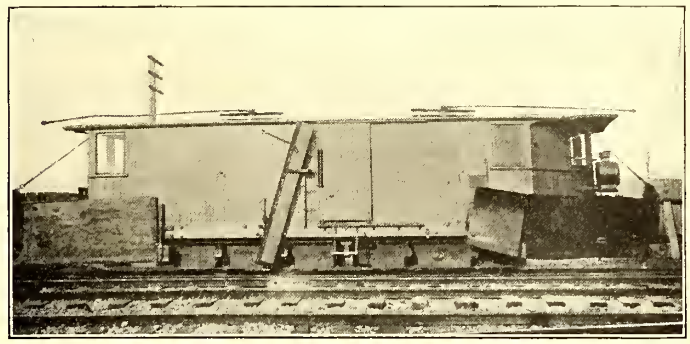
for snow in the upper Mohawk Valley is one with which I am glad to comply. Our snowfall during the winter is usually very heavy, and since between Utica and Little Falls we operate over our own right of way for a distance of practically 38 miles, the snow question is one of our most serious problems.

Our snow-fighting equipment consists of four types, viz.: scrapers, sweepers, shear and nose plows, and rotaries. Scrapers are carried on all cars, and we depend upon them for taking care of very light snows. Our sweeper equipment consists of two machines, which are used in the paved streets, and which take care of all snowfalls up to a depth of from 5 ins. to 6 ins. One of these is an old type of Lewis & Fowler sweeper, with motor-driven broom; the other is the latest type of Smith &



SINGLE-TRUCK SHEAR PLOW

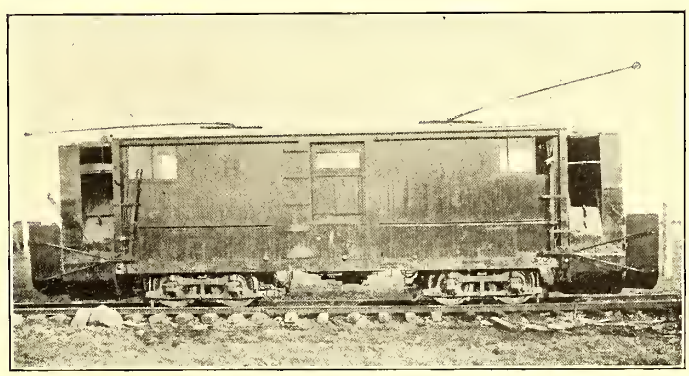
Wallace sweeper, with steel frame and motor-driven brooms. The advantage of the steel frame is, of course, that the plow keeps its shape better under the heavy work to which it is subjected, and we have found it extremely rigid. The brushes are adjustable in height and are raised or lowered, depending upon whether the snow is wet or light. This is a single-truck sweeper, with two motors for driving the sweeper and one motor for driving the brooms. Our third type of snow-fighting apparatus consists of the shear and nose plows. We have two double-truck, steel-frame shear plows; one single-truck, steel-frame shear plow, and one single-truck, steel-frame nose plow. The double-truck plows are fitted with four motors each, with air brakes and air mechanism for operating the wings and shears, and were supplied by Smith & Wallace. The single-truck plow is similarly equipped, except that it is fitted with two motors. Our fourth type of snow apparatus consists of two double-truck Ruggles rotary plows and one single-truck Ruggles plow. The double-truck plows are driven by four



DOUBLE-TRUCK SHEAR PLOW

motors, and has also two motors connected to the rotary shaft. The single-truck plow is equipped with half this number of motors—that is, two for moving the machine and one for operating the rotary shaft. All of our plows are also equipped with jacks, cables, chains, etc., so as to do wrecking business. We have found that this has been necessary owing to the great chances of their derailment. During the winter of 1902 we were obliged to have the rotaries out on the road only twice, but last year they were required frequently, and during the month of February they were in operation practically every night during the month.

In addition to the plows and sweepers mentioned, we make



DOUBLE-TRUCK ROTARY PLOW

extensive use of snow fences. These fences are collapsible, and are taken down in the summer and piled away, but are erected during the fall, on the westerly and southwesterly side of the track, which is the side of the prevailing winds. We use snow fences for every foot of our right of way that is exposed to drifts.

To every plow and sweeper owned by the company, double crews are assigned, one for day and one for night service. Each crew consists of a motorman, a conductor and three helpers, making five men in all. The motorman is placed in charge of the plow. As soon as snow begins to fall, whether it is by day or night, the motorman in charge of each plow or sweeper must communicate at once by telephone with the despatcher for instructions. He is not allowed any discretion in this matter, but is required to report for orders whether he is on his run or at his home. His instructions advise him at what time he is to report for duty, and in the meantime he notifies the men belonging to his crew and keeps in close touch with the main office. While on duty, the snow crews receive an advance of 20 per cent over their regular pay.

If the snow is too deep for the sweeper—that is, if it is 6 ins. or more, or if the indications point to a heavy snow—the nose or shear plows are put in operation, and, as a rule, within the city, are always followed by a sweeper, which cleans the snow off right down to the pavement. The rotaries are reserved for snow of 30 ins. in depth or more and for cutting through deep drifts. As a rule, they are used only in the country, but on one or two occasions have been employed in the city as well. At such times their baffle plates have to be so turned that the snow will not be thrown against the houses.

During the winter of 1903-04, the total expense charged to account 24, which is the cost of removing snow and ice, on the Utica & Mohawk system, amounted to $15,803, equivalent to $.0046 per car-mile. C. Loomis Allen.

NEW YORK & QUEENS COUNTY RAILWAY COMPANY

Long Island City, Jan. 16, 1905.

Editors Street Railway Journal:

I notice the subject of fighting snow is being discussed in your columns. Our method of caring for snow differs somewhat from that of a great many other companies, in that we place a great deal of dependence upon sweepers, and although we use shear plows, we operate the sweepers ahead of the plows. I think that this is logical, because a shear plow will sometimes get stalled in a heavy snow; while the sweeper will get through practically any drift, slowly, it is true, if the snow is deep; but if kept at work it will finally eat its way through. As, however, the sweepers remove the snow for a distance of only 6 ins. or so outside the outside rails, a shear plow is necessary, when the snow banks up, to push it back from the rails. Of course, for the very deepest snows, rotary plows are the most desirable, and during any one severe storm will pay the interest on the investment many times over.

I agree with the sentiment expressed in your editorial on snow fighting, that it is economy to have plenty of snow apparatus and to start in early with its use. If the snow is allowed to gain headway, it not only breaks up the schedule, but more power is required to remove it. In this latitude, it is advisable to have a sweeper to every 10 miles of track, and a sweeper to every 7 miles or 8 miles is better. There ought to be about the same number of shear plows. There is nothing which counts so much in the opinion of the public as the fact that a road is kept in operation when adjoining steam roads are snowed in, and we enjoyed this experience during the storm last week. When there is not enough power to operate all of the cars and plows, it is better to reduce the number of cars and substitute plows and sweepers, so as to keep the snow under control.

Another important point to bear in mind is that the service on the motors of the sweepers and rotary plows is continuous, and consequently is more severe than with ordinary car service. It is sometimes thought that because the snow apparatus is in use for short periods only, almost any controller or motor is good enough. Actually, only the best equipment should be used, as this is a part of the rolling stock which the management cannot afford to have break down. The rule applying to equipment also applies to the brooms. An extra supply of broom blocks, filled with the best rattan, should be kept on hand, as no sweeper will give good results with a half-filled broom, and if this latter precaution is not taken, the sweeper may have to be taken out of service at the most critical period of a storm. F. L. Fuller.

Since the Petaluma & Santa Rosa Electric Railroad has been in operation, the amount of freight to be handled has increased so much that the stern-wheel steamer "Gold" has been unable to carry it all, and the stern-wheel steamer "Sonoma" has been secured to run in conjunction with her between Petaluma and San Francisco. The "Sonoma" will continue in the service until a new steamer has been built to take her place.

COST OF ELECTRIC RAILWAY POWER PRODUCTION AND TRANSMISSION IN THE STATE OF INDIANA*

BY A. S. RICHEY

As the methods of conveying the energy from our coal pile to our car axles is the one thing which makes possible our business, and especially as the cost of this energy is one-fifth to one-quarter of our entire operating expense, it should be interesting to consider briefly the division of this cost into its components, together with a statement of the average costs per unit of the power used on the Indiana interurban roads.

A very comprehensive listing of the principal physical features of our electric railways was given in a paper entitled "Interurban Electric Railways of Indiana," presented by Robert P. Woods at a meeting of the Indiana Engineering Society, just a year ago.† The statistics as given in that paper stand practically correct to-day, when we add the 20 miles of the Indiana Northern Traction Company, now operating between Marion and Wabash. Supplementing Mr. Woods' paper as a source of information from which to draw the conclusions presented in this paper, we have written to officials of the various electric railways of the State, requesting car mileage and cost of power statistics. Nearly all of the roads have very kindly taken the pains to reply to our inquires in a very satisfactory manner, and it is due to their kindness in this regard that we are enabled to furnish some average figures on power costs.

We now have about 800 miles of interurban electric railways in the State, operating 100 cars regularly. These cars vary in size from the ordinary street car to the 60-ft. 35-ton car in use on the Indianapolis & Northwestern. The average weight of the 100 cars in regular daily operation is 25.61 tons, and their average scheduled speed is 20 m.p.h.

Twenty-four power stations furnish current to these cars, the combined station capacity (exclusive of the Indianapolis Traction & Terminal Company's station) being slightly over 20,000 kw, or an installed capacity in generators of about 200 kw for each interurban car operated and 25 kw for each track-mile operated. One-half of the twenty-four power stations generate and deliver to the cars direct current, while the other twelve generate alternating current, distributing to the cars as direct current through thirty-four sub-stations. The individual power station capacities vary from 200 kw to 6000 kw, and comprise units of nearly every standard rating from 65 kw to 1500 kw.

Assuming a power consumption of 100 watt-hours per ton-mile, we have an average total at our 100 interurban cars of about 5000 kw, using the average figures as given above of 25.61 tons as the weight of car and 20 m.p.h. as the schedule speed.

The average load factor of the power stations appears to be about 40 per cent of the installed capacity. Therefore the average output at power station bus-bars is over 8000 kw, which appears to indicate that the aggregate losses in overhead lines, rail return, sub-station apparatus, step-up transformers, etc., amounts to more than 3000 kw average, or an average efficiency from power station bus-bars to car motors of say 60 per cent. As the assumption of 100 watt-hours per ton-mile is probably high, this average efficiency of distribution, if in error, is to be considered higher rather than lower than the actual.

This loss of 40 per cent of the total power generated must be divided between the stations generating direct current and those generating and transmitting alternating current and converting to direct current through rotary converters at sub-stations. But 20 per cent of the railway power generated in

*A paper read before the first annual convention of the Indiana Electric Railway Association, at Indianapolis, Jan. 12, 1905.

† See Street Railway Journal, June 18, 1904.

the State outside of Indianapolis is the output of direct-current generators. Allowing 20 per cent for the transmission losses from the direct-current stations, leaves us an efficiency of about 55 per cent for the remaining 75 per cent of the generated power, which is the product of alternating-current stations. This efficiency is probably made up about as follows:

	Per Cent.
Efficiency of step-up transformers	94
Efficiency of transmission lines	97
Efficiency of step-down transformers	93
Efficiency of rotary converters	80
Efficiency of direct-current distribution	80
Combined efficiency	54

The figures given above as the efficiencies of transformers and rotary converters will, of course, not compare with the efficiencies guaranteed by manufacturers, as the guaranteed efficiencies are based on full load or nearly full load conditions, while the average load on rotary converter sub-stations in the service which is most general on our roads is hardly greater than 25 per cent of their rated capacities. This difference in distribution efficiency as between 80 per cent for the average direct-current station and 55 per cent for the average alternating-current station, is at first glance a surprising one, and helps many a company to spend a large proportion of the dollars saved by an economical power station. Without doubt, there is more than one railway in the State now operating an alternating-current generating plant with transmission lines and sub-stations that could have invested the same money in direct-current stations and trolley feeder, and be operating today with a less charge to cost per car-mile. On the other hand, there are several alternating-current generating stations in the State which are delivering power to the car axles, after paying the price for the losses, at a cost much less than that at which they could accomplish the same result from direct-current stations. The question of which system should be installed in a given case is one that should be carefully considered before a decision is made, as too often in the past few years has the alternating-current generating plant with rotary converter sub-stations been installed, seemingly because such an outfit was in style, when the much more simple system of direct-current stations with plenty of trolley feed-wire would have been much more economical.

For instance, let us briefly consider a given case as follows: Two cities of about 25,000 population each, situated 20 miles apart, each with a street railway system of say ten city cars. These two systems are owned by a company which is to construct an interurban road connecting the two, the plans contemplating new power equipment. The schedule will call for two regularly operated interurban cars and twenty city cars, and an installation of say 1000 kw capacity in power generating machinery. The location of an a. c. power station midway between the two towns, with a sub-station at each end and rotaries in the power station, will mean average transmission and conversion losses of about 45 per cent of the total power generated.

The location of a combination a. c.-d. c. plant at one end, with sub-stations at the other end and midway, will mean average transmission and conversion losses of about 35 per cent. With two d. c. stations, one at each end, and direct-current feeders on the interurban line, the same results will be attained with power losses of but 20 per cent; the first cost of the installation will be no greater, and the costs of generating the power would be but very little, if any, greater, provided, of course, that the facilities for obtaining coal and water are the same in the two towns. Assuming a generating cost of 10 per cent more in the two small stations than in the one larger one (which is high), we have the cost of power at the car from the d. c. stations averaging about 25 per cent lower than from the a. c. station at the middle location, and over 10 per cent lower than from an a. c.-d. c. station at one end of the line, without considering the additional labor at sub-stations which would be required with either of the a. c. stations.

If the given conditions be varied by the elimination of the city cars at one end of the line, leaving a load to be considered consisting of an interurban line of 20 miles in length, operating two regular cars on an hourly schedule, with a city system of ten small cars centering at one end of the interurban line, then one direct-current power station at or near the city car load probably will prove to be the most economical. In this case, of course, the trolley feeder must be increased greatly, and possibly a booster set will be required, but this additional investment will not reach the cost of transmission lines, sub-stations and sub-station apparatus, plus the capitalized cost of sub-station operation and losses.

However, when the proposed line is much to exceed 20 miles in length, especially if future extensions are very likely, and no great number of city cars is to be operated, economy begins to favor the alternating-current station with high-tension transmission and sub-stations, and as the length of line increases, and with it the number of cars to be operated and the total load on the station, it finally reaches a point where there is no question as between the one a. c. station and a number of small d. c. plants. With the construction of a power plant of several thousand kilowatts capacity, coal may be easily handled, and the many refinements conducive to economical operation may be introduced which are not possible or practicable in smaller stations. These points, together with the low cost per kw-hour for labor, which is possible with a large station, combine to reduce the initial cost of power to such a low figure that the seemingly low average efficiency of transmission and conversion, together with the cost of sub-station operation, may be met, and power still be delivered to cars many miles distant at a cost which will compare very favorably with direct-current distribution within much smaller possible areas.

In this discussion, no mention has been made of the purely alternating-current system, in which the car motors are designed for the use of alternating current, and for which the following claims are made: Reduction in first cost, by the elimination of the rotary converter and saving in trolley feeder; reduction in operating expenses, by doing away with constant sub-station attendance; an increase in efficiency by the reduction of trolley and feeder losses, reduction or elimination of rheostatic car starting losses and the complete elimination of rotary converter losses. As soon as the new alternating-current motor can demonstrate these points and prove to us that it is as well adapted to our purposes, as efficient, as reliable and as easy of maintenance as the direct-current series motor, we must seriously consider it in our future plans.

The operation of cars by this system has just been started on the Rushville division of the Indianapolis & Cincinnati Traction Company, and the operation of this line will be very closely watched by street railway engineers and managers until the success of the system has been fully demonstrated.

The replies which have been received to our letters of inquiry represent 85 per cent of the total installed generating capacity of the railway power stations of the State. These power stations generate an average of 5,845,450 kw-hours per month at an average total cost of $44,156.38, or .755 cent per kw-hour.

This average cost per kw-hour is divided as follows:

	Cent.
Fuel	0.526
Labor	0.158
Lubricants, waste and miscellaneous supplies	0.032
Repairs	0.039

The lowest total cost per kw-hour reported is 0.505 cent, while the highest is 2.024 cents. The lowest cost of fuel is 0.368 cent, the highest, 1.405 cents. The lowest cost of labor is 0.100 cent, the highest, 0.331 cent. The lowest cost of lubricants, waste and miscellaneous supplies is 0.015 cent, the highest, 0.086 cent. The lowest cost of repairs is 0.010 cent, the highest, 0.218 cent.

Deducting the output of the two most economical stations, representing two-thirds of the total output reported, the average cost of the balance of the power generated in the State is 1.021 cents per kw-hour.

The figures which have been given are on cost of power at power station switchboards. As six of the thirteen stations reporting are a. c. stations with transmission lines and sub-stations, these costs must be increased by the addition of sub-station operating expenses. With this addition, the total cost of power delivered to direct-current feeders is $47,500.01, or 0.964 cent per kw-hour, the lowest cost reported being 0.747 cent, and the highest being 2.024 cents.

The total amount of coal burned in all the stations reporting averages 532½ tons daily, 80 per cent of which is Indiana run of mine and slack. The average cost of all coal burned is $1.89 per ton. The average consumption of coal is 5.56 lbs. per kw-hour, the highest consumption reported being 10.7 lbs., and the lowest being 4.9 lbs. per kw-hour.

The power station capacity per interurban car operated averages, as has been stated, about 200 kw, the lowest being 150 kw, and the highest, 350 kw.

The roads reporting give a monthly car mileage of city cars of 1,122,060, and the interurban cars of 630,258 car-miles. The average power consumption is 1.48 kw-hours per car-mile for city cars and 5.18 kw-hours per car-mile for interurban cars. On this basis, the average cost of power per car-mile is 1.43 cents for city cars and 5 cents for interurban cars.

As illustrating the beneficial effect of the careful consideration of operating features in the engineering design and construction of a road, such as reducing curves and grades to the practical minimum, the careful location of sub-stations with respect to their loads, and an economical distribution of copper, some figures on the Indianapolis Northern division of the Indiana Union Traction Company, as compared with the balance of that system, may be of interest.

The Indianapolis Northern division consists of the lines from Indianapolis to Logansport, Kokomo to Peru, and Tipton to Elwood. This portion of the line is fed from the power station at Anderson, through 30,000-volt transmission lines, to six sub-stations, located 26 miles, 42 miles, 43 miles, 59 miles, 59 miles and 61 miles, respectively, from the power station the average distance of all rotary converters being over 46 miles from the generators.

The balance of the system is fed from the same power station through rotaries at the power station, and through 15,000-volt transmission lines to eight sub-stations, the average distance of all rotary converters on this old division being but 15 miles from the power station.

The entire alternating-current output of the station is measured by an integrating wattmeter on the generator switchboard, while a second wattmeter measures the input to the step-up transformers supplying current to the transmission lines feeding to the Indianapolis Northern sub-stations only.

Notwithstanding the fact that 12 per cent of the power used on the old divisions is delivered directly from the power station with no a. c. transformer or transmission losses whatever, and that the average distance from generator to rotary is 31 miles greater on the Indianapolis Northern division, the power station output to these new divisions is but 33 per cent of the total, while handling 42 per cent of the total car mileage. In other words, the power consumption per car-mile, including all losses from generator to car motor, on the new line is but two-thirds as much as on the old lines, even though the average transmission distance is three times as great. The class of cars in use on all divisions is the same, and the average schedule speed is slightly greater on the new lines than on the old.

TRACK AND ROADBED CONSTRUCTION AND MAINTENANCE WITH PARTICULAR REFERENCE TO THE LIFE AND CHEMICAL PRESERVATION OF TIES*

BY THOS. B. McMATH

As all present may know, the question of securing good ties is each year becoming more difficult, as timber becomes more scarce the quality offered in ties becomes poorer. Good white and burr oak ties are difficult to secure, and the attention of all railroads is called to the advisability of using treated timber. At present, the most satisfactory treatment for prevention of decay in timber is its impregnation with creosote; the additional life of treated timber fully justifies the expense, and it is possible to substitute a grade of timber utterly unsuited for ties, yet, which when treated, will show a life double that of the best untreated timber heretofore used.

Wood is composed of a great number of tubes firmly united and of varying sizes, the more open tubes being in what is commonly known as the sapwood; the older tubes are filled with various substances, as resin, gum, etc. The sapwood is the living part of the tree, the tubes allowing a free passage of water, while the heart wood, due to changes, no longer allow such free passage of water. Decay is caused by the entrance of living organisms, as insects, bacteria or fungi, and sapwood being more open, is the more readily attacked. The best conditions for their activities and growth exists in the presence of heat and moisture.

The treatment of timber consists in the introduction of substances poisonous to these destroying agents. It must penetrate all parts of the timber and must remain there permanently. Experiments have been made with the creosoting process for about forty years. Assuming that the results of the present creosoting will be as good as those obtained twenty years ago, we can assume that the life of a tie can be increased by treatment to twenty or twenty-five years.

Experiments have shown that the undesirable woods, such as red and black oak, owe their quick decay to the open and porous condition of their wood cells. Woods of this character are the ones in which the effect of treatment is greater, and their life compares very well with the life of the treated white and burr oak timbers.

On a visit to a Southern city, the writer was shown creosoted sap pine ties that had been in service on street railway track for more than fifteen years and were evidently good for nearly as much longer; also creosoted sap pine piles that were said to have been in position for about eighteen years and still were in a good state of preservation.

Sap pine is the poorest and cheapest grade of lumber in the South, on account of its open and porous nature, and is the most successfully treated. The writer was told that the treated ties cost in the vicinity of 40 cents, and treated sap pine poles could be secured for about $6 for a 30-ft. pole. He has written to parties for definite prices on these ties and poles delivered in Indianapolis, but has not as yet received a reply. Local creosoting works have quoted prices, but having an inflated idea of the value of their particular process, their prices correspond. I think, however, a good creosoted tie could be secured in Indianapolis for less than 65 cents, and that such a tie placed in track would last under ordinary conditions double the life of the ordinary white oak tie, especially white oak ties of the quality now obtainable. The life of a creosoted sap pine pole, considering its greater strength over cedar, is such as to strongly recommend its use.

The features in which track construction and maintenance in cities differ from ordinary steam and interurban railways are, first, the work must be such that no repair is necessary

*A paper read before the first convention of the Indiana Electric Railway Association, at Indianapolis, Jan. 12, 1905.

except at long intervals of time, and second, it must be such as to permit the ordinary types of street paving to be applied. Deep rail sections must be used in order that ties may be low enough to permit the paving of the tracks, instead of employing, as in railroad construction, the shallow rail and partly exposed ties. We use deep rails of from 6 ins. to 9 ins., laid on ties or without ties, in combination with concrete, the rails being laid on blocks in trenches which are filled with concrete, forming a beam under and around the rail, the rails being held in position by the concrete beam, with the aid of the street paving material. This type of construction has been in use for the past ten years.

In some cities this type of construction has been considered satisfactory, while in others it has been condemned. In Indianapolis we have several miles of track of 9-in. girder rail laid on concrete beam, with ties spaced 12 ft. apart, and paved with brick laid on a concrete base. This construction is inadequate for interurban traffic. The College Avenue line of this city was constructed with 7-in. T-rails, on ties spaced 2 ft. between centers, ballasted with natural cement concrete, which concrete extends from 6 ins. below the bottom of the tie to within 5 ins. of the top of the rail, the street surface being vitrified brick, with nose brick forming the flange groove adjoining the rail. This construction has proven entirely satisfactory for interurban traffic.

The tracks built last season and now used by the interurban cars on Ohio Street and Capitol Avenue, were built with 7-in. T-rails, on ties spaced 12 ft. apart, and resting on a concrete beam 24 ins. wide and 20 ins. in depth under each rail. Tie-plates were used at intervals of 4 ft., and securely held by anchor bolts extending through the concrete.

It is a deduction of the writer from experience in concrete beam work that track constructed in the old manner failed from lifting, and that such anchorage, in addition to holding the track in line and gage, would increase its stability by avoiding vertical movements. The use of the tie-plate between the ties permitted the suspension of the anchor bolts in their proper position during the process of concreting, the track having previously been brought to surface and line by tamping the ties. The concrete used was made of the best grade of Portland cement and had ample time to set.

The flange groove alongside of the rail was obtained by the use of a special nose block, much larger than the ordinary paving brick, this block being 5 ins. wide, 4½ ins. thick and 10 ins. long, the balance of the pavement being the ordinary paving brick. The special shape of this block permitted its being laid longitudinally directly upon a mortar bed on the concrete, strips of wood being used to fill the cavity under the head of the rail, to prevent the special nose brick from coming in contact with the rail and to reduce the rumble of the passing cars. These wooden strips also act as a semi-elastic material adjoining the rail, taking up the thrust due to the expansion of the pavement between the rails.

Brick pavements expand from temperature causes, and if rigidly held by the rail, the brick rises off the sand cushion to the detriment of the pavement, forming a sounding board which increases the noise.

The 7-in. T-rail now used in this city was especially designed for the heavy interurban car. All Shanghai rails previously rolled by the mills were too light in the web for such heavy loads, being designed for ordinary weights of city cars, and as city pavements required the rail to be 6 ins. in height or over, the webs in use were extended in height, but remained ⅜ in. in thickness.

As interurban cars use a 3-in. tread wheel, it was considered advisable that the head of the new rail should be 2⅜ ins., the web 9-16 ins. thick, the rail 7 ins. high and base 6 ins. wide. This rail weighs 91 lbs. to the yard. To the credit of those interested in the designing of this rail, it may be said that a subsequent design of rail, for similar conditions, made by a committee from the American Street Railway Association, is very similar, the main difference being that the committee made the head of their rail 3 ins. wide.

Perhaps the most trying feature of track maintenance in Indianapolis is the adjustments of gage on special work to fit it for wheels of all varieties. In this city are found all kinds of wheels, from ⅝-in. flange and 2-in. tread up to the M. C. B. with 1⅛-in. flange and 4-in. tread. If the guard rail on a curve is placed with the proper width of groove for the big flange, the ⅝-in. flange wheel can never touch the guard rail unless the wheel on the other end of the axle is riding with its flange on the rail. On the other hand, if the guard rail is set with reference to the little flange, the big flange will ride up on top of the guard rail.

We have made it a practice on curves where rolled guard sections are used to gage curves 4 ft. 8⅜ ins., and where we have been able to get this condition, we have had no derailment trouble, although the big wheels squeak and it takes power to send them around. Such places we keep well greased.

The outcome of this condition is that the interurban lines must be reasonable about their wheel flanges, and use a flange not over 1 in. deep x 1 5-16 ins. thick, so that guard rail sections can be used, and then, all wheels on city cars should be made to conform. The saving in special work renewals would pay for changing all the wheels in two years; the addition of ½ in. on the width of tread of city car wheels would immediately add 50 per cent to the life of every frog and switch in the track.

H. J. McGowan has taken an initial step in interurban railway development in erecting the terminal station and building, in which we now meet, and in which station enter interurban cars from all parts of the State of Indiana. Arrangements have been perfected by which through buffet parlor cars from Ohio will also enter this station. Indiana has taken the initiative in providing elegant and commodious accommodations for interurban railway patrons.

This association should therefore lead in the work of standardizing all equipment and secure the co-operation of other similar organizations in fixing such standards. Standard car-wheel flanges, width of tread, diameter of wheel and standard gage for pressing wheels should be adopted at the earliest possible moment, as cars of different lines are now frequently sent over connecting lines, and all city railroads over which interurban companies operate their cars are vitally interested. The difficulties arising from irregularities in any of the above-mentioned items cause the most disastrous results, and, until this is done, special work cannot be intelligently ordered.

SINGLE-PHASE, THREE-PHASE RAILWAY SYSTEM

A new system of power distribution for electric railway work has recently been patented by J. H. Hallberg, of New York, in which a single-phase synchronous or induction motor on the car or locomotive drives a three-phase generator, which in turn supplies current to three-phase motors on the axle. The system is claimed to be superior to that in which a d. c. electrically-driven generator is used on the car and d. c. on the axles, in that no commutators are employed. Changes in speed are secured by varying the frequency and amount of current in the three-phase circuit, and by the use of resistances in the secondaries of the motors. The exciter for the a. c. generator is mounted on one end of the motor-generator shaft, and a small single-phase self-starting motor on the other end of the shaft is used for bringing the motor members up to speed. Where low-voltage overhead wires can be installed, the inventor states that three-phase current can be collected for direct use by the motors.

OVERHEAD LINE APPLIANCES FOR SINGLE-PHASE ELECTRIC RAILWAYS

The development of the single-phase system naturally introduces the question of the necessity for better trolley line insulation than on low-voltage railways, and it is interesting to note that a number of the equipment companies have already taken up this important subject. Among them, the Electric Railway Equipment Company, of Cincinnati, has brought out a series of overhead appliances which have been designed by Elmer P. Morris, and which are illustrated in the accompanying diagrams. These are of a number of types, the first of which is illustrated in Fig. 1.

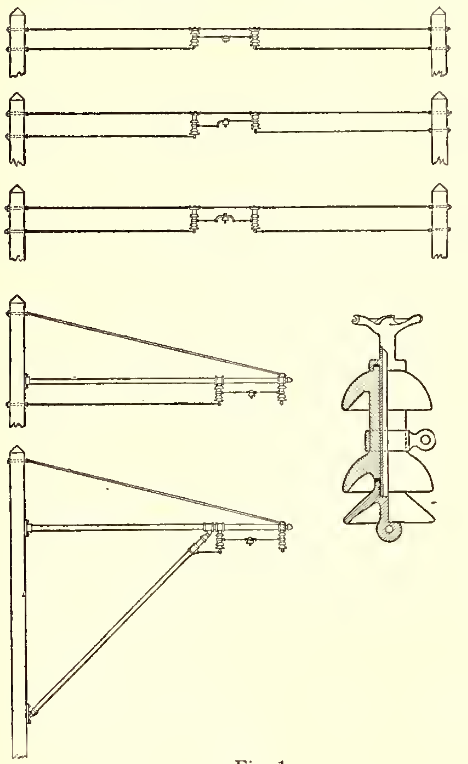


Fig. 1

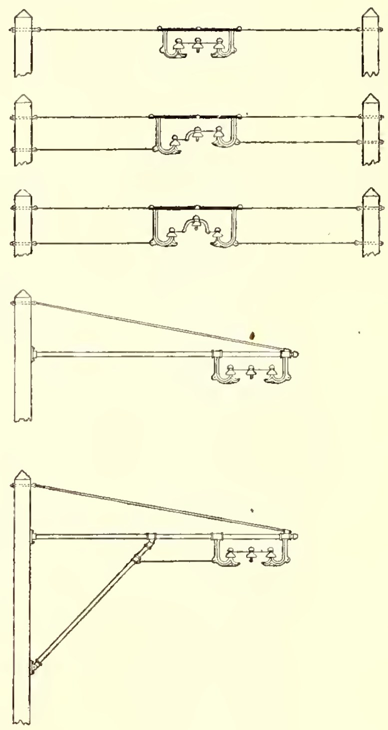


Fig. 2

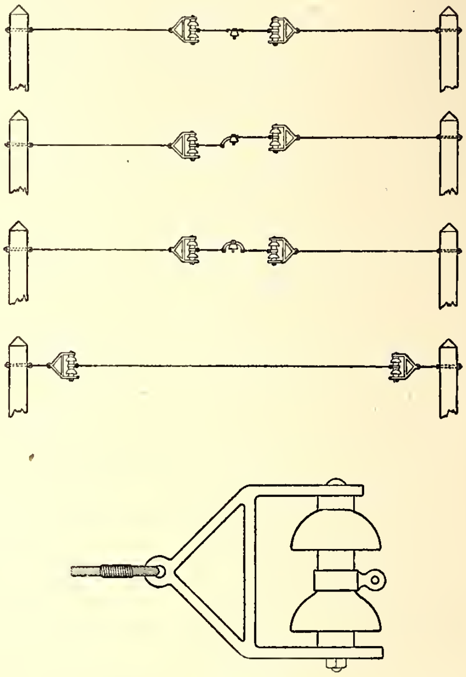


Fig. 3

FIGS. 1, 2 AND 3.—OVERHEAD INSULATORS FOR SINGLE-PHASE ROADS, SHOWING METHODS OF SUSPENSION

The insulator, as shown in the larger drawing in Fig. 1, is of the double petticoat type and of porcelain. This insulator is supported by an iron core, which has an iron upper cap, and is threaded at the bottom to carry a lower cap and eye. Rubber bushings are inserted between the caps and the porcelain to prevent the latter from cracking. A metal band with eye is placed around the middle shank of the porcelain, and this carries the regular hanger, which can be either of the ordinary type or an all-metal hanger. The other diagrams in Fig. 1 show, respectively, the method of using this insulator on straight line, single pull-off and double pull-off work, also two methods of bracket suspension. In span construction, the insulators can, of course, be placed any distance apart.

Fig. 2 illustrates a second style of overhead insulator, in which a double petticoated porcelain insulator of the ordinary form, carried on a wrought-iron support, is used. This support is provided with a shoe, as shown, so that there is no danger of the trolley breaking the insulator in case it should come off the wire. The methods of installing this insulator in span and bracket construction are also illustrated. In span construction a spacing bar or pipe is employed to keep the insulators apart.

A third system of single-phase insulation is illustrated in Fig. 3. This insulator is also of porcelain, with iron core, somewhat like that shown in Fig. 1, but it is held in a bracket, which equalizes the strain on both ends of the iron core.

Fig. 4 illustrates a novel form of auxiliary insulator for high-tension feeder lines, which has also recently been brought out by the same manufacturers along Mr. Morris' design. This insulator consists of a flat or semi-circular piece of porcelain with corrugations on its upper surface, and is designed to fit around the pin of an ordinary insulator. Its object is to catch the feeder wire in case of breakage of the insulator proper, so that the wire will not fall on the cross-arm or other support. To permit the installation of this insulator on lines already erected, it is made in two parts, which dovetail when in place.

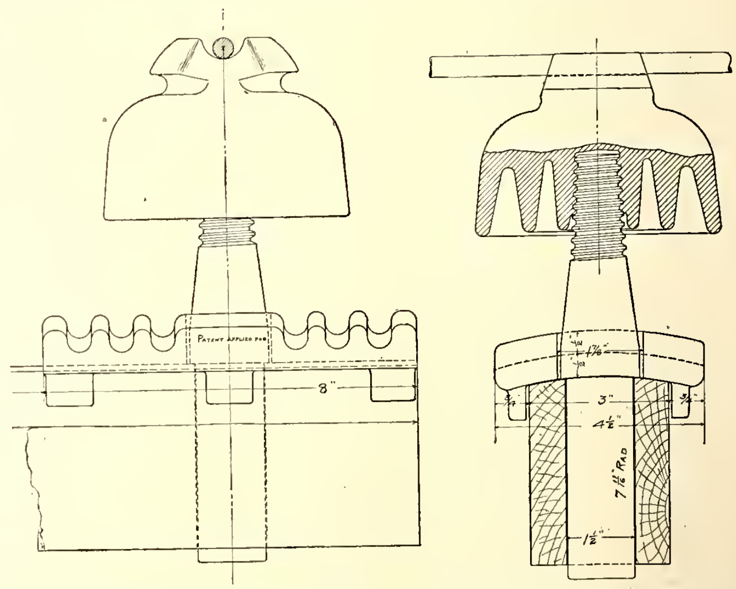


FIG. 4.—END ELEVATION AND SECTION OF AUXILIARY INSULATOR FOR HIGH-TENSION FEEDER LINES

The Old Colony Street Railway Company has increased the rate of fare on some of its lines. The fare from Brockton to New Bedford is 50 cents, as against 35 cents before Jan. 1, and the fare to Taunton from Brockton is 25 cents, as against 20 cents. General Manager Goff, of the company, says that street railways cannot be operated on a fare of less than 1½ cents a mile.

SOME RECENT VALVE DESIGNS

The Crane Company, the well-known valve manufacturer of Chicago, has recently brought out some new designs in renewable seat and disc globe and angle valves, suitable for working pressures up to 250 lbs. and tested to 700 lbs. pressure per square inch.

The renewable parts are of a hard and superior composition, made to last many times longer than those in the ordinary valves. They are especially suitable for any hard work where extreme pressure is used and where the wear and tear on the valve is most severe. By unscrewing the nut on bottom of the valve, which is shown in Fig. 1, all parts are accessible and removable from the top, thus making it convenient to substitute a new seat or new disc when required, or to replace any worn part. The disc being attached to the stem by a slot, is easily removed and replaced. The seat and disc can be removed and the two ground together if necessary.

In putting the valve together, the seat is replaced and the nut tightened on the bottom of the valve, which holds the seat in place; then the bonnet is screwed and the valve closed. The construction of these valves is such that they may be packed when open without steam escaping.

The renewable seats and wedge straightway valves are made with copper seats and hard metal wedge; they are suitable for working pressures up to 250 lbs., and are tested to 800 lbs. pressure per square inch. Soft metal rings or seats are furnished for water or air, when so specified.

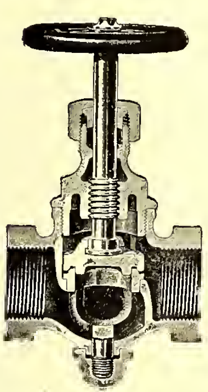


FIG. 1.—RENEWABLE SEAT OR DISC VALVE

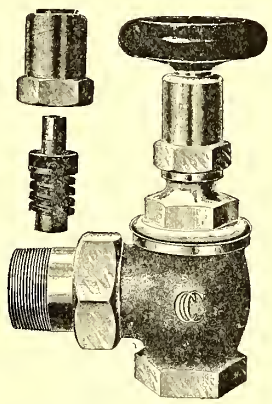


FIG. 2.—SELF-PACKING VALVE

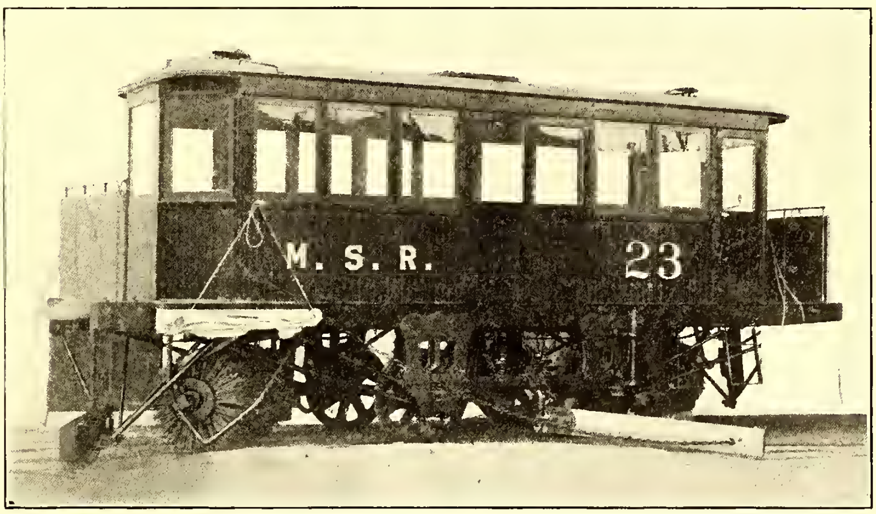
The "self-packing" globe and angle and radiator valves, shown in Fig. 2, are made with Jenkins disc and non-rising stem to supply the demand for valves embodying this very desirable self-packing feature. All users of radiator valves know that leaky stuffing boxes are a source of a great deal of annoyance, caused by the escape of steam and water, soiling the trimmings of valves, as well as the carpets, walls and ceilings.

Former attempts to produce a self-packing valve were unsuccessful, because the valves were made with two metallic parts, which, grinding together, would soon become leaky. In this self-packing valve a piece of vulcanized rubber is introduced between these two metallic parts, which makes a perfect seat. Should these valves become leaky, a new vulcanized rubber disc can readily be inserted. The application of this device when applied to globe and gate valves will be appreciated by all users of steam and water, as it obviates the constant attention of the engineer or other persons in charge of the plant in looking after leaky valves. The threads on the bonnet of these self-packing valves are the same size as those in the Jenkins disc valves, made by the Crane Company, and those wishing to replace the old style trimmings with this new self-packing device can do so without removing the valve.

SNOW SWEEPERS FOR THE MONTREAL STREET RAILWAY

The Montreal Street Railway Company has added to its snow-fighting equipment three new sweepers, like the one shown in the engraving, built by the J. G. Brill Company, which are similar to those furnished to the Metropolitan Street Railway Company, of New York, and other large cities. The Montreal Street Railway Company has used Brill sweepers for several years, and the details of this last order are practically a repetition of former ones. Under the experienced management, and because of the excellent equipment, the schedules are maintained without interruption throughout the winter, although no city railway system on the American continent has more to contend with as regards the removal of snow. The system includes about 120 miles of track and over 700 cars are operated.

This type of sweeper, which is known as the Brill Standard, has a single short broom at each end; these brooms are about three-quarters the length of long brooms used in other types, and, it is claimed, may be set at a more acute angle to the rails than is possible with long brooms, enabling the snow to be thrown clear of the rails and not piled up ahead. It is also stated that short brooms work and wear more evenly and are easier to handle, that they are capable of independent adjustment and can be made to conform to the curvature of the pavement between the rails, so that with one end set a little lower than the other, the rattan digs into the hollow of the rails and cleans them out thoroughly. Brush boards and wings, set at the same angle as the brooms, keep the rails on the side of the car not covered by the revolving broom, sufficiently free to prevent the stalling of the sweeper in deep snow, and the revolving broom at the rear cleans up what is left.

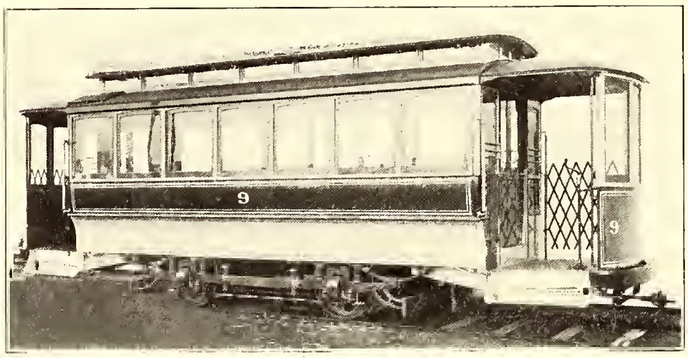


ONE OF THE NEW SNOW-SWEEPERS RECENTLY FURNISHED TO THE MONTREAL STREET RAILWAY COMPANY

The length of the body of these sweepers is 21 ft., and the width over the side sills, 7 ft. The side sills are $4\frac{1}{4}$ ins. x $8\frac{3}{4}$ ins., and the sill plates are 8 ins. x $\frac{1}{2}$ in. The side sills extend 6 ins. beyond the dashers, for the purpose of supporting the iron pieces to which the shear boards are movably secured, and which extend 2 ft. 8 ins. outside the rail. The levelers at either side have a vertical adjustment, and the brush boards are arranged to fold up against their supports; besides the double doors at either side, single doors are provided at the diagonally opposite corners, and all doors are arranged to swing outwardly. Three motors are used, two for propulsion and one for the brooms. The cars are mounted on Brill gear trucks, with a wheel base of 7 ft. and 33 ins. diameter of wheels. The truck axles are 4 ins. in diameter, and the axles for the brooms, $3\frac{1}{2}$ ins. The weight of each sweeper without motors is 14,000 lbs.

NEW EQUIPMENT FOR LEXINGTON, KY.

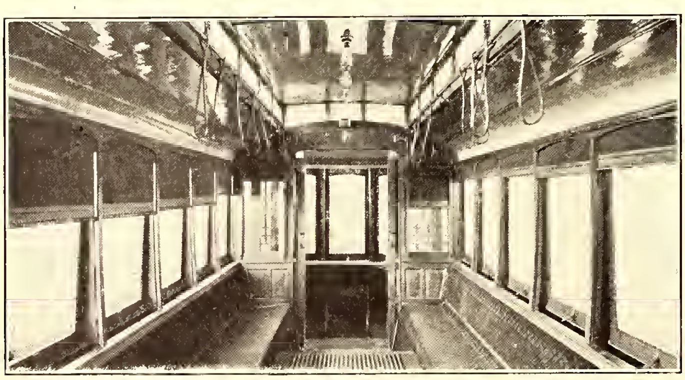
The American Car Company has recently furnished the Lexington Railway Company, of Lexington, Ky., several cars of the type shown. The Lexington Railway Company operates about 15 miles of lines in the city and vicinity, and is doing a prosperous business. Lexington is the chief railway center of



SINGLE-TRUCK CAR USED IN LEXINGTON, KY.

the northern section of Kentucky, and has several large educational institutions. It is in the heart of the celebrated blue grass country. There has been a large increase in population in recent years, and there are bright prospects of further rapid growth.

Each car measures 20 ft over the body and 29 ft. over the crown pieces. The width over sills, including the panels, is

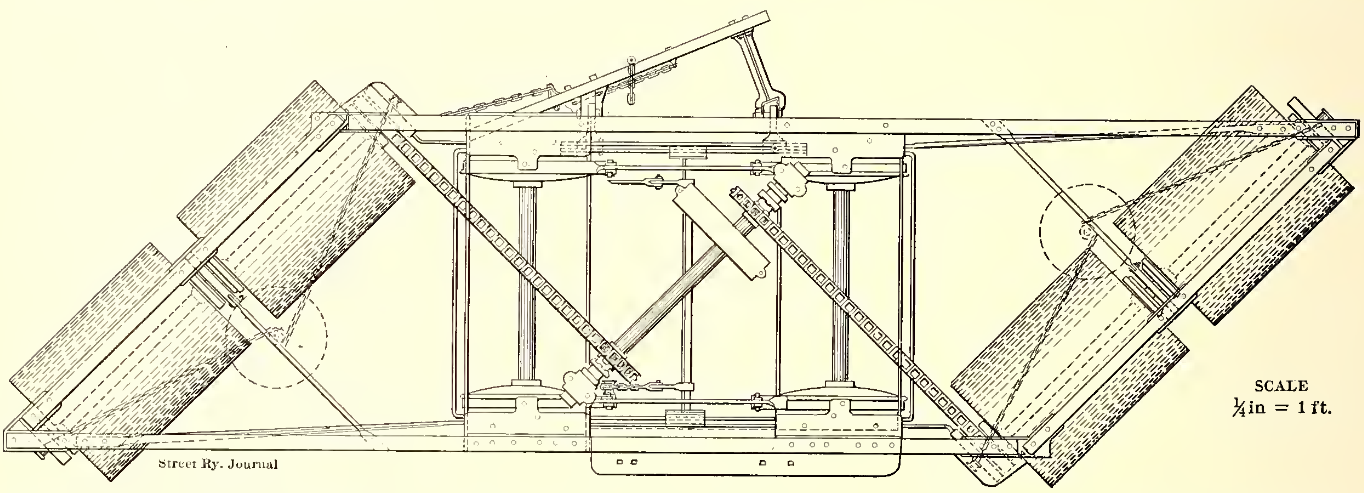


INTERIOR OF LEXINGTON CAR

6 ft. 3 ins., and over the posts at the belt, 7 ft. 5½ ins. The sweep of the posts is 8 ins. The distance between the centers of the posts is 2 ft. 9½ ins.; thickness of corner posts, 3¾ ins., and side posts, 1¾ ins. The side sills are 4 ins. x 7¾ ins., and the end sills are 4 ins. x 7 ins. The distance from the rail to he platform step is 15⅜ ins., and from the step to platform, 12 ins. The interior finish consists of cherry in natural color, with ceilings of maple. The windows are of polished plate, and the sashes are arranged to drop into the pockets. Wilton velvet carpet is used for the covering of the longitudinal seats. Instead of being nailed in the usual manner, the floors are screwed down. The central sash of the portable vestibules is arranged to slide to one side. The platform timbers are reinforced with angle iron and the construction is of an extra substantial character. Angle-iron bumpers, "Dedenda" gongs and "Dumpit" sand boxes of Brill manufacture are included among the furnishngs.

THE CONSTRUCTION OF McGUIRE-CUMMINGS SNOW SWEEPERS AND THEIR USE

In the Street Railway Journal of Jan. 7, a communication was published by B. F. Stewart, calling attention to certain radical differences in the construction of various types of snow-sweepers. In that letter the fact was brought out that in the McGuire sweeper there is a revolving broom in advance of the truck the full width of the track, instead of only half the width as in older types. The accompanying plan of the frame work of the McGuire sweeper shows this construction better than it can be explained. The sweeper is constructed



PLAN VIEW OF SWEEPER, SHOWING THE STEEL FRAME, WITH DIAGONAL ENDS, FOR CARRYING THE REVOLVING BROOMS

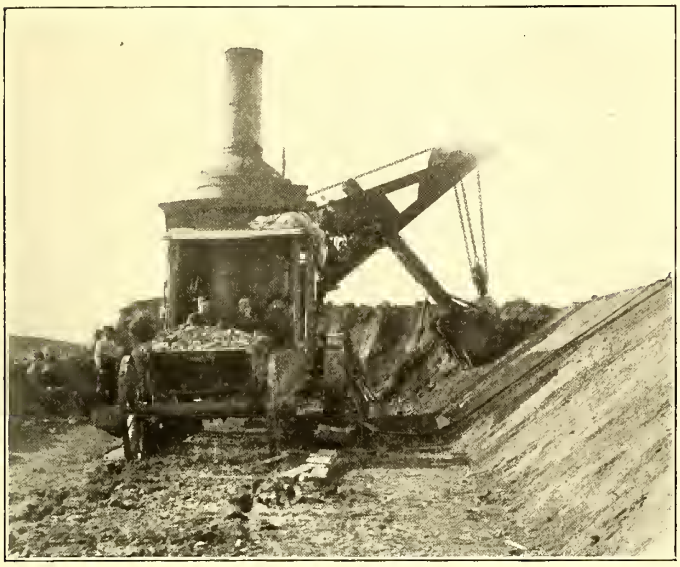
with a steel frame having diagonal ends, which carry the revolving brooms. The brooms are carried far enough in advance of the car platform so that when out on interurban track the snow curtains can be removed so as to throw snow entirely clear of the track, after the manner of a rotary plow. The revolving broom cleans clear down to the rail, which, of course, is more than can be done with a plow which must have a certain amount of clearance above the rail.

This change makes the plow efficacious on interurban lines, where it can clear drifts as deep as 4 ft., as in Joliet and Denver. Other large interurban railway companies which depend on this type of sweeper for the removal of snow are: The Elgin, Aurora & Southern; Toledo, Bowling Green & Southern.; Chicago General; Ashtabula Rapid Transit; St. Louis & Suburban; Joliet & Plainfield.

General Manager Selvedge, of the Holland Palace Car Company, has been in Cleveland conferring with a number of prominent interurban managers relative to the practicability of installing parlor car service on some of the long connecting lines in which Cleveland people are interested. The Holland Company is building some magnificent 60-ft. parlor chair cars and is working out a number of long routes over which it believes such cars could be operated profitably. Nothing definite has been accomplished.

A STEAM SHOVEL FOR ELECTRIC RAILWAY GRADING

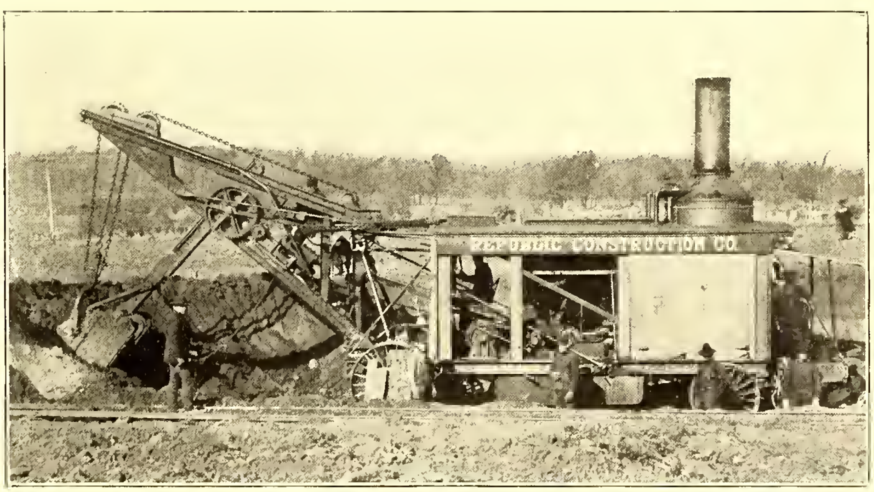
In the construction of electric interurban railways, the grading is frequently done by the slow process of employing horses and scrapers. Often, however, this could be accomplished more economically by the use of a steam shovel, but the extent of a single job of grading may not warrant the expense of purchasing a steam shovel of the size as ordinarily constructed,



VIEW SHOWING THE FINE SLOPE GIVEN BY STEAM SHOVEL

and these are, moreover, too heavy to be readily transported from one job to another.

The Vulcan Iron Works Company, of Toledo, Ohio, has designed a shovel that is peculiarly adapted to construction work on electric railways. This is the "Little Giant Traction Shovel," which weighs but 26 tons. It is well illustrated in the two accompanying illustrations, showing it in service on the Rockefeller extension of the Chicago & Milwaukee Electric Railway. A notable feature in one of the illustrations is the elegant bank and slope given to the cut by the machine.



STEAM SHOVEL IN OPERATION ON THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY

The shovel is mounted on wheels with broad tires and is self-propelling. It is 10 ft. wide over all and 23 ft. long. The car itself stands 13 ft. high. The dipper has a clear lift above the ground of 8 ft. 6 ins., and will cut a bank 16 ft. high. One double engine hoists the dipper and another swings the crane. It will work in clay, sand, gravel, iron ore and similar materials, and is well adapted for use in brick yards, stone quarries, stripping coal fields, loading coal and other work of this nature, besides interurban grading.

One great advantage of the machine is that it is of such a size that it can be hauled by teams when steam cannot be used, and when desired, it may be so constructed as to be readily taken apart for transportation on wagons to places not easily accessible. If the services require, it may be mounted on railroad trucks and carried on a track.

The expense of operation depends, of course, on the local conditions, varying sometimes from $50 per day on 1500 cu. yds. to $25 per day on 1500 cu. yds. The crew required to operate it usually consists of one engineer, one cranesman, one fireman and two pitmen, making a total of five.

A study of the conditions governing many jobs of grading will no doubt make it evident that this steam shovel can be employed to a greater advantage than the method requiring scrapers and teams.

TERMINAL FOR NEW JERSEY & PENNSYLVANIA TRACTION COMPANY IN TRENTON

The New Jersey & Pennsylvania Traction Company has purchased the Clark Building, at Warren and West Hanover Streets, Trenton, N. J., and will convert it into an up-to-date electric railway terminal. The building was formerly occupied by a large department store, and was partially destroyed by fire some months ago. The traction company purchased it at Sheriff's sale for $19,720, with assessments, which will bring the total price up to about $21,000. The building has a frontage of 60 ft. on Warren Street, one block from the City Hall, and within 100 yds. of the leading hotels, theaters and other electric railway terminals. It runs back about 170 ft. on West Hanover Street, joining the company's present office building and car house, which has frontage of 61 ft. on West Hanover Street, and 84 ft. on Chancery Street. The Clark Building was four stories high, and the fire destroyed the third and fourth floors and elevator shaft, the walls remaining practically intact. While no definite plans have as yet been decided upon for the new terminal, it is understood that the cars will be run direct into the remodeled building, so that passengers may enter the large waiting room (which will extend across the Warren Street front) without stepping out of doors. The company's offices will be located in the building, and the present car house will be utilized entirely for the repairing and storing of cars. It is probable that the present curves from the street will be done away with and that the cars will be backed into the car house from the new terminal, into which the cars will run. When the work is completed, the New Jersey & Pennsylvania Traction Company will have a terminal which could not be duplicated for $100,000 (including the present car house), and the only one of the kind in the State of New Jersey. It is located only a block from the terminus of the New York cars, and the New Jersey & Pennsylvania Traction Company operates cars to Princeton, N. J., and Newtown, Pa., and will soon be running to Newhope, Pa., and Lambertville, N. J. Another line will extend to Willow Grove, Philadelphia's famous pleasure resort, and the Morrisville (on the Newtown line) cars make direct connections with the Philadelphia, Bristol & Trenton cars, so that the new trolley terminal may be said to be the key to the traffic of the two States. The New Jersey & Pennsylvania Traction Company also has a storage house on North Willow Street, capable of holding all its cars, and owns the former offices, adjoining the house, so that it is in possession of a valuable lot of real estate within the city limits which could not be duplicated for the price, and which will rapidly increase in value.

FINANCIAL INTELLIGENCE

WALL STREET, January 18, 1905.

The Money Market

Increasing ease developed in all branches of the money market this week, rates for all maturities being forced to the lowest point attained in months by the continued heavy offerings of funds by both local and out-of-town institutions. At the opening call money loaned at 2½ per cent, but subsequently the rate ran off to 1¾, which was the final figure. On time, the volume of business was extremely small, partly owing to the extreme ease in call money and partly to the entire lack of demand from stock commission houses. Sixty-day funds, which commanded 3 per cent a week ago, were obtainable during the present week at 2½ per cent, while four and five months' contracts were in moderate supply at 3 per cent. Six months' maturities were firmly held at 3¼ per cent, but a break in the rate to 3 per cent would not be at all surprising. Nine months' funds loaned at 3¼, and contracts for the balance of the year were offered at 3½ per cent. The movement of currency in this direction continues on an extremely large scale, and in addition, the local institutions continue to gain on their operations with the Sub-Treasury. The bank statement published last Saturday was better than generally expected, and showed clearly the vast accumulation of funds at this center. The increase in cash amounted to $15,348,900, while the surplus reserve increased $12,851,025, bringing the total up to $24,459,275, as against $12,851,025 in the previous week. The outflow of gold to Europe continues, and is likely to do so for an indefinite period. The local rates of exchange remain strong, while the rising tendency in Paris discounts, and the decline in the Paris cheque rate, indicates that the gold requirements at Paris have not yet been satisfied. As the movement is confined to gold bars entirely, it is not expected that the gold exports will assume large proportions, owing to the limited supply of assay office bars. At London and Berlin the discount rates were not materially changed from those ruling a week ago.

The Stock Market

Trading in the local securities market continued upon a comparatively small scale this week, and, although prices continued to show more or less irregularity, the movements were, for the most part, confined to narrow limits. The early dealings were accompanied by a generally higher range of prices, the principal features being the strength in the Pacific stocks, and in Northern Securities on the curb, which established a new high record at 147½. The advance in these shares gave rise to rumors of an amicable settlement of the Northern Securities dissolution plan, but subsequently these issues reacted sharply, on the announcement that the recent decision of the United States Circuit Court of Appeals would be appealed to the United States Supreme Court. In other parts of the list prices were advanced sharply, but toward the end a heavy realizing movement developed, which carried prices for most issues off sharply. Exceptionally strong features in the final dealings were Reading and Omaha, the latter advancing 19 points on an increase of ½ per cent in the semi-annaul dividend declaration, thus placing the stock on a 7 per cent basis. Notably weak features were Baltimore & Ohio, Illinois Central, Union & Southern Pacific and Amalgamated Copper. The money market displayed extraordinary ease throughout, rates for all maturities loaning at the lowest points attained since last November. The ease in money was reflected in an increased demand for high-grade bonds, the market for which was considerably more active and higher.

A noteworthy feature of the trading was the activity and strength in the local traction issues, practically all of them scoring sharp advances in sympathy with the upward movement in Interborough. The advance in these shares was accompanied by the usual crop of rumors of a "deal," but all of them were flatly denied by all interests. Brooklyn Rapid Transit was the feature of the group, the price scoring an extreme gain of 4⅝ points to 64⅞, but toward the close the price ran off to 63¾. Since Jan. 1, the earnings of the company have shown an increase of $5,000 per day, while from July 1 to Jan. 1, the gross earnings have increased $600,000, an average increase of $100,000 per month. Manhattan advanced to 169⅝, a net gain of 1⅝, while Metropolitan Street Railway and Metropolitan Securities advanced 1⅛ and 2 points to net, respectively.

Philadelphia

Increased activity developed in the market for local traction shares, and prices generally displayed strength. Interest centered largely in Philadelphia Rapid Transit and United Gas & Improvement. The first-named opened weak at 17⅞, owing to the rumored dissension among the local politicians, but subsequently it rose quite sharply to 19 on buying said to be for the New York interests. It is said that all the preliminary work incident to having the stock listed on the New York Stock Exchange, and that the new engraved certificates of stock will be finished the last of this week, when the instalment of $5 per share will be due, making the amount paid in $20. In all, about 15,000 shares were dealt in. Upward of 40,000 shares of United Gas & Improvement changed hands at prices ranging from 105½ to 109⅝, the final transaction being made at 109¼. The advance in this stock was based upon reports of a "melon-cutting" in the near future. Philadelphia Traction rose from 99½ to 100 and ended the week at 97⅞, while Fairmount Park Transportation advanced from 18¼ to 22. Philadelphia Company common moved between 41 and 42, while the preferred moved up from 46⅞ to 47. Union Traction sold in small amounts at from 58⅞ to 58⅝, and Consolidated Traction of New Jersey brought from 79⅝ to 80⅛. American Railways sold at 48 for about 400 shares.

Chicago

Local interests in touch with a large number of medium shareholders in Chicago City Railway express doubts at the syndicate's ability to secure a majority of the stock at $200. They maintain that from the fact that the Easterners are trying hard to obtain control, they may, at a later date, prove willing to pay even more for the property. A great many believe that the stock ought to be sold at least on a 4 per cent basis, which would make it worth $225.

Mr. Mitchell, president of the Illinois Trust and Savings Bank, says an effort will be made to bring the surface traction lines of Chicago under the control and management of one company. But that no further step in that direction will be made until the franchise matter has been satisfactorily disposed of. The control of the different roads is now so concentrated that the negotiations on behalf of the corporations can be conducted by one interest, and this should greatly simplify matters. All that the corporations want is that the municipal authorities show a fair spirit. The street railways wish only that which is fair.

The annual meeting of the Northwestern Elevated will be held January 25. It is expected the total surplus will show around $900,000 in the annual report.

The annual report of the South Side Elevated will be held on January 26. The annual report is expected to show a decrease in gross receipts of about $100,000.

Dealings in the traction stocks were rather quiet, there being a general disposition on the part of traders to await further developments in the local street railway situation, but prices, as a rule, held firm around those prevailing at the close of a week ago. Chicago City Railway opened at 194, and on profit-taking it ran off to 190. In the later transactions, however, the price advanced sharply to 198, and closing at 197¾. West Chicago sold at 60 for small amounts, but several hundred thousand dollars' worth of the Consolidated 5s changed hands at from 82 to 95½. North Chicago 5s sold at 95. Chicago Union Traction dropped from 12 to 9½, but later it advanced to 13, and closed at 12. Sales of the preferred were reported at 45. The Elevated stocks were strong on reports of the efforts making to merge all of the Elevated lines. It was further reported that the same interests that are interested in merging the surface lines, are behind the new deal. Metropolitan Elevated sold at 22, while the preferred moved up from 59½ to 61 and closed at 60⅞. Northwestern sold at 24½ and 24, and South Side brought 95.

Other Traction Securities

The feature of the Baltimore market was the activity in Norfolk Railway Light 5s, which sold at 91 to 91½ for about $25,000. United Railway issues were comparatively quiet, the first mortgage 4s selling at from 93 to 92, and the incomes at from 50 to 51½, and back again to 50½. The stock changed hands at 13 to 13½. Other transactions included Baltimore City Passenger 5s at 107, Macon Railway & Light 5s at 94½, Atlanta Street Railway bonds at 105½, Charleston Street Railway 5s at 105¼, and Charleston City Railway 5s at 93¾. The Boston market was absolutely featureless. Boston Elevated was extremely quiet and fractionally lower, sales of small amounts being recorded at 157 and 157½. Massachusetts Electric common sold at 13½ and 14, while the preferred changed hands at from 58½ to 59½. West End common advanced from 94½ to 95½ on the exchange of odd lots, while a small lot of the preferred brought 113½. On the New York curb Interborough Rapid Transit continued the upward movement, the price making a new high record at 193 on comparatively small transactions. Toward the close, however, the support which was in evidence earlier in the week was apparently withdrawn, resulting in a reaction to 186, with a rally at the close to 188. About 25,000 shares of the stock were dealt in. The advance was based upon the large earnings of the company, which are said to be equal to 15 per cent on the stock, and to renewed reports of a "deal." The latter report was flatly denied. New Orleans Railways common was stronger, the price advancing from 3 to 4¼ on light purchases. North Jersey Street Railway 4s sold at 79½ for $25,000. Jersey City, Hoboken & Paterson 4s changed hands to the extent of $59,000 at prices ranging from 79 to 79½. Public Service Corporation issues were active and strong, 1000 shares of the stock selling at from 140 to 141, $50,000 of the certificates at from 73 to 73¼ and $100,000 of the 5 per cent notes at 97¼.

Cincinnati, Dayton & Toledo issues continue active in Cincinnati, in anticipation of the leasing plan soon to be announced. About a thousand shares of the stock sold at 23 to 24, and about $25,000 worth of the 5 per cent bonds at 85 to 85½. Cincinnati Street sold at the old price, 144. A block of $30,000 worth of Columbus Railway 5s sold at 91½. Cincinnati, Newport & Covington preferred sold at 91, and the common at 32, while a block of the 5 per cent consolidated bonds sold at 111½. Detroit United sold at 78½, Toledo Railway & Light at 23, and a round lot of Miami & Erie Canal stock at 1½.

Northern Ohio Traction continued active at Cleveland, and the price crossed 20, but failed to hold, and dropped back to 19½. Cleveland Electric Railway touched a new high figure of 80, but receded a trifle at the close. Western Ohio receipts dropped from 14 to 11⅛, but strengthened up to 12½, and are in good demand at that, with few offerings. A number of scattering sales of Northern Texas traction were made at 44¼. Cincinnati, Dayton & Toledo stock sold at 23¼. Muncie, Hartford & Fort Wayne was wanted at 41, but there were few offerings.

Security Quotations

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

	Jan. 11	Jan. 18
American Railways	47½	48
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	156½	157½
Brooklyn Rapid Transit	60¼	63¾
Chicago City	192	193
Chicago Union Traction (common)	12	11
Chicago Union Traction (preferred)	45¾	45
Cleveland Electric	74¼	a79
Consolidated Traction of New Jersey	78½	80½
Consolidated Traction of New Jersey 5s	108½	108½
Detroit United	77¾	77½
Interborough Rapid Transit	186	187
Lake Street Elevated	—	—
Manhattan Railway	167¾	169¼
Massachusetts Electric Cos. (common)	13½	13⅝
Massachusetts Electric Cos. (preferred)	58½	59½
Metropolitan Elevated, Chicago (common)	22	20½
Metropolitan Elevated, Chicago (preferred)	59	60
Metropolitan Street	115¾	116⅞
Metropolitan Securities	75	76¾
New Orleans Railways (common)	2¾	4
New Orleans Railways (preferred)	11	14
New Orleans Railways, 4½s	74½	76
North American	100¼	100½
Northern Ohio Traction & Light	17	—
Philadelphia Company (common)	24	18½
Philadelphia Rapid Transit	41	41¾
Philadelphia Traction	—	99¾
South Side Elevated (Chicago)	96	—
Third Avenue	127	127
Twin City, Minneapolis (common)	105¼	106¼
Union Traction (Philadelphia	58¾	58¾
West End (common)	95	95½
West End (preferred)	113	113

a Asked.

Iron and Steel

The "Iron Age" says the markets have been rather quiet in the past week, and there are some alarmists who show symptoms of uneasiness. The fact that we are producing and consuming so enormous a quantity for this season seems to inspire doubts as to the possibility of maintaining the pace. On the other hand the principal preoccupation of other conservative interests is that we may be in danger of a runaway market as the busy season approaches.

In spite of fact that United States Steel is turning nearly every wheel, the corporation is forced to pro rate shipments in the order in which specifications have been received, being unable to fill demands of all.

The event of the week has been the purchase on the part of the Steel Corporation of 25,000 tons of Bessemer pig at $15.50. A considerable tonnage of ore is being contracted for.

The steel rail market is quiet. Rail makers are confident and count on some heavy orders later on for the West and Southwest.

CHICAGO TRACTION MATTERS

A petition has been filed in the Circuit Court by Attorney Edward Roby as plaintiff, for an injunction restraining the city from passing the tentative ordinance for the Chicago City Railway, which the city proposes to submit to referendum in the spring. The petition also asks that the city be prevented from recognizing any right of the company to occupancy of the street. The basis of the petition is the claim that the legislative acts of 1859, 1861 and 1865, under which the Chicago City Railway Company has been operating, were never passed by the general assembly of the State and never became laws.

The petition, averring that the railway company at present has no rights, declares that the city, in granting any franchises to the company in return for the relinquishment of all unexpired rights, would in reality be giving the franchises without any consideration.

In its answer to the injunction bill, the city upholds the validity of the acts and asserts its rights to pass any ordinance.

PROPOSED CONSOLIDATION IN CHICAGO

Last week mention was made of the proposed consolidation of the Chicago City Railway Company with the Chicago Union Traction Company. It appears now that matters have not gone quite as far as the first reports would indicate. What has been done is to form a syndicate to purchase Chicago City Railway stock. The active men in this move are Marshall Field, John J. Mitchell and P. A. Valentine, of Chicago. J. P. Morgan & Company are syndicate managers. Hollins & Company, who are heavily interested in Chicago Union Traction, will participate in the underwriting. Messrs. Field, Armour and Valentine, in behalf of the syndicate, are advertising for Chicago City Railway stock, for which $200 per share is to be paid, provided sufficient stock to secure control of the company is pledged by March 31 next. These gentlemen are already heavily interested in the Chicago City Railway. P. A. Valentine represents the Armour interests.

DEVELOPMENTS IN APPLEYARD AFFAIRS

A number of developments have taken place in the affairs of the Appleyard lines of Ohio, which, as noted in the Street Railway Journal of Jan. 14, have passed into the hands of receivers, and also in the affairs of the defunct German Bank of Buffalo, which Mr. Appleyard controlled and of which Richard Emory, formerly the Appleyard representative in Columbus, was president.

According to the Columbus "Press," Mr. Appleyard secured control of the German Bank of Buffalo, with deposits of $6,000,000, by an outlay of $29,999 in actual cash. He then is said to have secured from the bank loans aggregating $644,000.

Of the loans $207,000 was to the Central Market lines of Columbus, and to the Dayton, Springfield & Urbana Traction Company. The other loans were made largely on collateral, consisting of bonds of the Ohio Union Traction Company, which was formed to take over the Appleyard lines, but which, as far as can be learned, had not done so and therefore had no assets, so the "Press" says.

EXTENSION ORDINANCE OF THE NORTHWESTERN ELEVATED PASSED

At last the Ravenswood extension of the Northwestern Elevated Railroad in Chicago seems to be assured. The City Council of Chicago, on Jan. 16, passed the ordinance over the mayor's veto upon the recommendation of the mayor. An ordinance providing for this extension was originally passed last spring, but it was saddled with an objectionable amendment requiring half fare for children on the entire road. The company did not accept the ordinance. The citizens of that part of the city through which the extension is proposed, circulated petitions and urged upon the Council the passage of the ordinance because of the necessity for the road. A great sensation was made in the council at the time by one of the members, who charged that attempts had been made to bribe him to vote for the ordinance. This aroused great indignation in the Council. The matter was investigated by the committee of the Council and the grand jury, and the officers of the Northwestern Elevated Railroad Company asked that the ordinance be reconsidered and defeated if any taint of bribery could be proved in connection with it. The charges of bribery were found to be entirely without foundation, and the alderman making the charges was severely censured by the Council. Mayor Harrison felt obliged to veto the ordinance, but at the last meeting of the Council, recommended that, since the bribery charges were without foundation, the Council pass the ordinance over the veto, which was done.

THE FACTS OF THE HUNTINGTON DEAL IN CALIFORNIA

Final arrangements have been completed in a financial transaction involving approximately $2,000,000, for which amount Henry E. Huntington has acquired the minority interest of I. W. Hellman, C. E. de Guinne and Antone Borel in the Pacific Electric Railway Company and the Los Angeles Interurban Railway Company. Now Mr. Huntington owns an even half interest in these properties. The other half interest is possessed by E. H. Harriman of the Southern Pacific and his associates. The interest of Mr. Hellman and his associates amounted to about 15 per cent. Mr. Huntington's elaborate plans for the expansion of the electric railway systems outside of the city of Los Angeles to suburban and country points can now go on unhampered, inasmuch as he and Mr. Harriman are said to have a thorough understanding and are agreed on that point.

Mr. Hellman gives as his reason for selling that he is unable to spare from his banking business in Los Angeles and San Francisco the money necessary for present needs in the Huntington-Harriman plans for the development of Southern California. While Mr. Hellman and his associates have disposed of their interests in the Pacific Electric Railway Company, and the Los Angeles Interurban Railway Company, they will continue to own a minority interest in the Los Angeles Railway Company. This property, however, is absolutely controlled by Mr. Huntington, who owns 55 per cent of the stock; the remaining 45 per cent being divided into thirds and owned by Mr. Hellman, Mr. de Guinne and Mr. Borel.

The stock of the Los Angeles Railway Company is firm on the market at 105, though it has never paid any dividends, and it is not Mr. Huntington's policy that it shall for several years to come, his idea being to put the earnings into betterments until the system approaches what he considers to be perfection.

With Henry E. Huntington and E. H. Harriman each owning a half interest in the Pacific Electric Railway Company, and the Los Angeles Interurban Railway Company, extensive plans are maturing for future construction work on interurban lines. These plans, it is said, involve the expenditure of from $20,000,000 to $30,000,000, in addition to the vast sums already spent in Mr. Huntington's effort to give Los Angeles and the surrounding sections the best constructed and most thoroughly equipped system of interurban railways in the world. Each of the companies is capitalized at $10,000,000. Mr. Huntington is now in New York, and it is understood to be his purpose to dispose of the bonds of the Los Angeles Interurban Company while there.

The Hudson Companies, the construction concern which is to tunnel the North River, has elected as permanent directors, William C. McAdoo, John W. Simpson, Frederick B. Jennings, William C. Lane, Anthony N. Brady, Pliny Fisk, and William M. Barnum, and the following, who are also directors of the Interborough Company: Walter G. Oakman, Andrew Freedman, Gardiner M. Lane, Cornelius Vanderbilt, and William Barclay Parsons. Mr. Oakman is president.

THE RESULTS WITH THE INTRAMURAL ROAD AT ST. LOUIS

One of the most interesting of the final reports of World's Fair divisions is that of Manager Thomas Murphy of the Intramural Road, which was submitted recently through Director of Transportation Scullin to President Francis. It is shown that the road was one of the notable successes of the Exposition for the amount of revenue it brought in, its economy of operation and the absence of accidents. During the 177 days the road was operated 6,274,738 revenue passengers were carried. There were no dead-head passengers. On the Philippine extension, which was operated for 95 days, 58,305 passengers were carried from whom no fares were collected. Only one car was operated on this branch, and the cost of operation was $459.80. During the hours of heavy travel the cars were run in trains of two cars each on a three-minute schedule. The average speed maintained was twelve miles an hour, and the number of cars operated daily was sufficient to handle the travel, except on St. Louis Day. There were but two collisions between cars. Neither of these was serious, and no injuries resulted to passengers. A statement of earnings of the road shows:

Receipts from passengers	$627,473
Receipts from advertising	2,294
Gross earnings	$629,767
Operating expenses	60,995
Gross earnings less operating expenses	$568,772
Total number of passengers carried	6,274,738
Total number of days in operation	177
Total number of trips made	70,125

The Intramural road at Chicago was in operation 184 days. During that time 5,805,893 passengers were carried over the line. Its operating expenses were $91,653.30. The fare on the Intramural road at the Chicago fair was 5 cents. At the St. Louis Exposition the fare was 10 cents.

HEARING ON BROOKLYN TUNNEL PLANS

A hearing was given Thursday, Jan. 12, by the New York Rapid Transit Commissioners on the recommendations of Engineer Parsons for proposed transit facilities in Brooklyn. The original intention of the commission was to hear argument on all of the commissioners recommendations as made on Thursday, Dec. 29, which included the consideration of transit matters of concern to Manhattan and the Bronx. The delegation from Brooklyn, however, was so large, and the claim of that borough for consideration so important, that problems affecting that borough alone were considered. Mr. Parsons' plan, as outlined in the Street Railway Journal of Jan. 7, 1905, provided for a subway in Fourth Avenue, Brooklyn, out to Fort Hamilton, and for a line to run from the Battery, New York, across Governor's Island and Buttermilk Channel, along the shore of Fort Hamilton. These recommendations were purely tentative. Delegations from all parts of the borough were in attendance to argue for their particular plans.

The plan that seems best to conserve the interests of the majority was proposed by Lawrence Abrahams, who represents some ten civic organizations and boards of trade. Mr. Abraham's plan, in brief, provides for the construction of a line from the City Hall, Manhattan, under the river to Washington Street, Brooklyn, and thence to Court Street, Brooklyn, under the subway now being constructed, to Atlantic Avenue, to Fourth Avenue to Fort Hamilton, with a spur from Atlantic and Fourth Avenues connecting with the main line on Fulton Street at Fulton Street and Flatbush Avenue. Mr. Abraham proposes that the second tunnel shall be used exclusively for express trains (these trains to be the south-bound Manhattan local trains, which shall become express after leaving the bridge station, Manhattan), and the line now in course of construction for local service—the trains running through this route being the south-bound Manhattan express trains, which are to be transformed into locals after leaving the bridge station, Manhattan. By this scheme Brooklynites on their way to this borough at night, from north of Chambers Street, Manhattan, and those from the down-town section of that borough, around Wall Street, would be segregated, and there would be no overcrowding and none of the inconveniences that Mr. Abraham said he believes will be sure to follow the opening of the Brooklyn tunnel because of its being only a two-track line.

The hearing is being continued this week, so as to give the allied boards of trade of the eastern district a chance to agree on the proposition for a subway under Broadway in the eastern district.

MR. GOULD'S ELECTRIC PLANS IN THE SOUTH

Brief mention was made in the STREET RAILWAY JOURNAL of Jan. 7, of the plans of Frank J. Gould and his associates of building an extensive system of electric railways in the South. Since then it has been learned that application has been made in Virginia, by Henry M. Anderson, of the law firm of Munford, Hunton, Williams & Anderson, of Richmond, representing Mr. Gould, for a charter to build an electric railway from Richmond to Ashland, and thence through King William, King and Queen and Essex Counties to Tappahannock, Va., across the Tappahannock River, and thence through Northumberland and Lancaster Counties to Chesapeake Bay; also from Ashland through King William, King and Queen, Gloucester, Mathews and Middlesex Counties to Gloucester Point. This plan will require the building of about 150 miles of line, and perhaps more. As the proposed line will parallel the Richmond, Fredericksburg & Potomac Railroad, in which the State has an interest, the question of granting a charter will have to be passed upon by the Supreme Court, without the approval of which the corporation commission cannot grant a charter. A general objection to Mr. Gould's scheme was entered before the Supreme Court of Appeals in Virginia on Jan. 10, by the Attorney-General of the State. This is purely a technical objection, and no fear is entertained for the ultimate granting of the right to build.

Mr. Gould is president of the Virginia Passenger & Power Company, of Richmond, and Mr. Anderson is vice-president of the company. The proposed line is supposed to be connected and affiliated with the existing roads of the Passenger & Power Company

CLEVELAND CAR-HOUSES TO BE EQUIPPED WITH SPRINKLER SYSTEM

The General Fire Extinguisher Company, of Providence, R. I., has recently closed contracts, through its Cleveland office, for the equipment of the Lake View car shops and the Miles Avenue car house of the Cleveland Electric Railway Company, with the Grinnell automatic sprinkler system. Both plants are to have complete sprinkler equipments throughout all buildings, the Miles Avenue car house having, in addition to the usual arrangement of sprinklers, lower lines of sprinklers next to the car windows, for direct protection against fire which arise in the cars themselves.

The plant at the Lake View shops is to have a 50,000-gal. storage tank mounted upon a 75-ft. steel tower, which will be supplied by two 6-in. connections to city water mains upon two different streets. Several fire hydrants will be installed in the shop yard, to fight outside fires, while there will also be two Siamese steamer connections to the sprinkler delivery piping, for connecting fire engines in case of a fire which the elevated tank cannot take care of.

The system of the Miles Avenue car house will be supplied from two 35,000-gal. gravity tanks, each erected on a 75-ft. steel tower with independent 8-in. connections to the city water mains. This equipment includes, in addition to the sprinkler systems within the buildings, a hydrant in front of the car house for handling outside fires. An outside Siamese connection for fire engines is to be provided in this system also, to permit city fire engines to assist the elevated tanks in fighting a serious fire, if necessary.

DETAILS OF WASHINGTON, BALTIMORE & ANNAPOLIS REFINANCING

The details of the arrangements for the completion of the Washington, Baltimore & Annapolis Railway have been announced. The property has been taken over by a syndicate headed by George T. Bishop and John Sherwin, of Cleveland, who built the Northern Texas Traction Company's line. The new company will have a capital stock of $3,000,000, and will issue $2,000,000 first mortgage 5 per cent bonds and $1,000,000 second mortgage bonds. The Bishop-Sherwin syndicate will take the $2,000,000 first mortgage bonds and $2,000,000 of the stock at 95, the money to be used in completing the road. The subscribers to the old Washington, Baltimore & Annapolis underwriting will receive 50 per cent of the money they paid in in second mortgage bonds and 50 per cent in stock. The Washington, Berwyn & Laurel bondholders will receive 100 per cent of second mortgage bonds, and is understood that the steam road will receive 100 per cent second mortgage bonds and 125 per cent of common stock. The line from Washington to Baltimore will be double track on private right of way the entire distance, and it is stated that the running time between the two cities, 41 miles will be 50 minutes. The steam road owned by the company, which is to be electrified, is the only line between Washington and Annapolis. When completed there will be about 120 miles of track in the system.

ST. LOUIS TRANSIT EARNINGS

With gross earnings in December of $683,722, the United Railways Company falls but $49,577 short of fulfilling the prediction made early in the year of gross receipts of $10,000,000 for 1904. The December, 1904, earnings exceeded those of December, 1903, by $83,619. The gross earnings for the year amounted to $9,950,432. While the company has sources of revenue aside from its earnings by the operation of cars, it is not believed that the total gross revenue will amount to $10,000,000. It is estimated, based upon previous figures, that the cost of operation and taxes in 1904 will amount to $5,591,785, out of which must be paid interest on underlying liens, amounting to $754,400, and the interest on $28,292,000 first general mortgage bonds, amounting to $1,131,680. Thus a surplus will be left of about $2,332,285.

Based upon the statement of operation in 1904, 1903 and 1902 and 1901, it is estimated that the gross earnings for 1905, with other income, will amount to $8,384,872, and that the operating expenses and taxes will amount to $4,750,877, which, after payment of fixed charges, would leave a surplus of $1,697,915.

A statement of the earnings for 1904, by months, follows:

January	$565,098
February	563,257
March	645,481
April	710,368
May	837,872
June	925,387
July	984,644
August	1,014,776
September	1,051,452
October	1,095,842
November	875,524
December	683,722
Total	$9,950,423
Gross earnings in 1903	7,259,460
Gain of 1904 over 1903	$2,690,963
Gain of 1903 over 1902	873,242
Operating expenses and taxes in 1903	4,513,514
Estimated operating expenses and taxes in 1904	5,591,785
Estimated surplus after payment of fixed charges	2,232,285

ST. LOUIS PASSENGER STATISTICS

The "City Register," on Jan. 11 received the annual statement of trips made and passengers carried by the St. Louis Transit Company and the United Railways Company during the past year. An increase of 745,456 round trips was made, and 54,175,103 passengers were carried over 1903. Similar figures are not obtainable from the St. Louis & Suburban Railway, as the company has not filed statements of its traffic for two quarters. The statement of the Transit Company and the United Railways Company follows:

TRIPS MADE, 1904

First quarter	1,223,074
Second quarter	1,551,168
Third quarter	1,754,652
Fourth quarter	1,537,158
Total for 1904	6,066,052
Total for 1903	5,323,596
Increase, 1904	742,456

PASSENGERS CARRIED, 1904

First quarter	35,731,471
Second quarter	50,027,717
Third quarter	61,861,515
Fourth quarter	53,695,829
Total for 1904	201,316,532
Total for 1903	147,141,429
Increase, 1904	54,175,103

TRIPS COMPARED

Fourth quarter, 1904	1,537,158
Fourth quarter, 1903	1,308,274
Increase, 1904	228,884

TRAFFIC COMPARED

Fourth quarter, 1904	53,095,820
Fourth quarter, 1903	37,583,108
Increase, 1904	16,112,631

EQUIPMENT FOR LIMA ROAD

The General Electric Company will supply the equipment to be installed in the sub-station, and the car motors for the electric traction system to be built in Lima, the capital of Peru, to which reference was recently made in the STREET RAILWAY JOURNAL.

A Peruvian syndicate has been formed for the purpose of electrically converting the existing mule tramways operated by the Ferrocarril Urbano de Lima. The system is about 20 miles long. Fifty open cars will be ordered in the first instance. They will be of the eight and ten bench type. The former will be equipped with double General Electric 25-hp. motors, while the others will have double General Electric 38-hp. motors.

Power to operate the new system will be derived from the hydro-electric plant of the Empresa Electrica de Santa Rosa, Limitada, located at Choosica, 35 miles from Lima. A 1200-kw sub-station will be built at Lima for the purpose of operating the new electric road.

ST. LOUIS & SUBURBAN TO ISSUE NEW STOCK

The majority stockholders of the St. Louis & Suburban Railway voted the $1,500,000 issue of new stock, at the annual meeting held Jan. 9. About four-fifths of the stock was represented at the meeting.

The deal is to be financed through a construction company and a local syndicate, which, it is said, have agreed to underwrite the issue. President Walsh and other directors declined to make public the name of the construction company or of the members of the underwriting syndicate. The officers were reticent about the plans, and would go no further than to state that an arrangement had been closed with the construction company to improve the property and take the entire 15,000 shares of new stock in payment. The construction company is insured a market for the stock by the underwriting syndicate. The figure at which the stock is to be underwritten is withheld. It was stated that there are about twenty members in the syndicate, but no names were given. All of the present directors are presumed to be members of the syndicate, together with several new stockholders.

The announcement was made that the meeting voted to increase the board of directors by eight new members, to be chosen at the option of the board. The former directors were re-elected, as follows: S. M. Kennard, Breckenridge Jones, Ben Altheimer, C. H. Huttig, H. I. Drummond, W. D. Orthwein, W. F. Nolker, Julius S. Walsh and C. Marquard Foster.

The improvements to be made to the property will cost in the neighborhood of $1,000,000. A double track will be laid along the divisions from Suburban Park to Florissant and Ferguson, from Clayton to Kirkwood, and from the branch line from Brentwood to West End Heights. About 15 miles of new track will be required. Another extensive improvement will be the laying of new track on the St. Louis & Meramec division from Sarah Street to Maplewood and Kirkwood. Several new steel bridges in the county also are contemplated. The improvement of the suburban right of way in the city from Vandeventer Avenue to De Hodiamont will probably come within the general scheme. The plans for this consist in making a sort of railroad parkway out of the alley through which the line runs by planting trees and lining it with gravel paths, terraces of grass and flower beds.

The par value of the new stock will be $100 a share. Several days ago it was stated that subscribers who compose the syndicate talked of had agreed to take the entire issue at $60 per share. Before the stock is finally disposed of, present stockholders will be given an opportunity to subscribe their pro rata at whatever figure has been agreed upon. Suburban stock has not been traded in for several months on the stock exchange. The present quotation is 64 asked and no bids.

The St. Louis & Meramec River Electric Railway Company also held its annual meeting Jan. 9 and re-elected the following board: Henry Semple Ames, president; E. H. Benoist, W. G. Lacky, J. H. Keebaugh, secretary, and William McC. Martin.

The construction company which is to take the contract for the improvements on the St. Louis & Suburban Railroad contemplated under the new issue of stock has been organized and has applied for a charter with a capital stock of $5,000. it has taken the name of the Florissant Construction, Real Estate & Investment Company. The incorporators of the company are: Henry Semple Ames, Warren G. Bartlett and Clarence Sharp. Mr. Ames is president of the St. Louis & Meramac Railway Company, whose line is part of the suburban system. The Florissant Company, it is announced, is to take over the 15,000 shares of new stock voted this week by the Suburban Company in payment for the construction work.

'BUS LINES IN CONNECTION WITH STREET RAILWAYS IN WASHINGTON

A statement made by Vice-President Harries, of the Washington Railway & Electric Company, during a hearing of the House Committee is of concern to street railway interests throughout these United States. Mr. Harries has said that the plan of his company is to operate 'busses as feeders to its street railway lines. Already the announcement has been made in these columns that 'bus service is to be given by the Schenectady Railway Company in reaching outlying districts that do not at present justify the expenditure that would be entailed by the building of branch lines of railway. The announcement from Washington is, however, the first to be made of plans to operate a regular service of this kind in connection with city lines whose business already is well established. Herein lies the significance of what Mr. Harries has said.

The plans are, of course, in embryo. So far as they have been made public it is apparent that two distinct lines will be operated. One of these lines is to be built across the city, starting at a point near North Capitol and N Streets; the other line will probably run north and south through Southeast Washington. The crosstown line is to run out N Street to New Jersey Avenue, to P Street, around Iowa and Dupont circles, and probably out Massachusetts Avenue. The Southwest line will commence at Eleventh and G Streets, southeast and go up Eleventh Street to Maryland Avenue, to Fifteenth and H Streets, northwest. Transfers are to be given from the 'busses to the street cars. The capacity of the coaches will be limited to 20 persons, so it is said.

NEW POWER HOUSE FOR SOUTH SIDE ELEVATED, CHICAGO

The construction of a new power plant has been determined upon by the South Side Elevated Railroad Company, of Chicago, and specifications regarding same are expected to be issued inside of the next sixty days. The capacity of the new station will be about 6000 hp. Sargent & Lundy, of Chicago, will be the consulting engineers in charge of the work.

NEW ZONE PLAN TO BE TESTED IN CLEVELAND

The Cleveland Council at its meeting Monday evening, Jan. 16, authorized the Cleveland Electric Railway to make a test of the zone plan. The company's proposition was embodied in a letter in part as follows:

"As the result of several conferences with Mayor Johnson, it has been suggested that the company should, by experiment, determine whether it could afford to carry passengers within a limited zone at a three-cent fare without transfers, and that such tests be made on portions of all the various lines of the company by operating three-cent fare additional cars on the east side lines as far as Wilson Avenue, on the south side lines as far as Clark Avenue and Pearl Street; on the west side lines as far as Gordon Avenue, and on the Wilson Avenue line during the experiment to be operated from Forest City Park to its northern terminus at a three-cent fare without transfers, or a five-cent fare with transfers, such special cars not to be operated during night hours of light travel, but for at least fourteen hours per day for six days in the week, and the company to maintain its present service at its present rate. While the company has already stated that it feels certain that it cannot afford to operate even with the limited zone at a three-cent fare without transfers, it is nevertheless willing to demonstrate the correctness of its views in that respect by an actual experiment along the lines suggested.

"The company has also been asked by your special committee to state what other experiments in operation at reduced rate of fare covering the entire city, it is ready to make, and in response we beg to state that we will, if desired by the city council, in addition to the test above described, make a further test of operation over the entire system at a four-cent cash fare without transfers, or a five-cent cash fare with the regular transfers, or the company will make an experiment as to the practicability of the operation of the entire system as six tickets for a quarter with transfers under such reasonable regulations as will prevent the abuse of that privilege experienced by the company in its previous test of this rate of fare."

The streets mentioned for the zone limits are about 2 miles from the center of the city to the east, south and west; the lake being to the north of the city, there are no lines in this direction. President Horace Andrews of the company states that the low-fare cars will be placed in operation as soon as switches can be laid for turning cars at the streets mentioned.

THE BALL OF THE BUFFALO ASSOCIATION

The fourth annual ball of the International Railway Employees' Association, composed of employees of the International Traction Company, of Buffalo, was held Tuesday evening, Jan. 10, at Convention Hall, Buffalo. Not only was it the largest and most successful affair yet given by the association, but it was one of the largest ever held in the hall. A conservative estimate places the attendance at more than 4000. The ceiling and walls of the hall were heavily draped in green and white bunting, united in a striking design. The boxes were arranged around the hall in a circular form, and were lined with rugs. The decorations consisted of holly ropes and hemlock wreaths, in which were hidden small electric light bulbs. On the stage was a handsome electric design, in the center of which was a brilliant electric sun, with the initials, I. R. E. A. on its face. Among the officials of the company in attendance at the ball were: President W. C. Ely, General Manager T. E. Mitten, Assistant to the President Van Horn Ely, Superintendent of Transportation C. A. Coons, General Passenger Agent J. E. Stephenson, Treasurer R. F. Rankine, Auditor H. M. Pease, and others.

The proceeds of the ball will be turned over to the sick and death benefit fund of the Employees' Association.

THE CHICAGO & INTERURBAN RAILWAY COMPANY

The Chicago & Interurban Railway Company, formerly the Blue Island, Riverdale & Hammond Railway, is now under construction at several points, the contract for the construction having been taken by the Western Electrical Supply Company, of St. Louis. This road is laid out to extend from One Hundrel and Nineteenth and Halsted Streets, in the town of West Pullman, south on and near Halsted Street to Harvey, and thence in a southeasterly direction to Thornton and Glenwood to Chicago Heights. Another line is to extend from Blue Island to Hammond, making use of the north and south line before mentioned for a short distance. The Western Electrical Supply Company has established a construction office at Harvey.

TECHNICAL LECTURES BEFORE THE BROOKLYN RAPID TRANSIT EMPLOYEES' BENEFIT ASSOCIATION

In conformity with arrangements made by Prof. Edward Taylor, instructor of the electrical class of the Brooklyn Rapid Transit Employees' Benefit Association, Prof. Sydney W. Ashe, of the Brooklyn Polytechnic Institute, delivered an illustrated lecture in the Auditorium at the Railroad Men's Building, 1 Jamaica Avenue, Brooklyn, N. Y., at 8:00 p. m. on Monday, Jan. 9, on the safety appliances of the New York Subway.

Prof. Ashe, who has made an especial study of the subway, had a large number of stereopticon views of its principal features, including the equipment, signals, etc. His talk was very interesting and also of great practical value to all employees, particularly the shopmen, electricians and trainmen.

On subsequent Monday evenings, practical lectures will be delivered by prominent electrical engineers, and the class will also be given a number of trips over the Brooklyn Rapid Transit System, visiting power houses, shops, etc. All employees are cordially invited to join the electrical class, to which no cost is attached. As the lectures for the remainder of the session will each be complete in themselves, omission to attend previous sessions will not detract from gaining the full benefit from the remaining lectures. On Monday evening, Jan. 16, Max Lowenthal, electrical engineer of the Prometheus Electric Company, delivered an address on the Niagara Falls power developments.

REPORTED SALE OF THE JOHN STEPHENSON COMPANY TO BRILL INTERESTS

Reports received from reliable sources, just as this paper is on the press, state that the control of the John Stephenson Company, of Elizabeth, N. J., has been purchased by interests connected with the J. G. Brill Company, of Philadelphia. This purchase was followed by a meeting held this week at which William H. Heulings, Jr., of Philadelphia, was elected president of the Stephenson Company, Samuel M. Curwen was elected vice-president, and James Rawle was elected treasurer.

ENGINEERS FOR THE UNITED ENGINEERING BUILDING

At the meeting of the conference committee on the United Engineering Building, held Jan. 7, Alfred R. Wolff was appointed consulting engineer for the heating and ventilation of both the United Engineering Building and the Engineers' Club, to be erected at Thirty-Ninth and Fortieth Streets, New York, under the Carnegie gift to engineering, of $1,500,000. C. O. Mailloux was elected as the consulting electrical engineer for the United Engineering Building, and the firm of Bates & Neilson were selected as consulting electrical engineers for the Engineer's Club. All these gentlemen are well known in connection with the execution of large work of the class named in New York and vicinity, in addition to which they are prominently identified with the organizations that will occupy the buildings in question.

ELECTRIC RAILWAY RESORTS IN CENTRAL NEW YORK

There is to be unusual activity along the line of new amusement parks and resorts in the vicinity of Syracuse in the coming summer, and several important new propositions will be carried out. The Syracuse & South Bay Railroad Company early in the summer will have completed a 10-mile double track electric road between Syracuse and Oneida Lake, a body of water 20 miles long and 6 miles wide. At South Bay, the terminus of the line, there is a large summer hotel owned by the railroad company, which also owns considerable land there.. A first-class amusement park is to be established on Norcross Point, not far from this hotel, while on Frenchman's Island, a short distance out in the lake, will be a popular picnic ground. At Lewis Point, Sylvan Beach, and other places along the lake, improved resort features are to be introduced. The electric railroad will unite with the steam railroads in the vicinity in developing the excursion business to the lake, organzing the Oneida Lake Steamboat Company, soon to be capitalized at $200,000, to operate a fleet of modern passenger and freight boats on the lake. The Syracuse & South Bay Railroad Company intends to use two electric locomotives to draw trains of ten cars to handle the excursion business.

The Auburn & Syracuse Electric Railroad Company has just bought two steamers on Skaneateles Lake, and is planning to build another one, the object being to develop the excursion business to this lake. The company has bought land in Skaneateles village for a park, and will establish another amusement resort further up the lake. The Syracuse syndicate, which controls the Auburn & Syracuse Electric, and the Rochester, Syracuse & Eastern Railroads, have just acquired control of the Syracuse, Lakeside & Baldwinsville Railway, and is planning to introduce new amusement features along this line this summer.

Another company proposes to spend about $125,000 in the establishment of "Fairyland," at the Onondaga Valley Park of the Syracuse Rapid Transit Company. The only remaining electric railroad in the vicinity of Syracuse is the Syracuse & Suburban, and this company, in addition to developing its Suburban Park at Edward Falls, will establish a new one at Fiddler's Green, near Jamesville.

REPORT OF THE AMERICAN RAILWAY MECHANICAL & ELECTRICAL ASSOCIATION

The official report of the St. Louis convention of the American Railway Mechanical & Electrical Association has been published, and is a volume of 165 pages, which is extremely creditable to both the association and its energetic secretary, Mr. Mower. The discussions at St. Louis were very instructive, and in the printed report they have been amplified by one or two diagrams which were not presented at St. Louis. There is a frontispiece of President Olds, and the cover, which is the official brown, bears a representation of the St. Louis pin.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 10, 1905.

779,404. Life Preserver for Railway Cars; Warren W. Annable, Grand Rapids, Mich. App. filed May 19, 1904. Comprises a series of spring fingers, vertically disposed, consisting of coils of spring wire provided with elastic coverings, and means for supporting the spring-fingers in front of the car.

779,405. Brake Mechanism for Railway Cars; Warren W. Annable, Grand Rapids, Mich. App. filed May 19, 1904. A brake mechanism comprising, in combination with the wheels of a car-truck, independently-movable brake-shoes, a lever pivotally connected to each brake-shoe, rods connecting the levers at the respective sides of the truck, an equalizing-beam connected at its respective ends to the levers at the respective ends of the truck, and means for moving the equalizing-beam pivotally connected to the middle thereof.

779,410. Continuous-Rail Railway Crossing: Argyle Campbell, Chicago, Ill. App. filed Aug. 22, 1904. Consists of a movable member which can be moved to two different positions, in one position rendering one rail continuous, and in the other position rendering the second or intersecting rail continuous, while the opposite rail in each case is open.

779,441. Trolley Device; Henry O. Reese and Henry C. Weitzel, Baltimore, Md. App. filed June 10, 1904. Consists of a rocker carrying two trolley wheels and centrally pivoted at the upper end of the trolley arm, immediately above the shoulders formed near the pivot in position to catch the rocker in either of its positions, whereby to limit the rocking motion of the latter.

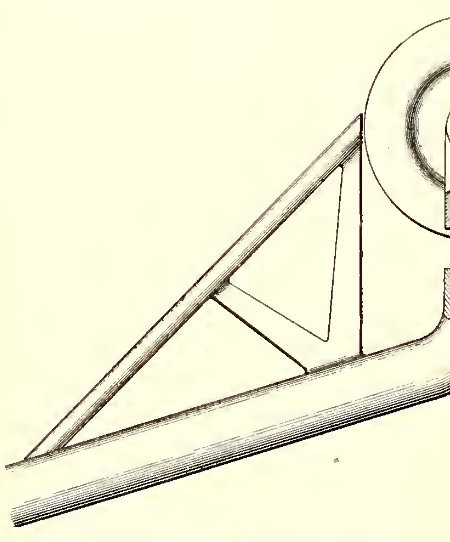
779,448. Life Guard for Electric Tram-cars or Other Road Vehicles; William A. Turner, Marple, and George A. W. Turner, Stockport, England. App. filed Oct. 7, 1904. The surface of the fender is caused, by a system of gearing, to travel in a direction opposite to that of the car, thereby facilitating the picking-up of any obstacle encountered.

779,470. Plate Fastening for Railway Track Structures; George M. Ervin, Johnstown, Pa. App. filed Dec. 5, 1903. Relates to the installation of wear plates at switches and crossings.

779,471. Railway Track Structure; George M. Ervin, Johnstown, Pa. App, filed Jan. 29, 1904. Relates to details of track construction.

779,475. System of Electrical Distribution for Electric Railways; Josef H. Hallberg, Cincinnati, O. App. filed Feb. 26, 1904. Comprises a source of alternating single-phase current means for converting said current into a continuously symmetrical polyphase current, and polyphase motors actuated by such polyphase current and adapted to give motion to the vehicles upon which they are located.

779,506. Slot Switch-Tongue and Slot Switch-Box Mechanism for Conduit Railway Construction; Henry C. Stiff, Johnstown, Pa.



PATENT NO. 779,850

App. filed Dec. 24, 1902. A slotted junction-piece having lateral recesses in the two upper portions of the conduit at opposite sides of the slot at the junction, ribs or bars connecting the upper and lower parts of the recessed portions, two slides with upwardly-extending notched portions arranged to work in the recesses and to extend through the openings between the ribs or bars, and means for operating the slides.

779,554. Trolley Bridge; Robert T. McCarroll, Columbus, O. App. filed June 4, 1904. A trolley bridge for car house doorways, in which steel rolling curtains are employed, comprising a pivoted bridge-piece which is adapted to close when the curtain is drawn up and thus bridge the opening in the trolley line through which the curtain passes.

779,557. Ticket Issuing and Recording Machine; John F. Ohmer and Elmer H. Bridenbaugh, Dayton, O. App. filed March 25, 1904. By this mechanism a single ticket or transfer may be issued at a time and a record made thereof, a printed record taken to show the number of transfers issued for any given period of time, each class of transfers separately registered, and the transfers perforated at different places as they are issued.

779,640. Suspension Device for Trolley Wires; Theophilus P. Chandler, Philadelphia, Pa. App. filed Oct. 7, 1904. Two gripping parts or plates, each having two oppositely arranged jaws adapted to extend partly around the wire on oppisite sides and jointly inclose it for more than half its circumference, the parts or plates being formed with a gap or clearance space between the jaws to receive the wire and allow it to come into the plans of the jaws.

779,654. Trolley Retriever; Emil J. Jonas, Hamlet, O. App. filed April 1, 1904. Pneumatic means for controlling the trolley pole.

779,739. Protective Device for Third Rails; John Ryna and Anthony C. Guntzer, New York, N. Y. App. filed Nov. 5, 1903. A protective housing for third rails.

779,774. Bracket Step for Street Cars, etc.; Robert Dunning, Winton Place, O. App. filed Nov. 14, 1904. A step for mounting to the roof of the car which also furnishes the means for the attachment of a handle to be used by passengers in getting on and off the car.

779,850. Trolley for Electric Railways; George C. Hohein, Norfolk, Va. App. filed Sept. 17, 1904. The trolley wheel is spring-mounted upon the harp in such a manner as to allow the wheel to move independently of the harp.

779,920. Track Switch for Electric Railways; George H. Fretts, Springfield, Mass. App. filed March 25, 1903. The switch is actuated by trolley current, and the motorman operates the same by either turning on or off the current to the car when passing under the contacts in the trolley wire controlling the switch.

PERSONAL MENTION

MR. GEORGE WILLIAM SMITH has resigned as president of the Frederick & Middletown Electric Railroad, of Frederick, Maryland.

MR. GEORGE J. KOBUSCH, president of the St. Louis Car Company, has been on a visit to New York for the past few days. He is stopping at the Hotel Imperial.

GOVERNOR MYRON T. HERRICK, of Ohio, has accepted an invitation to be the guest of honor and one of the speakers at the annual meeting and banquet of the Ohio Interurban Railway Association at Dayton, Jan. 26. Gov. Herrick is interested in several interurban and city properties in Ohio.

MR. ALBA HOUGHTON WARREN has been appointed local manager of the Brockton & Plymouth Street Railway Company, with headquarters at Plymouth, Mass. Previous to this appointment Mr. Warren was in operating charge of the Houghton County Street Railway Company, at Houghton, Mich. Both of these roads are controlled by Stone & Webster, of Boston.

MR. EDWARD LINDON PHILLIPS, president of the Hewes & Phillips Company, engine builders of Newark, died suddenly Saturday, Jan. 14, at his home, in Chatam, N. J., of apoplexy. at the age of fifty-four years. Mr. Phillips was born in Newark, and was a son of John L. Phillips, a well-known manufacturer of his day, who, after having his son educated in the public schools and Newark Academy, placed him in his own works and made him serve his time as an apprentice. The son was afterward graduated from Cornell, and when his father died, in 1886, he was made president of the company. He is survived by a widow and two daughters.

MR. EUGENE KLAPP has been appointed consulting engineer of the Brooklyn Rapid Transit Company. Mr. Klapp was graduated from the Columbia School of Mines in 1889, and shortly afterward was appointed chief engineer for the South Side Elevated Railway of Chicago. At the outbreak of the Spanish war, he was made a captain in a volunteer regiment of engineers, and at the conclusion of hostilities, he was selected as manager of the National Construction Company, which built the extensive drainage plant for New Orleans. When the New York Rapid Transit Commission began work on the subway, Mr. Klapp was for sometime engineer in charge of the fourth division of the work.

MR. GUY C. BARTON, first vice-president of the Omaha & Council Bluffs Railway Company, of Omaha, Neb., was elected president of the company to succeed the late Mr. Frank Murphy, at the annual meeting recently. Mr. G. W. Wattles was elected to succeed Mr. Barton as vice-president, and Mr. M. F. Hopkins, of Columbus, O., was selected for second vice-president. Mr. W. A. Smith was re-elected treasurer and general manager; Mr. F. A. Tucker as general superintendent, and Mr. R. A. Leussler as secretary. Mr. Frank Hamilton was elected to fill the vacancy in the board of directors. The present directors are Mr. Guy C. Barton, Mr. G. W. Wattles, Mr. N. V. Morse, Mr. W. A. Smith and Mr. Frank Hamilton, Omaha; Mr. C. R. Tyler, of Council Bluffs; Mr. Albert Strauss, of New York City; Mr. Randall Morgan, of Philadelphia, and Mr. Hugh J. McGowan, of Indianapolis.

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Heavy Electric Traction at the New York Railroad Club

Under the presidency of Mr. Vreeland, the New York Railroad Club has grown to be one of the most important organizations of its kind with which we are acquainted. The membership was originally made up almost entirely of steam railroad operating men, but during the last few years a number of those connected with electric railways have joined the club and papers on both branches of transportation are presented with impartiality at the monthly meetings. It is hardly necessary to say that the topic discussed last Friday evening was one which vitally touched both interests, as the attendance and list of speakers showed. Outside of the reference to the new gasoline motor car of the General Electric Company, Mr. Potter's paper was chiefly interesting on account of further details given of the single-phase motor system and d. c. locomotives manufactured by his company, and the estimates of comparative cost of electrical and steam operation. Other figures of this kind have been published, but as the latest available, and as representing the views of the author, the comparison contained in Mr. Potter's paper is most valuable. The discussion revealed a dissimilarity of views as to details of electrical equipment, but a noteworthy concord in the opinion that an important early development of electric traction on steam roads is impending. This seemed to be the conclusion alike of the advocates of a. c. and d. c. running, and of third-rail, overhead trolley and sliding bow. We should be glad to see all of the systems discussed at the meeting tried out carefully under the conditions for which each is most suitable, a plan which seems certain of early fulfillment. When this has been done, we shall have the data at our disposal by which the more doubtful cases, or those of the border line between a. c. and d. c. operation, can be considered. Certainly the speech by Mr. Wilgus defined in no uncertain way the advantages of electric power for New York Central conditions, and we shall be very much mistaken if the benefits described by him are not recognized by other roads, and if the conclusions reached by his board of directors in favor of electricity are not adopted by many other similar bodies during the next five years.

Keeping Sub-Station Records

It is safe to say that few tasks are more irksome to the general run of active street railway men than those which involve any species of bookkeeping. There is a feeling in many quarters that the writing of reports and keeping of systematic records are matters of small consequence in comparison with the important work of keeping the cars in motion. Over more than one employee and official an almost irresistible impulse comes to take to the woods when the time for preparing departmental records draws near, and yet every progressive manager realizes that without regular data of operation it is impossible to conduct properly the business of a road.

There is a great difference, however, between essential and non-essential records, and much may be done in the way of relieving employees of the work of preparation if a little thought is given to the matter. Thus, one firm of engineers controlling some two dozen railway and lighting properties, sends its local managers report blanks in which only the questions in black ink are to be filled out, the deductions being made at the home office by the statistical department. These deductions are posted in the records as answers to questions in red ink, and thus the local managers are relieved of a vast amount of burdensome work which is more properly handled by specialists. As an example of the refinement to which the division of labor has been carried, even in highly intellectual work, the foregoing practice is of interest.

A general agreement exists among managers as to the importance of keeping continuous records of power house loads, coal consumption, the use of water, oil, waste, car mileage and the like, but the usefulness of keeping simple data in regard to sub-stations is not so widely appreciated. At first sight, there appears little need of keeping sub-station records in cases where the power output of the generating plant is regularly tabulated, but when one realizes what a simple matter it is to put down the more important sub-station readings, the great value which such data acquires when future extensions and changes are planned and its usefulness in checking the operation of the system justify looking into the problem. There is little wisdom in installing a heterogeneous collection of power factor and frequency indicators, ammeters, voltmeters and wattmeters simply for occasional reference. What is wanted is a system of regular, simple readings, chiefly the energy output of the sub-station at the direct-current bus-bars, the daily rise and fall of load and striking variations in voltage, with an idea of the variations on the high-tension side as well. Sub-station attendants ordinarily have plenty of time to attend to these matters, and a few simple blank forms can easily be made up at headquarters for such uses.

In a rotary converter or motor-generator sub-station there is less need of installing automatic recording instruments, excepting wattmeters, than in sub-stations of the purely alternating-current type, which are coming into wider usefulness as the development of the single-phase motor roads proceeds. The cost of obtaining regular records from the former type is insignificant, but with the absence of attendance expected in the new type of sub-station, the importance of curve-drawing apparatus is bound to increase.

Aside from the readings of a sub-station showing conclusively when the machinery is beginning to be regularly overloaded, and when the usual course of operation is disturbed, they really constitute data of no small financial value when it is necessary to figure upon extensions. Too often such information is assumed by the parties who recommend the changes, or else drawn from a few hasty tests, rather than obtained from regular daily readings. The very inexpensiveness of obtaining sub-station records is certainly one of their chief advantages. Last but not least, the calibration of instruments should be looked after every year or oftener.

Costs of Power

We commented briefly last week on Mr. Richey's most valuable paper on the costs of power production on the Indiana railway systems, but the subject is of sufficient importance to call for more extended discussion. It is very difficult to generalize on power costs, since conditions vary so widely from place to place, and perhaps even averages cannot be fully trusted. But averages are the only attainable basis of comparison, and the data collected by Mr. Richey give at least a definite clue to the economic facts in the case. The question of the gains to be made by the consolidation of power production is one which we have often discussed. We have been disposed to take rather a conservative stand in this matter, and we are glad to see that Mr. Richey joins us in sounding a note of caution in the transmission question. His figure for the net efficiency of distribution through rotaries is even lower than we should have been inclined to put it. Fifty-four per cent is an efficiency that leaves much to be desired, and that leaves, too, a wide margin for competition by stations feeding the lines directly. The practical question which it raises is the saving in power station expense required to offset a clear loss of 25 per cent or 30 per cent in distribution, aside from the extra costs entailed in the extra investment and operating costs. In working the large consolidated stations there is to be considered, first, gain directly through working on a big scale, and second, gain through increase in the average load factor. To our minds, the latter is really far more important than the former, and also decidedly more difficult to evaluate.

One fact often overlooked in this connection is that the gain from increased load factor is relatively much greater in small than in large stations. This cuts both ways—on the one hand, it shows a relatively great saving in passing from small stations with bad load factors to large ones with good load factors. On the other hand, if the small stations are really well administered they can push the big ones very hard indeed. Mr. Richey's figures suggest that most of the stations with which he is concerned are pretty badly off in load factor. The costs which he quotes for power at the bus-bars are fairly low, but are subject to some uncertainty in the matter of relative bookkeeping. The conspicuous thing about them is the evidently large consumption of coal, which, in spite of low prices, cuts a very large figure indeed. The reported average of 5.56 lbs. of coal per kw-hour bespeaks very bad load conditions or poor utilization of fuel, or both. Even taking into consideration the fact that most of the coal is Indiana slack and run of mine, the fuel cost still looms up. In the figures from the individual stations of the Boston Elevated Company which we published last year, the fuel costs were about 10 per cent below Mr. Richey's average, although the Boston coal cost $3.60 per ton as against $1.89. Following up the costs further, it appears that the addition of sub-station operating expenses brings the average cost of power delivered to the direct-current feeders up to 0.964 cent per kw-hour. If to this must be added the fixed charges on the transmission systems, and proper allowances for up-keeps and depreciation upon them, it would appear that the roads concerned are hardly yet basking in the sunshine of cheap power. It is customary to report power costs free from fixed charges and depreciation, which is all right when comparing similar plants, but when, as in the case of high-voltage transmission, compared with direct supply, the variations in up-keep and fixed charges is a vital factor in the comparison—they should assuredly be included.

However, power transmission has come to stay, for long roads cannot be economically fed at 500 volts unless the traffic is much denser than can practically be expected. Transmission to rotaries in such cases is far from ideal, but it is the best present way out of a bad scrape. As regards its use, Mr. Richey raises one very interesting question. Granted that on certain roads, A, B. C. D, etc., individually feeding at 500 volts from separate stations is cheaper than transmission, at what, if any, point of consolidation will a general transmission to several or all of them pay? This is a question that constantly arises in practical engineering, and, so far as we can see, it admits of no general answer. If each road can save money by generating direct current at two or more points, it certainly does not follow that the same scheme will be economical after a consolidation, but, on the other hand, a common station may not pay. In the average case we are inclined to think that a single large generating station for the whole system is a mistake from an operative standpoint, and that two or more stations with interlocked transmissions will be both more economical and safer. If the alternating-current railway motors already in tentative use in that territory pan out, as we hope they will, the whole situation will be greatly relieved. They can be operated from high-tension working conductors, which is the key to long-distance railroading, and once this is possible the transmission and sub-station costs will drop so far as to clear up the majority of the puzzling cases now met with. It will also be possible to extend the transmission systems far more freely than at present, and thus to help out the load factors and to take advantage of the best station locations. In a coal-bearing country, the place for a station is over against a coal mine. Pending the determination of the working properties of these alternating-current motors, the wise man will be cautious in jumping into large transmission work, since it is a most painful thing to purchase a large amount of apparatus which one may wish to be rid of within a comparatively short time.

Interurban Railway Statistics

Information regarding the financial and traffic conditions of interurban electric railways is eagerly sought after these days, both by promoters of new interurban enterprises and would-be investors in their securities. The interurban electric railway, as it now exists in such large numbers in the Central States, is of such recent origin that its exact status has not been as thoroughly established as that of steam railroads. This is one reason probably why interurban railways securities have not commanded quite the confidence in the financial world that is enjoyed by steam road securities of much less intrinsic financial merit. We are not among those who are disposed to deny that the building of interurban electric railways has in some cases gone too far, and that the construction of certain systems has been a detriment to the electric railway business. But taking the interurban railway business as a whole, the condition of things is very satisfactory.

In this connection, the table of statistics of Ohio electric railways published in our issue of Dec. 31 last, affords one of the best opportunities for studying the relative earnings and capitalized liabilities of this class of roads that has yet been offered. There are several reasons why this table is so valuable. Ohio has more interurban electric railways than any other State, and the electric railways of that State are all required to make reports of earnings, capital stock and bonded indebtedness to the Auditor of State. It was therefore possible in the Ohio table which we compiled to average up the statistics of all the roads of a certain class in that State. Statistics of this kind are much more valuable than figures from a few interurban roads scattered here and there, for the reason that the roads publishing their earnings as a regular thing are quite likely to be the best earners, and those having earnings below the average often do not make public reports. It is therefore worth while to go somewhat into an analysis of the figures from Ohio roads to bring out some of the more important facts than can be derived from the table mentioned. It may be said incidentally that the conditions of interurban roads in Ohio in general correspond very nearly with those prevailing in neighboring States.

Of the roads given in the Ohio table, there are thirty-four which may be classed as purely interurban roads having 85 per cent or more of their mileage outside of cities, and which have been in operation long enough so that the annual earnings per track-mile can be obtained. The average gross earnings per mile of track for the year ending April 30, 1904, of these thirty-four interurban roads, was $3,960. The average bond issue per mile of track of twenty-seven of these thirty-four interurban roads was $22,880. The other seven roads either had no bond issue, were carrying on a lighting business also, or are partly outside of Ohio, so that the bond issue corresponding to the mileage of railway track operated in the State was not obtainable.

There is another class of road, namely, the mixed city and interurban railway, which operates the city systems in some of the smaller cities and some interurban mileage, the interurban mileage being over 85 per cent of the total. We find that the average annual gross earnings of the ten roads of this class is $6,035 per mile of track, and that the average bond issue per track-mile of eight of these ten is $29,889. As roads of the classes under discussion usually operate for from 50 per cent to 60 per cent of the gross receipts, the average earnings are sufficient to leave a good margin for depreciation and dividends after paying operating expenses and interest on the average bond issues.

In compiling the Ohio table, the earnings per capita of tributary population were given in two columns. In one column were given the earnings per capita, excluding terminal cities of over 75,000 inhabitants. In the other column, the earnings per capita of tributary population were given, including terminal cities. A study of the table shows the wisdom of drawing an arbitrary line of this kind. The earnings per capita where terminals of over 75,000 inhabitants are excluded, show no such confusing variations as do the earnings when large city terminals are taken into consideration, and also the earnings of roads having no terminals as large as 75,000 inhabitants are sufficiently uniform, so that an average of some value can be obtained. We have therefore averaged the per capita earnings of two classes of purely interurban roads. In one of these classes we have placed eleven interurban roads which have no terminals of over 75,000 inhabitants. The average is $2.90 per capita per annum. In the other class we have placed eighteen interurban roads having terminals of over 75,000 inhabitants. Excluding the terminal population, the average annual per capita earnings of these eighteen roads is $5.83. Both of these per capita figures apply only to interurban roads of the class having 85 per cent of their mileage outside of cities, and not to the mixed class. We have always considered that in figuring population, the roads operating out of very large city terminals should be considered on a different basis from those operating between small cities. It is a difficult matter to tell just where to draw the line as to what constitutes a large city terminal, but, judging from the results in the Ohio table, we are inclined to think that the classification made in that table is about correct. However, when one of the cities to be served by a projected interurban road is between 50,000 and 75,000, it would be well for the engineers reporting on such projects to figure both with and without such a terminal and compare these figures with those given on both classes of roads.

The per capita earnings vary greatly each way from the average. For example, taking the eleven roads having no terminals of over 75,000, the average, as before stated, is $2.90 per capita, while the maximum is $4.94, and the minimum $1.04; the latter, however, being on parallel roads between two cities. Taking the other class of interurban operating out of large cities of over 75,000, the average is $5.83 per capita, with the maximum $9.80, and the minimum $3.21. In these figures also the disastrous effect of parallel electric lines is shown. There are many special conditions which must be taken into account in figuring upon the possible traffic of any road, but these Ohio averages probably come very nearly to those in surrounding States. There is some reason to believe that further West, in Illinois and Iowa, the farming population will yield more revenue per capita than a farming population in Ohio, but the evidence on this point is as yet incomplete.

COMPLETION OF THE INTERURBAN LINK BETWEEN TOLEDO AND DETROIT

An important epoch in the development of interurban electric traction in this country was marked by the recent completion and opening for through traffic of another trunk line connecting two important electric railway centers. This line, the Detroit, Monroe & Toledo Short Line, will bear a special relation to interurban development in that it supplies the only missing link between the 1000 miles of interurban lines radiating into the State of Michigan from Detroit and the aggregation of electric lines in the State of Ohio, comprising over 1000 miles reached directly from Toledo and over 1500 miles reached by way of Cleveland. The possibilities of through ticket selling, and eventually the development of through traffic, that are thus made possible, are evident. In fact, only a short section of line remains to be completed east of Erie, Pa., when an unbroken trolley connection will be afforded through to Buffalo, N. Y.

MAP OF THE COMPLETED LINE OF THE DETROIT, MONROE & TOLEDO SHORT LINE, SHOWING ELECTRIC RAILWAY CONNECTIONS AT DETROIT AND TOLEDO

The importance of this event was signalized by a special through trip on Nov. 15 from Cleveland to Detroit and return. H. A. Everett, president of the Toledo Railways & Light Company, took a party of electric railway officials over the new route, making the run from Cleveland to Toledo over the lines of the Lake Shore Electric Railway Company, and from Toledo to Detroit over the new Detroit, Monroe & Toledo Short Line. The initial portion of the trip, a distance of 119 miles, was made in three hours and thirty-five minutes, and that over the new line, 56 miles, in one hour and thirty-seven minutes, the total time from Cleveland to Detroit, 175 miles, thus consuming only five hours and twelve minutes. This trip was considered more than usually significant by those in attendance. Mr. Everett's party included a representative from every electric line running out of Cleveland, among whom were: Warren Bicknell, president of the Lake Shore Electric Railway; F. J. Pomeroy, president of the Cleveland & Southwestern; C. W. Wason, president of the Cleveland, Painesville & Eastern, and J. J. Stanley, general manager of the Cleveland Electric Railway Company. J. C. Hutchins, president; F. W. Brooks, general manager, and E. W. Moore, director, of the Detroit United Railway, were also present. The new system was represented by Matthew Slush, president, and Judge C. J. Reilly, president of the Detroit & Toledo Construction Company, the company which has carried out the construction work.

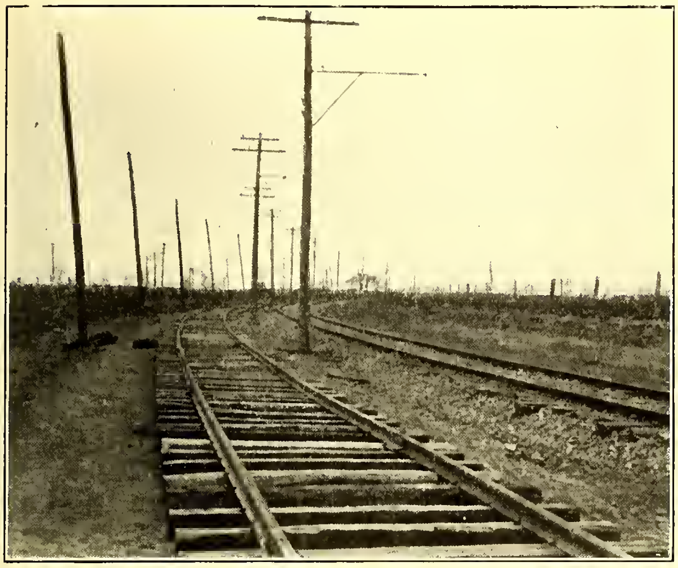
The new work upon the Detroit, Monroe & Toledo Short Line embraces properly an extension from Monroe to Detroit, the section from Toledo to Monroe having been built in 1901 under the name of the Toledo & Monroe Railway, as described in the Aug. 3, 1901, issue of the Street Railway Journal. For the past year or so, however, subsequent to the abandonment of actual work upon the Everett-Moore line between Toledo and Detroit and the sale of its completed right of way and trackage to the Grand Trunk Railway, construction work upon the extension has been actively pushed by the company, as reorganized under the name of the Detroit, Monroe & Toledo Short Line, and the various sections have been opened up for service as rapidly as completed. The system has been operating as far north as Wyandotte, 12 miles south of Detroit, for several months past, pending the settlement of the difficulties connected with the entrance into the city of Detroit. This was finally arranged peacefully, and upon Nov. 5 through service was inaugurated.

THE NEW CONSTRUCTION

The total length of the system as now operated is 56 miles,

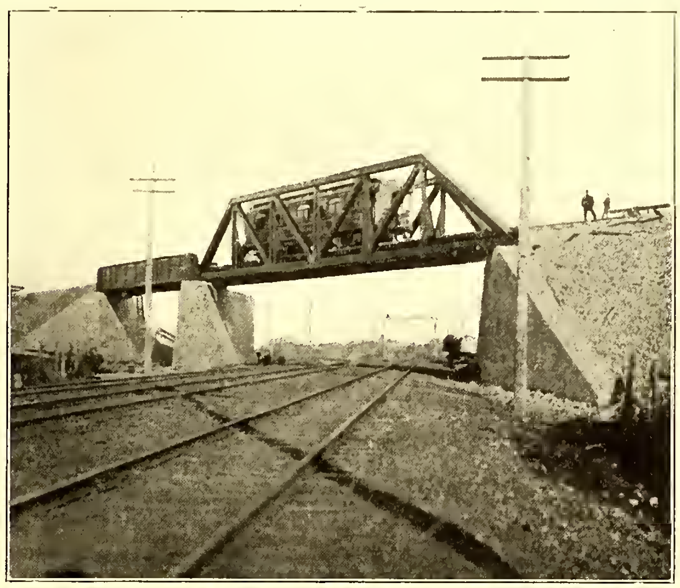
TYPICAL SINGLE-TRACK CONSTRUCTION NEAR ROCKWOOD, SHOWING ALSO BRIDGE OVER THE HURON RIVER

the newly completed extension from Monroe to Detroit embracing 35 miles of this distance. Upon the extension, as well as upon the older portion of the system, the road is built over a private right of way. Only in the three cities reached does the line operate over city streets; in Monroe the line traverses one of the main streets for a distance of 2 or 3 miles, while in Toledo and Detroit the last 5 miles of the run to the terminal is made over the tracks of the local street railway company. In Detroit the company has provided a ticket office and waiting room at 28 Cadillac Square, past which the cars run in turning for the return trip, while in Toledo the union interurban station near the corner of Superior and Adams Streets (described Oct. 25, 1902, page 704) is made use of as the terminal; in both cities these stations are convenient to the retail shopping districts and to all local city cars.

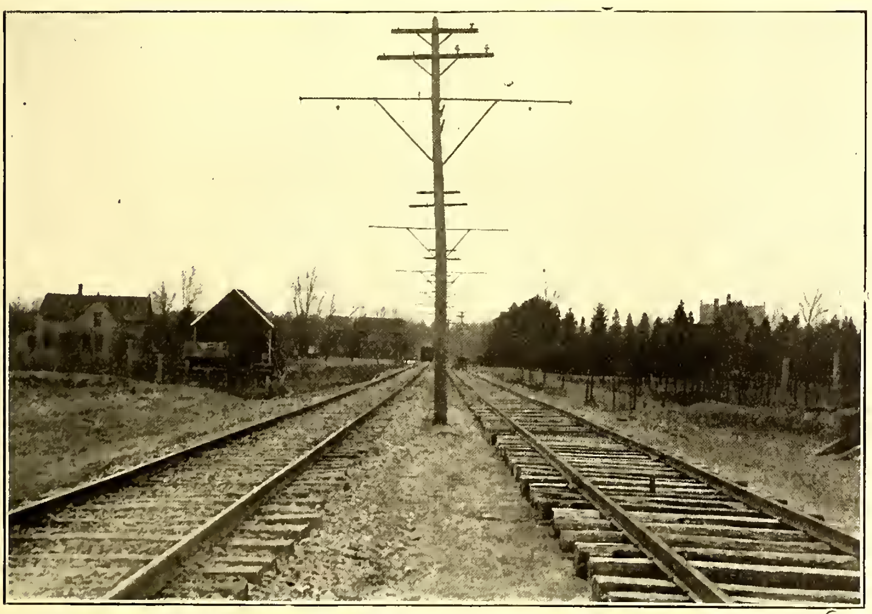


VIEW ILLUSTRATING TYPICAL USE OF DOUBLE-TRACK CONSTRUCTION ON CURVES, TO AVOID POSSIBILITY OF COLLISIONS, CARS TAKING RIGHT-HAND TRACK

The construction work upon the extension corresponds in general to that upon the older portion of the road, as illustrated in the above-mentioned article descriptive of the Toledo & Monroe section. The advantage of a somewhat wider right of way, however, is to be had on the extension, which follows a minimum of 66 ft. throughout; this will permit of double-tracking with the least possible trouble. In fact, the purpose of the general method of construction adopted is to provide for double-tracking without rearranging tracks or poles. As may be noted from views along the line, the present track is located toward one side of the center of the right of way, the side-bracket pole line occupying the center—in this way to add the second track in double-tracking, it is only necessary to build it on the opposite side of the pole line and add the trolley hanger brackets for that side. That double-tracking is to be attempted is evident from the fact that in the vicinity of Wyandotte the double track is completed for 10 miles. Also at many meeting points the turn-outs are being made of unusual length, 1 mile or over, so that a direct approach is being made to double-track conditions.



OVERHEAD CROSSING OF THE WABASH AND MICHIGAN CENTRAL RAILROADS NEAR DETROIT, SHOWING USE OF CONCRETE ABUTMENTS

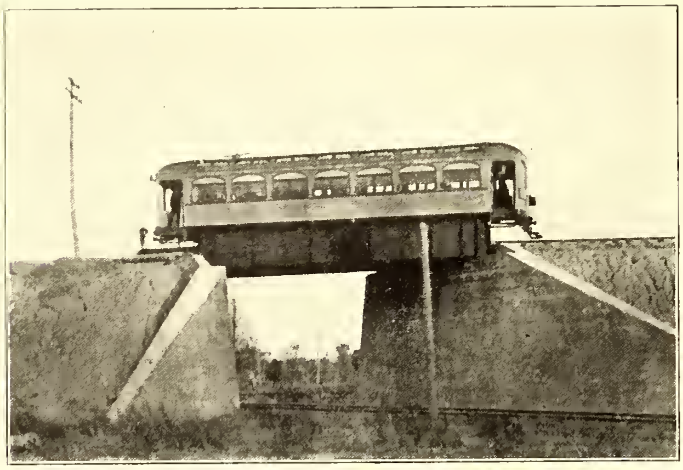


DOUBLE-TRACK LINE CONSTRUCTION AS USED AT ALL TURN-OUTS TO PERMIT CARS PASSING AT SPEED

As in the case of the Toledo & Monroe section, the roadbed is of the very best order, involving a construction that rivals the latest and most approved steam road practice. A 70-lb. standard A. S. C. E. section T-rail is used, while the ties are of cedar and oak, spaced 24 ins. between centers. The track is very heavily ballasted with broken limestone, which makes a very heavy and firm bedding; even at the beginning the cars operate with a characteristic smoothness, which indicates what may be expected from the line after settling in time to its ultimate level. The rails are pressed bonded for the return circuit with crown bonds, supplied by the American Steel & Wire Company, located inside the fish-plates. No all-copper return was considered necessary in the original installation, but the rails and the negative rotary lead at the power house are given an effective running water ground in the adjacent river bed.

All culverts and bridge abutments are of concrete, with steel superstructures, and embrace the very best types of construction. Two accompanying views show the character of the bridge work, both bridges being overhead crossings of steam railroads. These filled inclines also involve the heaviest gradients encountered (from 1 per cent to 2 per cent) upon the line, as the country traversed is so generally level and the line so nearly straight that no grades or curves of any importance are necessary. All steam railroads are crossed either above or below grade, with two exceptions, one a side track leading to a quarry and the other the main line of the Pere Marquette Railway in the city of Detroit, where an overhead crossing would be impossible. A view of the heavy double-track drawbridge over the River Rouge, just outside of Detroit, is also given to indicate the permanent character of the steel work used. There is a considerable amount of marine traffic in this river, which necessitated the installation of a drawbridge—this was built for double-tracking to provide in advance for the inevitable rapid development which such thorough and excellent methods will produce.

The drawbridge is mounted upon a center pier of great stability, and is provided with an electrically-driven turning mechanism. The pier is of solid concrete, resting upon piles driven to a depth of 60 ft. below the bottom of the river. The turning motor is of the railway type, taking current through a submarine cable, which also supplies the trolley wires upon the bridge. The motor-controlling mechanism is conveniently housed and arranged for facilitating operation. The two-span overhead crossing illustrated involves the combined crossing of the three-track right of way of the Wabash Railroad and a single-track branch of the Michigan Central Railroad. The other plate-girder overhead crossing is over the main line of the Detroit Southern Railroad, 2 miles south of Trenton.



OVERHEAD CROSSING OF THE LINE OF THE DETROIT SOUTHERN RAILROAD NEAR TRENTON

The standards of overhead construction adopted for the extension also follow closely those used upon the Toledo & Monroe end. The poles are of cedar, in general 35-ft. poles being used, set 6 ft. into the ground. Two cross arms, located near the top of the pole, carry the high-tension feeders, while the direct-current feeders are carried upon the bracket arm. The high-tension feeders are of No. 4 bare copper, while the direct-current feeders are of 500,000-circ. mils copper, bare also except in cities. The grooved section wire, No. 000, is used for the trolley line, and is installed in duplicate on all single-track sections. Two telephone circuits are carried upon the pole line in each direction from the power house, for use in the despatching system.

DISTRIBUTION SYSTEM

The operation of the extension required the addition of two sub-stations to the former electrical distribution equipment. One is installed at South Rockwood and the other at Ecorse. The former is illustrated in an accompanying photograph. The building used here serves for the combined purpose of a sub-station and freight and passenger station, this style of architecture being the adopted standard of the company for new construction. The sizes and arrangement of the rooms in the building are shown in an accompanying plan; the construction is of steel, brick and concrete, with tile roofing, the result being as nearly fireproof as is possible.

Current is received from the transmission lines at the sub-stations at 15,000 volts, three-phase alternating, being stepped-down in oil transformers to 380 volts before entrance to the rotary converters. The rotaries deliver to the trolley lines at 650 volts direct current. Each sub-station has two 300-kw rotaries, which are fed by three 200-kw step-down transformers. The switchboard equipment is very simple and conveniently arranged for uninterrupted operation, consisting of one transformer, two rotary and two feeder panels. Each sub station feeds 3 miles to either side. The sub-station electrical equipment, as well as that in the power plant, was supplied by the Westinghouse Electric & Manufacturing Company.

INTERIOR OF THE PASSENGER WAITING ROOM, RECENTLY ESTABLISHED AT DETROIT

POWER PLANT EXTENSION

The power plant at Monroe, as originally built for the Toledo & Monroe Railway, provided for an equipment of considerably greater capacity than necessary to operate the entire system, and the wisdom of this provision was made evident by the facility with which the increase of size was made. An idea of the extensions made in the power plant may be had from the plans of the same presented in the descriptive article of the Toledo & Munroe Railway on page 122 of the Aug. 3, 1901, issue. In the drawings of the plant there presented, the entire projected equipment, embracing five boilers and four generating units, are shown, but, while the building was built to its full

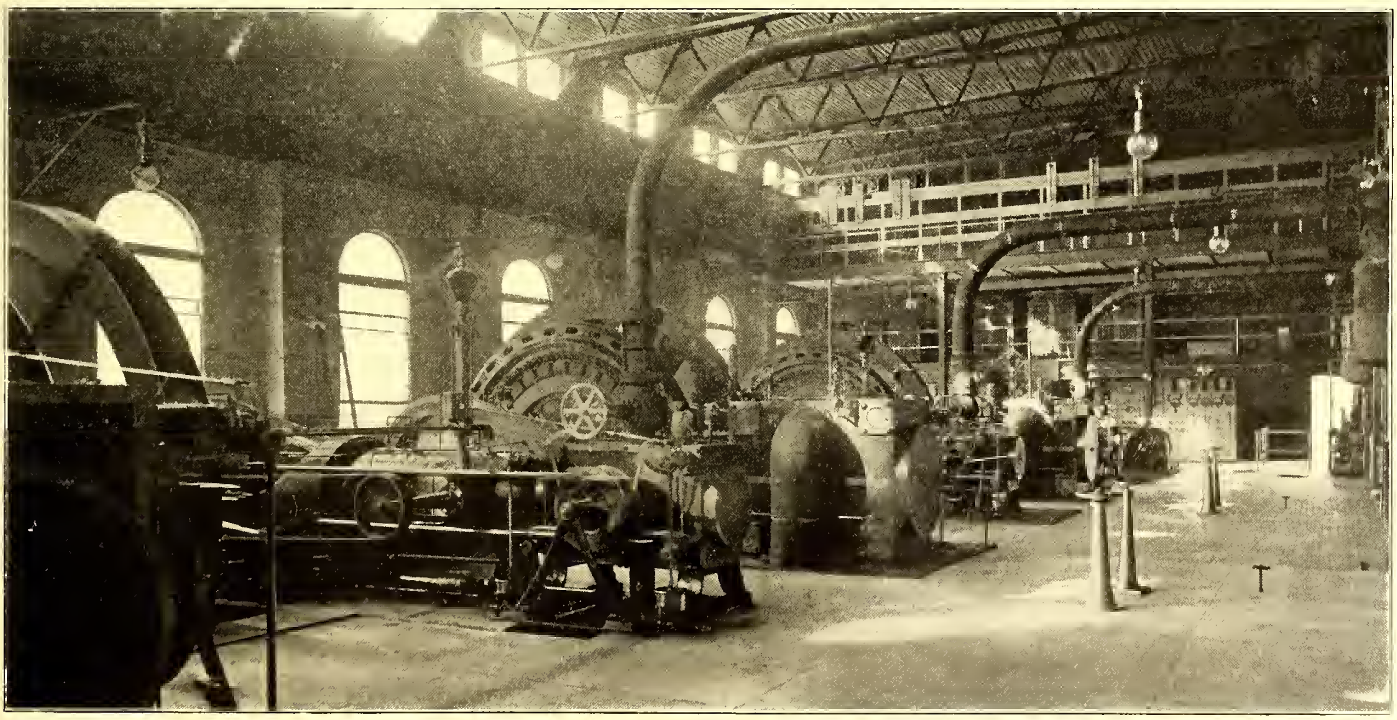
THE DOUBLE-TRACK DRAW-BRIDGE CROSSING THE RIVER ROUGE, NEAR DETROIT size at first, only the two boilers and two engines and generators at the switchboard end of the plant were installed. Recently, however, an additional boiler has been installed beyond the stack, leaving space still for two more, and also the third generating unit. The remainder of the space in the engine room is now partitioned off and occupied for the offices of the company, here being located the office of Mr. Tarkington, the superintendent, the auditor's and the despatcher's offices, besides, also, a locker room and recreation and bath rooms for the car service employees.

THE STANDARD TYPE OF SHELTER HOUSE USED AT ALL ROAD CROSSINGS FOR PROTECTION TO WAITING PASSENGERS

The power house is a large, convenient structure, 150 ft. x 109 ft., and is located about 250 ft. from the river, whence condensing water is had. It has a 165-ft. self-supporting steel stack, with draft controlled by Spencer draft regulators, and is mounted upon a massive foundation. The original boilers are 400-hp Babcock & Wilcox water-tube boilers with extension furnaces, but the new boiler is a Cahall horizontal water-tube boiler, of similar size, with traveling chain grate, all of which was furnished by the Aultman & Taylor Machinery Company, Mansfield, Ohio. The extension furnaces under the original Babcock & Wilcox boilers are also now being replaced by standard furnace construction, with similar traveling chain grate stokers. A very flexible system of piping connections was provided, not only for boiler feeding and boiler room auxiliaries, but also for the high-pressure steam supply to the engines and pumps.

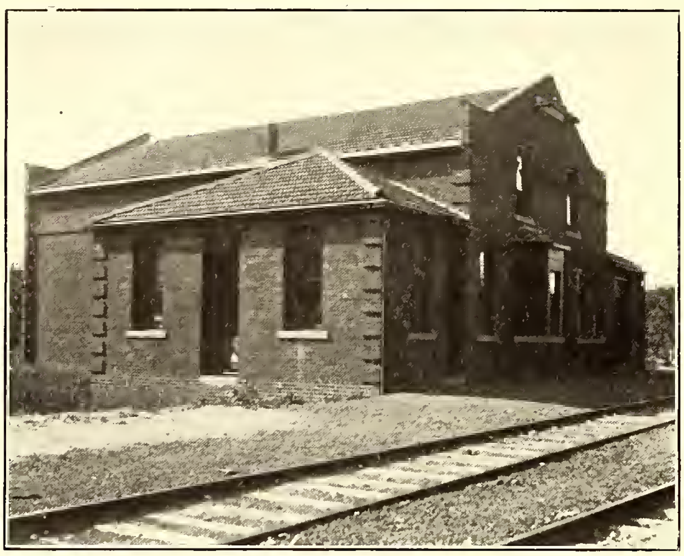
The engines are all, including the new one recently added, 18-in. and 36-in. x 42-in. compound-condensing Hamilton-Corliss engines of the heavy-duty type, built by Hooven, Owens & Rentschler Company, Hamilton, Ohio, and each is direct connected to a 400-kw three-phase 25-cycle Westinghouse generator. The engines are rated at 600 ihp, at one-quarter cut-off and a speed of 100 r. p. m. The generators deliver at 380 volts, which passes directly through the switchboard to the rotary converters at the station or to the step-up transformers. There are two 300-kw rotaries located in the power plant, this rotary equipment being in duplicate of that at the new sub-stations. The exciters include a steam and a motor-driven unit, the latter being used in preference to the steam-driven unit.

EXTERIOR VIEW OF THE MAIN POWER PLANT AND OFFICE BUILDING AT MONROE



VIEW IN ENGINE ROOM OF THE ENLARGED POWER PLANT, SHOWING ARRANGEMENT OF GENERATING APPARATUS

The switchboard equipment is located at the north end of the building beneath the gallery which carries the step-up transformers. It contains thirteen panels at present, including, from left to right, two exciter panels, three generator panels, four high-tension feeder panels and four 650-volt direct-current rotary and feeder panels. Spaces are left for one more generator panel and two more high-tension feeder panels. The step-up transformer equipment consists at present of three 135-kw and three 300-kw transformers. The electrical apparatus was supplied by the Westinghouse Electric & Manufacturing Company.



THE DEPOT AND SUB-STATION AT SOUTH ROCKWOOD, SHOWING STANDARD COMBINED CONSTRUCTION

ROLLING STOCK

The rolling-stock equipment now includes twenty-one passenger cars, two express cars and two freight or construction locomotives. The company also owns thirty-five freight cars, including box, flat, gondola and ballast cars, with which it is carrying on a considerable freight business; these were used in the construction work upon the road, but are now being retained for regular service.

The new cars bought to provide for the extension include twelve 30-ton cars, 52 ft. long, which were built by the John Stephenson Company. They are mounted on Peckham extra heavy M. C. B. trucks, and are equipped with four No. 76 Westinghouse motors (75 hp) and L-4 Westinghouse controllers. The cars are all equipped single-ended, with the control apparatus located in the enclosed front platform, used as a cab; this greatly simplifies the car wiring and, under the system of operation adopted, is found to be fully as effectual. Furthermore, it may be stated that the plan of using single-ended cars and turning them at terminals, is meeting with favor in many other interurban installations.

The cars have interiors nicely finished in dark mahogany, and are divided in two compartments, that in front being the smoking room (seating sixteen), while the rear portion is the main passenger section (seating thirty-eight). At the rear of the main compartment is located a water closet compartment. The seats are finished in red plush in the main compartment and rattan or pantasote in the smoker. The cars present a beautiful external appearance, being finished in bright yellow; an external view of one of the cars is presented in an accompanying engraving.

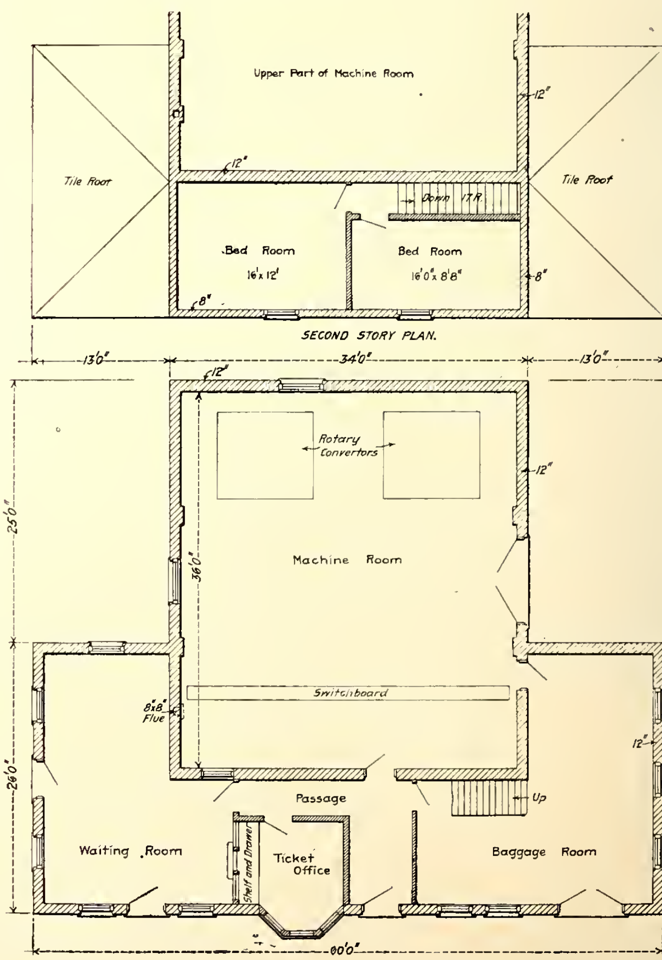
The total weight per car is 60,000 lbs., of which only 25,000 lbs. is in the car body, the remainder, 35,000 lbs., being below, thus bringing the center of mass very low. Of the 35,000 lbs. below the car body, the trucks weigh 16,000 lbs. and the motors 16,000 lbs., while the air-brake equipment, storage tanks, etc., make the remaining 3000 lbs. The cars are all equipped with the Holland roller-bearing trolley base, supplied by the Holland Roller Bearing Trolley Company, Cleveland, Ohio. Other features to be noted are United States headlights of the Moshier type, Knutson trolley retrievers and Van Dorn No. 11 radial type couplers.

STORAGE AIR BRAKES

A novel feature of this road's equipment is to be noted in the use of the storage air-brake system. This method was installed some time ago upon the older cars used upon the Toledo & Monroe section, after quite a thorough investigation by the officials of prevailing braking systems. It was thought that the advantages to be gained from the use of the large central air compressor plant, from which storage tanks upon the cars should be filled occasionally, seemed to weigh out of consideration any other scheme. The new system has proven very economical, and in practical operation is very satisfactory.

VIEW IN WAITING ROOM OF THE SOUTH ROCKWOOD DEPOT, LOOKING TOWARD TICKET OFFICE

The details of the system follow in general the lines of the systems that have been installed in Detroit, St. Louis and else-



DETAILS OF THE STANDARD COMBINED SUB-STATION AND DEPOT BUILDING CONSTRUCTION USED UPON THIS SYSTEM where. Each car is equipped with two large storage tanks; these tanks deliver at a pressure of 250 lbs., through a pressure-reducing valve to a small service reservoir, from which the brake connections are made in the usual manner. The air-brake equipment was supplied by the Westinghouse Traction Brake Company, the style of system used being the Westinghouse straight-air system, type SM-1.

The compressor, which is a Hall two-stage steam-driven machine, is installed in the basement of the engine room, together with the storage and cooling tanks. It has ample capacity for the operation of the road, and is controlled automatically by the pressure in the storage tanks. Delivery is made to cars at the side of the power house, next to the car house, through a long hose which is usually kept in a box alongside the sidewalk. It is found that the tank capacity, provided upon each car, is sufficient to supply braking for more than two complete round trips under normal conditions of operation.

THE NEW STANDARD OF PASSENGER CAR FOR HIGH-SPEED OPERATION

VIEW OF CAR AT THE STORAGE-AIR SYSTEM STATION AT THE MAIN POWER STATION IN MONROE, SHOWING METHOD OF CHARGING THE CAR RESERVOIRS WITH THE HIGH-PRESSURE AIR

OPERATION

The very favorable physical conditions offered for high-speed operation by the level nature of the country traversed are of great importance, yet, on the other hand, it is interesting to note the careful preparations that have been made in construction to further the possibilities of a high-speed schedule. All switches at turn-outs are laid out with long leads and No. 12 frogs, so as to permit passage to either side at high speed, while passing tracks, which are spaced 2½ miles apart throughout, are, in many cases, lengthened out to a mile or so in length to permit cars to continue on their run in passing—an impossibility with short passing sidings. Furthermore, additional safety is insured by the use of a despatching system. Telephone booths are located at every passing track from which the motormen call up the despatcher and receive orders for proceeding in case of disarranged schedule, etc. These telephone booths are lighted electrically at night, in connection with the switch lights.

The amount of both through and local traffic that has already been worked up is remarkable—in fact, it may truly be stated that here a large amount of traffic has been created. Considering, for instance, that the through round trip rate between Detroit and Toledo is $1.50, as compared with $2.60 upon the two steam roads which it parallels, and, in addition, that hourly service is given, the reason is not hard to discover. Furthermore, the electric line lands the passenger at any point he may desire within the city and not in a depot at one side and out of the way. The time consumed per trip (two and one-half hours, according to the present schedule) is not excessive as compared with that of the steam roads, the latter being slightly over two hours. While the trip time of two and one-half hours has been determined upon for the coming season, the extreme ease with which the schedule

THE QUARRY AND STONE-CRUSHER PLANT AT NEWPORT, OPERATED BY THE RAILROAD COMPANY, FROM WHICH 60,000 CU. YDS. OF STONE BALLAST HAS BEEN REMOVED FOR TRACK BALLASTING is maintained tends to indicate that it would be no hardship for the cars to make the run in less than two hours. After the roadbed is thoroughly settled, it is intended to cut the schedule time per trip down to two hours.

THE BATHING BEACH AT MONROE PIERS, A SUMMER RESORT ON LAKE ERIE, REACHED BY A BRANCH OF THE SYSTEM AT MONROE

In addition to passenger and express traffic, the road is handling a large amount of freight, thirty-five miscellaneous freight cars having been provided for the purpose. The first attempt in this direction was made in hauling coal from Toledo to the power plant, and subsequently a very considerable amount of freight traffic has developed, and this with very little effort on the part of the officials. Direct access is given to many industries, as a result of which shipments will be much more convenient over the electric line than by the steam roads. The city of Wyandotte, 12 miles south of Detroit, stands third among the cities of Michigan in point of freight shipments, while the country traversed further to the south is notable for being a prosperous farming district. Recently a contract was carried out for delivering 4,000,000 brick for the construction of the new St. Mary's Academy at Monroe, involving the delivery of 800 carloads up to date. At present two freight trips are being made each way daily, but it is evident that the rapid development will soon demand an increase.

A valuable industry in the form of a limestone quarry is owned and operated by the company at Newport, having thus far been operated to the extreme of its capacity to supply crushed stone for ballasting the new track. But, subsequently,

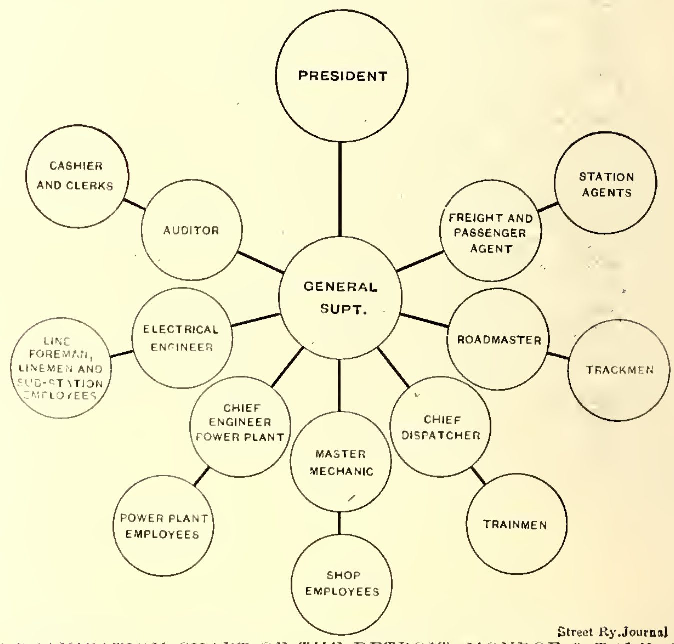
TYPICAL YACHTING SCENE AT MONROE PIERS IN SUMMER

it is expected to operate the quarry as a separate company for supplying stone in carload lots anywhere along the line; it is already found that there will be a large demand for the stone in the various grades. Adjacent to the right of way is located the steam power plant for operation of the rock drills in the quarry, the crusher and storage bins for the various grades of stone being electrically operated—this, together with a general view of the quarry, is illustrated in a photograph on the opposite page.

PARK DEVELOPMENT

A valuable side extension of the system was built a year ago at Monroe, which will serve as an important traffic feeder in summer time. This is a branch 4 miles long leading from the main line to Monroe Piers, a beautiful summer resort upon Lake Erie. The accompanying photographs give an excellent idea of the advantages of this location as a watering place, and illustrate the popularity which it developed last summer as a result of the accessibility given it by the entrance of the trolley system.

Monroe Piers is one of the most popular summer resorts of the Middle West, and every summer visitors flock there from the South and West. Around the Piers and Monroe, the descendants of the old French settlers have made a last stand for individuality, and there is a halo of romance and adventure spun around the country. In the days before Toledo appeared upon the map, the mouth of the Raisin was famous as a fishing and hunting ground. To-day the different clubs along the River Raisin own the thousands of acres of marsh land and the game



ORGANIZATION CHART OF THE DETROIT, MONROE & TOLEDO SHORT LINE

is carefully protected. Pleasant Bay, a cove at one side of the Piers, is an ideal hunting ground for ducks; snipe, plover and woodcock are bagged there during the year. Also, from early spring till late fall, fish are plentiful, and the Raisin River and the lake are dotted with fishing parties. At this point also is to be found the only desirable bathing beach upon the western end of Lake Erie, which will make the resort especially attractive.

It is the intention of the company to develop this resort as rapidly as possible. Increased facilities will be provided for handling passengers and through cars from Toledo and other points will be run to the Piers as travel warrants. The public in the vicinity of the line have welcomed the advent of this branch, particularly on account of the general lack of watering places in that country, and the company will anticipate the demands of this traffic by establishing a schedule which will be adequate for safely and effectively handling it.

The officials of the Detroit, Monroe & Toledo Short Line are as follows: President, Matthew Slush; vice-president, C. A. Black; secretary, Elisha H. Flynn; treasurer, Charles R. Hannan; general superintendent and purchasing agent, W. B. Tarkington. Mr. Slush has been prominently identified with the organization of several important electric railway properties, while Judge Reilly, president of the construction company, built the first interurban line out of Detroit, the Rapid Railway System, to Port Huron. Mr. Hannan, who was also closely identified with this important development, is a well-known financier of Boston, Mass. The operating staff consists of: Auditor, V. R. Ronk; passenger and freight agent, G. M. Henry; electrical engineer, C. R. Osgood; chief engineer power plant, Lewis Wonn; master mechanic, Eugene Youngs; train despatchers, E. H. Raupp and H. A. Charter; roadmaster, A. J. Law, and foreman electric lines, Robert Bell, all of whom are under the supervision of the president and general superintendent, as shown in the accompanying organization chart. Acknowledgement for this interesting information is due Mr. Tarkington.

MEASURES ADOPTED BY THE CLEVELAND & SOUTHWESTERN TRACTION COMPANY TO OBVIATE THE SPITTING NUISANCE

General Manager Nichol, of the Cleveland & Southwestern Traction Company, has started a crusade against men who expectorate on the floor of cars. Cars have signs warning against the practice, and conductors are instructed to warn violators of the rule. This has not stopped the practice and the company is now securing the names of habitual violators, and proposes to arrest some of them. Some time ago, General Manager Nichol adopted the policy of removing cuspidors from the smoking compartments of cars, believing that such receptacles were unsanitary and obnoxious, also believing that if a man did not find a cuspidor he would be apt to expectorate out a door or window.

This theory worked well in summer when all the windows of the car are open, but resulted in spitting on the floor during the winter.

THE EQUIPMENT OF THE EAST BOSTON TUNNEL

The larger engineering problems met in the construction of the recently completed East Boston Tunnel have been discussed to a greater or less extent in the technical press and in the reports of the Boston Transit Commission, but comparatively little has been printed in regard to the equipment of the tunnel. In considering some of the particular features of interest in connection with the roadbed, track, lighting, power supply and ventilation systems, the main physical characteristics of the tunnel will first be outlined.

The length of the tunnel is about 7450 ft., measured along the tracks from Maverick Square, East Boston, to Court Street, in the city proper. There are two tracks in the tunnel, one for eastbound and the other for westbound traffic. The tunnel is noteworthy by reason of the absence of sharp curves, its liberal size, depth and extended length under the harbor. The shortest radius curve is 230 ft. in central radius. The next sharpest curve has a radius of 2000 ft., and the next 3000 ft. At its deepest point the tunnel's bottom is approximately 40 ft. below the 40 ft. dredging line at the bottom of the harbor. The maximum grade is 5 per cent. On the east end of the tunnel grades vary from 4.7 to 5 per cent through a continuous run of about 2000 ft. In point of cross-section the tunnel is designed to accommodate the elevated cars in use on the Boston Elevated Railway Company's system, although the present plan is the operation of the company's standard type of surface car in the tunnel. Two underground stations, Court Street and Devonshire Street, are at present in use, and one at Atlantic Avenue will be opened for business as soon as it can be completed. The tunnel walls, including the upper arch and the invert, are made of concrete, which is reinforced by steel tie rods at a few special points. The tunnel is below ground throughout its entire length, except where it comes to the surface at Maverick Square. At present there is no physical connection between the tunnel tracks at Court Street station and

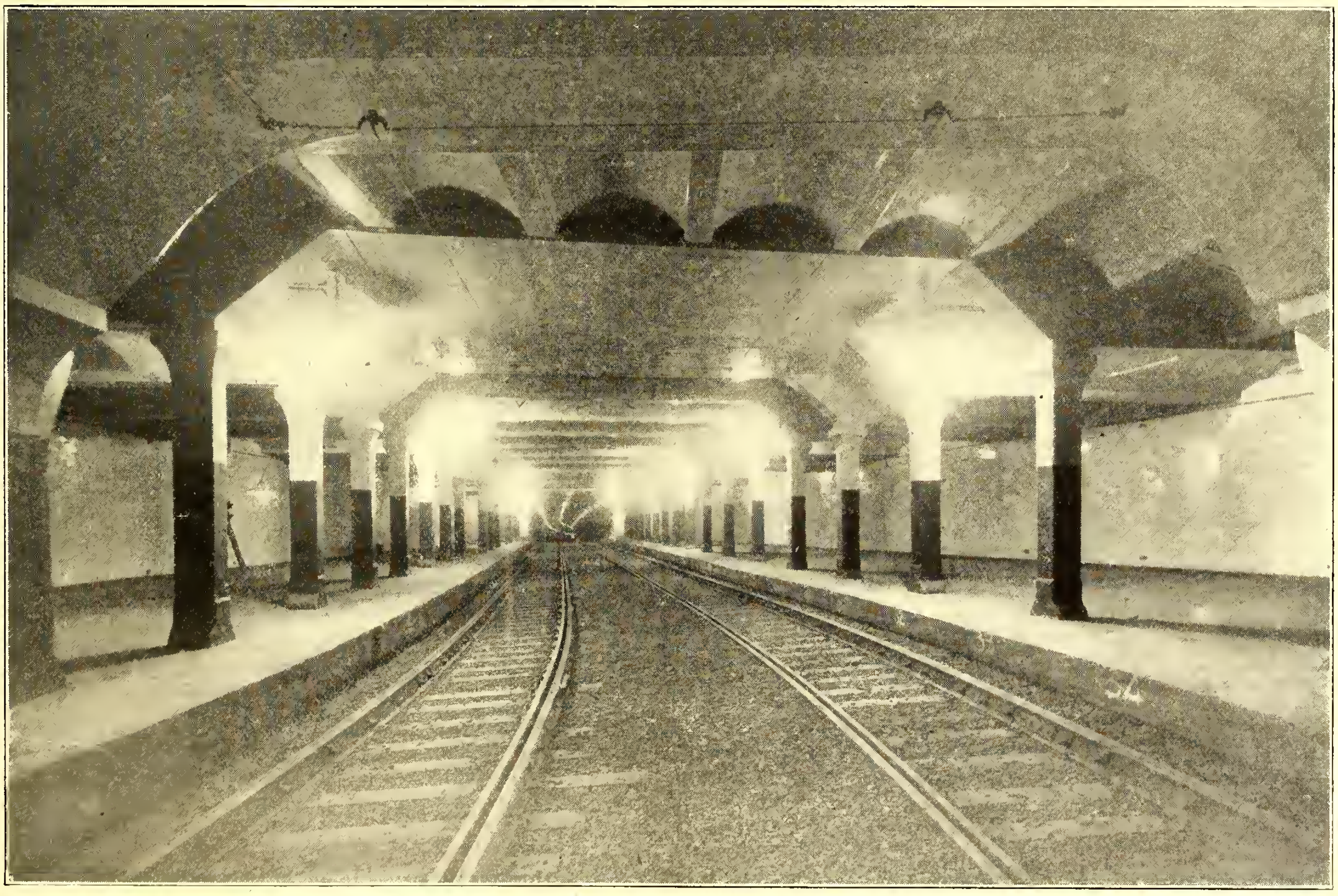


FIG. 1.—EAST BOSTON TUNNEL, DEVONSHIRE STREET STATION

the Tremont Street subway tracks at Scollay Square. Passengers going between the subway and the tunnel transfer through foot passageways. Special provision was taken to strengthen the foundations of the tall office buildings on State Street, which might otherwise have been endangered by the construction of the tunnel. About four years and seven months were occupied in the building of the tunnel.

Fig. 1. is a view taken looking eastward, at the Devonshire Street Station. The photograph was made by the illumination given by the station lights, which are arc lamps of the direct current, 6 amp., 110 volt type. It will be noted that there are no island platforms at the station, which is of the most liberal design. The platforms are of concrete, and the station walls are faced with enameled tile. The track ballast is of trap-rock, and the tunnel proper, beyond the station, is illuminated by three parallel rows of 16-cp incandescent lamps. Since the photograph was taken, sheet-iron shields painted white on one side and dark on the other, have been installed at each lamp in the side rows, so that the light is cut off from the motorman's eyes as he approaches. The two left-hand rows of lights are visible in each direction. The only lights intended to be seen at the motorman's right side are the block signal lights, which will be described later. The radical difference in the station design, as compared with the subway and elevated stations in Boston, is immediately apparent from the illustration.

Fig. 2 is a cross section of the tunnel beneath the harbor. Guard rails are laid throughout the entire tunnel. The center conduits carry power cables belonging to the railway company; those at the right, looking east, contain circuits of the Boston Edison Company, and those at the left, cables of the New England Telephone & Telegraph Company. The conduits are of the 3-in. single duct vitrified clay type.

The general layout of the track and roadbed is shown in Fig. 3. Service rails are of the A. S. C. E. T-section, 85 lbs. per yard. Weber joints are used, 24 ins. long, with four bolts. The rail lengths are 60 ft. with the service and 30 ft. with the guard-rails. Goldie tie plates are used at each service rail-joint, 6 ins. x 8 ins. x 5-16 in. The guard-rails weigh 57½ lbs. per yard, and are of the Pennsylvania No. 262 section. The tie plates at the guard-rail joints are 4½ ins. x 5 ins. x 5-16 in. Plain four-bolt joints, with splice bars, are used. Spacing blocks of malleable iron 3½ ins. long are installed every 5 ft. between the running and the guard-rail. These blocks are held by ⅞-in. steel bolts. On the sharp curve, previously mentioned, and at special work, the blocks are spaced 2 ft. 6 ins. apart on centers. The ties are 7 ft. and 8 ft. long, the cross section being 6 ins. x 8 ins. They are of hard pine and are spaced sixteen to every 30 ft. Every third tie is longer than the preceding two, so that third-rail insulators may be readily installed in the tunnel in case it becomes desirable to operate trains in it. Goldie spikes 5½ ins. x 9-16 in. are used upon both service and guard-rails.

The arrangement of the guard-rail is of special interest. Its section and installation gives a flange space of 1¾ ins. between it and the service rail, and the top of the guard-rail is 9-16 in. higher than the top of the running rail. It was considered vitally important by the officials of the Boston Elevated and the railroad commissioners to avoid all possibility of derailment in the tunnel, and it is believed that the arrangement of guard and service rails installed precludes such accident. An advantage further occurs in the facility of repairs possible by the layout. Either rail may be taken up without putting the other out of service. Two grades of ballast are used, the larger grade passings through a 2½-in. mesh, and the smaller through a 1 in. mesh. The smaller ballast is used below the ties to a depth of 2 ins., and it is also tamped around the ties and levelled off at their tops. The larger grade of ballast is used below the smaller grade, with particular reference to the better drainage obtained through the 2½-in. size. Fig. 2 shows the drainage channel at the bottom of the tunnel. A shoulder, along which authorized persons can walk, is provided on the conduits at each side of the tunnel.

The trolley wire is circular in section, No. 00 B. and S. gage. The method of its support is shown in Fig. 4. A Brooklyn strain insulator is anchored into the concrete of the tunnel by an expansion bolt. The stranded steel span wire is attached to the other end of this insulator. It terminates in a globe insulator, which in turn is fastened to the concrete of the tunnel ventilation duct. The hanger is attached to the span wire, supporting the trolley 13 ft. 6 ins. above the top of the rail. The spans are 20 ft. apart. Above the trolley, throughout the tunnel,

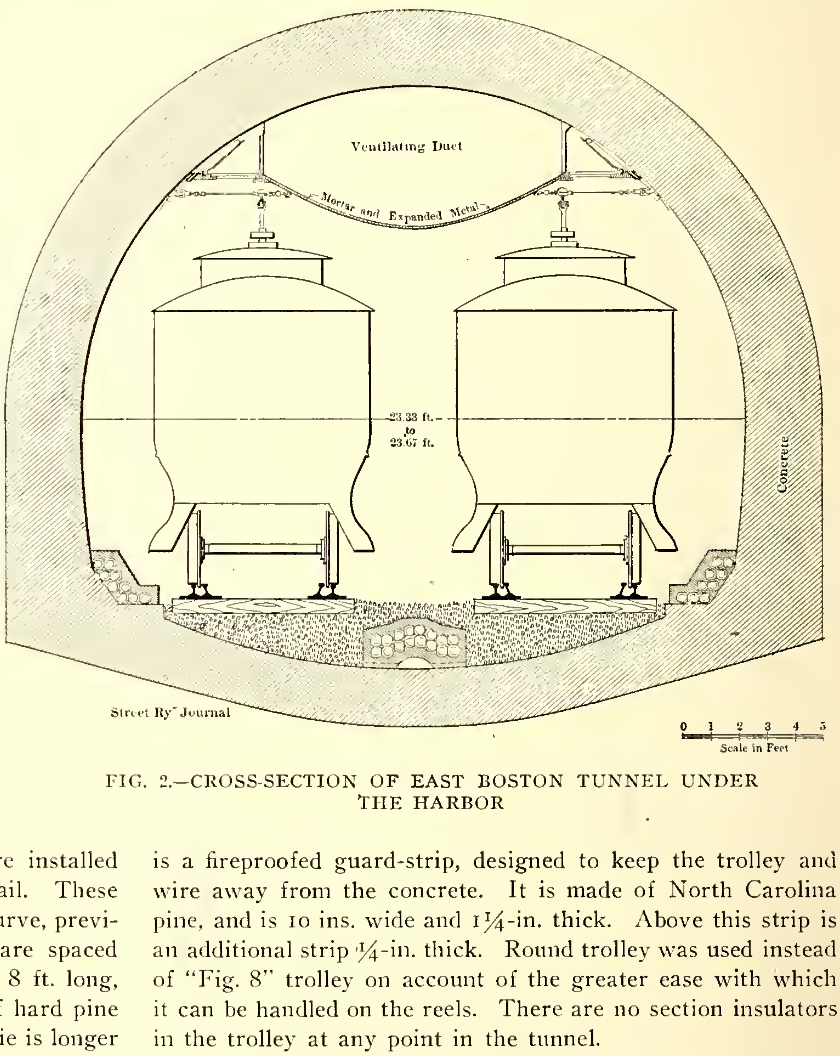


FIG. 2.—CROSS-SECTION OF EAST BOSTON TUNNEL UNDER THE HARBOR

is a fireproofed guard-strip, designed to keep the trolley and wire away from the concrete. It is made of North Carolina pine, and is 10 ins. wide and 1¼-in. thick. Above this strip is an additional strip ¼-in. thick. Round trolley was used instead of "Fig. 8" trolley on account of the greater ease with which it can be handled on the reels. There are no section insulators in the trolley at any point in the tunnel.

The feeder system of the tunnel is shown in Fig. 5. Two cables of 1,000,000-circ. mil cross section each are run southward from Lincoln power station on Atlantic Avenue along the elevated railway structure to the Atlantic Avenue station of the tunnel. Additional cables, used by surface and subway lines, are also run from Lincoln power station to this point. Here all the cables for the tunnel conduits pass down the structure to a distributing switchboard located in that part of the Atlantic Avenue tunnel station, known as the Atlantic "Chambers," shown at the right centre of the diagram. From the switchboard the cables feeding the tunnel pass into the conduits, the cables being four in number and each of 500,000-circ. mil cross section. Two of these 500,000-circ. mil cables pass through the tunnel eastward, one being laid in each of the center conduits. A brick fire wall has been built to separate the center conduits into two groups. The other two 500,000-circ. mil tunnel cables pass through the tunnel to the westward, both being laid in the south conduit. At Devonshire Street the conduit gives a connection with Central Power Station, and here the surface feeders carried through the tunnel are brought to the street conduit. Throughout the tunnel the trolley is alternately fed by taps from first one and then the other feeder. In each of these taps is inserted a switch which enables the feeder to be open-circuited for testing purposes.

The lighting of the tunnel is one of its most interesting features. There are three rows of 16-cp, 110-volt incandescent lamps spaced 12 ft. apart throughout the tunnel. All told, there are 600 incandescents in service. Fig. 6 shows the general scheme of lighting. The one point most kept in mind by the engineers was the importance of providing continuous illumination. The current supply for lighting may be drawn from three sources, i. e., Central Power Station, Lincoln Power Station and the Edison Electric Illuminating Company's system. The lighting of the station and tunnel sections is controlled locally instead of from a central switchboard, as in the Tremont Street subway. Normally the lights are supplied from Lincoln Power Station through a No. 0000 B. and S. lead-covered rubber insulated cable. Five lamps are in service in each circuit. The lamps in the tunnel may also be thrown upon the trolley circuit in the tunnel and fed from that, if desired. The trolley feeder, Edison, Lincoln and Central Power Station lines are all brought to a main distribution board at the Devonshire Street station, as shown in the diagram. The Edison current is drawn from a transformer as 500-volt, 60-cycle, single-phase supply.

Turning to Fig. 6 the reader will note the various switches mounted on the distribution board. Switch No. 8 is a single-pole double-throw knife switch, which throws the tunnel lights upon either of the company's power stations. No. 9 is normally closed, so that Edison current will be instantly available in case the Elevated supply fails. No. 10 is an automatic switch with two blades at right angles. It is fitted with a no-voltage release coil, which permits a powerful spring to throw the upper switch-blade into the top jaw in case the current from the Elevated Power Station fails. At the same time the lower blade is pulled away from the lower jaw to a horizontal position. The transfer of the tunnel lights is made so quickly by this switch that the eye does not notice the slightest flicker unless one is watching very closely and expecting the change. From switches No. 6 and No. 7 the distribution circuits pass into the tunnel conduits. All the fuses are of the enclosed type. Switch No. 11 controls the trolley connection. Both the station and the tunnel lights may be operated from any one of the sources of current above mentioned. At each station in the tunnel is a switchboard panel controlling the lights at that particular station by suitable snap switches and fuses. Several arc lights are also installed at each station, and wired independently of the other circuits, on the Edison three-wire system through the switch-box shown in the diagram, thereby preventing the total darkness at stations which might otherwise result from the loss of the regular power supply.

As will be seen from the diagram, the leads from switches No. 6 and No. 7 are No. 3 B. and S. cables carried in the underground conduits of the tunnel, while the No. 8 B. and S.

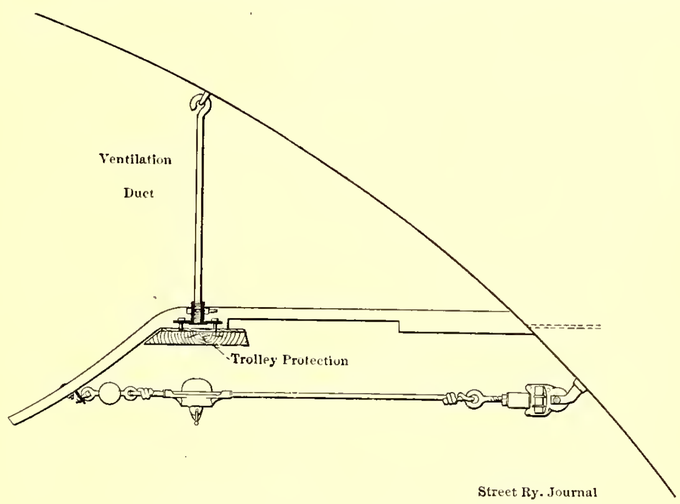


FIG. 4.—DETAILS OF TROLLEY PROTECTION

emergency trolley supply is run in two parallel lines through overhead pipes along the tunnel sides. At regular intervals in the tunnel distribution, boxes are installed as shown, each box feeding six groups of five lamps each, through enclosed fuses and suitable circuit wires. On the north side of the tunnel are eleven such boxes; on the south side there are nine. Alternate lamps are fed from the same circuit. In each box is a single-pole double-throw knife switch for throwing the tunnel incandescents in that section upon either trolley or regular elevated power. The iron pipe is 3/4 in. "electroduct." Ticket offices are lighted by two 16-cp incandescent lamps each, with frosted globes.

The only heating done in the tunnel is in connection with the ticket offices. Each of these is equipped with two Simplex enameled electric double heaters taking 2.05 amps. at 560 volts.

The bonding is carried out with particular thoroughness, the Chase-Shawmut soldered type of bond being used. Two of the four service rails are bonded with two 350,000-circ. mil bond under the fish-plate at each joint. Each of the four guard-rails is equipped with two 350,000-circ. mil bonds, one being placed on the head of the rail and the other at the foot. The copper con-

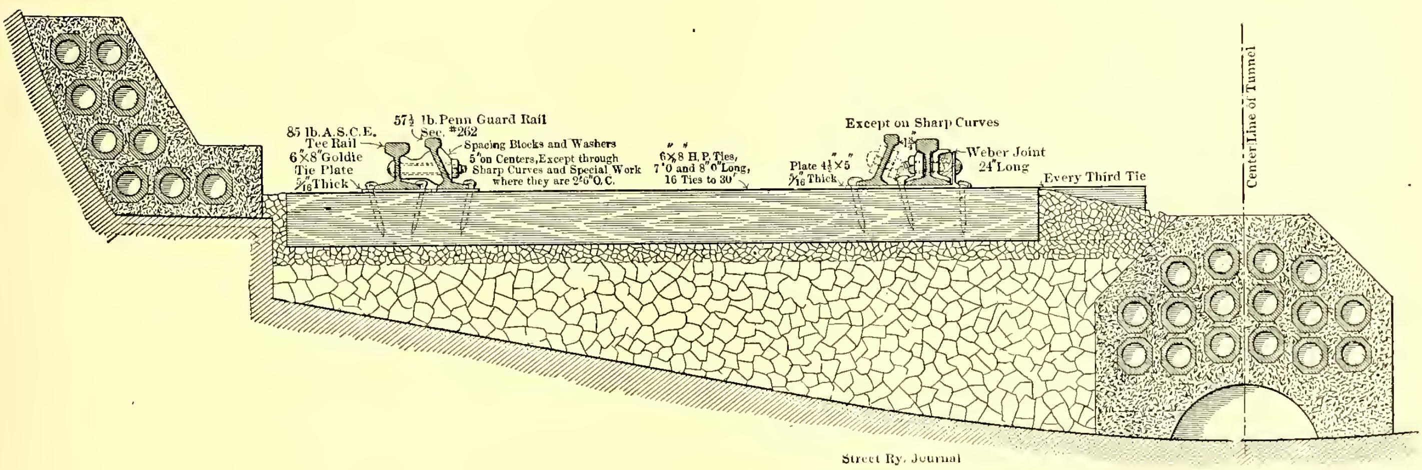


FIG. 3.—A TYPICAL HALF CROSS-SECTION BETWEEN STATIONS

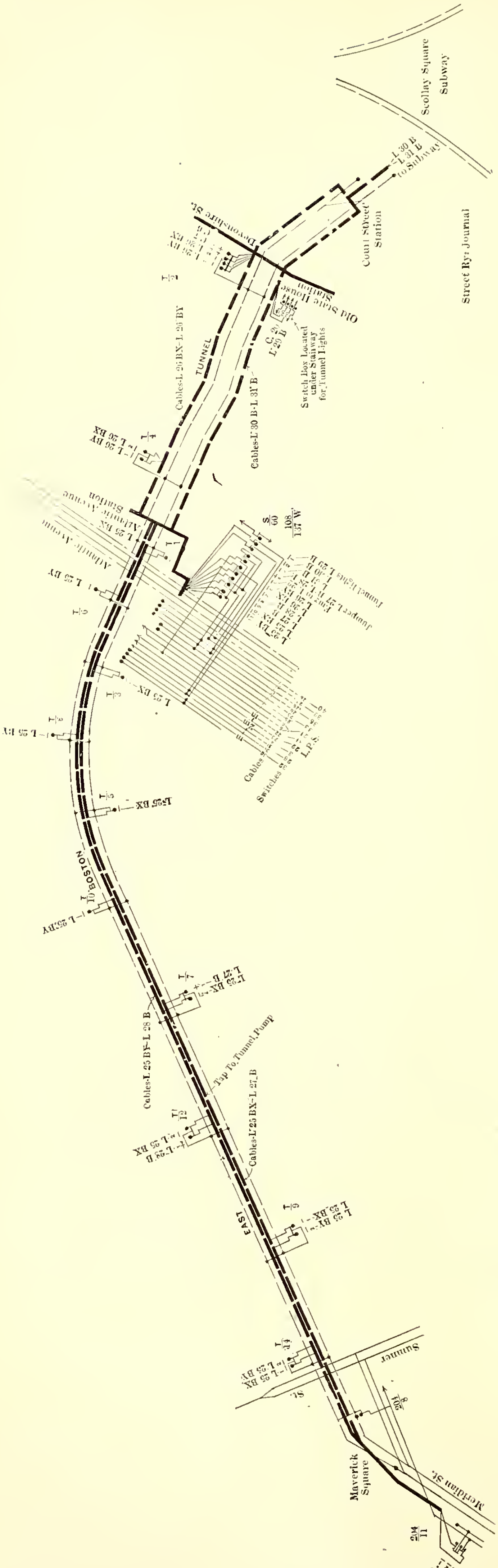


FIG. 5.—PLAN OF FEEDERS IN EAST BOSTON SUBWAY

necting strips of each bond are fastened together in two bunches for the sake of flexibility. No supplementary return circuit is at present installed. The other two service rails are bonded with one 600,000-circ. mil bond.

As soon as possible the tunnel will be equipped with a new alternating-current block signal system, designed by the Union Switch and Signal Company. There will be, according to the present plans, twelve automatic track circuit home signals, with two distant signals working therewith, and four fixed yellow station signals. There is also an interlocking signal at the Court Street crossover (where the westbound cars switch back to the eastbound track), operated by the station master with a push button. The longest block is about 1800 ft. and the shortest 500 ft. in length of track. The signals are so designed as to permit three eastbound cars at the same time on the long grade leading up into Maverick Square, and two westbound cars at the same time on the downward run over the same grade. The first home signal beyond each station platform is located about 100 ft. beyond, so that loaded cars can leave the platform as soon as the passengers are aboard, move down the track to the signal and lose no time in getting under way after the signal clears. The stations are not included in the track circuits, which accounts for the fixed caution signals above mentioned.

Perhaps the most interesting point about the signals is the fact that the running rails are both used for the return power circuit from the cars. On the Elevated division of the company one of the running rails is given up entirely to signal purposes. In the East Boston Tunnel the two rails of the track are divided by insulated joints at each block section. The joints are spanned by a connecting wire attached to the central points of two pairs of differentially wound coils. Each pair of coils bridges across the track, one on each side of the rail-joint, so that the whole arrangement, in diagram form, looks like the letter H, the two sides being perpendicular to the rails and the middle bar, parallel to them. The coils are wound upon iron cores to give a high impedance. Consequently, the trolley return current flows through them with little hindrance, but the alternating current used in the signal circuit is debarred practically as successfully as though there were no electrical connection between the adjacent rails. The current supply for the signal system is to be derived from a 500-volt, 60-cycle alternating circuit, and then transformed to 3 volts for the track circuit. As a duplicate source of supply, a 5-kw motor-generator set will probably be installed at the Atlantic Chambers. The motor-generator capacity is based upon not over 200 watts per block, including the signal lights. When a car enters a block its wheels short circuit an alternating-current track relay in the corresponding signal, closing the circuit through a pair of 4-cp, 50-volt lamps, located behind a red bullseye and lens. The signal remains at danger until the car leaves the block, when the release of the short circuit establishes current in another similar pair of lamps, located behind a green bullseye, the lamps behind the red bullseye going out as the relay armature changes its position. One bullseye is located above the other, in the signal case.

The tunnel is equipped with a ventilating duct, extending from East Boston, under the harbor, to the Atlantic Avenue station. The duct has a cross section of about 38 sq. ft., and it is divided into two portions by a separating wall located midway between the two ends. On each side of the partition there are fourteen openings, each 4 ft. x 1 ft. 5 ins. in area, in the flat portion of the duct, and at intervals of about 550 ft. there are other groups of openings, diminishing in number as they approach the fan chambers. The latter are located at the discharge ends of the ducts. These openings are equipped with doors which can be opened or closed from the tunnel below. They are opened and closed according to the direction and force of the wind outside the tunnel. Fresh air enters the tunnel proper from the East Boston portal and through the station near Atlantic Avenue; it moves through the tunnel to the middle or near it, and is then drawn to the east and west, being finally discharged at the Atlantic Avenue fan chambers and at Lewis Street, East Boston. This duct is about 4335 ft. long. There are six fans, each of the centrifugal type, and driven by 4-15 hp and 2-10 hp, 580 volt direct connected motors from the elevated power circuits. Each fan is capable of exhausting 18,000 cu. ft. of air per minute. The two 10-hp fans are located at India Street, the other four being at East Boston

Summing up the equipment of the East Boston Tunnel, the most striking feature of its design and arrangement is the matter of safety to passengers. At every point precautions have been taken to prevent accidents, failure of the lighting system, stoppage of the power supply, poor ventilation, etc. As the tunnel stands completed it illustrates the best practice of the present day in operating street cars beneath large bodies of water.

Acknowledgements are due to C. S. Sergeant, vice-president

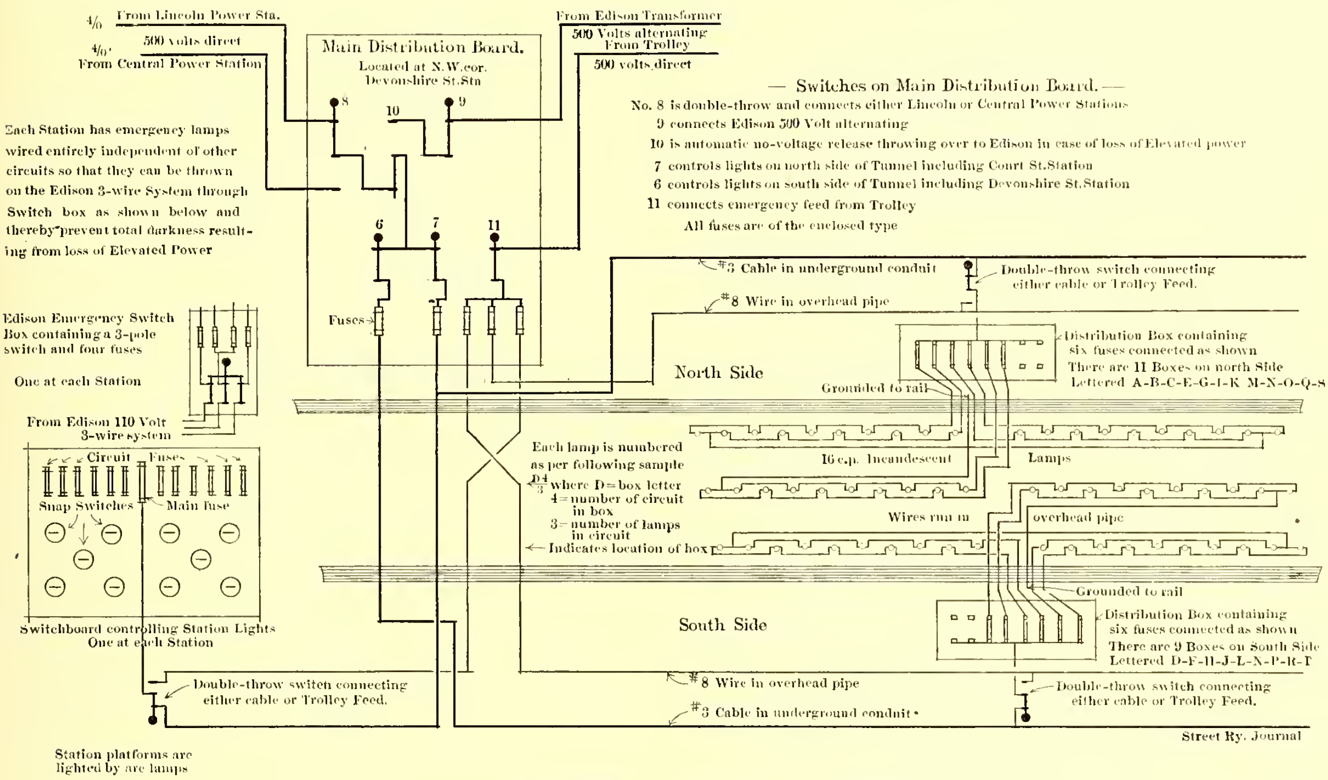


FIG. 6.—DIAGRAM OF LIGHTING SYSTEM OF EAST BOSTON TUNNEL

and Atlantic Avenue. The India Street and East Boston fans have vertical shafts and the Atlantic Avenue fans horizontal shafts.

The tunnel is drained into pump-wells located at the lowest point under the harbor. This drainage is then pumped out by an equipment of two 4-in. x 6-in. Goulds triplex plunger pumps, geared to 2-hp, 580-volt direct-current Holtzer-Cabot motors. The pumping plant operates automatically, the motors being controlled by Cutler-Hammer rheostats, and switches operated by floats in the pump well. The pumps each have a capacity of 32 gals. per minute, and they pump the water into the harbor on the East Boston side through a 4-in. discharge pipe, which leaves the tunnel through the East Boston ventilating chamber. The combined efficiency of the pumps and motors is given as 47 per cent, and the pump wells have an emergency storage capacity of 4000 cu. ft. The normal leakage of the tunnel is less than 8 gals. per minute, according to the tenth annual report of the Boston Transit Commission.

The Atlantic Avenue station is to be equipped with four electric elevators, which will run from the platforms to the street level, a vertical rise of about 56 ft., and to a landing about 14 ft. above the street. This landing will be connected with the present State Street elevated station by a bridge. A peculiar feature of these elevators is that they are required to have a horizontal travel of about 6 ft. in travelling this vertical distance of 56 ft. They are to run on curved guides, so that the car floors will be kept level at all times. The maximum speed of the cars is to be about 250 ft. per minute, and each will have a platform area of about 60 sq. ft. and a capacity of forty or fifty passengers.

of the Boston Elevated Railway Company, and to H. A. Carson, chief engineer of the Boston Transit Commission, for courtesies extended in the preparation of this article.

THE NORTHWESTERN ELECTRICAL ASSOCIATION CONVENTION

The Northwestern Electrical Association held its thirteenth annual convention at the Hotel Pfister, Milwaukee, Jan. 18 and 19. Street railway men were invited to take part in this convention this year, but because of the heavy snowfall over the Northwest many electric railway men were kept at home.

At the opening session President T. F. Grover, of Fond du Lac, general manager of the Eastern Wisconsin Railway & Light Company, referred to the recent decision to enlarge the scope of the association so as to take in the street and interurban railway men, and spoke of the opening of the New York Subway and the advent of the single-phase railway as important steps in the art during the past year.

The only paper on the programme devoted to an electric railway subject was one by Clarence Renshaw, of Pittsburg, on "Single-Phase Railways and Their Possibilities." This paper described the Westinghouse single-phase railway apparatus and auxiliary appliances.

The Long Island Railroad Company, now electrifying some of its lines, has filed for public record plans for an extensive electric repair shop to be located at Morris Park, where its other shops are. The building will be 425 ft. long x 75 ft. wide, and will be of fireproof construction throughout.

DEVELOPMENTS IN ELECTRIC TRACTION*

BY W. B. POTTER

The developments in electric traction are doubtless attracting more attention than any other subject in the electrical, or, indeed, entire engineering world. This is partly due to the many schemes and systems which have been and are being devised by engineers, both in Europe and America. A vast amount of literature has been written concerning these, but it would be wearisome and beyond the scope of this paper to discuss even one-half of the schemes that have been suggested.

The recent advances made in electric traction have made it possible to deal with many classes of traffic which would not have been considered a few years ago; and, although we recognize that there are still many long-distance lines handling a certain description of traffic which is unfavorable to electric haulage, these cases are being reduced each year by the progress of invention, and also by the changes which are taking place in traffic conditions. By this is meant that the passenger service on many lines, which was of a concentrated nature a few years back, is now becoming more distributed, and is, therefore, favorable to the installation of an electric system.

It is impossible to enter into this great question in too detailed a manner; but, broadly speaking, it is probable that, taking into consideration the many different electrical schemes now developed, and being developed, there are few steam railroads which would not find the partial electrification of their lines, and in some cases the entire electrification, a profitable undertaking. To what extent such equipment is justified is rather a financial consideration than one involving technical difficulties. Not only is the amount of capital invested in steam railroad rolling stock a point to be considered, but also the expense of electrical equipment. But at the same time it must be remembered that although electrification involves a greater capital outlay, it is cheaper to operate and maintain, and, what is more important, it is capable of earning a greater percentage of interest on invested capital.

Electric traction is peculiarly adapted to suburban and interurban railways, and the general increase in this class of traffic has been enormous since the inauguration of electric service. The old city limits in vogue when the street railways were operated by horse traction and the suburban lines by steam locomotives are limits no longer. Throughout the entire country we find electrically operated suburban lines, handling a great amount of traffic in a manner profitable to themselves and at the same time opening up new districts to the great advantage of the community at large.

The ultimate profits to be derived from any new traction scheme, whether steam or electric, must, of necessity, depend upon the resulting effect on traffic. This is, in many cases, a more or less unknown quantity when the proposition of electrification is first considered; but both history and experience have proved that in the past, the amount of traffic has increased approximately in proportion to the facilities given the public, and that it is quite possible to create a new traffic, as well as to provide for that already existing. It is the function of a railway not only to deal with the business community, for whom it is imperative to travel, but to give the greater comforts and facilities which will induce people to patronize their lines who would either stay at home or travel by other means if no such improved conditions existed.

For this reason, in considering the electrification of a steam system as a whole, or the electrification of its branch or suburban lines, it is not sufficient to obtain figures showing the likely profits to be derived from such an undertaking merely by compiling data showing the cost of installation and the traffic receipts based upon the number of passengers traveling at that time. A margin may be allowed in favor of electrification, due to the extra traffic that the increased facilities are practically sure to induce. The most profitable method of handling a distributed passenger service is by running many short or long trains, as the case may be, at frequent intervals, whereas with steam locomotives it is the general practice to deal with the traffic with only long trains capable of conveying a comparatively large number of people at one time. I draw your attention to this fact, as it shows very forcibly that in a great number of instances where the traffic is of a concentrated nature at the present time, and therefore considered as unfitted for being handled electrically, were an electric system installed, the traffic would naturally change from the concentrated to the distributed form.

Electricity as a motive power has been considered for traction in many different ways; but, broadly speaking, these may be divided under two main headings—direct-current ("d. c.") and alternating-current ("a. c.") systems. These expressions are somewhat misleading, as, strictly speaking, the term "d. c. system" should be reserved for a system using direct current only, and therefore should not be applied to one employing three-phase generators and transmission lines. However, since the single-phase motor has entered the traction field, it has become common practice to style a system as either d. c. or a. c., according to the type of motors used on the car.

The d. c. system, with a central station feeding numerous rotary converters, through the medium of three-phase high-tension transmission lines, which in turn supply an overhead trolley network with direct current at a pressure of from 550 volts to 600 volts, is without doubt the most highly developed and best known system in this country. The a. c. system may either employ single or three-phase generators and transformers. Both the generators and transformers will be three-phase where three-phase induction motors are used on the cars; and in such cases the line is equipped with two overhead trolley lines and the track rails serve as the third conductor. When single-phase motors are used on the cars, either three-phase or single-phase generators and transformers may be used, the choice being dependent on local conditions.

Three-phase systems have been extensively used in Europe, especially in Switzerland, Italy and Germany. The three-phase induction motor is particularly well adapted for service in which it is desired to control the speed of the car by means of the motors on down grades, either for the purpose of returning energy to the line or as a measure of safety.

A great deal has been written concerning the possibilities of single-phase traction, and, as is often the case with the development of a new principle, many appear to have formed too optimistic ideas of its capabilities. While we recognize the advantage of such a system in many cases, it is a mistake to imagine that it will be a cure for all ills and will revolutionize the railway world. It is well, therefore, to have a clearer idea of the advantages and disadvantages of single-phase traction, and also to analyze the reasons governing the choice of such a system. It is self-evident that the relative expenditure for equipment, operation and maintenance should be the fundamental reason governing the selection of a system for any particular service.

The single-phase a. c. system possesses two features which recommend its use—economy of trolley copper, due to the higher trolley voltages, and the elimination of the rotary converter. The chief advantage gained by these features is a saving in the initial cost of equipment; factors which increase in importance in proportion to the amount of power required by each car or train and with the length of the trolley line. On the other hand, the a. c. car equipments cost more than the d. c. equipments for a similar service and the same given rise in temperature of the motors. It is therefore apparent that the

* A paper presented at a meeting of the New York Railroad Club Jan. 20, 1905.

relative cost of an a. c. or d. c. system will be materially affected by the number of cars employed.

The saving in power resulting from the elimination of the rotaries is about offset by the greater weight and slightly lower efficiency of the a. c. motor.

The efficiency of the a. c. control during acceleration will, generally speaking, be somewhat higher than that of the d. c. system with series parallel control. With the a. c. system fractional voltages can be obtained from the transformer on the car. Each step of the a. c. controller therefore gives a running position which corresponds with the series and parallel positions in a d. c. controller.

The potential of the transmission lines from the power station may be selected, as in the case of the d. c. system, without reference to the trolley or secondary voltage. The trolley voltage must, however, be considered from a different basis than that of the d. c. system, for the reason that, in addition to the ohmic resistance of the trolley and track circuit, there is an apparent increase in resistance, due to the alternating current. This increase in apparent resistance for 25-cycle alternating current, as compared to direct current, is about 50 per cent greater in the trolley wire and between six and seven times greater in the rail return. The rails being steel, the increase in apparent resistance is relatively much greater than in the trolley wire.

As the resistance of the track return with large steel rails is proportionately much less than that of the trolley wire, the apparent increase in resistance for the latter and the track taken together will be, roughly, from one-half to twice that for direct current. An alternating current at 1000 volts is therefore about equivalent to 600 volts direct current so far as affecting the amount of trolley copper, and to secure the advantages of the a. c. system to a reasonable degree at least 3000 volts, or, for heavier service, perhaps 5000 volts must be employed.

The design of an a. c. motor as regards length of air gap and armature speed is affected by the lower average flux density. For this reason an a. c. motor is larger and heavier than a d. c. unit of the same output. The commercial a. c. motor represents a compromise, in which the armature speed is somewhat higher and the air gap slightly less than would be the case in a d. c. motor of corresponding capacity. I have mentioned these facts to indicate that the maintenance of an a. c. motor will, in all probability, be greater than that of an equivalent d. c. motor, due both to the higher armature speed and the smaller air gap.

The equipment of heavy locomotives with a. c. motors for high-speed passenger service is a possibility, but owing to the limitations imposed by the space available for the motors, it seems probable that two locomotives, each with four motors, would be required for service which could be performed by a single d. c. locomotive with four gearless motors. For locomotives in slow-speed work, such as freight or shifting, a double-gear reduction will, in many cases, be required, owing to the difficulty of winding an a. c. motor of large size for slow speeds.

In view of the extensive application of the d. c. system, it is fortunate that the a. c. motor and its control may be so arranged as to be well adapted for operation on either high-potential alternating or 600-volt direct-current lines. This adaptability is an important factor in the net earnings, as the equipments are not necessarily limited at all times to a particular route, and, further, where d. c. trolley lines are available, the expense of installing a special a. c. trolley is saved.

The above comparisons relating to a. c. and d. c. systems indicate certain financial and technical differences which have to be met. There is no question as to the successful operation of a. c. apparatus, and the advisability of its use when such an installation will prove financially advantageous.

The power required per ton-mile for moving trains varies so greatly with conditions of traffic that any direct comparisons between electricity and steam as a motive power can only be made by assuming a given class of service. The suburban type of traffic is generally recognized as being more especially suited to electrification, and a comparison in such service of the steam locomotive and an electrically equipped train of equal seating capacity may be of interest.

It is admitted that the first cost of equipping a railroad electrically is higher than the initial outlay for equipping the same road with steam locomotives; but it is well-nigh impossible to make a general comparative statement as to the relative first cost. This will depend on the number of locomotives required to handle the traffic in the one case, and in the other upon the density of the traffic, and it is the latter factor upon which the size of the generating station and transmission lines are dependent.

For example, assume a suburban train of four cars hauled by a steam locomotive and a similar train operated by electric motors under the cars:

	Tons
Weight of steam locomotive	110
Four cars, 40 tons each	160
Total weight of steam train	270

The electric equipment for these four cars to perform the same service would weigh, approximately, 50 tons.

	Tons
Electric equipment	50
Four cars, 40 tons each	160
Total weight of electric train	210

Tests on a steam locomotive in this class of service have shown, approximately, .07 ihp-hours per ton-mile and a coal consumption of 6.86 lbs. per ihp-hour, charging up the full amount of coal used during the twenty-four hours, whether running or idle. On the above basis, assuming coal at $2.50 per ton, we have the following as cost of coal per train-mile:

Ihp-hours per ton-mile	.07
Ihp-hours per train-mile	18.9
Pounds coal per ihp-hour	6.86
Pounds coal per train-mile	130.
Cost of coal per train-mile	14.5 cents

The cost of electric power per kw-hour is well established by records from many power stations. The following is a typical record from a station in railway service:

Coal ($2.85 per ton)	.00286
Water	.00036
Labor	.00158
Supplies	.00011
Maintenance	.00009
Total	$.00500

As the cost of coal and labor is a variable quantity, we will assume $.006 as a basis. The labor and maintenance of sub-stations may be taken as 10 per cent additional, making a total cost per kw-hour of $.0066. The efficiency of transmission and sub-stations may be taken as 78 per cent. The cost of power for the electric train would therefore be as follows:

Weight of train	210 tons
Watt-hours per ton-mile (equivalent to above .07 ihp-hours)	58
Kw-hours per train-mile at train	12.2
Kw-hours per train-mile at power station	15.6
Power per kw-hour at train	$ .0066
Cost of power per train-mile	10.3 cents

The wages per day for a train crew in steam service may be taken as follows:

Engineer	$3.50
Conductor	3.00
Fireman	2.00
Two train hands	3.50
Total	$12.00

The crew for the electric train will be the same, omitting the fireman. In steam service this crew will make a train mileage of, approximately, 100 miles per day. In an electric service, due to its greater flexibility, it is a reasonable assumption that the crew will make a mileage of 150 miles per day. Under this assumption the wages per train-mile will be:

Steam	12 cents
Electric	6.7 "

The maintenance of steam locomotives varies, but in this class of service 6.5 cents per locomotive-mile seems a fair basis from the records available. The maintenance of the electrical equipment per car-mile on the Manhattan is about $.0025, and as these equipments are larger, we will assume 1 cent per car or 4 cents per train-mile.

A summary of the comparative cost per train-mile is as follows:

	Steam	Electric
Coal or equivalent electric power	14.5	10.3
Water	.5	
Train crew	12.	6.7
Maintenance	6.5	4.
Supplies	.5	.2
	34.0	21.2 cts.

Assuming a yearly mileage of 50,000 miles, which is a reasonable assumption for the electric train, the yearly difference in cost of operation, in favor of electricity, would amount to $6,400, representing an interest on the total investment per train which would be more than sufficient for that usually required for the car equipment and the proportionate part of the power station and transmission. Furthermore, to this capitalized investment should be credited the cost of a steam locomotive equipment capable of making 50,000 miles per year.

As this is a brief consideration of a general example, it is hardly worth while to enter into refinement, but in nearly every case the use of electric power will make it possible to secure many incidental economies, both in utilization of rolling stock and cost of operation, the aggregate of which may be a large item.

The following comparison from statistics covering the steam and electric operation of the Manhattan Elevated shows the increase in traffic and the lower cost of operation per car-mile, resulting from electrical equipment. The probable increase in traffic was not sufficiently recognized, prior to the electrical equipment, as to be reckoned an important factor in the earnings of the road, but its influence to this end will be better appreciated when it is remembered that during the latter period of steam service the number of passengers carried decreased each year.

Date	Steam 1896	Electric 1904
Operating ratio, per cent	58.1	41.2
Passengers carried	185,138,000	286,634,000
Car mileage	43,241,000	61,743,000
Receipts per car-mile, cents	21.6	22.95
Total operating expenses per car-mile	13.2	9.5
Total operating expenses per passenger	2.92	2.04

Careful calculations should be made on each individual road considering electrification, as actual results will vary with every new set of conditions. The point at issue is whether the traffic is, or is likely to be, of such a character that the saving in operation or increased receipts will show a proper return upon the required capital.

In considering the application of electric power to freight service, the subject may be considered more strictly from the standpoint of existing traffic, as the reasons which influence the growth of passenger traffic will apply only in so far as the movement of freight may be facilitated and cheapened. Electric power in a single unit, such as a locomotive, is best suited for general freight, although there may be special cases where it will be advantageous to equip several or all of the cars in a train and control from the leading car.

The following table has been prepared as an illustration of the use of electric locomotives. Three typical freight roads have been selected, the cost of steam locomotives being taken from the actual records, so far as obtainable. The costs of electric operation are being derived from the records of existing electric locomotives, and from a study of the service conditions to which they would be subjected in each particular case. Details of the present operating expenses with steam and the estimated cost of operation of an electrical installation to duplicate the present service are given in parallel columns:

	Road A.		Road B.		Road C.	
	Steam Operation.	Electric Operation.	Steam Operation.	Electric Operation.	Steam Operation.	Electric Operation.
Length of Road	15.4	15.4	34.5	34.5	113	113
Character of Service	Pusher	Pusher	Gen.Frt	Gen.Frt	Ore	Ore
Trains—Daily Number—Total	20	20			44	44
—Average Number Cars	40– 60	40– 60	8– 20	8– 20	30.4	30.4
—Average Weight Trailing Load	275–600	275–600	240–690	240–690	2070–547	2070–547
Locomotives—Weight—Total	145	85	130	90	130	80
—Weight on Drivers	86	85	70	90	80	80
—Number—Total	23	12	43	27	35	20
—Number in Daily Service	18.8	10	39	24	30	18
—Daily Mileage—Regular	455	455	1150	1150	5000	5000
—Daily Mileage—Switching	560	560	450	450		
—Daily Mileage per Locomotive	54.4	102	41	67	160	278
Cost of Coal per Ton	$1.26	$1.26	$1.87	$1.87	$3.25	$3.25
Daily Number 1000 Ton Miles—Gross	288	261	1109	1047	7155	6896
Operating Expense per Engine Mile:						
—Fuel	$0.0852		$0.1620		$0.1665	
—Power		$0.0422		$0.1400		$0.0903
—Engine Crew	.1058	.0651	.1310	.0488	.0620	.0398
—Maintenance and Repair	.0883	.0243	.1010	.0258	.0524	.0250
—Round House and Inspection	.0168		.0339		.0090	
—Oil, Waste and Supplies	.0084	.0014	.0092	.0020	.0038	.0020
—Total	.3045	.1330	.4371	.2166	2937	.1571
—Depreciation	.0518	.0500	.0680	.1265	.0293	.0453
Total per Engine Mile	.3563	.1830	.5051	.3431	.3230	.2024
Operating Exp. per 1000 Ton Miles						
—Fuel	.3030		.2340		.1165	
—Power		.1640		.2150		.0655
—Engine Crew	.3770	.2530	.1895	.0747	.0434	.0285
—Maintenance and Repair	.3140	.0945	.1460	.0396	.0367	.0181
—Round House and Inspection	.0599		.0477		.0063	
—Oil, Waste and Supplies	.0295	.0055	.0133	.0052	.0026	.0015
—Total	1.0834	.5170	.6305	.3345	.2055	.1136
—Depreciation	.1820	.1950	.0985	.1940	.0205	.0328
Total per 1000 Ton Mile	1.1654	.7120	.7290	.5285	.2260	.1464

In the above table, road "A" uses locomotives for pushers over a heavy grade, and the second column shows the estimated economy which could be obtained by substituting electric locomotives for steam over the short section on which these pushers are operated. Road "B" handles general freight over a section in which a large part of the traffic originates, where the service demands a great proportion of switching and short runs. Road "C" hauls ore over a section with heavy loads in one direction and empty trains in the other.

These results further emphasize that every case demands an intimate study of itself. For example, considering the cost of depreciation per engine-mile under road "A," the cost of depreciation with steam operation is $.0518 per engine-mile, while with electrical operation it is estimated at $.05 per engine-mile. In the other two cases, the cost of depreciation with electric operation is greater than with steam. The reason for this being that on road "A," due to the excessively severe service, the life of steam locomotives is short and their repair and maintenance account very high. At the same time, being a short line, the cost of electric equipment is relatively low. In the other cases the lines are more extensive and the cost of electric equipment is greater proportionally than in the case of road "A."

As with the steam locomotive, the design of the electric locomotive is influenced by the service for which it is to be used. The bogie truck type, following the precedent of the motor car, was the first to come into general use, and it has become a well established type for general service in high-speed haulage, or for yard shifting where there are many curves.

The articulated type is well represented by the locomotives originally supplied to the Baltimore & Ohio Railroad for the Baltimore tunnel. This type is shown diagrammatically in Fig. 1. It is much the same as two coupled locomotives, with the disadvantage of not being two independent units, either of which can be operated or repaired independently of the other.

The rigid frame type, as exemplified in Fig. 2,* is one in which all axles are held square with the frame and parallel to one another. The mechanical design is strong and simple and well adapted for heavy slow-speed haulage. The additional equipments for the Baltimore & Ohio tunnel are of this type. Two of these locomotives, with a total weight of 160 tons on the drivers, are ordinarily coupled together and controlled as a single unit.

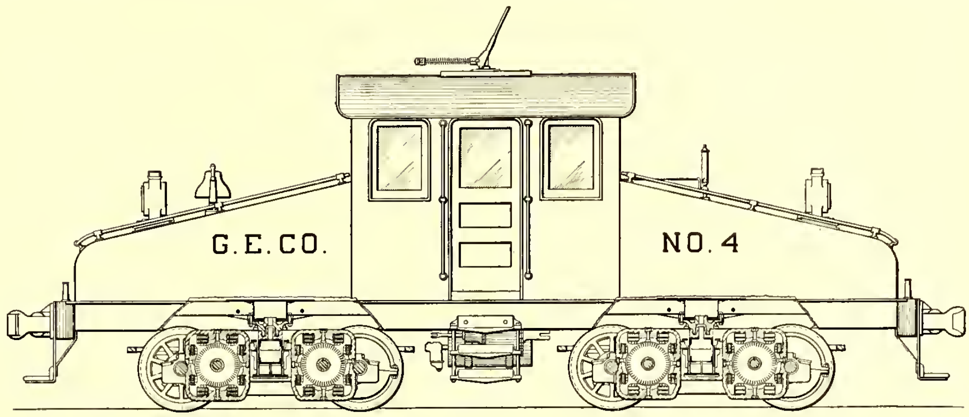


FIG. 1.—SECTIONAL ELEVATION OF ARTICULATED TYPE OF ELECTRIC LOCOMOTIVE

The requirements of high-speed passenger service are especially severe, demanding a locomotive of large power and, consequently, of heavy weight, as well as one possessing a reasonably flexible wheel base.

The locomotive recently designed and built by the General Electric Company and the American Locomotive Company for the New York Central Railroad,† is the result of a careful study of many different types. This electric locomotive differs from any that have previously been built, in having a rigid frame for the drivers and pony trucks at each end for guiding. It is also an innovation with respect to the type of motors. The high speed for which the motors were designed made it possible to economically utilize material in the form of bi-polar units. The poles of the motors are provided with flat faces,

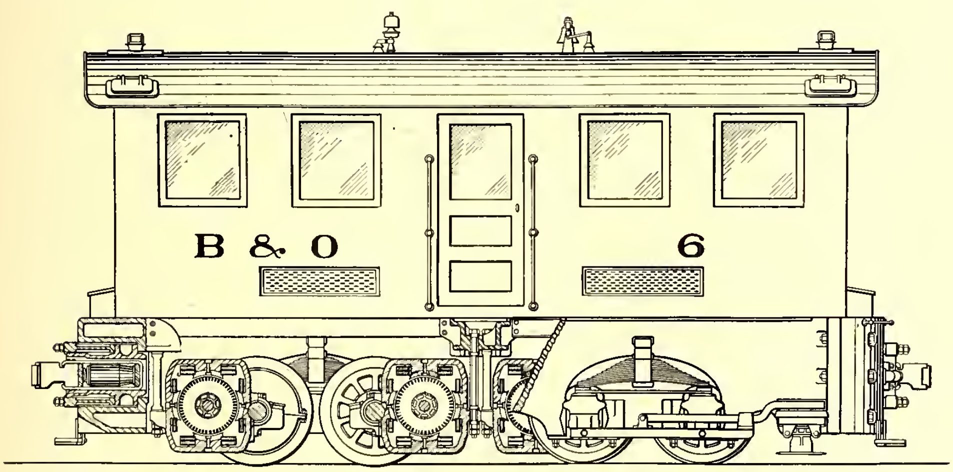


FIG. 2.—SECTIONAL ELEVATION OF RIGID FRAME TYPE OF ELECTRIC LOCOMOTIVE

between which the armature can move in a vertical direction. The commutation of the motors is not affected to any appreciable extent by such a movement, and this arrangement enables the locomotive frame being utilized as the magnetic circuit, as well as permitting all the magnetic material and the field coils being supported on the main springs. The armatures, wheels, axles and journal boxes are the only parts of the motor or locomotive frame which are not borne upon the springs.

The air compressor for the New York Central locomotive is a new direct-connected design running at 175 revolutions and with a piston displacement of 75 cu. ft. per minute. This compressor supplies air at 130 lbs., both for blowing the whistle and braking the train. A sectional view is shown in Fig. 3. To economize space and simplify the bearings, the compressor is provided with two motors, which, by reason of the low speed, are connected in series with each other. The air pressure is maintained by a governor, which automatically starts and stops the compressor within a variation of about 10 lbs. pressure.

The method of conveying electric power to a car or train is influenced by the size of equipment and conditions under which it operates. The simple trolley and wheel in general use has been surprisingly satisfactory in service much more severe than that for which the trolley wheel was originally considered. The limitation of its capacity is rather in the life of the wheel than from any particular difficulty in collecting the current. With cars of medium size, at moderate speed, an upward pressure of 15 lbs. or 20 lbs. against the trolley wire is sufficient, and the life of the wheel is frequently 10,000 miles or over. At car speeds of 50 miles to 60 miles an hour, an upward pressure of 35 lbs. to 40 lbs. appears necessary to insure the wheel maintaining close contact with the wire over the irregularities of the suspension. This greater pressure, coupled with the larger amount of current commonly taken at such speeds, results in the rapid wearing of the trolley wheels, which is more especially noticeable on account of the large daily car mileage common to high-speed service.

Considerable attention is being given to the development of a collector for heavy service which will cost less to maintain than the present trolley wheel. The bow form of trolley, in which a sliding bar of copper or aluminum at right angles to the trolley wire replaces the trolley wheel, has been used to some extent abroad and seems to have met with considerable favor. The cars on which the bow trolley has generally been used are of comparatively slow speed and power, and such tests as have been made indicate that in the equivalent of our suburban service the maintenance of the bow trolley would considerably exceed that of the trolley wheel. A modification of the bow trolley, in which a roller replaces the sliding bar, has been used in a number of cases, with excellent results. Where the trolley wire is maintained within a foot or two of uniform height, a reversible trolley contact with a pantagraph mechanism, carrying a roller for contact with the wire, can readily be applied. Where the variation in height of the trolley wire is considerable, on different parts of the same line, the panta-

* See also Street Railway Journal, Aug. 22, 1903.
† See Street Railway Journal, Nov. 19, 1904.

graph construction must necessarily be of considerable size. The first electrical equipment of the Brooklyn Bridge was provided with this pantagraph form of trolley, prior to the installation of the third rail. Another instance of the use of this

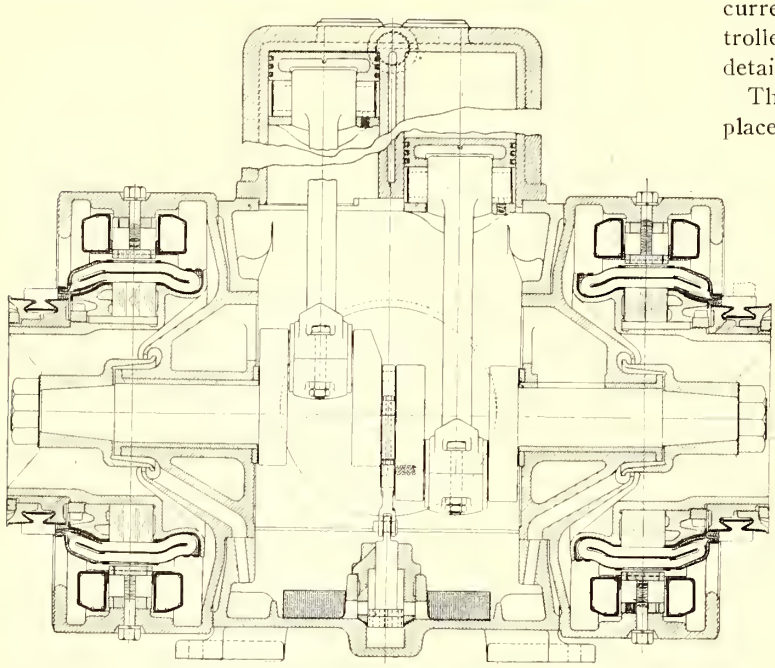


FIG. 3.—SECTION OF MOTOR AIR COMPRESSOR

type of trolley is on the San Francisco, Oakland & San Jose Railway, illustrated in the STREET RAILWAY JOURNAL for Feb. 20, 1904. It is customary to install two pantagraph trolleys, each collecting its share of the current, and where necessary to collect a larger amount, as might be the case in locomotive work, additional trolley contacts may be installed to any extent required. A pantagraph type of trolley, provided with a shoe instead of a roller, is well adapted for use in connection with third-rail operation, where it is desired to make overhead contact through special track work or road crossings where the third rail cannot be conveniently installed. On the New York Central locomotive, this particular contact device is fitted with an air piston to provide a convenient means of depressing the contact shoe.

The ordinary methods of trolley wire suspension and insulation are not well adapted for high potential alternating trolley lines, and what is known as a catenary suspension of the trolley

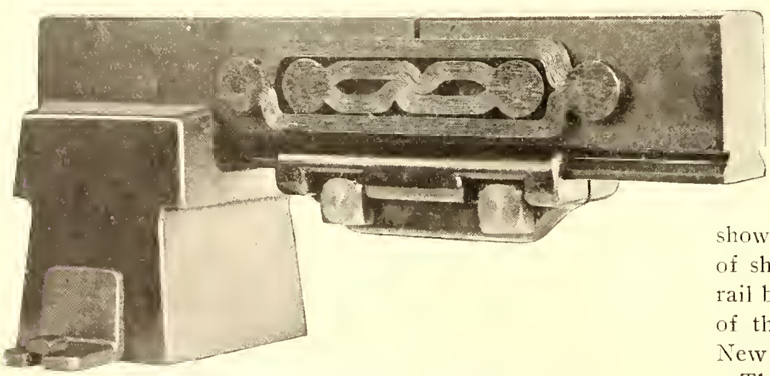


FIG. 5.—PROPOSED FORM OF THIRD RAIL

wire will probably be more generally used. In the catenary suspension, the supporting cable or catenary is carried over the top of high potential insulators at the point of support and the trolley wire is attached by clips and hangers directly to the catenary without intervening insulation. The catenary thus serves as a supplemental conductor to the trolley wire, and it may be of either steel or copper. As the trolley wire is supported at frequent intervals, the poles for the catenary can be spaced at longer distances than common with the ordinary type of trolley construction. While especially advantageous for high potential work, there is no reason why the catenary form of suspension should not be more generally employed for direct-current work, and it provides a means for supporting a larger trolley wire, if desired, than is now commonly used. Several details of the catenary construction are shown in Fig. 4.

The third rail, although used to a considerable extent in place of the trolley, has been criticised, particularly from the standpoint of danger and trouble from sleet. The unprotected rail is open to both these objections, but with a suitable protection against accidental contact and from sleet, these objections are to a great extent overcome. A protection providing these features is in use on the Wilkesbarre & Hazleton Railway, Interborough Subway, and one is under construction for the New York Central.

The location of the third rail, with reference to the track, would seem to be a simple question, but owing to local conditions, nearly every installation has been different. Between clearing the low-pressure cylinders of compound locomotives, the hoppers on the large steel coal cars and keeping within the bridge abutments and tunnels, the location is generally a case of compromise. It will be advantageous to facilitate the interchange of equipments by establishing a uniform location of the third rail, and the importance of such a standard and difficulty of finally determining it will increase with every new installation.

Fig. 5 shows a suggested section of third rail, which has the merit of providing large conductivity with a minimum of height. As the amount of insulation that can be provided is in a measure dependent upon the distance between bottom of the third rail and the tie, a minimum height is for this reason advantageous.

The subdivision of the third rail into sections which will be normally disconnected from the supply circuit and automatically connected when in the immediate vicinity of the car, has many times been proposed. Such an arrangement appears to have little or no advantage, as apart from the complication introduced, the sectional third rail should be protected by a covering to the same degree as an ordinary third rail. Unless the sections are very short, the rail will be energized for some distance beyond the car, and persons getting on or off, or working about the car, would be likely to receive shocks, and more especially so as the rail would ordinarily be considered harmless. Another important reason for protecting the rail is that the cover will form a shield from sleet, which is much more troublesome on a sectional third rail than on the ordinary third rail.

The third-rail contact shoe, which has been quite generally used, depends on gravity for its contact with the rail; therefore, at high speeds with any unevenness on surface of the third rail, this type of shoe shows a disposition to jump and arc excessively. A better form of shoe is one in which the contact is held against the third rail by a spring, this principle being applied to the hinged type of third-rail shoes in use on the Interborough Subway and New York Central locomotive.

The Boston Elevated Railway was originally equipped with gravity shoes, which have been replaced with others provided with a spring, as described in the STREET RAILWAY JOURNAL of Feb. 6, 1904.

The initial expense of electrical equipment, more especially that due to the cost of power station and trolley line, has deterred many steam railroads from electrifying branch lines in sparsely populated districts. Such lines could be served more profitably by independent cars than by steam trains, as the possibility of economically operating single cars on frequent headway, by providing a better service, would have an important influence upon the development of the traffic.

To meet the requirements of this class of service, a self-propelled car, independent of any feeder system, seems particularly well suited. With this end in view, there have been numerous schemes suggested and tried, some employing steam and others compressed air as a motive power; and again, storage batteries and gasoline engines have been used. Without discussing the relative merits of these different methods, it may be briefly stated that the gasoline engine seems to have the advantage of possessing the greatest power for a given weight, and is also building of a successful car of this description is a problem depending entirely upon the engine; and there seems reasonable ground for the belief that an engine well adapted to this class of work can be produced.

The General Electric Company has under construction an equipment of this character which, if successful, should be well adapted to meet the requirements of the class of service under consideration. The engine was purchased abroad. This car is provided with passenger, smoking, toilet and baggage compartments, and is 65 ft. over all. The engine room is at one end, and a motorman's compartment is provided at each end of the

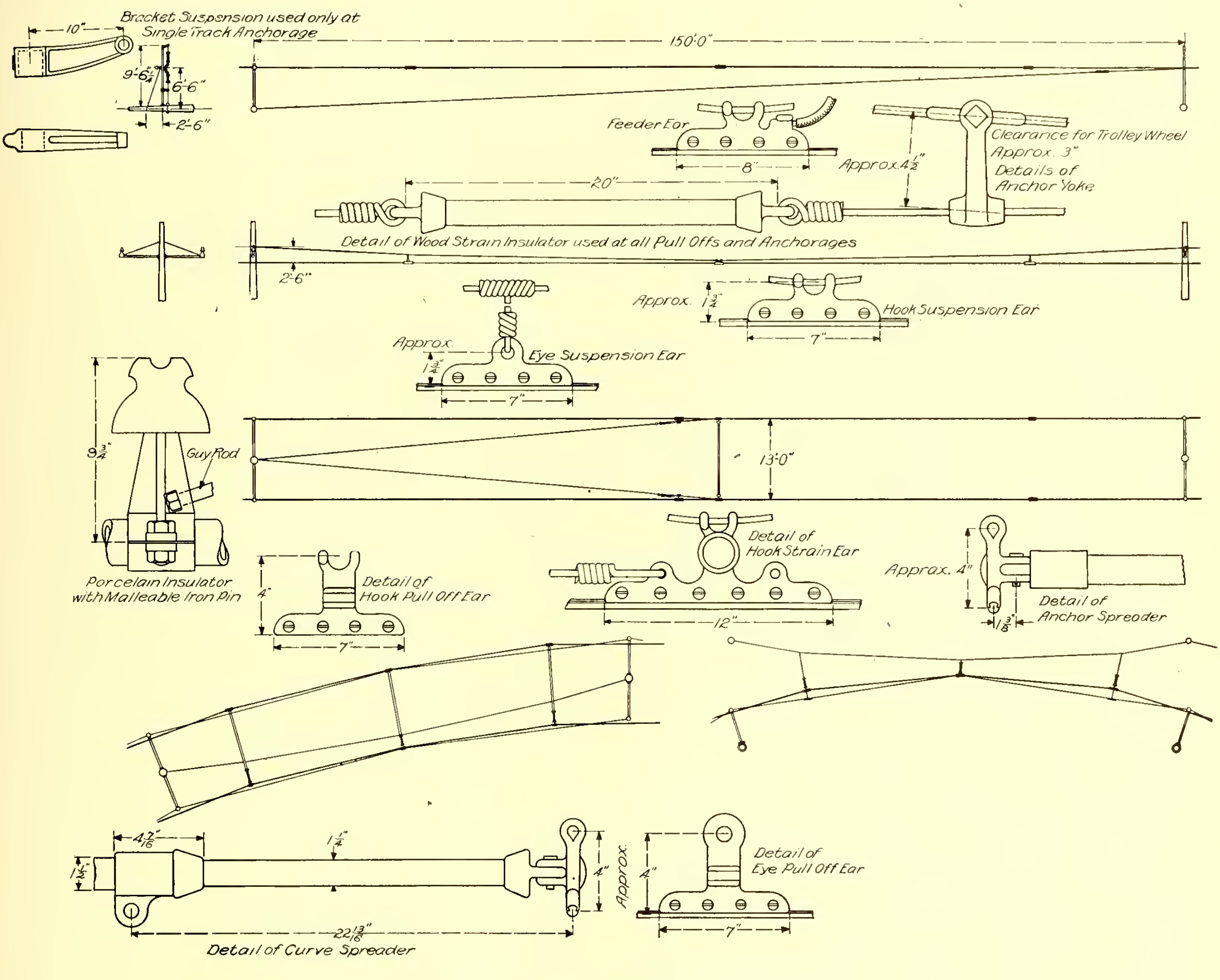


FIG. 4.—DETAILS OF CATENARY CONSTRUCTION

able to cover considerable distances, owing to the concentrated nature of the fuel and the high efficiency of the engine in relatively small sizes.

A number of such equipments are in operation abroad, some being provided with a mechanical transmission to the wheels similar to an automobile, and others having a generator direct connected to the engine, with the electric motors mounted on the trucks in the usual way. For cars of the weight commonly used on steam railroads in this country, and those which have bogie trucks, the gasoline-electric combination seems in many respects the better suited.

The principal difficulty that has been experienced with this type of equipment is the insufficient capacity of the engine; and this is not surprising when we appreciate that the motors of a 40-ton electric car under ordinary service conditions are frequently required to develop 500 hp during acceleration. The car, to permit its being operated in both directions. The car complete will weigh, approximately, 55 tons. A general idea of such an equipment may be obtained from Fig. 6, showing plan and elevation of the car body. This print is partially in section to show the arrangement of engine and generator.

The engine will have a full load output of 200-brake-hp and will run at 600 revolutions. It will be direct connected to a 600-volt generator, the fields of which will be separately excited from an exciter driven by the engine. The controller for the motors will be provided with a series-parallel switch, but no starting resistance, in the usual sense, will be required, as the speed of the motors will be regulated by controlling the voltage of the generator through field resistance points in the controller. The water-cooling system for the engine will be carried through radiators on the top of the car during the summer, and in the winter through the ordinary heater pipes for the purpose of warming the car. An engine of the size proposed will provide for an acceleration sufficient to maintain a schedule speed of 20 m.p.h. to 25 m.p.h. where stops are 3 miles to 4 miles apart and the car can be easily maintained at a running speed of 40 m.p.h. There are no data on which we can accurately base the operating cost of such an equipment, but it seems probable that, including all expenses—of the motorman, conductor, fuel and maintenance—the cost will be between 15 cents to 20 cents per car-mile. This will depend somewhat on the daily mileage made by the conductor and motorman, as their wages amount to a considerable portion of the total expense. Reference has been made to this type of equipment, because considerable interest appears to exist regarding the possibilities in this direction, but what measure of success will be attained can only be determined by a thorough trial. Several different types of engines are under consideration, as is also the use of kerosene as a fuel. The object in view is to produce an equipment comparable in some respects to the all-electric car, and at the same time cheaper to operate than the steam trains, which are usually run over the lines for which an equipment of this type is intended.

Within the limits of this paper, it has been possible to touch only upon a few of the features pertaining to electric traction. The power station and sub-station equipment, the motors and controlling apparatus for the car, and the various automatic protective devices, each bear their due relation to the subject as a whole. The subject of electric traction affords a variety and scope for engineering investigation which makes it exceedingly attractive, and the developments in this direction within the next few years, in connection with the heavier class of service, give promise of being equal in importance to the influence of teh trolley line upon the horse railway.

DISCUSSION

After reading his paper, Mr. Potter presented a large number of lantern-slide views, illustrating the principal features of the Schenectady-Ballston single-phase line, described in the Street Railway Journal of Aug. 27, 1904, and gave details of the catenary suspension system, which are shown in Fig. 4. He stated that this system was an ideal one for trolley suspension. The pull-offs and anchorages are second growth hickory which has been subject to a vacuum compound insulating treatment. This consists of introducing into the pores of the wood a mixture of various oils and rosin, which, due to their nature, make it thoroughly impervious to moisture. At the same time they possess the property of not cracking when the wood is subjected to bending strains after the insulation itself has dried. Insulators, after they have been treated in this manner, can withstand practically the same high potential voltage tests as a dry insulator after they have been immersed in water for a period of twenty-four hours. Such insulators are made in 18-in., 20-in. and 30-in. lengths. The 30-in. insulator will stand a high potential test of 50,000 volts. The 20-in. insulator is recommended for 3300-volt trolley wire; these insulators are tested for 5000 volts and will stand a high potential test of 25,000 volts to 35,000 volts. Views were also shown to illustrate the development of the electric freight locomotive, as exemplified in the articulation rigid frame types of the Baltimore & Ohio electric locomotives for tunnel work, Figs. 1 and 2, as was also a large number of views of the New York Central locomotive apparatus and of the Hoffmans, N. Y., section of the New York Central Railroad, on which a large number of elaborate tests have been and are being made. These later views, together with the performance curves presented, will be found in the Street Railway Journal of Nov. 19. The programme of the complete tests to be conducted on the New York Central locomotive was given in detail in the issue of Jan. 21, 1905. Mr. Potter also showed a plan view of the gasoline engine, illustrated in the text of his paper herewith. (See Fig. 6.) This engine is now equipped with a six-cylinder vertical engine, but the company hopes to secure more room in the car by the use of a four-cylinder engine of the same capacity.

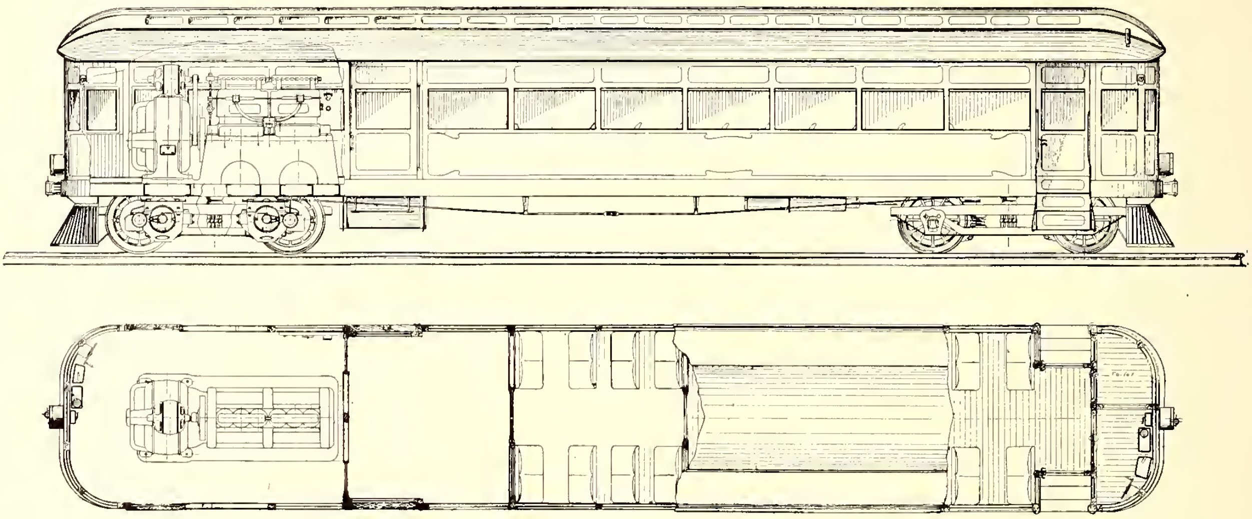


FIG. 6.—GASOLINE-ELECTRIC MOTOR CAR (PROVISIONAL PLAN)

After the presentation of the slides, the chairman announced that, owing to the large number of well-known electrical engineers present, he felt that the only thing he could do would be to call them up to participate in the discussion in alphabetical order. For this reason, he requested B. J. Arnold to take the floor. Mr. Arnold, however, retired in favor of W. J. Wilgus, fifth vice-president of the New York Central Railroad.

Mr. Wilgus congratulated the author of the paper of the evening on the very able and comprehensive manner in which he had treated the broad subject of electrification of steam railroads. He felt that there was a growing necessity for making some improvements in steam railroad operation, especially in the suburban service. One point, however, which was often overlooked was that the cost of electrifying a steam railroad was not the principal item of expense. The New York Central had found that the cost of electrifying a suburban division, comprising about 60 miles of four-track line, will be only about one-fourth of the total expenditure necessary to secure the full benefits of electrification. There must be more frequent units; a separation of slow and fast traffic, which means separate express and local tracks, or the increase of two tracks to four and of four tracks to eight in some cases, and the elimination of all grade crossings, as the latter would be absolutely impossible with electric traction. It also means, in the case of the New York Central Railroad, that the platforms of all stations will be raised to the level of the car floor and the reconstruction of many stations, including the Grand Central terminal. The proper way to look at this question is from the standpoint of increase in business, rather than that of decrease in cost of operation. Mr. Wilgus said that in his opinion the value of suburban service had hitherto been ignored by most steam railroads; some have tried to make it so disagreeable to their patrons that it seemed as though they wanted some excuse to give it up entirely. The New York Central felt, however, that this was the wrong principle, for even if it made no money out of its commuter business, electrification would make the territory attractive and bring in a large population, which would result finally in an increased long-haul passenger and freight business. He said that the suburban service of a line like the New York Central was analagous to the wagon delivery service of a department store; each could not be taken by itself, but would have to be studied as to its effect on the other parts of the business.

Another point which Mr. Wilgus said he desired to bring out was the ability of electricity to increase the capacity of the terminals in a way which would be impossible if steam is the motive power. With the latter system in use, only the surface area of the terminal property owned by the company was of value, and extensions in terminal facilities as the railroad traffic grew was almost impossible, owing to the existence of adjoining streets, buildings, etc. The only possible expansion in such cases was either up or down, and this can be accomplished only by electricity. In the case of the New York Central's terminal in New York, electrification meant the reclaiming of about 40 acres of land, allowing the cellar part of the property to be used for railroad purposes, and also giving an enormous increase in the capacity of the terminal. Another great advantage of electricity was the absence of switching. With steam service on suburban lines, locomotives must be cut off and stand idle for hours, flying-switches must be adopted, with a great loss of time standing on sidings, etc. All of this is avoided by the installation of the multiple-unit system in electrical operation, making it possible to handle the traffic on a trunk line to a degree of density approaching that of the New York Subway or Elevated line without the use of twenty to thirty standing tracks. A local advantage would be the increased comfort to passengers when traveling through the Grand Central tunnel. There would also be a great saving in cleaning, as it is necessary at the present time to clean the tunnel about every two weeks. The gases from the steam locomotives are rapidly eating away the iron I-beams overhead, and if steam operation had been continued, this would have meant the early renewal of that feature of the tunnel at an enormous expense. The absence of engine houses in the terminal, with their accompanying scores of smoky locomotives, ash pits, water plugs, etc., will also avoid much annoyance and give valuable space for other purposes.

The president then introduced Frank J. Sprague as the father of the electrical development of railways. Mr. Sprague commended Mr. Potter upon his paper, and especially upon the note of conservatism with regard to the claims made for alternating-current apparatus and operation. He thought that with regard to trunk lines, concerning which he had made numerous statements during the past fifteen years, Mr. Potter was over-optimistic, for in his comparisons he had neglected sundry vital elements, such as capital account and up-keep of the transmission and trolley systems. He had been accused by some of his enthusiastic associates as being over-conservative. They expressed surprise that having—justly or otherwise—been classed in the past as one having confidence, even to the extent of possible rashness, in electric railway development, he should now be found occupying a critical attitude. He saw no reason to change his past views on this subject because of that natural enthusiasm which has greeted every new and important development in electrical science. With regard to the New York Central work—to which, important as it was, some undue significance might be attached—he wished to congratulate the General Electric Company and its engineers on a daring departure in electric motor and locomotive construction, one which promised marked success. This was all the more gratifying in view of the fact that when first proposed, with but limited motor tests, the commission as well as the company had to take something of professional risk. Considering the general subject as practical railroad officials and engineers, he said: "The vital question is not now whether all tramways and suburban or interurban roads be operated electrically, or whether electricity shall be installed for trunk line terminals and for special purposes, as in the cases of the Baltimore & Ohio tunnel and the New York Central and Pennsylvania Railroads, but the broad one—will trunk lines be operated electrically?" This was not a problem alone of high or low potential on the trolley line, or of the use of a. c. or d. c. current in the motors. It was essentially a financial problem affected, of course, largely by these elements.

It has been said that a road of considerable length could not be operated on a moderate rail potential of 650 volts. In answer to this he wished to make two axiomatic statements, as follows: "Any line, so far as physical handling of traffic and reasonable cost were concerned, could be operated on the working potentials common to-day, provided there was sufficient density of traffic, and on the other hand, no matter to what trolley potential one might go, and no matter how perfect the motor, there were conditions which were prohibitive of electric operation." This dependence of successful operation upon the element of density was one which he had frequently emphasized, and its meaning should be fully realized. It had been suggested that a high load factor was important, which was undoubtedly true, but considered alone it was of little moment, as on straight-away running on a long line a single equipment could give a very high load factor and yet electric equipment be out of all serious consideration. The fact was that a number of units between terminals, with a fair distribution of load as well as a good load factor, ordinarily contributed the elements necessary for really successful commercial operation. Every road presented a special problem, and the wisdom of adopting electricity could only be determined by a most careful analysis of all conditions.

He was as keenly alive to the economic advantages of higher potentials as the most ardent advocate of the alternating-current motor, and just as friendly to that piece of apparatus, but it would not materially advance electric railway progress to shut one's eyes to the failure of claims made in the past and certain facts as to present apparatus. This might be illustrated by reference to the attitude once assumed toward the commutator of the d. c. motor and the wonderful predictions made for the commutatorless polyphase motor—all of which was of no present effect when it is realized that in developments as indicated to-day the best designers have gone back to the series motor with a commutator, adapting it by special construction to single-phase a. c. operation, although it is complicated somewhat by the transformer action which takes place in it. The ease with which the alternating current makes possible economical transmission of large amounts of power over long distances, and the marvelous simplicity of transformation from one pressure and volume to another, higher or lower, give this system certain inherent advantages over continuous current transmission which are undisputed, but it is to be remembered that on the initial transmission to and through the static transformers at the sub-stations, which, although varying in number, must be an element in any large railway system, and are, in fact, local stations distributing currents of lower potential to sections of the railroad, this advantage and condition as to initial transmission remains unchanged, no matter what the pressure used on the trolley supply or what the type of motor.

The object then in a. c. development is to eliminate the cost and losses of the moving element—the rotary converter—from sub-stations; to separate the latter by greater distances, thus reducing their number and increasing the average load on each, and to lower the cost of the secondary or trolley system for unit distance and capacity. Elimination of moving parts at the sub-station was, of course, desirable, but that did not necessarily mean doing away with attendance. Moreover, inasmuch as a. c. motor equipments are heavier and more costly than d. c., much of the saving of the cost of rotaries on a large system would be offset. This increased weight of car equipment would also affect the size of the trolley line with any given potential.

Referring to the question of trolley potentials, comparison between the a. c. and d. c. trolley supply must be carefully made. Mr. Potter had clearly shown that because of the increased losses on any kind of conductor or rail when using a. c. instead of d. c. current of given volume, with like losses at fixed distances and amounts of energy, the relative average potentials of the a. c. and d. c. currents would be about in the proportion of 5 to 3, and when the maximum potentials are considered the proportion would be about 7 to 3. Therefore, to get materially increased distances between sub-stations, the trolley potentials for a. c. operation must be pretty high. In this connection it must also be remembered that, unlike fixed transmissions, the load on a railway must generally be assumed to vary as the unit distance, so that, considering a. c. and d. c. trolley supplies independently, the distance between sub-stations with given unit load and unit investment in trolley lines would only vary directly as the increase of potential, the relation between maximum potentials under like distances and loads being as already indicated, about in the proportion of 7 to 3. It was the speaker's opinion that dealing with larger railway propositions the ordinary practice by no means indicated the limit of operative d. c. potentials, as should be evident from theoretical considerations as well as practical demonstrations already made. But eliminating for the moment the question of danger, the developments possible by the successful use of very high trolley potentials were such that all progress in this direction was to be heartily welcomed, especially on single-phase lines, as the polyphase motor did not, in his opinion, offer any promise of meeting the conditions of general railway operation.

The next speaker was B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company. He said that while during the last few years there had been a great increase in the size of electrical units and in voltage, the railway motor had gone up in voltage from 500 volts to only about 650 volts. The problem of heavy railway work had hardly been touched. Instead of increasing the voltage of the motor, the development had been in the direction of increasing the current, and the necessity of collecting heavy currents had finally resulted in the adoption of the third rail. But he felt the third rail could not be considered a general solution. In a freight yard, for instance, the third-rail system for many tracks would not be very satisfactory. Any system which would permit a high enough voltage would allow keeping the satisfactory feature of the overhead construction. For general service, with many tracks, it looks as if we must go to higher voltage overhead construction. There is a limit to the direct-current voltage which is allowable, but with alternating current we can use any desired voltage. Assuming the use of alternating current, we must next choose between polyphase and single-phase; as the polyphase system with its two overhead wires would be impracticable for freight yards, our choice narrows down to the single overhead wire of the single-phase system. Single-phase current can be utilized in two ways—by a motor-generator on the car or by transformers and motors. In either system the voltage at the car motors is independent of the voltage of the trolley. The voltage of the trolley is limited only by the insulation used; 10,000 volts transmission has already been used, and 18,000 volts on the trolley is now being planned. At the present time his company is building a 1500-hp freight locomotive, which is to run on 6000 volts single-phase. The equipment is to operate at 10 m.p.h. normal speed, using single-reduction motors. The building of a higher speed passenger service locomotive would be much easier. The catenary form of trolley construction appears to be an ideal one for this service, and could be applied with great advantage to heavy railway service, and also to freight yards. The advantage of this system over that using the motor-generator set is its greater flexibility; the motor-generator set might be all right for heavy service where heavy currents are required, but would not be so suitable on the branch lines requiring less power. The pure single-phase system for locomotives is the best, as the voltage can be adjusted at three places —at the power house, sub-station or on the car. We can use one voltage in the yard, another in the suburban limits and another on the outside lines. The consumption of power is directly proportional to the work done, which is not true with the d. c. system, owing to the rheostatic method of control. The speed may be varied by transformer action without breaking contacts, such as is usual in ordinary direct-current control.

Following Mr. Lamme, Bion J. Arnold took the floor. He said that Mr. Potter had made a very fair statement of the case, and he felt gratified to hear him say that the a. c. motor is now a success, as it was the first time the General Electric Company had gone on record to that effect. He said that, although other single-phase systems might be better than his own, he believed that his early stand in favor of the single-phase system had borne fruit. Mr. Potter, he said, had mentioned only one form of single-phase traction, although that form, he believed, would also take in the Westinghouse type, namely, a series a. c. motor. He then called attention to some features of the motor-generator method advocated by Ward Leonard. He was against the third rail personally, but felt that its use so far had been necessary on account of certain conditions. Ultimately he believed that the steam railroads will all become electrified. He did not claim that electricity was cheaper, and said that not one road in a thousand in the United States could be equipped with the direct current commercially; but there are a great many on which a high-potential alternating-current system could be installed, and the railways eventually will be equipped therewith. He believed that a beginning would be made in a manner somewhat like the following: Some steam road having a sufficient density of traffic between two large cities will be equipped electrically. That road, on account of the liking of the public for electric travel, will get the bulk of the passenger traffic, and consequently the neighboring lines must soon follow. Having their passenger service handled electrically, it will not take long before the freight will be similarly taken care of, especially as fuel becomes dearer.

The next speaker, George Gibbs, consulting engineer of the Interborough Rapid Transit Company and electrical engineer of the Long Island Railroad, stated that he had but one point to emphasize, and this was in connection with third-rail and trolley-contact clearances, especially in reference to the necessity of meeting a great variety of conditions with a continuous electrical conductor located along the railway line. He instanced the case of the Long Island electrification, where trains travel underground, on an elevated road, and on the surface across country; also with through running possibilities with city elevated roads and subways. It would seem, under these conditions, that the overhead contact for low-tension d. c. transmission was almost impracticable; and, under certain conditions, positively dangerous where the roofs of cars ran within from 4 ins. to 6 ins. of the subway roof. Under this latter condition a collision or derailment would almost certainly bring the light roof of the car into contact with the charged overhead conductor. He stated that some three years ago he had written to the executive committee of the Master Car Builders' Association calling their attention to the necessity of establishing some standard clearance lines for car equipment, which would put a limit on the encroachment of steel hopper cars and other special cars on the clearances at and near the track level. He suggested that 27 ins. between the gage line of track rail and middle of the third rail was about the limit for a practical gaging of the third-rail contact. He stated that if car equipment continued to encroach on clearances that this distance for third rail would soon become impracticable. His suggestion to appoint a committee to establish car clearances was evidently misunderstood, as it resulted only in a committee to establish the "standard position of the third rail;" this subject was manifestly not within the province of the Master Car Builders' Association, whereas that of establishing maximum car dimensions was. As a result of this misunderstanding nothing was accomplished and the matter is in the same unsatisfactory condition as heretofore. He said he hoped that the railway members of the club would agitate this question anew in order to bring it to some practical conclusion.

J. G. White being called upon, made a few remarks to the effect that the problem of electrification was largely one of dollars and cents. Incidentally, he said that the ordinary bow trolley, which is so extensively used on the continent of Europe for ordinary city roads, had proved unsuitable in its present form for high-speed work, as shown by the experience of his company in the initial operation of the Amsterdam-Haarlem Tramways, described in the Street Railway Journal of Jan. 7. It had been found necessary to make some important changes in the construction of the usual type to meet high-speed conditions, principally because the bows had worn out very rapidly.

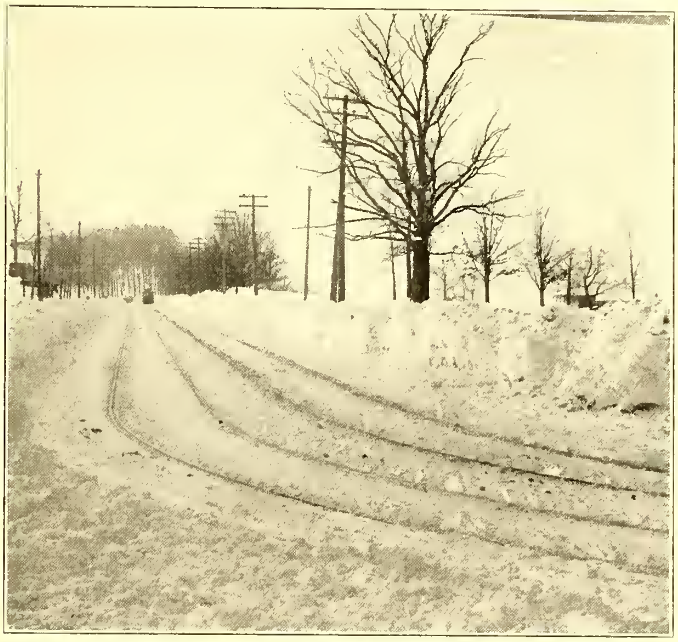
Mr. Potter was asked to make the concluding address, and in referring to the remarks of the preceding speaker said that his reports about the bow trolleys were in confirmation of Mr. White's experience. He thought that the pantagraph trolley, described in his paper, was very suitable for collecting large currents, besides being adjustable for changes in level. He agreed with Mr. Gibbs in the importance of fixing upon a standard clearance for the third rail, and said that if this matter were not attended to soon the problem would become one increasing in difficulty with every additional installation.

SNOW REMOVAL IN SYRACUSE

BY E. G. CONNETTE

The Syracuse Rapid Transit Railway Company has 72.39 miles of track which cover 47.63 miles of streets. The equipment for keeping the tracks clear of snow consists of two snow sweepers, five shear plows, four "A" or nose plows and one plow built in the company's shops, which has a very long wing, and is used particularly to push the snow back a sufficient distance from the rails on paved streets to allow driving on both sides of the tracks without interfering with the movement of the cars.

The removal of snow is under the direct supervision of the superintendent. The system is divided into four divisions, and each division is in charge of an assistant, who receives his instructions from the superintendent. The equipment for the removal of snow is apportioned among the different divisions to the best advantage, and the assistant in charge of each division directs the movement of the plows and sweepers on his respective division. The names of about thirty of the best and most experienced motormen are kept posted in the car houses, and as far as possible they are selected from men who live in the vicinity of the car house so that they can report for duty on short notice. If a snow storm commences during the day, extra men are sent to take the places of the regular men on the cars, who are ordered to report to the car houses as quickly as possible for duty on the plows and sweepers. If a snow storm commences at night the men are called when needed.

WINTER VIEWS IN SYRACUSE, SHOWING METHOD OF PILING SNOW AT SIDE OF STREET

Three men are required to operate the snow sweeper, one man to operate the sweeper and brooms, one man to take care of the trolley, and one to watch horses en route that may be frightened by the action of the brooms. Four men are required to operate the shear plows, and the large type "A" or nose plows require five or six men, on account of the heavy wings, which have to be changed at intervals.

During last winter we were fortunate in securing the service of a large number of outside men, who were not regularly employed by the company, but who would report at the car houses when a snow storm began, or who left their addresses and could be sent for when needed. This saved the necessity of using extra motormen and conductors for this work.

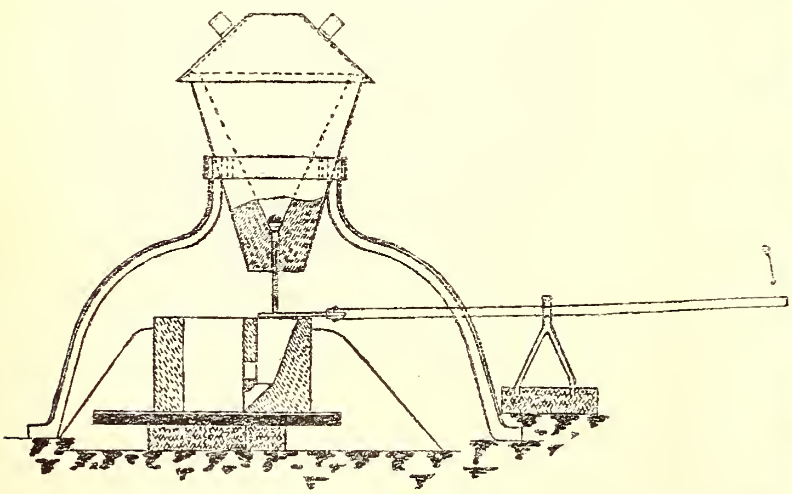
During the last winter some of the snow equipment was in service nearly every day from Nov. 20 up to and including April 20. Total cost for the removal of snow and ice during the past winter was $8,189.60. The total car-miles for fiscal year ending June 30 were 3,869,887, making the cost per car-mile for the removal of snow and ice .0021 cents.

Notwithstanding the heavy fall of snow during the last winter, there was not a single day during the entire time that we did not operate all of our lines. This winter, at points where we have experienced considerable trouble with drifting snow, snow fences of the standard type used by the New York Central & Hudson River Railroad Company have been erected. Fortunately, we have had very little snow and ice to handle during the present winter. The track scrapers on the cars have taken care of the snow so far this winter, and I may add that the track scrapers are capable of keeping the tracks clear in a snowfall of 4 ins. to 5 ins.

THERMIT RAIL-WELDING AT HARTFORD, CONN.

The Hartford Street Railway Company has been doing considerable work with the Goldschmidt thermit rail-welding process, and in view of the general attention that this process is attracting in America, a statement of the results secured in that city will be of interest.

The thermit process has been described in the columns of the STREET RAILWAY JOURNAL. It will be remembered that it is a purely chemical operation, based upon the fact that metallic aluminum, under proper conditions, will reduce many of the other metals from their compounds to their simple form; as, for instance, if aluminum is mixed with oxide of iron and the mixture is ignited, the aluminum will unite with the oxygen of the oxide, forming aluminum oxide (which is commercial corundum), leaving the iron free. As the process of reduction liberates a great amount of heat, the temperature of the mixture during the reaction rises rapidly (to about 5000 degs. F.), changing the iron to a molten low-carbon steel. Expressed in chemical terms, the equation, according to which the reaction takes place, would be $Fe_2O_3 + 2AL = AL_2O_3 + 2Fe$. This is the process utilized in welding rails. The oxide of iron is mixed with powdered aluminum in the right proportion, and introduced into a crucible lined with magnesia, or with material obtained from a previous fusion. Ordinarily, the mixture would be very hard to ignite, as it can be thrown into an ordinary fire, and even upon molten cast iron, without burning. In order to set off the contents of the crucible, a small quantity



CROSS-SECTION THROUGH CRUCIBLE, SHOWING METHOD OF DISLODGING PIN TO MAKE THE POUR

of ignition powder (barium peroxide and pulverized aluminum) is put in a small heap on top of the mixture, and is ignited by means of a match or red-hot iron rod. The reaction propagates itself quickly through the whole mixture, with the result that in a few seconds the whole charge is a mass of white-hot fluid material. The contents of the crucible have separated into two layers, the molten metal reduced by the aluminum being at the bottom and the molten aluminum oxide above it. The reaction takes place very quickly and, although the heat of the mass is intense, there is no explosive effect, as the product is not a gas, and the whole energy of the reaction is preserved as it were in the crucible, the operation being attended only with a violent bubbling or boiling of the mixture.

In the application to rail-welding, the cone-shaped crucible, with its magnesite lining, is mounted on a tripod over the joint to be welded, a properly prepared iron sand clay mold having been previously clamped around the joint. The conical crucible has a hole in the bottom, and, before the operation, a small iron rod or pin is placed in this hole, with its end projecting several inches below the crucible. Above the head of the pin in the bottom of the crucible is first carefully fitted an asbestos washer, and on top of this is placed a solid circular metal washer to hold it in place. About 15 lbs. or 20 lbs. of powdered aluminum and oxide iron are then poured into the crucible. This mixture is known as "Thermit," and is furnished properly mixed and ready for use in small bags by the manufacturers. On top of the mixture is placed a quantity of ignition powder, about enough to cover a 50-cent piece. When all is ready, a match is applied to the powder and a conical cover with a central opening is hastily placed on the crucible. In a few seconds the reaction commences, and within thirty seconds the contents of the crucible become a seething, boiling mass of molten metal. As soon as the reaction has reached its height, a man strikes the pin projecting from the bottom of the crucible with a rod or small shovel, driving the pin upward, thus freeing the hole and

CRUCIBLE AND MOULD IN PLACE READY TO MAKE WELD

allowing the molten metal to flow down into the mold around the joint, depositing a mass of metal around the joint and welding the ends of the rails into a continuous rail.

The Hartford Street Railway Company has just completed the welding of 162 joints by the thermit process. The work was done on the Wethersfield Avenue line, which is laid with 6-in. girder rail in 30-ft. lengths on standard wooden ties placed 2 ft. c. to c. The street along this stretch of track is paved with macadam. The track has been in use for several years, and the joints were low in many places.

In preparing for the welding work, the paving was first dug up around each joint. The end of the tie immediately under the joint was then cut off for about 2 ft., leaving the joint entirely free. The rails for a short distance from the ends were next cleaned with a wire brush. It is not necessary to thoroughly scour the rails, as the presence of oxide or rust on the surface of the rails does not interfere in any way with the making of the weld. The idea is merely to remove the loose dirt in order to get good contact with the metal. The welding work was carried on during very cold weather, so, of course, the rails were found very open at the joints. Where the space between rail ends was more than 1/8 in., a steel shim was driven down between the ends of the rail to give close fit.

The molds were then clamped on around the joints. As furnished by the manufacturers, these molds were made of sheet iron and angle iron, and cost in the neighborhood of $2.50 each. Mr. Tregoning, engineer for the Hartford Street Railway Company, to whom the work of overseeing the welding was entrusted, conceived the idea, however, that these mold boxes could just as well be made of cast iron. He conferred with the engineers of the Thermit Company, and it was finally decided to try cast iron. The results were entirely satisfactory, and the work was carried on with the use of cast-iron boxes, which were made at a local foundry at a cost of $1.05 each, as against $2.50 for the sheet iron. Another interesting departure was

THE FIRST STEP IN THE REACTION, GETTING READY TO DRIVE PIN UP AND MAKE POUR

made in the grade of filling used in the molds. The company first tried a mixture of half clay and half sand, or practically a brick clay. This was expensive, and it was hard to prepare, as the clay had to be broken up, tempered with water and then screened while damp. Mr. Tregoning finally came to the conclusion that this filling was an unnecessary expense, and he made experiments with ordinary foundry dry sand as filling for the molds. This was easily obtained from local foundries at insignificant expense and gave perfect results. Straight dry sand was used without blacking or other ingredients.

The molds used are open sand molds, made up, of course, to

DURING THE POUR, SHOWING THE MOLTED METAL FLOWING INTO MOULD

fit the section of rail to be welded. They were prepared at a local foundry at a cost of 50 cents for each pouring. The molten metal flows from the bottom of the crucible into a cup or lip on the mold, and then flows down one side of the rail, under the foot of the rail, and up the other side. It was found that better results were secured if the ends of the rails were heated by means of a blow-torch just before the weld was made. If the rails are cold, the molten metal, when it strikes the cold surface of the rail, will sputter badly and the weld is apt to be porous. The warmer the rails the quieter will be the flow of the metal.

In other American cities where experiments have been made with the thermit process, it has been reported that some trouble was experienced, due to the fact that the molten metal spattered and burned the rail. It is therefore of interest to know how this trouble was overcome at Hartford. By thoroughly heating the rail before the pour, much of this trouble was avoided, and it was also found that if the crucible was placed on the ball side of the rail, as far away from the rail as possible, the danger of the hot metal splashing on the rail was greatly reduced.

Another difficulty reported from other cities was the occasional premature pouring of the contents of the crucible before the reaction had reached the proper stage. A little trouble was experienced from this source at Hartford in the first work done, but it was soon overcome. Mr. Tregoning discovered that the premature pour was usually due to the fact that the washers covering the hole at the bottom of the crucible did not fit properly and were apt to slip and let the metal through before the pin was struck. He found that the magnesite lining in the crucible, after successive pourings, wore away at the bottom and did not provide a good seat for the washers. One lining will give from twelve to fifteen reactions or pourings, and must then be renewed, but after the third or fourth pouring, the lining, which at the bottom should be funnel-shape, wears away from the continuous cone contour and a ridge develops where the asbestos washer rests. This gives a square seat for the washer, whereas it must have a jam fit in order to hold back the mass of molten metal as it should. The trouble was easily remedied by cleaning out the lining with an iron rod after each pour, and by taking care to see that the asbestos washer had a tight jam fit before the new charge was put in the crucible. The best results were secured when the washer was carefully tamped all the way around with the fingers and pushed down tightly into the tapering opening through the lining, so that the weight of metal from above only served to drive it tighter. There is no danger of getting the washer too tightly placed, as it can always be dislodged easily by driving the pin upward with a sharp blow.

The mold can be removed from the joint after about ten minutes. As soon as the weld was cold, the end of the tie that had been cut off was replaced under the joint and the paving put back and tamped around the rail. After a short time it was almost impossible to find where the joints were, so thoroughly were the ends of the rail welded together.

In doing the work at Hartford, a slip joint was left in the rail about every thousand feet to take care of expansion and contraction. The slip joint consists of a joint left unwelded, with the fish-plates hot riveted to the rail, and the ends of each plate bonded to the rail.

Briefly summarized, the results secured at Hartford were as follows:

Of the 162 joints welded, six, or 3.7 per cent, were spoiled in the pouring, due largely to the breaking in of laborers who were not familiar with the work. Of the six defective joints, five were repoured, the sixth being left as a slip joint.

Of the total number, only two joints pulled apart by contraction after having been in the ground several days, during a particularly severe cold snap. In both cases the rail broke through a bolt hole. These were the only instances of broken joints. They were left as slip joints, with fish-plates hot riveted on, and No. 0000 bonds at each end of the plates.

A force of fourteen men, including the engineer in charge, was engaged in the work of welding. It was found this force could weld about twenty joints a day, including all the preparatory work of opening street at the joints, attaching the molds, etc. The work was done in very cold weather when the days were short. It is believed in summer, with a gang of thirteen men, twenty-five joints could be welded in a day.

The cost of labor, including stripping, fastening the molds, pouring, etc., can be stated at $1, roughly, per joint. The charge of thermit for pouring one joint under the conditions as found at Hartford was $2.77. To this must be added the pro rata cost of the molds and preparing the molds for each pour (about 50 cents per joint), and the pro rata cost of the crucible (crucibles cost $7.25 each and will last indefinitely), and the cost of renewing the crucible linings (one lining will last for from twelve to fifteen pourings, and it costs $2.50 to renew a lining).

It may be stated that the total cost per joint, including cost of excavation, preparing joint, making weld and repaving, at Hartford, was about $5.

The thermit process of welding rails has been used very extensively in Europe for several years. It is now being introduced in America by the Goldschmidt Thermit Company, of New York City, under patents owned by Dr. H. Goldschmidt, of Berlin.

A NEW HYDRO-ELECTRIC BRAKING SYSTEM

Many attempts have been made to design braking systems for electrical traction to use either the source of power that starts the train or the kinetic energy of the train changed into electrical energy by using the motors as generators. A system utilizing this idea has recently been developed by the Allgemeine Elektricitäts Gesellschaft, of Berlin, after the designs of Charles A. Mudge, of New York, who also controls the American patent rights. It has been installed successfully in

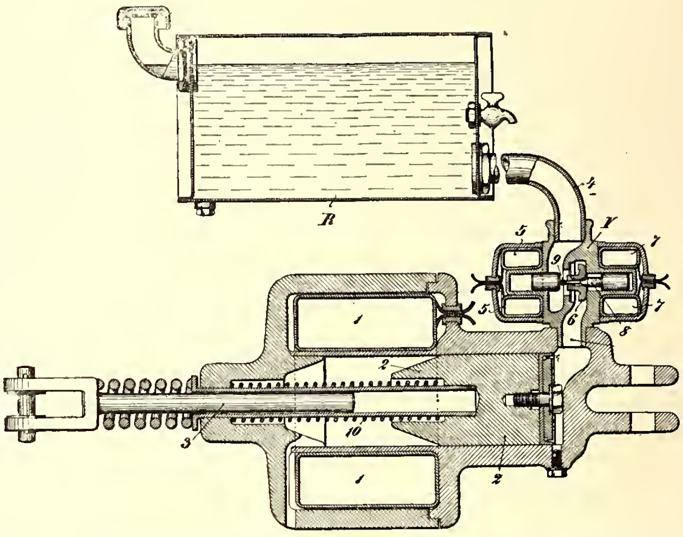


FIG. 1.—SECTION OF THE HYDRO-ELECTRIC BRAKING SYSTEM

several European cities, among them Stuttgart, Strassburg and Lodz.

A sectional drawing of this braking system is shown in the accompanying figure, representing a form of solenoid brake operated in the usual manner by admitting current to the main coil (1), which sets the piston (2) in motion, producing pressure on the brake rod (3), the magnitude of which varies directly with the amount of current flowing in the coil. The magnetic circuit of the brake is so formed that for approximately three-quarters of the stroke of the piston a pressure is exerted, which is practically constant when a constant current is flowing. At the beginning and end of the stroke the pressure falls off according to a predetermined value. R is a reservoir holding a liquid, either a thin oil or a mixture of water and glycerine. Between this reservoir and the brake is an electrically operated valve (V), whose function is to control the flow of liquid between the brake and reservoir.

The operation is as follows: The controller handle is turned

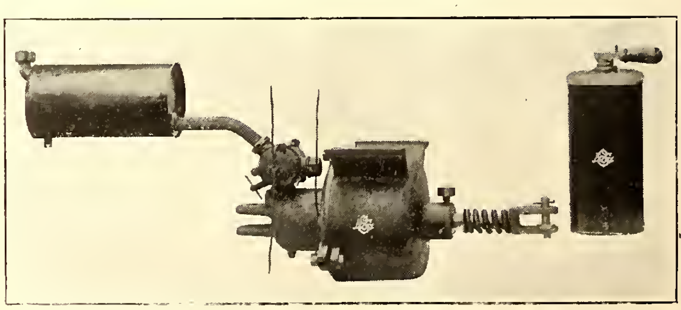


FIG. 2.—ASSEMBLY OF BRAKING SYSTEM; ALSO SHOWING PLATFORM CONTROLLER

from the off position through successive notches, admitting different current values to the brake coil (1) until the proper braking effect is obtained, when the handle is pressed downward, thus admitting current to the valve coil (5) and closing the valve (6), the space at the rear of the piston (2) in the meantime having filled up with the liquid from the reservoir.

The controller handle is then returned to the off position, which interrupts all current, the brake pressure being retained as the piston, cannot return to its original position, being held in place by the liquid between it and the valve.

This pressure may be retained for any length of time without the expenditure of electrical energy. To release the brake gradually, the controller handle is pressed downward in the off position, which admits current to valve coil (7), opening the small valve (8), allowing the liquid to slowly escape through the small hole shown in the large valve (6), which allows the main piston to gradually return to its original position, thus releasing the brake gradually. As soon as the current is cut off from the coil (7), the small valve (8) is closed by the spring (9) and the brake piston ceases to move. In this manner any brake pressure desired from that at which the brake was originally set to zero may be obtained. This feature is most valuable in making proper stops, due to the fact that the coefficient of friction increases as the speed decreases, thus necessitating a decrease of the brake pressure in proportion to the speed, so that no uncomfortable shock will be felt as the train is brought to a stop. It is valuable also for use on cars when coasting down long hills with varying grades.

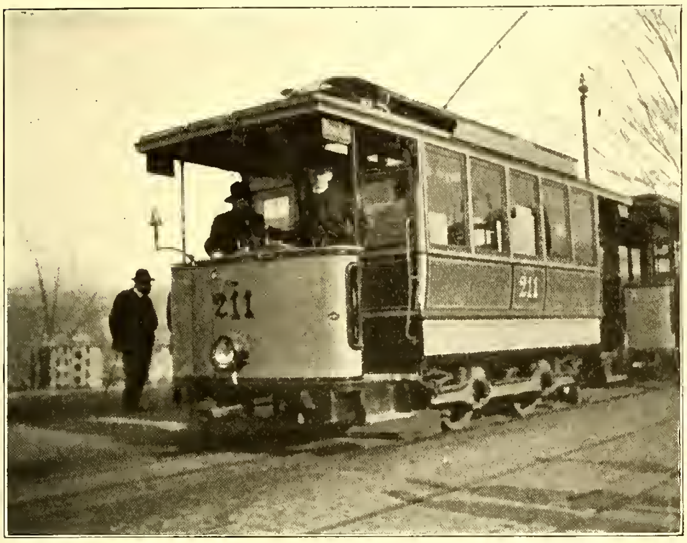


FIG. 3.—STUTTGART MOTOR CAR AND TRAILER EQUIPPED WITH HYDRO-ELECTRIC BRAKE

FIG. 4.—ANOTHER VIEW OF THE STUTTGART EQUIPMENT

To release the brake instantaneously, the controller handle is turned in the opposite direction to that used in applying the brakes. This admits a greater amount of current to the valve coil (7) than that used for the gradual release, which opens the large valve (6), allowing the liquid to escape rapidly from the rear of the piston, which is immediately returned to the position shown by the spring 10. An emergency stop is made by turning the controller handle through 80 degs. to the last braking position which allows the maximum current to flow, giving a total pressure on the brake-shoes nearly equal to that of the weight of the car.

Any number of these brakes may be connected together on a train so that all can be operated through a single controller located any place on the train, or through emergency switches in different parts of the train. All brakes work simultaneously, no matter how long the train may be, the braking effect being applied to each car at the same instant, so that no part of the train receives its retarding effect before other parts. The couplers between the cars contain three wires, and are so arranged that if the train should pull apart, a switch will be opened, setting the brakes.

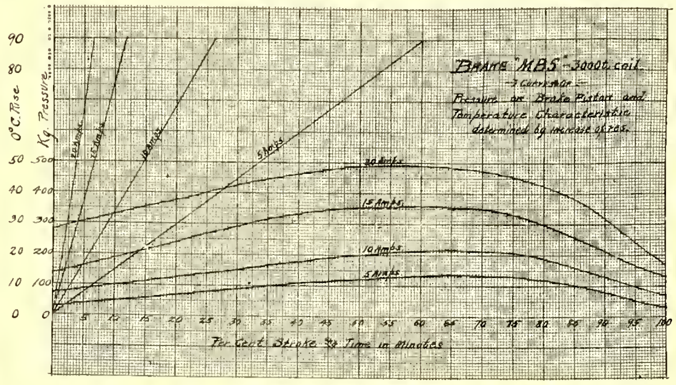


FIG. 5.—PRESSURE AND TEMPERATURE CURVES OF BRAKE USED ON CARS WEIGHING UP TO 10 TONS

The energy consumption is very low, an idea of which may be obtained from the amount necessary to operate the brake shown, which is the size used on ordinary street cars up to 10 tons weight. Current is never kept on over two seconds, at the end of which time the desired pressure has been found for the speed at which the car is running, when the brake is locked and current cut off. The maximum for this brake is 20 amps., which gives a pressure of 1100 lbs. at the brake cylinder. To release the brake requires 10 amps. for the same length of time. This equipment, including one brake, two controllers, resistances and cables complete, weighs 405 lbs.

That there may be a source of power always at hand for stopping the train, the controller is so arranged that if for any reason the trolley current fails, the controller may be turned to an emergency position, throwing the motors in short-circuit through suitable resistance, which brings the train quickly to a standstill. By suitable interlocking devices, this feature can only be used in case the trolley current is interrupted, and as this is seldom the case, this extra service upon the motors does not necessitate an increase in their capacity.

Figs. 3 and 4 are views of a Stuttgart motor car and trailer equipped with this braking system. The brakes were first tested on a train weighing 20 tons. The grades on parts of this line run as high as 6 per cent and 8 per cent for long distances; the low energy consumption was the determining factor in the selection of the braking apparatus. The curves reproduced in Fig. 5 were obtained from the type of this brake used on cars up to 10 tons weight, and show the effect of the shape of the magnetic circuit in this brake as compared with the ordinary type of solenoid, which has a curve similar to the speed curve of a series motor, its pressure increasing as the piston moves toward the end of its stroke.

The diameter of the wheels on the Stuttgart cars is 800 mm (31½ ins.), and the height of the car floor is 710 mm (28 ins.) above the track, under which run 130-mm (5-in.) stringers, making 580 mm (23 ins.) actual clearance above the rail for mounting the brake and its rigging. This space, however, is never filled by the brake or its rigging, no matter what type of this brake is used. The one used at Stuttgart is 315 mm (12½ ins.) high—that is, there is a clearance of 265 mm (10½ ins.) from the lowest part of the brake to the top of the rail. The reservoir in this particular installation is placed in the car under the seats, which is the usual practice on cars of this type. The valve is located directly under the reservoir on the under side of the car floor, where it is easily accessible for inspection. The three parts—brake, reservoir and valve—being independent parts of the equipment, may be mounted as desired. The reservoir, of course, is kept higher than the brake, to allow the liquid to run into the brake cylinder at all times. The reservoir holds about six times as much fluid as is necessary to lock the brake, hence it does not need to be mounted much higher than the brake itself. In case the valve, reservoir and brake are all screwed together, making the total distance from the bottom of the brake to the top of the reservoir 470 mm (18½ ins), the brake will operate on a 25 per cent grade. In special cases, as for cranes, elevators, etc., the reservoir is turned around 180 degs. from the position shown in Fig. 2, allowing the brake to be used vertically. Again, both reservoir and valve have been mounted with flexible connections (1-in. hose), this method having been found advisable in cases of severe vibration.

For cranes, hoists, elevators, etc., this system adapts itself most admirably, as any degree of brake regulation can be instantaneously obtained, no matter at what distance the operator is located from the brake itself, without the expensive and complicated systems of mechanical or air transmission of power at present so commonly in use. The current values used for large braking powers being so small, and the time during which it operates so insignificant, the cost of the installation, including the consumption of the electrical energy needed, is a very low figure, as the cables are few in number and the mounting of the brakes so simple.

VESTIBULE CARS FOR TRENTON, N. J.

The J. G. Brill Company has recently completed for the New Jersey & Pennsylvania Traction Company an order for five of its semi-convertible cars, some of which have 30-ft. 8-in. bodies, and are for use on the 14-mile division between Trenton and Lambertville. The type shown in the illustration is for use at Trenton. The railway company is constructing extensions to

ONE OF THE NEW JERSEY & PENNSYLVANIA TRACTION COMPANY'S LATEST SEMI-CONVERTIBLE CARS

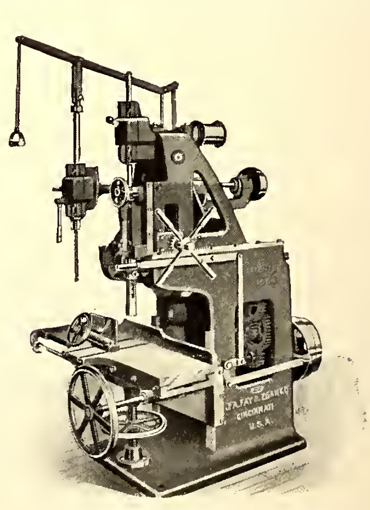
its system, which, when completed, will connect the principal cities and towns north, east and west of Trenton. The company is familiar with this type of car, having operated with it for a considerable time, and evidently it has proved satisfactory.

The car illustrated is 20 ft. 8 ins. over the end panels and 30 ft. 1 in. over the vestibules. The platforms are 4 ft. 8½ ins. The width over the sills, including the panels, is 7 ft. 11½ ins., and over the posts at the belt, 8 ft. 2 ins. The sweep of the posts is 1¾ ins. The side sills are 3⅜ ins. x 5 ins., and the end sills, 3½ ins. x 6⅝ ins. The sill plates are 12 ins. x ⅜ in. The thickness of the corner posts is 3¾ ins., and of the side posts, 2¾ ins. The distance from center to center of the side posts is 2 ft. 8 ins. Longitudinal seats for four passengers each are placed at the corners, a somewhat unusual arrangement for a car of this length, but which has the advantage of providing more aisle space at the ends, thereby facilitating the movement of passengers in and out. The transverse seats are 36 ins. long and the aisle between, 22 ins. wide. These seats have step-over backs, and both side and cross seats are upholstered in spring cane. The seating capacity of the car is thirty-two. Cherry in natural color constitutes the interior finish, and the ceilings are of three-ply birch veneer, neatly decorated. A simple device recently patented by the builder controls the movement of the folding vestibule doors. It consists of a guide rail, beyond which moves a roller situated at the top of the door. Other specialties of the same make are radial draw-bars, angle-iron bumpers, "Dedenda" gongs, ratchet brake handles, Retriever conductors' bells and window sill arm rests. The car is mounted on the 21-E type of truck, having 33-in. wheels and 4¼-in. axles. The weight of the car and trucks without the motors is 16,840 lbs.

A NEW MORTISER

One of the latest tools which has been designed for the woodworking department of railway shops is the hollow-chisel mortiser made by the J. A. Fay & Egan Company, of Cincinnati, Ohio. This machine is said to be easily adjustable and operated, besides being of strong and compact construction. It is designed for chisels up to ½ in. square, and it is recommended by its makers wherever clean cutting and accurate mortising are required.

The main column is cast in one piece, with broad floor base, making it steady and free from vibration or jar. The upper part is carried on friction rollers, making it easy of adjustment for mortises out of line. The pilot wheel for moving the upper column travels back and forth with it, always retaining it in a convenient position for the operator. Stops are provided for the transverse movement of the upper column, the extent of which is 11 ins. The chisel ram is mounted in a dovetail slide and has a stroke of 6 ins. It is counterweighted for easy adjustment, and can be quickly set to the different depths of mortise desired or compensate for thickness of material. The boring spindle in the chisel is driven by miter gears. This arrangement permits belting it from above or directly below the center of the machine.



HOLLOW-CHISEL MORTISER

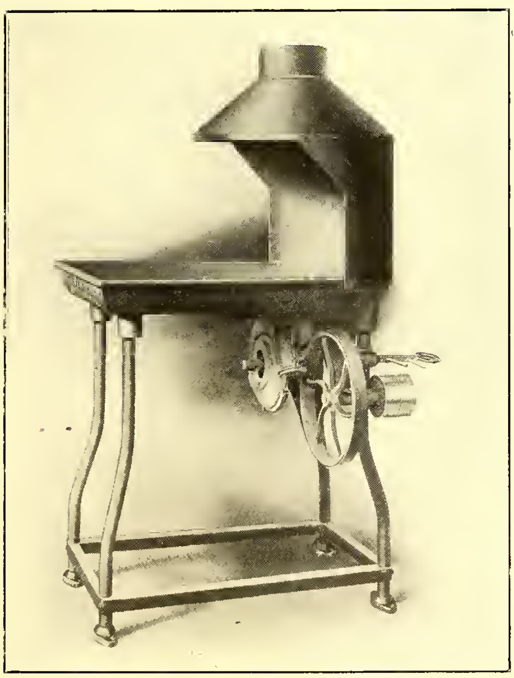
The feed mechanism is contained in the lower column and gives two speeds to the chisel. The chisel has a return stroke of "three to one," accomplished by means of elliptical gears. The feed is controlled by a lever within convenient reach of the operator, and is so arranged as to stop the chisel instantly at any point of its stroke. The table is mounted on the lower column, forms a take-up for all wear, and is 1 ft. x 4 ft. It is raised and lowered 12 ins. by screws, and has a lateral movement of 18 ins. by means of rack and pinions, and has stops for gaging the length of mortise. It will accommodate material

17 ins. high and 12 ins. thick. An adjustable lamp is provided for holding any thickness of mortise, and goes clear to the fence. The auxiliary boring attachments are placed on one or each side of the frame at such a distance from the chisel as will permit of adjusting them to an angle of 30 degs. in either direction. These are convenient for joint-bolt boring and save much handling of material. The depth of stroke of these boring attachments is 12 ins. and the transverse movement 11 ins.

PORTABLE FORGES

The adaptability of the Sturtevant portable forges to all light forge work, their endurance and ease of running, has given them wide popularity wherever small and medium sized forges are needed for heating, tempering and small repairs. From time to time new sizes have been added to the list to meet new applications, there being now no less than thirty-one sizes. The designs also have been perfected in every detail. The sheet metal work is of heavy steel plate, the running gear strong and easily operated. The tuyeres are made extra strong to resist the action of the fire, and the fire pan is of a double metal plate with asbestos between to prevent the heat from cracking the main pan or affecting the running gear. The blower is of the Sturtevant steel pressure type, has babbitted journal boxes and has been redesigned to give increased capacity.

There are seven distinct types. Types A, B and C are alike, except in the means of producing the blast. The blast for type A forges is provided by an attached blower driven by hand-power. The B forges are arranged for pipe connection, and receive blast from an independent blower, which may also supply a number of forges. Forges of the C type are fitted with a blower driven by a pulley on the forge, belt-connected to a line shaft or other drive.



PORTABLE FORGE NO. C-5

The A forge is built in five sizes, adaptable to all light work. The B type is made in eight sizes, particularly adaptable to mechanical laboratories of technical schools. The C forges are made in four sizes, and are fitted with a tight and loose pulley for belt connection; a continuous blast may be thus provided which can readily be regulated by means of a blast gate underneath the fire pan.

With some of the lighter forges a strong wooden box is furnished sufficiently large to hold a complement of tools, together with the forge itself. The equipment is therefore extensively used by repair and set-up men on account of its ease and convenience of transportation.

THE "INTER-POLE" VARIABLE-SPEED MOTOR

The Electro-Dynamic Company, Bayonne, N. J., has placed on the market a new motor, which is essentially a variable-speed motor, but which can also be used on constant-speed work. It was designed especially to drive machine tools, pumps, blowers, woodworking machinery and all other classes of machines, either driving the same directly or in groups. The motor operates on any two-wire, direct-current circuit from 110 volts to 500 volts. A striking feature of this machine is the introduction of four auxiliary poles in the field between the main poles of the motor. The main poles are in shunt with the armature, while the inter-poles, which are considerably smaller than the others, are in series with each other and with the armature.

In any direct-current, shunt-wound motor having a variable speed, the strength of the main field poles must be decreased if the speed of rotation is to be increased. Sparking at the brushes will then result, and if an attempt is made to fit the motor to run in either direction by shifting the brushes to positions equidistant between the poles, the sparking will be still further increased. In this motor, however, the brushes are placed equidistant between the poles, and it is capable of reversing its direction of rotation without sparking, with variable load as well as with variable speed. This is accomplished by means of the inter-poles, which may be seen in Fig. 1.

The coils in the auxiliary poles are so proportioned and arranged as to give the proper field for commutation, and as these coils are connected in series with the armature, weakening the field of commutation by increased load is prevented, and the inter-poles produce a compensatory field of commutation independently of the main field, which is weakened with an increased number of revolutions of the armature. The function or effect of the inter-poles is independent of the direction of rotation of the armature, for if the latter be reversed, the current in the auxiliary field is also reversed. The motor as applied to a Hendey lathe is shown in Fig. 2.

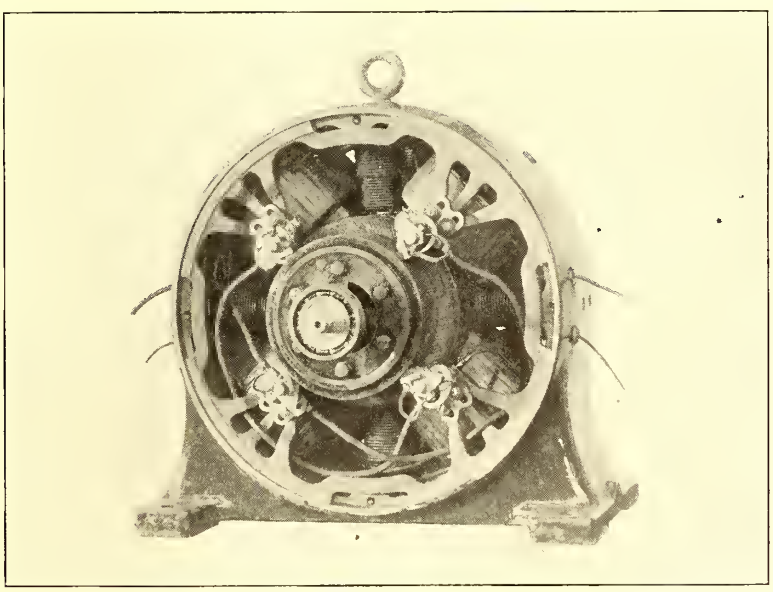


FIG. 1.—MOTOR WITH FRONT BEARING REMOVED, DEPICTING SIMPLICITY OF CONSTRUCTION AND COMPACTNESS

Another novel feature of this motor is the use of ball-bearings in place of the ordinary journal bearings. This bearing consists of two races, one of which is fastened to the armature shaft and the other to the bearing housing. Between the balls are placed spring separators, which are packed with mineral wool. This mineral wool takes up the lubricant and feeds it gradually to the bearing. The only attention required for the bearing is to have the lubricant renewed once about every six months. This bearing is shown in position on the end of the armature shaft in Fig. 1.

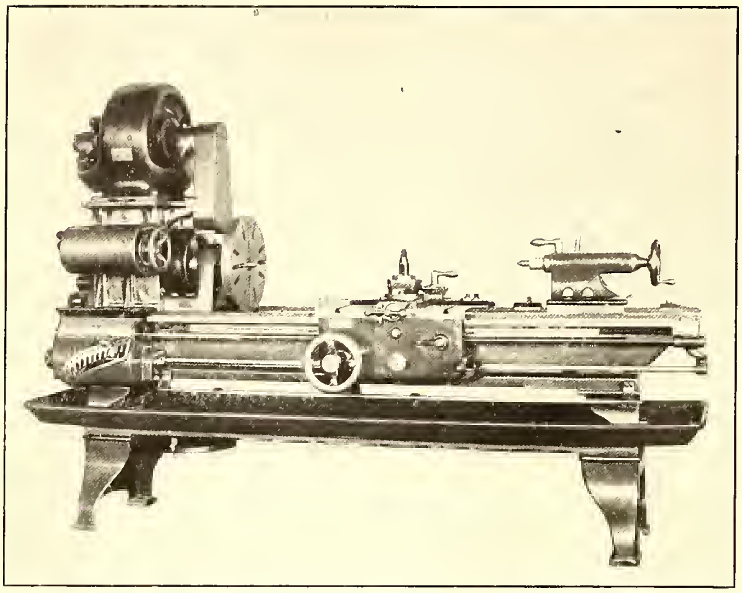


FIG. 2.—INTER-POLE MOTOR DRIVING 16-IN. HENDEY LATHE, THROUGH SILENT CHAIN. ANY DESIRED SPEED CAN BE QUICKLY OBTAINED

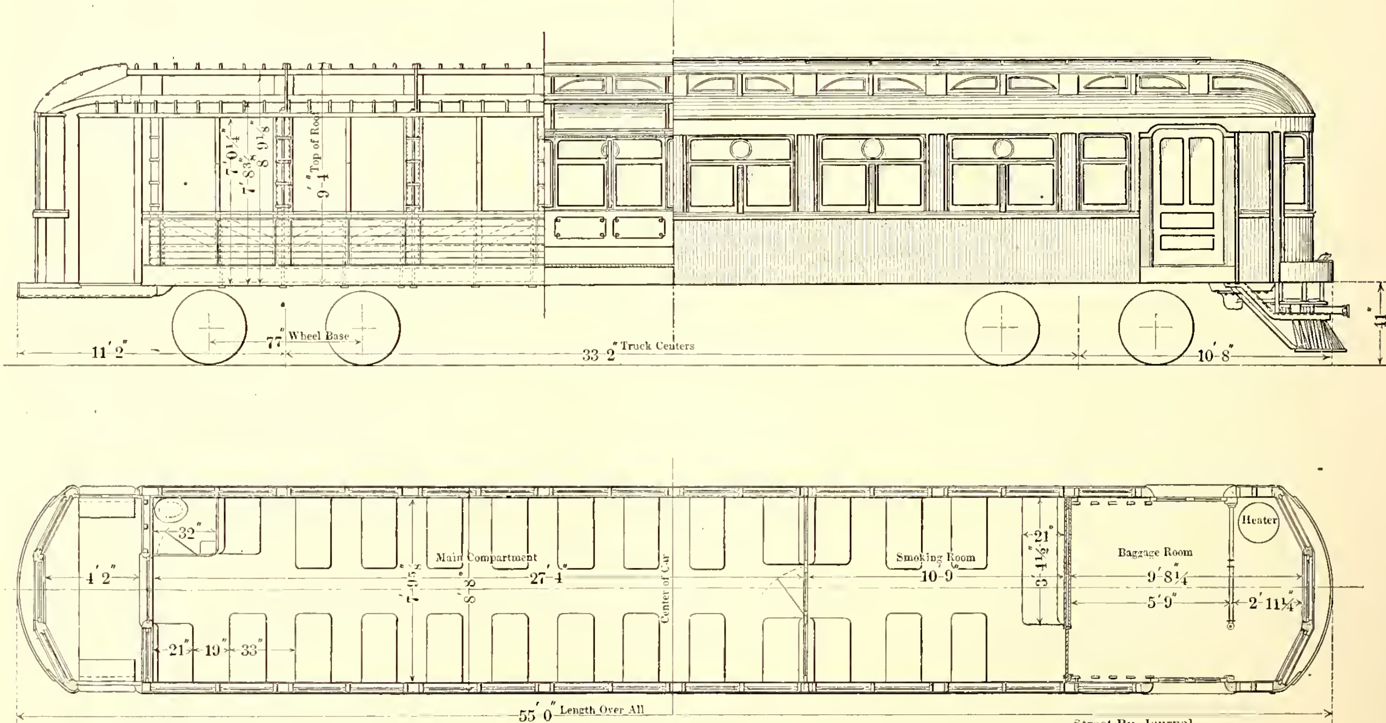
The motor has been designed so that it will operate in any position, even with the shaft vertical, without any change being made in the machine. It is readily adaptable for use open, semi-enclosed or enclosed. The average speed variation is 5 per cent from full load to no load, at any set speed of the controller. This is a particularly important point to be considered when machine tools are equipped with motors for variable-speed duty.

CARS FOR THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY'S SINGLE-PHASE LINE

The framing and dimensions of the ten cars which the St. Louis Car Company is completing for the new single-phase alternating-current railway of the Indianapolis & Cincinnati Traction Company are shown in the accompanying drawings. These cars are among the heaviest ever built for interurban service, the weight complete, including motors and electrical equipment, being 96,760 lbs. Part of this weight is due to a very heavy construction of the car body and trucks, and part to the fact that the car is equipped with alternating-current motors, which are somewhat heavier than d. c. motors of the same capacity, and which also require transforming apparatus on the car. The motor equipment consists of four 75-hp Westinghouse single-phase motors. The Westinghouse electro-pneumatic train-control system is used.

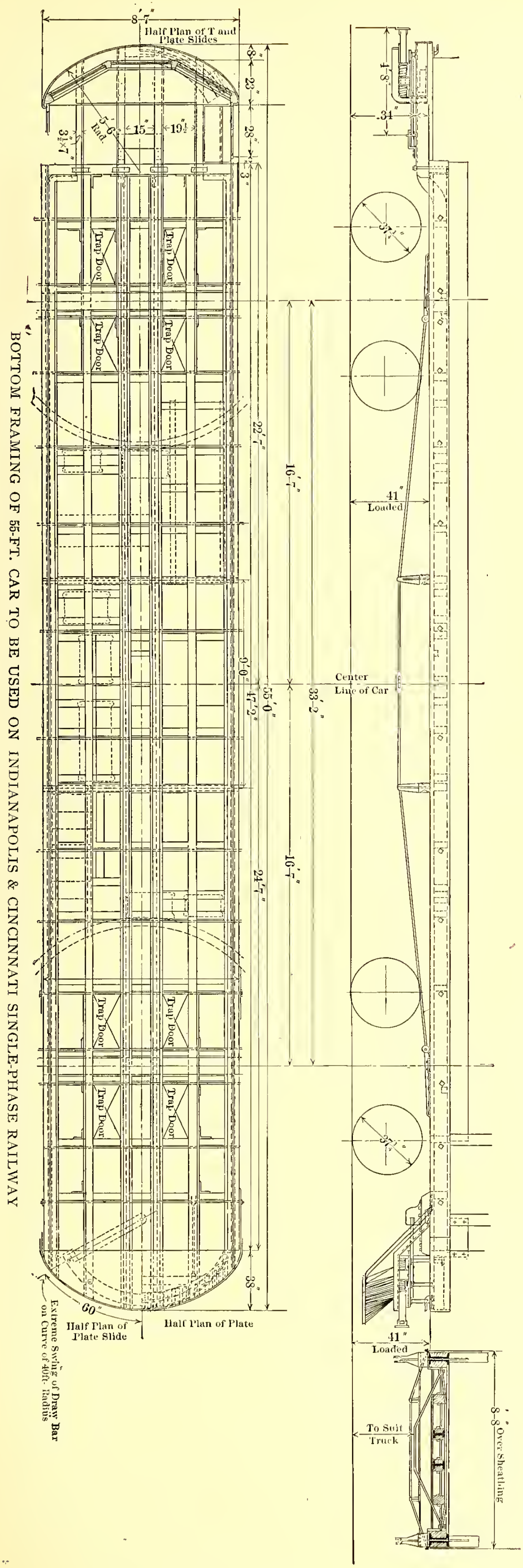
The cars are 55 ft. over all, with a rear platform extending 5 ft. There is no front platform. The motorman occupies the front end of the baggage compartment, with merely a pipe rail to separate his space from the baggage room. The wheel base is 77 ins., the distance between truck centers, 73 ft. 2 ins. The bottom frame is made very heavy. The side sills consist of two 10-in. steel channels, having between them a 20-in. steel plate which extends up into the wall of the car. The side sills are further reinforced with timbers. The other longitudinal sills are wood, reinforced with steel, as shown in the drawings. The cars are plainly but handsomely finished inside in mahogany, with simple inlay lines. Further details of the construction and arrangement can be seen from the drawings.

These cars are to be equipped with the usual form of trolley pole and wheel for use inside the city of Indianapolis, and with a bow, sliding contact trolley for use in the country. The contact surface of the bow is 3 ins. wide, so as to make contact on about 3 lineal ins. of trolley wire.



COMBINATION CAR FOR INDIANAPOLIS & CINCINNATI TRACTION COMPANY

The Schenectady Railway Company will hereafter instruct all new motormen on a skeleton car which was at the St. Louis Exposition as a part of the General Electric exhibit.

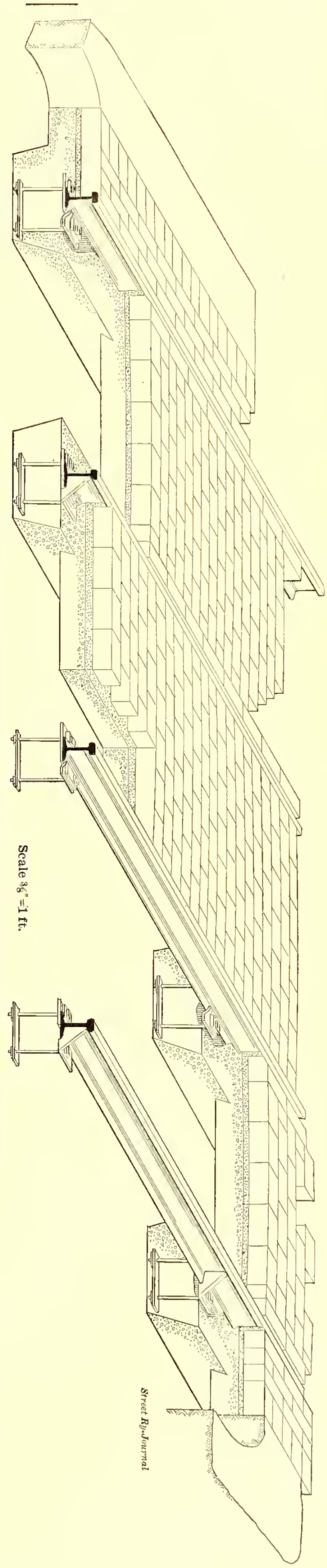


BOTTOM FRAMING OF 55-FT. CAR TO BE USED ON INDIANAPOLIS & CINCINNATI SINGLE-PHASE RAILWAY

THE LATEST CONCRETE BEAM TRACK CONSTRUCTION IN INDIANAPOLIS

The accompanying drawing shows the latest track construction on concrete beams laid by the Indianapolis Traction & Terminal Company. This construction was described in the paper of Thomas B. McMath, civil engineer of that company, which was read before the Indiana Electric Railway Association convention at Indianapolis, Jan. 12, and published in the STREET RAILWAY JOURNAL of Jan. 21. The accompanying drawing was also presented to the convention at that time. This construction is employed on the streets approaching the new interurban terminal station.

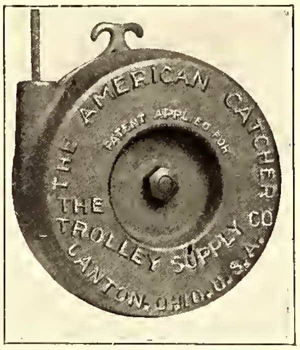
Wooden ties to hold the track to gage are placed every 12 ft. Concrete beams are laid under each rail to support the rail. The peculiarity of this construction lies in the anchor bolts holding the tie plates, which were inserted by Mr. McMath for the purpose of preventing the rails from kicking up under the traffic. This was apparently one of the weak points of previous concrete beam construction. The concrete beams extend about 11 ins. below the base of the rail and are 18 ins. wide at the base. The upper part of each beam is continuous with the paving foundation. The rail used is a 7-in. Shanghai T-rail with an extra wide head.



ISOMETRIC SECTION OF TRACK CONSTRUCTION ON CONCRETE IN INDIANAPOLIS

TROLLEY CATCHER FOR CITY SERVICE

The success of the Knutson trolley catcher and retriever for high-speed railways has led its manufacturers, the Trolley Supply Company, of Canton, Ohio, to bring forward a modified design known as the "American," for city work, which is simpler and lighter than the original type, owing to the absence of the retriever feature. The latter has been removed purposely, as it is not considered a necessity in ordinary city work, because the cars usually can be stopped before much damage is done. The new catcher has but seven parts, which are so disposed that repairs can be quickly made by any employee. It is made entirely of malleable iron, weighs 14 lbs., is 7 ins. wide and 4½ ins. deep. It is fastened upon the car dasher by a bracket, and can be easily interchanged in transferring from one end of the car to the other. Ample reel space has been provided to take care of the slack of the rope. Another good feature is the outlet provided in the bottom of the machine for drainage, which prevents the action of the reel from being stopped by rain, snow or sleet.



TROLLEY CATCHER ADAPTED FOR CITY WORK

CORRUGATED TROLLEY POLE

The trolley pole is so simple a piece of apparatus that the selection of a type best suited for the requirements would appear to be an easy matter compared with making a decision with reference to the adoption of some particular design of motor. Nevertheless, the subject is an important one, for the breaking of a trolley pole frequently results in as serious interruptions to traffic as would be caused by the failure of the more expensive apparatus.

CORRUGATED TROLLEY POLE

The essential qualifications of a good trolley pole, namely, lightness, strength and elasticity, are claimed to be well embodied in the seamless steel, taper drawn, corrugated pole made by Swazey & Smith, of Boston. This pole is made to fit the standard harp and base, and is manufactured in all lengths. It is said to be lighter and stronger than the ordinary weldless tubing, requires less tension in the base spring and will withstand the most severe strains likely to arise. In claiming the superiority of this corrugated tubing over the weldless tubing, the manufacturers of the former refer to a government test on tubes of these materials of the same length, weight, gage and diameter, the testing conditions being exactly the same. It was found that the weldless tubing stood a transverse test of 850 lbs. before giving way, while the corrugated tubing successfully resisted a strain up to 1300 lbs.

In a statement before the railroad committee of the Common Council of Milwaukee, President John I. Beggs, of the Milwaukee Electric Railway & Light Company, said that at present 110,000 commutation tickets are daily given in payment of fare, and that the company has to issue daily from 50,000 to 60,000 transfer tickets.

A TYPICAL HIGH-CLASS CAR USED FOR INTERURBAN SERVICE IN OHIO

As interurban electric railways have grown in importance, their rolling stock has been correspondingly improved, and today there are electrically-operated cars in service whose general construction and finish successfully rival the best coaches that are running on steam lines. This is especially true in Ohio, Indiana and other States of the Central West, where electric railways have reached a high state of development. An excellent type of the cars used in this section of the country is the one shown in the accompanying illustration, which represents a car used on the Akron-Bedford-Cleveland division of the Northern Ohio Traction & Light Company. This car is a product of the Niles Car & Manufacturing Company, of Niles, Ohio, which is now completing five of this type, the cars having been sold to the traction company through J. A. Hanna & Company, of Cleveland, who are the general sales agents for this car building company.

Of course, the illustration gives little conception of the beauty of the interior arrangement of the car, but the view of the exterior alone is sufficient to show its handsome outlines and substantial construction, and without doubt it is one of the finest interurban coaches entering Cleveland. This car is of the single-ender style, is 34 ft. long over the corner posts and has an extreme length of about 44 ft. 10 ins. The width across the sills is 8 ft. 6 ins. It is necessary to carry the cars 3 ins. off center toward the curb in order that they may pass each other on city streets.

The bottom frame is principally of steel, having two 6-in. I-beams in the center sills, 5-in. I-beams in the two intermediate sills and ¾-in. x 7¾-in. steel plates in the side sills. All these sills extend from the rear end sill under the front vestibule to the front buffer. The needle beams are of 7-in. steel I-beams. The cars have beveled edge plate glass throughout and silk-lined "Pantasote" curtains; are finished in solid mahogany with neat inlaid work. The ceilings are full Empire style, covered with green tinted burlap, and are lighted by clusters of electric lights in Holophane globes.

The seats in both compartments are Hale & Kilburn No. 99-EE, high-head roll back, with grip handle and mahogany seat ends, and are upholstered in dark green horse-hide leather. The toilet rooms are fitted with water flush closets, and the deck sash are glazed with leaded cathedral glass.

ONE OF THE HANDSOME INTERURBAN CARS NOW RUNNING ON THE AKRON-BEDFORD-CLEVELAND DIVISION OF THE NORTHERN OHIO TRACTION & LIGHT COMPANY

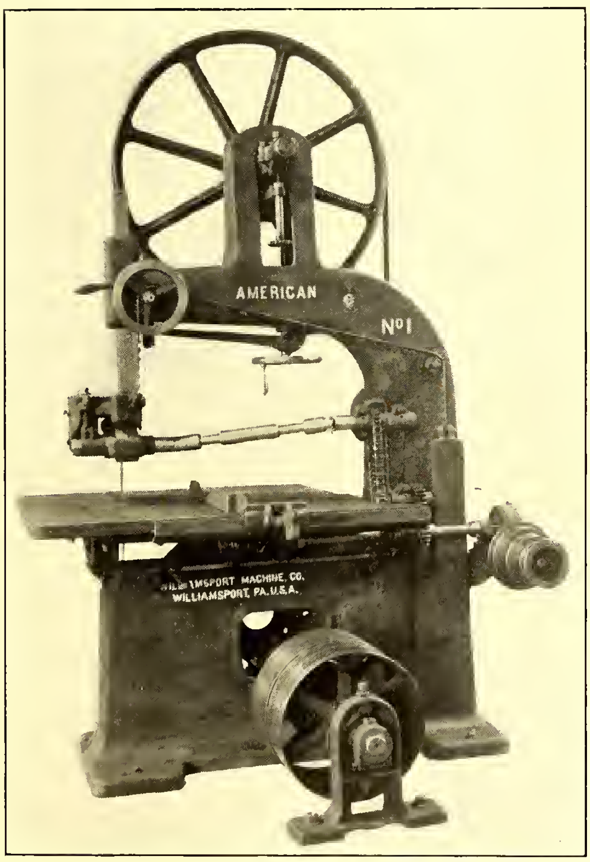
The cars are mounted on Peckham No. 40 A. M. C. B. style trucks, fitted with rolled-steel wheels 34½ ins. diameter, and equipped with General Electric No. 57 motors. The cars are extremely easy riding and comfortable.

Officials of the Lima Electric Railway, Light & Power Company, of Lima, Ohio, a few evenings ago tendered a banquet to the company's employees in recognition of faithful service.

GERMAN STREET AND INTERURBAN RAILWAY ASSOCIATION TO HOLD ITS ANNUAL MEETING NEXT SEPTEMBER

The Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen (Association of German Street and Interurban Railway Managers) has arranged to hold its tenth annual meeting on Sept. 6, 7 and 8, at Frankfort-on-Main. While some of the subjects to be discussed are of purely continental interest, others no doubt will bring out a great deal of information that will prove of equal value to both European and American railways. Last year the Verein decided to have a secretary who would devote all of his time to its interests. This action has greatly extended the usefulness of the Verein, and hence its coming meeting should prove productive of more good than those held under the old method.

After considering the general work of the association during the preceding year, several reports will be presented on matters of general interest to the members. These will include "The Liability of Street Railways," by Dr. Wussow, of Berlin, in connection with which a petition for remedial legislation is to be prepared by the Verein; "Special Rates of Fare on Street Railways" (a continuation of the former report on "The Latest Fundamental Principles for Rates of Fare on Street Railways"), by General Secretary Vellguth, of Berlin; "Finding the Cost of Operating Trail Cars," by the Grosse Berliner Strassenbahn; two reports on the "Reliability, First Cost and Maintenance of Mechanical Brakes for Electric Railways," one (in favor) by Director Scholtes, of Nürnberg, and the other (against) by the Grosse Berliner Strassenbahn; "The



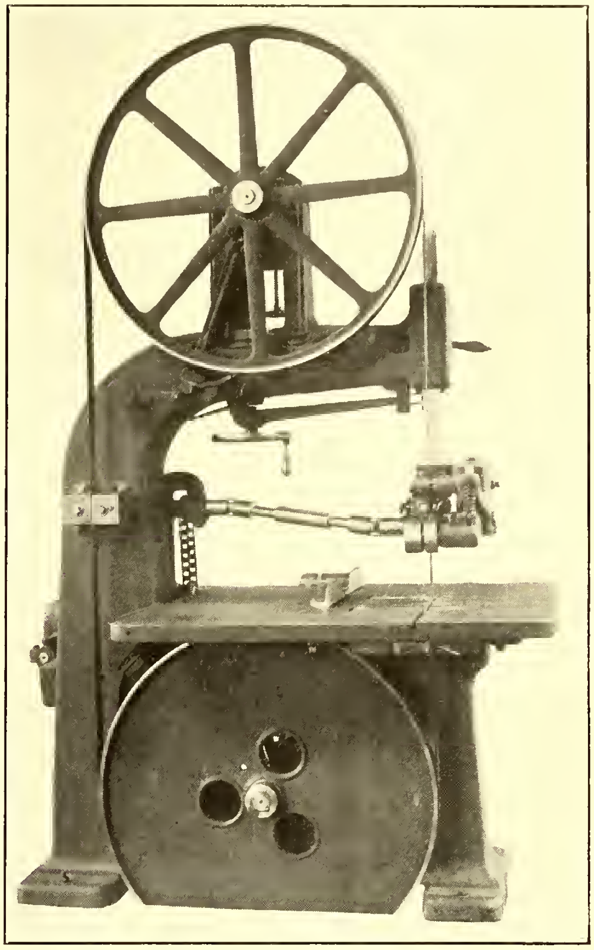
FRONT VIEW OF BAND RIP SAW

Present Knowledge of the Use of Rail-Joints on Electric Railways," by the Grosse Berliner Strassenbahn; "The Acceptance of Railroad Traffic Regulations as a Basis for the Promulgation of Rules for Interurban Railways," by Committee D.

The Verein will also consider the adoption of uniform disciplinary rules and examination systems for inspectors, trainmen, etc., based upon a report to be furnished by Committee D.

A NEW BAND RIP SAW

The No. 1 American band ripper is a new machine recently developed by the American Woodworking Machinery Company, of New York, for general ripping of lumber in all woodworking shops. The main frame is cast hollow with cross struts and heavy foot flanges. The shafts are all steel, extra



REAR VIEW OF BAND RIP SAW

heavy, and run in long boxes lined with babbitt metal. The table is of iron, and is 46 ins. wide x 44 ins. long, is fitted with the company's improved self-locking gage.

The feed is strong and reliable, and consists of three driven rolls, 5 ins. in diameter, and one press roll. The top in-feeding roll and press roll are hung in separate frames so they will yield for variation in thickness of lumber. They are attached to the heavy guide bar, which is indexed to show the height from the table to the bottom of the rolls. The two lower feed rolls in the table are also driven rolls, 5 ins. in diameter. The upper feed rolls are adjusted up and down by a large hand wheel, and these parts are counterbalanced with weight, as shown. The rates of feed are 60 ft., 105 ft. and 150 ft. per minute.

The wheels are 40 ins. in diameter. The lower one is very heavy, with solid center web; the upper one is as light as possible consistent with strength.

The capacity of the saw is 15 ins. vertically and 28 ins. horizontally. The blade is 2½ ins. wide.

L. B. Stillwell, electrical director of the Interborough Rapid Transit Company, controlling the subway and the elevated lines of New York, lectured before the Franklin Institute of Philadelphia on Jan. 18. His subject was "The New York Subway."

THE APPLICATION OF AUTOMATIC SPRINKLERS

The great interest which street railway companies are now taking in automatic sprinkler protection makes opportune a description of the sprinkler system made by the Manufacturers' Automatic Sprinkler Company, of New York City. This system has been installed in a large number of manufacturing establishments, warehouses and other places where valuable material is stored. It was also one of the two systems used during the car house test at Newark, described in the STREET RAILWAY JOURNAL for Jan. 14, and in this test these sprinklers made an excellent showing.

While practically all automatic sprinklers depend for their operation upon the melting of the solder in the sprinkler head by the heat of the fire itself, it does not follow that all are equally reliable in service. Moreover, the efficiency of even the best sprinklers is largely dependent upon the proper design and installation of the piping, dry valve and other features.

The car house equipment advocated by this company consists of the use of a low line of automatic sprinkler heads, level with the tops of the car windows, as described in the Newark car house test, and supplemented by ceiling sprinklers. The principal features of the heads are their non-corrosive

FIGS. 1 AND 2.—SHOWING DETAILS OF SPRINKLER HEADS

quality, duck-bill form of strut and rotary deflector. Figs. 1 and 2, which show the heads five-eighths size, illustrate these three points.

The non-corrosive quality is secured by making all points of contact of either German silver or porcelain. The manufacturer claims that in the use of the duck-bill strut less solder is employed than in any other type, thereby insuring greater sensitiveness. A small coil spring is employed under the porcelain disc, as shown, to unseat the head quickly under small or no pressure, but it has no influence on the solder or sensitiveness of the head. This head is so constructed that it must open even without water pressure as soon as the fusible link is released. The melting point of the link can be made to depend upon the local conditions. When the valve is released the water is distributed to cover approximately 80 sq. ft. of floor space. The deflector is of the rotating type, so as to give good distribution. The set screw cannot be readjusted after the head is in place, thus preventing injury to the fusible joint and loss by water.

The dry-pipe valve is shown in Fig. 3, and is known as Manufacturers' dry-pipe valve. This valve intervening between the outside water supply and inside air system in the sprinkler pipes, makes practical the use of dry-pipe sprinkler systems in property not protected in winter against freezing. The record of this valve in the past ten years and more has been instrumental in convincing all interests that dry-pipe systems controlled by this valve are as reliable as wet-pipe systems.

This valve is purely mechanical in operation, and is not dependent upon springs, diaphragms or weights. The ratio of the air to the water is sufficient to hold the valve closed against any water pressure with only 15 lbs. of air. The levers cannot remain in position unless air is on the system, and the valve can be quickly tested by turning the wheel on the drain valve. An important feature, said to be embodied only in this dry-pipe valve, is the anti-water column, which makes it impossible to column the valve, as the air line from the air cup in the valve is carried to a point above the first floor and into the riser pipe.

By the use of this device the air, to release the leverage system, is drained through the anti-water column fixtures, and

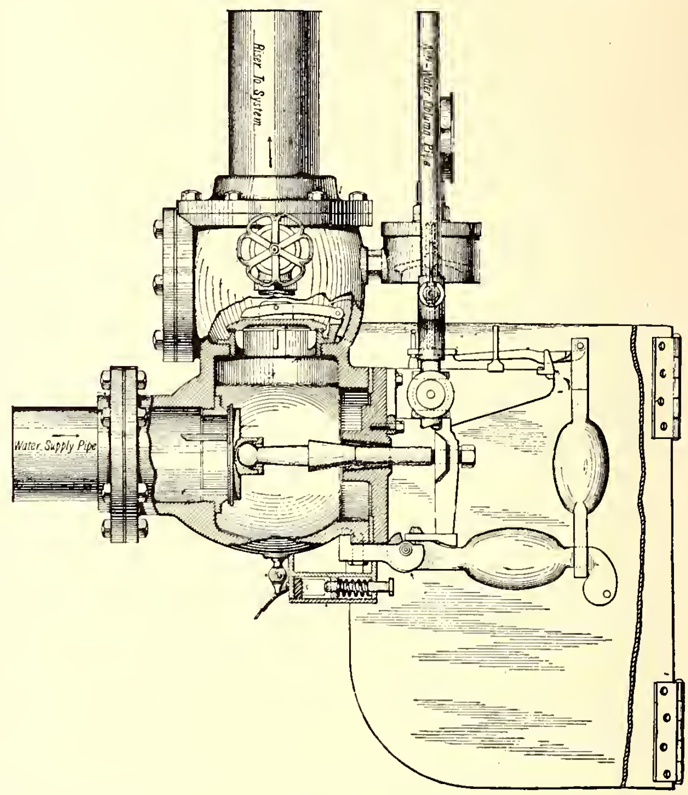


FIG. 3.—DRY-PIPE VALVE PLACED BETWEEN OUTSIDE WATER SUPPLY AND INSIDE AIR SYSTEM OF THE SPRINKLER PIPES

not through the lower riser pipe or air-valve chamber, where drainings from the system used as wet pipe in summer, as is often the case, might accumulate a water supply above the check valve into the system that would seriously interfere with or retard the opening of the valve.

The simplicity of construction allows of the quick resetting of valve after it has been tripped or opened, and no parts require any systematic renewing. A valve shield incases all exterior working parts or levers.

NEW TRACKLESS TROLLEY LINE IN ITALY

The Societa Italiana per Trazione Elettrica Ing., Meriggi, Diaz & Company, of Milan, has been given a contract for the construction of a trackless trolley 'bus line, 16 km (10 miles) in length, between Spezia and Portovenere. Three 'buses will be run. The overhead material is being supplied by the Ohio Brass Company.

A representative of the Post-Office Department in Washington has been investigating the electric railways in Northern and Eastern Indiana, with a view to bringing them into competition with the steam railroads as carriers of the mails. The frequency of the service on the electric lines gives them an advantage over the steam railroads that is not compensated for by anything that the steam roads have to offer.

FINANCIAL INTELLIGENCE

Wall Street, Jan. 25, 1905.

The Money Market

The extraordinary ease which has characterized the money market for some weeks past, continues, and at the present time there is nothing in the situation to warrant the belief that rates will improve appreciably in the near future. About the only factor that is likely to result in the stiffening of interest charges is the existing labor troubles throughout the Russian Empire; but as yet the local market has not in any way reflected the unsettled condition prevailing in that country. Gold exports to France continue on a moderate scale, but as yet the movement has been confined to gold bars, the entire output of the Assay Office having been engaged up to the middle of March. The strength of foreign exchange, however, continues, and indicates an increased demand for gold by Paris bankers, with a view of protecting themselves against any contingency that may arise from the present unsettled state of affairs in Russia. During the week there has been tentative inquiries at the Sub-Treasury for gold coin for export, but according to local bankers, the belief prevails that even should the outward movement of gold assume large proportions, it would be some time before they would be reflected in any material advance in money rates. The receipt of funds from the interior continues on an extremely large scale, which, together with the considerable amounts of funds received from Western institutions, to be placed in the local market, has resulted in a pressure of funds in this market, and which has forced rates to the lowest point attained in several months. Money on call opened at 2½ per cent, but subsequently, on heavy offerings by the large national banks, the rate ran off to 1¾ to 2 per cent, and at the close lenders experienced considerable difficulty in obtaining over 2 per cent. In the time loan department business was practically at a standstill. The demand from stock commission and mercantile sources was extremely light, and borrowers were able to do business on practically their own terms. Sixty-day funds were obtainable at 2½ per cent, while three and four months maturities were offered at 2¾. Five and six months' contracts were made at 3 per cent, the funds being supplied largely by out-of-town institutions. Specialists in mercantile paper reported an increasing demand for prime material, but the supply was light, merchants not being obliged to make much paper in view of the good collections making throughout the country. There was no national change in the discount rates at the principal European centers. At London the rate is 2½ for three months' bills, at Berlin the rate is 2½ per cent, and at Paris 2½ per cent is quoted.

The statement of the associated banks, published last Saturday, was in the main favorable. The feature was the increase in loans of $34,474,700, which was attributed to syndicate operations. The increase in cash of $10,438,300 was larger than generally expected. Deposits increased $44,655,100, while the reserve was $11,163,775 greater than the previous week. The surplus decreased $725,475 to $23,733,800, as compared with $26,072,675 in the corresponding week of last year, $26,414,975 in 1903, $25,332,400 in 1902, $36,799,450 in 1901, and $29,277,975 in 1900.

The Stock Market

Increased activity developed in the stock market this week, but the price movements continued to show considerable irregularity. During the early part of the week the dealings were on a rising scale of activity, and prices generally displayed an advancing tendency. The strength was pronounced in Reading, Union Pacific and the Erie, while in the less active issues New York Central, Omaha, Chicago & Northwestern, Pullman, and many other issues ruled decidedly strong. On Saturday the bank statement failed to impress traders favorably, on account of the enormous figures of loans and deposits, and the selling by them ended in a severe reaction in prices in all quarters of the market. The developments at St. Petersburg over Sunday was a matter of great concern, and the market ruled weak under its influence. At the close there was a decided improvement in the foreign markets, London being liberal buyers of American securities, but the local market continued weak and unsettled. A feature of the week was the activity and strength in the bond department, which was attributed directly to the extraordinary ease in the local money market. The absorption of high-class stocks and bonds, by investors, has continued throughout the week, and at the close an urgent demand exists for all high-grade issues. Trading in the local traction issues were fairly active, but prices moved in sympathy with the rest of the market. Brooklyn Rapid Transit was decidedly weak, the price declining 3¼ points net, to 60¼, and closing at the lowest. The weakness in this stock was attributed to reports that the road was in a poor condition, which would necessitate the expenditure of large sums, and to the rumors of another issue of bonds. The latter report was, however, denied. Manhattan was strong and ended the week with a small gain, while the net changes in Metropolitan Street Railway and Metropolitan Securities were limited to ½ and ¾, respectively.

Philadelphia

Considerable activity developed in the local traction stocks this week, and prices generally displayed decided strength. Interest centered largely in Philadelphia Rapid Transit, which established a new high record price on extremely heavy transactions. Initial transactions were made at an advance of ¾ at 19½, from which the price advanced steadily to 25¾, with a subsequent reaction on profit-taking to 24⅞. There was no need to explain the sharp rise in this stock. It was said, however, that New York interests continue to accumulate the stock, in view of the listing of the stock upon the New York Stock Exchange. It is understood that as soon as the engraved certificates of stock are completed the application to list the same will be accepted. About 20,000 shares of the stock were dealt in. Another noteworthy feature was Consolidated Traction of New Jersey, which also established a new high record. From 81½, at the opening, the price advanced to 83½, and closed at the highest, or 3 points above the closing figure of a week ago. Philadelphia Traction was strong at 100, but the amount of stock traded in was very small. Union Traction was firm at 58⅞ to 59. Philadelphia Company declined ⅞ to 41⅛ on limited dealings, but the preferred remained unchanged at 47. United Gas & Improvement opened strong at 109¼, but subsequently the price ran off to 108⅛, where it closed.

Chicago

There have been no important developments in the traction situation this week. The franchise question is still a matter of much discussion in the council, and the prospect of a satisfactory settlement is remote. At the last meeting of the Council over forty amendments to the tentative ordinance were offered, and were finally sent back to the local transportation committee for revision. The representatives of the syndicate now seeking control of the Chicago City Company are to be asked to participate in the reconstruction of the ordinance so as to make it apply to the entire city. Public hearings will be given on the amendments, which include an extension of the transfer system, remove tracks from Michigan Avenue, and a revision of ambiguous provisions.

Although no official announcement has yet been made, it is understood that the syndicate has secured sufficient City Railroad stock at $200 a share to carry control. It is said that service of the largest individual holders of the company's stock have already deposited their stock under the syndicate's agreement.

Trading in the traction stocks has been devoid of feature during the week. Dealings have been extremely small, and price fluctuations have been confined to a narrow range. Chicago City Railway sold at 196, or 1¾ points below last week's closing, but the amount of stock involved was only 125 shares. Chicago Union Traction was steady at 11, West Chicago lost a point to 60, while North Chicago held steady around 83. The elevated railway stocks were extremely quiet. Metropolitan sold at 20, and the preferred at 61 and 60. Northwestern brought 24½ for a small amount, while the preferred changed hands at 64. The bond market was also quiet and without noteworthy feature. The week's transactions included $20,000 North Chicago 5s at 100. West Chicago Consols at 88, $1,000 Northwestern Elevated 4s at 94½, and $2,000 Metropolitan Elevated extension 4s at 86.

Other Traction Securities

In the Baltimore market the dealings in traction stocks were confined almost exclusively to the United Railway issues, all of which were strong. The stock changed hands to the extent of several hundred shares at 13¼ to 13¾, an advance of ⅝. The 4 per cent bonds sold from 93 to 93¼, a gain of ½, while the incomes brought 50⅝ and 51. Norfolk Railway & Light 5s were in good demand, $24,000 selling at 95, an advance of 1⅞ points.

Macon Railway & Light 5s advanced from 94½ to 96. At Boston the traction stocks were practically neglected, but such transactions as were made were at somewhat higher prices. Boston Elevated fluctuated between 157 and 158, the final sale being made at the higher price. Massachusetts Electric advanced 1½ points to 15½, but subsequently reacted to 15, while the preferred rose from 59½ to 61, the closing transaction taking place at 60. West End common held firm at 96, while the preferred stock changed hands at 114¼ to 114, a gain of a full point. Interborough Rapid Transit has been the principal feature on the New York curb, both on account of activity and erratic price movements. During the early part of the week trading in it was extremely quiet, but toward the close the transaction assumed enormous proportions, while the price fluctuated wildly. From 186, at the opening, the price advanced rapidly to 202⅜, from which there was a reaction to 194. Subsequently, there was another upward movement which carried the stock back to 200, but at the close there was a decline to 187¾, on account of reports of dissatisfaction on the part of the company's employees. New Orleans Railway was fairly active and weak, about 1000 shares changing hands at from 4⅝ down to 3¾.

Cincinnati, Dayton & Toledo stock continues in strong demand at Cincinnati. About 2000 shares changed hands at the uniform price of 24. Ten thousand dollars' worth of the 5s of this company sold at 86 to 87. Several lots of the old Southern Ohio 5 per cent bonds sold at 96½. Cincinnati Street Railway was inactive at 144½. Cincinnati, Newport & Covington preferred advanced to 91½ on several sales, and the common sold at 31½ to 32. Several large blocks of Indianapolis Street Railway 4s sold at 87, while thirty thousand dollars' worth of Columbus Railway 4s sold at 92; the preferred stock of this company sold at 108¾.

Cincinnati, Dayton & Toledo stock also featured in Cleveland selling at 23½ to 23⅞, a shade lower than in Cincinnati. Cleveland Electric sold at 79½ and 80 on moderate sellings; it dropped back slightly, the first of the week, on indications that the 3-cent fare test would not solve the franchise problem in Cleveland. Muncie, Hartford & Fort Wayne made a new high mark of 41½. Northern Texas continues strong at 45. Northern Ohio declined slightly to 19. There is a steady demand for Western Ohio receipts at 12½, with but little coming out. Several blocks of Northern Texas 5 per cent bonds at 90 to 90½. The underlying issues of the Cincinnati, Dayton & Toledo bonds were in strong demand.

Security Quotations

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

	Jan. 18	Jan. 25
American Railways	48	48
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	157½	157
Brooklyn Rapid Transit	63¾	60⅛
Chicago City	193	195
Chicago Union Traction (common)	11	a12
Chicago Union Traction (preferred)	45	a48
Cleveland Electric	a79	—
Consolidated Traction of New Jersey	80½	83¼
Consolidated Traction of New Jersey 5s	108½	109
Detroit United	77½	75½
Interborough Rapid Transit	187	197
Lake Street Elevated	—	—
Manhattan Railway	169¼	169½
Massachusetts Electric Cos. (common)	13⅝	15
Massachusetts Electric Cos. (preferred)	59½	60
Metropolitan Elevated, Chicago (common)	20½	20¼
Metropolitan Elevated, Chicago (preferred)	60	60
Metropolitan Street	116⅞	116½
Metropolitan Securities	76¾	76¼
New Orleans Railways (common)	4	3¼
New Orleans Railways (preferred)	14	14
New Orleans Railways, 4½s	76	74
North American	100½	98
Northern Ohio Traction & Light	—	—
Philadelphia Company (common)	41¾	41
Philadelphia Rapid Transit	19½	25
Philadelphia Traction	99¾	99¾
South Side Elevated (Chicago)	—	94½
Third Avenue	127	125
Twin City, Minneapolis (common)	106¼	105
Union Traction (Philadelphia)	58¾	58¾
West End (common)	95½	96
West End (preferred)	113	114

a Asked.

Iron and Steel

The "Iron Age" says that the purchase by Cambria Steel of 40,000 tons of basic Bessemer pig at $15.50 is regarded as significant, and was followed by further purchases from other sources of 20,000 to 25,000 tons. In the Pittsburg market, most sellers are now asking $16.

In the steel markets there is a good deal of pressure for material, and it is only lately that a leading interest declined to consider altogether one contract for 25,000 tons.

New England was the principal buyer of rails during the past week. In the East the Baltimore & Ohio and in the West the Rock Island are in the market.

Ninety thousand tons of railroad bridge work is imminent, of which one-half will be placed in the next three months, and 500,000 to 600,000 tons of building work are on architects' boards. Reports from the whole line of lighter finished material continue exceedingly encouraging.

A REPORT ON THE PHILADELPHIA RAPID TRANSIT

Chandler Bros. & Company, bankers and brokers, of Philadelphia, have recently issued in pamphlet form an extended report and statistical analysis of the financial condition of the Philadelphia Rapid Transit Company, of that city. Figures are given of the earnings of the street railway systems in Philadelphia for a number of years back, with passengers carried, gross and net earnings, underlying properties, etc. There is also a table of quotations of the high and low for the last five years of all of the principal Philadelphia securities.

INDIANA SINGLE-PHASE LINE OPENED

The Indiana & Cincinnati Traction Company's single-phase line was opened for traffic between Rushville and Morristown, 16 miles distant, on Saturday, Jan. 21, on a regular 2-hour schedule. The line from Morristown to Indianapolis is expected to be completed in a few weeks. Cars will then be run to the interurban terminal station in Indianapolis.

ANNUAL REPORT OF THE BRITISH THOMSON-HOUSTON COMPANY

The annual meeting of the British Thomson-Houston Company was held in London, Dec. 15. The profit and loss account for the year ending March 31, 1904, showed net earnings, after charging off selling charges, etc., of £182,570. From this amount £20,000 was written off for suspense account and £23,810 for depreciation, good will and patents, leaving a balance of £11,903, which was carried forward to next year. The report states that the works at Rugby have been completed, and mentions the condition of several recent contracts taken by the company.

A. I. E. E. ANNUAL DINNER

The preparations for the Annual Dinner of the American Institute of Electrical Engineers are being pushed actively, and the affair promises to be a great success. It will be devoted, as already announced, to signalizing the triumphs of electric traction. President Lieb has appointed the following committee, which is already at work: Messrs. T. C. Martin, chairman; W. C. Gotshall, L. B. Stillwell, H. G. Stott, Calvin W. Rice, F. C. Bates, H. W. Blake, P. G. Gossler, E. B. Katte, C. W. Price, W. A. Pearson and W. L. Conwell. This committee has organized, and subcommittees are at work on different features of the banquet. Some original and novel features will be included, and it is believed that the oratory will be unusually interesting. Frank J. Sprague and Leo Daft are to speak for the Institute pioneers in this great field of electrical development. The banquet will be held in the grand ball-room of the Waldorf-Astoria, on Feb. 8, and it is expected that between 400 and 500 will be present, including many ladies. Tickets are $5 each, exclusive of wine. It may be mentioned that in addition to the features connected with the dinner itself, there will be exhibited, for the first time, the beautiful oil painting just presented by the British Institution of Electrical Engineers, as a souvenir of last year's visit, to the Institute, representing Dr. Gilbert making magnetic experiments before Queen Elizabeth. The bust of Prof. Ferraris, also presented to the Institution last year, will be exhibited in the Astor Gallery reception room.

A NEW LINE OUT OF CHICAGO

Cornelius J. Ton, secretary of the South Side Suburban Railway Company, of Chicago, says the construction of the company's proposed line from Chicago to Chicago Heights and Hammond, Ind., will be begun about April 1. The system will call for the construction of 41 miles of standard-gage track; part to be equipped with the overhead trolley, and part with the third-rail system. About twenty-two cars will be used. The power station will be built at Calumet River and Wentworth Avenue. Here, also, will be located the repair shops. At Hammond, the terminus of the road, connection will be made with a proposed line building in Indiana. At Thornton Park, through which the new line will pass, an amusement resort will be laid out. The officers of the company are: C. C. Heisen, president; S. A. Foster, vice-president; Cornelius J. Ton, secretary and general manager; C. L. Taylor, auditor; W. D. Ball, electrical engineer; S B. Spencer, engineer of power station. The office of the company is at 1325 First National Bank Building, Chicago.

RECOMMENDATIONS FOR IMPROVEMENTS IN BROOKLYN—WHAT HAS BEEN DONE THERE

Recommendations to be made to the Brooklyn Rapid Transit Company by the Railroad Commissioners for the improvement of its service will call for the expenditure by the company within the next three years of $20,000,000. This has been decided upon by the commisioners as a result of a report to be made by Commissioner Baker of the board. He will recommend that the sum of $8,500,000 be spent within a year; that $5,000,000 be spent within the following year, and that the balance be spent within the third year. Among the things that it is known will be specifically recommended are the purchase of 200 surface cars, 100 elevated coaches, and the investment of $2,300,000 in increasing power facilities.

Of what the company has done in the way of betterments since the preent management assumed charge of the property, readers of the Street Railway Journal are familiar through the many articles that have been printed about work that has been of general interest. To some of the plans of the company for the future, detail reference has also been made in these columns. The statement that $4,800,000 was spent in betterments last year conveys better than any generalities the magnitude of the work done in a twelve-month. Of this sum, $4,000,000 came from bond issues and $800,000 from earnings, which was divided among the following improvements: For new tracks and terminals, $800,000; for the central power station on Third Avenue, $740,000; for the Williamsburg power house, $235,000; for new cars, both surface and elevated, $1,500,000; for rebuilding cars, both surface and elevated, $1,500,000; for new sub-stations, $160,000; for building underground conduits for carrying the feeder wires, $420,000; for rebuilding old track, $80,000, and for track improvements, such as bonding of rails by electrically welding the joints, $332,000.

Best of all, perhaps, the effort of the management to mitigate abnormal conditions is generally recognized. There is kindly toleration by the public of a service that in some cases will not permit of improvement until a number of municipal betterments shall have been made, and a tendency is shown by the public willingly to co-operate with the company in adjusting itself to changes that are made for the benefit of the majority. The efforts of the company have also met with fitting acknowledgement by the daily press. "The Brooklyn Daily Eagle," in a recent laudatory editorial on what has been done for the improvement of the service, says:

"The company has made large expenditures for improvements, as Mr. Baker shows, and other large projects are under way, but the traffic grows faster than the company is able to keep up, just as the school population grows faster than the board of education is able to build school houses. During this last November, 150,000 more passengers were carried than in the November previous, and the heaviest day's traffic last year, 1,167,000 passengers, was 67,000 larger than on the heaviest day of the year before. * * * But the figures explain the difficulty of the problem. They show that these conditions are not the choice of the Rapid Transit Company, but its misfortune, and they show that an expenditure and an energy which would make the service of a city like Boston or Baltimore palatial in its comfort is simply swamped by the increasing crowds of Brooklyn. * * * If President Winter could draw unlimited checks on the treasury of the United States he could not alter a good many of the conditions which hamper the service here. He could not make the Brooklyn Bridge carry more surface riders than it is carrying, and he could increase the capacity of the elevated trains which cross the bridge but slightly. Neither could he get more cars between Fatbush Avenue and the bridge, at least until Livingston Street has been widened."

NEW YORK CENTRAL AND NEW HAVEN BUY MORE ELECTRICS

Reports are confirmed of the purchase by the New York Central Railroad interests of the Schenectady Railway, and of the purchase by the Consolidated Railway Company, acting for the New York, New Haven & Hartford Railroad, of the Berkshire Street Railway in Massachusetts.

The purchase of the Schenectady system by the New York Central adds another to the already formidable properties in New York State controlled by that company, and in fact seems to be the welding of another link in what is fast assuming the shape of a chain of lines between Albany and Buffalo. The property was controlled by the General Electric Company. It comprises the city lines in Schenectady; a double-track line between Schenectady and Albany, a distance of 12 miles; a double-track line to Troy, about 12 miles, and a suburban line to Ballston, which it is planned to extend to Syracuse. The local system in Syracuse is owned by the Central, and as the company plans to operate by electricity to the west of Syracuse on its Auburn branch, the line is complete to Rochester. The financial consideration is not even intimated.

By its purchase of the Berkshire Street Railway the New Haven has come into the possession of 42 miles of line operated in and between Pittsfield and Great Barrington, Mass. Control of the property was secured through the purchase of a majority of Berkshire stock, for which, so an unofficial source says, payment will be made, in bonds bearing 3 per cent. per annum for a number of years, and later 3½ per cent. It is also said that negotiations are being conducted by the Consolidated Company for the purehase of the principal street railways in the Connecticut River Valley including the Springfield, Holyoke, Northampton, the Hartford & Springfield Companies, and possibly the Greenfield, Deerfield & Northampton Street Railway.

AUGUST BELMONT ON TRANSPORTATION PROBLEMS IN CHICAGO

August Belmont was the principal speaker at the annual banquet of the Chicago Real Estate Board at the Auditorium Hotel on Thursday, Jan. 19. Mr. Belmont's subject was on "Subways: What to Do and How to Get Them." Mr. Belmont's remarks were, of course, more particularly on municipal transportation facilities in their relation to a subway system. After calling attention to the New York subway, which was constructed by the city of New York and leased to an operating company for fifty years, with a renewal period of twenty-five years, he said:

"In my opinion, under right conditions, not only are there no fundamental objections, but, on the contrary, there are distinct advantages to a city in going beyond what are considered to be strictly its governmental functions and acquiring and continuing to hold the title to a transportation system, whether by land or water; perhaps even to other quasi public enterprises. Yet if associated with municipal ownership there is municipal operation of these properties, then I think the justifiable line of municipal activity has been overstepped.

"The great danger in the present situation in Chicago is that in seeking relief from present conditions, something permanent and enduring, and yet absolutely undesirable, may be determined upon. On such occasions, it is well for us all to be on our guard against the adoption or even the serious consideration of many inchoate ill-digested schemes which bring about merely change, but not improvement. The change should be as desirable as it is to be enduring.

"The results which foreign cities have accomplished in the matter of operation of so-called public utility corporations are not of such character as to stimulate their duplication in this country. Municipal operation has, in the main, according to the view of Robert P. Porter, the economist, been an unsuccessful municipal speculation, whether the experiment has taken plaee in England or Australia, or even in the United States."

Mr. Belmont suggested that all litigation and controversy over the street railway franchises in Chicago be suspended and the companies be permitted to develop and rehabilitate their properties so as to meet the public need; that if the operation was not up to the prescribed standard, the city have the right to take the properties at a figure fixed by arbitration, and after the payment of the money be permitted to enter upon the operation itself or to select a new private occupant. If this 'compromise' did not work out favorable results, Mr. Belmont said Chicago would be free to undertake the venture of municipal ownership, with its financial and civic responsibility.

POWER IMPROVEMENTS IN MONTREAL

The Montreal Street Railway has arranged for the expenditure of $500,000 during 1905 in securing and distributing additional power and making improvements over the system.

An important project which will greatly improve the company's power facilities calls for the erection of three sub-power stations at different terminals of the system. The capacity of each sub-station will be 1000 hp. One of the stations will be located on Glen Avenue near Notre Dame Street, opposite the St. Henri car houses and will supply the western sections of the system; a second station will be located at the corner of St. Denis and Comte Avenue, immediately north of the company car house above the C. P. R. Railway track on St. Denis Street, and will supply lines in the northern sections of the city, and the third station will adjoin the large power station of the Shawinigan Water Power Company at Hochelaga, and will supply the lines in the east end of the city. The central station will then be used only for the lines in the center of the city.

The sub-power stations in the west and north ends of the city will be supplied by a direct line from the Shawinigan power station at Hochelaga.

The company, it is announced, has concluded arrangements for the purchase of twenty acres of land north of the car houses on St. Denis Street. The land would enable the company to extend its system of houses when the requirements demand it.

RIGHT OF WAY RULING IN PENNSYLVANIA

The Supreme Court has sustained the decision of the Potter County Court in an important ruling affecting railway options and rights of way; the case being that of J. D. Newton vs. the Goodyear Construction Company, of Buffalo, N. Y. About 15 years ago George Dillinger and J. D. Newton surveyed and located a line in Potter County under an old charter, Mr. Newton having taken options on the lands along the line in his own name. About three years ago Mr. Dillinger sold his maps, surveys, etc., to the Goodyears. Mr. Newton also agreed to sell his options, but failed to turn them over, subsequently attempting to sell them to an electric railway syndicate. The Goodyears began grading, when Mr. Newton enjoined them, and the court sustained the old survey and decided that "the options without the survey, on which the land ownars agreed and did assign the right to use, were worthless, and there was an implied understanding that the land to be used was that land which the survey located, and no other. It follows, therefore, that to take right of way options without locating a survey cannot be used subsequently, and are worthless, as the survey and location is the only thing to hold the right of way therein described. The Supreme Court held to the same view, deciding that "all options for lands must be confined to the location and survey made at the time, and to no others."

CHICAGO TRACTION MATTERS

The most important development in Chicago traction affairs the past week was the drafting of an ordinance by the local transportation committee of the Chicago City Council to cover an extension of the franchises of the Chicago Union Traction Company. This measure is drawn up along the same lines as the ordinance proposed for the Chicago City Railway Company. The principal features of this proposed ordinance are summed up by the "Chicago Tribune" as follows:

City grants Traction Company a franchise to operate for twenty years for compensation of 5 per cent of gross receipts for first thirteen years and 10 per cent for remainder of the period, reserving the right to commute either percentage into a reduction of fares at any time.

Company is to reconstruct at once the antiquated portion of its equipment and establish a first-class service.

Motive power on all lines shall be electricity—underground trolley within territory bounded by Chicago Avenue, Halsted and Twelfth Streets, and overhead trolley outside of that area.

Company is required to give continuous passage for a 5-cent fare from any point on its lines to any other point within present or future boundaries of city, and is to exchange transfers with City Railway and any other line in city limits.

City may purchase property of company at any time after expiration of thirteenth year of the grant at fair cash value, to be appraised by stated authorities.

Company is to pave certain streets of its right of way and keep in repair all such pavements and remove snow and refuse, sprinkle and otherwise care for streets in which it operates.

Company may be required to operate its cars through proposed downtown subway.

It is reported that Chicago City Railway stockholders are responding well to the offer of the recently formed consolidation syndicate to buy City Railroad stock at $200 per share.

TERRE HAUTE POWER HOUSE BURNED

The power plant of the Terre Haute Traction & Power Company, of Terre Haute, Ind., was partially destroyed by fire on Friday, Jan. 20. The conflagration started in the boiler room, and swept through the plant with great rapidity, doing serious damage to the engines and dynamos before the flames were gotten under control. The lighting service of the city is temporarily crippled, and horse cars had to be resorted to for transportation. The company has a new plant under construction in the city, and the part of this equipment now ready for use will be pressed into service at once to afford relief. The property loss to the burned plant is variously estimated from $100,000 to $150,000. This loss, however, is inconsiderable when compared with the loss that must necessarily result from the partial paralysis of the company's service that the fire has caused.

INTERBOROUGH EMPLOYEES HAVE GRIEVANCE

Committees representing the Brotherhood of Locomotive Engineers, the Brotherhood of Locomotive Firemen and the Amalgamated Association of Street Electric Railway Employees of the Interborough Rapid Transit Company, including the elevated and subway divisions, declaring that the terms of agreement made last summer and entered into between them and the Interborough officials had been absolutely violated in every particular, held a meeting Tuesday, Jan. 24, as a result of which a communication will be presented to the Interborough officials, demanding redress for what the men claim are violations of the working agreement between the company and the men. They ask that the automatic stop now in use to safeguard express trains from collision be installed on the local tracks. They also contend that the men are compelled to work overtime in violation of the term of the contract governing hours of service.

BOSTON Y. M. C. A. ESTABLISHES EVENING CLASSES IN APPLIED ELECTRICITY.

For several years the Boston Young Men's Christian Association has conducted one of the most extensive and highly developed evening schools in the United States. It has now established a school to teach the theoretical and practical application of electricity in such a comprehensive, yet thoroughly educational manner, as to be within the grasp of the average man, to eliminate non-essentials, and both in the lectures and laboratory work to use simple and intelligible language, to avoid extreme technicalities and mathematics, and to illustrate the points presented with the actual object under discussion.

The association has secured accommodations in the Park Square Automobile Station on Columbus Avenue. Here a lecture hall has been constructed with accommodations for over one hundred students, office of the superintendent, coat room and large laboratory. The laboratory has been furnished with an equipment illustrating the various subjects included in the school programme.

The association has been most fortunate in securing as the head of this school Professor William L. Puffer, of the Massachusetts Institute of Technology. Professor Puffer is a man of broad technical training and experience, a member of the American Institute of Electrical Engineers since 1893, consulting electrical engineer for the Associated Factory Mutual Fire Insurance Companies since 1893, electrical adviser at the annual meeting of the Underwriters' National Electric Association, lecturer in the course of practical electricity under the auspices of the Lowell Institute for the past sixteen years. Professor Puffer brings to this work every quality essential to the successful conduct of such an enterprise, and students may go to him for advice with assurance of careful personal attention. The instructing staff has been selected with great care from men who are eminently qualified to instruct in the special branches of electricity which have been assigned to them.

The first term of the school was opened on Jan. 10, 1905. The work of this year will consist of a lecture course of eight weeks, on Tuesday and Thursday evenings from 7:30 to 9, a recitation on Friday evenings from 7:30 to 9, and laboratory course as outlined below. The laboratory course will open upon the conclusion of the lecture course, and will extend well into the spring months, requiring two evenings per week, Monday and Thursday or Tuesday and Friday, from 7:30 to 9:30. The instruction will be planned to supplement the work of the lecture course and to familiarize the student with methods of using various kinds of instruments in the making of tests.

MIAMI & ERIE CANAL SENSATION

Sensational charges have been made against the promoters of the Miami & Erie Canal Transportation Company in a suit and answer in cross petition filed last week by T. H. Johnson, of Cleveland, who asked that the court compel the original canal syndicate to pay back to the company the original securities amounting to approximately $3,000,000 par value. Mr. Johnson alleges that he is the holder of stock and bonds of the company, and his answer is in reply to a suit brought by the Cleveland Construction Company to enforce the stockholders liability. Mr. Johnson also alleges that the original distribution of the securities was illegal. His suit amounts to an effort to compel the original syndicate of bankers who floated the company and made the allotment to the subscribers of the underwriting to return the securities to the company. The specific allegation upon which his suit is based is his statement that certain of these securities were given to subscribers without due cash consideration therefore. The defendants named in the Johnson suit are among the best known bankers and traction promoters in Cleveland. The result of this petition, if granted, would be to reopen the entire Miami & Erie case, which was thought to have been settled when the reorganization committee recently announced that it had acquired all the outstanding claims against the company.

STEPHENSON PLANT CHANGES HANDS

As announced in the last issue, the large car and truck plant of the John Stephenson Company, at Elizabeth, N. J., was purchased last week by parties connected with the J. G. Brill Company, of Philadelphia, who have organized a new company under the old name with the following officers: W. H. Heulings, Jr., president; Samuel M. Curwen, vice-president; James Rawle, treasurer, and J. G. Root, secretary and assistant treasurer. Peter M. Kling, who was general manager of the old company, is retained in the same capacity. The sale of the Stephenson Company is one of the most important transactions which has occurred for a long time in street railway manufacturing circles. The recent taking over of the American Car Company and the G. C. Kuhlman Car Company by people interested in the Philadelphia concern, has given rise to a report that a consolidation of all the car building interests is about to take place, and that there will be an alliance with British manufacturers. Acccording to the best authorities, however, there is no foundation for such a report; the purpose of purchasing these plants is simply to reduce freight rates and afford facilities for an ever-increasing business. The American Car Company, the G. C. Kuhlman Car Company, and the Stephenson Company each has a distinct organization, and aside from being licensee of the patented cars and trucks and specialties of the J. G. Brill Company has no other connection therewith, and does not confine its business to any especial territory.

The Stephenson plant at Elizabeth is of a comparatively recent date, having been completed about five years ago. It is situated on 90 acres of ground in the southern outskirts of the city, and has excellent shipping facilities on account of the proximity of two trunk railroads with which the plant is connected. The shops are large and well lighted, and the arrangements for handling cars are of the best. A fine power house supplies the current for the machinery, which is all electrically-driven, and the electric cables between the power house and the various buildings extend through tunnels. The plant is well stocked with material, and the work on the orders in hand is being continued without interruption.

The John Stephenson Company is the oldest concern in the car business. Its founder was the designer and builder of the first street car, which had the appearance of three stage coaches joined together, and was mounted on a pair of wheels at either end and drawn by a pair of horses. This car was built in 1831, and operated in New York City. Before his death, in 1893, John Stephenson had developed an immense business in all parts of the world. The plant was formerly located in New York City at Twenty-Sixth Street, between Fourth and Fifth Avenues, and the business had reached such a magnitude a few years after the death of Mr. Stephenson that it became necessary to seek larger quarters. The company has been very successful in its new plant, and among important orders recently executed were cars for the New York Subway, and cars of a convertible type put in use last season on the Brooklyn Elevated Railroad. It has a reputation for building fine interurban cars, and a notable exhibit at the St. Louis Exposition was one by the company, of the largest electric car ever built, which was mounted on the first six-wheeled trucks made for electric service. The officers of the new company are all men who are widely known in the railway world.

THE BROOKLYN TUNNEL HEARING

The hearing by the New York Rapid Transit Commission on the recommendations of Engineer Parsons for the construction of subway lines to Brooklyn was continued last week. The session was given over entirely to the consideration of the claims advanced by interests in the eastern district of Brooklyn, which territory would not benefit by the building of the tunnels along the lines recommended by Mr. Parsons. In building to Brooklyn there is much more to be considered than the building of lines north and south. Interests in several sections will have to be pacified by the route that is finally decided upon. The claim of the eastern district interests is unquestionably sincere, but it seems to fall equally as far from being ideal as some of the other proposals made to the commission. The route proposed by the eastern district interests would be a part of the East Side subway, in New York, making a continuous route from the Bronx to Jamaica. It would run from Union Square, under Fourteenth Street, across the East River to North Seventh Street, Brooklyn; through Union Avenue to Broadway, through Broadway to Jamaica Avenue, and on to Jamaica. It would be about thirteen and a half miles long. The contention that this line would relieve congestion on both the Brooklyn Bridge and the Williamsburg Bridge is well taken, but the part of the city now suffering most from congestion—that near the City Hall—is entirely ignored in the recommendations. A hearing is being held as the Street Railway Journal goes to press on an alternative subway proposal advanced by still another faction in Brooklyn.

WATSON MACHINE COMPANY TO BUILD CONOVER CONDENSING APPARATUS

The Watson Machine Company, of Paterson, N. J., announces that it has secured the full line of patterns, working drawings, templets, tools, good-will, etc., of the Conover Manufacturing Company to manufacture the full line of condensing apparatus originated by E. K. Conover, who will be retained as manager of the condenser department of the Watson Machine Company.

The Watson Company's object is to manufacture a complete line of first-class condenser outfits, from the smallest units to the largest. These manufactures will comprise the following: independent steam driver and belt-driven jet condensers, surface condensers, centrifugal pump, independent air pumps, combined air and circulating pumps, cooling towers adapted for fan or natural draft, and dry vacuum pumps.

The company's new erecting shop will have a 25-ton crane, with a 40-ft. span, a runway of 150 ft., and a clearance of 30 ft. under the hook, and as the equipment embraces modern machine shops, foundry, smith and pattern shops, the company is in a position to manufacture all parts of the above condensing outfits under its own supervision, and can therefore guarantee the highest grade of workmanship and materials.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 17, 1905

780,040. Brake Shoe; Harry Jones, Bloomfield, N. J. App. filed Dec. 16, 1903. Comprises a cast body portion and a pair of attaching lugs composed of malleable strap.

780,055. Electrical Controlling Apparatus; Frank C. Newell, Wilkinsburg, Pa. App. filed May 5, 1902. The object of this invention is to place all the apparatus required for the control of the motors on a moving car, outside of the car, so that no current will have to go into or through the car.

780,058. Controller for Electric Motors; Thomas S. Perkins, Wilkinsburg, Pa. App. filed June 24, 1902. Relates to details of a controller in which movement of the handle in reverse direction operates a reversing switch to connect the motors in a local braking circuit and varies the resistance of such circuit.

780,066. Brake Block; Firt W. Sargent, Mahwah, N. J. App. filed April 6, 1904. A combined brake head and shoe consisting of a cast wearing sole and supporting means for the brake beam anchored therein.

780,072. Brake Shoe; Alfred L. Streeter, Chicago, Ill. App. filed March 23, 1903. The shoe is provided in its wearing face with a metal insert consisting of a plurality of longitudinally extending parallel bars across the central portion of the face of the shoe.

780,117. Register; John O. Morris, Richmond, Va. App. filed Dec. 9, 1903. Relates to details of construction of that class of register in which an alarm is sounded after a certain number of fares has been "rung-up," indicating that the person paying the fare at the time of the alarm, is entitled to a rebate or a free ride.

780,194. Sheath for Trolley Wheels; Santos Jurado, New York, N. Y. App. filed March 25, 1904. Provides a sheath for trolley wheels and a pivotal support on the sheath through which support the bearings for the trolley wheel extend.

780,211. Axle for Railway or Other Vehicles; Augustus C. Massey, Los Angeles, Cal. App. filed Sept. 2, 1902. The car axle is constructed in two portions connected by ball bearings, the object being to prevent torsional strain when rounding sharp curves.

780,239. Switch Operating Device; Wilber K. Smith, Denver, Col. App. filed April 28, 1904. Mechanism for throwing the switch from a moving car comprising a vertically-swinging frame, rollers arranged in the frame at opposite sides of its pivot, the rollers being arranged at opposite sides of a lengthwise center line through the frame, and an operating lever extended through the platform of the car and having connection with said frame.

780,268. Rapid Transportation System; Edward W. Curtiss, New York, N. Y. App. filed March 30, 1904. A circular-moving platform to facilitate mounting to an endless train of cars, the circumference of the platform adjacent the cars being adapted to travel at substantially the same speed as the train, while the center travels slowly.

780,276. Brake Mechanism for Six-Wheeled Trucks; George L. Fowler, New York, N. Y. App. filed April 20, 1904. The braking mechanism is confined to each side of the truck, so as to permit greater space within the same for the mounting of electric motors, or for other purposes.

780,316. Third Rail Insulator; Paul Winsor, Weston, Mass., June 10, 1904. Comprises a metallic cap and base and an interposed body of insulating material firmly joining cap and base together, and having an outer covering or shell of non-metallic material provided with a glazed surface.

780,388. Trolley; Guthie H. Tuttle, Shorter, Ala. App. filed Oct. 26, 1904. Comprises two sections separated transversely of the axis, and a support for the sections whereby the sections may move into parallelism and also into oblique relation with each other.

780,410. Automatic Railroad Switch; Goff Currier, St. Paul, Minn. App. filed June 17, 1904 A cam in the road-bed shifted from side to side by a projection on the car, thereby throwing the switch.

PERSONAL MENTION

MR. E. H. MULLIN, of the General Electric Company, died at his home in Millburn, N. J., on Jan. 25. The cause was heart failure.

MR. R. A. WHITE has resigned as engineer of Ford, Bacon & Davis, Birmingham, Ala., office to accept the position of engineer and assistant manager of the Mobile Light & Railroad Company, of Mobile, Ala.

MR. THERON W. ATWOOD has been reappointed Commissioner of Railroads for the State of Michigan, and has announced the reappointment of Mr. D. Healy Clark as deputy commissioner, and of Mr. James Bice as mechanical engineer.

MR. WILLIAM R. KING, M. E., consulting engineer, of New York, is now associated with Sanderson & Porter, of New York, in their general practice as consulting engineers and contractors for the development of railway, light, hydraulic and power propositions.

MR. MARTIN SCHOENHALLS has been appointed master mechanic of the Cincinnati, Dayton & Toledo Traction Company, with headquarters at Trenton, Ohio, to succeed Mr. L. M. Sheldon, resigned. Mr. Isaac Smith has been appointed chief engineer of the company, with headquarters at Trenton.

MR. C. O. LENTZ has resigned as assistant mechanical engineer of J. G. White & Company, of New York, to become connected with Sanderson & Porter, of New York. Mr. Lentz has been with Messrs. White & Company for three years, and formerly was connected with Sargeant & Lundy, of Chicago.

MR. WILLIAM N. STEVENS, assistant mechanical engineer of the Interborough Rapid Transit Company, of New York, has resigned from the company to become connected with J. G. White & Company, of New York. Mr. Stevens formerly was with the Manhattan Elevated Railway Company, of New York.

GEN. WILLIAM A. BANCROFT, president of the Boston Elevated Railway Company, delivered an address on Jan. 19 before the Commercial Club, of Boston, on "Local Transportation in American and European Cities." The salient differences between street railway practice in this country and that noted abroad in the speaker's recent trip were discussed, and the lecture was illustrated by lantern slides. Speaking of the East Boston Tunnel, Gen. Bancroft said that his company is considering the operation of cars therein, which, according to present plans, are to be nearly 46 ft. long, with large vestibules and exits about 3 ft. 6 ins. wide. Prof. Elihu Thomson presided at the meeting, which was attended by about 50 members, all of whom are prominent in business and professional circles in Boston.

MR. WILLIAM SELLERS, head of Wiliam Sellers & Company, of Philadelphia, manufacturers of machine tools, died Tuesday, Jan. 24, at the University Hospital, that city, after an operation. He was 80 years old. Mr. Sellers was a member of the American Philosophical Society, and was at one time president of the Franklin Institute.

MR. J. M. COX has been appointed electrical engineer of the Atlantic City Railroad Company, of Atlantic City, N. J., to succeed Mr. Ellis E. Brown, resigned. Mr. Cox has been the electrical engineer of the Philadelphia & Reading Company at its power house at the Reading Terminal station. He will be succeeded at the power house by Mr. D. T. Williams, assistant engineer of the station.

DR. S. S. WHEELER, of the Crocker-Wheeler Company, is being prominently mentioned for the presidency of the American Institute of Electrical Engineers at the coming election. The name of Mr. J. G. White, of New York, is also being very favorably received as a candidate for vice-president. The usual blanks for nominations under the rules of the Institute are to be mailed to members at an early date.

MR. LOUIS H. HAYNES has become connected with the engineering staff of the New York Central & Hudson River Railroad, and not with the New York, New Haven & Hartford Railroad as previously mentioned in these columns. Mr. Haynes formerly was electrical engineer of the Boston Suburban Electric Companies, from which corporation he resigned to become connected with the New York Central Company.

MR. ARTHUR L. LINN, JR., assistant secretary and treasurer of the Utica & Mohawk Valley Railway Company, of Utica, N. Y., has resigned from the company to become general manager of the Fairmont & Clarksburg Traction Company of West Virginia, and will assume the duties of his new position about Feb. 1. Mr. Linn has been associated with Mr. John J. Stanley, of Cleveland, the general manager of the Cleveland Electric Railway and the first vice-president of the Utica & Mohawk Valley Company, for some twelve years, and for the past four years he has filled acceptably the position of assistant secretary and treasurer of the Utica Company. Prior to that time, he held a responsible position with the Cleveland Electric Railway. The road of which Mr. Linn is to become manager is 20 miles long, and connects Fairmont with Clarksburg. It runs through a rich coal country, and it is the intention of the company to develop the mines and find a Northern market for the coal. Some of the men who are interested with Mr. Andrews and Mr. Stanley have money invested in the company, and Mr. Linn's new position is in the nature of a promotion. When Mr. Linn reaches Fairmont, which place will be his headquarters, plans will be made to build an extension of 20 miles to the road. Mr. Linn is a member of the executive committee of the Street Railway Accountants' Association of America.

PROF. W. ELWELL GOLDSBOROUGH, director of the School of Electrical Engineering, Purdue University, and who, for the past three years, has held the position of chief of the department of electricity at the Louisiana Purchase Exposition, has become associated with J. G. White & Company, of New York City. Mr. Goldsborough will ultimately be permanently located in New York. For the present, however, his time will be divided between Lafayette, Indiana, and New York City. Incidentally, he is still giving attention to the matter of closing up the affairs of the electrical department of the exposition, which will necessitate his being in St. Louis at times during the next month or so. Prof. Goldsborough was graduated from Cornell University in 1892, with the degree of M. E. After graduation he accepted the position of electrical engineer for the Colliery Engineering Company, of Scranton, Pa , and the following year took charge of the Department of Electrical Engineering of Arkansas University, Fayetteville, Ark. In 1894 he was appointed associate professor of electrical engineering at Purdue University, and two years later was advanced to its full professorship. Prof. Goldsborough is most widely known, however, through his papers before the American Institute of Electrical Engineers, and as chief of the department of electricity of the Louisiana Purchase Exposition. His contributions to the Institute have included papers on extensive tests carried on by him in the power station at the Edison Company at Baltimore, Maryland, and on the system of the Union Traction Company, of Indiana. He was also chairman of the executive committee of the Electric Railway Test Commission, under the direction of which an elaborate series of wind resistance tests is now being conducted at Anderson, Indiana.

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Instituting Reforms

Reforms in the direction of economy are often necessary in street railway operation, but those whose necessity will not readily be recognized by the public should be made gradually. Perhaps as an abstract proposition, nearly every fair-minded man will admit that a street railway company should be so operated as to show a fair profit on the investment. Practically he will use every objurgation in his vocabulary if on an interurban line his favorite car is taken off, or on a city line if the headway is changed from five to ten minutes, or from ten minutes to every quarter hour. Such changes as these are often absolutely necessary, but it is easy to see that there are favorable and unfavorable periods in which to put them in operation.

The present is perhaps an appropriate time to refer to this point, because this is the season for annual meetings. At these meetings many a director, especially if he is not a resident of the city in which the railway is located, will advocate strenuously for lower operating expenses. To his mind the schedule can often be cut in half to advantage, the employees' wages should be reduced, and "those monthly commutation tickets which were on sale last year to Lonesomeburgh should be withdrawn." Moreover, in his opinion, there are entirely too many passes out, and what's the use of paying out all you take in. Now, perhaps all of these criticisms have some foundation and some retrenchment is possible. But if all of the reforms are attempted at once, particularly if the road is known to be fairly prosperous, a storm will be raised by the former holders of passes, the commuter and the local passenger will feel aggrieved, retaliatory measures will be taken and the latter condition of that property will be worse than the first. Had, however, the railway company introduced the reforms gradually and selected some favorable time for their enforcement, the effect would not be so great. During the winter storms, for instance, when delays are unavoidable, or at other times when the traffic is light, a gradual lengthening out of the schedule is not very noticeable, but a period during which the company is being held responsible by the public for inadequate service is obviously not a desirable one to select for raising fares or reducing passes.

High Speed Railroading

Again at the beginning of a new year, we have to raise up our voices in lamentation that the day of high-speed electric traction seems to be still afar off. For more than a decade the 100-mile-an-hour train has been on the road, but it has not yet come around the curve. The feasibility of such speed has now been thoroughly demonstrated, but nothing is doing. It is a curious fact that the speed records on railways have stood, in some cases, for many years. One of the most notable of them, 53¼ miles in forty-seven minutes, on the Great Western line out of London, was made more than half a century ago. The records between New York and Buffalo and between Chicago and Buffalo were made nearly ten years ago, and the famous mile record of thirty-two seconds is still older. The actual running of a train from Chicago to New York in less than eighteen hours, in 1895, does not seem to have stimulated enthusiasm for fast trains, and in spite of all the cry about modern improvements and American supremacy in railroading, the fastest regular train in the world is in France, and on a run, by the way, longer than that of the Empire State Express. Electric locomotives for high speed were planned more than ten years ago, and we hear periodically of the great things that are to be done when the projected Jamboree & Jericho line is completed. But it never is completed; something happens; the city fathers of Jamboree are convinced that the road will involve public danger, or Dodge & Hedge, the distinguished bankers, who underwrote the bonds, fail for 11 cents on the dollar. Anyhow, the road is not built, and it next appears as projected between Syzygy and Cacptch, somewhere or other on the Bulgarian frontier, only to go through the same dreary cycle of sorrows. It is positively worse than that 5-acre meteorite that falls every two or three years somewhere in Mexico or Southwestern Texas. Meanwhile the running time between New York and Washington holds to the same old figures, some of the fast express trains are pulled off the westbound lines and the electric roads stay in the same conservative rut. After the Zossen tests, things began to look up a bit, but nothing has actually come of them. It would certainly seem that some progress should have been made in ten years, but they have slipped by and there is nothing to show for it.

Of course, one of the real difficulties is the relative unimportance of half-way measures. It signifies little to cut half an hour off the running time between New York and Washington or Boston. It could be done with the greatest ease, but it would make small difference to anybody, since the saving in time is so insignificant. But get down to the 100-mile-an-hour basis, or somewhere near it, and the saving in time would amount to something practically. That would mean reaching either of the cities named in less than three hours, including stops, and would give a free business day in either place. On the longer distances the gains would be even more important. A twelve-hour train to Chicago means only about 80 miles an hour actual average, which leaves ample margin below speeds demonstrably possible.

The electrical supply of power for such a feat is, of course, a big undertaking, and the first try at big speed can scarcely be expected over so long a distance. But the point of the matter is that, with all the resources now at the command of mankind, nothing has yet actually been done above what might have safely been predicted as regards speed half a century ago. Of course, the general improvements in railroading have been enormous within that period, and we are duly thankful for them, but the growth in speed has not been commensurate with the rest of the improvement. Will improvement come soon? A decade since, we should have unhesitatingly answered in the affirmative, but as time goes on we hesitate. In one of H. G. Wells' clever stories, he relates how a far-sighted engineer, scoffed at by the public, insisted in laying out a broad road structure, with a special way for vehicles running over 100 miles an hour, and how, in the passage of years, the prophecy came true. Perhaps the automobile on a first-class roadbed may push the speed records up a peg and shame the backward railways into action. Certainly every experiment at high speed shows clearly that reaching it is far less difficult than had previously been imagined. We understand clearly enough the practical and material difficulties that stand in the way of building a high-speed electric road in this country. The effect of such a road when in operation upon general railway operation would be so tremendous that it could not be long withstood. Anyone who tries to get a right of way for such a purpose will have the fight of his life, with every railroad influence concentrated against him. Frankly, we think the first great step will probably be taken abroad, where there are autocracies that can have their way in spite of "vested interests." In due time the first step will be taken, and then things will begin to move. It cannot be that travel is to remain permanently at or near the present range of speeds. Time is too valuable to waste in transit, and now that it is well understood that high speeds are feasible, they must come in due season. Steamship speeds have steadily risen in spite of relatively much greater difficulties, and when the whole world hits up its pace, travel on the rail cannot stay at its present rate of deliberation.

The Cost of Car-Storage Facilities

"What shall we do with our out-of-season cars?" is a problem that forces itself at least twice a year upon the attention of those companies whose properties happen to be located North of the Mason and Dixon line, where the annual range of temperatures makes a double equipment of summer and winter cars almost imperative unless some form of convertible car is used. On the smaller roads, the problem is usually solved, perhaps as satisfactorily as any other way, by building the operating car house sufficiently large to store the duplicate cars in one section or in an adjoining bay. But on the larger systems, where the value of the out-of-season equipment runs into the hundreds of thousands of dollars, this becomes only a makeshift solution at the best. The fire underwriters have acquired an unfortunate habit of tacking on a few per cent to the already overburdened insurance rate whenever they find large values in car equipments grouped within confined space. Then, too, the cost of erecting what are termed "operating barns," as they are now usually built, is so high that it would seem to be an unnecessary expenditure of money to build them large enough for storing the double equipment during the off season; just as it would be to build a modern office building to include sleeping quarters for all those doing business in the building, when dwelling accommodations can be secured so much cheaper and better in less expensive buildings.

In this connection, the suggestion made by D. F. Carver in his article describing the Plank Road storage house of the Public Service Corporation, published elsewhere in this issue, is of more than passing interest. Mr. Carver believes that entirely aside from the question of insurance, it is cheaper to build two smaller car houses—one for operating and one for storage—than it is to erect one large house combining operating and storage facilities. His proposition is based on authentic statements of costs obtained after wide investigation of actual experience. The figures have been reduced to a cost-per-cubic-foot basis, a method of comparing the cost of buildings which is used extensively by steam roads, although its advantages up to the present time do not seem to have been recognized fully by managements of electric roads.

The proposition in a nutshell is just this: Assume an electric road owning 100 cars, half of which are for summer and half for winter service. It will have fifty cars to store during the off season. Granted that it has been decided to build two houses, one for operating fifty cars and one for storing fifty cars. The operating house to accommodate fifty equipments will have to contain, roughly, 760,000 cu. ft., and if built with approved steel truss roof construction, with brick walls (but no fire walls), with shops, waiting rooms, men's rooms, depot master's office, plumbing, etc. (but disregarding track work and real estate, as these do not enter as factors into the problem before us), the building will cost $0.0616 per cubic foot, or approximately $46,800. A building for the exclusive purpose of storing cars, consisting essentially of heavy brick walls and approved slow-burning timber roof construction, divided into bays by heavy fire walls of brick, with not over three tracks to the bay, with no pits or heating arrangements, and exclusive of track and real estate, will cost $0.042 per cubic foot, or for a fifty-car house with cubical contents of roughly 520,000 cu. ft., the total cost of the building will be approximately $21,800. The cost of the two separate buildings will be therefore $68,600. Now, what will be the cost of an operating house the same as regards detail of construction, finish and completeness as the smaller operating house before mentioned, but large enough to accommodate 100 cars? It must be borne in mind that the cost per cubic foot for a house of the operating type will decrease within certain limits as the size of the house is increased, while the cost per cubic foot for the storage house will remain nearly constant, inasmuch as the building will consist essentially of narrow parallel bays, the number of which can be added to almost indefinitely without changing the cost per cubic unit. On the other hand, there will be considerably more lost space in the peaks of the roof in the larger operating house by reason of the longer spans required, so that one house with capacity for 100 cars will enclose cubical contents nearly 40 per cent greater than the combined contents of the two separate houses. According to Mr. Carver's figures, the one large house will contain at least 1,720,000 cu. ft. of contents, and it will cost to build $0.059 per cubic foot, or $101,000, as against $68,600 for the two separate buildings.

As a matter of fact, it is not urged that every company under the given conditions can save $30,000 in cost of car house construction as between the two methods, because there enter into the equation, as into all questions having to do with electric railway practice, the modifying factors of local influences. However, it is believed there are few conditions where a saving will not be evident. Be this as it may, the figures contain enough to furnish food for some good sober thought.

Special Safety Precautions

The operation of an interurban railway system, while involving, as we have many times pointed out, the same general methods and precautions as any other railway system, is subject to difficulties which are rather peculiar to itself and which demand special treatment. As interurban lines have grown in length, speed and traffic, these difficulties have become acute and deserve the very careful consideration of every manager. Perhaps the chief basic difference between modern interurban service and ordinary railroading, as respects safe operation, is the very much greater number of operating units characteristic of the former. Where a minor steam line would run ten trains a day an interurban line would, during the busy hours, run as many cars per hour, with a nearly corresponding increase of danger from collisions, assuming the same proportion of human carefulness. The single cars have nearly as great speed as would the trains, and while they can certainly be stopped more promptly than the trains, they are more difficult to hold to a rigorous schedule, and are thus more likely to be running on precariously close headway. Cars running on, say, ten-minute headway, even upon a double-tracked road, have comparatively small leeway, and in thick weather, as experience has shown, are apt to get closer than is conducive to safety. On a single-track road with turn-outs the risk is proportionately greater. There have been a good many forms of block signals devised to meet these conditions, some of them embodying excellent features, but in interurban service an absolute block system which tries to meet every exigency of traffic would sometimes prove very inconvenient, and a permissive system is apt to leave a good many loopholes for entering accidents.

A double-tracked road fully equipped with a block signal system is certainly less liable to collisions than any other, but under existing conditions the number of such roads is necessarily limited, and one of the most serious questions that comes before the manager is the preservation of an adequate system of safety appliances on ordinary roads. In the ordinary routine of operation things go smoothly enough, but when traffic presses and extra cars have to be run the situation is different. To begin with, on either a single-track or double-track line there is no danger of collision between cars. If they run, say, on ten-minute headway, and hold to it and obey orders at turn-outs, everything will go smoothly. It is when this regularity is departed from, as it now and then must be, that trouble is likely to begin. It seldom happens that cars collide in clear weather. It is in fog or storm, or in coming at night around a blind curve or over the crest of a grade that they get too close and sometimes cannot be stopped in time. It takes several hundred feet to bring a heavy interurban car to a standstill, and it is easy enough to get within that range of another car in a storm or a fog. It strikes us that there is need of a far freer use of visible and audible signals than is usual under such circumstances. Systematic use of a powerful red rear light, automatically duplicated when the car is stopped, would many a time warn the following motorman to keep his car under control. Rear lights are, of course, now used to a certain extent, but in a dark night it is not easy to estimate the distance or to tell whether or not the car is under way. Another thing which could be done with small trouble and expense would be to install at blind curves and grades signals for day and night, worked by track instruments several hundred feet away on each side, just as highway crossing signals are often worked on railroads. Protection of this sort can be put just where it is needed and can gradually be added to as the traffic increases. Some roads already use such devices, but they certainly are not employed anywhere nearly as systematically as they should be to secure the best results. Still another desirable plan is to double-track such curves, as is done quite frequently in the Middle West.

Audible signals, too, are very much neglected on electric lines. Air whistles there often are, to be sure, but they are generally far from being powerful enough to answer the purpose fully. In thick weather a signal should be sufficiently penetrating to be heard some distance to be effective. We remember seeing a few years ago an electric horn worked on the buzzer principle that would have roused Rip Van Winkle. A pair of these, differing radically in pitch, installed on each car, one for use on the up run and the other on the down run, would serve a very useful purpose. Blasts when nearing curves in the fog, and when slowing down or stopping, would avert many a close call. And the same scheme would considerably lessen the accidents at street crossings, where passengers not infrequently get off one car and pass squarely in front of one coming up on the other track. A short blast at nearing a car stopped and discharging passengers would warn many a victim of his own carelessness. One looks several ways at once for a gong, while a distinctive track signal tells its own story at once. Given good local protection by special signals, audible signals for use in a fog and good air brakes, any intelligent motorman ought to be able to keep his car out of trouble. Running at full speed without signals is simply looking for trouble. On some roads with heavy grades danger of a car getting out of control is considerable in slippery weather, and there is a good deal to be said in favor of track brakes, which are often suggested but rarely used. It is perhaps an open question whether they could advantageously be substituted for ordinary brakes in regular service, but as emergency devices they have no small merit. Every road really has requirements of its own to insure safety, and it is the part of wisdom to look them over and to meet them at every point. Not every road can be given the safety precautions of a trunk line railway, but that is no reason why danger spots at curves and grades should not be eliminated. An intelligent attention to detailed protection will greatly reduce the danger of accidents, and it is generally neither difficult nor expensive.

THE STREET AND INTERURBAN RAILWAY SYSTEMS AT TERRE HAUTE, INDIANA

Heretofore the greater part of the development of interurban lines in Indiana has been in the eastern portion of the State. There is, however, one city in the western section which is fast developing into an interurban center. This is Terre Haute. Two interurban lines already lead out of the city to the east and north, another will be built west to Paris, Ill., within a short period, and several others are contemplated. The tracks of the extension west to Paris will pass over the Wabash River on the new steel bridge now being erected by the county at a cost of $271,000.

The reason for this rapid development is not difficult to discover. A population of 60,000 is claimed for the city alone, and within a 30-mile radius there are 250,000 people. In 1900, the population of the city was 36,673. The phenomenal growth in the last four years has been due directly to the natural resources in the surrounding section and to the facilities offered by the several railroads for shipping to central markets. Within a radius of 30 miles there are more than 2000 square miles of coal fields, and over 1600 carloads of coal are sent out daily. An inexhaustible supply of water may be obtained by drilling to a depth of about 80 ft., one of the distilleries pumping 8,000,000 gals. per day from its own wells. Thus both fuel and water, the two requisites of manufacturing plants, are easily obtained. The abundance of coal, which may be purchased as low as 60 cents per ton, has attracted from the eastern portion of the State many factories which were recently compelled to seek other locations because of the failure of natural gas. The factories of the city alone employ almost 10,000 men, and their yearly products are valued at $30,000,000.

Eleven railway lines branch out from the city in all directions, furnishing direct routes to the larger cities for the shipment of the manufactured products and coal. Chicago is 178 miles distant; Cincinnati, 187 miles; St. Louis, 168 miles, and Louisville, 161 miles. Freight loaded for any of these cities one day arrives at its destination the following morning. With such natural resources, together with the central location, the city and surrounding country bid fair to become so thickly populated as to support an extensive interurban railway system.

ORGANIZATION AND HISTORY

The street railway systems of the city and the two interurban roads out of the city—the Clinton line to the north, and the Brazil line to the east—are operated by one company, known as the Terre Haute Traction & Light Company, of which Gardner F. Wells is resident manager. This is one of the several Western railway systems controlled by Stone & Webster, of Boston.

The system had its origin in the Terre Haute Street Railway Company, organized in 1866. It is interesting to note that the price paid for the flat rails at that time was $108 per ton. In 1889 it changed ownership and electric traction was adopted. A short time later, the system attracted considerable attention from the fact that it reconstructed its tracks in the city with shanghai T-rails. This construction was so unusual at the time that it was the subject of a paper read by Russell B. Harrison, then president of the road, before the thirteenth annual convention of the American Street Railway Association, held at Atlanta, Ga., in 1894. The road may also be remembered as the first to use the Westinghouse No. 12 railway motors, some of which are in service at the present time.

POWER STATIONS

The power stations are in charge of H. E. Smith, chief engineer of the system. There are three separate power houses—a new steam turbine plant known as the Mulberry Street station, the original station of the Terre Haute Traction Company at Ninth and Cherry Streets, and a station at Brazil.

THE MULBERRY STREET STATION

The new station, which ultimately will be enlarged to furnish power for the entire system, is located in the western portion of the city, on the banks of the Wabash River, two blocks north of Wabash Avenue. A general view of the station is shown in Fig. 1. It has been the intention of the management for some time previous to erect a new station at a future date, but the overloaded condition of the Cherry Street plant, brought about last winter by the increased commercial load, hastened its construction. The location was chosen because of the facilities for

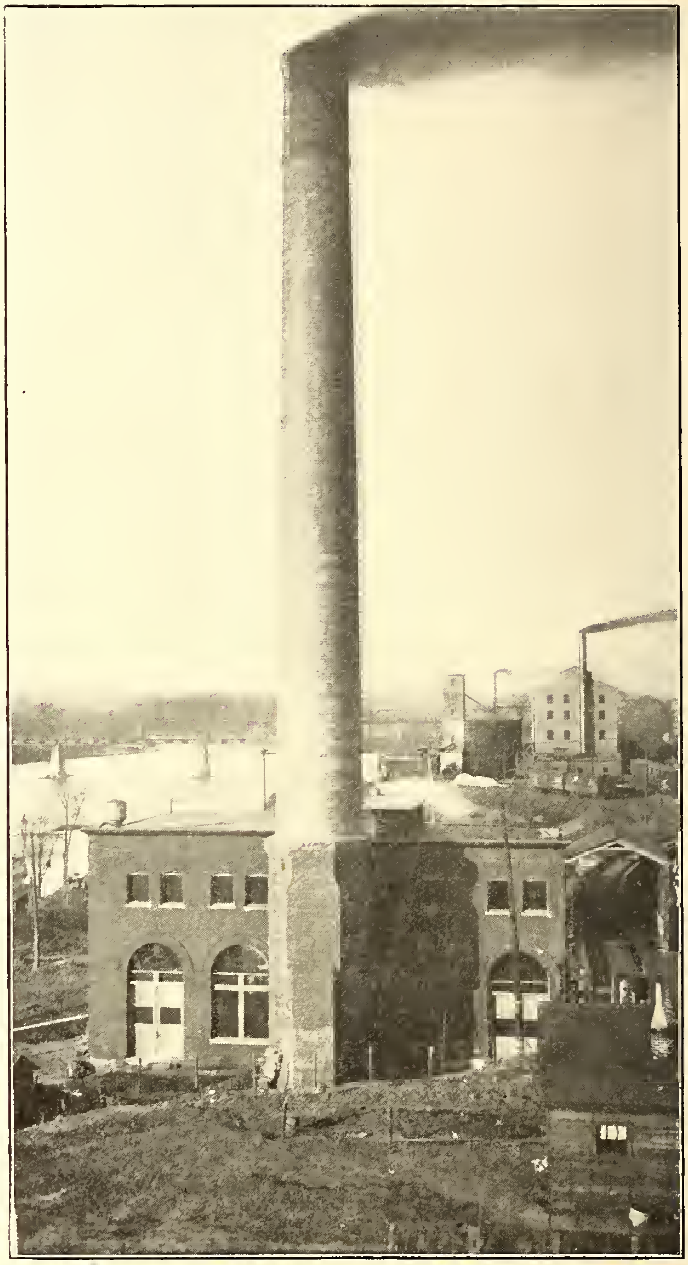


FIG. 1.—MULBERRY STREET STATION FROM THE SOUTH

obtaining condenser water, which is drawn from the Wabash River, and because of its convenience to the railways. Although it is now on the side of the city opposite to that of the interurban development, when the proposed new extension west to Paris, Ill., is completed, it will be reasonably near the center of the system.

While the station is a modern one in every particular, its chief point of interest lies in the fact that it is a steam turbine plant. At the present time but one turbine is installed, this being of 500-kw capacity. The building, however, has been constructed with the view of installing another of 1500-kw capacity whenever the service demands it. The structure, which measures 80 ft. 6 ins. x 50 ft. 5 ins., consists of a steel framework supporting the steel truss roof. Figs. 2 and 3 show the plan and section of the station. The south wall is built up permanently of brick. The other enclosing walls are of corrugated iron, and are temporary because of anticipated additions to the building. A brick wall built into the steel columns separates the boiler and engine rooms. The roof, which is divided into two sections at this division wall, is of tar and gravel laid on 2-in. hard pine planking. This in turn is supported by channels resting on the roof trusses. A monitor built in the boiler room roof affords proper ventilation.

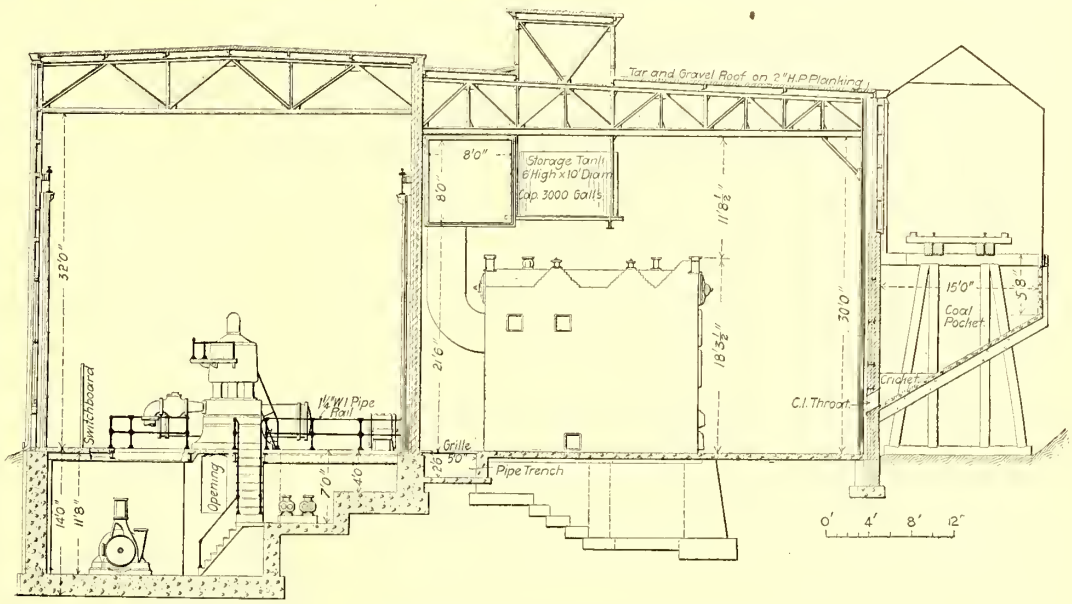


FIG. 2.—CROSS SECTION OF POWER STATION

The floors of the building are all of concrete except that under the northern portion of the engine room. This is temporarily of wood. The boiler room rests directly upon the ground. The concrete floor of the engine room, which is immediately over the basement, is 4 ins. thick, and is built in between 25-lb. 10-in. I-beams, placed 3 ft. 8 ins. apart. The basement floor is also of concrete. As the river frequently rises above the floor of the basement, the walls are all waterproof. Any leakage taking place will drain to a sump, from which it will be pumped through the condenser water return mains to the river.

The chimney was built by M. W. Kellogg & Company, of New York. The method of constructing the concrete foundation may be observed in Figs. 4 and 5. This foundation is octagonal in shape, and at the bottom measures 22 ft. across, narrowing by four steps to 16 ft. 2 ins. at the top. The octagonal section continues to a height of 40 ft. above the base. Circular construction then begins, this being 14 ft. in outside diameter, with walls 20¼ ins. thick. The walls decrease in thickness by steps, and at the top, 165 ft. above the base, they are 7½ ins. thick. The bottom of the flue opening, which measures 5 ft. 6 ins. wide x 9 ft. 3 ins. high, is 21 ft. 6 ins. above the base.

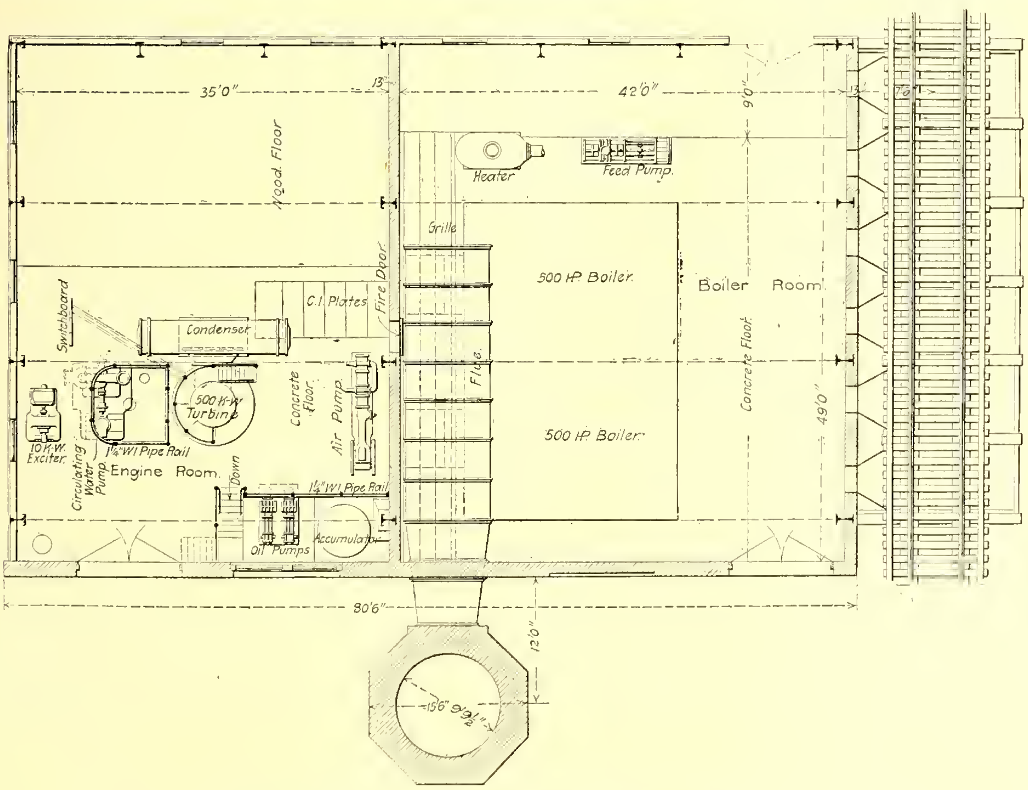


FIG. 3.—PLAN OF MULBERRY STREET POWER STATION

The boiler room contains two Cahall horizontal water-tube boilers, equipped with superheaters. They are rated at 520 hp each, and are guaranteed to raise 15,600 lbs. of steam per hour to a pressure of 150 lbs., and to a temperature of 515 degs. F., corresponding to a superheat of 150 degs. A total of 11,000 sq. ft. of heating surface is provided and 175.12 ft. of grate surface. They are supplied with Crosby steam gages with 12½-in. dials, and Reliance low-water alarm columns. A spur from the tracks of the Vandalia Railroad passes over a trestle several hundred feet in length and along the east wall of the boiler room. Built into the trestle immediately beneath the track is a coal bunker of 120 tons capacity. This trestle and track is well shown in Fig. 7. The boiler room wall forms one side of the bunker, and through this wall are several chutes with cast-iron throats, as shown in Fig. 8. A steel car placed immediately under the chutes receives the coal and conveys it to the boilers. At the present time the ashes are removed through the ash doors of the boiler front. The future plans, however, contemplate an ash pit beneath the floor, from which the ashes will be removed by means of a car running in a tunnel. The flue gases pass from the boilers upward through individual flues to the main smoke flue, which measures 8 ft. square. This goes directly to the chimney. Dampers are placed in both the individual flues and the main flue. To the north of the boilers are located the feed-water heater and the feed-pump. The latter is of the duplex piston type, with cylinders 7½ ins. x 4½ ins. x 10 ins. The position of the boilers, feed-pumps and heater is shown in Fig. 9. The boilers deliver steam to an 8-in. flanged header, supported by brackets to the division wall between the boiler and engine room. From this, a 6-in. main descends to the turbine, as shown in Fig. 10. The steam line for the auxiliaries is taken off from the main line just before it enters the turbine. A branch from this goes directly to the dry vacuum pump, while the main auxiliary steam pipe descends to the basement, where the condenser circulating pump and other auxiliaries are located. The turbine, of 500-kw capacity when run non-condensing, is of the Curtis type, built by the General Electric Company. It runs at 1800 r. p. m., and the speed is guaranteed to vary not more than 4 per cent with sudden fluctuations of load, and with reasonable fluctuations not more than 2 per cent. With 150 lbs. pressure at the throttle and condensing with 2 ins. absolute back pressure in the condenser, the turbine will operate at full load on 21 lbs. of dry steam per kw-hour. At half load, the guaranteed consumption is 23 lbs., and at 50 per cent overload, 21½ lbs. These guarantees reduced to horse-power give 15.66 lbs. at full load, 17.15 lbs. at half load and 16.03 lbs. at 50 per cent overload. The turbine and generator combined stand 12 ft. 4 ins. high above the base, and have a diameter of 7 ft. 8 ins. at the base. The weight of the combined unit is 40,000 lbs. It sets on a brick foundation, which extends into the basement underneath. An opening in this permits the removal of the step bearing. A pressure oiling system is provided for the bearings. Two special duplex, outside packed, plunger pumps, shown in Fig. 11, force the oil from a storage tank into a high-pressure piping system of 1½-in. brass pipe. Through ⅜-in outlets this system supplies the top bearing and the step bearing of the turbine. After passing through the bearings, the oil returns by gravity to the storage tank. The oil is maintained at a pressure of 180 lbs. The high-pressure system is connected with what is termed an accumulator, the base of which is shown to the left of the oil pumps. This assures the pressure being kept constant, and also gives a reserve capacity in case of failure of the oil pumps. It consists of an upright piston standing 18 ft. high. Over this is fitted a long cylinder with an outside diameter of 18 ins. The cylinder is weighted down with weights, according to the pressure it is desired to maintain. The high-pressure pipe enters at the base of the piston, and the oil pressing against the upper end of the movable cylinder is raised to any predetermined height. When

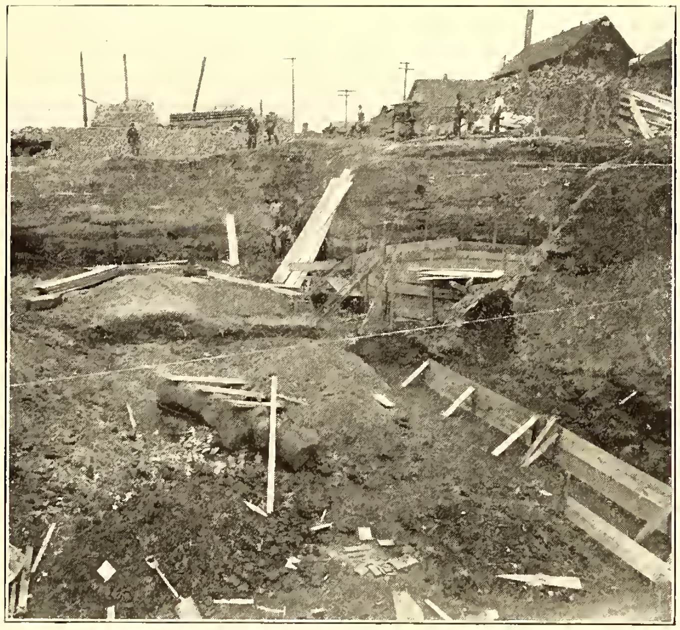


FIG. 4.—EXCAVATION, SHOWING BASE OF CHIMNEY

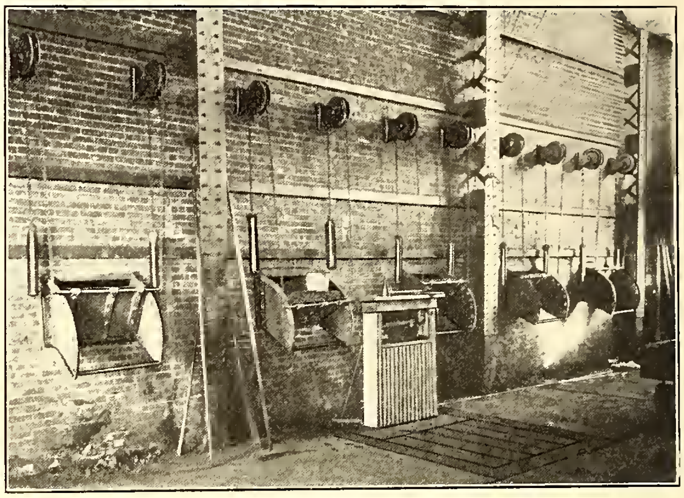


FIG. 8.—CHUTES FROM BUNKERS IN BOILER ROOM

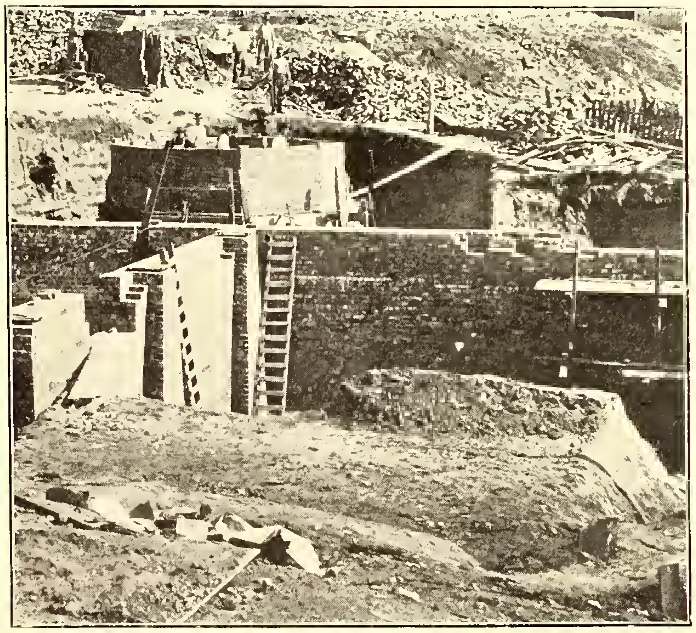


FIG. 5.—FOUNDATION WALLS FOR NEW STATION

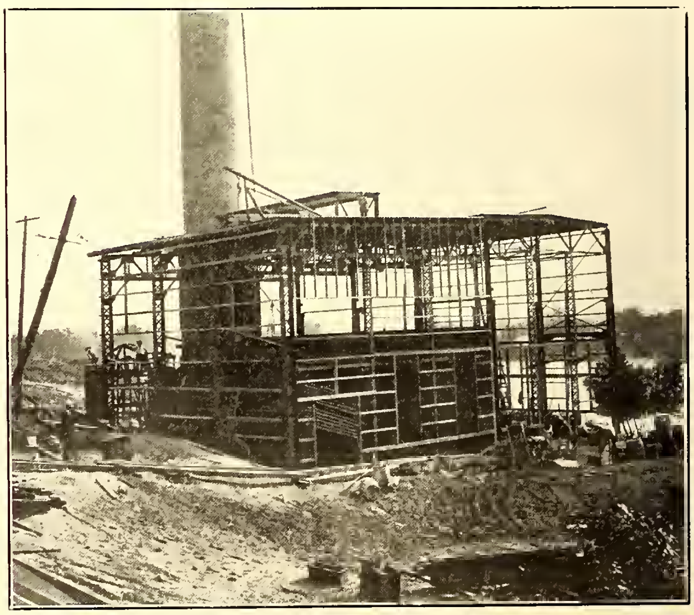


FIG. 6.—FRAMEWORK OF THE MULBERRY STREET POWER STATION IN PROCESS OF ERECTION

this height is reached, the supply of steam is automatically shut off. Should the cylinder fall below a predetermined height, more steam is admitted to the pump. In case the pump in service fails for any reason, the piston, by falling a few inches further, will admit steam to the second pump. Should both pumps fail, the oil in the accumulator will operate the system for almost an hour. The accumulator was built by R. D. Wood & Company.

A relief valve placed on the high-pressure piping is set for 600 lbs. The return or low-pressure oil piping consists of extra heavy cast-iron pipe, the whole piping system being constructed to withstand a pressure of 450 lbs.

The exhaust from the turbine is either direct to the condenser or through a 12-in. main which, descending immediately to the basement (Fig. 12), leads to a free exhaust, rising through the roof at the southwest corner of the building. The condenser, of the Alberger counter-current surface type, with 2000 sq. ft. of condensing surface, is placed on the main floor immediately north of the turbine. A horizontal two-stage dry vacuum pump, a hot-well pump and a centrifugal circulating pump complete the condensing outfit. The condenser will maintain a vacuum of not more than 2 lbs. absolute pressure when condensing 12,000 lbs. of steam per hour, a sufficient amount of condensing water at 70 degs. being supplied. The condensing surface consists of 844 seamless brass tubes, each ¾ in. in diameter. These are so secured in the tube sheets as to permit of the attendant expansion and contraction. Steam is admitted at the bottom of the condenser. The circulating water is piped in at one end and at the top. It makes three passes through the tubes, leaving at the bottom. The water, in its last pass through the tubes, comes in contact with the tubes exposed to the entering steam. The condensed water falls downward over the tubes to the hot well. From this it is removed, by a double-acting piston pump of the submerged type, to the main storage reservoir. This hot-well pump is automatically controlled by a float in the hot well. A two-stage Alberger rotative dry vacuum

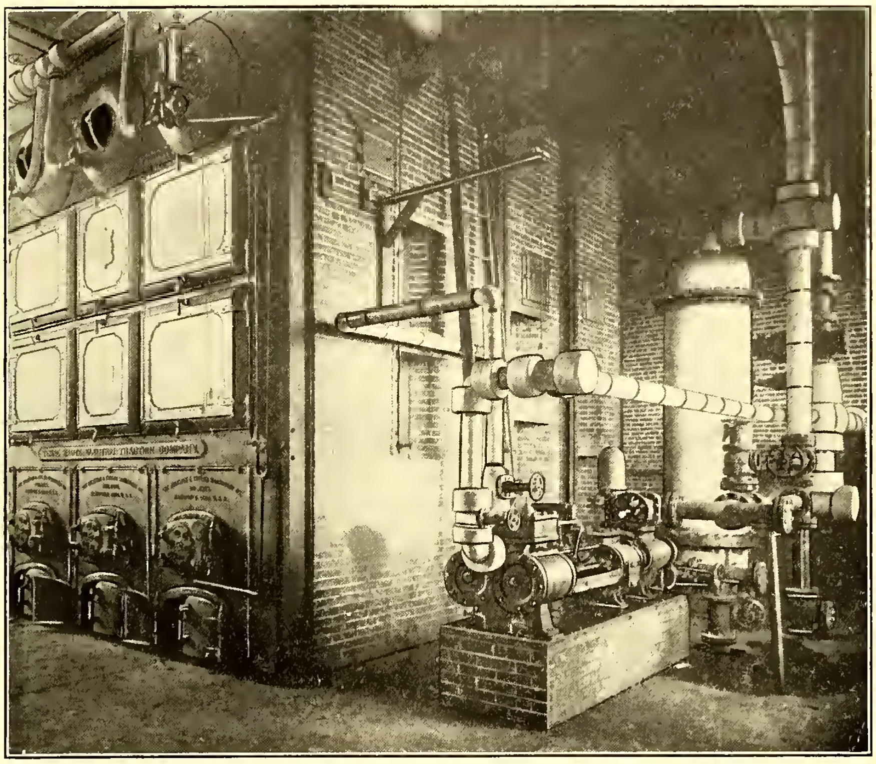


FIG. 9.—BOILERS, FEED-PUMP AND HEATERS IN THE MULBERRY STREET POWER STATION

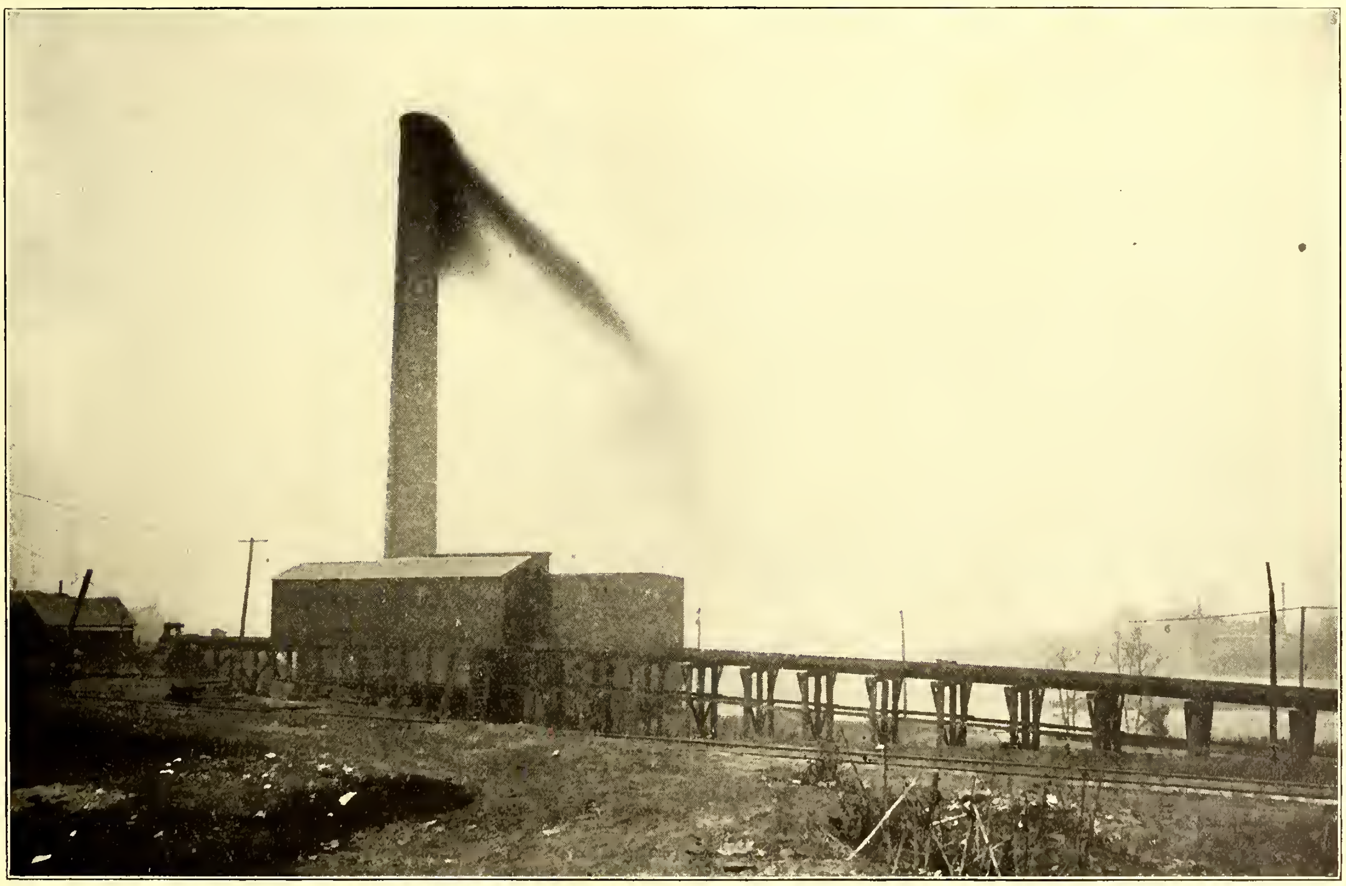


FIG. 7.—MULBERRY STREET STATION FROM THE EAST, SHOWING TRESTLE APPROACH AND BUNKERS

pump (Fig. 13), located on the engine room floor near the wall of the boiler room, maintains a vacuum in the condenser. The pump consists of a steam cylinder and two vacuum cylinders mounted on a Y frame. The fly-wheel shaft carried two eccentrics, one of which operates the balanced steam valve, the other

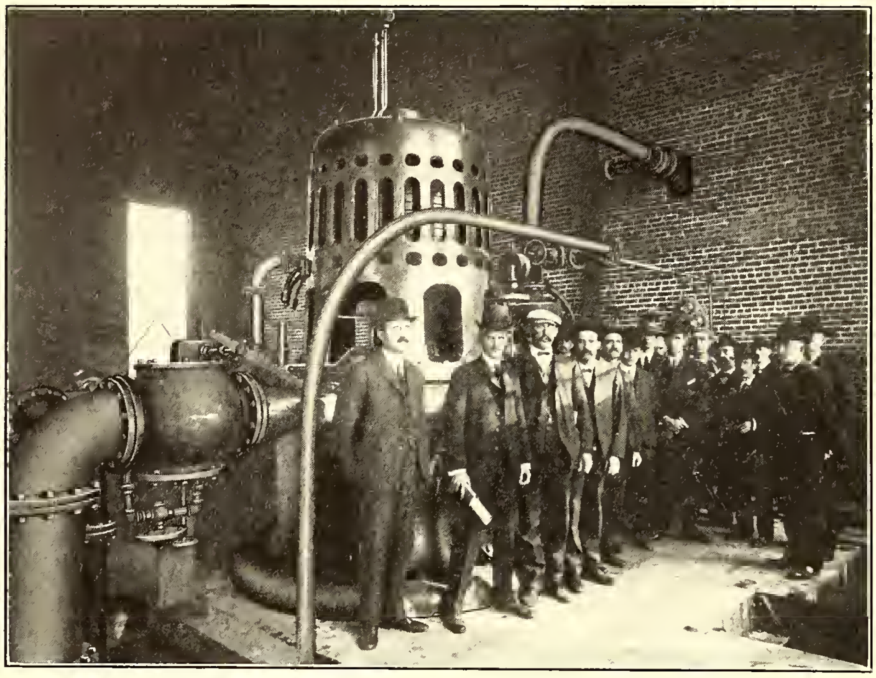


FIG. 12.—THE 500-KW STEAM TURBINE IN COURSE OF ERECTION

the semi-rotary air induction valves in one of the vacuum cylinders. A throttling governor controls the speed. As previously stated, the condenser water is obtained from the Wabash River. The hot and cold well is located near the water's edge, about 80 ft. west of the plant. The current of the river sweeps over toward the shore at this point, forming a deep hole, into which the intake pipe is laid. The intake and discharge pipes, which are 30 ins. in diameter, run from the bottom of the hot and cold well and extend a distance of about 30 ft. into the river. Considerable difficulty was experienced in laying them. A coffer dam of the usual type was built out into the river and excavation made. Several times, when the excavations were completed and the pipes were ready to be laid, quicksand rose up from the bottom and completely filled the excavations. The pipes, as laid, are supported by cross timbers between piles driven on each side. The ends of the pipes are protected by a pile driven on the up-stream side.

The construction of the hot and cold well is not illustrated here, nor are the details of the double screens in the hot well. It is worthy of note, however, that the latter are so constructed that they may be readily lifted out for cleaning. Both lines of pipe, that from the cold well to the rotary pump and that from the condenser to the hot well, are 24 ins. in diameter and are of cast iron. For a portion of the distance they are placed above the ground. As they are above the frost line, no check valve was placed in the supply pipe. This necessitates starting the dry vacuum pump first and pulling water into the system before the rotary pump will operate. This causes considerable delay, and it may eventually be deemed advisable to put in a check valve.

The circulating pump, Fig. 14, which is located in the basement, is of the centrifugal type, and is direct connected to a 9-in. x 9-in. vertical engine provided with a fly-ball governor. The pump has a 10-in. discharge and a 12-in. suction pipe, which divides to enter the pump on each side of the volute. The top of the volute is provided with the necessary connections for priming. The pump is built to work satisfactorily with a suction of 20 ft. and a discharge head of 15 ft. In its present location, the center line of the intake is 19.6 ft. above the low-water mark of the river, which is 436.40 ft. above the sea level. A large duplex pump, located in the basement near the centrifugal pump, supplies the necessary make-up water. This is pumped direct from the condenser discharge to the storage tank. The same pump is used to empty the drainage sump in the basement. By closing and opening the proper valves, shown in Fig. 14, water is pumped from the sump into the condenser discharge. Thus the pipe, which, in supplying make-up water, was the suction, becomes the discharge. The exhaust from the several auxiliaries is lead to the heater in the

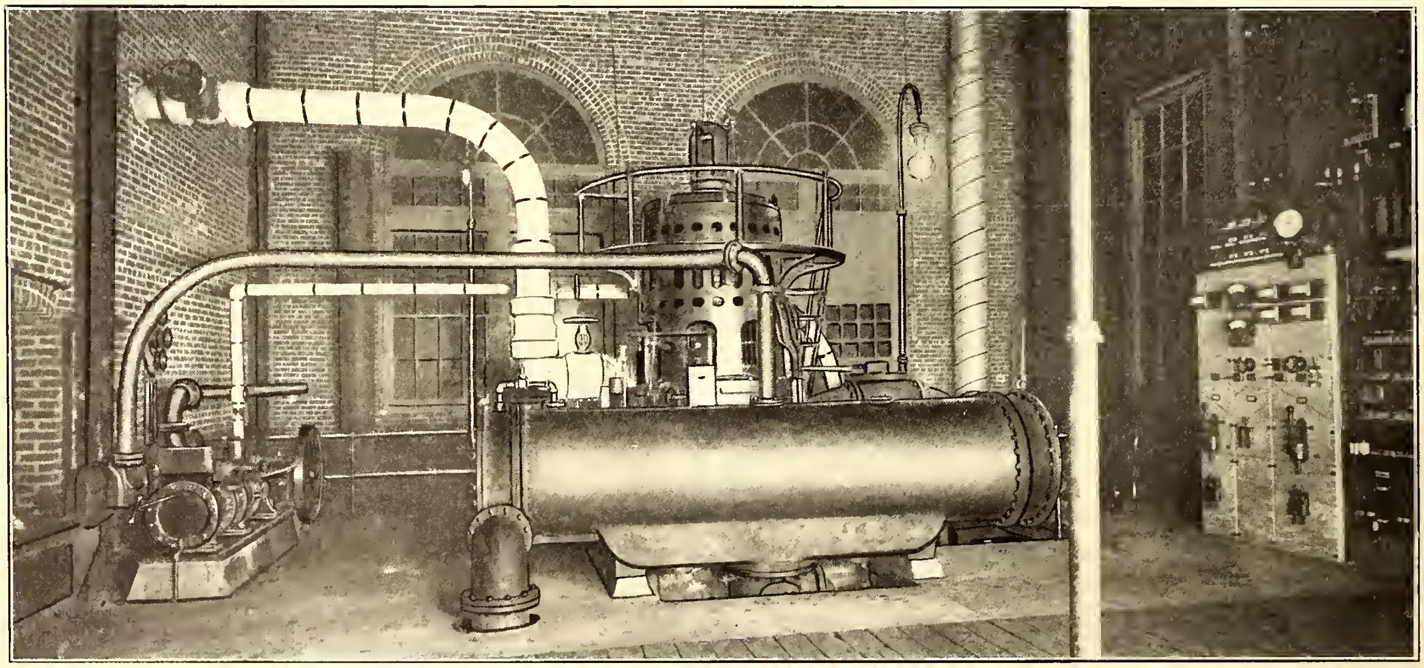


FIG. 10.—GENERAL VIEW OF OPERATING ROOM, SHOWING TURBINE AND CONDENSER

boiler room. A by-pass around the heater is provided, however, and the exhaust may be passed direct to the atmosphere through a riser passing out the boiler room roof.

The generator immediately above the steam turbine is a four-pole, three-phase, 60-cycle machine, generating current at 2300 volts. With a continuous full load, the guaranteed temperature rise will not be above 40 degs. C. The machine will not be injured by a 100 per cent overload applied momentarily. The maximum rise in voltage when full non-inductive load is thrown off, is 8 per cent, the speed and excitation remaining constant. A 10-kw direct-driven motor-generator set furnishes the necessary current for exciting the generator. This is located near the west wall of the building. A quarter-phase induction motor drives the 125-volt, four-pole dynamo. In starting the plant, current for the induction motor is obtained from the Cherry Street station, over the wires which are also used for lighting the engine and boiler room. This current, at 2300 volts and 60 cycles, is stepped down to 220 volts by means of two single-phase type H transformers placed in the basement.

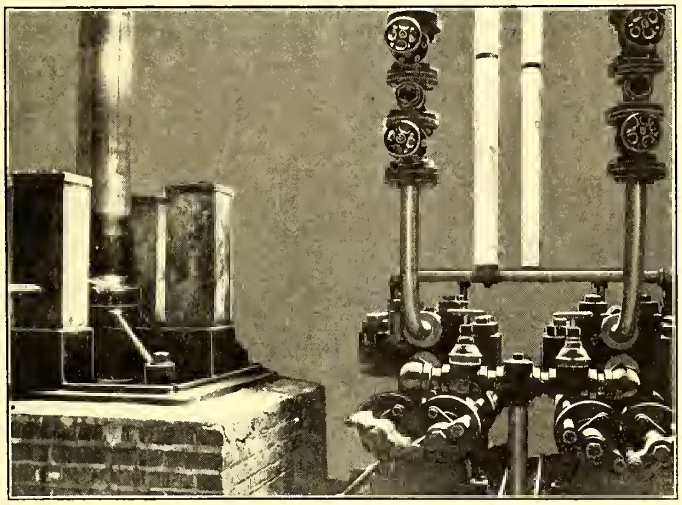


FIG. 11.—OIL PUMPS AND BASE OF ACCUMULATOR IN THE BASEMENT IN THE MULBERRY STREET POWER STATION

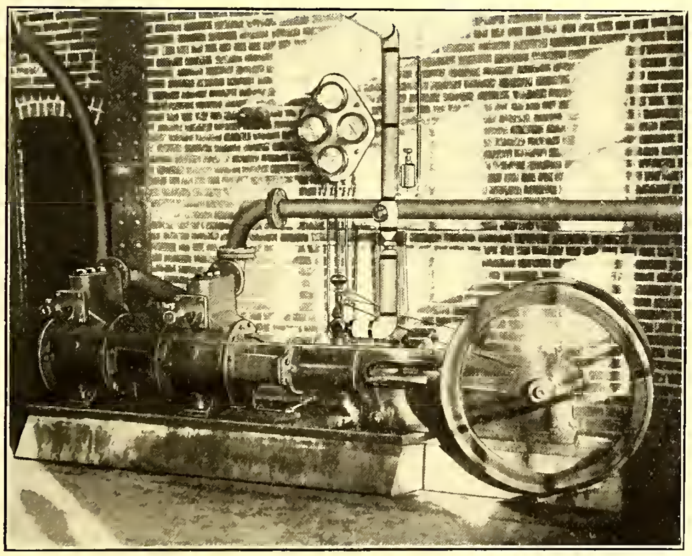


FIG. 13.—DRY VACUUM PUMP

The switchboard (Fig. 15), all the apparatus of which is of the General Electric make, and which is shown in the accompanying engraving, contains three panels of blue Vermont marble. The one on the left is mounted with the necessary instruments and switches of the motor-generator set. The central panel controls the generator, while the one on the right is for the load. The exciter panel carries a 25-amp. Thomson astatic ammeter, a 2500-volt oil switch and an overload relay. A 15-amp. Thomson recording wattmeter mounted on the back of the board measures the energy input of the exciter set. On the generator panel is mounted a 300-amp, two-pole, single-throw knife switch, a 175-volt Thomson astatic voltmeter and a 400-amp. ammeter. The load panel is equipped with an overload relay, a 300-amp. type F, four-pole oil switch, power factor ammeter, indicating wattmeter, and two 200-amp. ammeters, one in each phase. A 150-amp. recording wattmeter measures the total output. A single set of series transformers furnish current for the several measuring instruments, while another set of potential transformers provides low voltage current for all the voltmeters and wattmeters. From the load panel four 0000 cables carry the current direct to the switchboard of the Cherry Street station. Over the same pole line smaller wires are carried from the Cherry Street station for lighting the new station and operating the induction motor of the exciting set when the turbine of the new station is started. In bringing this pole line to the station, the poles were so placed as to not interfere with the contemplated extensions to the building. The station was erected by the Columbia Improvement Company, of Boston, O. A. Bridges having charge of the work.

The rapidity with which the plant was constructed is rather creditable to those in charge. The several accompanying photographs show the rapid progress. The first one (Fig. 4), taken May 14, shows the excavating not yet finished. Fourteen days later, May 28 (Fig. 5), the foundations were almost completed. On July 9 (Fig. 6) the framework of the building was up and the chimney erected. On Nov. 5 the plant was operated under load.

THE CHERRY STREET STATION

The station at Ninth and Cherry Streets is the largest of the three. It is located just to the rear of the present freight depot, which was formerly the car houses and the repair shops. The stacks from the several boilers and the roof of the power house may be seen in Fig. 16, which is a reproduction from a photograph of the Terre Haute freight depot. This station, with

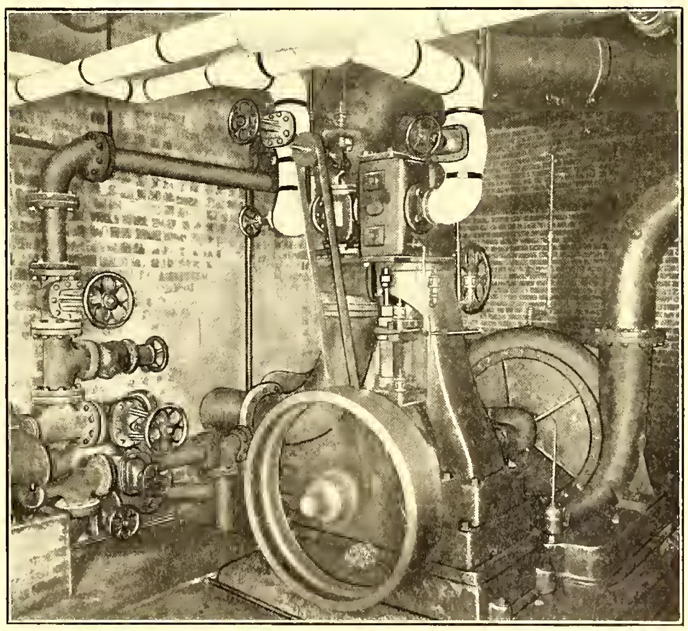


FIG. 14.—ENGINE-DRIVEN ROTARY CIRCULATING PUMP

the assistance of the current obtained from the new turbine plant, in addition to operating the street railway system, furnishes current for all the electric power and lighting of the city of Terre Haute. In addition, an extensive system of steam heating mains, which supply heat to the business section of the city, leave the station. Although the station has been recently overhauled, it cannot be considered a modern one. However, it contains several features of interest.

Coal is hauled to the station in wagons from the neighboring railroad yards. Tracks are provided for hauling this in cars, but the added expense of operating the conveyors at night, the only time the coal car could be operated without interfering with schedules, and other attendant expenses, make it advisable to employ wagons. Before reaching the receiving hopper, the wagons pass over a platform scales and the coal is weighed. A Hunt bucket conveyor of about 15 tons capacity per hour elevates the coal to overhead bunkers, which have a total capacity of 280 tons. The bunkers are divided into separate sections for each boiler, so that different grades of coal may be burned in the several furnaces. The same conveyors carry the ashes to an overhead bunker. An ash car (Fig. 22) receives the ashes from the bunker through a chute leading into the alley. The boiler room contains seven Cahall vertical water-tube boilers of 250 hp each, and two Climax vertical boilers, each of 500 hp, giving a total of 2750 boiler-hp for the station. All the boilers are equipped with Roney mechanical stokers, driven by Westinghouse engines. The stokers are arranged in three independent sets, two of these being in connection with the Cahall boilers. The boiler feed-water is obtained from the city water mains. Before passing to the boilers, however, it goes through a process of filtration and softening, this being that of the Industrial Water Softening Company of New York, the plant having a capacity of 5000 gals. per hour. In this system the chemicals, which precipitate the scale-forming solids, are introduced in two separate tanks. The paddles stirring the mixtures are operated by a water wheel, this being turned by the water entering from the city mains. Large settling tanks receive the mixture, and from these the treated water is pumped to a receiving tank by a motor-driven triplex pump located in the engine room. From the receiving tank the water flows by gravity to the four Dean feed-pumps. After passing through heaters, where it is raised to a temperature of 210 degs., the water enters the boilers. Each boiler is connected through an 8-in. bend to a 16-in. steam header, from which the separate engines are supplied. In all, there are seven generating units, five of which are located in the main engine room (Fig. 17), while the remaining two, which are belted, occupy an adjoining room. Non-condensing engines are used entirely, the exhaust being utilized in cold weather in the steam-heating system previously referred to. Four of the units generate alternating current used for power and lighting in the city, and for operating the sub-station on the Clinton interurban line. The current for the sub-station, generated at 2200 volts, 60 cycles, two-phase, is carried to a transformer sub-station located 600 yds. distant. It is here stepped up to 11,000 volts by means of Scott connected two-phase to three-phase transformers, and is transmitted as three-phase current over a high-tension line, consisting of three No. 4 aluminum wires, to the sub-station at Atherton, 11 miles distant. Here it is stepped down to 360 volts by two three-phase to two-phase 125-kw transformers, and passes to a 200-kw, 550-volt rotary converter. The direct-current generators consist of a 300-kw, 550-volt Westinghouse generator direct connected to a 450-hp Fitchburg simple non-condensing engine; a 300-kw, 550-volt General Electric generator to a 500-hp Armington & Sims engine, and a 200-kw, 550-volt Westinghouse generator belted to a 250-hp Westinghouse compound engine. For the alternating-current machines, two exciter units are provided. These consist of two 25-kw generators. One is direct connected to a 50-hp Westinghouse induction motor, the other being driven by a Westinghouse compound engine.

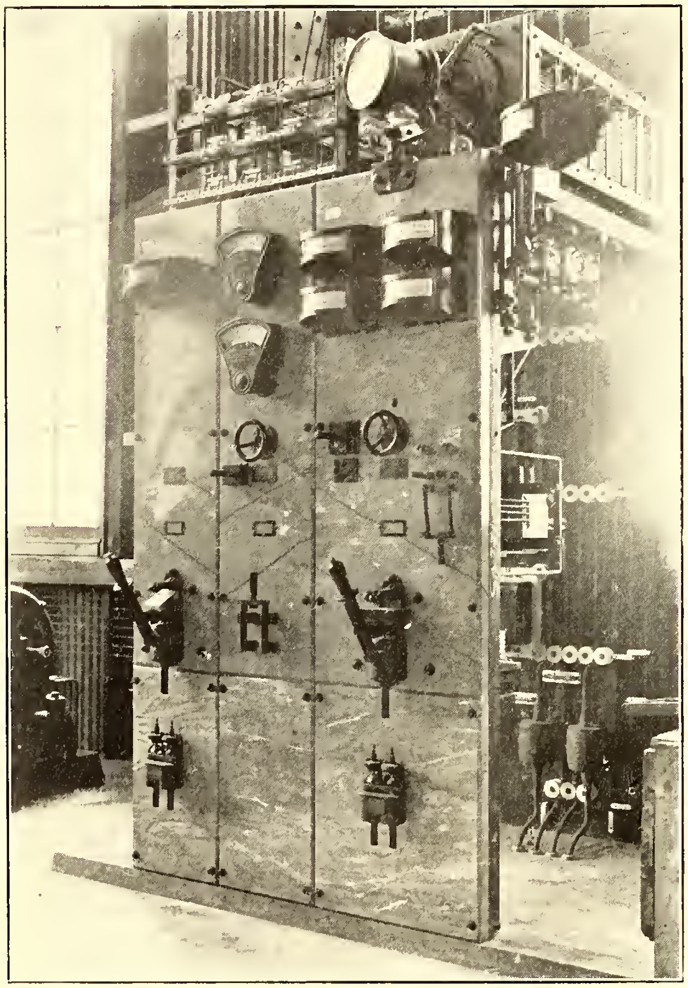


FIG. 15.—THREE-PANEL SWITCHBOARD IN MULBERRY STREET POWER STATION

The oil from the several machines in the power house drains to a filter in the basement. This consists simply of three tanks, arranged one above the other, the oil flowing from the top of one tank to the one immediately below it. Two small duplex pumps then elevate it to a storage tank above, from which the distributing system leads to the oil cups of the several machines.

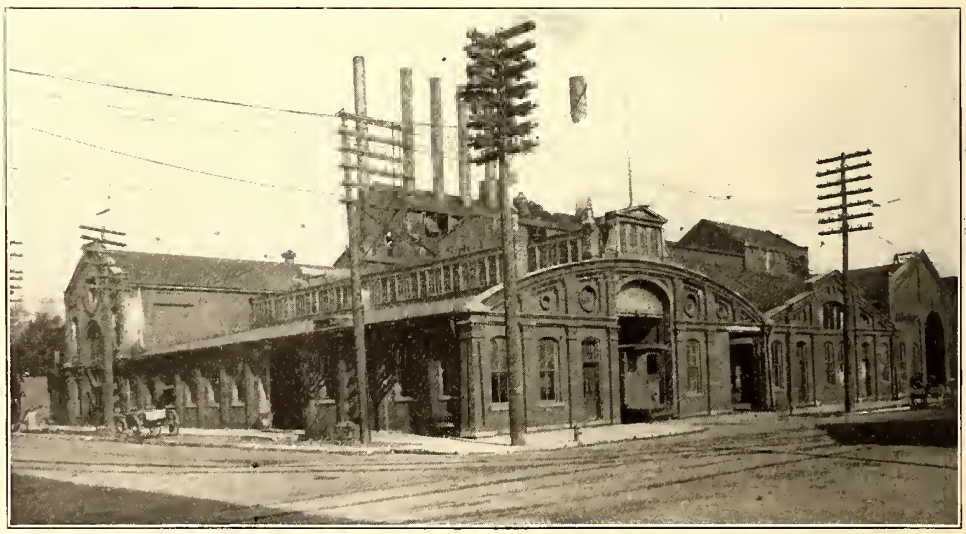


FIG. 16.—FREIGHT DEPOT, WITH CHERRY STREET POWER STATION IN THE REAR

THE BRAZIL STATION

The station at Brazil is likewise used for city power and lighting service, in addition to railway work. The boiler room contains seven horizontal tubular boilers, having a combined capacity of 660 hp. The engines are all belted to generators of different types. Of these, four, having an aggregate of more than 300-kw capacity, are for direct current at 550 volts. The alternating-current machines include one 200-kw and one 100-kw, 2200-volt Wood alternators. It is intended eventually to generate all the power for the system at the new turbine station on Mulberry Street, which, as has been stated, is so constructed as to permit of future enlargement.

CITY SYSTEM

The city is about equally divided by Wabash Avenue, extending east and west, which is laid with a double track. Single tracks branching off at several of the cross streets completely cover the city. The Wabash Avenue line continues east, forming the interurban line to Brazil. A continuation of the North Thirteenth Street line operates to Clinton. A twelve-minute schedule is maintained on all the city lines, each car usually having a run which takes it from the northern to the southern part of the city, or vice versa.

CARS

In all, there are eighty-six cars on the system. This number includes a snow-plow, a cinder car, a line car, two freight and express cars, and closed motor cars ranging in size from those of 16-ft. bodies to the interurban coaches on the Clinton or north line, which are 49 ft. over bumpers. There are twenty-three ten-bench open motor cars for regular city service, while for interurban work and for handling crowds in the city on special occasions there are six fifteen-bench cars of the same class. The standard closed city car, which has a 22-ft. body, and the standard ten-bench open car for city service are shown in Figs. 18 and 19. The cars operated on the Brazil or east interurban line were built by the Laconia Car Company. There are six of these, each 46 ft. 8 ins. over bumpers, 8 ft. 4 ins. over sills, and having a seating capacity for forty-six people. They are equipped with Brill 27-G trucks.

The three cars on the Clinton or north line (Fig. 20) were built by the John Stephenson Company, and are somewhat larger. They measure 49 ft. over bumpers, 8 ft. 9 ins. over sills, and seat fifty-two people. The four Westinghouse 38-B motors by which they are driven are mounted on St. Louis Car Company M. C. B. trucks, and are operated by means of K-14 controllers. The engraving (Fig. 21) shows one of the two freight and express cars. These were built in Terre Haute by the American Car & Foundry Company, being 32 ft. 9 ins. in length, 6 ft. 11 ins. in width, and the bodies are 7 ft.. in height. The cinder car, previously referred to (Fig. 22), used in conveying ashes from the Cherry Street power house, is equipped with cabs at each end. Wood uprights support the two trolley bases. All the longer cars are provided with two trolleys, and the city, as well as the interurban cars, are equipped with controllers at each end, so that they may be operated in either direction, there being no loops at the ends of the lines.

Wilson trolley catchers are provided on both city and interurban cars. Wagenhals electric headlights are used on the interurban lines. The style of sign in use on all cars is plainly shown in the engraving of the standard open city motor car (Fig. 19). This is manufactured by the company, and was

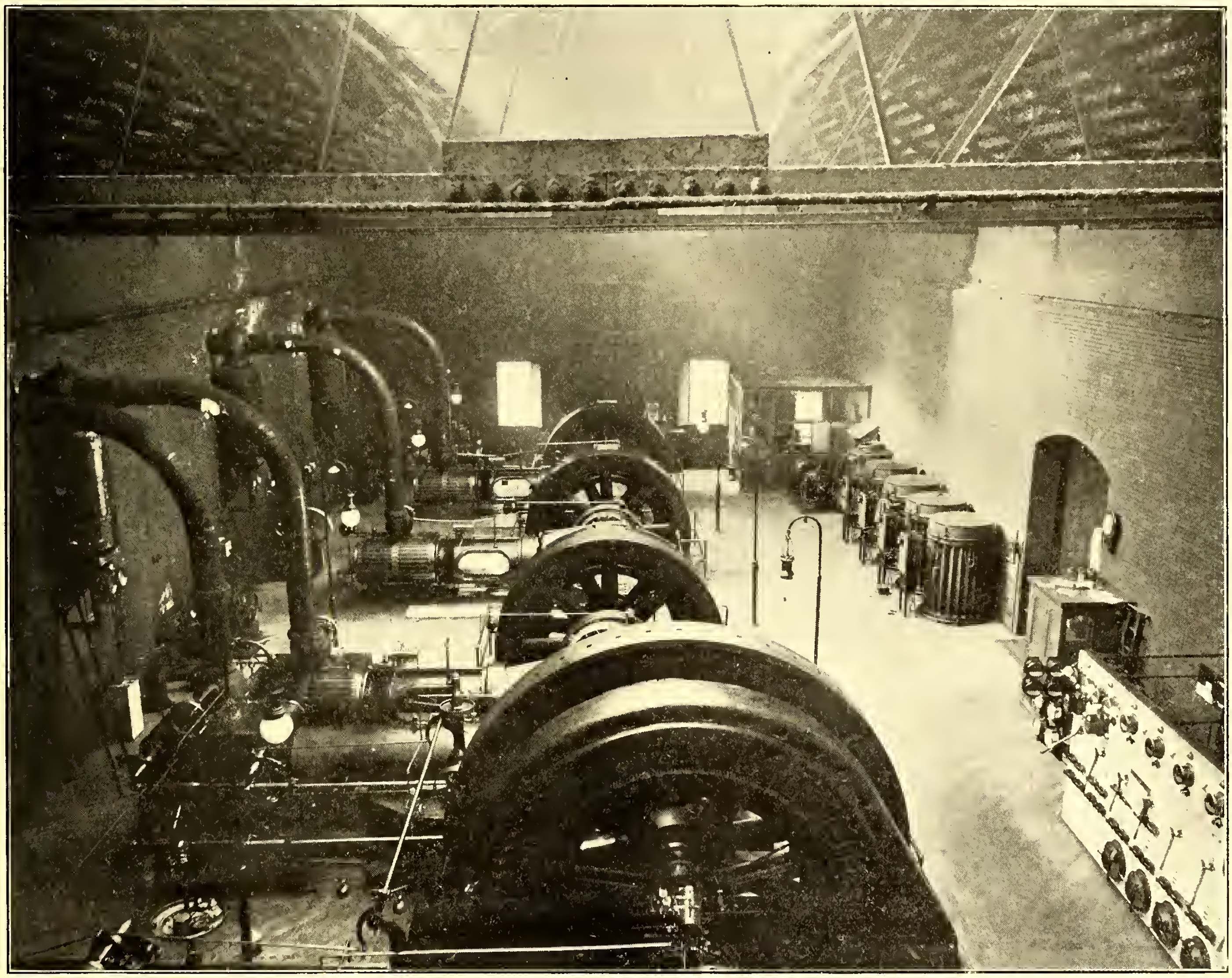


FIG. 17.—ENGINE ROOM OF CHERRY STREET STATION, FROM THE WEST

designed by Mr. Wells, the resident manager of the system. The overhanging hood not only protects the painted sign, which may be easily removed for the insertion of a different one, but

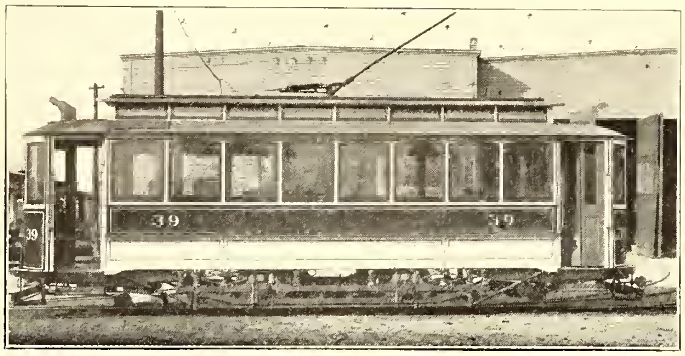


FIG. 18.—STANDARD CLOSED CITY MOTOR CAR

it also serves as a reflector for the two 16-cp lamps placed inside of it.

INTERURBAN SERVICE

The interurban line running east extends to Harmony, a small town east of Brazil, and 19.17 miles distant from Third Street and Wabash Avenue, Terre Haute, which is the western

FIG. 21.—STANDARD EXPRESS AND FREIGHT CAR

terminus of the run. Over the portion of this line between Brazil and Harmony, probably the first interurban service in Indiana was inaugurated on July 15, 1893. A schedule with cars at one-hour intervals is maintained. This requires three cars, three hours being consumed in making the round trip.

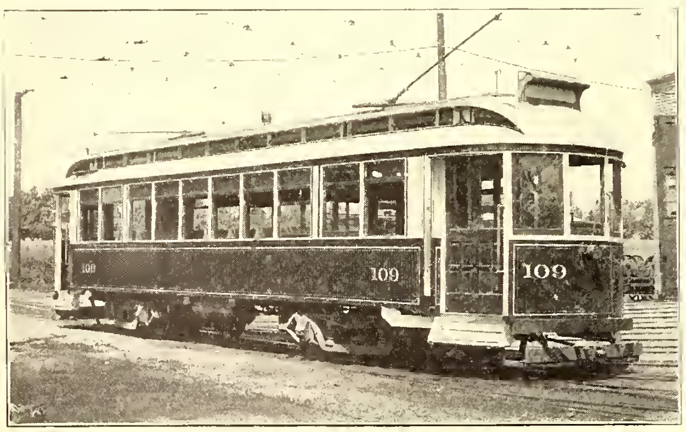


FIG. 20.—INTERURBAN CAR ON THE CLINTON LINE

The actual run to Brazil, 15.685 miles from the western terminus, requires but one hour, but to allow the cars to leave Brazil on the hour, it is necessary to consume one hour in making the round trip between Brazil and Harmony. The first car leaves Terre Haute at 4:45 in the morning. This runs through to Harmony. The car leaving Terre Haute at 5 o'clock runs to Brazil only, and leaves there on the return trip at 6 o'clock. Immediately behind it follows the car which has previously gone through to Harmony. This arrangement is affected for

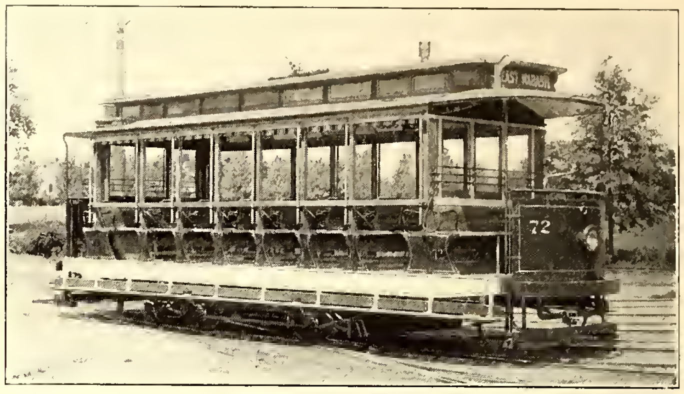


FIG. 19.—STANDARD OPEN CITY MOTOR CAR

the accommodation of miners employed in the several coal mines between Brazil and Ermandale. At Ermandale the rear car turns back to Brazil, arriving there in time to leave on the regular 7 o'clock schedule. After this, the regular hourly schedule is maintained throughout the day and until 11 o'clock at night. Late in the afternoon, however, two extra trains are run to return the miners along the line to their homes in Brazil and Harmony.

In addition to the passenger car schedule, a freight and express car makes two round trips on the line each day. The interurban line north extends 16 miles to Clinton. Only two cars are required to maintain a one-hour schedule. On this line, too, a freight train makes two round trips a day. On Sundays it is necessary to double the schedule on the interurban lines to accommodate the increased travel.

INTERURBAN CONSTRUCTION

The interurban line to Brazil, which has been in operation since Sept. 1, 1900, was originally known as the Brazil Rapid Transit Company. The track is laid with 60-lb. standard T-rails in 60-ft. lengths, the joints being bonded with Chase-Shawmut bonds. The maximum grade on the line is 6 per cent, while the sharpest curve

FIG. 22.—CINDER CAR USED FOR CONVEYING ASHES FROM THE POWER HOUSE

is of about 65-ft. radius. The track is well ballasted with gravel obtained from the company's pit near Williamstown. Bracket type of line construction is used except in towns and villages, where the trolley is supported by span wires in the usual manner.

The poles for the bracket construction are 35 ft. in length, placed 6 ft. 10 ins. from the center line of the track. Above the bracket a single cross-arm is bolted. This carries four telephone wires and a single feeder, the pin for the feeder being placed near the pole on the side opposite the bracket. For a distance of 3 miles east from Terre Haute and west from Brazil, the single feeders are 500,000 circ. mils in area. They are then returned to 0000 wire for the remaining 4 miles in either direction to their termination. This leaves a gap of 2 miles between the terminals of the feeders. A 0000 feeder extends east from Brazil toward Harmony, a distance of 2 miles.

Double trolley is used. These are of 00 wire, and are hung on the brackets 19 ft. from the rail. At intervals of about 2 miles, sidings are located. Between Terre Haute and Harmony, the end of the line, there are ten of these, which divide the 19 miles of the line into eleven sections. This makes the distance between sidings comparatively small, and, consequently, very little time is lost by cars lying on sidings while waiting for others going in the opposite direction to pass.

Where the Southern Indiana Railway and the line intersect, the former passes over the electric line on a long wooden trestle. At the Glen Stock Farm, the second siding out of Terre Haute, the line passes over the tracks of the Vandalia Railroad. A steel viaduct (Figs. 23 and 24) several hundred feet in length carries the track at this point. Steel trolley poles of the lattice type support the trolley. Wood fillers insulate the brackets from the poles.

In general features the interurban line north to Clinton is similar in construction to the Brazil line. The rails are of the same weight, but are in 35-ft. lengths. The poles, 35 ft in length, carry between Terre Haute and the sub-station at Atherton, two cross-arms above the bracket. The upper one, together with a pin on top of the pole, support the three high-tension wires, these being arranged in a triangle with 27-in. sides. The lower bracket carries two telephone wires, and for the greater portion an aluminum feeder of 0000 copper equivalent. A single 00 trolley placed 19 ft. above the rail is used. The sidings are numbered, there being five between Terre Haute and Clinton. Spring frogs, as well as spring switches, are used in the track construction. At Clinton the line crosses the Wabash River over the county bridge. One-half mile east of the bridge the road passes over a low portion of the river bottoms, necessitating a heavy fill, which, together with a trestle 700 ft. long, extends for more than a mile.

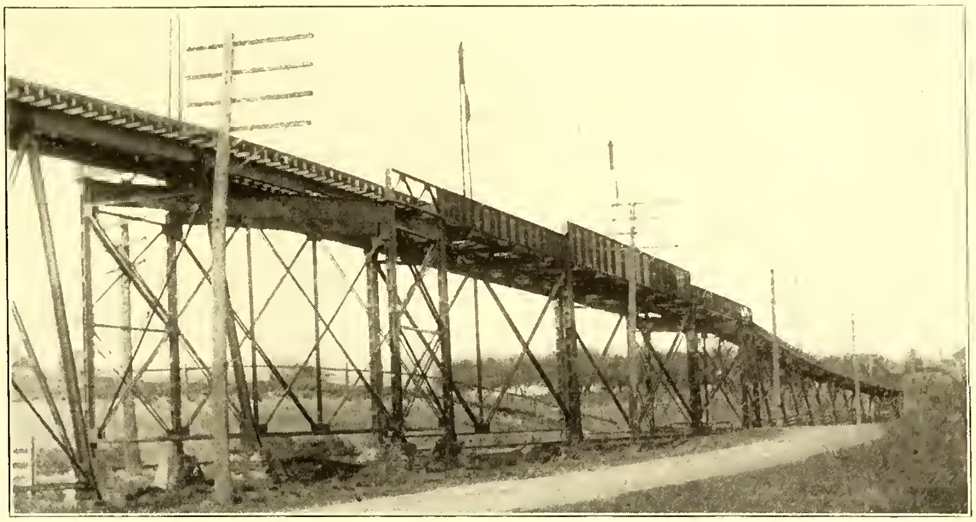


FIG. 24.—ANOTHER VIEW OF THE VIADUCT OVER THE VANDALIA RAILROAD, AT GLEN STOCK FARM

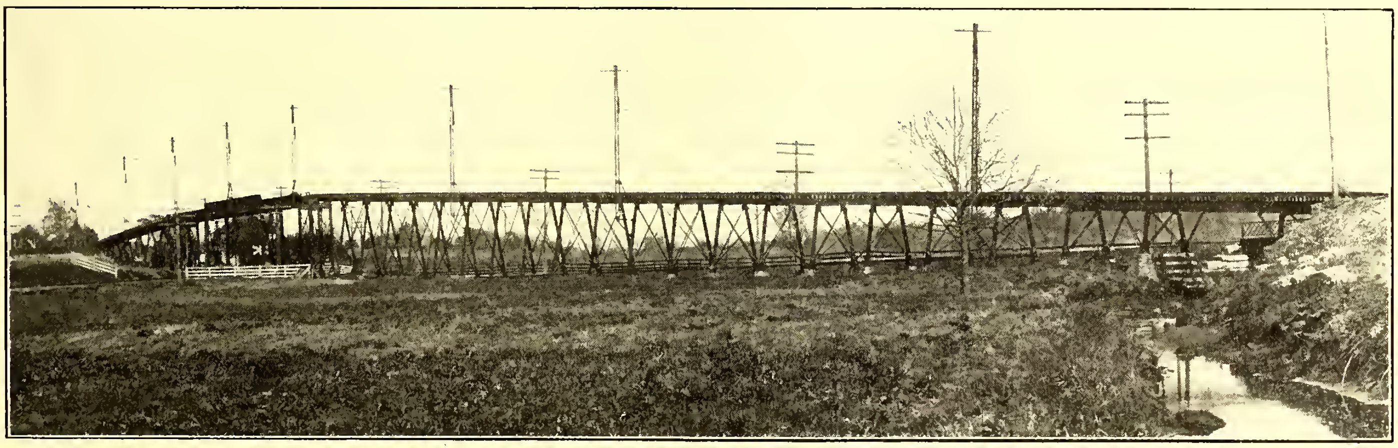


FIG. 23.—VIEW OF VIADUCT OVER VANDALIA LINE AT GLEN STOCK FARM

The fare charged on the interurban line approximates 1½ cents a mile. The through fare between Terre Haute and Brazil, however, is only 20 cents. Twenty-five cents is charged between Terre Haute and Clinton. For through passengers the total amount of fare is collected at one time and a cash fare receipt given. For others, it is collected as each of the several 5-cent sections are passed over. The passenger traffic is largely that of the class usually found on interurban lines terminating in cities. It is, however, considerably augmented by the traffic between the several coal mines along the lines and by carrying the miners to and from their work. The freight traffic, previously referred to, is varied in its character, as may be observed by the assortment of freight ready for shipment, shown in (Fig. 25) the illustration of the freight car being loaded at the station. In addition to the freight hauled in the regular freight cars, every third passenger car carries small packages of express matter.

DESPATCHING

Cars are despatched over the interurban lines by telephone, the despatcher being located at the shops on Wabash Avenue. Three lines terminate at his board, one from the Clinton line, one from the Brazil and one from the switchboard in the offices of the company down town. The sidings of the north or Clinton branch are equipped with stationary telephones, while on the Brazil line each car is supplied with a telephone and cut-in boxes are located at the sidings. Formerly the Brazil line was operated without a despatcher, the car obtaining right to the block by throwing a switch at each siding. This system having been abandoned, the wires formerly used will be utilized as duplicate wires to the despatcher's office in case of accident to the present one. Each telephone cut-in box will be equipped with a double-throw switch. In case one of the telephone lines becomes deranged, all the cut-in boxes may be connected to the other line by throwing the double-throw switch in the opposite direction. On the Brazil line, the conductor receives the orders

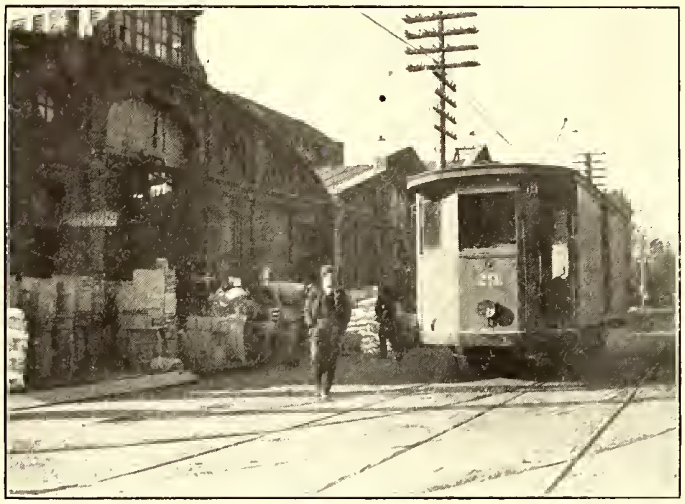


FIG. 25.—FREIGHT AND EXPRESS CAR BEING LOADED AT THE TERRE HAUTE FREIGHT STATION

from the despatcher and repeats them to the motorman. The Egry system of receiving despatches is employed on the Clinton branch. The motorman receives the orders and the conductor writes them down on the triplicator. Three copies are made, one of which is given to the motorman, while the conductor receives another, and the third remains locked in the machine.

The cars on regular schedule have regular meeting places, and despatching is resorted to only in case the cars get behind their scheduled time or extra trains are run. Although it is usually customary on other roads to give the car on scheduled time the right of way over the one behind time, in arranging passing points on this system no definite plan is pursued. In general, orders are given that will cause the least delay to both cars.

REPAIR SHOPS

The repair shops (Fig. 26) for the entire system are located on East Wabash Avenue, in Terre Haute, near the city limits, and are in charge of Morris M. Nash, railway superintendent and master mechanic of the system. The main building is of steel frame construction, with brick walls built in on the rear and the sides. The storage house contains ten tracks, all of which are provided with pits, the floor and track being supported by brick piers. The shops proper occupy the western portion of the building, a brick wall separating them from the storage section. They are well equipped for repair work, and practically all of it is done here, notwithstanding the fact that several large industrial plants of Terre Haute offer every facility for doing the heavier work. All the special work for the tracks is made in the shops. The rails are bent to shape by heating them and then bending them by means of jacks and a trip hammer. Motor repairs are all made from below. A hydraulic jack runs in a trench below the pits and at right angles to the tracks. This trench continues the full width of the building, passing under all the twelve tracks, so that repairs are readily made on any of the tracks of the storage house. When an armature is to be removed, the jack, which runs on a track in the trench, is shoved under the defective motor and raised against the lower shell. The hinge pins have all been removed from the motors, so that removing the necessary bolts permits the lower shell containing the armature to drop down with the jack. The jack carrying the armature and shell is then shoved to the eastern end of the pit, where it is immediately under an overhead traveler leading to the winding room. The armature is lifted by means of chain falls and carried to the winding room. After being repaired, the armature may be carried by means of the traveler to the lathe in the machine shop, where the commutator may be turned. By this arrangement all heavy lifting is avoided and much time saved, as one man alone may handle the heaviest armature.

Wheels are also removed from below. In several of the tracks immediately over the jack trench, sections of the rails may be removed. Wheels are dropped down by means of a jack and removed at one end of the pit. Cast-iron wheels are employed. These are made at the plant of the American Car & Foundry Company in Terre Haute. This company does all the heavy wheel work, the railway company sending the old wheels on the axles to them, and the axles are returned with the new wheels mounted. No attempt is made to grind flat wheels. When the flat spot becomes so large as to be objectionable, the wheel is removed. All armature coils, field coils, etc., are purchased, no attempt being made to wind them. Before being marked O. K., repaired armatures are submitted to an insulation test of 1000 volts. This voltage is obtained from a small

FIG. 26.—CAR HOUSE AND SHOPS ON WABASH AVENUE

step-up transformer located in the winding room and connected to the 110-volt alternating-current system used for lighting shops. Motors are carefully inspected and oiled each night. Once a month they are given a careful overhauling. The lower shell is dropped and the armature is removed. The shells are washed out with kerosene, and usually the inside is painted. The armature is likewise cleaned and painted. The motor axle bearings and the armature bearings of the cars on the Clinton line are equipped with oil lubricators of the Standard Automatic Lubricator Company, of Philadelphia. The lubricators are filled every three or four days, when about half of a pint of oil is required to each bearing.

PAINTING

A separate room is assigned in the shops for painting the cars. The standard body colors are green and white. The trucks are painted dark green, while the roofs are given a light drab color. Iron trimmings receive a coat of black asphaltum. In general, the striping and lettering is very plain, no corner ornaments being used, as may be observed in the engraving of the standard city box car. On the dark portions of the car, the striping and lettering is of aluminum leaf.

REGULATION OF HEATERS

Electric heaters are employed on the interurban cars as well as on those of the city system. The company recognizes the immense waste occasioned by electric heaters when in the hands of negligent trainmen, and has inaugurated a novel system to avoid much of the loss. The heaters are wired so that three gradations of heat may be obtained. At a specified place at the car houses, and at Sixth Street and Wabash Avenue, where all the cars of both interurban and city lines pass, signs with the numbers 0, 1, 2, 3 are hung up. When the sign with the zero mark is in place, the motorman understands that he is to keep his heaters turned off. The other signs indicate the number of points the heater switch is to be turned. The shop foreman exercises his own judgment as to what point the heater switches are to be turned when the cars start from the shop. The downtown sign is in charge of the starter, who hangs up the different signs according to the temperature. To insure the motorman following the signs, an inspector boards the car occasionally and notes the position of the switch.

MUTUAL BENEFIT ASSOCIATION

The company has sought to promote the welfare of its employees by all possible means, and has provided for their comfort, so far as their quarters are concerned, such facilities and accommodations as comport with the best afforded by companies of like character and size.

It has promoted and assisted in an organization of its men, known as a Mutual Benefit Association, and to this organization nearly all of the employees of the operating departments, both railway and lighting, belong.

Each member pays as dues 15 cents per week, and receives in benefits when sick, $5 a week, and in case of death a proportionately larger sum.

The government of the association is vested entirely in the men, but the company takes an active interest therein, and its officials are always welcome at any of its meetings.

EDUCATION OF EMPLOYEES

Both motormen and conductors are given a very thorough instruction in reference to their duties, both orally and by practical experience in the operation of a car, before they are passed to the status of full-fledged trainmen.

Not only are accepted applicants for work tested and instructed upon the cars by specially selected instructors, but they are also required to spend several days in shops, familiarizing themselves with the electrical equipment of the car and all the different parts of the apparatus connected with same.

While every endeavor is made to give a new man all help and assistance possible, and to expedite his advancement as rapidly as may be necessary, the process of education results in a sifting out of those who do not display natural aptitude for the work, or are not disposed to apply themselves honestly and thoroughly to the acquirement of the requisite knowledge, and by a final test, which is given by way of an oral examination by the superintendent and his helpers, the best men are selected and placed on the extra list for work.

The manager and his assistants are thoroughly alive to the necessity of securing a class of employees which shall be efficient and a credit to the company, but, as well, pleasing and agreeable to its passengers, and any method or system which is likely to insure the accomplishment of this object meets with ready adoption by the company's officials.

CALCIUM CHLORIDE FOR REMOVING SLEET AND PREVENTING ITS FORMATION

Since the introduction of the third-rail method for collecting current, every recurring winter has demonstrated anew the need for using some effective method to prevent the more or less annoying traffic interruptions due to ice-covered rails. Mechanical means involving the employment of scrapers and brushes usually are sufficient where the ice is of appreciable thickness, but they are seldom effective in those cases where a very thin glaze is formed, either through the freezing of rain or the condensation of surrounding vapor, on the colder rail. Despite its great thinness, this layer is an undesirably good insulator of the current-carrying rail, so that its speedy removal is a matter of considerable importance. Various electrical methods have been suggested whereby the sleet would be melted off the rail by raising its temperature, but none of these has been found economical, owing to the large amount of current required, particularly on long interurban lines, where the temperature often falls considerably below the freezing point.

It is fortunate, however, that a number of chemical experiments have also been made along this line by railway companies, and that the chemicals which have proved the best, namely, common salt (Na Cl) and calcium chloride (Ca Cl), are at the same time inexpensive. As is well known, water containing salt in solution has its freezing point lowered according to the density of the solution, and when salt is mixed with ice, the latter will melt at temperatures below the freezing point of water alone. These facts apply also to calcium chloride, but in considering the two, it is essential to bear in mind that calcium chloride is much superior to salt, because, unlike salt, its solutions have practically no corrosive effect on either steel or iron. Both chemicals corrode copper, but this point does not appear to be of any great importance, as very little of the solution squirted on the rails reaches the bonds.

A calcium chloride solution of the proper strength will prevent the formation of ice at a temperature so low as 32.6 degs. F. below zero. The following table, which was prepared by the Carbondale Chemical Company, of Carbondale, Pa., gives the quantity of 75 per cent "Solvay" fused or solid chloride of calcium required to make solutions of given specific gravities and corresponding freezing points:

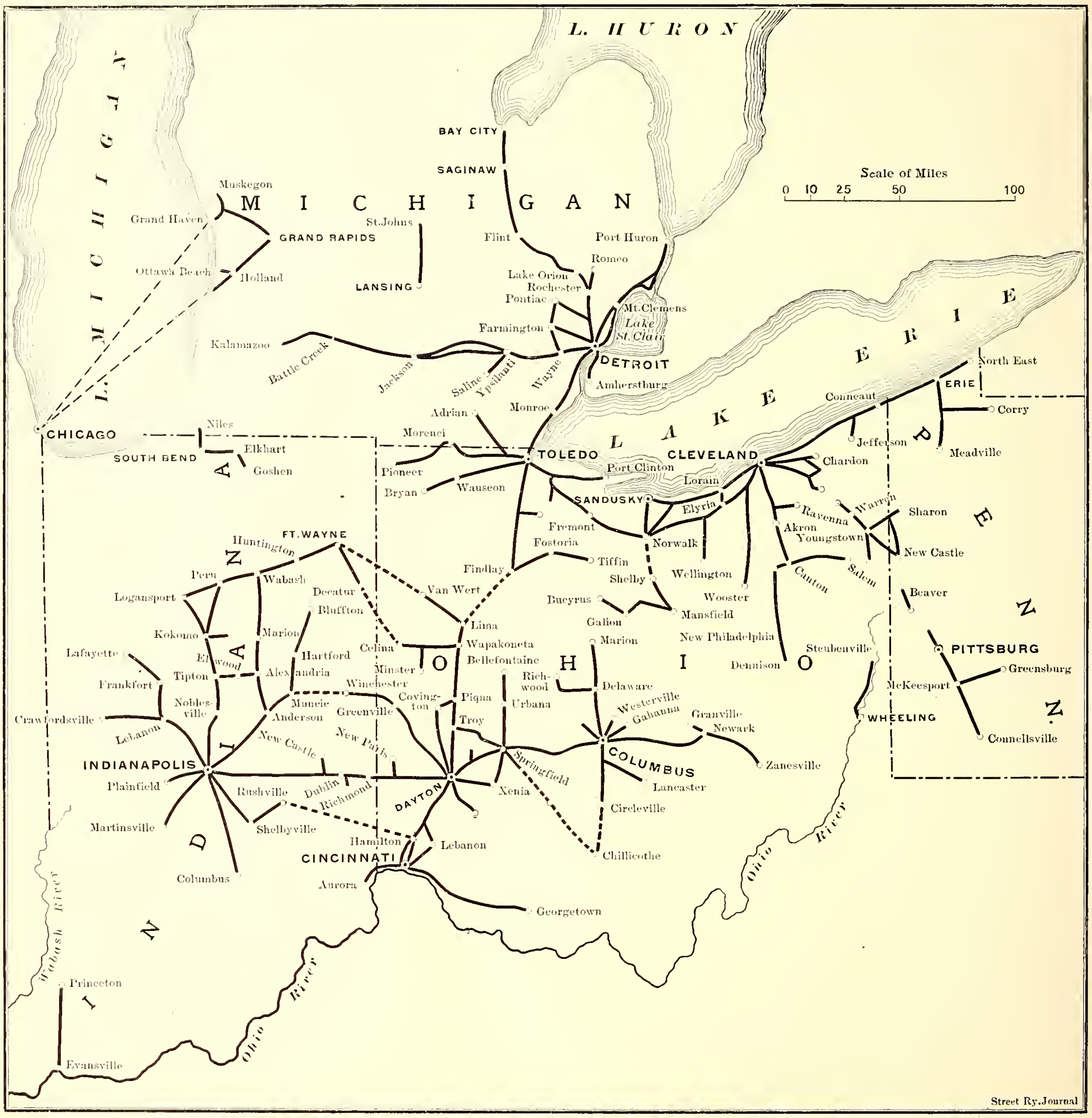
Specific Gravity	Per Cu. Ft. Solution	Per Gal. Solution	Freezing Point
1.250	28.75 lbs.	3 83 lbs	—32 6 degs F
1.225	26.55	3.54	—18.0
1.200	23.00	3.06	—9.0
1.175	19 72	2.63	Zero
1.150	16.83	2.24	7.5
1.125	14.09	1.88	13 0
1.100	11.82	1.57	18.0

The success and economy of calcium chloride on third rail is well exemplified by the article in the Jan. 21 issue regarding its use on the Aurora, Elgin & Chicago Electric Railway. The solution used by this company has a specific gravity, varying from 1200 to 1250, or a temperature range of —9 degs. F. to —32.6 degs. F. As 38 lbs. of calcium chloride is used for every 7½ gals. and only 1 gal. of the solution is required per mile, it is evident that the application of this method involves very little expense. Where the temperatures do not fall so low as on the line mentioned, the cost is even less, as the strength of the solution can be reduced.

A solution of chloride of calcium for fire pails is superior to one of salt or bicarbonate of soda, on account of its lower freezing point, non-corrosive effect on the ordinary iron or steel pail and its tendency to absorb water from the air instead of evaporating it.

LIMITED SERVICE AND INTERLINE BUSINESS

The year just closed has seen more important innovations in various branches of the electric railway industry than any other in the history of the business. It has witnessed the adoption of the single-phase alternating-current motor for interurban work, the use of the turbo-generator in traction power houses, the opening of the New York Subway, the adoption of without resorting to the steam roads, and hand in hand with this development has come the adoption by many of the connecting lines of high-speed limited trains, giving service equal in many respects to that of steam roads. Composite sleeping and parlor cars, buffet and chair cars and observation cars are now in actual service on some of the roads in this district, while other roads are planning to install similar service. These innovations have been referred to from time to time, but a de-



MAP OF PRINCIPAL INTERURBAN ELECTRIC LINES IN OHIO, INDIANA AND SOUTHERN MICHIGAN, SHOWING THROUGH ROUTES

electric locomotives on the New York Central terminal and the high-speed tests preliminary to this service, and the purchase of competing electric lines by a number of the great steam systems.

Perhaps of greater importance to the industry at large has been the completion of connecting links between the great network of traction lines in Pennsylvania, Ohio, Michigan and Indiana. Three lines completed within the past year render it possible to travel for hundreds of miles through these States

tailed review of the conveniences and possibilities for fast long-distance travel now offered to patrons of electric roads are calculated to open the eyes of even those engaged in the business.

The scheme of operating limited trains is not altogether new, but different requirements lead to their adoption on different roads, although, of course, the desire to compete with a parallel steam road was a salient feature in every case. The service given by some of the roads in this district, together with rates

LIMITED TRAIN SERVICE

NAME.	From To	Distance.	Time.	Time on City Track	Stops	LIMITED Trains Each Way.	REG'LAR Fare.	Excess.	Steam Fare.	Baggage on Limited.	Charge for Baggage.	Seating Capacity.	Length of Car	Number and Size Motor	Size of Wheels	Kind of Wheel.	Flange Dimensions.	Weight of Car.	Special Features.
			Hrs. Min	Min.			$		$				Feet.				In.	Tons.	
Lake Shore Electric Ry	Cleveland to Toledo	118	4 45	60	13	3	1.75	No	3.25	Yes	No	42	50	4- 75	34½	Steel Tire	1	34	
Lake Shore Electric Ry	Cleveland to Sandusky	60	2 30	40	6	5	1.00	No	1.80	Yes	No	42	50	4- 75	34½	Steel Tire	1	34	
Western Ohio & Dayton & Troy	Dayton to Lima	80	2 37	35	5	4	1.45	No	2.20	Yes	Yes	46	51	4- 75	37	Steel Tire	1⅛	35	
Dayton & Western & Ind. & Eastern	Dayton to Indianapolis	108	4 15	55	8	3	1.75	.50	3.30	No	Yes	26	45	4- 50	33	Steel Tire	⅞	32	Parlor-Buffet
Indianapolis & North Western	Indianapolis to Lafayette	69	2 30	35	5	5	1.05	.20	1.90	Yes	Yes	66	62	4- 75	33	Steel Tire	⅞	42	
Indianapolis & North Western	Indianapolis to Crawfordsville	52	1 50	30	3	6	75	.10	1.35	Yes	Yes	66	62	4- 75	33	Steel Tire	⅞	42	
Indiana Union Tr. Co	Indianapolis to Logansport	81	3	30	15	9	1.25	.25	2.35	No	Yes	48	56	4- 75	37¼	Steel Tire	⅞	36	Chairs in Smoker
Indiana Union Tr. Co	Indianapolis to Muncie	57	2 5	35	10	10	.85	.15	1.50	No	Yes	48	56	4- 75	37¼	Steel Tire	⅞	36	Chairs in Smoker
Columbus, Newark & Zanesville	Columbus to Zanesville	65	2 30	30	1	3	1.05	.35	1.75	No	Yes	24	51	4-150	..	......	..	50	Holland Sleeper
Detroit, Ypsilanti, Ann Arbor & Jackson	Detroit to Jackson	76	2 55	35	4	8	....	.20	....	No	Yes	56	52	4- 75	36	Cast Chill.	11/16	32	Chairs in Smoker
Jackson & Battle Creek	Jackson to Battle Creek	46	1 30	25	3	8	.65	No	.90	No	Yes	64	60	4-125	28	Steel Tire.	..	44	Observation End
Grand Rapids, Holland & Chicago	Grand Rapids to Holland	34	1 15	30	7	13	....	No	....	No	Yes	52	49	4- 50	33	Cast	⅞	30	

of fare as compared with those of competing steam roads, details of equipment, etc., are graphically shown in the accompanying table.

The Lake Shore Electric Railway, the pioneer in long-distance limited train service, has amply demonstrated that with fast service many people can be induced to use electric roads for trips of 100 miles or more. The service adopted a year ago between Cleveland and Toledo has proven so popular that frequently it has been necessary to run double-headers on these runs. Recently the limited service was extended to cover Sandusky, and there are now five fast trains each way between Cleveland and Sandusky; three running to Toledo. Plans are being perfected to extend the service to Detroit, 178 miles. The per cent of through business is increasing each month. The low rate of fare attracts those who aim to travel as cheaply as possible, while the convenience of having trunks carried with them and checked free attracts an unusually large number of traveling men. Reports covering ten months of operation indicate that limited cars earn an average of 38 cents per car-mile, as compared with 25½ cents per car-mile for all interurban passenger cars, including limiteds. The cars used in this service have a baggage compartment and a smoking room similar to that in a Pullman sleeper. Seats in both compartments are upholstered in leather and are comfortable for a long ride. By an arrangement with a caterer at Norwalk, passengers on the noon limiteds are served with attractive lunch en route. Cars leave Toledo and Cleveland at 7:30 a. m., 1:30 p. m. and 7:30 p. m., and stop only at the larger towns.

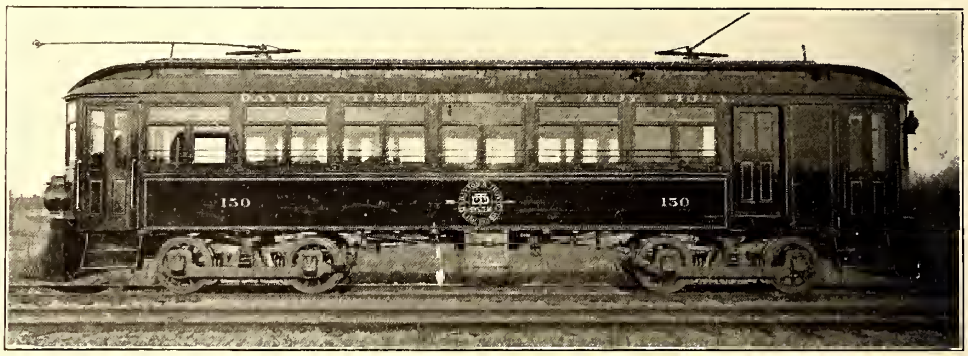
The interline limited service conducted by the Dayton & Troy Electric Railway and the Western Ohio Railway between Dayton and Lima, is probably the fastest regular service in the country for the distance. Cars leave each terminal at 8:18 a. m., 11:18 a. m., 2:18 p. m. and 5:18 p. m., this arrangement being made so as to allow passengers ample time to make connection at terminals with cars on other roads arriving and departing on the even hour. The schedule provides for an average speed of 33 m.p.h., although the cars traverse about 6 miles of city streets and make five regular stops, collecting and taking off baggage. The time is practically the same as that of the parallel steam road, and a record kept by a disinterested party for a month recently indicated that the electric cars were on time 40 per cent more times than the steam trains. Under the arrangement between the two companies, each road furnishes a car and crew, and they run through without change, each company maintaining its car and paying its own crew. The earnings are divided on a basis of local fares. The Dayton & Troy Company states that the earnings from limited cars is about 5 cents per car-mile greater than those of regular local cars, while the operating expenses are about 25 per cent less. At present no excess fare is charged, but the companies are planning to place carpets and chair seats in these cars and make a slight excess charge. No change has been made in the regular hourly service on these roads by reason of the limiteds, and the business on local cars does not appear to have fallen off.

Under an arrangement with the Richmond Street & Interurban Railway and the Indianapolis & Eastern Railway, the Dayton & Western Railway is operating "Interstate Limiteds" between Dayton and Indianapolis. The Dayton & Western has been running parlor buffet cars between Dayton and Richmond for two months, and the lowering of the grade under a bridge at Richmond now renders the through service possible. There are three trains each way, leaving either terminal at 7:10 a. m., 12:10 p. m. and 6:10 p. m.. This is arranged so that people will take advantage of the buffet service and to make close connections with limited cars on other roads. The cars stop only at stations in the larger towns, and a passenger is required to purchase a seat check before entering the car. Sales of seats are telephoned ahead and seats are reserved, and sales never exceed the seating capacity of the car. The interurban lines have a more direct route between the terminals than the competing steam lines, and the running time is nearly as good. Including the excess of 50 cents for the through run, or 25 cents between points on any one or two roads, the fare is considerably cheaper, and in view of the superior accommodations it is believed that the service is bound to be successful. The buffet service is claimed to be the first in regular service on an interurban road. The menu follows closely that used on regular Pullman buffet cars, and the prices are very reasonable. A copy of the menu is shown herewith. It contains three coupons, one to be retained by the waiter, one is handed to the conductor with the cash, and the third the passenger's receipt. The buffet cars were built by the Barney & Smith Car Company, and illustrations of interior, exterior and floor plan are shown herewith. The cars are finished in St. Jago mahogony, with inlaid decorations of the most recent design. The floor of the smoking room is covered with inlaid linoleum, while that in the main room has heavy Wilton carpet. Chairs in the smoking room are leather covered, while those in the main room are plush. The buffet between the two compartments contains stove, refrigerator, sink, shelves, etc. There is also a toilet room, lavatory, water cooler, etc. The floor framing is particularly heavy for a car of this length, and the floors

WESTERN OHIO 'LIMA LIMITED"

are thoroughly deadened. The car is mounted on Barney & Smith class J trucks. It is fitted with four Westinghouse No. 56 motors, Christensen AA-1 air brakes, K-14 controller, Wagenhals headlight, and 33-in. steel-tired wheels with 1-in. x 1-in. flange. Although the motor equipment is somewhat lighter than that used by many roads for similar service, the cars have shown a speed of 65 m.p.h., and have been run continuously all day without overheating the motors.

For the past five months the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Traction Company, which are operated by one management, have been operating two Holland composite sleeping and parlor cars between Columbus and Zanesville. The run, of course, was not long enough to make use of the sleeping car feature, but the cars make magnificent parlor cars. They have chair seats with foot stools, individual reading lamps, smoking compartment with leather chairs, electric cigar lighters, toilet rooms and lavatories for both men and women, and the finish is of the highest quality. The scenery along this route is probably as fine as is to be found on any interurban road in the country, and with such luxurious equipment, and without the smoke and dust of the steam road, it makes a trip that ought to attract all the business, particularly as the fare, including the excess, is 35 cents less than that of the steam roads. The cars ride like Pullmans, as they weigh nearly 50 tons each, and have five separate floors, each deadened by a layer of asbestos. They have four 150-hp motors, and are capable of a speed of 70 m.p.h. The arrangement with the Holland Company is very similar to that made by steam roads with the Pullman Company. The Holland Company maintains the interior of the car, the painting, etc., pays the porters and retains the excess fares, and also receives a mileage for the use of the car. The railway company pays its own crew and maintains the equipment. Seats are sold the same as in a Pullman, and the seating capacity of the car is not exceeded.



DAYTON & TROY "LIMA LIMITED"

The earnings of the Holland cars when used as sleepers will necessarily be very much larger than when they are employed as chair cars for day service only, as at present. So far the local conditions on the connecting lines have not been such as to permit of any long trips as that for which sleeping cars are required, but physical connections and improvements are under way on many of these roads by which sleeping cars can be operated over the long routes for which they are designed. The Holland Palace Car Company is now conducting negotiations with several of these connecting lines by which these cars will be taken off of the lines of the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, London & Zanesville Traction Company, so that the present arrangement will shortly terminate.

These companies have therefore arranged to use for this service a parlor car which they have at present. This car, which was heretofore used for private parties, is 55 ft. long and has chair seats. The excess fare will be reduced to 15 cents to Newark and 25 cents to Zanesville. For the balance of the winter there will be two runs instead of three, which will make it possible to take care of the service with the one car. Next spring another car of this type will probably be installed and the old schedule adopted again.

The Indiana Union Traction Company has had long experience in the operation of limited cars, and has settled on the policy of making every other car a limited. Limited cars over two of its lines leave Indianapolis on the odd hours. They make stops only in the centers of towns, while the local cars sandwiched between make all local stops. The excess on limiteds runs from 5 cents to 25 cents, according to distance. The excess is not large enough to be objectionable to the majority of the people in the towns, while the faster service is of great convenience to such people as well as to traveling men. The theory that the country people, who a few years back had no access to the cities other than driving, should be satisfied with a car once in two hours, and not insist upon all cars stopping in front of their doors, is one which is gaining favor, and a number of roads are following the example of the Indiana Union Traction Company. For the limited service, the company has a number of fine 56-ft. cars, built by the Cincinnati Car Company, and described in this paper some time ago. They have chair seats in the smoking compartment and have a buffet compartment, although this is not used at present.

The Indianapolis & Northwestern Railway operates limiteds over two divisions, at intervals of about three hours, and the local car is dropped out on the hours that the limiteds run. Baggage is carried on every car, and the service is used very largely by commercial traveling men. The cars are among the largest used in interurban service, and were built by the Laconia Car Company; one of them is illustrated. Limited cars on this line earn about 8 per cent more per car-mile than local cars.

The Detroit, Ypsilanti, Ann Arbor & Jackson Railway has recently instituted limited service between Detroit and Jackson. The limiteds, known as "Specials," leave Detroit every two hours. Between these are four cars; two making a local run to Wayne, 12 miles; one making a local run to Ann Arbor, and the third a local run to Jackson, all on the same route. A small excess is charged, and the cars are drawing a class of traveling men that the road did not get heretofore. If the service proves profitable, special parlor cars will be installed.

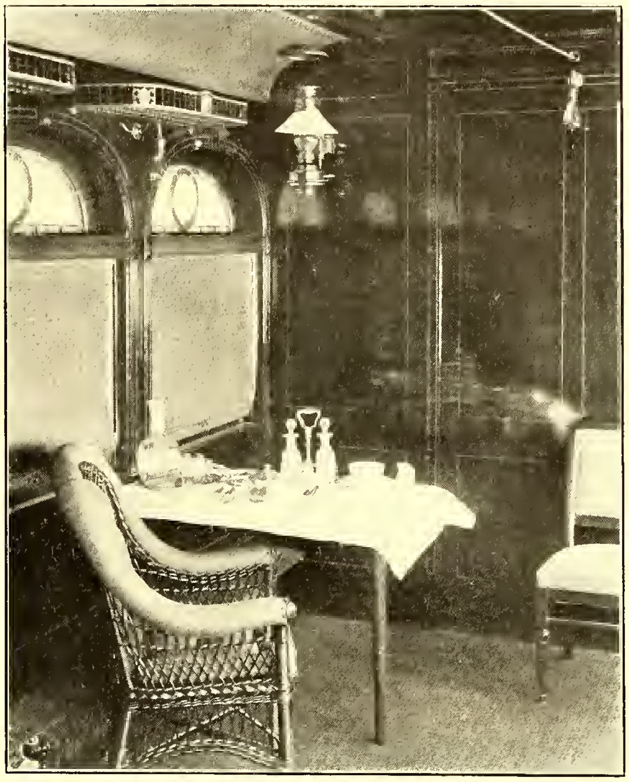
The Jackson & Battle Creek Traction Company operates limited cars between Jackson and Battle Creek at intervals of two hours. They make three regular stops and several flag stops. There are also five through locals and three locals for intermediate points a day. The limiteds seem to have worked up a tremendous amount of through business, as the company states they earn an average of 153 per cent more per car-mile than local cars. These limiteds make direct connection in both directions with the limiteds on the "Ypsilanti" line, rendering possible a trip of 122 miles in four hours and thirty-five minutes. The cars used in this service were described and illustrated in a recent issue of this paper. They have a circular smoking compartment and an observation end, in which there are chair seats. The running time is within five minutes of that of steam trains making the same stops.

The Grand Rapids, Holland & Chicago Railway has hourly headway the year around between Grand Rapids, Holland and Douglass. During the late fall, summer and early spring, it operates half-hour cars, which run limited, stopping only at towns. These cars are scheduled only at starting point and run through as fast as possible, the road being double track. The schedule is arranged so that a car runs limited in one direction and returns as a local. It is found that this counterbalances any evil effects from the continuous strain of high speed and makes all the equipment work alike. The company also runs cars each way night and morning to connect with boats to Chicago. These cars run through without stops except at steam crossings, and make 2 miles in Grand Rapids, 1½ miles in Holland and 26 miles in the country in fifty-six minutes.

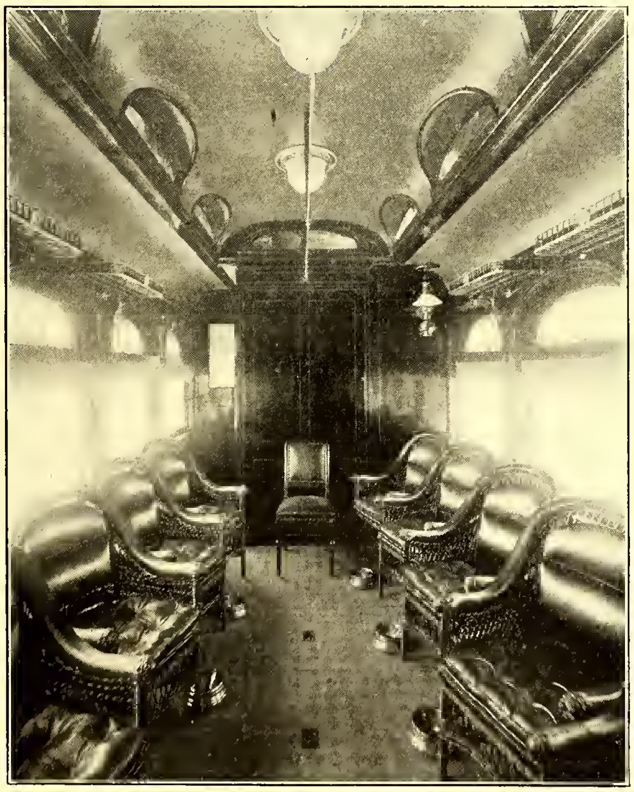
The Grand Rapids, Grand Haven & Muskegon Railway operates limited cars morning and evening to connect with boats for Chicago, and make the 34 miles in one hour and twenty minutes. For this service a dining car has been fitted up and breakfast is served to passengers for Grand Rapids.

The Detroit & Port Huron Shore Line Railway operates limited cars between Detroit and Port Huron, leaving Detroit at 7:45 a. m. and 3:15 p. m. These cars make five stops and cover 71 miles in two hours and thirty-five minutes.

The Cleveland, Painesville & Eastern Railway has operated for several years limited cars from Painesville to Cleveland in the morning and returning at night, for the benefit of Painesville people who do business in Cleveland, making the 31 miles in one hour and twenty minutes. The Cleveland, Painesville & Ashtabula Railway has a car from Ashtabula each morning

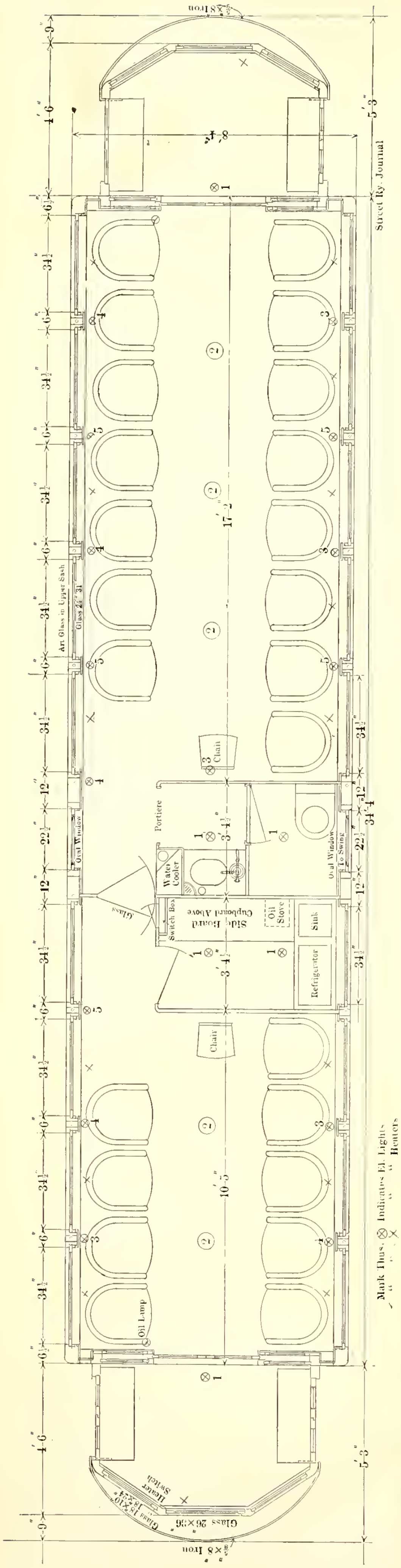


BUFFET LUNCH, DAYTON & WESTERN "LIMITED"



SMOKING COMPARTMENT, DAYTON & WESTERN "INTERSTATE LIMITED"

PARLOR COMPARTMENT, DAYTON & WESTERN "INTERSTATE LIMITED"



SEATING PLAN OF LIMITED CAR USED ON "INTERSTATE LIMITED," DAYTON & WESTERN TRACTION COMPANY

"THE WAY TO GO" D AND W

BUFFET SERVICE
MENU

Passenger will please make cross ⊗ mark in circle before each article desired
If more than one portion is wanted, specify in figures

○ Sliced Oranges, 10c	.10	0	0	0
○ Shredded Wheat Biscuit, with Cream, 20c	.20	0	0	0
○ Grape Nuts Food, with Cream, 20c	.20	0	0	0
○ Consomme or Tomato Soup, 20c	.20	0	0	0
○ Oysters on Half Shell, 25c	.25	0	0	0
○ Oyster Stew, 30c	.30	0	0	0
○ Boned Chicken, 30c ○ Sardines, 30c	.30	0	0	0
○ Cold Boiled Ham, 25c	.25	0	0	0
○ Baked Beans (hot or cold), 20c	.20	0	0	0
○ Boiled Eggs, 15c	.15	0	0	0
○ ______		0	0	0
○ Queen Olives, 15c	.15	0	0	0
○ Imported Chow Chow, 20c	.20	0	0	0
○ Pickles, 10c	.10	0	0	0
○ Bread and Butter, 10c ○ Boston Brown Bread, 10c	.10	0	0	0
○ Ham, Cheese or Tongue Sandwich, 15c	.15	0	0	0
○ Sardine Sandwich, 20c	.20	0	0	0
○ ______		0	0	0
○ Crackers, 10c	.10	0	0	0
○ Imperial or Swiss Cheese, 15c	.15	0	0	0
○ Caviar, 20c	.20	0	0	0
○ Coffe, 10c ○ Tea, 10c ○ Milk, 10c	.10	0	0	0
○ Cigars—Domestic, 10 and 15c		0	0	0
○ Cigars—Imported Havana, 15c st, and two for 25c		0	0	0
Total				

A separate check must be issued to each passenger

Waiter's No. 1 2

B. S. Passenger's Receipt for Meal.
To be punched by Waiter and returned to passenger.

Waiter's No. 1 2

Cents	50	55	60	65	70	75	80	85	90	95
	0	5	10	15	20	25	30	35	40	45
Dollars	0	1	2	3	4	5	6	7	8	9

This Receipt should correspond with amount of your order. Please report any overcharge or inattention to duty on this car to General Passenger Office, Dayton, enclosing this receipt with report.

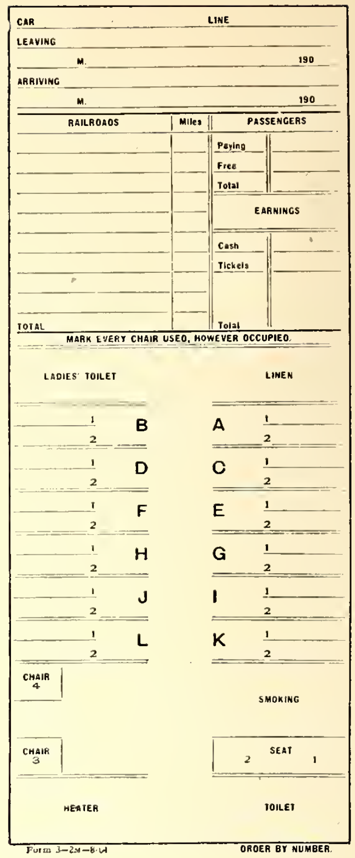
B. S.

Dollars	0	1	2	3	4	5	6	7	8	9
Cents	0	5	10	15	20	25	30	35	40	45
	50	55	60	65	70	75	80	85	90	95

After duplex receipt has been punched, waiter will detach this portion of check and give at once to conductor.

Waiter's No. 1 2

REGULAR MENU CARD, DAYTON & WESTERN "LIMITED"



PORTER'S CHART, HOLLAND SLEEPER, C. N. & Z. R. R.

which connects with the Painesville limited, giving a run of 61 miles in two hours and twenty minutes. No excess is charged.

The four roads between Cleveland and Erie, Pa., have arranged their schedules so that all hourly cars on these roads make close connections, and tickets are being sold through for $1.85, as compared with $2.75 on the steam roads. Negotiations are on for through limited cars between these points.

A number of roads are figuring on instituting limited service next spring. The Canton-Akron Railway Company and the Northern Ohio Traction & Light Company are planning to institute three fast cars a day between Canton and Cleveland, stopping only at Cuyahoga Falls and Akron, making the 59 miles in two hours and twenty minutes. The Canton & Akron Company is also planning to institute limited service between Canton and New Philadelphia.. These cars will connect with the Cleveland cars, giving fast service from New Philadelphia to Cleveland. The Pennsylvania & Mahoning Valley Railway is instituting a new limited service from Warren, Ohio, to New Castle, Pa., in much faster time than has prevailed heretofore. The Toledo, Bowling Green & Southern Traction Company will shortly institute limited service between Toledo and Findlay; three trains each way; time, one hour and fifty minutes, a tremendous improvement over the old schedule of three hours and ten minutes, and practically the same as the time of the steam road. The Detroit, Monroe & Toledo Short Line will

DAYTON & WESTERN PARLOR BUFFET CAR, "INTERSTATE LIMITED" institute limited service between Detroit and Toledo as soon as the north end of the road has been thoroughly ballasted. The 60 miles will be made in two hours instead of two and one-half hours, the present schedule. It is very probable that

INTERIOR OF HOLLAND PARLOR & SLEEPER, NEWARK & ZANESVILLE "LIMITED"

cars will be run through from Cleveland to Detroit under an arrangement with the Lake Shore Electric Railway. This run of 178 miles will be made in six hours and thirty minutes.

POSSIBILITIES FOR THROUGH TRAVEL

The existing possibilities for through traffic and those in sight in this district are most interesting. The accompanying map shows the connecting lines of Western Pennsylvania, Ohio, Indiana and Southern Michigan, together with a few roads nearing completion; it is not intended to be a complete map of all the roads in this district. The present longest possible continuous trip is from Corry, Pa., to Kalamazoo, Mich., about 480 miles. From Dennison, Ohio, to Bay City, Mich., gives a trip of about 450 miles. From Logansport, Ind., to Zanesville, Ohio, is a trip of 335 miles. It will be noticed by

INTERIOR COMPOSITE SLEEPER AND PARLOR CAR, PARTLY CONVERTED

reference to the map that there is a zone extending through Northern Indiana, Central Ohio and Western Pennsylvania which has not yet been crossed by any electric line. This year the gap between Lima and Findlay, Ohio, will be closed and probably other lines will be built across this zone, and it will then be possible to make journeys of from 800 miles to 1000 miles. The steam road man will say that it is preposterous for electric roads to hope to secure business over any such distances, but well-informed electric traffic men know that it is coming their way. The low rates of fare are bound to be an attraction, while the frequent service, the possibility of close connections, aided by the instituting of limited trains, places the electric lines in a position to capture a considerable amount of the business between points 200 miles to 300 miles apart. Of course, when such points are on the same steam trunk line, the steam has the advantage, but if they are accessible only by traveling over two or three steam lines, particularly where they are branch lines with one or two trains a day, the electrics can frequently deliver the party at his destination before the steam roads. Here are cases presented in the "deadly parallel":

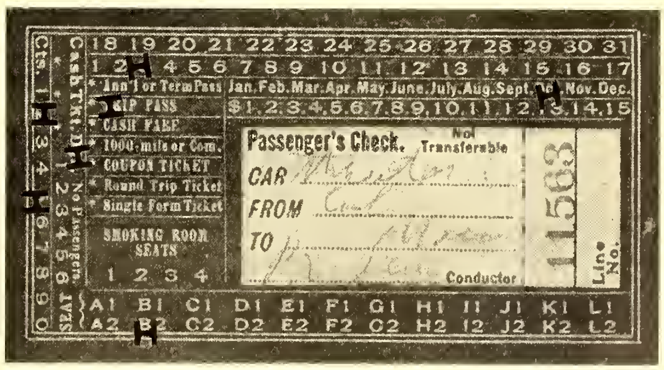
A MAN GOING FROM AKRON, OHIO, TO KALAMAZOO, MICH.

Steam Roads	*Electric Roads*
Leaves Akron, 6:37 a. m.; reaches Cleveland, 8:00 a. m.; leaves Cleveland, 10:35 a. m.; reaches Elkhart, Ind., at 6 p. m., and finds there is no train for Kalamazoo until 5:36 a. m., which gets him to Kalamazoo at 7:10 a. m. Fare, $8.07; miles, 355.	Leaves Akron, 5:30 a. m.; leaves Cleveland, 7:30 a. m.; leaves Toledo, 12 m.; arrives Detroit, 2 p. m.; leaves Detroit, 2:45 p. m.; arrives Jackson, 5:45; leaves Jackson, 5:55; arrives Battle Creek, 7:25; leaves Battle Creek, 7:30; arrives Kalamazoo, 9:45 p. m. Fare, $5.45; miles, 365; 22½ m.p.h.

A MAN GOING FROM INDIANAPOLIS, IND., TO ZANESVILLE, O.

Steam Roads	*Electric Roads*
Leaves Indianapolis at 8:10 a. m.; reaches Columbus, 12:45 p. m., but finds no train for Zanesville until 6:10 p. m.; reaching Zanesville at 8:20 p. m. Fare, $6.95; distance, 256 miles.	Leaves Indianapolis, 7:10 a. m. (Interstate Limited—breakfast on car), reaches Dayton, 11:25 a. m. (35 minutes for dinner); leaves Dayton, 12 m.; reaches Columbus, 3:50 p. m.; leaves Columbus, 4:00 p. m., (Zanesville limited), reaching Zanesville, 6:30 p. m. Fare, $4.70, including parlor car fares. Distance, 250 miles; 22¼ m.p.h.

The Detroit & Port Huron limiteds make close connection at Detroit with limiteds on other roads, and make possible a trip from Battle Creek to Port Huron, 191 miles, in seven hours and forty-five minutes, a rate of 24.9 m.p.h., making no deductions for layovers. Or it is possible to leave Cleveland at 7:30 a. m. and reach Port Huron at 5:50 p. m., 249 miles, in ten hours and twenty minutes, equal to 24 m.p.h., making no deductions for the layover of one hour and fifteen minutes in Detroit. A representative steam road in this district has a schedule of seven hours and fifty minutes for the 191 miles from Toledo to Russiaville, Ind., and a schedule of ten hours and six



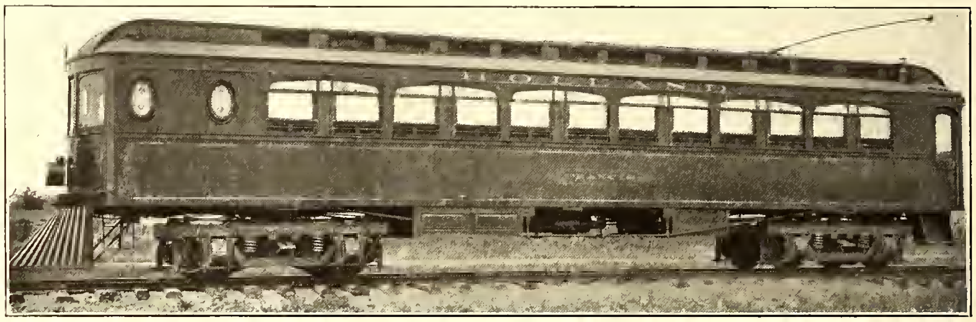
PASSENGER SEAT CHECK ISSUED ON HOLLAND SLEEPER

minutes from Toledo to Veedersburg, 249 miles, on a through train having no layovers.

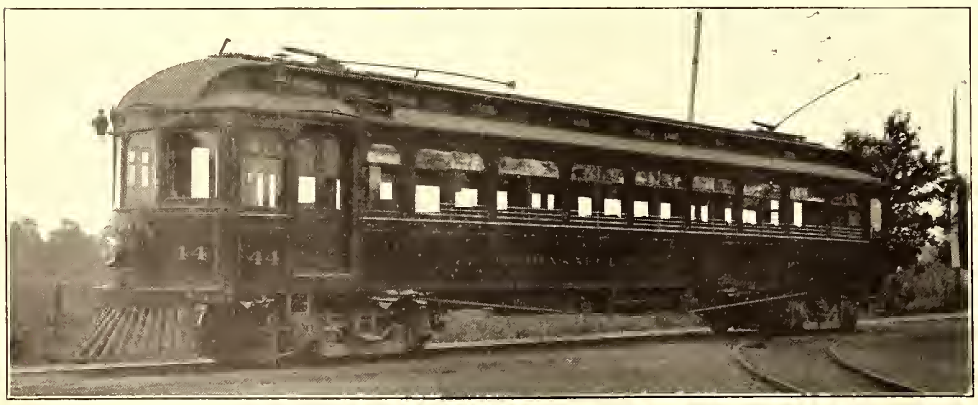
The Dayton & Western "Interstate Limiteds," connecting as they do with the "Lima Limiteds" at Dayton, make possible a trip from Indianapolis to Lima, 188 miles, in six hours and forty-five minutes, which is better connection than can be made by way of Dayton on steam roads. Similar instances almost without number could be found if one figured for connections between small towns widely separated, and the possibilities would be greater were it not for the fact that few electric roads operate cars before 5 a. m. and after 12 p. m.

The significant feature of these comparisons is the fact that such journeys could be made quicker if the two systems worked hand in hand and interchanged business. The embargo of steam roads against electrics is bound to be broken sooner or later, and the few roads that have entered into such alliances have clearly disproved the assertion made by the steam traffic associations that the benefits of such alliances would be all on the side of the electrics. The Clover Leaf, a steam road operating from Toledo, Ohio, to St. Louis, connects with a large number of electrics in Ohio, Michigan and Indiana, and interlines with practically all of them, thereby offering low rates to hundreds of points in this district which it otherwise could not touch. Tickets are sold every day from Cleveland to St. Louis by the Lake Shore Electric; during the World's Fair it sold over 2000 of these tickets. In connection with the Indianapolis & Northwestern Traction Company, fast time is made between Indianapolis and Toledo, and in connection with the Detroit, Munroe & Toledo Short Line, good time is made to Detroit.

HOLLAND SLEEPER LEAVING COLUMBUS UNION STATION



SIDE VIEW OF HOLLAND SLEEPER



INDIANAPOLIS & NORTHWESTERN PARLOR "LIMITED" CAR

The Dayton & Western Company has made an arrangement with the Clover Leaf whereby it will sell through tickets and make direct connections for St. Louis. A passenger leaving Dayton on the 5:55 p. m. "Interstate Limited" reaches Indianapolis at 1:10 p. m., where connection is made with a limited car on the Indianapolis & Northwestern, reaching Frankfort in good time for the Clover Leaf night train, which reaches St. Louis at 7:36 a. m. The fare is, of course, much lower than an all-steam route, since one-third of the trip is on electric cars. A similar arrangement will soon be announced for through business from Dayton to Chicago.

The Dayton & Troy Electric has announced a most remarkable through service beginning Feb. 1. It has fitted up a handsome chair car, which will be known as the "Clover Leaf Special." Leaving Dayton at 5:18 p. m., it will run through to Delphos, 95 miles, over the Western Ohio and Fort Wayne, Van Wert & Lima electric lines, making close connections with Clover Leaf trains for both Toledo and St. Louis, reaching the former place at 11 p. m. and the latter place at 8:50 a. m. next morning. Going to Dayton, it will be possible to leave St. Louis at 8:15 a. m. or Toledo at 6:58 p. m., connecting with an electric car at 9:25 p. m., reaching Dayton at 12 midnight. On this trip the electric special will make 95 miles in two hours and thirty-five minutes, a rate of 36.8 m.p.h., undoubtedly the fastest long-distance run in the country. Baggage will be checked through on these cars, and Pullman reservations will be made in Dayton and all points on the electric lines. Rates will be $8 to St. Louis and $3.50 to Toledo, as compared with $9 and $4.30, the steam rates to these respective points.

The rebuilding of the Cincinnati, Dayton & Toledo Traction Company's line from Dayton to Cincinnati, and the extension of the Western Ohio from Lima to Findlay, both of which will probably be accomplished the coming summer, will mean fast all-electric service clear through from Cincinnati to Toledo and Detroit, while the purchase of the Appleyard lines between Dayton and Columbus by a strong syndicate, a change which undoubtedly will soon take place, will mean limited trains on these lines, with correspondingly improved service between Cincinnati and Columbus and Indianapolis and Columbus.

EARNINGS FROM LONG-DISTANCE SERVICE

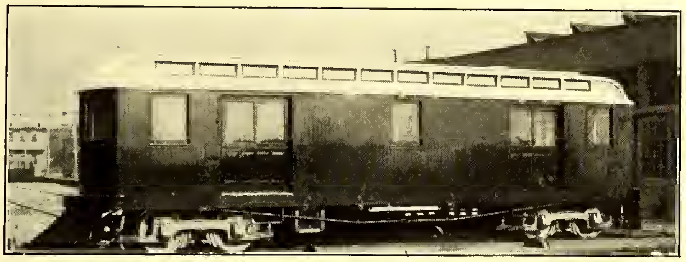
The willingness with which many steam roads have released their hold upon short-haul business is evidence that the long haul is the more profitable. The electric roads which have gone into this branch of the business have been more than pleased with the results. Figures given above indicate that already limited long-distance trains are earning from 25 per cent to 150 per cent more per car-mile than local cars. Furthermore, almost without exception, the experience is that such cars cost 10 per cent to 25 per cent less per car-mile to operate, due to the less frequent stops, resulting in smaller power consumption, less wear and tear on equipment and less labor charge per mile.

SHALL EXCESS FARE BE CHARGED?

There is a difference of opinion as to the advisability of charging excess fare on limited trains. Some roads that have installed chair cars and other expensive features argue that these attractions, combined with faster schedules, make the service well worth the small excess fare they are charging. Other managers argue that the faster service, improved facilities, and particularly the low rates, are the points which are attracting people, and that when you charge excess fare you detract from one of the strongest attractions of the electric service. On a long journey, excess fare over a number of roads will bring the total cost of the trip up to practically the steam rate, destroying the object in view.

HANDLING BAGGAGE

The question of handling baggage on interline business is a serious problem. The Ohio Interurban Railway Association, which has been successful in securing the adoption of a form of interchangeable transportation, and of a standard form of interline ticketing, expects soon to evolve a plan for the through checking of baggage, but there are phases of this problem which are difficult to adjust. To charge or not to charge for baggage is a point which is being discussed by many roads. The majority of interurbans in this district make a charge of from 15 cents to 25 cents for each piece of baggage. This is not objectionable on a short trip, but on a long journey over a number of roads it counts up, and will undoubtedly prove a serious drag on interline business. It is a question if a great many roads are not actually losing business at the present time because they charge for checking baggage. The experience of the Lake Shore Electric Railway tends to prove this. This company handles on an average of 2000 trunks per month on its 150 miles of interurban lines, all checked free. A neighboring system of 100 miles, in a territory equally as good, handles



BAGGAGE CAR USED ON THE LINE OF SCIOTO VALLEY TRACTION COMPANY

only 250 trunks per month, charging 25 cents each. The latter road collects sixty odd dollars a month for baggage, but how about the 1750 traveling men whom it does not get? There is food for thought in this proposition.

The plan of carrying baggage on all cars, especially on limited cars, is gaining favor, although a number of roads take the opposite plan and carry baggage on locals and not on limiteds. Roads that have chair cars object to using space for baggage, because chairs have already greatly reduced the seating facilities. There is no denying that the majority of traveling men want to carry their baggage with them. There is no advantage in making quick jumps from one town to another if samples cannot be carried. The Lake Shore, Indianapolis & Northwestern, Western Ohio and other roads that carry baggage on all limiteds have demonstrated to their own satisfaction that they would lose a great deal of business if they could not accommodate traveling men in this way, and they find that by careful arrangements at stations the time lost in taking on and off baggage is not a bar to a fast schedule. While the interurban development has been remarkable, it has not yet reached a point where roads can afford to ignore the requirements of the great mass of traveling men for the sake of catering to the few who want "twentieth century limited" accommodations.

SLEEPING CARS

Sleeping cars for night service are not yet in actual operation, but this is due more to physical conditions, which prevent the operation of cars having the width, height and weight of those cars which have been designed for this service, than to other objections to this proposition. The Holland Palace Car Company, which hopes to occupy the relationship to electrics that the Pullman Company does to steam roads, has made praiseworthy progress in the right direction, and the conditions which have barred the use of its cars on certain roads are being overcome. The improvements of the coming season will render it physically possible for these cars to be operated from Cincinnati to Detroit, from Detroit to Cleveland, from Columbus to Indianapolis, and other routes made possible by combining these routes, and this paper repeatedly expressed the opinion that such service might be made to pay over comparatively short routes where the passenger does not care for speed so long as he lands at his destination at an early hour in the morning.

The Holland Palace Car Company has made a tentative arrangement with the Western Ohio, Dayton & Troy, Dayton & Western, Richmond Street & Interurban and the Indianapolis & Eastern for the operation of two of its sleeping cars on the route between Lima, Ohio, and Indianapolis. The distance is 190 miles, and the run will be made in seven hours or less. It is probable that the cars will be used for both night and day service. Tests are being made to determine the power consumption, speed and clearances of the cars, and if these points are satisfactory, the service will be tried.

HEAVY TRAFFIC ON INTERBOROUGH LINES DURING RECENT NEW YORK BLIZZARD

"The transit lines of New York were put to the most severe test of the winter during the recent storm," says Vice-President Bryan, of the Interborough Rapid Transit Company, of New York. "On the day after the storm (Jan. 26) the elevated lines of the Interborough system carried 835,000 passengers and the subway lines 411,000 passengers, making a total of 1,246,000 passengers carried in twenty-four hours, with little or no interruption of traffic. The popularity of the subway was clearly demonstrated, and the ease with which the 411,000 passengers were carried shows that the system, with the present incomplete terminals and facilities, is amply able to handle 150,000,000 passengers a year. This carrying capacity could be very easily increased by putting in effect on the local tracks of the subway the train schedule as now maintained on the Manhattan Elevated."

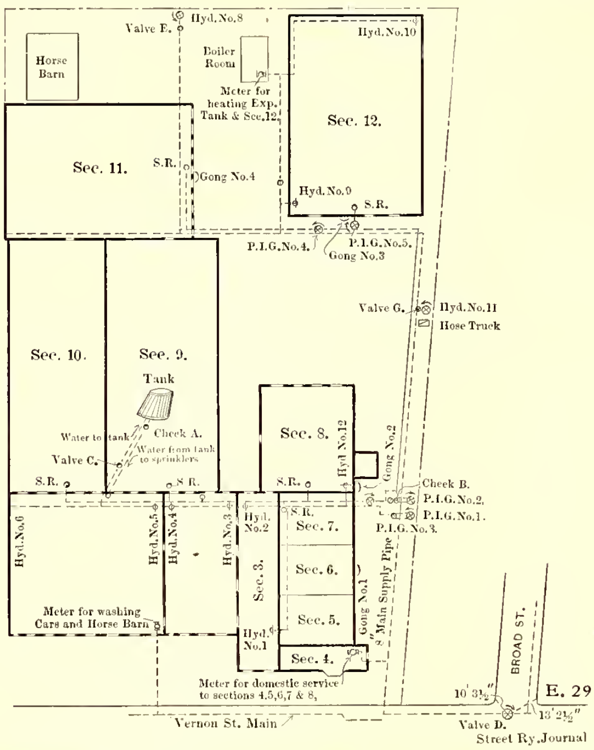
TESTS ON NEW YORK CENTRAL ELECTRIC LOCOMOTIVE

For fourteen consecutive hours electric locomotive No. 6000, built by the General Electric and American Locomotive companies for the new York Central's terminal in New York City, was run up and down the stretch of third-rail track near Hoffmans, N. Y., on Jan. 25, in order to see how the bearings would act in regard to heating up. The test was a part of the daily tests that have been going on since the locomotive was completed, and was highly satisfactory to the officials of the General Electric Company. There was no heating of the bearings to speak of, and during the time of the test the engine ran 900 miles in a blinding snow storm.

The Brooklyn Polytechnic Institute has recently increased its evening instruction in electric engineering by the addition of a laboratory course in dynamo and motor testing. These tests will include a number of railway experiments with trolley equipment in the laboratory. The course began on Jan. 16, and will include twenty experiments, usually held on Monday evenings from 7:30 to 9:30. This work will be under the direction of Prof. Sydney W. Ashe, who is an instructor in physics and electrical engineering in the day classes of this institution.

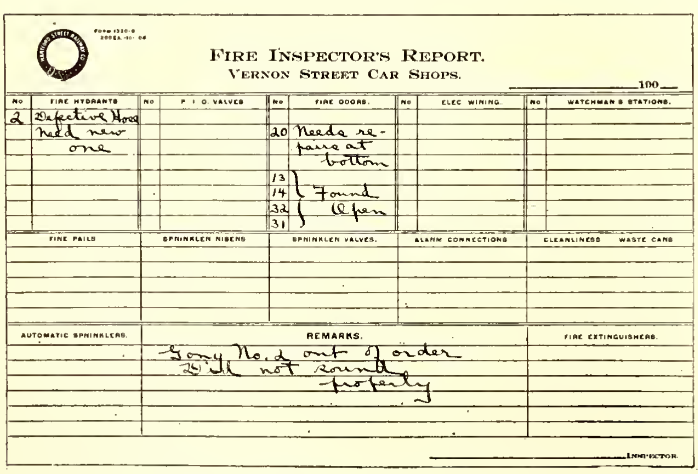
FIRE INSPECTIONS AND FIRE PRECAUTIONS IN HARTFORD, CONN.

The Hartford Street Railway Company has in force at all its various buildings, including three car houses, power house, office building, etc., a system of fire inspection that is unusually rigid and complete. It is of interest to note that this system of inspection, in conjunction with the methods of construction followed in the design of all these buildings, has resulted in the granting of a very low rate of insurance by the fire insurance companies.



REPRESENTATIVE DIAGRAM USED IN CONNECTION WITH THE FIRE-INSPECTION SYSTEM

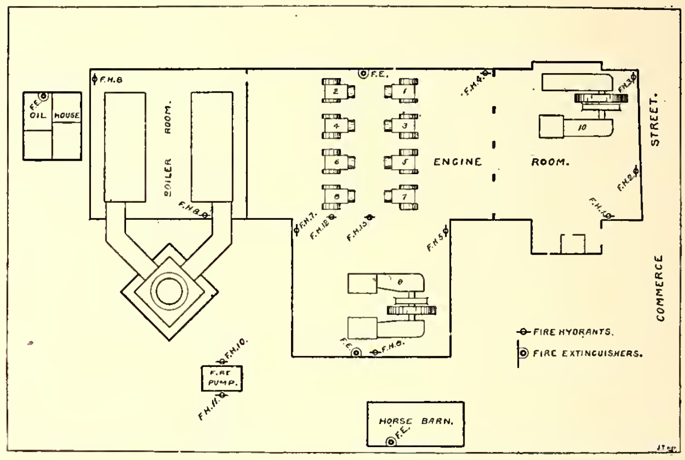
The conspicuous feature of this system of inspection is the care taken to make sure that all apparatus intended for fire-fighting purposes, from fire pails to automatic sprinklers, are always in place and are always ready for use at an instant's notice. The company's motto, indelibly impressed upon the mind of every employee, is: "In case of fire, fight the fire," and it is the duty of a responsible official to see that there are always men and means available to fight the fire, no matter in what part of any building, or at what time of the day or night it may be dicovered.



FACE OF INSPECTION CARD OF VERNON STREET CAR SHOPS

All of the buildings belonging to the company, as car houses and power station, are divided into sections for fire-fighting purposes. These divisions are not necessarily fire walls, but the area of each building is arbitrarily apportioned off into fire sections, the number and extent of which depend on the individual conditions. A special study is then made of each separate section, and each is provided with such fire hydrants, hose, fire pails, extinguishers, fire doors, etc., as the conditions in each area may seem to require for effectually confining and extinguishing any fire that might occur therein.

The idea is well illustrated by means of the representative diagram reproduced herewith, which shows the fire sections, hydrants, hose, sprinklers, etc., at the Vernon Street shops of the company. Diagrams similar to this are made for all the buildings, and are posted in blue print form at conspicuous

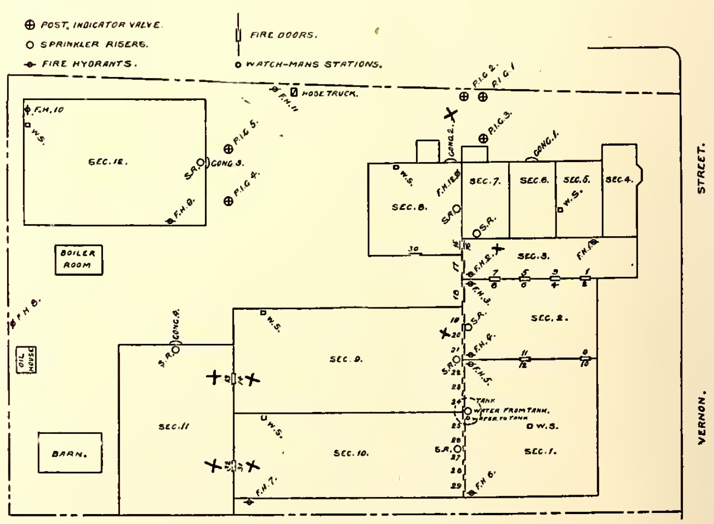


REVERSE OF INSPECTION CARD FOR POWER HOUSE

places where they can be easily consulted. Accompanying these diagrams are carefully prepared instructions, explaining the diagram and telling just what to do in case of fire. The set of instructions for the Vernon Street shops is as follows:

DIRECTIONS FOR OPENING AND CLOSING VALVES IN CASE OF FIRE

To open P. I. G. valves (referring to post indicator gate valves



REVERSE SIDE OF INSPECTION CARD USED AT THE VERNON STREET SHOPS

in the city water mains) Nos. 1, 2, 3, 4 and 5, and hydrants Nos. 7, 8 and 11, turn handles and wheels in the direction of arrows.

If sprinkler service is required in any section from the tank service, see that P. I. G. valve No. 3 is open and P. I. G. valve No. 2 is closed. This will allow check valve "A" to open and check valve "B" to close. The latter will prevent the water in the tank at the top of building from flowing back into the 8-in. main supply pipe, and supply water to automatic sprinklers in any section.

P. I. G. valve No. 1 supplies hydrants Nos. 1, 2, 3, 4, 5, 6, 9, 10 and 12, all of which are domestic hose service in sections 1, 2, 3 and 8, and sprinklers in sections 1, 2, 7, 8, 9 and 10; also sprinkler riser in section 7, and sprinklers in sections 4, 5 and 6.

To shut off sprinklers from section 12, close P. I. G. No. 5.

To shut off sprinklers from section 11, close P. I. G. No. 4.

Tank is refilled automatically with ball cock in tank. To shut off water supply to tank, close valve "C."

City pressure is at all times on sprinkler system and domestic hose service, through P. I. G. valves No. 1 and No. 2.

Tank pressure is on sprinkler service when P. I. G. valve No. 2 is closed.

Close valves E. F, G for repairs to hydrants 7, 8 and 11.

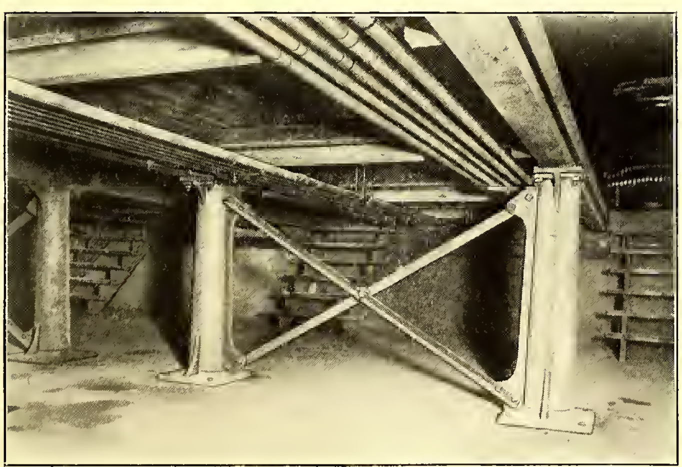
Valve D shuts off water from the whole system.

GONGS

No. 1 gong gives alarm for sections 3, 4, 5, 6 and 7; No. 2 for section 8; No. 3 for section 12; No. 4 for section 11.

The primary idea of the inspection system is, as stated, to make sure that every part of the fire-fighting equipment is at all times ready for action. To this end various means are taken for impressing upon the minds of employees the necessity for keeping pails, hydrants, hose, etc., in working order. For instance, it was found that the space around fire hydrants would frequently become cluttered up with scrap and rubbish of all kinds, this accumulation greatly interfering with the usefulness of the hose. To do away with this the wall back of each hydrant in the car houses and power station was painted yellow to a height of 4½ ft. above the floor and for 2 ft. each side of the apparatus. Around the yellow was painted a deep black border. In conspicuous black letters against the yellow background are the words "Keep this space clear," and on a white mat against the yellow is painted the hydrant number, as, for instance, "Fire Hydrant No. 3." The hydrants, sprinkler risers, valves, pails, etc., are painted red. This color scheme serves to accentuate the importance of keeping everything connected with the fire-fighting system free from rubbish and in working order. The fact that each piece of apparatus is numbered serves as a means for locating the various parts of the water-supply system and (in connection with the diagrams with which every employee is required to be familiar) greatly simplifies the giving of orders when the emergency arises.

All doors in fire walls in all the buildings are sheathed in tin and are balanced with counterweights, in accordance with the underwriters' requirements. The wall around each door is painted yellow, for the purpose of emphasizing the fact that nothing must be set against the wall in this space which would interfere with the operation of the door. All fire doors are also numbered and their locations are indicated on the diagram.

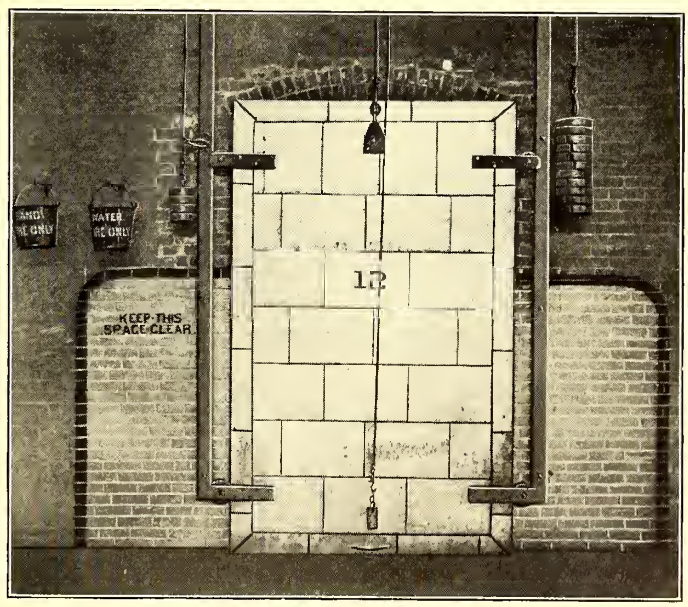


VIEW IN PITS, SHOWING HEATING AND SPRINKLER PIPES UNDER FLOOR

The employees at each building are organized into fire companies and frequent drills are given. The day foreman is captain of one company and the night foreman is captain of the other. Each captain has an assistant, who is to take charge in the absence of the foreman.

The responsibility for inspecting fire apparatus rests upon the company's engineer, who makes a trip every two weeks around all the company's property. He tests hydrants, valves, sprinklers and all water supply pipes, and inspects hose, pails, etc.

VIEW OF HYDRANT, ILLUSTRATING SCHEME OF PAINTING SPACE AT BACK OF HYDRANT



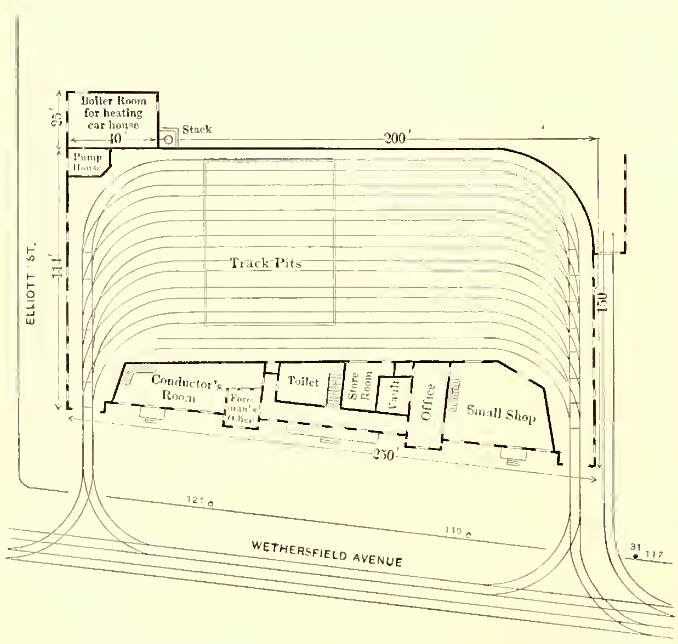
THE SYSTEM OF PAINTING AS APPLIED TO FIRE DOORS

For reporting anything found out of order a set of cards has been designed, as reproduced herewith. These cards are 6 ins. x 9 ins., and one is printed for each separate building, the card for each building being of different color. On the front of the cards are columns, as shown, for reporting the nature of the trouble, and on the back of each card is a diagram of the building to which it refers. These diagrams are small reproductions of the large blue print diagrams, previously mentioned, and show the location of each feature of the water-supply system. The small diagram on the back of the card is used for indicating, by marking a small cross, the location of the trouble reported on the front of the card. For instance, the card as made out for the Vernon Street shops reports that hydrant No. 2, which is in section No. 3, has a defective hose; fire door No. 20, in section 9, needs repair at bottom; fire doors 13, 14, 32 and 31, between sections 11 and 9 and sections 11 and 10, were found open, contrary to the rules; gong No. 2, in section 8, is out of order.

EXTERIOR VIEW OF WETHERSFIELD CAR HOUSE

After each tour of inspection the cards are sent to the general manager's office and any defects reported are immediately repaired. If the report would seem to indicate improvements along any line, steps are at once taken to place these in effect, or if the reports call for reprimands for violations of the fire regulations, the occasion is taken to impress upon negligent employees the necessity for strict adherence to the rules.

The cards and system of inspection have received the hearty approval and indorsement of the New England Insurance Exchange, and it is not without interest to add that the inauguration of the scheme is saving the Hartford Street Railway Company $2 a day in fire insurance premiums. The general idea has been worked out by J. T. Tregoning, engineer for the Hartford Company, in conjunction with Norman McD. Crawford, general manager, to whom acknowledgement is made for the information and diagrams reproduced in this article.

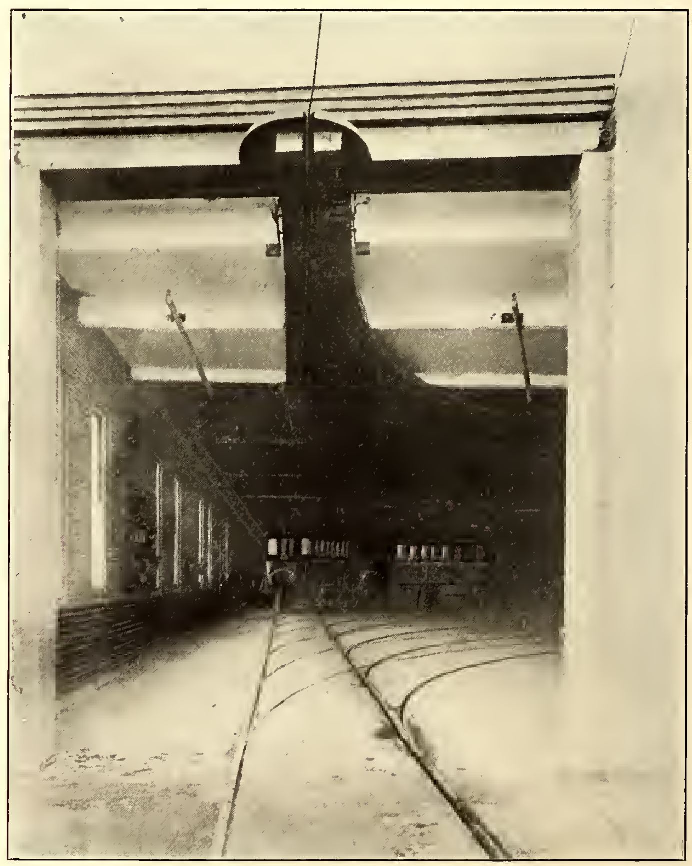


PLAN OF WETHERSFIELD AVENUE CAR HOUSE

In connection with the system of fire inspection at Hartford, it is in order to describe some of the engineering details of the various buildings covered in the insurance scheme. At least two of these buildings, namely, the Wethersfield Avenue car house and the central power station, are characterized by the extensive use that was made of concrete work in the foundations and wherever fire-resisting material seemed to be called for. The Wethersfield car house is the newest of the Hartford Company's car houses, and while it is a large structure and is provided with ceiling instead of inter-track sprinklers, it embodies many other late ideas recommended by the fire underwriters for buildings of this nature.

The house is designed for combined storage, minor repair and operating purposes. It has a frontage of about 250 ft. and a depth of 114 ft. The roof is supported by steel girders resting upon steel columns. The heavy brick walls rest upon concrete foundations, the general structural details of the building conforming closely to the adopted standards of modern fireproof construction.

Owing to the location of this house in the outskirts of the city, it was thought desirable to supplement the city water supply with ample water storage facilities for fighting any fire that might occur in or near the property. In view of the expense of building an elevated tank for water storage purposes, it was finally decided to provide a large underground storage reservoir having a capacity for holding 100,000 gals. of water, and to connect the sprinkler system and the fire-hydrant system of the car house property to this reservoir.

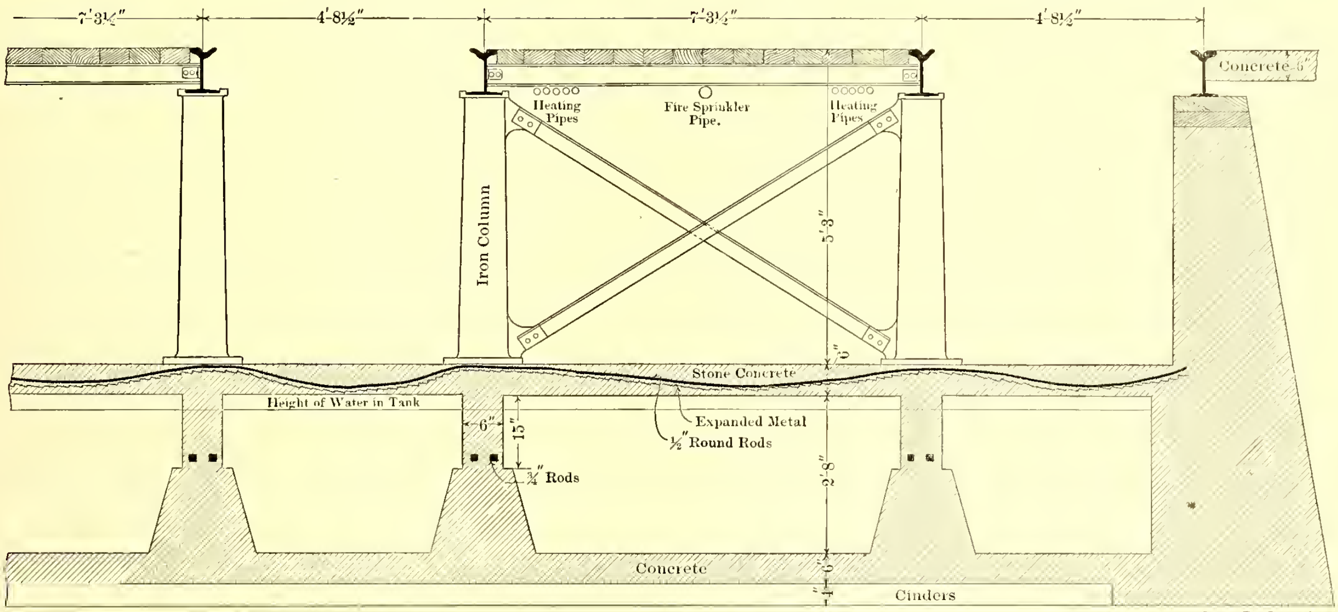


ENTRANCE DOOR, WETHERSFIELD CAR HOUSE, SHOWING LADDER TRACKS INSIDE THE HOUSE

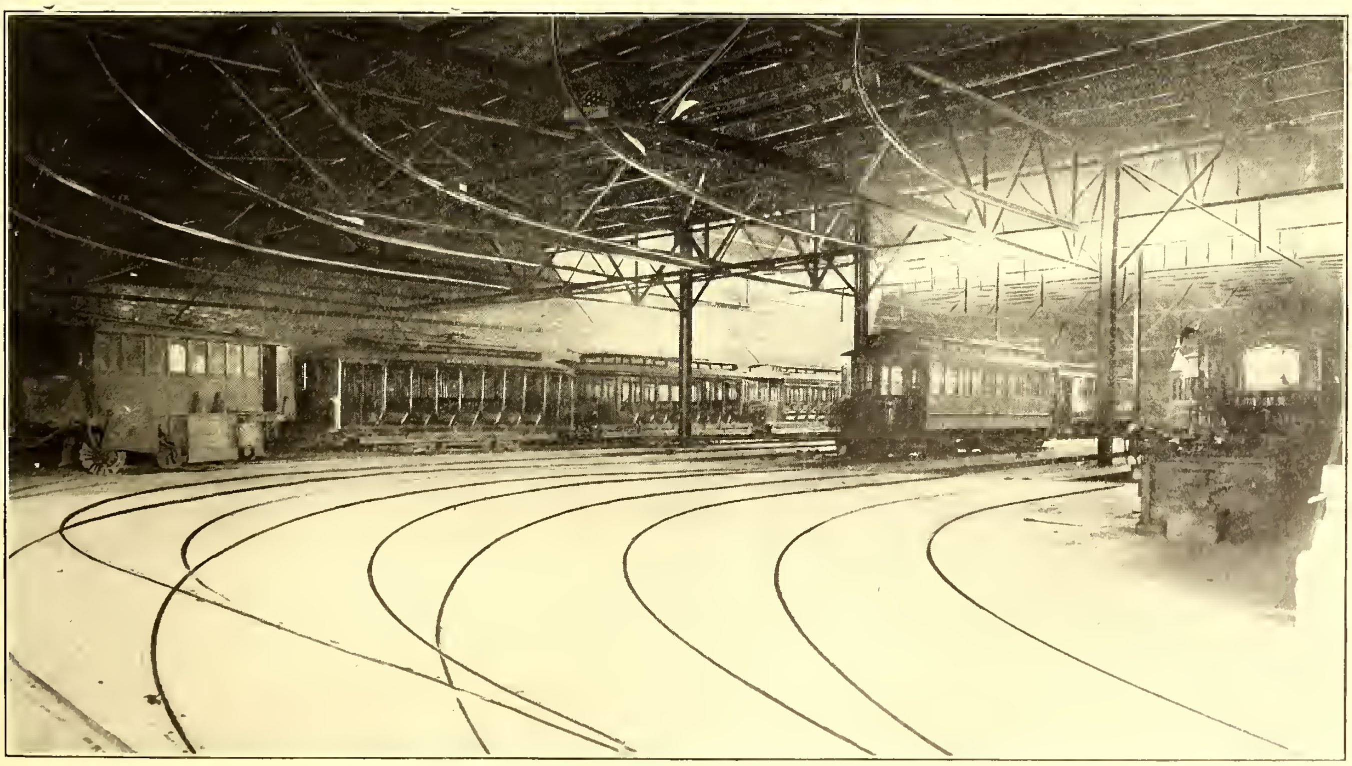
The underground cistern or tank is 60 ft. long and extends underneath eight tracks. In building it, the space was excavated to a depth of 9 ft. 3 ins. below the floor level. In the bottom of the space 4 ins. of cinders well tamped were first laid; on this, 6 ins. of concrete were placed, and the walls of

EMPLOYEES' TOILET ROOM

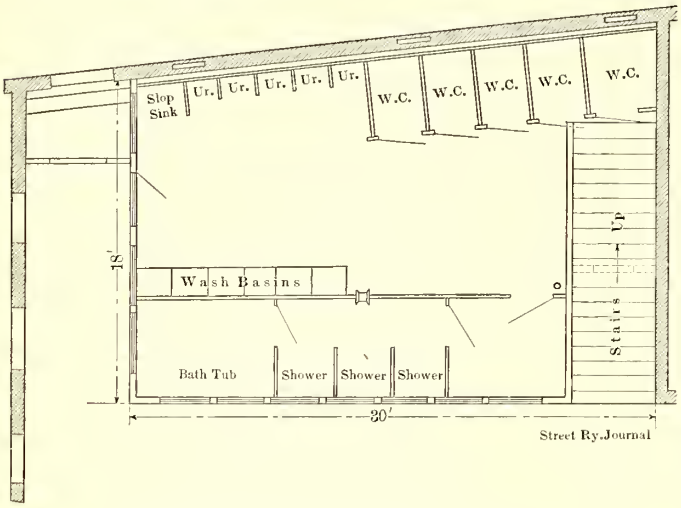
BATHS, SHOWERS AND WASH BOWLS IN THE EMPLOYEES' TOILET ROOMS



SECTION THROUGH TRACK PIT IN THE WETHERSFIELD AVENUE CAR HOUSE



INTERIOR OF WETHERSFIELD AVENUE CAR HOUSES, HARTFORD the reservoir were built up with concrete cement work. The water reservoir itself measures 2 ft. 8 ins. from the concrete bottom to the roof. This roof consists of 6 ins. of concrete cement, reinforced with ½-in. round rods and sheets of expanded metal placed in the manner shown on the cross-section



PLAN OF TOILET AND WASH ROOMS

drawing. The top of the roof of the reservoir serves as the floor of the car house pits, the pits measuring 5 ft. 3 ins. from bottom to the floor level. The track rails in the car house rest upon hollow iron pipes or columns 10 ins. in diameter, the bases of these columns in turn resting upon the concrete roof of the reservoir. Under the line of each column concrete piers were built up from the floor of the reservoir in the manner indicated. The iron columns for supporting the track rails are cross-braced with angle-iron bracing. At the car house floor level the space between tracks was planked over with heavy plankink. The pipes for heating the pits were carried just beneath this flooring, and a pipe line from the sprinkler system was also carried underneath the floor between each set of tracks, with sprinkler heads spaced every 10 ft., and designed to throw water upward against the floor in the event of fire.

The entire car house is protected with the Esty automatic sprinkler system, made by the H. G. Vogel Company, of New York City. The system can be fed either from the city water mains or from the underground storage reservoir by means of fire pumps of the underwriters' type. Fire hydrants with hose attached are placed in various parts of the building, as described in the foregoing article. The underground storage tank receives the drainage from the roof of the car house, and is also connected with the city water mains. In view of the fact that this underground tank will render available 100,000 gals. of water at all times and that it can be drawn on in the event of a large conflagration in the neighborhood, the insurance interests considered themselves justified in rating this car house as a particularly good fire risk.

The heating system was installed by Evans, Almirall & Company, of New York City. Heating of the building is accomplished by the circulating hot-water method, the heating system including a separate boiler plant and live steam heater to heat the water. A pump is inserted in the water circuit to keep the water in rapid, continuous circulation. The water pipes are carried around the walls of the building near the floor and between each set of tracks in the pits.

The general layout of the tracks in this house will be seen from the accompanying plan. It will be noticed that the entrance to the house is through two small doors, all the special work in connection with the entrance tracks being under cover. This arrangement does away with all troubles from ice and snow clogging up the switches, and facilitates the moving of cars in and out. The layout, of course, uses up considerable space inside the house, but this lost space is about made up by the ample space at the front of the building for employees' rooms and store rooms. It will be seen from the photograph showing the exterior of the house that the front of the building is three stories high, which, with the two towers, give a number of large, light rooms for offices and other purposes. On the ground floor is a large room where conductors and motormen can spend their time when off duty. This is fitted up with card tables and various games. There are also on the ground floor a store room, a large office with vault, and a small shop. On the second floor is the employees' association room, fitted up with billiard table and easy chairs. This room has a large anteroom, which is used for checking coats and serving lunch when the association desires to give a sociable. On this same floor is another room in which entertainments, card parties, dances, etc., are given. The third and fourth floors are used as draughting rooms and offices.

The employees' toilet and wash rooms at this house are very complete, as will be evident from the engravings. These are finished in tile and fancy brick, with porcelain wash bowls and

EMPLOYEES' ENTERTAINMENT ROOM, SHOWING PAINTED SPACE AROUND HYDRANT TO THE RIGHT OF THE CENTER POST

urinals. The toilet closets and bath room are enclosed with slate slabs. There are two showers and a large porcelain bath tub.

It will be noticed from the illustrations that the fire-hydrant system is extended through the men's rooms and the offices, and the same color scheme and inspection system are carried out as in the car storage and operating sections of the car house.

The power house of the company is on Commerce Street, near the river, and has been described in previous issues of the Street Railway Journal. All of the building foundations and the foundations for engines, generators and boilers at this power house are built of concrete cement. The steam and suction pipes from the condensers are carried in a concrete subway. All the walls and roof are either brick or steel, and there is no woodwork used in the building, so that it is as near fireproof as modern engineering can make it.

The other two houses of the company, namely, the Vernon Street shop and the State Street shop, are brick and steel structures, and are thoroughly protected with sprinkler and hydrant service, as outlined in the foregoing article.

ELECTRIC TRAMWAYS IN HONG KONG, CHINA

Although little more than sixty years have elapsed since the island of Hong Kong became a British possession, its rise in importance, both as a commercial and naval center in the Far East, has been both rapid and unique. Situated near the mouth of the Canton River and distant about 90 miles from the ancient Chinese city of Canton, it possesses one of the finest and most beautiful natural harbors in the world. This must have been recognized by the Chinese themselves hundreds of years ago, as the Chinese characters representing the name of the island are said to signify "Good Harbor." The island itself is some 11 miles long and from 2 miles to 5 miles broad, and consists of lofty uncultivated hills. In the younger days of the colony it was considered a most unhealthy place, owing to the virulence of malaria, but to-day the efforts of the Sanitary Board on the one hand and the Afforestation Department on the other have completely altered these characteristics. During the summer months the humidity of the atmosphere renders the heat very trying to Europeans, but from September to March the weather is all that could be desired. The population of Hong Kong is estimated at 284,000, and of these, 274,500 are Chinese. Its trade is estimated at $250,000,000 per annum. It has excellent dock accommodation, is strongly fortified and is the permanent naval base of England in the Far East.

A SCENE ON ONE OF THE MAIN STREETS OF HONG KONG, SHOWING THE CONTRAST IN TRANSPORTATION BY THE YOKE, 'RICKSHA AND TROLLEY CAR

In 1902 an ordinance was passed by the Legislative Council of Hong Kong authorizing the tramways to be laid down by the Hong Kong Tramways Electric Company, an English company, with its headquarters in London, and work was commenced in May, 1903, and completed last July. The detailed plans and specifications were prepared by the company's consulting engineers, Alfred Dickinson & Company, of Birmingham, who appointed Harold Hackwood to act as their representative in Hong Kong, as resident engineer in charge of the construction. The contractors were Dick, Kerr & Company, of London, who carried out the whole of the work.

The total length of single track is 14½ miles, laid in 9¼ miles of route, to a gage of 3 ft. 6 ins., with rails of the girder type, weighing 86 lbs. per lineal yard. Each rail-joint is double bonded with 000000 S. W. G. copper bonds. The lines within the city are laid for the most part as center-pole construction, but the eastern portion of the route being outside the city boundary, is laid as single line, with passing places equipped on the side-pole system.

With the exception of a short branch line which runs to the race course, the route runs parallel with the water front, and aside from a short length at Quarry Bay is practically level. At Quarry Bay some road grading has been done, the original grade of 1 in 10 having been reduced to 1 in 15. Beyond Quarry Bay is the eastern terminus of the line, where is situated the small Chinese village of Shankiwan.

Owing to the varying nature of the ground, three forms of permanent way construction have been adopted. Where the ground was solid the rails were bedded on a concrete beam 18 ins. wide and 6 ins. deep; where the ground was not so good a bed of concrete 6 ins. deep and 7 ft. 3 ins. in width, extending under the whole track and 1 ft. 6 ins. on either side, was adopted; over doubtful ground which had been recently reclaimed from the sea, this concrete bed was increased to 8 ins. in depth. The concrete used was mixed in the proportion of 6 to 1, Portland cement of local manufacture and exceptionally good quality being used. After the rails and the bottom concrete were laid, the road surface was made up to rail level with concrete and finished off with a smooth surface to the proper camber of the road.

The overhead construction has been carried out in a very neat manner, the length of arms on the center poles not exceeding 2 ft., while the arms on the side poles vary in length,

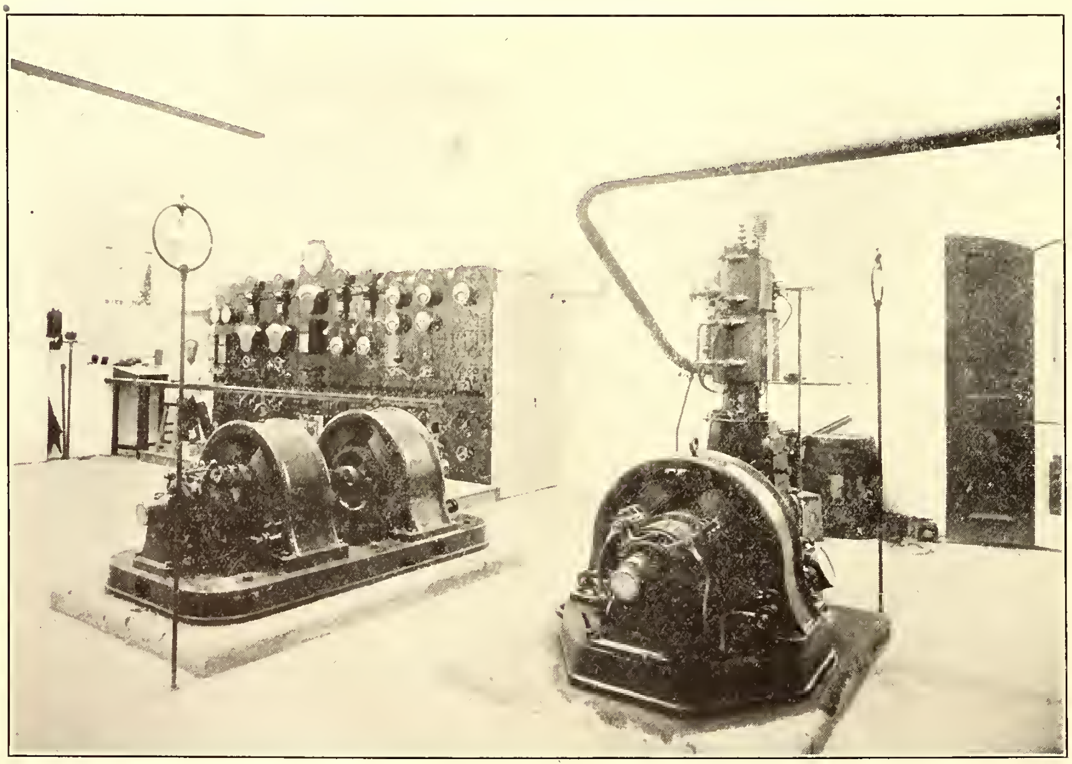
CHINESE COOLIES AS TRACK MEN

the majority of them being 6 ft. long. The poles are of mild steel, 28 ft. 3 ins. long, 7 ins. in diameter at the base, tapering to 4 ins. in diameter at the top. They are set 6 ft. in the ground in a solid block of concrete. Within the city, ornamental base castings greatly add to the appearance of the poles, which are still further enhanced by the addition of wrought-iron scrolls on the bracket arms.

The trolley wire is divided into ½-mile sections by means of section insulators, and at each of these points the main feeder cables are tapped and current is taken to supply each section of trolley wire. This is accomplished by running the feeders through a feeder pillar containing the necessary switches and fuses, the connections from the feeders to the trolley wires being made with rubber-covered cables, carried up inside the poles and along the sides of the bracket arms. The pressure on the trolley wire is 500 volts. A lightning arrester is provided in each feeder pillar, and also a telephone giving direct communication with the power house. The feeder cables were supplied by the Callenders Cable & Construction Company and laid on the solid system. In addition to the main feeders running east and west from the power station, a return booster feeder has been laid in each direction to within a mile of the two distant termini, where it is connected to the rails; it also makes connection with the rails at each feeder pillar. A three-core pilot cable has also been laid from the power station to each terminus, one core being connected up for testing purposes and the remaining two cores being used for telephone service.

The generating station is as nearly as possible in the center of the system, a convenient site having been obtained alongside the Bowrington Canal, from which water for condensing purposes is obtained, and which enables coal and materials to be delivered by barges direct on the site. The only objection which could be found with the site lay in the fact that a very few years ago it was reclaimed from the sea, and consequently no good foundation could be obtained for either buildings or machinery; however, as it was the best site obtainable in all other respects, this difficulty had to be overcome, and efficient foundations were obtained by the driving of over 5000 piles. These were spaced so as to support the whole weight of the buildings themselves, the ground, which greatly varied in solidity, being left as an additional factor of safety. China fir poles, 15 ft. long and 5 ins. in diameter, were used for the buildings and machinery, special 7-in. poles, 18 ft. in length, being used for the chimney foundations.

The depot comprises engine room and basement, boiler house and coal store, car shed and machine shop, blacksmith shop, paint shop and carpenter shop, and also offices.



INTERIOR VIEW OF SWITCHBOARD ROOM, SHOWING ALSO THE LIGHTING SET

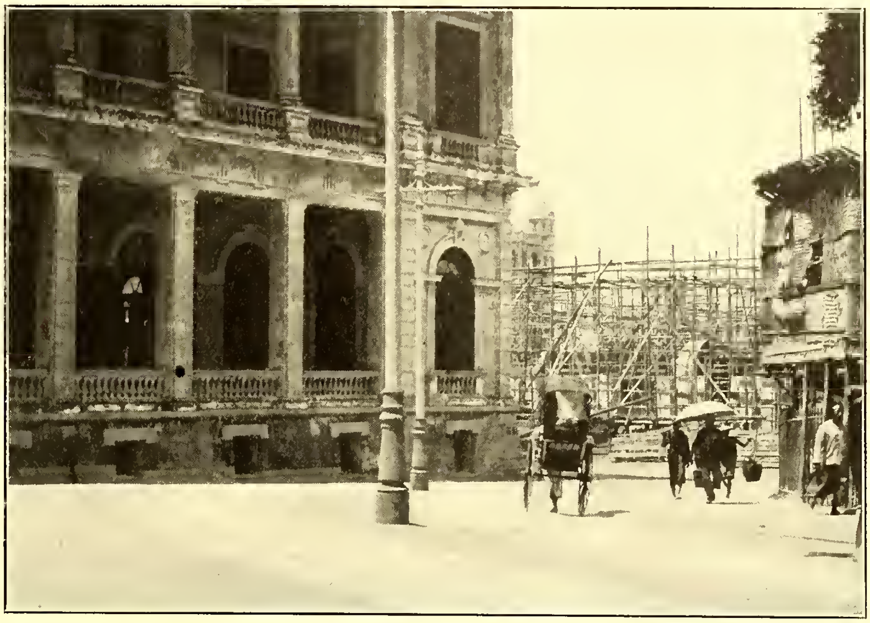
The engine room, which is lofty and well lighted, contains two Dick-Kerr direct-current, direct-connected railway generators, of the multipolar type, compound wound, giving a potential of 550 volts and running at 100 r. p. m. They are designed to run either separately or in parallel. The generators are keyed direct on to the main shaft of the engines, which are of the horizontal cross-compound type, each engine being equal to a maximum load of 557 bhp. The engines, built by Yates & Thom, are each provided with a Wheeler surface condenser of the Admiralty pattern, and may be worked either condensing or non-condensing. The condensers are fixed in the basement below the engine room, as also are all the steam and other pipes, thus leaving the engine room free and open. Circulating water is obtained for the condensers from the Bowrington Canal, which is alongside the site, the water first passing through sumps fitted with gratings and strainers to exclude obstructions. In addition to the two traction sets, there are two smaller plants for arc and incandescent lighting of the depot, one set being driven by a small high-speed engine and the other by a motor running from the 500-volt circuit. The lighting circuit is supplied at 100 volts pressure.

The switchboard, which is of Dick-Kerr's standard type, consists of nine panels. It includes a main station panel, two generator panels, two feeder panels, one Board of Trade panel and three lighting panels. The main station panel contains recording instruments of the latest pattern, including a recording wattmeter, showing the total output of the station. The Board of Trade panel is arranged for receiving test wires from different parts of the line, and is provided with instruments for making all the tests required by the Board of Trade.

An overhead traveling crane is provided, capable of lifting and traversing in any direction a load of 10 tons over the whole area of the engine room.

The boiler house, which is a lower level than the engine room, contains two double-drum water-tube boilers of the Babcock & Wilcox type, arranged to burn ordinary Japanese engine slack. Each boiler has 3654 sq. ft. of heating surface, evaporates 12,000 lbs. of water per hour and works at pressure of 160 lbs. per square inch. In addition to the steam and water gages, each boiler is fitted with a spring safety valve and a dead weight safety valve. Water is supplied to the boilers by two Blake & Knowles feed-pumps, which take water from either the storage tank or the hot well, and feed the boilers either direct or through a Green economizer. In case of mishap the economizer may be cut out, the flue gases being conveyed to the chimney by means of a by-pass or auxiliary flue and the feed-water being pumped direct into the boilers without passing through the economizer tubes. Two feed-water filters are supplied, and all water passes through one or other of these before entering the boilers.

The chimney, which is circular, is built of brick and is 153 ft. high. As Chinese bricklayers are unaccustomed to this class of work it presented greater difficulties in construction than any other part of the work, and as Hong Kong is subject to typhoons of noted severity, exceptional care had to be taken with both the foundations and the building of the shaft. With the exception of the foundations and the chimney cap, the whole of the brick work is built in lime mortar of special composition, as is also the brick work of the buildings.



A CURVE AT THE CITY HALL CORNER IN HONG KONG

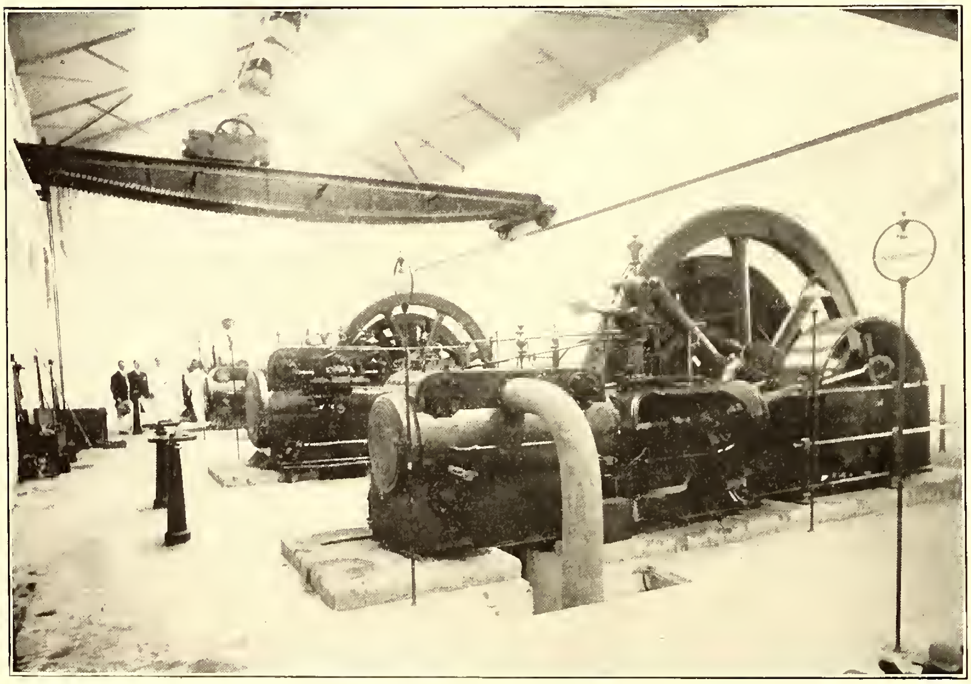
There are twenty-six single-deck motor cars, ten being of the combination type, with an enclosed portion in the center and an open platform provided with seats at either end. The remaining sixteen cars are of the open cross-bench type. The over-all length of the cars is 29 ft., the total width is 6 ft. 6 ins., and the wheel base, 6 ft. 6 ins. The combination car has a seating capacity for thirty-two passengers, and the cross-bench cars for forty-eight passengers. Each car is mounted on a truck of the Brill type, equipped with Dick-Kerr 25-A motors, the standard metallic shield blow-out controllers and the usual hand brakes. The trolleys, which are of the lateral type and provided with a swivel head, are 16 ft. 6 ins. in length, and enable the trolley wire to be fixed 10 ft. away from the center

SIX-TRACK CAR SHED OF THE HONG KONG TRAMWAYS, 220 FT. LONG, AND ACCOMMODATING THIRTY-FIVE 29-FT. CARS of the track, where necessary. The car bodies were built at Preston by the Electric Railway & Tramway Carriage Company, and were shipped to Hong Kong in sections, where they were fitted together and connected up in a very short space of time.

The car shed, which is a rectangular building 220 ft. long, contains six lines of track and gives accommodation for thirty-five cars. The roof is of iron, in two spans, partly glazed and provided with louveres, giving plenty of light and ventilation. Inspection pits run the whole length of the shed.

At one end of the car shed is a well equipped work shop, containing screw cutting gap lathe, wheel lathe, wheel press and drilling machines, the whole being driven by a 500-volt motor. A suitable smith shop, carpenter shop and paint shop are also provided.

Before the introduction of electric traction into Hong Kong, the popular 'ricksha drawn by a Chinese coolie was the principal means of locomotion, and of these nearly 2000 were licensed for hire, in addition to a large number owned privately. Although rather slow, the ricksha is hard to beat for general convenience; the fight for supremacy between the out-of-date ricksha and the new electric car will be of interest, but must of necessity end in the victory of the latter.



MAIN ENGINE ROOM, CONTAINING 10-TON OVERHEAD CRANE

As this is the pioneer system of electric traction in China, it is to be hoped the venture will meet with a well-deserved success, and that electrically-equipped lines will shortly be laid in other parts of the Celestial Empire.

President Schoepf, of the Cincinnati Traction Company, says that during the past year the company expended $3,000,000 in betterments, whereas under the terms of its lease it was necessary to spend only $2,000,000. He says the company has put on 50 per cent more cars since it took over the property two years ago, while the traffic has increased but 18 per cent. Fifty new large cars have been ordered and are being installed. Plans are being made to enlarge some of the power stations to increase the power facilities. Mr. Schoepf explains that Cincinnati is one of the hardest cities in the country in which to give good service, owing to its narrow and crooked streets, and to the fact that the public seems to demand that the cars shall all go to one point at Fountain Square, which congests the downtown district. Plans are under consideration for deviating certain lines to relieve this congestion.

CAR STORAGE HOUSES VS. OPERATING BARNS

BY D. F. CARVER

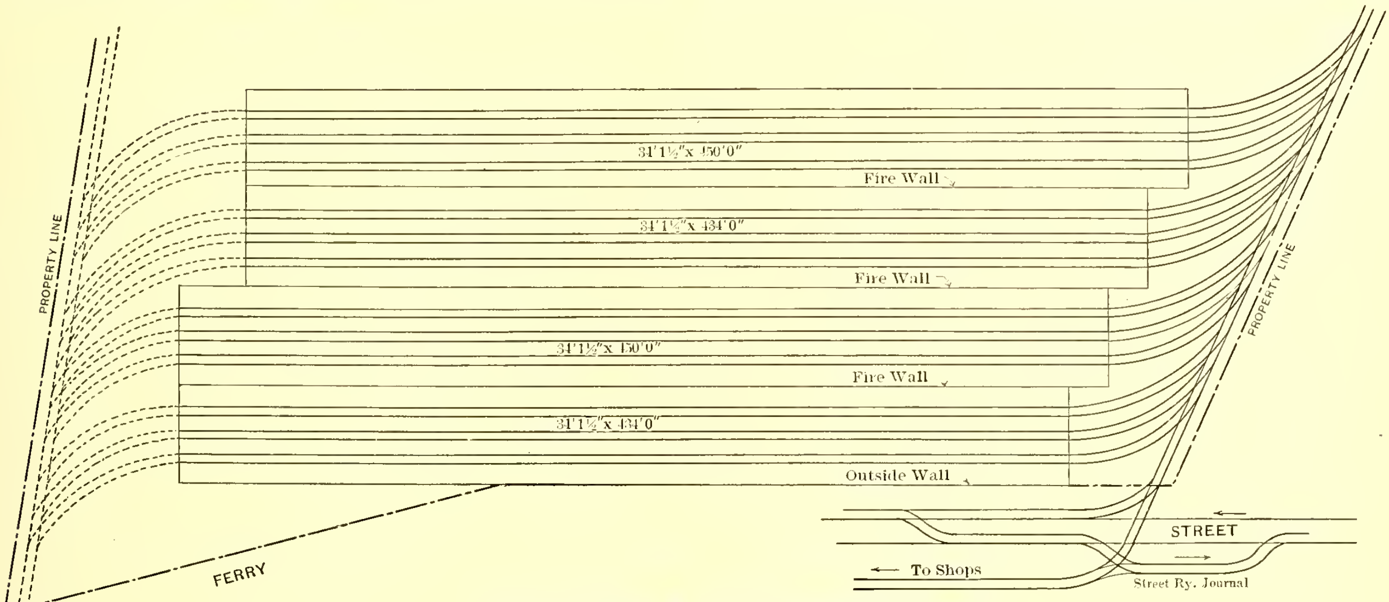
With those street railway companies which find it to their advantage and profit to operate with double equipment of summer and winter cars, whether or not the duplication of the equipment is of the bodies only or of the bodies and trucks with motor equipments, it becomes a question worthy of very serious study and consideration of how best to store the out-of-season equipment. Taking note of the fact that these equipments receive their yearly general overhauling at their out-of-season times, they should be stored during the off-season as near to the repair shops as governing conditions will admit for the greater convenience of the master mechanic and his department, and in order to reduce to a minimum the costly item of dead mileage of each car on four trips at least per year—two trips with its own equipments and two trips in tow—(and the towing of stripped cars is becoming a not unusual procedure since the development and improvement of motors and trucks has added to the amount invested therein, an amount too great to be left unproductive of revenue for six months in each); and for the further reason that the accumulation of the out-of-season equipment directly under the observation and control of the man who is most interested in maintaining it at the minimum cost and maximum of efficiency, places the responsibility for it without question on the one man—the master mechanic.

The theoretical and probably the most wise use of an operating car house on large city systems is for operation only, or as nearly as may be. But this is only a theory—it is open to interesting discussion, and is yet to be conclusively demonstrated, and even when demonstrated the principle can be applied on many existing city systems only within narrow limits because of the general layout of the lines. The apparently cheapest way to house a few more cars when not in use is to build an addition to an existing house, or fit up as economically as possible an abandoned car house which has been thrown out of use as an operating house. The items of cost in relation thereto are, however, worthy of very serious consideration, and here are some facts taken from actual construction. The figures are based on New York prices:

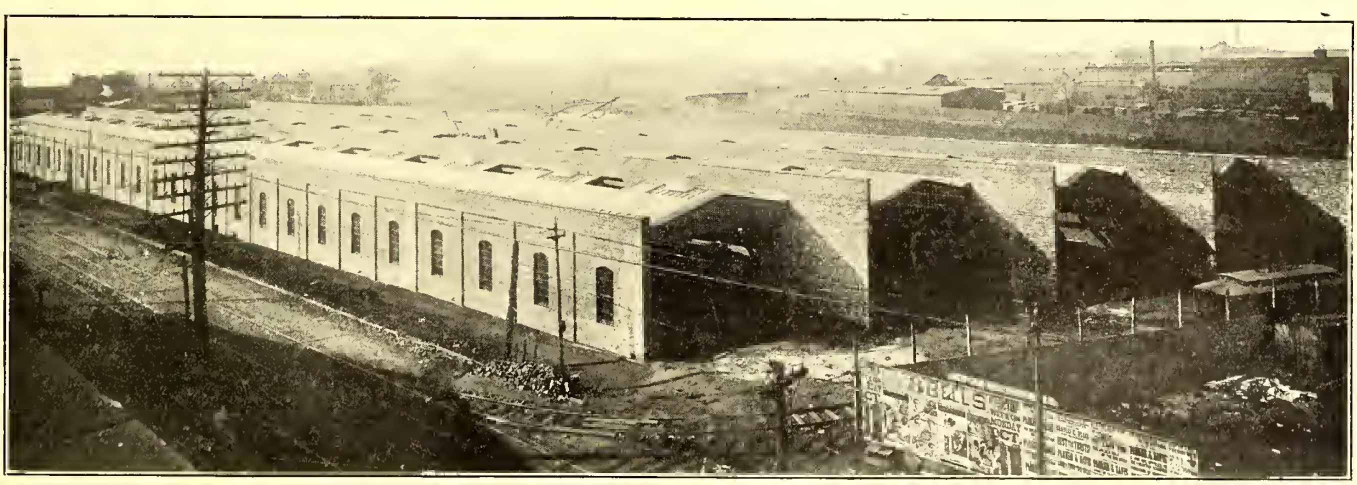
A most modern and complete operating barn of small size of the most approved truss roof construction with brick walls (but no fire walls), with shops, waiting rooms, men's rooms, depot master's office, plumbing, etc. (but exclusive of track work and real estate), of a cubical volume of 760,000 cu. ft., will cost $0.0616 per cubic foot. The same class of barn as to details, finish, completeness and convenience, but extremely large, covering an area of 60,000 sq. ft., with a cubical contents of 1,720,000 cu. ft., will cost $0.059 per cubic foot, whereas a barn designed and built for the special purpose of storing out-of-season cars, with a floor area of over 60,000 sq. ft., divided by fire walls into four compartments of about 15,000 sq. ft., the whole building having a cubical contents of 1,250,000 cu. ft., will cost (exclusive of real estate and track work) $0.042 per cubic foot. These figures are for one-story car houses only. Those for houses which are of necessity to be built in two or more floors with fireproof construction, as the term is ordinarily applied, are different. These figures show a decided economy in first cost of a purely storage barn compared with an operating barn as it is necessary to build the latter type.

Car bodies stored and out of service are obviously not under as close watch as those which are in daily operation, and it is not necessary that they should be, for many of the sources of car house fires are removed from them. Consequently, when for some unforeseen cause a fire does start among closely stored car bodies, it may gain much headway before it is discovered; then it can only be fought at a disadvantage among other cars which cannot be run out into the open. The argument is to separate entirely the out-of-season cars from the operating cars, and the endeavor is to show that it is an all around economical proposition as a general one. To produce the best results for economy's sake, the number of cars accumulated must be very large on large systems—their value may aggregate half a million dollars. This requires of the designer of these buildings that he shall confine as much as possible, consistent with the use of the building, the amount of area through which any fire can spread, and further, that for those parts of the building which, for lack of something better, the material of construction must be something which is subject to destruction by fire and water, he must select his materials and assemble them to produce that combination which will resist to the greatest the spread of flames. That is to say, the fire beyond control must be by the building, to the greatest possible extent, kept within the four walls and the roof in which it starts. The Electrical Bureau requests that this area shall not exceed 20,000 sq. ft., with 15,000 sq. ft. as much better.

The existing conditions surrounding the Plank Road shops of the Public Service Corporation in Newark were, in 1903, ideal for the development of this type of building, and a large car house exclusively for storage purposes has been erected during the past summer directly across the street from the Plank Road repair shops. When eventually completed, there will be storage room for 240 cars of the company's largest type, i. e., cars measuring 40 ft. over all. Room for only 120 was needed in 1903 and 1904, so only one-half of the building has been completed, this being built in four bays—two of them 434 ft. long each and two of them 450 ft, long each. All fire walls are 34 ft. 1½ ins. apart, face to face of pilasters, with three tracks between each fire wall, and a storage capacity in each bay of thirty cars of largest type. The bays are staggered across the lot, as shown on plan, to resist the possibility of flame licking around the end of one bay into an adjoining one. The plan and cross section show the method of construction very clearly.



PLAN OF PLANK ROAD CAR STORAGE HOUSE

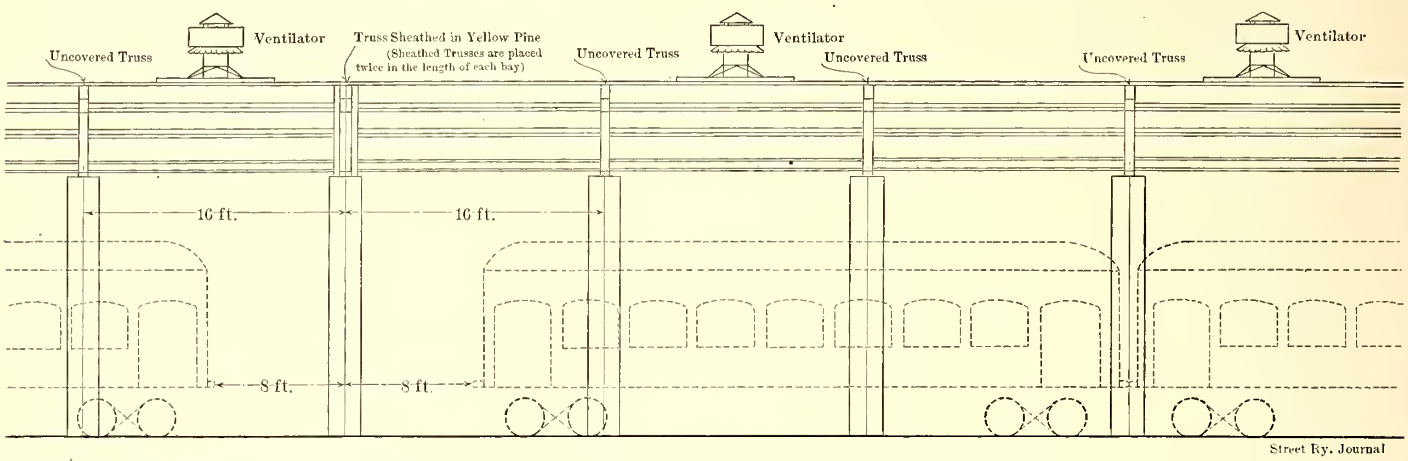


EXTERIOR VIEW OF STORAGE HOUSE, TAKEN DURING CONSTRUCTION TO SHOW FIRE WALLS

The following are the special details as worked out to resist travel of flame: The side walls and fire walls are brick. There are no metal girders in the building. All timbers are in very much larger sizes than is necessary to carry their working loads. The larger timbers will burn half-way through before they will fall, and will char all around for an inch and a half in depth or so, and after that, if still burning, there will be little dangerous flame from them. The trusses are 16 ft. apart center to center, and between every alternate one there is a skylight of 100 sq. ft. and a 48-in. ventilator. The lights are of

¼-in. thick hammered wired glass carried in metal frames. The skylights are framed in between the trusses, and not over them, the reason being that the ventilators would probably go first in a fire and would tend to draw the flames toward the openings, and it is desired to keep the trusses out of the path of flame as much as possible. The edges of skylights are bound all around with 8-in. x 8-in. timbers. This is done to resist as under the covered truss, then four cars close together and another 16-ft. open space under another covered truss, then three more cars together. This is illustrated in an accompanying sketch.

The tracks within the barn are second-hand T-rail of light section, laid in stone ballast, and is standard main line right of way construction. The ends of each bay are protected by steel

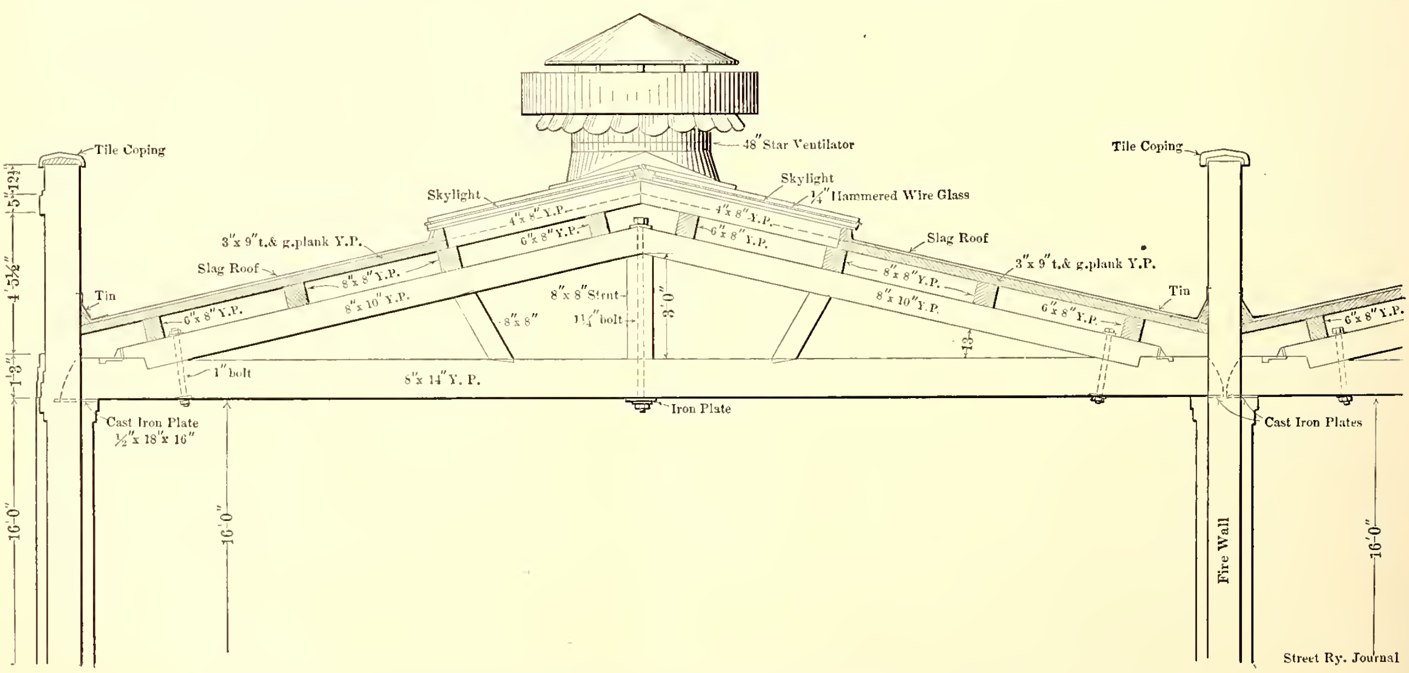


LONGITUDINAL SECTION DOWN CENTER LINE OF EACH BAY, SHOWING SPACING OF CARS ON EACH SIDE OF SHEATHED TRUSS

much as possible the burning of the roof sheathing on its edges. The sheathing is 3-in. x 9-in. yellow pine lumber, laid parallel to the line of the trusses and splined along the edges to resist burning through between planks on their edges. The fire walls rise 5 ft. above the line of the gutter, and are really higher than the comb of the roof. The 1¼-in. diameter tie rod of each truss is driven through a snugly bored hole down the center of an 8-in. x 8-in. stick. This will protect the rods from burning off except at the lower end, and further, the 8-in. x 8-in. timber will act as a strut if the joints at the foot of the truss should burn rolling doors, supplied by the James G. Wilson Manufacturing Company, of New York City.

There are no pits and no heat is provided for.

This barn was built with trusses 16 ft. apart center to center, but the subsequent development of the sprinkler system for car house protection will probably make it advisable to change this distance to 20 ft. in future construction. The ends of the trusses do not touch by 8 ins. where they abut at the fire walls. This space was filled with brick and cement as the wall was carried up. The fire walls are solid from end to end, and from



CROSS SECTION, SHOWING DETAILS OF ROOF TRUSS, PLANK ROAD CAR STORAGE HOUSE

away. Twice in the length of each bay a truss is completely sheathed and splined on both sides. This is done to resist the spreading of tongues of flame along the under side of the roof. These covered trusses will turn the flame downward, and they are spaced in relation to the stored cars, so that there are no cars directly under these trusses. In fact, there are no cars within 8 ft. on either side of these trusses. This gives the following car distribution along each track:

First three cars close together, then an open space of 16 ft. the neat line at foundation to the tile coping. The half-tone engraving on page 215, illustrating the exterior of the storage house, was taken during construction, and shows the arrangement of fire walls and method of staggering the bays across the lot. The openings shown in the roof will be covered eventually by the ventilators, the frames of which now appear at the sides of the openings.

Ground was broken for the foundations on Aug. 11, and the first cars for storage were run into one of the bays in seven weeks. Bruce E. Loomis, inspector for the New York Electrical Bureau, took personal interest in the construction work, and many of the ideas put into the work were his.

An interesting detail of this car house is the arrangement for securing good drainage.

The property lies on the eastern outskirts of the built up portion of Newark on the old Newark Plank Road to New York. This road was once a private enterprise, and while such, the railroad company acquired its land and laid its own sewer system with a 15-in. diameter trunk line sewer leading down the road into the Passaic River, but as new buildings were erected their sewage systems and surface drainages were turned into this, until its limit has been more than reached during heavy storms. The Plank Road with its sewer has passed into public control, and there being no public demand for a larger drain for storm water in this section, it became necessary for the company's engineers to devise some method of disposing of the storm water collected by 125,000 sq. ft. of roofs. It was out of the question for the railroad company to construct a long line of new sewer in a public highway, so the expedient is being tried of increasing the rate of flow through the 15-in. crock sewer at any time when the natural flow of water due to the fall of the drain is not sufficient to carry away the storm water as fast as it is falling. This is done by building a cistern at the head of the 15-in. line, from which it leads, and connecting to the cistern all the storm water drains from the new building. There is a horizontal centrifugal pump 10 ins. discharge connected with the end of the main sewer, and this pump is driven by a motor automatically controlled by a float on the surface of the water in the cistern. During mild storms the sewer carries away the surface water as fast as it falls, but during heavy showers or floods, the water in the cistern will rise, taking the float along with it, and the pump will increase the rate of flow equal to a head of 10 ft. There are several catch-basin openings along the sewer, and as its depth is not over 5 ft. anywhere, these openings will relieve the sewer of bursting pressure from the pump if the pipe should become stopped up along its line. The pump was built by the Buffalo Forge Company, of Buffalo, N. Y., and the motor by the Northern Electric Company, of Madison, Wis. The controlling box and float were supplied by the Cutler-Hammer Company, of Milwaukee, Wis.

It should be borne distinctly in mind that the foregoing reference to costs is an explanation of a solution made necessary by governing conditions which applied to this particular case. These restricting or governing conditions are never the same in any two instances, and the proper solution for each situation requires much special consideration.

MASSACHUSETTS RAILWAY MANAGER ADDRESSES WORCESTER BUSINESS MEN

Frederick A. Huntress, general manager of the Worcester Consolidated Street Railway Company, of Worcester, Mass., gave an address on the "Development and Progress of Street Railways" on the evening of Jan. 19 before the Worcester Board of Trade. The address was illustrated by stereopticon views. After sketching the growth of street railways during the past thirty years, Mr. Huntress summed up his address by stating that "the street railway has expanded and beautified the city; the crowded city has been expanded into the country; towns and cities have been brought into communication where none existed before; the value of property has been vastly increased and streets made cleaner and healthier; in fact, the city of to-day is as much unlike its former self as is the street railway unlike its predecessor in construction, equipment and operation."

CORRESPONDENCE

THE REMOVAL OF SNOW

UNITED TRACTION COMPANY

Albany, N. Y., Jan. 20, 1905.

EDITORS STREET RAILWAY JOURNAL:

The system of the United Traction Company consists of approximately 80 miles of track. For fighting snow we have eight single-truck plows and eight single-truck sweepers, or one plow and one sweeper for about 10 miles of track. As soon as a snow storm gives evidence of becoming serious, or when about 1 in. of snow has fallen, we start out the sweepers. Each sweeper has its proportion of track to cover, and it is required to cover its section every two hours. The sweeper crews report to the division superintendent at the terminal of each line. This routine is kept up till the snow stops. If the storm continues and the snow begins to get heavy the plows are ordered out. If the storm still continues, both sweepers and plows are kept in service so that the entire system can be covered every hour.

We believe the secret of fighting snow successfully lies in getting at it and keeping at it. The sweepers and plows must keep to schedule time, and we impress upon the sweeper and plow crews that they are running on regular schedule and must keep up the schedule.

After snow has ceased falling the sweepers are sent out daily between the hours of 1 o'clock and 4 o'clock a. m. over the entire mileage to clear up any loose snow and keep it back from the tracks. This is done every day while snow remains on the grounds, as wagons and teams are apt to drag snow into the tracks, and if this is not cleared away it will make slush and increase the number of burned out armatures.

We have had storms when the only way to get into or out of the city of Albany was over the tracks of the United Traction Company.

EDGAR S. FASSETT, Superintendent.

ROCHESTER RAILWAY COMPANY

Rochester, N. Y., Jan. 18, 1905.

EDITORS STREET RAILWAY JOURNAL:

Apropos of the letters appearing in your columns recently relative to fighting snow, our method of handling the snow problem at Rochester may be of interest.

The Rochester Railway Company operates 89 miles of track in its city division, 80 miles of which are within the city and 9 miles outside. Our snow-fighting equipment consists of ten single-truck shear and nose plows, three sweepers, one double-truck plow and two rotary plows. The suburban division is not included in these remarks.

The ten small plows are equipped with two motors each. All of them have adjustable wings at the side for pushing snow away from the tracks. The sweepers are mounted on single trucks, each sweeper having two motors to move the machine and one additional motor for operating the brooms. The double-truck shear plow has four 40-hp motors. The single-truck rotaries each have two motors on the truck and two additional motors for rotating the fan shaft.

For snow-fighting purposes, the pick of the regular car crews are assigned to plow duty, and each plow is assigned to a certain route. At the first signs of snow, the snow crews report at their respective car houses, and the sweepers and plows are sent out as required. The sweepers start first, and if the storm shows a tendency to continue, they are followed by the shear and nose plows.

The latter type of plows are equipped with powerful flangers to dig out the groove of girder rails, and these have been found valuable additions, as the snow in this section of the country is usually wet and heavy. If the snow is particularly heavy and deep, the small plows require pushers, and we couple up a passenger car behind each plow to push it along.

The passage of plows is reported to the superintendent's office by telephone once every hour, so the superintendent is kept informed of the condition of the various lines at all times. The supervision of snow-plow work is directly under the division superintendents, each division superintendent having as assistants the inspectors of the lines, who assume charge of the plows in their district, and when necessary the inspectors ride on the plows in order to keep things moving.

Our passenger cars are equipped with track scrapers, and these help materially in the work of keeping the tracks open.

The removal of snow and ice from the street and the care of curves, crossings and switches during snow storms comes under the supervision of the track department. For this purpose the city is divided into sections, each under a section foreman in charge of gangs, the size of the gangs varying with the amount of work to be done. It is the policy of this company to keep a certain number of track men during the winter for this purpose, and at times of heavy snow extra men are taken on for fighting snow, the extra men being largely men who work on track during the summer.

For removing snow from the streets, we co-operate with and act in conjunction with the city authorities. We use our own teams and hire as many extra teams after each storm as are necessary to get the streets into shape. The teams are in charge of the roadmaster. The city also starts its own wagons and teams at work removing snow, and between us we get the streets into shape in the shortest possible time. The total cost of removing the snow is then divided between the railway company and the city, in the proportion that the area covered by our tracks, including a 2-ft. strip each side of the tracks, bears to the total area of the street, measured from fence line to fence line, and to the area from curb to fence line.

During the winter of 1903-04, the amount charged to "cost of removing snow and ice" on the Rochester Railway was $20,305. The total car mileage for the system during the year was 6,138,030, giving $.0033 as the cost per car-mile for fighting snow. The Rochester & Sodus Bay Railway, which is leased to the Rochester Railway Company, has 40 miles of interurban track, all of which is kept open with three rotaries.

R. E. DANFORTH, General Manager.

GETTING THE ADDRESSES OF WITNESSES

New Haven, Conn., Jan. 15, 1905.

EDITORS STREET RAILWAY JOURNAL:

An important part of a conductor's duty is to secure the names of witnesses to an accident, but there are often difficulties in obtaining many names during the excitement which follows a casualty of this kind. To overcome this trouble, I have adopted the practice of finding out, as well as I can, the names and, if possible, the addresses of certain regular riders. I enter these names in a small book and keep it in my locker at the car house. By this means I am able, when an accident occurs, to furnish more names than I would otherwise be able to, an important consideration, as the claim department is always glad to have more than the usual number of names furnished by conductors, say three or four.

As to the method of getting names beforehand, several ways will suggest itself to anyone interested, as no set rules can be laid down on the subject. With a little practice, the faces of many regular riders soon become familiar. Sometimes, if there is any passenger on the car whom I know, I ask him the name of some other regular rider; sometimes I glance at the address on an envelope.

A good way for a company, which sells tickets in bulk, to obtain the names of witnesses to an accident, would be to require everyone purchasing tickets to leave his name and address. Thus, if there were an accident, the trip envelope of the conductor could be gone over, and if ticket 234,567 was in that envelope, the records could be looked up to see who was the purchaser of ticket book No. 234,567, and that passenger could be approached as a witness.

T. C. MORRIS.

TWO REGISTERS ON CARS

Newark, N. J., Jan. 29, 1905.

EDITORS STREET RAILWAY JOURNAL:

The Public Service Corporation of New Jersey is installing two registers on all of its lines where a single fare is collected and where the Ohmer register is not used. The old registers are to be pensioned off and made do duty for transfers, while a modern register for the main fare is used. The much mooted question, "Should transfers be registered?" will, therefore, be settled.

The writer has always claimed that a long trolley car, to be inspected properly, should have a main fare register on the rear end and one on the front, to work simultaneously. If this were done an inspector sitting at the back of the car, under one register, could look at the other. To those who do not wish to follow this practice the following suggestion may appeal: Place a mirror in the center of the car, so hinged that it will catch the reflection of the register and make it visible from any part of the car. That it will pay a company to have a separate register for transfers is obvious.

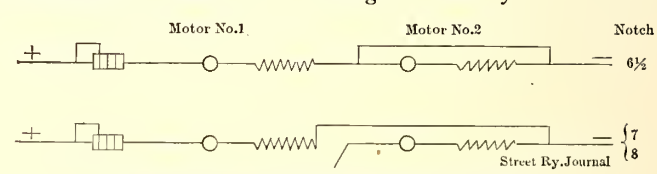
JOSEPH ANDREWS.

THE CONTROLLER PROBLEM

Boston, Jan. 19, 1905.

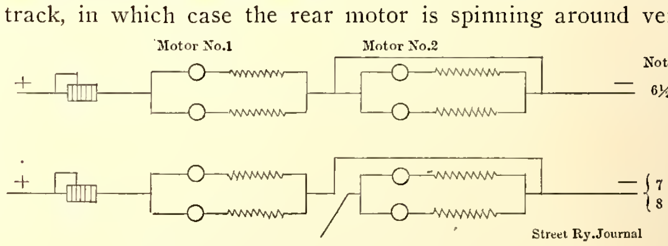
EDITORS STREET RAILWAY JOURNAL:

I have read with much interest the article on surface car controllers in the STREET RAILWAY JOURNAL of Jan. 7, 1905, by Edward Taylor. The subject is certainly important, and anything which can be brought forward to illuminate the problem of short-circuits in car wiring is certainly worth careful



TRANSITION NOTCHES, K-10 CONTROLLER

consideration by electric railway engineers. There was one point in connection with these controller short-circuits which did not receive mention in Mr. Taylor's article—the occurrence of such troubles in passing from series to multiple when the motors are carrying widely different loads. Such a condition often occurs when the forward motor, through its connected car wheels, is slowed down by the bind of the curve in the track, in which case the rear motor is spinning around very



TRANSITION NOTCHES, K-12 CONTROLLER

rapidly on the tangent track behind; sometimes a marked difference in grades between the front truck and the rear truck causes this difference in loading, and again, the front motor, or pair of motors, in a snow-plow equipment very frequently catches this uneven load.

Now, at this point, as will be seen by the accompanying skeleton pen diagrams of the transition notches on a K-10 and a K-12 controller, motor No. 2 (or the second pair of motors in a four-motor equipment) is first short-circuited and then open-circuited in passing from series to multiple. Under the conditions above mentioned, when the motors are loaded unevenly and No. 2 is spinning around rapidly, the open-circuiting of No. 2 (single or pair) generally is accompanied by a heavy flash in the controller, caused apparently by the breaking of the heavy current flowing through No. 2 and its short-circuiting connection. Acting as a generator at this time also, No. 2's high speed and resulting abnormal potential seem to make matters worse, as the opening of the circuit under normal conditions of loading ordinarily gives little trouble.

In view of the foregoing facts, it is considered desirable by more than one operating man that the surface controller of the future shall be designed so that the circuit of No. 2 will not be opened in passing from series to multiple. The difficulties of the problem are doubtless not to be minimized, and the question is one for the controller expert rather than the average electric railway engineer. With a four-motor equipment the flashing is far more destructive than with a two-motor outfit.

HOWARD S. KNOWLTON.

DETECTING BEATS

Brooklyn, N. Y., Jan. 12, 1905.

EDITORS STREET RAILWAY JOURNAL:

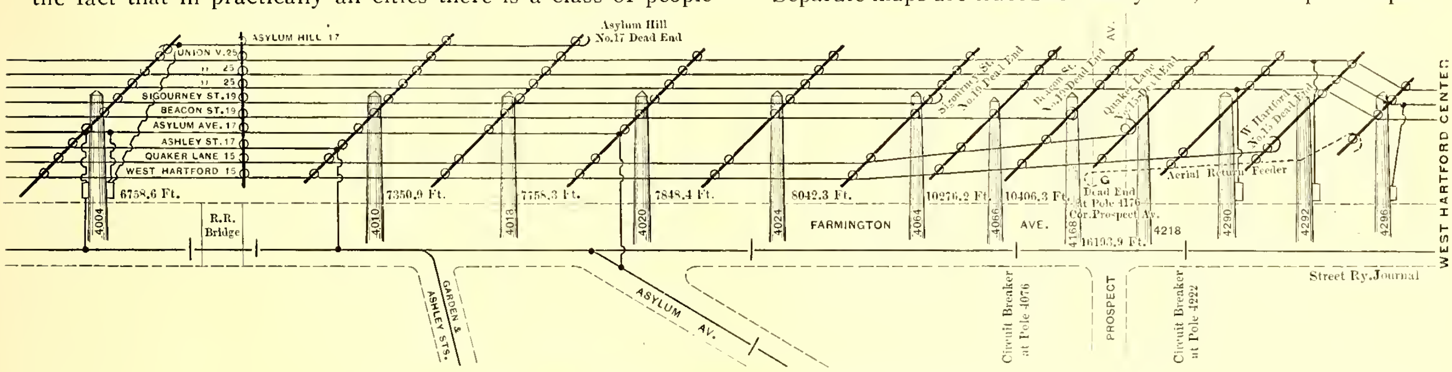
Your recent editorial on collecting fares calls attention to the fact that in practically all cities there is a class of people that "beat" the conductor and are proud of it. They usually do this on a crowded car by claiming that they have already paid their fare, when they are asked by the conductor for their nickle. To protect its own interests, a company should take measures to break up this practice, as these people by their boasting lead others to follow their example, especially if they are among a large number of workmen in a shop. One plan would be to detail a detective to listen to one of these men and then secure a warrant for his arrest, both as a disorderly person and for defrauding the company. A few examples like this would have a wonderful effect and stop a great deal of this kind of swindling, which is practiced especially on new conductors.

R. P. WILLIAMS.

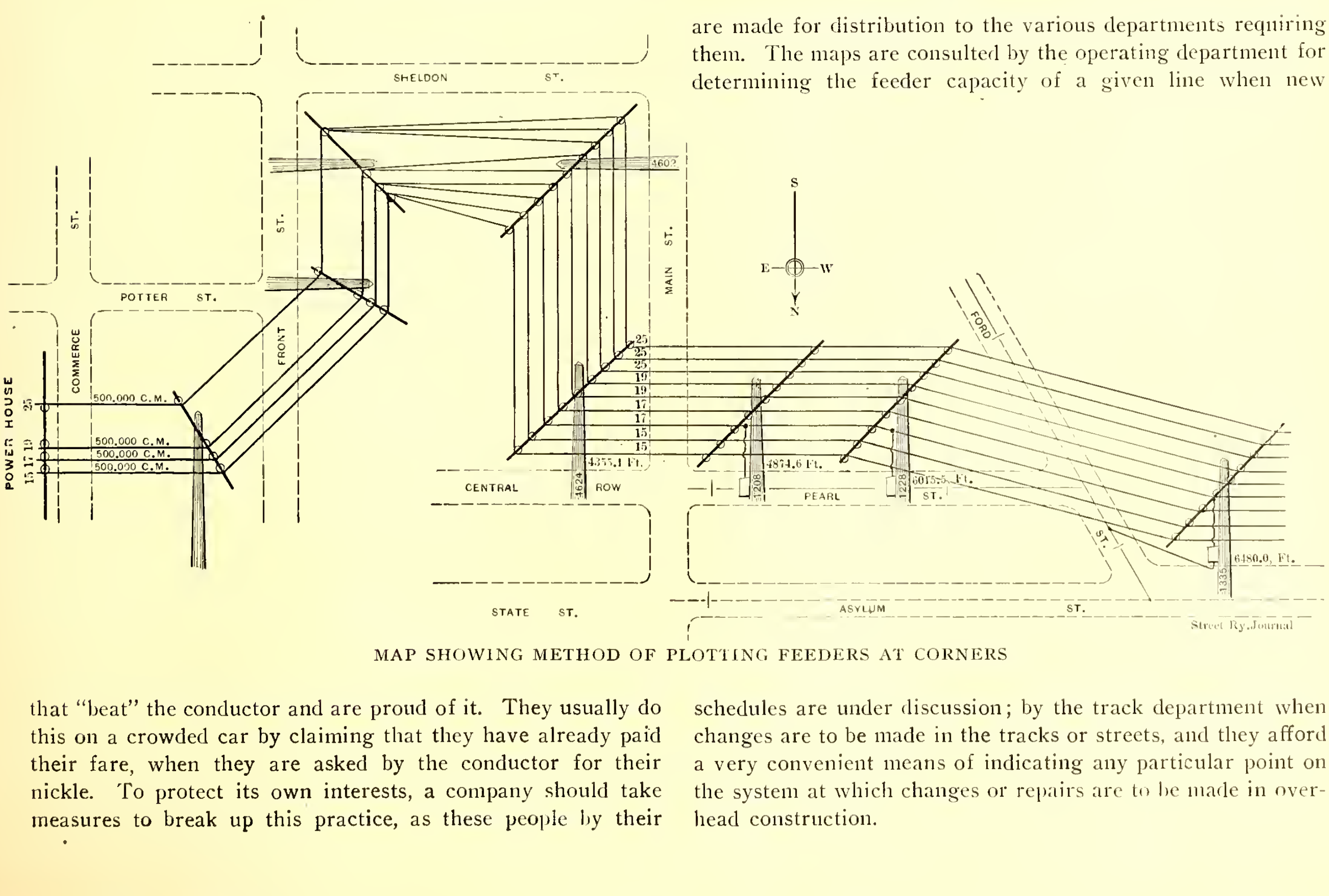
PLOTTING FEEDER MAPS

Through the courtesy of J. Tregoning, engineer of the Hartford Street Railway Company, of Hartford, Conn., the feeder map is reproduced herewith, showing the method adopted by the engineering department of the Hartford Company for plotting, in form convenient for quick reference, the feeder layout on each line of the system. The maps are not drawn to scale, but they show the size and length of each separate feeder, and also the location of each pole at which a feeder ends or where there is a tap to trolley wire. The curb lines of the streets are also superimposed upon the maps so as to show the exact location of the feeders and poles with reference to the street lines. Distances, as shown, are indicated in feet, and are measured from the bus-bars at the power house.

Separate maps are traced for every line, and blue print copies are made for distribution to the various departments requiring them. The maps are consulted by the operating department for determining the feeder capacity of a given line when new schedules are under discussion; by the track department when changes are to be made in the tracks or streets, and they afford a very convenient means of indicating any particular point on the system at which changes or repairs are to be made in overhead construction.



MAP SHOWING METHOD OF PLOTTING FEEDERS ON STRAIGHT LINES



MAP SHOWING METHOD OF PLOTTING FEEDERS AT CORNERS

RECENT METHODS OF CONSTRUCTION AND PAVEMENT OF TRACKS IN BOSTON

BY ARTHUR L. PLIMPTON
Civil Engineer of the Boston Elevated Railway Company

8-IN. T-RAIL CONSTRUCTION

Although the high T-rail has been in use in paved tracks in other parts of the country for some time, particularly in the West, the Boston Elevated Railway never seriously considered using it on its system until this last summer. The attention of some of the officers of the company was called to it in Minneapolis while visiting that city. They were so much pleased with its appearance and its perfect construction that the final result has been that several lengths of it have been laid on the Boston system, amounting in all to a little less than 13,000 ft. of single track. The Minneapolis form of construction, as described in the Aug. 29, 1903, number of this journal, was practically followed in most of the work, and does not differ materially from what has been done in several cities. Nevertheless, as in one case, bitulithic pavement was used, and as possibly there are some other differences in the details, the following drawings, showing what was actually done in each case, may be of general interest.

As illustrative of this general type of construction in Boston, Figs. 1 and 2 are presented, showing respectively a cross section of the tracks in High Street, Medford, and the form of construction used in Boylston Street, Boston. In each of these cases, twelve ties were used in each 30 ft. of track; tie rods were placed 5 ft. apart and continuous rail-joints were used. It will be noted that in the case of High Street, the concrete base is carried to within 2 ins. of the surface and that this forms the base for the bitulithic surface, although usually this surface is laid upon a solid bed of broken stone. The reason for this change was that it was found that it would be impossible to properly roll the broken stone without injuring the tie rods, which came a little above what would have been the top surface of the broken stone.

The use of a rail with a T-rail head and the omission of a tram altogether, constitute, of course, a radical departure from girder-rail construction. It should not be supposed for a moment that, on any narrow streets where there is heavy team traffic, this form of construction would prove to be durable, as in such places, ruts of irregular depth would before long be formed alongside of the rails. The places selected for trial, therefore, were either where there is very little team travel on the street generally, or where the cars run so frequently, and where there are such good roadways that the teams keep off the tracks, as is the case on Boylston Street.

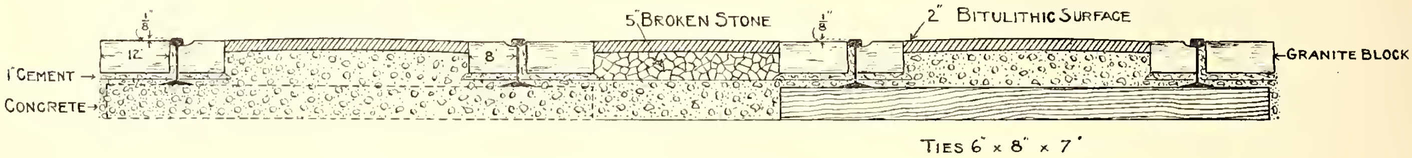


FIG. 1.—CROSS-SECTION OF TRACKS IN HIGH STREET, MEDFORD

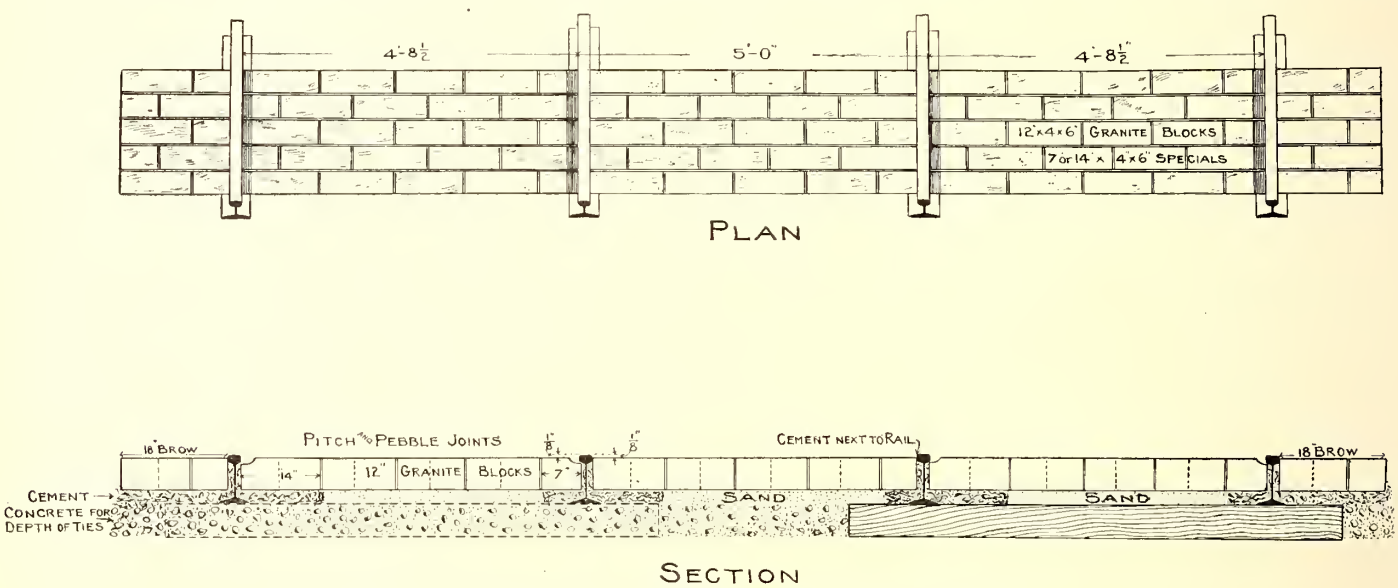


FIG. 2.—FORM OF CONSTRUCTION IN BOYLSTON STREET, BOSTON

BITULITHIC PAVEMENT

Besides its use in connection with the T-rail track, bitulithic pavement has been used in several places in girder-rail track, the form of construction being shown in Fig. 3, which represents a cross section of the tracks of the Boston Elevated Railway Company in Springfield Street, Cambridge. Here again tie rods prevented properly rolling a foundation of broken stone, so that concrete was used instead, except in the center between tracks.

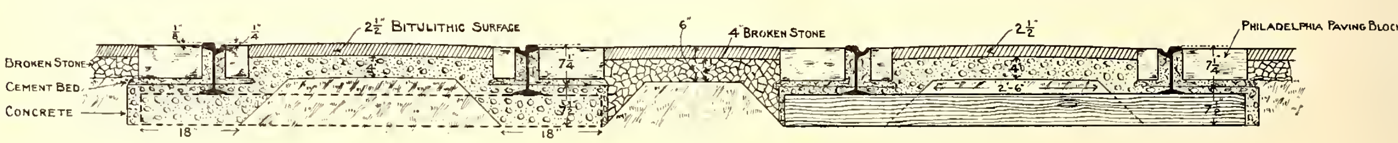


FIG. 3.—CROSS-SECTION OF TRACKS IN SPRINGFIELD STREET, CAMBRIDGE

How durable this form of pavement will be cannot be stated from actual experience on the Boston Elevated system, as this last season was the first time that it was ever tried. It is a very satisfactory pavement in one respect, as it presents a gritty surface, and horses can get a better foothold on it, when the street surfaces generally are in a slippery condition, than they can on most smooth pavements.

RELAYING TRACKS WITHOUT INTERRUPTING CAR SERVICE

One of the greatest difficulties that presents itself at the present time in connection with the relaying of street railway tracks in the central parts of our cities where the streets are laid with a modern pavement on a concrete foundation, is to do the work properly without interrupting the car service.

To allow the concrete in the track to properly set and to become strong enough to stand the pounding of the heavy electric cars without injury, the cars should be taken off for a week or ten days. On a line of great traffic it is impossible to carry the traffic on a single track, and in narrow streets it would be impracticable to lay a temporary track outside of the permanent location, so the result is, all work on the tracks has to be done during the time at night when most of the traffic is suspended, which is for about five hours. The problem before the track

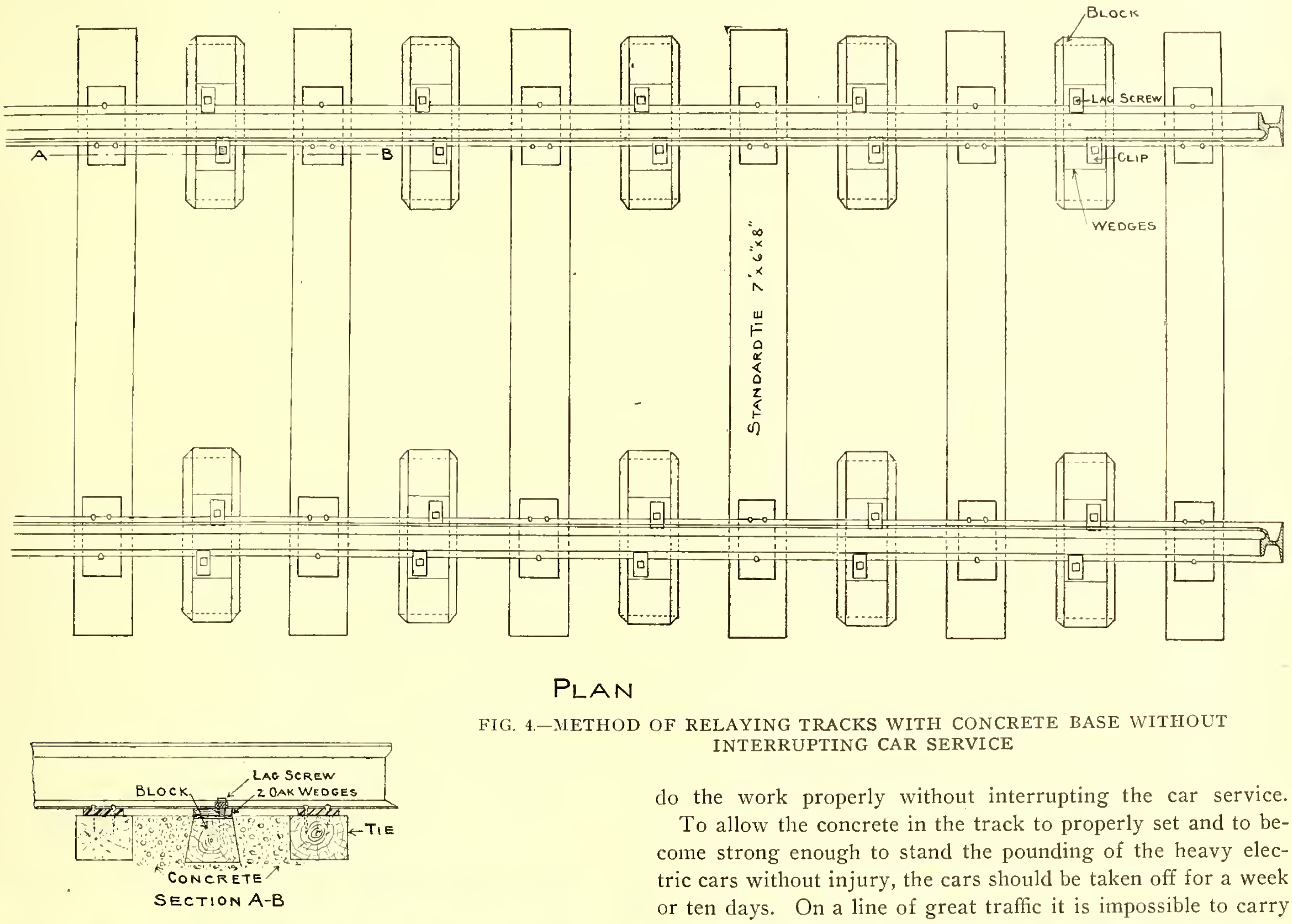
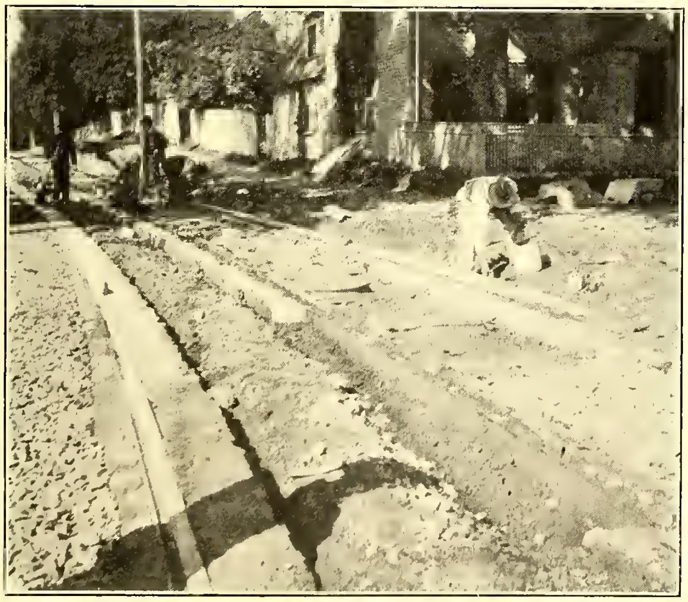


FIG. 4.—METHOD OF RELAYING TRACKS WITH CONCRETE BASE WITHOUT INTERRUPTING CAR SERVICE



BOSTON ELEVATED RAILWAY CONSTRUCTION OF TRACKS IN HIGH STREET, MEDFORD, SHOWING STONE BLOCK HEADERS LAID ON PORTLAND CEMENT CONCRETE FOUNDATION AND GROUTED WITH PORTLAND CEMENT

BOSTON ELEVATED RAILWAY, HIGH STREET, MEDFORD, SHOWING THE THICKNESS AND UNDER SIDE OF A SECTION OF THE BITULITHIC PAVEMENT, CUT FROM BETWEEN THE TRACKS TO INSTALL A CATCH-BASIN INLET engineer is therefore to put in durable construction and yet not to injure the fresh concrete by allowing the cars to operate over the track the next morning.

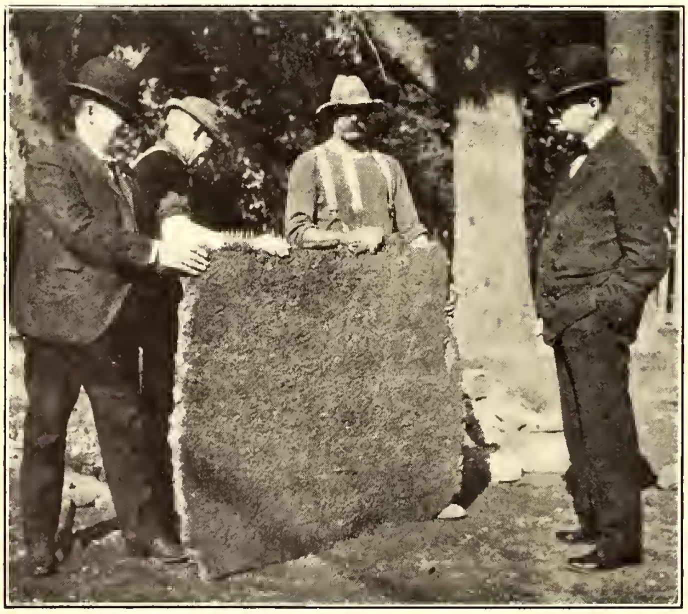
The writer has given this matter considerable study, and has devised a method which has been tried in an experimental way, and which promises a solution of the difficulty.

The method is as follows: A short length of track, as much as it is practicable to complete in the ordinary way on ties 2½ ft. on centers, is relaid each night. The 6-in. layer of concrete is then put in between and around the ties and the cars are allowed to run over the track the next morning. The effect of this, of course, is to break the bond between the ties and the concrete, allowing a slight up and down movement of the track.

Although not previously stated, we install under each rail and in each space between the regular ties a block of wood about 2 ft. long, 8 ins. wide and 6 ins. deep, with the sides beveled one way and the ends the other, so as to insure a bond. This block is bedded in the concrete and is left so as to give a space of 1 in. between the top surface of the block and the under side of the rail.

The movement of the track in no way disturbs these blocks, which at the end of ten days are held solidly in the concrete. Then at each block two wedges are inserted between it and the rail, one on each side of the rail, and are driven in so as to transfer the entire weight of that part of the track to the block. The method employed in the experiment was to then fasten the rail by means of clips and lag screws; see Fig. 4. By these means practically all movement of the rail under a passing car is eliminated.

It is advisable now to completely fill the spaces between the ties and the concrete, and the spaces under the ties created by the movement of the tracks, with quick-setting Portland cement grout. The pavement can then be put in without fear of movement of the rail disturbing the



BOSTON ELEVATED RAILWAY, HIGH STREET, MEDFORD. SHOWING THE UPPER SURFACE OF A SECTION OF THE BITULITHIC PAVEMENT CUT FROM BETWEEN THE TRACKS TO INSTALL A CATCH-BASIN OUTLET

block next to it. The wooden block can be dispensed with and vertical bolts can be bedded in the concrete instead for holding the rail, or any other method that is desired and which will accomplish the same result can be used. The essential point is to create new points of support on the solid concrete to take the place of those permanently injured by the operation of the cars on the tracks before the concrete has hardened enough to stand the strain.

FUEL, ASH AND GAS TESTING: I, LABORATORIES

BY J. STANLEY RICHMOND

As most of the large power houses are equipped with testing laboratories at present, it will be the main object of this article to place before the smaller undertakings as briefly as possible

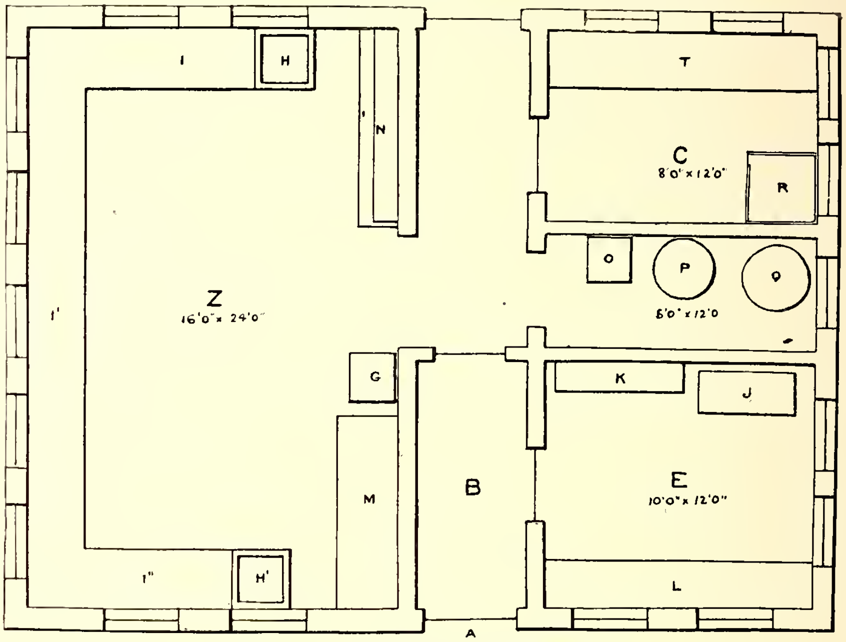


FIG. 1.—LARGE-SIZED LABORATORY

a description of how this class of work should be carried out to suit their smaller financial ability. For, with the inexpensive laboratory and apparatus required, the necessary tests are of such a simple character that they can easily and rapidly be made by any young engineer who is a college graduate or has an elementary knowledge of chemistry. And, in nearly every power house, there is some minor official possessing such qualification who would be quite willing to give a couple of hours a day (often otherwise wasted) to undertake this work in return for a small increase in his salary. To assist in the description, this article will be divided under three headings—laboratory, apparatus and work; while the last will be treated of under three sub-headings—outside sampling, inside sampling and tests.

LABORATORY

The laboratory, if possible, should be a one-story building, detached from any other structure and located near the smokestack. In choosing the location, due attention should also be given to the question of the gas, heat and water supply. In case gas is not obtainable from the mains, it can be provided for by the occupant of the laboratory with some inexpensive apparatus, which will be described further on. Figs. 1, 2 and 3 are rough ground plan sketches of suitable buildings. Which one should be chosen will depend on the amount of the appropriation placed at the disposal of the engineering staff. The scale of each is ⅛ in. = 1 ft.

Fig. 1 illustrates, approximately, the ground plan of a laboratory with which, besides fuel, ash and gas testing, water, oil, paint, iron, steel and general metallurgical testing may be carried out, a description of which will considerably assist anyone undertaking to equip or operate a medium or small sized one. *A* is the main entrance; *B* is a passageway; *E* is the balance room, which is also used as a library and office; *C* is the sample room, and Z is the laboratory proper. M is the stink cupboard, which is built of wood, and about 2½ ft. deep by about 5 ft. high, with hinged glass doors, and is supported on wooden legs, and the inside connected to the power-house stack by means of a wooden tube. If connection to the stack is difficult, a wooden tube, having an inside sectional area of about 1 sq. ft., can be attached to the nearest tall building and connection be made to it instead. Such tube should, of course, be run to about 12 ft. above the top of the wall. G is a four-legged stool about 2 ft. high and having a top about 2 ft. square. This serves for a stand for a 10-gal. or 20-gal. glass or stone jar to hold distilled water, which water should be used in all operations without any thought of economy. N is a reagent cupboard extending from the floor to the ceiling, the lower portion of which is provided with two or three shelves and wooden doors, while the upper portion is divided by shelves to suit the different sized reagent bottles, and has a front composed of three sliding glass doors. H and H' are sinks made out of enameled ware or of wood lined with lead. These should be about 2 ft. square by about 12 ins. deep, and the top edging around them should slant inward. I, I' and I'' are benches with about 2-in. tops and about 2½ ft. deep, so arranged that a single tier of drawers is located below them (tops), while the space between the tier of drawers and the floor, by the use of plain hinged doors, becomes available for storing purposes. On the wall, about 12 ins. above the benches, is fastened a gas pipe with cocks and hose outlets about every 18 ins., each one of which should be provided with about 3 ft. of heavy rubber tubing for connections to Bunsen and solid flame burners. At each of the corners, where the benches meet, should be placed a water bath.

The floor of the laboratory proper should be of cement or, preferably, of glazed tiles, and should always be mopped and not swept, for sweeping raises the dust, which settles on and in the glassware. J is a roll-top desk; K is a bookcase, and L is a bench for two balances and a few desiccators. The floor of this room should be covered with linoleum. O is a small four-legged stool about 3¼ ft. high, with a top about 2 ft. square, which is used as a support for the muffle furnace, which muffle is heated by gas or by air blast in connection with a small oil-gas tank similar to those used in dental work. P is

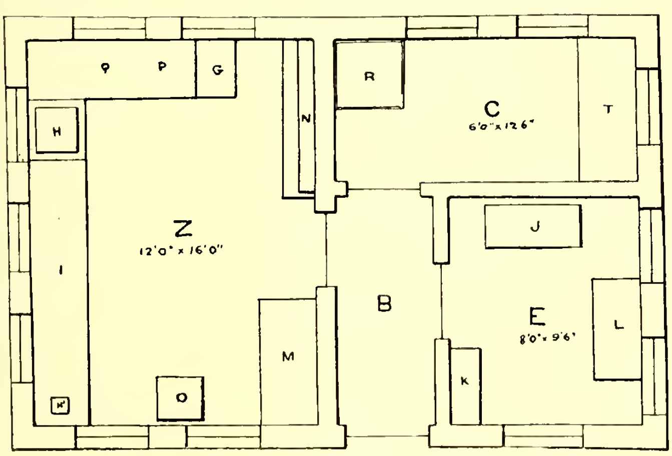


FIG. 2.—MEDIUM-SIZED LABORATORY

a circular tank about 6 ft. deep and 3 ft. in diameter, supported on a stool about 2½ ft. high. Inside the tank is a coiled tin condensing tube, which is soldered to and passes through the side of the tank about 1 ft. from the top, the outer portion being expanded so that the nozzle from the copper still Q can be inserted into it, the coupling being made steam tight with asbestos. The bottom end of the tin coil is soldered to and passes through the front of the tank about 2 ins. from the bottom, protruding about 6 ins. The incoming condensing water is allowed to trickle into the mouth of a long-necked tin funnel (about 6½ ft. over all), which funnel, of course, is inserted in the tank so that the cold water runs to the bottom of it. The hot water is carried away to the drains by means of a piece of rubber tubing attached to a nipple soldered to the tank about 6 ins. from the top. The still is set in an iron-plate furnace provided with a small grate for burning coal, which furnace can be made out of a piece of boiler plate by any average blacksmith. The floor of this room should be of cement and the

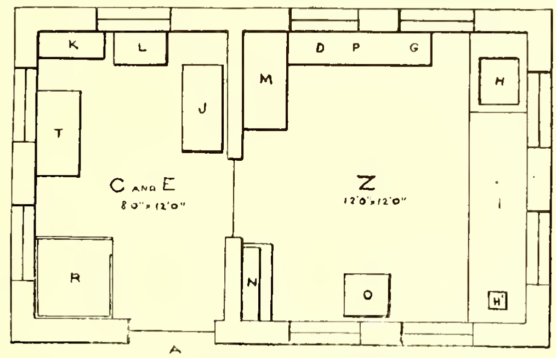


FIG. 3.—SMALL-SIZED LABORATORY

room be provided with a door, which should be taken down in winter—that is, only used in summer, otherwise the heat from the muffle and furnace is insufferable during the hot months. C is a sample room, the floor of which should be covered with sheet lead. R is a solid brick support about 2½ ft. high, with a cast-iron top about 3 ft. square, which top has a raised edge about 1 in. high all around it except for about 6 ins. at the corner S. T is a bench table provided with a well-balanced scoop scale to weigh up to about 5 lbs., and of such a grade that the index needle will move with the addition of 10 grains to one side of it.

Fig. 2 is a rough ground plan of a smaller laboratory, in which Z is the laboratory proper, M is the stink cupboard, N is the reagent cupboard, I is the bench, H is the sink, H' is the water bath, and QPG is a table with a small copper still heated by gas, a small condensing tank and a distilled water bottle on it. C is the sample room, R is the sampling table, and T is the bench. B is the passageway, E is the balance room and office, J is the desk, K is the bookcase, and L the table for the balance and desiccators.

Fig. 3 is a rough plan of a still smaller arrangement, in which E is the sampling room, office and balance room. R is the sampling table, T is the bench, K is the bookcase, J is the desk, and L is a small case with a glass front that can be lifted upward, and in which the balance is kept. Z is the laboratory, M is the stink cupboard, N is the reagent cupboard, I is the

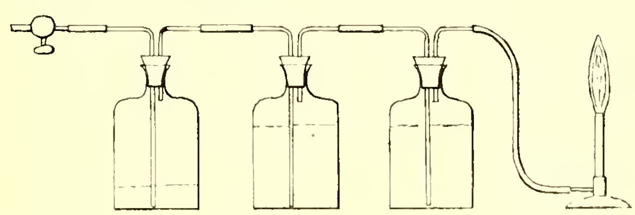


FIG. 4.—GAS-GENERATING APPARATUS

bench, H is the sink, H' is the water bath, and QPG is a table with a copper retort and condensing tube for distilling water.

Having described the laboratory buildings, it may not be out of place to now give the details of the apparatus necessary for the production of gas, provided that such is not obtainable from regular gas mains. The first thing to do is to obtain a small blower and motor and erect them in the sampling room or other convenient place, and connect the blower to the gas piping in the building. Between each Bunsen and its gas-cock is connected in series three bottles, each one having a capacity of about 1 quart, and each fitted with a cork and bent-glass tubes, as shown in Fig. 4, so that the air will be carried down in succession to the bottom and pass out at the top of each bottle. The bottle nearest to the gas-cock is about one-quarter full of commercial sulphuric acid, which extracts the moisture from the air. The other two bottles are about two-thirds full of gasoline or some other light petroleum oil, which oil is volatalized by the air and passes over with it to the Bunsen burner, where it is ignited and burns like ordinary gas.

OVERHEAD EQUIPMENT*

BY H. M. SAYERS, M. I. M. E.

The stresses on all the supporting structure of an overhead construction are functions of the size and weight of the trolley wire used, and to keep down the size, weight, number and expense of supports the wire should be chosen as small as will serve the designed purpose. It is easy to show that there is no electrical necessity for using any wire larger than No. 0 S. W. G. (.324 in. diameter), where the trolley wire is fed as usual at ½-mile intervals, unless the traffic is extremely heavy. But on suburban or interurban lines carrying an infrequent service it may be necessary to avoid the expense of underground feeders and to employ heavier trolley wires or, preferably, overhead feeders. Heavy traffic, especially over curves of short radius, may also afford a reason for the use of larger wire in order to increase the life and remove the risk of breakage on account of heavy mechanical wear. The most economical size of trolley wire to employ in any particular case is thus mainly a question of its life as a mechanical wearing part, the cost of renewal and the loss by scrapping having to be put against the capital expenditure. But it must not be forgotten that a heavier wire involves heavier poles and other supports, the cost of which must be properly brought into the account. The conditions are too complex, and at present too little determined by experience, to admit of the formulation of any general rule, but it is probable that where the conditions are very severe it is better to employ one of the harder bronze alloys than a copper wire of larger size.

One reason for this is that the wearing qualities of hard-drawn copper wire are not directly proportional to its weight, the hardness diminishing from circumference to center. This is well shown by the fact that the post-office specification for such sizes as Nos. 12 and 14 calls for a breaking strain of 28 tons per square inch, while the usual trolley wire specification is equal to 22 tons, over 20 per cent less. The effective thickness of the hard skin varies with the details of the manufacturing process, and very little seems to be known about the subject by users; but, from the behavior of trolley wire under long wear, it seems probable that the hardness diminishes gradually and, up to such sizes as No. 0, a considerable thickness is appreciably hardened. It is also possible that the rolling of the trolley wheel has a further hardening effect, but where the wheel rubs or grinds, hard abrasion removes the hard exterior and the softer metal inside is soon reached. On these facts it is clear that a material that is hard right through should be preferred. Very little experience with these bronze wires has been made public, and as some are brittle and some pit badly under arcing, they should not be extensively adopted without trial. They are all of higher electrical resistance than copper, and therefore require feeding at shorter intervals if the traffic is heavy. The mechanical and electrical qualities required in trolley wire are well known, easily verified by test and readily complied with by a considerable number of makers. Very high tensile strength should be regarded with suspicion as probably indicative of brittleness, and bending and falling weight tests should be made in such cases.

The maximum distance apart of supports is settled by the Board of Trade regulations at 40 yds.; on straight lengths there is no reason for diminishing this, and it is therefore taken as the standard. But at curves, junctions and termini, the positions of poles have to be carefully considered and so arranged as to take the longitudinal pulls of the straight lengths or tangents as directly as possible, to hold the trolley wire closely and firmly to the required curves, and to hold "special work" to its correct place. There is often but a limited choice for pole positions, especially at junctions where streets cross, and in all such cases an accurate large scale survey should be made, the trolley wire and special work laid down on it, and the best arrangement of span and pull-off wires that will suit the possible pole positions worked out. The labor of drawing several alternatives will be well repaid by the workmanlike and satisfying appearance of the completed work, and by the absence of working troubles.

One essential point at these places is to anchor the straight lengths as directly as possible to a heavy pole. If such a pole can be placed at the intersection of the tangents it can take both anchor wires. The ends of the curves should also be anchored in the usual way. This anchoring is very important, because it makes the straight lengths and the curve work mutually independent; the span wires are not distressfully pulled out of line, and the pull-off wires intended to shape the curve have not to take indefinite components of the pull of the straight lengths. Most important of all, if any accident happens to the overhead work on either the curve or one of the straight lengths its effects will be stopped by the anchoring. Anchoring is also necessary at section insulators, and it is advisable to anchor every quarter of a mile, even on a perfectly straight line, in order to localize the effect of a trolley wire breaking. Termini, curves and junctions are the keystones of the whole structure, and, when the pole positions at these places have been worked out, the tangents between have only to be divided up into equal lengths of as near 40 yds. as circumstances permit, but never exceeding that distance. Side poles with brackets can rarely be used to carry wires central to the track, as the bracket arms would be unduly long; the choice lies between span wires and central poles. Where there is room, central poles have certain advantages, especially that of neat or even ornamental appearance, and their cost is somewhat less than that of span-wire construction. But as the clearway between the tracks has to be from 2 ft. to 2 ft. 6 ins. wider to give the regulation clearance between cars and standards, the total cost to the tramway undertaking is rather increased than diminished. They also have to be lighted sometimes at the tramway expense. To other traffic in a busy thoroughfare central poles are a nuisance and a danger, but, where streets of magnificent width relatively to the traffic on them exist, the disadvantages may be inappreciable. On even slight curves center poles are insufficient, as there is no means of "pulling off" the outside wire, and, if side poles are added for that purpose, they look very odd.

Feeding points have also to be reckoned with in laying out pole positions. The best way of cutting up the work into ½-mile sections will depend upon many local conditions, but one constant consideration is to arrange that a fault on any section shall have a minimum effect upon the whole service, and consequently sections frequently terminate at junctions. Section insulators should be kept out of the junction special work, and, where this is complex or important, it is best to insulate it on all sides and feed it separately. Section insulators should not be put on curves or on steep gradients. With span-wire construction on curves more and stronger poles are needed on the outside or convex side of the road than on the concave side, the pull of the trolley wire being centripetal. Bracket-arm poles should always be on the outside or convex side of the road.

* Abstract of paper read at the meeting of the British Tramways and Light Railways Association, Jan. 13.

Having arrived at the pole positions, the next point to determine is the strength of pole to be used in each. Generally speaking, three grades of strength will suffice. The Engineering Standards Committee has recently issued a standard specification for tubular tramway poles in which the three strengths are classed as light, medium and heavy, and the strength defined by the loads needed to produce a temporary deflection of 6 ins. and a permanent set not exceeding ½ in. under conditions fairly representing the working loads. The temporary deflection load may be regarded as the maximum safe working load, and the permanent set load as marking the commencement of danger by deformation. The loads are as follows:

Class of Pole.	Load for Temporary Deflection of 6 Inches.	Load for Permanent Set Not Exceeding ½ Inch.
Light	750 lbs.	1,000 lbs.
Medium	1,250 "	1,750 "
Heavy	2,000 "	2,500 "

Occasionally heavier poles than the standard "heavy" class may be needed, but these occasions are rare, and may often be avoided by dividing the load between two "heavy" poles. The choice as between sectional and taper poles is mainly one of taste and price. That the appearance of a pole of uniform taper is better than that of a pole built of three parallel sections is a general opinion. At present, for equivalent mechanical tests, taper poles to standard dimensions are dearer than sectional poles and somewhat heavier. The absence of the swaged joints is put forward as a mechanical advantage, but it is very rarely found in practice that a sectional pole fails at the joints. If taper poles are used it is desirable to have them solid rolled, as a lap-weld the whole length of the pole may prove a line of weakness. Solid rolled tube is an improvement in sectional poles, but there is not a great risk of poor welds in these comparatively short lengths, and if the joints are set at 120 degs. in plan, as they should be, the pole as a whole will show no line of weakness. Wooden poles should be chosen to give the same temporary deflection as would be called for in steel poles. As this depends upon stiffness, it will generally be found that very thick timber is necessary, and the poles will have a stumpy and heavy appearance. The first cost will generally be lower than for steel poles, but the ultimate economy is somewhat doubtful and should be considered with full knowledge of the special conditions, especially the probable life of the wooden pole in the local soil and climate. In any case the poles should be creosoted to the post-office specification, and they should not be set in concrete.

Lattice poles can be purchased, and are sometimes used on the Continent. They are said to be cheaper than tubular poles of equal strength, but are very ugly, and it is probable that the painting necessary to preserve them from rapid corrosion in this climate will neutralize the initial saving.

The type, positions and sizes of poles being settled, the intermediate supports between poles and wires claim attention. The choice lies between span wire and bracket arms, but it is frequently necessary to use both constructions in different parts of a tramway network. Span-wire work will generally predominate, but there are many exceptions, especially on systems which are mainly composed of single lines with turn-outs. Where bracket arms are employed it will be wise to use the flexible suspension.

Span and pull-off wires are generally of galvanized steel, but in many towns this material has but a short life on account of atmospheric pollution, and in such cases phosphor or silicon-bronze wire should be used. This applies equally to guard wires and their supports; whichever is used the metal parts of the suspension fittings should be of similar metal. There is no means of preventing galvanic corrosion where dissimilar metals are in contact, and such contact should be avoided. The use of iron insulated bolts screwed into brass ears is almost universal, and frequent trouble results at this point. Gun-metal bolts would be better, but there is some difficulty in getting them made.

The size of span wire should not be less than 7/14 S. W. G. There seems no reason for using larger wire, but such use is quite common even up to the monstrosity of 19/12. This wire should have a breaking point equal to from 35 tons to 40 tons per square inch after stranding; the galvanizing should be carefully examined and tested in the manner prescribed by the post-office. Galvanizing that is originally defective, or that cracks and peels off in erecting, is useless; the wire will rust through at the unprotected points in a brief period.

To secure the wire at the poles it should be laid around a horse-collar thimble of size proportioned to the size of strand and properly bound with galvanized charcoal wire—not twisted up. Better than the thimble is a shackle or reel of porcelain with a central hole to take the strap bolt. Porcelain is a far better, more durable and cheaper insulator than any of the compounds used in turn-buckles, globe strains, etc. There is no need to provide any tension adjustment at the ends of span wires—insulated turn-buckles, strains, etc., are quite unnecessary and represent wasted money. With a dynamometer on the draw-vice, or by the measurement of the sag from the ground, span wires can be put up with the greatest uniformity and the certainty that the trolley wires will be carried at their correct level. This level can be checked, if desired, by loading the span wires at the correct points with weights representing the working load, but this only needs to be done once for each width of street.

Bracket arms are generally made of 2-in. steel steam tube either screwed or expanded into a socket on the pole clamp. These arms are often much too long for safety. A 2-in. tube 12 ft. 6 ins. long, fixed as a cantilever, and loaded with the weight of a span of trolley wire and the suspension fittings, is very near its breaking point. Longer arms are therefore entirely dependent upon tie rods. The longer the arm the less efficient the tie rod, owing to the more acute angle between the two members. As generally made, tie rods are pulled up by a nut so that their effective strength is the resistance of the threads to shear. Bracket arms 18 ft. and 20 ft. in length are therefore extremely unsafe, having practically no margin of safety. It is better to use eye-ended tie rods and dispense with nuts, and no real difficulty arises in erection if the clamps are fixed at measured distances, so that the brackets and tie rods make the correct calculated angle; but if adjustment is necessary it is best provided by a long, solid, right-and-left threaded sleeve fitting the two parts of the rod like a rigging screw. Struts are usually inapplicable, but if the scroll work can be made to give some support so much the better. Bracket-arm pole clamps should be of substantial length, and a good fit on the pole by internal fitting rings at top and bottom. The bolts should fit through long bored sockets in the planes of the fitting rings and be kept close in to the poles. The socket receiving the arm should be of ample length and well thickened out to the body of the clamp. In fact, in designing bracket arms and their fittings, the stresses and strains should be calculated out as for a loaded cantilever, ignoring the tie rod, but adding 50 per cent to the dead weight to allow for the rolling load and its hammering effects. Then the tie rod and its fastenings should be designed to carry the same load safely. Malleable cast iron is the best material for pole and bracket-arm clamps and bow-string brackets. These last are often too short to give proper clearance, and are spaced too close on the bracket to give the elasticity so desirable. They should be pinned or otherwise secured so that they will not slide along the arm. Porcelain shackles should be used as the secondary insulation of bow-strings.

On straight work the "straight line" hanger is the best insulated fitting, but on curves and wherever there is a probability of lateral pressure on the wire, the pull-off pattern must be used. The caps of these should be provided with some form of locking device, and a soft leather washer should be placed between the head of the insulated bolt and the cap. The insulating material on the bolts is far from perfect. While new the insulating qualities are very good, but in a short time the atmosphere deposits dirt on the exposed surface, and sooner or later, in damp weather, a trifling leakage of current chars the surface and break-down follows. This should not happen if the secondary insulation remains good, and, if porcelain is used, such break-downs are very rare, because a porcelain surface does not char with a small creeping leak; it dries up and the leakage ceases. This matter is a really serious one, and the insulated bolt is probably the most unsatisfactory item of the whole overhead equipment. The cure may be found in redesigning the arrangement in such a way as to remove the insulator itself from so trying a position, but there are obvious difficulties. The usual practice of keeping the two trolley wires for up and down directions separately insulated and separately fed is highly advantageous. But at junctions this becomes very difficult. Insulated crossings are a variety best avoided, and, as above stated, the best course is to feed junction work separately; the next best thing is to feed it through one wire only of one of the junctioning lines, and to insulate the junction from all the other wires. In bow-string suspensions care should be taken to provide ample clearance above the cap of the hanger. Sometimes only a small fraction of an inch is left between the cap and the bracket-arm tube, with the result that at every passage of a trolley wheel the hanger strikes the arm, damage soon resulting.

The soldered ear is the best form of attachment for the trolley wire. Many patterns of mechanical ear have been devised and tried, but it is hard to see how any mechanical clip can give equal security without adding to the effective diameter of the wire on the arc in contact with the wheel. The use of wire of figure 8, or grooved section, makes the mechanical ear satisfactory, but such wire is at once more expensive and more troublesome to erect, so that the balance of advantage remains with the soldered ear. The metal used for ears should be a tough bronze or gun-metal, and careful inspection after machining is necessary to eliminate defective pieces, as the castings are somewhat apt to show blow-holes and other weak places. The groove to receive the trolley wire should be milled to a hundredth of an inch larger diameter than the wire, and should come to a sharp edge. It is doubtful whether the small lugs, which it is usual to provide at the ends of the ears for hammering over the wire, serve any useful purpose. They sometimes hold up a wire that has not been properly soldered until traffic commences. Fifteen inches is the minimum length of ear for straight work, the tendency is to increase the length up to as much as 24 ins., but the advantage seems doubtful. On curves longer ears are necessary, and by bending them to a proper radius the change of direction of the trolley wheel is much smoothed. Unfortunately, curved ears tend to pull into angular shape with use. There seems no good reason why they should not be cast curved with lateral webs to impart stiffness. It would not be necessary to use many different radii, as the varying radii of the track curves should be met by the use of a larger or smaller number of pull-offs, with a standard deviation at each. Splicing ears should not be needed in building a new line, but are necessary for repair work. They are rarely well designed, the wire ends having to be bent too sharply, and some patterns are provided with foolish little steel-set screws, that invariably set fast and break off. Anchor ears should be provided with stout eyes of rounded section, to which the anchor wire can be secured without bending to a dangerously small radius.

Section insulators present a combination of difficulties, and in selecting a pattern both mechanical and electrical considerations must be studied. The pull of the wires has necessarily to be transmitted through insulating material, and it ought to be so transmitted as a straight pull without any binding or twisting component. This is inconsistent with the necessity for allowing a straight level path for the trolley wheel. Hence the best designs are but compromises, and the worst may be guaranteed to break down within a few months. The terminating arrangements for the wire ends need the same easy curvature as in splicing ears. It is better to dispense with set screws for securing either the feeder cable or the trolley wires and to have tinned sockets or grooves into which they can be soldered. The air-gap pattern is probably better than that with a gap stick, but there should be two distinct air gaps, and an insulated running piece between them, to prevent an arc being drawn in the event of an earth on one wire. Gap sticks of lignum vitæ have been found to wear smoothly and give a regular life. Section insulators are very heavy, and saving of weight is a merit to be fully credited. Easy and rapid replacement is another virtue which will be appreciated when the line is at work. The sweating of the connections is not inimical to this, because, knowing that it has to be done, the fire pot and bit will be ready, but a rusted-in set screw cannot be calculated for.

Junction special work fittings also require careful selection. For central wires and rigid trolley heads the frog makes a satisfactory facing point, provided that it is properly set, with reference to the track points and the lengths of the cars and trolley booms. Crossings are apt to give more trouble than frogs or switches. The greatest care should be taken to get them of the correct angle to suit the track crossing, but as the angle is also affected by the lengths of car and trolley boom, the junction should be drawn to scale, a template of the car and trolley boom fitted to it in successive positions to ascertain the best angle and position for the crossing. All these fittings should be so designed that the trolley wires need not be cut when fixing them, and so that they can be securely held by pull-off and span wires to their positions.

THE FOWLER SOLID ROLLED STEEL CAR-WHEEL

The Duquesne Steel Foundry Company, of Pittsburg, has purchased from the American Car & Foundry Company all of the rights to manufacture the solid rolled-steel car wheel formerly made by that company under the H. W. Fowler patents, and will soon put this wheel on the market for electric railway service. This wheel is claimed to be cheaper than the steel-tired wheel, and when properly made quite as serviceable. It has been used pretty extensively, but in rather an experimental way, by electric companies and railroads. Practically the only criticism that has been made by the users of the wheel so far has been a lack of uniformity in wearing qualities. This has been due to the fact that the American Car & Foundry Company, having no steel foundry of its own suitable for this purpose, has been compelled to purchase the blanks used and which it has afterward rolled. The company has found it impossible to secure a uniform quality of steel in these blanks; that is to say, some of the blanks would be soft, giving a minimum amount of wear in service, while others would be of proper hardness. When the proper grade of steel was used very gratifying results as to mileage were obtained.

The Duquesne Steel Foundry Company proposes to change this condition of affairs by making the wheels of uniform quality and of a grade that experience has shown gives the best results. To secure this uniformity, it is proposed to make the wheels in special heats. The company's steel foundry is a large modern plant, well equipped with appliances for expeditious and economical handling of the important work to be undertaken.

THE OPEN FEED-WATER HEATER

BY E. T. WALSH

In the design and operation of modern power stations, the economy possible through an intelligent use of the feed-water heater, and particularly of the open feed-water heater, is often overlooked. There is, however, a partial explanation for this fact. The advantages of the open feed-water heater have often been neglected in the past, owing to the difficulty heretofore experienced in separating the oil used for lubricating the cylinders from the exhaust steam, and the serious consequences if this oil should pass into the boilers. This difficulty is now disappearing, and the open heater, particularly in bad water districts, is now being widely installed almost as a matter of course.

The reason for the difference in efficiency between the open and the closed heaters is not difficult to understand. In the closed heater no attempt is made to use the water of condensation, all of which is allowed to waste either at the drips or through the vapor pipe. As the steam and water are separated by the metal in the tubes, the percentage of heat that will pass from the steam to the water depends on the conductivity of the metal of which the tubes are made, and also upon how clean they are. The heater, therefore, decreases in efficiency directly as the tubes foul, which they must do from the oil in the steam and scale or deposits from the carbonates in the feed-water. Another source of loss in the closed heater is from tubes bursting or leaking from any cause. When such accidents happen, the usual course adopted is to plug the defective tube, continuing to plug the tubes as they give out, until there are enough out of service to make it necessary to shut down the heater and replace them all at one time. As the closed heaters are generally rated by their area of heating surface, allowing one-third of a square foot per boiler-horse-power, it will be seen that the rating is seriously reduced by having one or more tubes out of commission. It has, in fact, been said by good authority that closed feed-water heaters are seldom provided with sufficient surface to raise the feed temperature to more than 200 degs. F., and as it is under boiler pressure, it is subject to all the troubles that come with high pressure.

On the other hand, the open feed-water heater, from its construction, must have a practically constant efficiency as the exhaust steam comes in direct contact with the feed-water.. The deposits on the trays do not interfere in the least with the action of the heater, and its capacity is limited only by the quantity of water and steam that can be brought together—that is, within certain reasonable limits. Before the exhaust steam enters the open heater proper it passes through an oil separator, which consists usually of a chamber in which is placed a baffle plate on which the steam impinges. The baffle plate catches the oil, while the steam, thus relieved, passes through ports at the sides of the baffle plate into the heater, the oil dripping into a trap below. For an additional depositing surface and for filtering purposes, a bed of coke or crushed quartz is spread on perforated plates placed a short distance above the bottom of heater; through this the water must pass before it enters the pump to be pumped to the boilers.

Open heaters have been condemned sometimes in the past on account of the poor success of the oil separator. That this was caused by unfavorable conditions or locations is shown by the fact that a separator placed under the normal conditions for which it was designed will give the desired results, and as it is a mechanical appliance, it will repeat these results whenever the conditions are repeated. Assuming that the separator is properly designed, efficient separation depends on three factors:

1. The velocity of the exhaust steam passing through the separator must not be excessive; there is a limit to the capacity of a separator just as much as to the capacity of a boiler or an engine.

2. The oil to be taken out must be one that will remain in a liquid condition at the temperature of the steam—which is, of course, the only kind of an oil suitable for cylinder lubrication.

3. The separator must be properly drained.

With this understanding of what constitutes normal conditions, it will be recognized that the conditions upon which efficient separation is dependent are most reasonable and logical, and that they can be established in any well designed and well regulated plant.

Another objection to open heaters which has sometimes been raised has been the difficulty experienced in pumping hot water, and that it is necessary to do this will be readily understood, as the boiler feed-pump must be placed between the heater and the boilers. However, to pump hot water it is only necessary to keep solid water against the piston or plunger of the pump; this is accomplished by providing a sufficient head of water on the pump to lift the pump suction valves and overcome the friction in the suction pipe. The pump should be of ample capacity for the work, and should be equipped with metal valves.

It might be said here that with an open heater, two pumps will be required to get the water into the boiler, unless, of course, it passes into the heater under a head. This second pump is not altogether a disadvantage, however, and the actual work done by it is only a part of that which would have to be performed by a boiler feed-pump in pumping the water from the same level, and the heat in its exhaust steam not utilized in performing its work is returned to the boiler in the feed-water. In a condensing plant this may be very desirable, as the supply of exhaust steam at atmospheric pressure that is available for the purpose is rarely sufficient to heat the feed supply to the highest possible temperature. However, this second pump is rarely found necessary, as in nearly every steam plant where feed-water must be pumped from a river or well, an elevated tank is provided for storing sufficient water for boiler use, fire protection, sanitary purposes, etc.

In the present trend of power plant design, in which the steam turbine takes such an important part, the open heater is peculiarly adaptable, as the perfect freedom from entrained oil in the exhaust makes it safe to use the whole of the water of condensation again in the boilers, without the use of an oil separator. The heater may be so placed that the water of condensation will flow from the condenser hot-well by gravity into the heater, from which it will be pumped into the boiler. By using the exhaust steam from the auxiliaries to heat the water of condensation from the hot well of the condenser, it is quite possible to introduce the feed-water into the boiler at a temperature of 210 degs. F., showing a saving of 10 per cent in fuel.

In addition to the above saving of the heat in the auxiliary exhaust, it is evident that all of the condensation will be saved and returned to the boiler except the very small percentage lost in the oil separator. This condensation is distilled water, and is therefore perfectly pure, having been relieved of all of its scale-forming properties in the process of distillation, and, with the addition of the small percentage of raw make-up water, which effectually neutralizes the possible corrosive effect of pure distilled water, it makes the very best quality of boiler feed. The economy that will result from using 99.8 per cent of the feed-water over again, when water must be bought, for instance, at $1 per 1000 cu. ft., requires very little study and a few figures to become obvious to the most incredulous.

When reciprocating engines are used with surface condensers, the foregoing advantages still obtain, except that the oil must be removed from the exhaust steam before it reaches the condensers, the location of the condenser and heater with respect to each other being as described for the turbine layout. When the latter arrangement is made, the results are about as described for the turbine installation, but when jet condensers are used and the circulating water is such that the presence of sewage, salt or other foreign matter makes it inadvisable for boiler-feeding purposes, the temperature to which the boiler feed can be raised is limited by the quantity of steam exhausted from the auxiliaries at atmospheric pressure.

It is necessary to have a high vacuum in the condenser, in order to obtain the best results, in the case of engines running condensing. To secure this, all entrained air and vapors should be removed from the system, for which purpose it is usual to employ either wet or dry vacuum pumps. Every cubic inch of air removed by these pumps, however, means power used, and all air and vapors that can be eliminated without recourse to the pump means a gain in efficiency. In a closed steam cycle, or where the feed-water is used again in the boilers, the open heater, by its construction, performs to a greater or less extent the important function of relieving the air pumps, the vapor pipe permitting the air and gases liberated from the water free exit to the atmosphere.

That the open heater is receiving favorable consideration at the hands of engineers is proven by the fact that one of the largest all-turbine plants in course of erection near New York City is to have installed one 15,000-hp open feed-water heater. Another large installation in New Jersey has an order placed for a 3000-hp heater of the open type. A large turbine electric light plant at Detroit, Mich., has open heaters aggregating 15,000 hp in operation, and other instances might be mentioned where open heaters are replacing those of the closed type.

THREE-CENT FARE IN FORCE IN CLEVELAND

The zone plan of low fares is now being tested by the Cleveland Electric Railway. On Monday morning, Jan. 23, special cars bearing large signs, "Three-Cent Fare. No Transfers," were placed in operation on twenty routes, embracing all the lines within the district bounded by Wilson Avenue on the east, Clark Avenue on the south and Gordon Avenue on the west, these streets being on an average of about 2¼ miles from the Public Square, the heart of the city. The regular cars and system of operation are not interfered with in any way, except that, owing to the fact that the company has pressed every car into service, it is impossible to operate so many trippers night and morning. The regular cars charge 5 cents within the zone, as heretofore. The 3-cent cars operate at intervals of five minutes on all the lines, and run from the Public Square to the zone limits and return. In several instances they return by the same routes, while in others they form loops with other lines, and cars are operated around the loops in both directions. The new service necessitated the adding of 113 cars to the regular schedules.

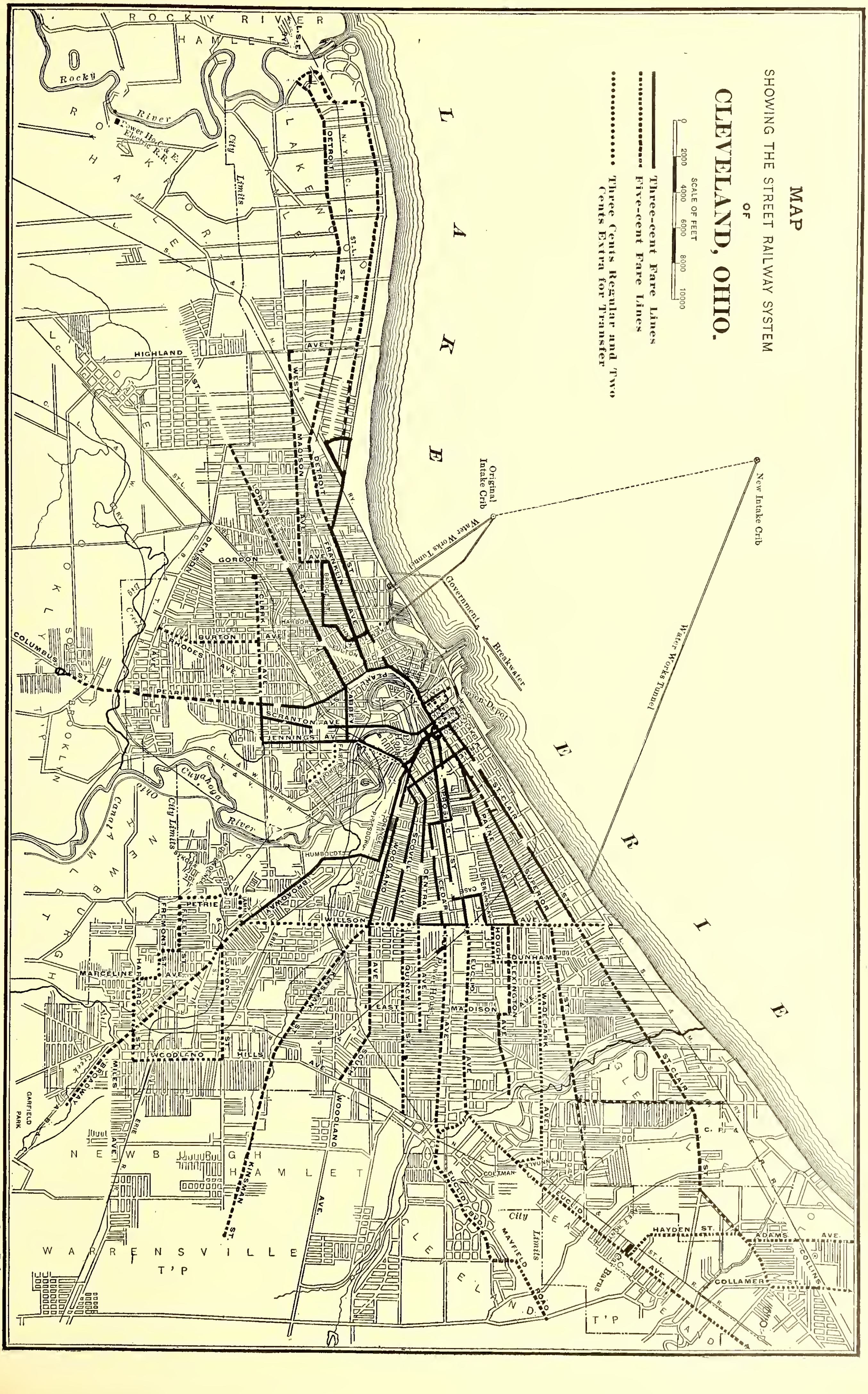
Of course, by reason of this plan the operating expenses of the system are increased something over $1,000 a day. The object of the test is to give the best possible service to determine what effect the low rate of fare will have upon the gross earnings of the company. Mayor Johnson has maintained that a 3-cent fare will cause people to ride short distances where heretofore they have walked, and he claims that the additional receipts will more than compensate for the smaller fare to the people within the zone. If the truth of this contention is made apparent to the company it would use the same cars for both services, but in the test it preferred to keep the two plans entirely independent and operate the 3-cent cars as if they were operated by a separate company, believing that by this plan a better test could be given than by any other. Only in the case of the Wilson Avenue crosstown line, the Fairfield line and the Abbey Street line, which are entirely within the zone, was it found necessary to make the two systems interchangeable. On these lines a passenger can ride for 3 cents, but if he wishes a transfer he pays 5 cents. For the convenience of passengers, five tickets are sold for 15 cents. These will be accepted on the 5-cent cars with 2 cents additional, or two of them will be accepted for one fare and 1 cent returned, amounting in either case to a 5-cent cash fare. The tickets bear the words, "Good for 3 cents toward fare on the Cleveland Electric Railway." In consequence, if the scheme is not adopted permanently, they will still represent only 3 cents.

The results of the test thus far are in no way conclusive and the company is not yet prepared to state what it thinks of the scheme, but, nevertheless, the results which are apparent are most interesting. In the first place, the service is unquestionably better than Cleveland has ever seen before. At all times of the day there are more cars than there have been heretofore during the heaviest rush hours. It is practically a rush-hour schedule from 5 a. m. to 7 p. m., which is the length of time the 3-cent fare cars are operated. One result is that the congestion at the Public Square is something terrific, and the schedules of all the cars, both 3-cent and 5-cent, are maintained with great difficulty. Under ordinary conditions the congestion in the heart of the city has been bad enough, but with 115 extra cars, all of them turning at the square, where formerly the majority of the extras ran through, a condition is made that cannot long continue. During the rush hours the situation is, of course, worse than at other times, because the cars have to make so many stops.

Many people were not familiar with the plans for the test and a great deal of confusion resulted. There was much wrangling over transfers, as they were neither given nor accepted on the 3-cent cars, even though the passenger desired to go to a point within the zone. Up to the present writing the scheme does not look like a success. On some of the lines people are riding very freely in the 3-cent cars, while in others they are practically empty. It is noticed that on the Euclid Avenue line, which traverses the aristocratic portion of the city, people do not take kindly to the low-fare cars. The lines which carry the workingmen are carrying a great many passengers. From the general talk at present, the greatest objection seems to be that separate cars are used. The people admit that it makes too much congestion and the movement of all cars is slower. The company will consider the advisability of making the fares interchangeable, as this would reduce the number of cars.

The result of a week's trial has shown that very few of the cars have earned their way and that the vast majority of them have been operated at a large loss. The officers of the Cleveland Electric Railway Company decline at the present time to give out any figures concerning the operation of these cars, they having agreed with Mayor Johnson not to publish the figures until the experiment was actually completed. At this writing the officials have not decided whether to discontinue the service at once or to allow it to continue for a few days longer. The STREET RAILWAY JOURNAL will publish the full details of the conclusions arrived at from this most interesting test just as soon as the officials of the Cleveland Electric Railway Company are willing to give them out.

One of the bills introduced into the Massachusetts Legislature at the present session makes it compulsory upon the Boston Elevated Railway Company to give to passengers on its cars coming from South Boston to the South station a transfer check good on any car either on the surface or on the elevated railway going northward, and to give to any passenger on any of its cars, either on the surface or on the elevated, coming from the North to the South station, a transfer check good for transportation on any car of the company to South Boston. The object of this suggested legislation is to have established a transfer station for the Boston Elevated Railway Company at the South station.



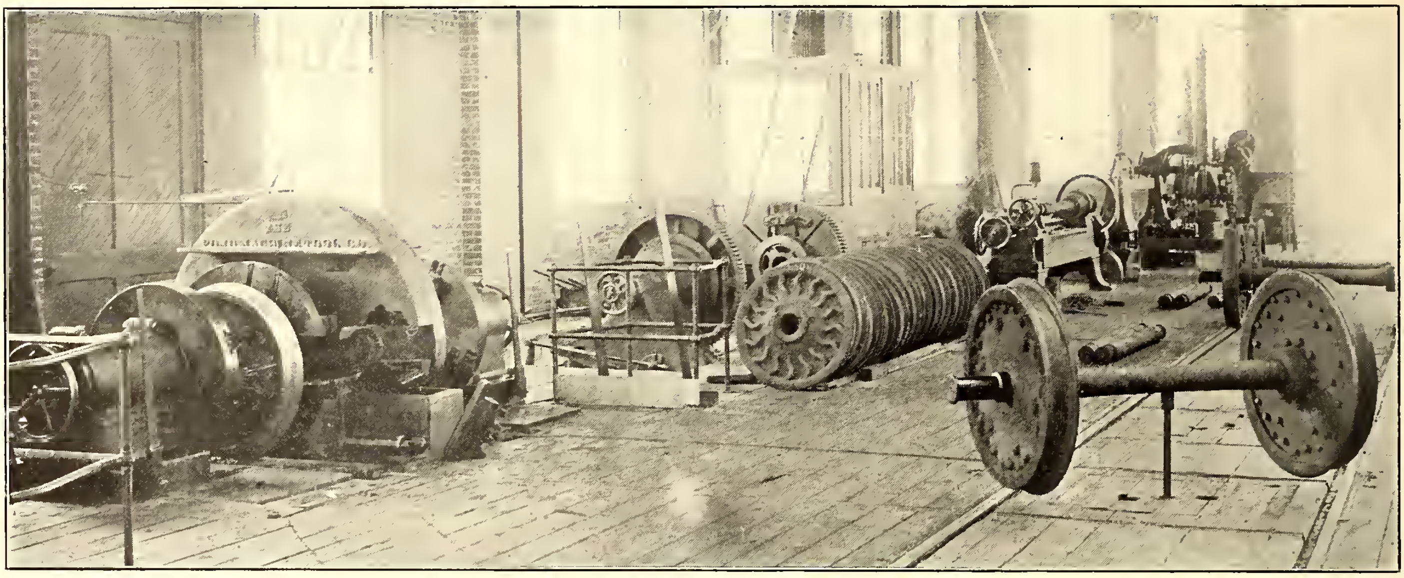
Street Railway Journal

A TYPICAL SHOP EQUIPMENT FOR HANDLING STEEL-TIRED WHEELS

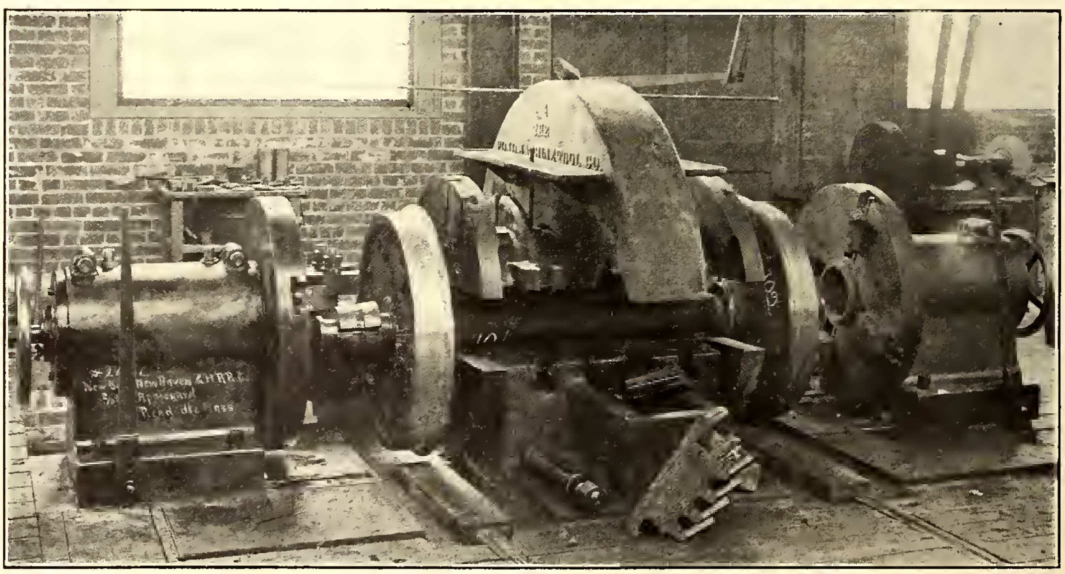
With the growing use of the steel-tired wheel in electric railway service, for more adequately withstanding the heavy duty imposed by the heavier weights and speeds and faster schedules now in vogue, the question of shop handling in keeping the wheels in the best condition has grown to be a problem of considerable importance. In many cases of electrical operation that might be cited, wheel problems of the magnitude of those met in steam railroad practice are incurred, which have come to demand careful study. For the best results it has been very generally found that this problem must be given very thorough treatment, including frequent inspections of wheels and truings in the lathe when worn badly in the face or flange; many economies may be effected in the handling as well as the effectiveness of the work; in this connection there is, indeed, much to be learned from the practice of the steam railroads in this direction.

The accompanying illustrations show the arrangement of equipment and facilities in a model wheel plant, a study of which will be instructive. This is the wheel department of the new Readville shops of the New York, New Haven & Hartford Railroad for the general handling of the steel-tired wheels which are used upon both its steam and electrically operated lines. Not only the arrangement but also the selection of this equipment is the result of many years of experience, and also a very careful study of the work. The arrangement of facilities represents a most desirable scheme for quick and economical handling of the work, while the tools selected enable the work to be turned out in the shortest possible time. It is, however, only recently that tools of the productive capacities of those shown have become available, and the result has been one of great advantage for economical operation, particularly as the improved Pond steel-tired car-wheel lathe, illustrated herewith, is capable of truing 42-in. wheels, with the hardest Krupp tires, at an average rate of six pairs per day of ten hours.

The general view below shows only a portion of the entire equipment in this shop plant, there being installed here three of the large 42-in. lathes, one of which appears at the left. At the right of this is a smaller car-wheel lathe which differs from the 42-in. center-driven lathe, in that it is arranged for face-plate driving; this allows of truing sets of wheels with motor gears in place upon the axles. Still, to the right of the latter tool, may be seen an axle lathe, a wheel press and, lastly, a car-wheel borer. A noticeable feature of the arrangement of this shop is the absence of overhead crane or hoisting facilities; the scheme of handling the wheel, as here arranged, entirely obviates the necessity of lifting of wheels into or out of the lathes.



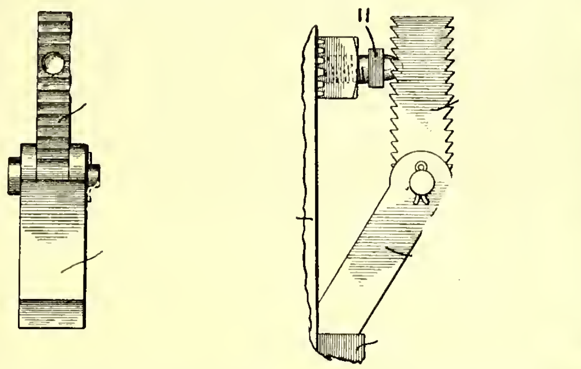
A TYPICAL WHEEL SHOP FOR MACHINING STEEL-TIRED CAR WHEELS, SHOWING ARRANGEMENT OF AIR LIFT OPERATED BY FOOT VALVES IN FLOOR FOR QUICKLY HANDLING WHEELS TO THE RIGHT-ANGLE TRACK



METHOD OF PLACING A PAIR OF WHEELS IN THE WHEEL LATHE, SHOWING APPLICATION OF CENTERING BUSHINGS TO THE AXLE JOURNALS

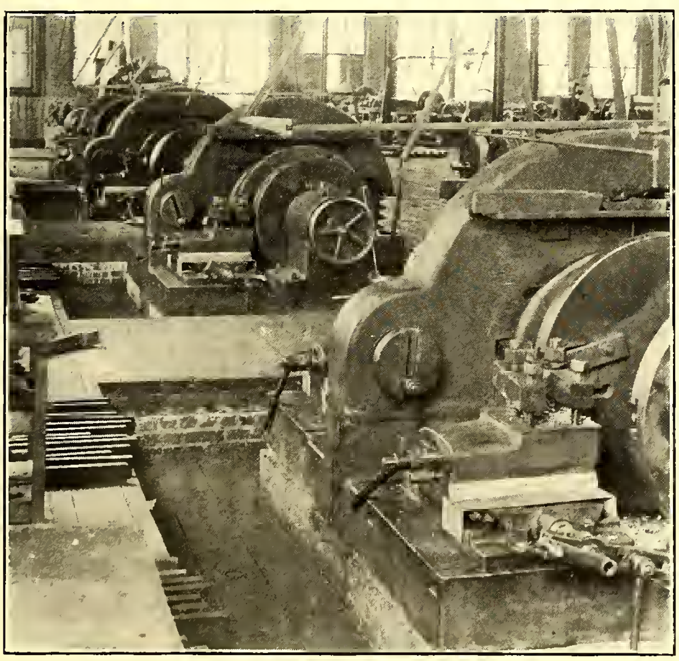
The lathe beds are set flush with the shop floor so that the wheels may be easily rolled in, being provided, moreover, with pits on the tool side for the convenience of the machine operators. Tracks consisting of ⅝-in. x 2-in. bar iron, planed with a groove in the middle for the wheel flanges, lead from the longitudinal shop track across to each lathe. The wheels are rolled into the shop on the longitudinal track, and at the junctions of this track with each of the various tracks leading across to the machines, air lifts, operated by foot valves in the floor, are provided, which enable the wheels to be quickly lifted, swung around and thus tranferred from one track to another. In rolling the wheels into the lathes, these tracks save much time, as they are thereby rolled in absolutely central.

In handling the steel-tired wheels in the shop, they first go to the journal lathe, if the journals need truing, and thence to the car-wheel lathes. In putting a pair of wheels in the car-wheel lathe, first three-piece taper bushings, as shown in the



DETAILS OF THE "SURE GRIP" DRIVER MECHANISM USED ON THE CHUCKS FOR DRIVING DIRECT TO THE TIRES

detail view of one of the lathes, are put on the journals, then the wheels are rolled in and the tailstocks brought up. The adjustment of the chucks and the new "sure-grip" driver is the next step, and to the use of this new style of driver a large part of the increase in production is due. The chuck jaws in the face plates hold the tires rigidly, and by screwing up the set screws of the "sure-grip" driver the tires are firmly wedged between the driving plates and the chuck jaws, so that the full power of the machine can be utilized. The application of this

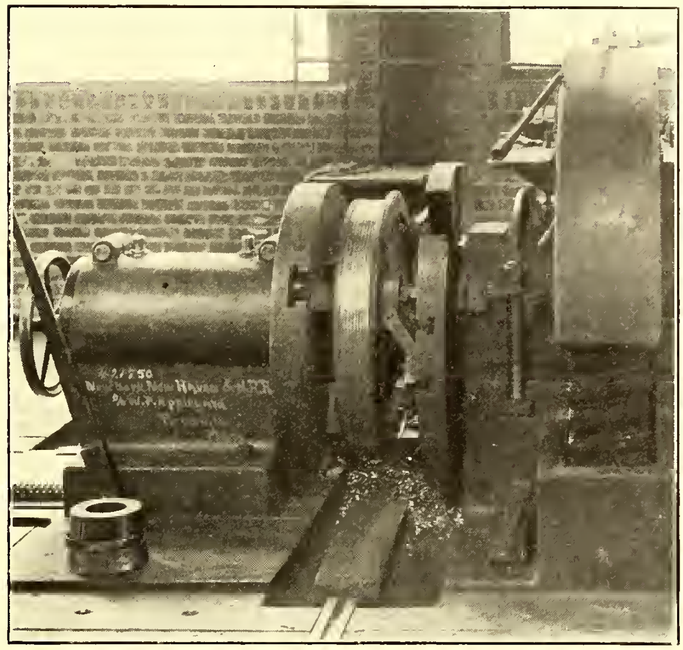


THE ARRANGEMENT OF PITS IN FRONT OF THE WHEEL LATHES TO PERMIT ACCESS BY THE OPERATOR TO THE TOOLS

special driving mechanism is illustrated in one of the detail half-tones, and also in constructional detail.

The self-hardening steel stock used for the cutting tools is of 3-in. x 1¼-in. section, which is large enough to prevent springing or breaking; the large cross section also has the advantage of carrying away rapidly the heat generated at the cutting edge. Especial care should be devoted to the shaping, as well as also the subsequent grinding of the tools; the correct cutting contours should be provided and strictly maintained in grinding. Examples of what may be said to represent the most desirable cutting shapes, as indicated by practice, are shown in the accompanying drawings.

The cut on the tread of each wheel should be started next to



VIEW OF A WHEEL IN THE LATHE TO SHOW THE DRIVER MECHANISM IN PLACE BETWEEN THE CHUCK AND THE TIRE

the flange, using a round-nose roughing tool with ⅜-in. to ½-in. feed, or whatever the tool will stand; this operation takes from twenty-four to forty-five minutes. The outer edge of the tire should next be rounded and a scraping tool applied to the tread, which is smoothed up in one or two revolutions of the lathe; this consumes five or six minutes, and the tread is then finished.

Next, the tops of the flanges are cut down to proper height, using a flat-nose tool, as indicated for this work in the drawing. The outside of the flange is roughed to something near the correct shape with the round-nose tool, and reduced, if too thick; it is finished with a flange tool which is the exact shape of one-half of the flange. Next, the back of the flange is roughed in the same manner as the other side, and is finished with another flange tool. These flange tools should be kept carefully to shape by grinding on the tops only.

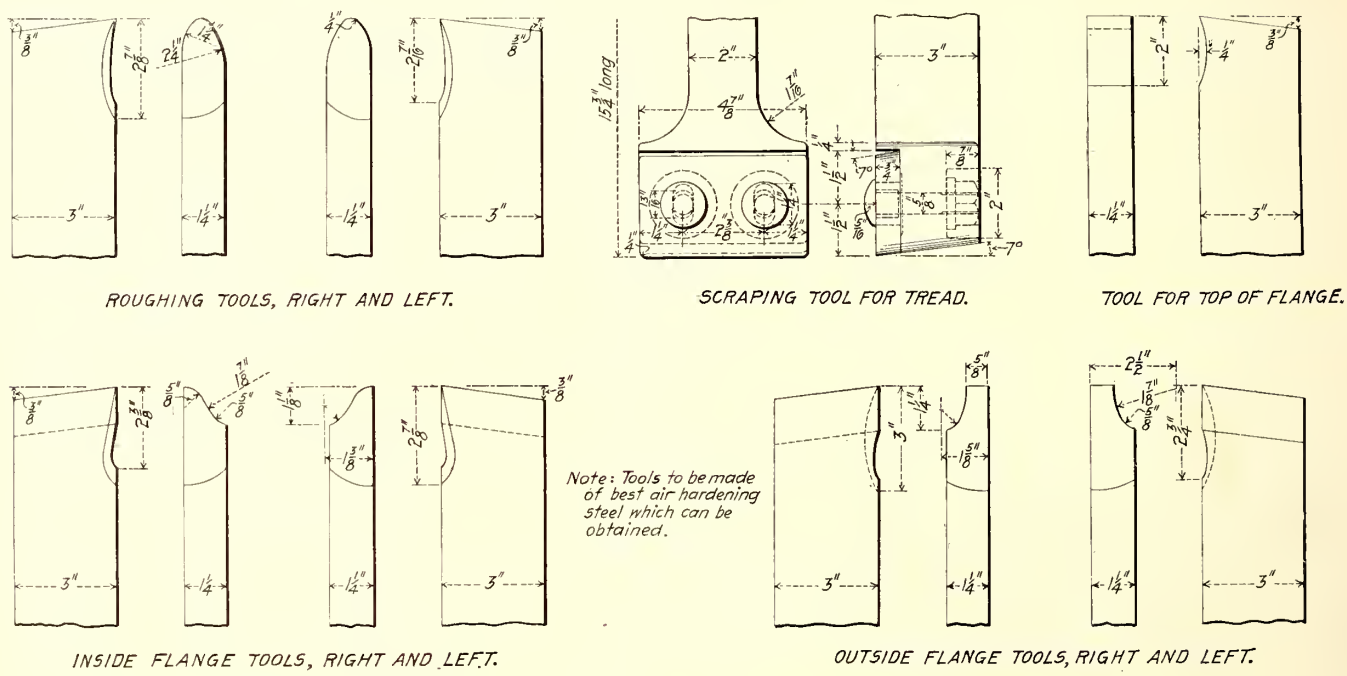
It has been found that the output of the lathes is the greatest when the feed and depth of cut are at maximum, rather than when a high speed of cutting is used. The usual cutting speed is from 6 ft. to 10 ft. per minute, or, in general, whatever the tool will stand.

The actual time of taking out a pair of wheels and putting in another pair should not consume more than eight to twelve minutes, with wheels convenient to the lathe. Lathes with the equipment just described, with an experienced operator, should turn from five to seven pairs in ten hours, or an average of thirty-six pairs a week, reference being had particularly to the class of steel-tired wheels used in steam railroad service; for the type of steel-tired wheels ordinarily used in electric railway service, it is probable that this output would be increased by more than 50 per cent.

The provision of cutting tools properly shaped and ground for this work is one of considerable importance. Much difference of opinion may exist with machinists as to the proper tool shapes, but those illustrated in the drawings herewith have been found, as a result of extended experience, to be best adapted for the requirements of the work upon steel-tired wheels. As indicated, five classes of tools are required for efficient work, in three of which cases both rights and lefts are necessary. It is recommended by the lathe builders, the Pond Machine Tool Company, that each lathe should be equipped, to provide for grinding, dressing, etc., with at least six right-hand and six left-hand roughing tools; two right-hand and two left-hand of each kind of flange tool; two sets of scraper blades; four flat-nosed tools and twenty-four cold chisels of 1¼-in. steel, dressed narrow and blunt, and a 5-lb. hammer to take out hard spots that may develop in the tires. The "hard spots" above referred to are frequently met in the use of steel tires; they are usually the result of variations in chemical composition in portions of tire, but often also are the result of local hardening, due to the unequal heating caused by skidding the wheels.

The lathe illustrated here is an interesting tool, having been especially designed by the Niles-Bement-Pond Company to enable the complete advantages of the use of the high-speed tool steels to be taken. This is made possible by the peculiarly smooth and powerful character of its worm-gear drive, and is greatly enhanced by the improved facilities provided for chucking the wheels by centering them in relation to the journal surfaces, and then rigidly gripping the tires themselves by special chuck jaws for the actual drive. The use of these chucks and chuck jaws, in connection with the special driving dogs attached to the centrally-driven plates, prevents any springing of the axle or crowding the wheels out of true sideways. For mounting the wheels in the lathe for turning, they are rolled into position, as shown, a removable section of the large driving gear having been lifted out to permit access for the wheels' axle; when the axle is in position, the gear section is replaced and clamped rigidly into place by means of a special key, which brings the section up into the pitch line.

The use of the special three-piece journal centering bushings is of great importance, as it is effective in bringing the trued tire faces concentric with the worn journal faces. This is obviously more logical than attempting to turn the tires when the axles have been centered in the lathe by means of the original axle centers; the journals are the determining points of the truth of revolution of the whole axle and pair of wheels, and the journal faces are subjected to inevitable wear. The use of the centering bushings results in bringing the trued tire faces concentric with the journal faces, no matter if the latter are worn badly eccentric.

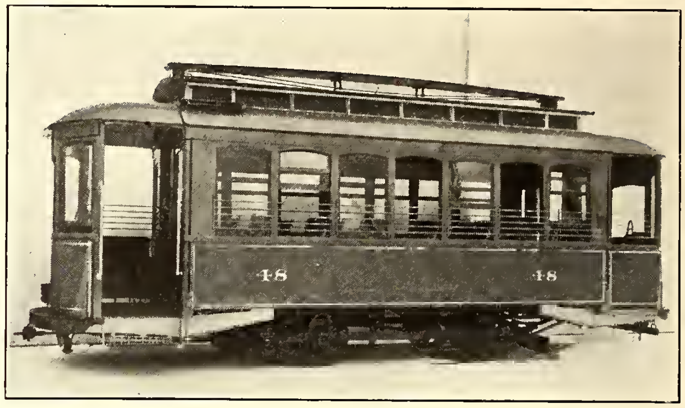


DETAILS OF CUTTING TOOLS THAT HAVE BEEN FOUND BEST SUITED TO WHEEL LATHE WORK

INTERESTING CARS FOR MOBILE, ALA.

Four interesting cars recently delivered to the Mobile Light & Railway Company, Mobile, Ala., by the American Car Company, are of the semi-convertible type built under the Brill patents.

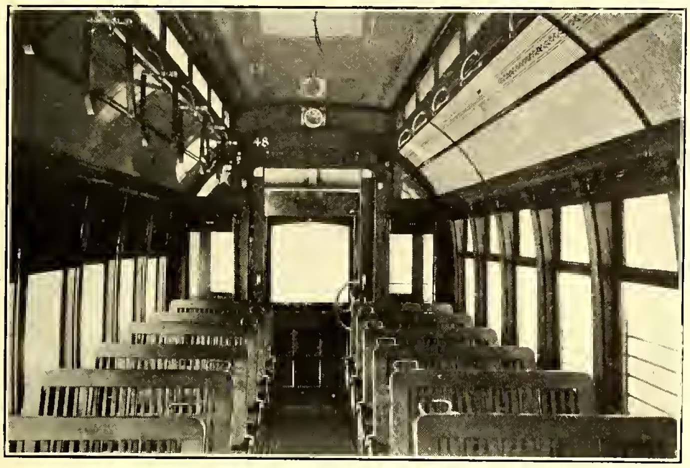
The railway company operates the only electric system in Mobile, and has a trackage of 42 miles and 110 cars. The company also furnishes lighting. A popular amusement park in the suburbs is owned by the company, at which the repair shops also are located. Mobile is the metropolis and the only seaport of the State. It was founded by the French in 1711, and to-day is one of the chief ports in this country for the export of cotton, besides having a large trade in timber, naval stores and coal.



MOBILE SINGLE-TRUCK SEMI-CONVERTIBLE CAR WITH LONG-TRUSSED TROLLEY BOARD

It is rare to see a long-trussed trolley board like that shown in the illustration. The purpose is to bring all the weight of the trolley pole and stand upon the car ends. The car seats are placed transversely, are 36 ins. long and are of the step-over type. They have slat seats with square spindle backs with corner grab handles. Each car accommodates twenty-eight seated passengers. The interior finish is cherry with bronze trimmings, and the ceilings are three-ply veneer bird's-eye maple. The platforms are arranged with one entrance, so that passengers must board the car at the rear end, the metal dasher being brought around to the body at the other side. Five-bar window guards are furnished for the closed sides of vestibules as well as windows at the sides of the cars. The sashes in the vestibules drop into pockets, while those in the sides of the car are raised into pockets in the roofs when not in use.

The platform timbers are reinforced with angle iron and the car is unusually substantial throughout, including inside trusses

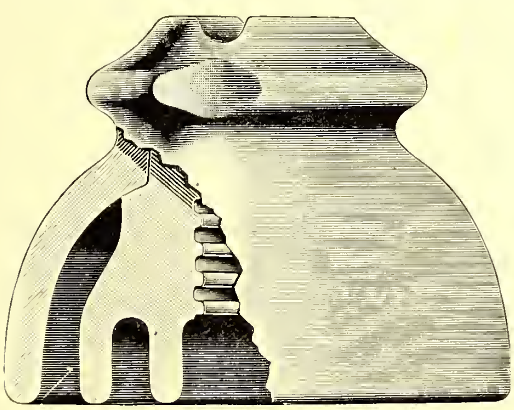


INTERIOR OF MOBILE CAR

as well as 12-in. x 5/8-in. sill plates. The side sills are 4½ ins. x 7¾ ins., and the end sills, 4½ ins. x 6⅞ ins. The thickness of the corner posts is 3¾ ins.; the side posts, 3¼ ins. The distance from the center to center of the side posts is 2 ft. 5 ins. The length of the cars over the body is 18 ft. 10 ins., and over the vestibules, 27 ft. 10 ins. The width over the posts at the belt is 18 ft. 2 ins., and over the water tables, 8 ft. 6 ins.; the height of the platform steps from the rails is 15¼ ins., and the height of the risers, 12 ins. The cars are equipped with angle-iron bumpers, "Dedenda" gongs and other Brill specialties, and are mounted on trucks of the same make, type No. 21-E, with 7-ft. 6-in. wheel base and 33-in. wheels, equipped with 40-hp motors.

RECENT PROGRESS IN HIGH-TENSION INSULATORS

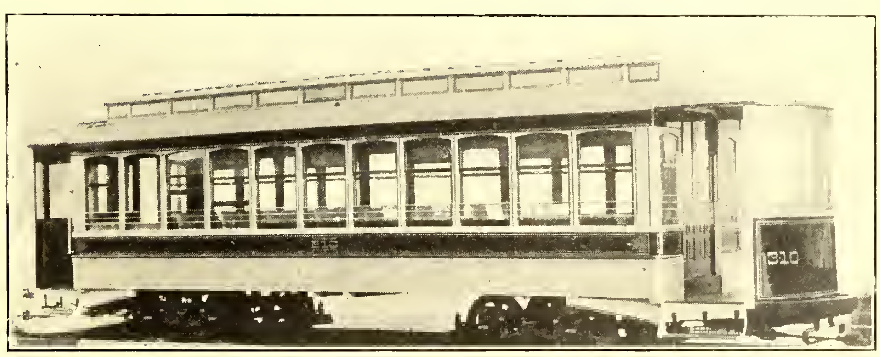
A type of high-tension insulators coming into extensive use on a number of transmission lines is shown in the accompanying cut. It is the product of the Lima Insulator Company, of Lima, N. Y., which has appointed the W. R. Garton Company, of Chicago, to act as its exclusive general Western agent. The Lima Company is making a specialty of the highest grade of high-tension porcelain insulators, and is planning to adopt such methods that its insulators will give the most satisfactory results. The company fully realizes the requirements in this class of insulators, and that unless every detail is given the necessary attention trouble may result. It is therefore proposed to place on the market insulators that will establish for themselves readily a reputation and place this produce at the top rung of the ladder. The W. R. Garton Company has also spent several years giving close attention to the requirements of high-tension work and is prepared to serve the trade intelligently and faithfully in this particular. The company's engineering knowledge and railway experience insures good judgment in this direction. The Lima Insulator Company will gradually increase its facilities until it is able to meet the demand in every particular, and will turn out a gas-fired, white and brown porcelain which will be pleasing to the eye, attractive in form and satisfactory in service. The Garton Company now records among its patrons for high-tension insulators large numbers of some of the most prominent properties in the country. It, therefore, anticipates for the new year a very largely increased trade.



A NEW TYPE OF GAS-FIRED HIGH-TENSION INSULATOR

SEMI-CONVERTIBLE CARS FOR GREATER NEW YORK

The New York & Queens County Railway has just received ten of the semi-convertible cars built by the J. G. Brill Company similar to the one illustrated. The railway company operates all the surface lines in Long Island City and extending to College Point, Flushing and Jamaica; in all, a system of 75 miles, and using 230 cars. Long Island City adjoins the northern side of the borough of Brooklyn, and has a long water frontage on the East River opposite the northern half of the borough of Manhattan, with which it is connected by several ferries. Its population, something over 160,000, is comparatively small, owing to the better transportation facilities from the business centers of New York and Brooklyn in other directions, but property has advanced considerably of late, and it is safe to say that the population will be enormously increased in the near future on account of the new Blackwell's Island Bridge, which will have four tracks for trolley cars and two tracks for elevated trains, and also the four-track tunnel which is being built by the Pennsylvania Railroad. The current of population, which like all other currents always flows in the direction of the least resistance, will soon after the completion of these great arteries flood this territory, and its proximity to the business centers of the borough of Manhattan will give it advantages over the borough of Bronx, which lies north of Manhattan Island. Some of the lines extend to several popular resorts on Flushing Bay, and others run to large cemeteries.



ONE OF THE FIVE SEMI-CONVERTIBLE CARS FURNISHED RECENTLY TO THE NEW YORK & QUEENS COUNTY RAILWAY

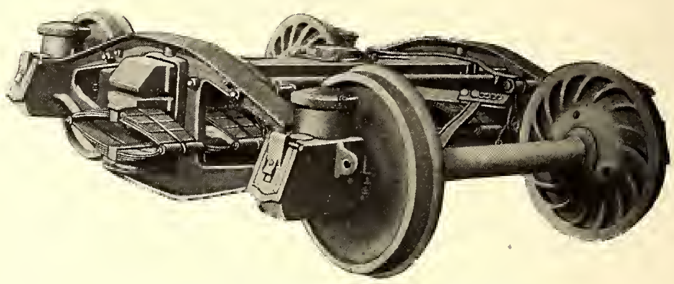
The new cars present a very pleasing appearance with their large windows and low window sills, and are excellently suited to the long runs on the suburban lines, both in summer and winter. The seating capacity of the cars is forty-four. The transversely placed seats are 37 ins. in length, leaving the aisle 24 ins. wide, and the longitudinal seats at the corners accommodate four persons each. All are upholstered in spring cane, the transverse seats having step-over backs and are of the manufacturer's latest type. The window sills are 24⅝ ins. from floor to top of sill and have arm rests bracketed upon them. The window guards, shown in the illustrations, are set in between the posts. The height of the lower sashes measured over the frames is 26½ ins., and over the upper sashes, 17¼ ins. They are capable of being raised with extraordinary ease into the pockets in the side roofs. The pockets in the wainscoting are arranged for the vestibule sashes. The platforms are 5 ft. long and strongly supported by angle-iron center knees which extend well back of the body bolsters, and by outside timber knees reinforced with angle iron. The side sills are of long leaf yellow pine 4 ins. x 7¾ ins., and end sills are 5¼ ins. x 6⅞ ins. White oak sill plates 12 ins. x ⅜ ins. extend well up the posts on the inside, to which they are securely screwed as an additional aid to firmness. The thickness of the corner posts is 3¾ ins., and of the side posts, 3½ ins. Sweep of posts, 1¾ ins. The general dimensions of the cars are as follows: Length over end panels, 30 ft. 8 ins., and over the vestibules, 40 ft. 8 ins. The width over the sills is 8 ft. 2½ ins., and over the posts at the belt, 8 ft. 6 ins. The height from the under side of the side sills over the trolley board is 9 ft. 9¾ ins.; from the rail to platform step, 16⅝ ins.; from step to platform, 14½ ins., and from platform to the car floor, 8 ins. The cars are all mounted on Brill No. 27-G trucks, with 4-ft. wheel base, 33-in. wheels and 3¾-in. axles. The weight of the car and trucks without motors and electrical equipment is 25,-940 lbs.

A NEW DOUBLE TRUCK FOR HEAVY ELECTRIC CARS

The gradual approach of electric cars in size and weight to steam coaches has made it necessary for the builders of electric trucks to make a careful study of the best steam car trucks to see in what respects the best features of the latter could be adapted to electric railway conditions. An example of this may be noted in the changes which R. B. Corbett has made in the side-frame type of the well-known Bettendorf steam car truck to make it especially fitted for heavy electric cars 40 ft. to 50 ft. long. This truck, which is shown in detail in the accompanying illustrations, has been placed on the market by Mr. Corbett's firm, the Thompson-Bonney Company, of Brooklyn, N. Y. Probably one of the most difficult matters with which master mechanics and foremen have to contend in the line of running repairs is the wear of wheel flanges. In the heavy traction on some roads the wheel flange wear has increased 500 per cent, and on interurban railways where improperly designed trucks are used, the additional power consumption, and the frequent renewals of motors, armatures, fields and bearings, has in more than one way demanded the attention of expert service to see if these troubles could not be minimized.

Quoting from the STREET RAILWAY JOURNAL of Aug. 20, 1904, on page 268, one truck designer, speaking of the faults of some trucks now in use, says: "Of course, the remedy is to reduce this lost motion to a minimum by a better construction of the trucks. By machine finishing the sides of the journal bearings and the inside of the journal boxes, this part of the lost motion can be reduced to at least 1-32 in. By adopting the equalizer bar type of truck the effect of the lost motion between the boxes and pedestals will be eliminated, as the boxes are held a fixed distance apart. Trucks which do not have their journal boxes connected by an equalizer bar could be made efficient, except for a very close shoe adjustment, by machine finishing the boxes and pedestals, but the rapid wear of these parts, due to friction between them when forced together by the application of the brakes, would soon increase the lost motion, so that the motor would then again be doing the aforesaid difficult stunt." (That is, the weight of the car body and truck is pushed against the brake-shoe.)

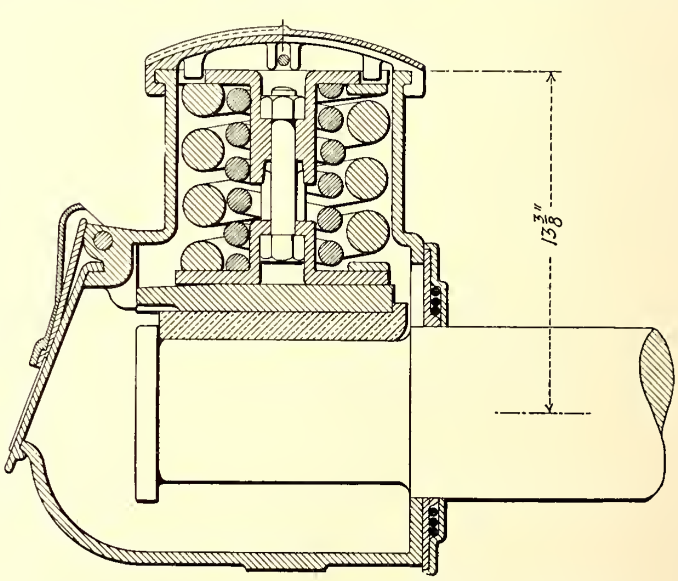
In trying to eliminate the faults of truck construction, the builder of this truck has produced a design which varies radically from other types now in use. One of its principal features is the construction of the side frame, which has the frame, column, spring seat and journal box combined into one steel casting. This departure in manufacturing retains all the good qualities of the old reliable arch-bar truck and corrects the objectionable features dependent on numerous parts. The absence of bolts and nuts on the bottom of the frame prevents the distortion of the truck and breaking of the journal boxes in cases of derailment. The use of cast steel instead of wrought iron gives the parts greater rigidity and enables the trucks to



A VIEW OF THE TRUCK COMPLETE

be kept more easily in true. Because of its flexibility and simplicity, this truck adjusts itself to the inequalities of the track, reducing derailment and flange wear to a minimum. It is claimed that there is at least 1000 lbs. saving in dead weight per car over any other type of truck. In this side frame there is but one piece. In one of the existing types there are forty-one pieces, and in others as many as ninety-three.

This truck has all the easy riding features of the equalized swing motion pedestal truck. The truck frame has over the journal bearing a spring barrel which is part of each journal box. Springs are placed within this barrel directly on the



ARRANGEMENT OF JOURNAL SPRINGS IN STEEL SIDE FRAME CASTING

wedges and brasses to permit the vertical movement of the axles within the boxes. This construction eliminates the great wear of journal boxes in pedestal jaws, which is the source of great expense in the present pedestal truck. It also wholly eliminates having the brake-shoes dragging and straining the motors.

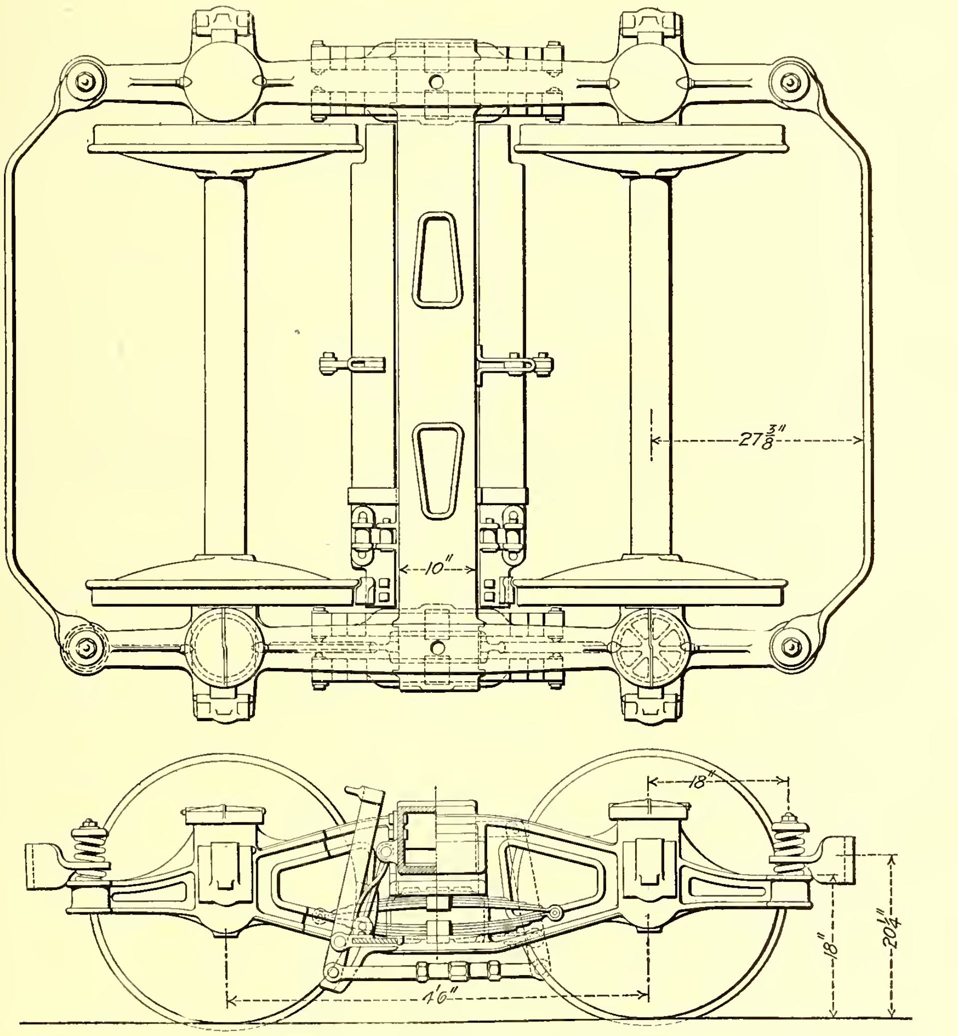
The bolsters are made of open hearth steel, and are shaped in powerful hydraulic presses. After the center bearings, side bearings and guides are riveted in position upon the bolster it is subjected to a further test in a 100-ton hydraulic press. This insures the perfect alignment of all the parts in relation to each other.

The truck is equipped with either elliptic or coil bolster springs. The swing motion of the bolster may be obtained by the use of roller bearings, eye-bolt hangers, or with ball and socket spring side bearings.

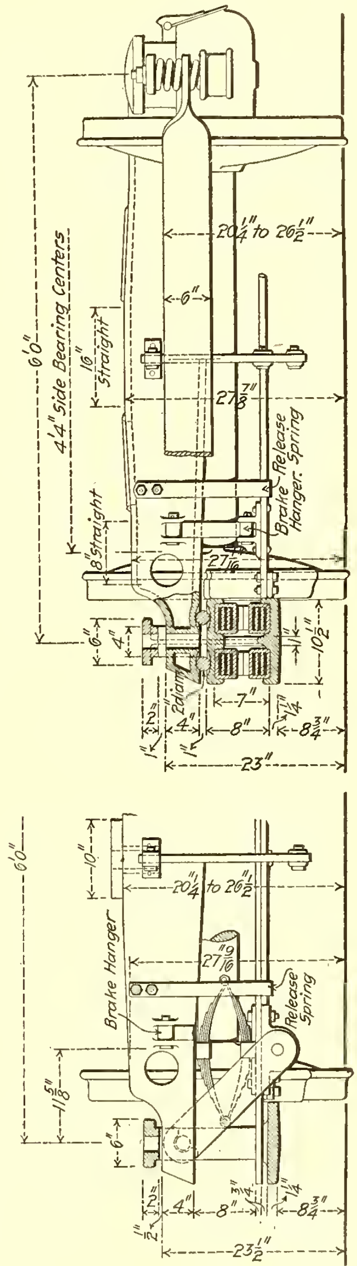
The designer of this truck is aware that ball bearings have been attempted before, but believes that the results proved unsatisfactory, because the bolster was so imperfect that it did not admit of their true application. This bolster is of pressed steel of one piece, and the bearings are true to those on the top bolster of the car.

By reference to any of the modern locomotives, it will be found that the wrought-iron frame for locomotives has been service on more than fifty steam railroads under all classes of cars. Bearings that have been in use for more than four years and have made over 500,000 miles, show no perceptible wear. These bearings have withstood the hard usage of the heaviest engine tenders now built, as well as on light coaches, electric cars, etc.

The improved designs are claimed to embody all the advantages that an ideal bearing could possess. Every part is made of the best material under improved methods, and is fitted by special machinery having all parts interchangeable. There are no loose pieces, such as springs, rivets, bolts, screws, trunnions, spiders, etc., to get out of order, mislaid or lost when repairing



PLAN, SIDE AND END ELEVATIONS OF STEEL SIDE-FRAME TRUCK DESIGNED FOR ELECTRIC TRACTION, SHOWING TWO DIFFERENT ARRANGEMENTS OF SWING-BOLSTER SUSPENSION



DETAIL OF SWING BOLSTER

abandoned. Cast steel is being used, being more rigid and more easily kept in tram. The same can be said of traction trucks. This type of truck construction has been in use under locomotives and under tank cars, carrying weights of 190,000 lbs., without failure and without derailment.

It is stated that in a test made by a committee appointed by the Master Car Builders' Association to test various styles of center plates, with a view to determining the amount of friction developed in curving, the style B ball center bearing used on this truck was the only one to turn under a load of 37 tons without cutting, which required a flange pressure of only 150 lbs. Another test has recently been made by loading a bolster equipped with this center bearing with 67,000 lbs. of pig iron. The flange pressure required to turn the truck under this load was less than 150 lbs.

Special attention is invited to the following points in regard to the ball center and side bearings. These bearings are in cars. The balls are suspended, kept central by gravity, and as they constantly change position they will not wear flat, clog, freeze up or become lost. In summing up the advantages of this truck the following points are made: Simplicity; flexibility; absence of lost motion from the axle to the king pin; great strength, with freedom from wear and tear of rivets and bolts, struts, transoms and bridge framing; dependence on wheels and axles to keep it in alignment instead of transoms and cross framing; less truck, armature and motor repairs, and less wheel replacements.

Besides the trucks built by the Bettendorf Axle Company for passenger service, it has also had a great deal of experience in the construction of trucks for freight and tank car work.

MEETING OF ALLIS-CHALMERS ENGINEERS AND SALESMEN

During the last month the management of the Allis-Chalmers Company called together at its Reliance Works the principal outside representatives of the company to discuss the plans and policy of the company for the coming year. Owing to the important steps taken by the company during the past year, and the consequent complete reorganization of its staff, a view of the men who are behind the guns will be of interest. For this reason the group view which was taken during the meeting is reproduced on this page, together with a key to assist in identifying those who were present. Quite a number of the men shown have achieved a national reputation. Taken collectively, they represent an aggregation of energy and brains of which any manufacturing company may well be proud.

GROUP PHOTOGRAPH OF THE ENGINEERS AND SALES REPRESENTATIVES OF THE ALLIS-CHALMERS COMPANY

1. James Tribe. 2. G. C. Forgeot. 3. A. Niedermeyer. 4. W. J. Sando, Manager Pumping Engine Department. 5. W. H. Whiteside, General Manager of Sales Department. 6. W. J. Chalmers, Vice-President and Treasurer. 7. B. H. Warren, President. 8. A. M. Mattice, Chief Engineer. 9. Arthur Warren, Manager of Publicity. 10. B. A. Behrend, Chief Engineer of Electrical Department. 11. C. C. Tyler, General Superintendent. 12. W. M. S. Miller. 13. Ervin Dryer. 14. F. F. Coleman. 15. James Ashworth. 16. H. A. Allen. 17. W. W. Nichols, Vice-President and Secretary. 18. J. F. Harrison, Manager Flour Mill Machinery Department. 19. Almon Emrie, Superintendent Milwaukee Works. 20. W. G. Starkweather. 21. J. R. Jeffrey. 22. C. J. Printz. 23. H. S. Mitchell. 24. I. L. Skeith. 25. G. C. Henry. 26. Robert Mulford. 27. J. C. Buckbee. 28. H. Woodland, Assistant Treasurer. 29. Clemens Herschel, Manager Hydraulic Turbine Department. 30. C. A. Burns. 31. H. L. Wells. 32. Franklin Wharton. 33. H. V. Croll. 34. G. L. Tifft. 35. J. D. Millar. 36. W. C. Trout. 37. M. C. Miller. 38. W. A. Wood. 39. H. Schifflin. 40. J. A. Milne, Comptroller. 41. H. S. Pell. 42. G. S. DeWein. 43. H. J. Holden. 44. M. J. Furlong. 45. George T. Thomas. 46. W. E. Dodds, Superintendent of Construction. 47. Richard Hoppin. 48. H. C. Helvey. 49. Albert Hoppin. 50. A. J. Gates, Superintendent Chicago Works No. 1. 51. George L. Fisher. 52. W. N. Tanner. 53. Richard Barnard. 54. F. W. Greenleaf. 55. H. S. Mallalieu. 56. H. I. Keen. 57. J. O. Watkins. 58. R. J. Glendenning. 59. G. F. Collins. 60. R. D. Tomlinson. 61. C. A. Derby. 62. G. A. Berg. 63. J. C. M. Lucas. 64. W. O. Everett. 65. H. A. Hammil. 66. D. T. Jones. (See key group below.)

KEY TO PHOTOGRAPH, ALLIS-CHALMERS ENGINEERS AND SALESMEN

The Columbus, Buckeye Lake & Newark Traction Company has obtained a contract from the Government to handle mail for Kirkirsville, Hebron, Newark and other points along its line. The arrangement gives these towns much better service than they had from the steam roads.

During the storm of Jan. 25 the Boston & Worcester Street Railway Company made the excellent record of operating cars over its 45-mile route in better time than the Boston & Albany Railroad, which runs between the same cities. In spite of deep snow, the electric railway line had cars moving all the time, while railroad trains were either stuck in drifts or held at stations because of the impossibility of working switches.

NICKELUMEN

Nickelumen is not a babbitt metal, but is a nickel-tempered aluminized white bronze which fuses at a temperature sufficiently low to admit its being melted and recast from an iron vessel. It is claimed to have the remarkable quality of parting very slowly with the heat which it absorbs upon fusing, which makes it possible to pour it into journal bearings the same as babbitt is used; hence by its use a fine quality of bronze bushings can be secured without the expense of machine work. Its manufacturers, the New Era Manufacturing Company, of Kalamazoo, Mich., make the claim that its wearing quality equals the best red or yellow bronze. Nickelumen cannot be alloyed with babbitt metals which contain lead, as neither nickel nor alminum amalgamate with that metal under ordinary conditions.

LEGAL DEPARTMENT*

LAWS LIMITING HOURS OF LABOR

In the year 1902, the Supreme Court of Rhode Island, in pursuance of a request from the Governor of that State—under a law permitting him to take the advisory opinion of the highest court upon the constitutionality of pending legislation—expressed the view that a statute limiting the hours of labor of certain employees of street railway corporations to ten hours a day would be constitutional and valid. (In re ten-hour law for street railway corporations, 54 Atl., 602.) The Rhode Island court places its decision partly upon the ground that the proposed law deals with public corporations and the use of a public franchise, and therefore the statutory regulation in question is legitimate. But the principal ground was that the law concerned public health and safety, and therefore fell within the police power. Statutes of this class are not uncommon. The laws forbidding ordinary business and labor on Sundays are constitutional, not at all because of their incidental religious bearing, but because certain periods of rest are necessary for preserving the health of the community, and unless an arbitrary rest day were fixed, the spirit of competition would lead first one and then another to work excessively, and gradually the whole community would feel the necessity for continuous labor in order to keep up with the enterprising persons who were determined to get ahead by any possible means. On such ground, Sunday laws have been universally upheld throughout the United States, although many years ago they were declared unconstitutional by some courts because it was thought that they involved official recognition of religious observances.

The principle would be the same as to limiting hours of work generally that may be performed on any day and in any week, and whenever there is anything especially trying to the health in a given occupation, the courts approve of legislation limiting the hours as to that particular calling, although in one view this is special legislation. The leading case is Holden vs. Hardy (169 U. S., 366), in which the Supreme Court of the United States held that a statute of Utah which limited the hours of labor in mines to eight hours per day, except in case of emergency, was a valid exercise of the police power and not in conflict with the fourteenth amendment of the Federal Constitution. A decision of the same class, though not as clearly right, was People vs. Lochner (177 N. Y., 145), in which the New York Court of Appeals sanctioned a statute of that State limiting the hours of labor in bakeries.

It is probable that the courts generally would sustain legislation limiting hours of labor upon street railways, always provided the limitation fixed was reasonable. There is, in the first place, the consideration of the health of the employees themselves, which would suffer if compelled to work for excessive periods, and, growing out of that, there is the factor of the safety of the public, which might be endangered if men were permitted to work on street railways who, because of lack of proper rest, were unfit to perform their tasks. This consideration may not be as strong in the case of street railways as in that of steam railroads, but is probably strong enough as to either to uphold the legislation. In People vs. Lochner (supra) it was remarked in one of the prevailing opinions: "In this law, which restricts the working hours of employees in bakery and confectionery establishments, I think we may, fairly, perceive a statutory regulation, reasonably promotive of the public health, because compelling the master of such an establishment to conduct it in a manner the least capable of affecting his product prejudicially. We may, not unreasonably, assume that an employee may work too long for his health under the conditions, and that an impaired vitality and the possible development of organic diseases may be the result. If to obviate the possible consequences to the consumer of the food manufactured, the Legislature determines to interfere, by limiting, among other regulations, the hours of the workman, I do not think we should hold the interference to be without reason."

* Conducted by Wilbur Larremore, of the New York Bar, 132 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

As to any occupation which directly affects the physical safety and comfort of the public, it will probably be held legitimate for the Legislature to provide against the impairment of vigor and alertness of employees through overwork.

As above intimated, the limitations of hours of labor, in order to be valid, must be reasonable, and as to the reasonableness of a law the court is the ultimate judge. Usually the discretion of the Legislature will not be overruled. If it be a mere question between legislative and judicial opinion as to reasonableness, where opinions may legitimately differ, the action of the Legislature will be allowed to stand. If, however, the court can say that a limitation is clearly unreasonable, the statute will be annulled as not being a proper exercise of the police power, and therefore unconstitutional.

Laws of this class generally provide, expressly or impliedly, that labor for more than a certain number of hours shall not be exacted or permitted, even though the employees consent or desire to work overtime. This is entirely proper, as the very theory of the legislation is to prevent impairment of physical condition by excessive exertion, and, to that end, not only to guard employees against mercenary domination of their employers, but also to save them from themselves.

CHARTERS, ORDINANCES AND FRANCHISES

ILLINOIS.—Eminent Domain—Exercise of Right—Street Railroads—Operation Through Rural Districts—Deflection from Highway—When Authorized.

1. Under Hurd's Rev. St. 1899, c. 131a, Section 1, providing that a street railroad may appropriate any property necessary for the construction of its road, a street or electric railroad constructed through rural districts may deflect from the highway when necessary, but must make an honest effort to follow the highway, and, unless it appears that it is in general following the highway, it has no right to condemn property upon the theory that it is necessarily deflecting or diverting from the highway.

2. Under the express provisions of Hurd's Rev. St. 1899, c. 131a, Section 3, a street railroad has no right to construct its road on any public ground outside of an incorporated city, town, or village, except upon the consent of the county board.

3. In condemnation proceedings by a street railroad proposing to construct its line through rural districts, evidence held insufficient to show that a digression from the highway was necessary because of inability of the road to follow the highway.

4. In so far as electric railroads incorporated as street railroads, under Hurd's Rev. St. 1899, c. 131a, Section 3, are authorized to travel through rural districts, it is upon the theory that they will be a benefit to the rural inhabitants, and not that only those living in towns where regular stations shall be maintained shall be the beneficiaries, and, if the country districts are so sparsely settled that the traffic along the roads through them will not support electric lines following such roads, their construction is not a public necessity, and the power of eminent domain cannot be called into action on their behalf.—(Hartshorn et al. vs. Illinois Valley Traction Co., 71 Northeast Rep., 612.)

INDIANA.—Eminent Domain—Street Railroads—Compensation to Property Owners—Interurban Railroads—Streets and Highways—Dedication to Public—Extent and Purposes.

1. It will not be presumed that a street railway company will violate its contract with the city, and an allegation in a complaint that it intends to do so, in advance of any act of the company constituting such violation, will not prevail against the presumption of good faith.

2. An abutting property owner is not entitled to an injunction against the construction of a street railroad if the use of the streets by the railroad in the manner proposed, and upon the conditions set forth in the contract between the railroad and the city, do not create an additional burden upon the street, and a deprivation of the property owner's beneficial interest therein. The mere anticipation of branches by the railroad of its contract with the city, and of consequent injuries to the abutting owner's property, will not entitle him to such an injunction.

3. The carriage of light express matter, passenger's baggage, and mail matter upon street cars does not constitute a ground of complaint on the part of abutting lot owners.

4. A street railroad is not an additional burden upon the street, and the owners of abutting real estate are not entitled to compensation on account of the appropriation and use of the street by such a road.

5. A railroad cannot construct a common passenger and freight railroad upon the streets of a city, in the absence of a license from

the abutting lot owners, without compensation first assessed and paid or tendered.

6. A street, platted or otherwise laid out in a city forms a part of the highway system of the state, and becomes dedicated to the use of the public for all public purposes, present and prospective, consistent with its character as a public highway, and not actually detrimental to the abutting real estate; and it is not exclusively dedicated to the use of abutting property, or the convenience or profit of any or all of the inhabitants of the particular municipality in which it is situated.

7. The construction and operation of an interurban electric railroad to carry passengers, their baggage, light express matter, and mail, in trains consisting of one, or, by special permission of the board of public works, of two, cars, of the best and most approved pattern, is not an additional servitude upon the street for which the abutting property owners are entitled to compensation.

8. An electric railroad is liable in an action for damages to an abutting property owner for any special injury to his property occasioned by the negligence of the railroad in constructing or operating its road.—(Mordhurst vs. Ft. Wayne & S. W. Traction Co., No. 19,950, 71 Northeast Rep., 642.)

KENTUCKY.—Taxation—Street Railways—License on Cars—Ad Valorem Tax—Recovery Back Interest.

1. Where a street railway company in a city of the first class continued to pay the sum of $50 as a tax or license on each of its cars under an ordinance enacted before the enactment of the new constitution and the statutes thereunder, and no such tax or license was required by any law or ordinance subsequent to said new constitution, in an action by the city to recover certain taxes imposed under the new laws the company was entitled to a credit for such payments, as the new act relating to the government of such cities was a substitute for the old charter and all of its provisions.

2. Where, in an action to recover taxes, the defendant impeaches the record in the county clerk's office, and shows it was incorrect in placing defendant's tax too high, but in doing this it shows that it could have learned exactly what its tax was from the records made by the board of valuation and assessment, interest should be charged on the taxes for the years unpaid.—(City of Louisville vs. Louisville Ry. Co., 81 S. E. Rep., 701.)

MASSACHUSETTS.—Street Railways—Limitation of Fare—Validity—Authority of Selectmen.

1. Under Pub. St. 1882, c. 113, Section 43 (Rev. Laws, c. 112, Section 69), providing that a street railway company may establish the rates of fare, subject to its charter and the statutes, and in view of the course of legislation (Pub. St. 1882, c. 113, Sections 44, 45; St. 1898, pp. 747, 748, c. 578, Sections 23, 26; St. 1901, p. 113, c. 180) relating to limitations and revision of rates of fare, St. 1898, p. 743, c. 578, Section 13, providing that the selectmen of a town, in granting a location to a street railway company, may impose such conditions as the public interest may require, does not authorize them to impose a limitation on the rates of fare the company may charge.

2. The acceptance by a street railway company of a location granted by a town does not make valid conditions in the grant as to fares, which the town could not legally impose, nor does it make a contract as to fares between the company and the town.—(Keefe vs. Lexington & B. St. Ry. Co., 70 N. E. Rep., 37.)

MICHIGAN. — Highways — Commissioner — Authority — Street Railways—Franchise—Use of Streets.

Under Comp. Laws 1897, Section 6446, being part of an act to provide for the formation of street railway companies, and declaring that any company may construct and maintain a street railway in and along streets and highways of any township upon such terms as may be agreed on by the company and the township board, the authority conferred will include state and territorial roads within the territory of a township, for whose condition the township is responsible; and a highway commisioner could not maintain proceedings to disfranchise a railway which had authority from the township board to operate and construct its line within the township, on the ground that the board was usurping the jurisdiction or authority of said commissioner.—(Smith vs. Jackson & Battle Creek Traction Co., 100 N. W. Rep., 122.)

MICHIGAN.—Estoppel—Railroads—Change of Grade of Street—Acceptance of Damages.

A railroad operated its trains over the tracks of a street railroad company, and in a suit by a property owner on the street the street railroad was required to pay damages for raising the grade, but no damages were allowed for an additional servitude. Complainant acquiesced in the decree and accepted the damages. Held that complainant was estopped from thereafter claiming that the street railroad company existed only on paper, and that the operation of the road should be discontinued by the railroad company on the ground that it was not authorized to operate a street railway, as such, or as part if its line, without compensation to the abutting owner, because it imposed an additional servitude.—(Ilgenfritz et al., vs. Toledo & M. Ry., et al., 99 N. W. Rep., 878.)

NEW JERSEY.—Error—Review—Ruling—on Demurrer—Eminent Domain—Electric Railways—Additional Servitude—Consent of Abutting Owners.

1. When a demurrer is overruled and then withdrawn, the decision upon it cannot be reviewed on error; but if the final judgment appears by the record to rest solely on the pleading demurred to, or if a ruling at the trial on the question raised by the demurrer is presented in a bill of exceptions, that can be reviewed on error.

2. The right to construct and operate electric railways, with their incidental poles and wires, within the lines of public streets, for municipal travel, is included in the ordinary public easement, and imposes no additional servitude on abutting property.

3. In order to obtain the consents required for the construction of an electric railway in a public street in accordance with the act of April 21, 1896 (P. L. p. 329), the railway company agreed with an owner of land abutting on the street to give him, for his consent, a valuable option on the purchase of the company's bonds and stock. Held that the agreement was in violation of the policy established in that statute, and could not be enforced.

(Syllabus by the Court.)—(Montclair Military Academy vs. North Jersey St. Ry. Co., 57 Att. Rep., 1050.)

NEW JERSEY.—Eminent Domain—Procedure—Appointment of Commissioners.

The requirement of the act entitled "An act to regulate the ascertainment and payment of compensation for property condemned or taken for public use" (Revision 1900; P. L. p. 79) that the justice appointing commissioners shall, in the order of appointment, fix the date on or before which the commissioners must file their report, is not directory, but mandatory, and an order which omits to fix a day is fatally defective.—(Doughty vs. Atlantic City & Suburban Traction Co., 58 Att. Rep., 101.)

NEW JERSEY. — Dedication — Acceptance — Street Railroads—Grant of Rights in Street—Consent of Municipality.

1. Acceptance of dedicated streets is found in a resolution of acceptance, and in the passage by a municipality of an ordinance granting permission to a street railway company to lay its tracks therein, and conditioning its permission upon the grading and paving the streets in a specified way.

2. A traction company incorporated under the act of March 14, 1893 (P. L. p. 302), obtains no exclusive right for a location of a route by reason of having filed a description of its route in the Secretary of State's office. It must also have the consent of the municipal authority.

3. In estimating the number of lineal feet of property necessary to authorize the consent of a municipality to the construction of a street railway, the cross-streets are to be omitted.—(People's Traction Co. et al. vs. Atlantic City et al., 57 Atlantic Rep., 972.)

NEW JERSEY.—Contracts—Consideration—Railroads—Crossings—Regulation—Freight and Fare Charges—Authority of Courts.

1. A railroad company, incorporated under the general railroad law of 1873 (Gen. St. p. 2,638), was maintaining certain bridges whereby the highway was carried over its tracks at an elevation; the duty to maintain the bridges being imposed upon the railroad company in behalf of the public by statute (P. L. 1891, p. 169; Gen. St. p. 2,661). A traction company proposed to construct a line of tracks along the highway, and to that end desired to strengthen and reinforce the bridges, so that they would sustain the increased weight of traffic placed upon them by reason of the maintenance and operation of the traction road. By agreement between the railroad company and the traction company, the former gave consent that the latter might strengthen and reinforce the bridges, and the parties agreed thereafter to share equally the cost of their maintenance and repair; the traction company being given the right to repair the bridges on default of the railroad company to do so, and the railroad company agreeing to pay one-half the cost thereby incurred. Held that this consent and agreement of the railroad company furnished a valuable consideration to support reciprocal covenants on the part of the traction company.

2. An agreement made between a railroad company and a traction company, whereby the former gives consent that the latter may construct a traction road across the line of the railroad at grade, and settling as between these parties the mode of crossing, is not void because made without application to the chancellor to define the mode of crossing under the statute. P. L. 1895, p. 462; Gen. St. p. 2,717.

3. The prohibition of the act regulating the crossing of steam railroads by steam or electric railroads thereafter to be constructed (P. L. 1895, p. 462; Gen. St. p. 2,717) is intended for the benefit of the parties named in it; the railroad company, the traction company, and the municipal authorities being made by the act the representatives of different public interests.

4. Section 15 of the general railroad law of 1873 (Gen. St. p. 2643) vests in the railroad company an uncontrolled discretion to establish such rates of freight and fare as its own interests may from time to time require, subject, only, to the maximum rates prescribed by the section, and to the reserved right of repealer and modification of the Legislature.

5. The courts have no general supervisory jurisdiction over the question of freight and passenger rates.

6. An agreement, made between a railroad company and a competitor, that during a limited period the former company "will not reduce its present rates of fare, unless required by law," is not contrary to public policy as established in this State.—Rariton River R. Co. vs. Middlesex & S. Traction Co., 58 Atlantic Rep., 332.)

NEW YORK.—Elevated Road—Rights of Abutting Lessee—Damages to Leasehold Interest.

1. The city of New York leased land under an agreement which was practically perpetual, with periods for renewal and readjustment of rentals. Before it consented to the construction of an elevated road in front of the premises, a building had been erected on the lot by the lessee. The building and the lease were sold after the commencement of the operation of the road to plaintiffs, and the lease thereafter renewed. Held that plaintiffs were entitled to damages for the impairment of their leasehold interest, though, when the renewal was made, defendant's road was built and in operation.

2. The city of New York leased certain premises, giving a right to renewal, and the lessee erected buildings thereon. Thereafter an elevated road was built on the street on which the lands abutted. The lease, after such construction of th elevated road, was renewed. Held that there was no presumption that the rents reserved in the renewal lease were fixed with reference to the presence of the elevated road, so that the lessees suffered no damage by such erection.—(Storms et al., vs. Manhattan Ry. Co. et al., 71 N. E. Rep. 4.)

NEW YORK.—Pleadings—Allegations of Complaint—Failure to Controvert — Effect—Separate Defenses—Availability—Stipulations.

The allegation in the complaint in a suit to enjoin the maintenance of an elevated railroad in front of plaintiff's premises that none of the owners of the premises had consented to its construction and operation, and that none of the defendants had acquired the easements, property right, or ownership of plaintiff in the street, which is not controverted by the answer, must be taken as true, under Code Civ. Proc. Section 522.

2. The separate defenses in a suit to enjoin the maintenance and operation of an elevated railroad in front of plaintiff's premises that defendant had acquired easements so to do, either through a conveyance or through an estoppel, are unavailing, in the absence of a denial of the allegation in the complaint that none of the owners of the premises had consented to the construction and operation of the road, and that defendant had not acquired an easement so to do.

3. A party stipulating that certain allegations of a pleading are true cannot thereafter claim the contrary.—(Driscoll vs. Brooklyn Union Elevated Ry. Co., et al., 88 New York Suppl., 746.)

NEW YORK.—Easements—Conveyances—Reservation—Notice of Reservation — Rights of Vendor — Damages — Release by Grantee—Consideration of Release—Evidence.

1. Where property was conveyed with the reservation of all right to the easements of light, air, and access, and damages for interference therewith by the construction of a railroad in front of the premises, the reservation of the easements which were appurtenant to the premises was ineffectual as a severance, and the grantee could execute a release of the damages to the railroad company.

2. Where a vendor reserved as part consideration the right to damages to the premises from interference by a railroad company with the easements of light, air, and access, and the deed containing the reservation was recorded, the reservation was effectual between the parties, and the railroad company, procuring a release of the damages from the grantee, was chargeable with notice of the reservation and the equitable lien of the vendor.

3. Where, pending an action against a railroad company for damages for interference with plaintiff's easements of light, air, and access, the premises were conveyed with a reservation of the damages to the easements as part of the consideration, and the deed containing the reservation was recorded, the railroad company procuring a release of the damages from the grantee, and paying the consideration to the grantee, without the knowledge of the plaintiff was not released from the equitable lien of the plaintiff, the grantee having no authority from plaintiff to receive the money.

4. Where a railroad company procured a release of damages for interference with the easements of light, air, and access from a grantee of the premises, who acquired them by deed, which was recorded, reserving such damages to the grantor as part of the consideration, the amount of the consideration for the release may be adjusted in an action by the grantor against the company and the grantee to declare the grantee a trustee and the release void, and it was error to exclude evidence as to value of the easement.—(McKenna vs. Brooklyn Union Elevated R. Co. et al., 88 New York Suppl., 762.)

NEW YORK.—Eminent Domain—Action by Owners—Injunction.

Under Code Civ. Proc. Section 3379, providing, among other things, that defendant in eminent domain proceedings may continue in possession of the land, an order staying defendant from continuing any action against plaintiff in condemnation proceedings, which action accrued prior to the commencement of such proceedings, is unauthorized.—(Wait et al. vs. Hudson Valley Ry. Co., 88 New York Suppl., 825.)

NEW YORK.—1. Municipal Corporations—Contract for Excavation in Street—Elevated Railroad Supports—Duty to Protect —Injunction—Issues.

Where a contract between a city and one who had contracted to make an excavation in a street required him to protect the elevated railroad structure and tracks, and the railroad sued to enjoin him from making the excavation, claiming that his method of protecting the structure was inadequate, no question as to plaintiff's duty to support the structure was open to defendant.—(Interborough Rapid Transit Co. vs. Gallagher., 89 New York Supp., 152.)

NEW YORK.—Street Railroads — Leases — Passengers — Transfers—Lines Embraced in Contract.

1. By Railroad Law, Section 78 (Laws 1892, p. 1398, c. 676), authority is given any corporation owning or operating any railroad to contract with any other such corporation for the use of their respective roads or routes, or any part thereof; but that section contains a provision that "nothing in this section shall apply to any lease in existence prior to May the first, 1891." Section 104 (page 1406) provides that "every such corporation entering into such contract" shall give to each passenger paying a single fare a transfer entitling such passenger to a trip to ony point on any road embraced in the contract. Held that section 104 applies to contracts made pursuant to Section 78, and hence has no application to contracts made before the date specified in Section 78.

2. Where a street railroad company leased its lines to the H. Street Railroad Company prior to May, 1891, and after such date another railroad company leased its lines to the H. Company—the latter lease making no reference to the other lease, and there being no recital that the lessee was operating any railroad—and thereafter the lessee road consolidated with other roads, and the consolidated road leased all the lines to defendant, defendant was not required to give a transfer from one to the other of the lines leased to the H. Road.—(Topham vs. Interurban St. Ry Co., 89 New York, Suppl., 298.)

NEW YORK.—Street Railroads—Lease of Line—Statutes—Transfers—Refusal—Penalty.

1. Laws 1885, p. 525, c. 305, making it lawful for any street surface railroad company to contract with another such company for the use of their respective roads or any portion thereof, subject to certain provisions and restrictions, and Laws 1890, p. 1082, c. 565, and Laws 1892, p. 1382, c. 676, continuing the privileges of contracting and the obligations incurred thereby, are in pari materia, and for the purposes of construction must be read together.

2. Under those statutes providing that street railroads entering into such contracts shall carry or permit any other party to such contract to carry, between any two points on the roads or portions thereof embraced in the contract, any passenger desiring to make one continuous trip between such points for one single fare not higher than the fare lawfully chargeable by either of the parties for an adult passenger, the Legislature intended, in consideration of the privilege of contracting, to require that the lines so brought together under the contracts should carry passengers for one single fare between any two points on the lines, "to the end that the public conveyance may be promoted," as expressed therein.

3. Street railroads accepting the provisions of statutes permitting them to enter into a contract for leasing lines of other companies, as authorized thereby, are bound to assume the duties and obligations imposed by the statutes as a consideration for the privilege.

4. In an action to recover the penalty provided by Laws 1892, p. 1406, c. 676, Section 104, providing that any street surface railroad company operating the lines of another by lease or consolidation, permitted by the act, refusing on demand to issue a transfer to any person paying one single fare, entitling the passenger to one continuous trip to any point or portion of any road embraced in the contract, shall be liable to a penalty of $50 to be recovered by the person aggrieved, it appeared that defendant was the operating company of several leased lines, under a contract entered into pursuant to the statute. Plaintiff was a passenger on one of such lines,

and demanded a transfer to another of the leased lines, which was refused. Held that defendant's liability for the penalty could not be defeated because plaintiff's initial trip was on one of defendant's leased lines, to be completed on another of such lines, instead of on the defendant's line, to be completed on one or the other of the lessor company's lines.—(O'Reilly vs. Brooklyn Heights R. Co., 89 New York Suppl., 42.)

NEW YORK.—Appeal—Review by Court of Appeals—Street Railroads—Trespass—Action by Abutting Owner—Pleading—Evidence—Injunction—Harmless Error.

1. In trespass against a street railway company by an abutting owner, the issue was whether plaintiff had title in fee to land lying in front of his premises, between the center of the highway and the boundary of such premises. The judgment of the trial court was unanimously affirmed by the Appellate Division. Held that the Court of Appeals could not review the question of title on the ground that the only question involved was a construction of the deeds under which plaintiff claimed, where they were offered to establish his title, and no question of law was raised by an exception to their admission.

2. In an action against a street railway company for trespass in the use of the highway, evidence that the company had not complied with the statutory requirements to enable it to build a road is inadmissible, where failure of the company to comply with the requirements of the statute was not alleged in the complaint.

3. Plaintiff, being the owner of land abutting on a street, brought trespass against a street railway company for using the same, but failed to establish his title to the street. Held that he was not entitled to an injunction, as an abuttor on the street, against the railway company, for having built in violation of law, where the action was based on ownership in fee, and on trespass against his rights as such owner.

4. Where, in trespass against a street railway, the court has held that plaintiff was not entitled to recover, admission of improper evidence on the part of both parties on the question of damages is harmless error.—(Kennedy vs. Mineola, H. & F. Traction Co., 71 N. E. Rep., 102.)

NEW YORK.—Eminent Domain—Elevated Railroads—Damages to Abutting Property.

Where, on proceedings by an elevated railroad to acquire a right of way on a street, it appeared that the fee and rental value of an abutting owner's property had been substantially diminished since the building of the elevated structure, and there was no claim of benefits arising from the propinquity of the railroad, an award of 6 cents as compensation was palpably erroneous.—(In re Brooklyn Union Elevated R. Co., 88 New York Suppl., 426.)

OHIO.—Jurisdiction of Federal Circuit Court—Case Involving Questions of Impairment of Contract—Obligation—Equitable Jurisdiction to Restrain Enforcement of Ordinance Reducing Street Railway Rates—Constitutional Law—Validity of Municipal Reduction of Street Railway Rates—Impairment of Contract Obligation—Municipal Corporations—Right to Renew Street Railway Grant Before Expiration of Original Grant.

1. An objection that no question as to the impairment of contract obligations could arise from the enforcement of a municipal ordinance reducing street railway rates, because the right to regulate such rates was expressly reserved in a prior ordinance, cannot be successfully urged to defeat the jurisdiction of a Federal Circuit Court of a suit to enjoin such enforcement, where complainant relies wholly upon contracts alleged to have resulted from subsequent ordinances which, it was in substance asserted, had deprived the municipality of the power to exercise such reserved right.

2. Jurisdiction of a Federal Circuit Court of a suit to enjoin the enforcement of a municipal ordinance reducing street railway rates cannot be defeated on the theory that a lack of delegated power to adopt the ordinance withdrew from the case any question as to the impairment of contract obligations, where the municipality's defense is that certain other ordinances asserted as contracts did not deprive it of its continued power to exert authority over such rates, because the state law prevented it from abrogating, by subsequent contracts, the right of regulation expressly reserved in a prior ordinance.

3. Equity will entertain jurisdiction of a suit to restrain, as impairing contract obligations, the enforcement of a municipal ordinance reducing street railway rates on a section only of a consolidated line, in view of the public interests and of the controversies, confusion, risks, and multiplicity of suits which would necessarily be occasioned by resistance to the enforcement of the ordinance.

4. The requisite written acceptances of various municipal ordinances for the consolidation and extension of street railway lines, which secured to the public, for the limited time during which the privileges therein granted should continue, the benefit of a single fare of not more than 5 cents for a continuous passage over the whole length or any portion of the consolidated and extended lines, created a contract right to charge that rate, which could not afterwards be reduced by the municipality over a portion of the consolidated lines, under the authority of a right to regulate fares, reserved in an ordinance adopted before the consolidation, granting a renewal franchise to the corporation which then owned that portion of the lines.

5. A municipal contract which secures to the public for a term of years the benefit of a single fare of not more than 5 cents for a continuous passage over the whole length, or any portion of consolidated and extended street railway lines does not violate the provision of Bates's (Ohio) Anno. Stat. 1897, Section 2502, that a municipal corporation shall not, during the term of a street railway grant, or renewal thereof, release the grantee from any obligation or liability thereby imposed, because such contract deprives the municipality of the right to regulate fares over a portion of the consolidated lines, reserved in an ordinance adopted before the consolidation, granting a renewal franchise to the corporation which then owned such portion of the lines.

6. The right to renew street railway grants, conferred upon municipal councils by Bates's (Ohio) Anno. Stat. 1897, Section 2501, may be exercised prior to the expiration of the original grant, although the language of such section is that "the council may renew any such grant at its expiration."—(City of Cleveland, Appt., vs. Cleveland City Railway Company, 24 Supreme Court Rep., 756.)

OHIO.—Street Railroads—Hamlets—Construction of Road in Streets—Consent of Hamlet.

Hamlets in existence at the time the Municipal Code of 1902 went into effect were municipal corporations, and thereafter, if they had a population of less than 5000 at the last federal census, they are villages; and a street railway company is without authority to construct its road on or above their streets or roads without their consent.—(Electric St, R. Co. vs. Hamlet of North Bend (two cases). 70 N. E. Rep., 949.)

PENNSYLVANIA.—Street Railways—Location of Route.

Where an act under which a street railway company incorporated provides that it shall have a continuous route, and it locates a portion of it on a street already occupied by the tracks of another company, in constant use, over which tracks it has no right to run, it has no continuous route, within the provision of its charter.—(Altoona Belt Line St. Ry. Co. vs. City Pass. Ry. Co., 58 Atlantic Rep., 477.)

PENNSYLVANIA.—Street Railroads—Grant of Rights in Street—Conditions—Injunction—Parties—Forfeiture of Franchise.

1. The supervisors of a township granted to a street railway company the right to lay its tracks on a highway, but stipulated, as a condition of the grant, that the company should not charge a fare exceeding a certain amount. Held that where the company, after the construction of its road, charged a fare exceeding the amount stipulated, owners of property abutting on the road, who had no contract with the company as to the rate of fare, were not proper parties to a bill by the township authorities to restrain the company from collecting a greater rate of fare than that stipulated in the contract.

2. Where a township granted a franchise to a street railway company to occupy a highway, the grant providing that, if the road was not built within a time specified, "then this franchise and all the rights thereunder to be null and void," no action on the part of the township to complete the forfeiture was required where the road was not built within the time designated.—(Millcreek Tp. et al. vs. Erie Rapid Transit St. Ry. Co., 58 Atlantic Rep., 613.)

TEXAS.—Street Railroads—Fares—Half Rates to School Children—Statute—Constitutional Law — Mandamus — Corporations —Date of Incorporation—Presumption.

1. Where a street railroad, defendant in mandamus proceedings to compel it to issue to a school child half-fare rates on its lines, pursuant to Act April 10, 1903 (Acts 28th Leg. [1903] p. 182, c. 116) was sued as a corporation, and answered as such, it will be presumed, in the absence of evidence showing when it was incorporated, that it is subject to the constitution of the State in force at the time of, and subsequent to, the passage of the act.

2. Where is appears in mandamus proceedings to compel a street railroad company to issue to a school child half-fare rate on its lines, pursuant to Act April 10, 1903 (Acts 28th Leg. [1903] p. 182, c. 116), that the right of the company to charge the full fare which it insisted should be paid did not vest until after Const. 1876 went into effect, the company is in no position to assert the invalidity of the act as impairing the obligation of a contract, in view of the provision of that Constitution that all privileges and franchises granted by the Legislature, or created under its authority, shall be subject to its control.

3. Where no evidence is offered in mandamus proceedings to compel a street railroad company to issue to a school child half-fare rates on its lines, pursuant to Act April 10, 1903 (Acts 28th

Leg. [1903] p. 182, c. 116), tending to show that the rate provided for in the statute is such as not to leave the company a sufficient income to pay repairs and a fair income on its investment, the company is in no position to assert the invalidity of the law, as depriving it of property without due process of law, and denying it the equal protection of the law.—(San Antonio Traction Co. vs. Altgelt, 81 S. W. Rep., 105.)

VIRGINIA.—Municipal Corporations—Street Railways—Control of Streets—Vested Rights—Competing Lines—Ordinance—Limitation of Time for Completing Line—Right to Take Advantage of Breach.

1. Where a street railway company has lines of railway constructed in territory under authority of the board of county supervisors, and the territory is subsequently incorporated as a city, the control of the streets, including those on which railway lines have been built, passes from the board of supervisors to the municipal authorities.

2. Where a street railway company merely has permission for the laying of a double track on a street which is subsequently included within the limits of a city, but the company took no advantage of the right to lay a double track, and used a single track, in disobedience of the orders of the city authorities, it has no vested rights which will prevent the city from granting to another street railway company the right to put down a double-track car line on the street.

3. Where a street railway company had the right to put down a track for the operation of its lines within a limited time, but failed to put the track down in the time limited, the waiver of the forfeiture of the company's franchise by the state or municipality is not the granting of a new right.

4. Where the failure to complete a street railway within the time limited for its construction is due to an injunction being granted against the company by a competitor, the right to put down the line is not lost by the expiration of the period limited.

5. The failure to complete a street railway line within the time limited for its construction cannot be taken advantage of in a private action by a competitor to enjoin construction of the line, but any forfeiture can be enforced only on behalf of the public at the election of the state.—(Newport News & O. P. Ry. & Electric Co. vs. Hampton Roads Ry. & Electric Co. [two cases], S. E. Rep., 839.)

ASSAULTS, EJECTMENTS, ETC.

INDIANA.—Carriers—Street Cars—Transfers—Ejection—Assault—Actions—Complaint—Evidence.

1. A street car company is bound to protect a passenger from assault and injuries by its servants, and is liable for breach of such duty, regardless of whether the servant committing the assault was acting within the scope of his employment or not.

2. Where, in an action for an assault on a passenger, defendant street railway company appeared, answered, and made defense, admitting that at the time of the accident it was engaged in hauling passengers for hire in the city in question, and the evidence showed the occurrence to have taken place in one of the streets in such city, and that plaintiff was ejected with force from one of the "company's" cars by one of the "company's" employees, the jury was justified in finding that defendant was the "company" referred to.

3. Where a passenger on a street car paid his fare to the conductor and asked for a transfer to a line belonging to the same company to which he was entitled to transfer, and the conductor, by mistake, gave him a wrong transfer, the passenger, on proper explanation, was entitled to be carried on the line to which he had requested a transfer.

4. Where unnecessary force was used in ejecting plaintiff from a street car, he was entitled to recover for the assault, without regard to whether he was entitled to the rights of a passenger.—(Citizens' St. Ry. Co. vs. Clark, 71 N. E. Rep., 53.)

MASSACHUSETTS.—Carriers—Street Railway—False Imprisonment—Ejection from Car—Transfers—Harmless Error.

1. A regulation of a street railway company requiring a passenger changing from one line to another to produce a transfer or pay his fare is reasonable.

2. The rules of a street railway company required that a passenger, on transferring from one line to another, should produce a transfer, or pay his fare on the second line. Plaintiff, on leaving a car in order to transfer to another line, was not given a transfer by the conductor of the car he was leaving, but such conductor shouted to the other conductor that plaintiff had paid his fare, and that he should be passed. Plaintiff refused to pay a fare on the car to which he transferred, and was ejected by the conductor. Held that the conductor had no right to disregard the rule, and had a right to eject plaintiff.

3. Plaintiff was guilty of an evasion of fare, within the meaning of Rev. Laws, c. 111, Section 251, imposing a penalty on any one evading payment of fare on street cars.

4. The rules of a street railway required that a passenger, on transferring from one line to another, should produce a transfer, or pay his fare on the second line. Plaintiff, on leaving a car in order to transfer to another line, was not given a transfer by the conductor of the car he was leaving, but such conductor shouted to the other conductor that plaintiff had paid his fare, and that he should be passed. Plaintiff refused to pay a fare on the car to which he transferred, and he was arrested at the instance of the conductor, who afterwards made a complaint. Rev. Laws, c. 111, Section 251, provides a penalty for evading payment of fare on a street car. In an action by plaintiff for false imprisonment, plaintiff offered to show that he had a conversation with the superintendent relative to the prosecution, and that an officer of the company asked for a continuance of the hearing on the complaint. Held that, while there was nothing to show that it was within the scope of the conductor's duty to cause plaintiff's arrest, yet, if it had been, the arrest was justified, because of plaintiff's violation of the statute, and hence the exclusion of the offered evidence was harmless.—(Crowley vs. Fitchburg & L. St. Ry. Co., 70 N. E. Rep., 56.)

MISSOURI.—Carriers—Passengers—Assault by Conductor—Liability of Carrier—Corporations—Damages—Elements—Excessiveness.

1. Where a conductor, while engaged in the service of a street railway company, in charge of one of its cars, willfully assaulted a passenger, the company, though a corporation, is liable therefor.

2. Where a passenger on a street car was willfully assaulted by the conductor, he was entitled to recover not only for physical injuries sustained, but for pain and suffering, and for the disgrace and humiliation he was subjected to by reason of the assault.

3. Where plaintiff, a passenger on a street car, was willfully assaulted by the conductor, who kicked plaintiff in the mouth and face and knocked out three of his teeth, a verdict in favor of plaintiff for $1,000 was not excessive.—(O'Donnel vs. St. Louis Transit Co., 80 S. W. Rep., 315.)

NEW YORK.—Carriers—Responsibility to Passengers—Unanticipated Assaults.

A street railway is not a guarantor of the safety of its passengers under all circumstances, but is required only to exercise requisite care, and it cannot be held responsible for an assault by one passenger on another, which its servants had no reason to anticipate.—(Stutsky vs. Brooklyn Heights Ry. Co., 88 New York Suppl., 358.)

TEXAS.—Carriers—Street Railroads—Passengers—Ejection—Justification—Actions—Burden of Proof—Instructions—Damages—Excessiveness.

1. Plaintiff, a passenger on a street car, on being asked for his fare, handed the conductor a transfer folded. The conductor returned it with a demand that plaintiff unfold it, which plaintiff refused to do. Thereupon the conductor demanded a nickel, and the second time demanded that plaintiff unfold the transfer, when plaintiff replied, "Damned if I am going to unfold it; unfold it yourself," whereupon the conductor seized plaintiff, threw him on the floor against a seat, and ejected him from the car. Held that plaintiff's language was neither profane nor obscene, and that his conduct was no justification for his ejection.

2. Where, in an action for the ejection of a passenger, one of the court's instructions was prefaced by the clause that, if the jury believed from the preponderance of the evidence that the conductor politely requested defendant to pay his fare, etc., the refusal of the court to charge that if the jury believed from the evidence that plaintiff's misconduct, if any, caused or proximately contributed to cause his injury, they should find for defendant, was not error, on the ground that such instruction would have cured the alleged error in the previous one, in that it in effect placed the burden of proof on the defendant.

3. In an action for ejection of a passenger, an instruction that the burden was on plaintiff to prove by a preponderance of the evidence the truth of the facts alleged, and that the jury should decide the issues submitted on a preponderance of the evidence, was proper.

4. An assignment of error not accompanied by a proposition of law will not be considered on appeal.

5. Where plaintiff was wrongfully ejected from a street car, and it appeared that the conductor jerked him from the seat, and that his back was injured by striking the end of another seat, for which plaintiff was attended by a physician, and from which he suffered at the time of the trial, a verdict for $500 damages was not excessive.—(El Paso Electric Ry. Co. vs. Alderete, 81 S. W. Rep., 1246.)

LIABILITY FOR NEGLIGENCE

MINNESOTA.—Street Railways—Defective Tracks—Indemnity to City.

1. Under the terms of an ordinance of the city of St. Paul, defendant was permitted to build its street railway tracks over the Rice Street Bridge, and to operate its cars thereon, upon condition that it was to indemnify the city for recoveries against it from injuries received by persons using the adjacent highway. The ordinance was accepted by defendant, and thereafter a lady was thrown from a carriage by reason of defects in maintaining the portion of the highway occupied by the tracks, for which she recovered from the city. Held in an action for the indemnity provided for in the ordinance, that defendant was liable upon findings of the trial court supported by the evidence.

2. Whether the requirement of the defendant company by the city to construct the tracks in a certain manner relieved the defendant was not involved in this case, as it had adapted itself to the demands of the municipality, and the claim for indemnity arose from failure to repair, rather than in the construction thereof, under findings of the court.—(City of St. Paul vs. St. Paul City Ry. Co., 100 Northwest Rep., 472.)

MISSOURI.—Carriers—Street Railroads—Derailment—Defective Switches—Injuries to Passengers—Res Ipsa Loquitur—Evidence—Witnesses—Instructions.

1. Error in the admission of evidence over objection was cured by the court's subsequently striking the same and directing the jury not to consider it.

2. Where, in an action for injuries to a passenger on a street car by reason of an alleged defective switch, there was evidence that the switch was in the same condition at the time it was examined by a witness, eight days after the accident, as it was at the time of the accident, his evidence as to its condition when he examined it was not objectionable as too remote.

3. In the absence of abuse, the exercise of the court's discretion in permitting the introduction of evidence in rebuttal which should have been introduced in chief will not be reviewed.

4. In an action for injuries to a passenger by a derailment of the car, caused by a defective switch, proof of the fact of derailment and of the injury was sufficient to establish a prima facie case of the carrier's negligence, which, unless explained, entitled the passenger to a recovery.

5. In an action for injuries to a passenger by a derailment of the car, caused by a defective switch, the fact that the cause of the accident was shown did not preclude the court from instructing the jury that proof of the derailment and of plaintiff's injury was sufficient to create a presumption of negligence on the part of the carrier.

6. An instruction that a street railway company is bound to exercise the highest degree of care reasonably practicable for the personal safety of its passengers, and that such care should be used for the purpose of safely operating its cars and trains, in having its tracks and switch appliances kept in a reasonably good and safe condition, and for such purpose it was bound to exercise the highest degree of care reasonably practicable in inspecting and keeping its tracks, switch appliances, etc., in good and reasonably safe working order and position, was not misleading.

7. An objection that such instruction was general was cured by other instructions, which limited plaintiff's right to recover to the specific negligence charged, and instructed that plaintiff could not recover merely because he was a passenger and received his injury, if any, without fault on his part.

8. That a passenger, injured by a derailment caused by a defective switch, testified that the switch was defective, and on cross-examination admitted that he had only casually observed the same and could not tell its manner of operation, did not authorize an instruction as to the credibility of plaintiff's evidence; such statements not being necessarily in conflict.

9. Where a requested instruction given substantially covered other instructions requested and refused, such refusal was not error. —(Logan vs. Metropolitan St. Ry. Co., 82 S. W. Rep., 126.)

MISSOURI.—Street Railroads—Crossing Accident—Driver of Vehicle—Contributory Negligence—Last Clear Chance—Application of Doctrine—Sufficiency of Evidence—Verdict for Plaintiff—Approval by Lower Court—Peremptory Instruction for Defendant—Refusal—Right of Appellate Court to Review—Presumptions in Favor of Verdict.

1. A judgment for plaintiff in a street railroad crossing accident case should not be reversed on appeal for the trial court's refusal to peremptorily instruct for defendant, unless, after giving plaintiff the benefit of the most favorable construction of all the evidence, and every reasonable inference in his favor that may be drawn therefrom, no other reasonable conclusion can be reached than that he was guilty of contributory negligence.

2. The Court of Appeals may review the refusal of a peremptory instruction for defendant by the lower court, though the jury has found a verdict for plaintiff which the lower court has approved.

3. The failure of the driver of a vehicle to pause, before crossing a street railroad track, until a moving car has passed out of his line of vision, so as to give him a clear view of the track, is contributory negligence as a matter of law, precluding recovery against the company for an ensuing collision with a car coming from the opposite direction.

4. Evidence in an action against a street railroad company for the death of a horse in a collision with its car examined, and held not to warrant the application of the doctrine of last clear chance in favor of plaintiff.—(Asphalt Granitoid Const. Co. vs. St. Louis Transit Co., 80 S. W. Rep., 741.)

MISSOURI.—Non-Suit—Setting Aside—Discretion of Court—Pleading—Suit by Next Friend—Appointment.

1. A defect in a petition by an infant, suing by next friend, because of failure to allege that the person acting as next friend had been duly appointed, may be raised by answer.

2. Where the court on motion set aside a non-suit without assigning a reason for sustaining the motion, the court on appeal will not consider the evidence, but it will be presumed, in the absence of any showing to the contrary, that the court's action was warranted by the facts disclosed by the record.

3. Where the court sets aside a non-suit on motion of plaintiff, it devolves on defendant on appeal to show that the court abused its discretion; and that the evidence may have shown that plaintiff was not entitled to recover will not establish the fact; otherwise the court on appeal must consider the evidence.—(Cohn vs. Metropolitan St. Ry. Co., 81 S. W. Rep., 846.)

NEBRASKA.—Negligence—Proximate Cause—Question for Jury—Street Railroads—Injury to Passengers—Presumptions—Verdict.

1. Where the proximate cause of an injury depends upon a state of facts from which different minds might reasonably draw different inferences, it is a proper question for the consideration of a jury.

2. The violation of any statutory or valid municipal regulations established for the purpose of protecting persons or property from injury is of itself sufficient to prove such a breach of duty as will sustain a private action for negligence, if the other elements of actionable negligence concur. Omaha Street Railway Company vs. Duvall, 58 N. W. 531, 40 Neb. 29, followed and approved.

3. Street railway companies are common carriers of passengers. As such they are bound to exercise, for the safety of their patrons, more than ordinary care. They are required to exercise the utmost skill, diligence and foresight consistent with the business in which they are engaged, and are liable for the slightest negligence. Lincoln Street Railway Company vs. McClellan, 74 N. W. 1074, 54 Neb. 672, 69 Am. St. Rep. 736, followed and approved.

4. The law presumes that one injured while being transported by a common carrier was injured in consequence of the latter's negligence, and to escape liability it must show that it has discharged the full measure of its legal duty, and was in no wise to blame for the accident, unless defendant's negligence contributed thereto. Lincoln Street Railway Company vs. McClellan, 74 N. W. 1074, 54 Neb. 672, 69 Am. St. Rep. 736.

5. Action of the trial court in refusing to enter judgment on a verdict not agreed to by all of the jury is correct.—(Lincoln Traction Co. vs. Heller, 100 N. W. Rep., 197.)

NEW JERSEY.—Trolley Line—Collision With Vehicle—Negligence—Evidence.

1. The rule with respect to the use by vehicle of a common highway on which a trolley line is operated requires that reasonable care should be exercised, by one about to cross such highway, not to drive in front of an approaching car, which, in spite of reasonable care in its operation, may strike him; and that the car must not be allowed to strike a vehicle so crossing its tracks if reasonable circumspection and control on the part of the motorman will suffice to prevent it.

2. If, from the testimony in a case, the jury may legitimately find that when the plaintiff started to cross the trolley tracks laid in a public highway it was apparently safe for him to do so under the conditions within his observation, one of which was a trolley car sufficiently distant to be checked, or if need be, stopped before it should reach him, the question of the plaintiff's contributory negligence is for the jury.

3. If, in such case, the jury do not find that the plaintiff was negligent in crossing the highway when he did, the question whether the collision could have been avoided by the exercise of reasonable care on the part of the motorman in the operation of his car is also one of fact for the jury when the testimony submitted to them will sustain the inference that the motorman did not have his car under proper control, in view of the conditions within his observation.—(Conrad vs. Elizabeth, P. & C. J. Ry Co., 58 Atlantic Rep., 376.)

NEW YORK.—Street Railways—Injury to Passenger—Violent Starting of Car.

Evidence that a passenger on an electric street car—a woman seventy-five years old—was thrown down while standing in the aisle, about to take a seat, because of an unusual, violent forward lurch of the car in starting, is, in the absence of evidence of contributory negligence, sufficient to go to the jury on the question of the company's negligence.—(Harty vs. New York & Q. Ry. Co., 88 N. Y., Supp., 422.)

NEW YORK.—Negligence—Owner of place of Public Amusement—Independent Contractor—Liability.

Defendant owned and managed a park for public amusement for an admission fee. Plaintiff paid the admission fee and entered the park to witness an exhibition of fireworks as advertised by defendant. During the exhibition a rocket was discharged which struck plaintiff and injured her. A third person whose business was that of exhibitor of fireworks did all the work in connection with the sending off of fireworks, under a contract with defendant to give the exhibition, and defendant had no control over the details of the work nor over the men who performed it. Held, that defendant was not liable, though the third person was negligent.—Deyo vs. Kingston Consol. R. Co., 88 N. Y., Supp. 487.)

NEW YORK.—Street Railways—Personal Injuries—Pedestrians —Use of Street—Paramount Right—Contributory Negligence —Negligence.

1. In an action for personal injuries by one who was run over by a street car while she was crossing the street, evidence examined, and held insufficient to support a verdict for plaintiff both on the issue of contributory negligence and on the issue of negligence of defendant.

2. Though a pedestrian has a right to cross a street between crossings, he is bound to use due diligence to discover the approach of a car, and, if a car is approaching within such distance that he would not have time to pass in safety, it is his duty to wait and accord to the street railway company its paramount right to the use of the track between intersecting streets.

3. If plaintiff, in crossing a street between crossings, passed behind a south-bound wagon, and stepped immediately on the north-bound track of a street railway, without looking or waiting to discover the approach of a car from the south, she was guilty of contributory negligence.

4. If plaintiff, in crossing a street between crossings, hurriedly passed in front of a south-bound wagon and onto the street car track in front of a north-bound car which was in plain sight, and there was nothing to obstruct plaintiff's view, she, knowing that the wagon would prevent her retracing her steps, was guilty of contributory negligence in not exercising greater care to discover the approach of the car.

5. Where plaintiff started to cross a well-lighted street between crossings, where there was nothing to obstruct her view, the driver of an approaching street car had a right to assume that plaintiff would stop and allow it to pass.

6 The fact that the driver of a street car which was approaching plaintiff, who was crossing a street between crossings in plain view of the car, was temporarily engaged in conversation with a passenger in answer to a question, did not necessarily constitute negligence, since, if he had been looking ahead, he would not have been expected to stop the car.—(Barney vs. Metropolitan St. Ry. Co., 88 N. Y. Supp., 335.)

NEW YORK.—Street Railways—Personal Injuries—Excessive Damages—Setting Aside Verdict.

In an action against a street railway company for personal injuries, the evidence was sufficient to show negligence of defendant; and it appeared that after the injury plaintiff was almost wholly disabled, and had a hacking cough, and chronic inflammation of the spleen, kidney and other organs and paralysis of the throat. Three physicians testified for defendant that they had examined plaintiff and found slight wounds, and that his condition had grown much worse at the time of trial, but attributed this to consumption, which they stated was a germ disease, and also testified that they found no injury to plaintiff's lungs when the accident occurred, and that the injuries they found would not produce consumption. A verdict for plaintiff awarded him $6000 damages, and, on motion to set it aside, the court stated he would entertain the motion as to excessive damages, and afterward set the verdict aside; stating that the evidence showed almost conclusively that plaintiff had tuberculosis, which could not be produced by the injury; that it was clear that the verdict must be based on the theory that plaintiff's condition at the time of trial was due to the injuries, and was against the weight of the evidence. Held, that it was error to set verdict aside; the verdict being merely excessive, and not showing that it was the result of a disregard of the evidence, or of instructions that plaintiff could not recover for injuries from tuberculosis.—(Pesant vs. Metropolitan St. Ry. Co., 89 N. Y. Supp., 314.)

NEW YORK.—Carriers—Injuries to Passengers—Assault—Complaint—Construction—Proof—Rules—Carrying of Packages—Verdict—Evidence—Acts of Conductor—Discretion.

1. Where a complaint charged that the conductor of defendant's street car, on which plaintiff was riding, unlawfully threatened to eject plaintiff therefrom, and did wrongfully, unlawfully beat and assault her, by reason whereof she was injured and greatly bruised, etc., but did not allege that she was actually put off the car, it stated a cause of action for assault and battery only, and not for ejection.

2. Where a complaint by a passenger on a street car alleged a cause of action for assault only, and not for ejection, and the proof showed that plaintiff, on being told by the conductor that she could not ride while carrying a large steel cage in her hand, left the car without being forcibly expelled, it was error to charge that, if plaintiff was illegally compelled to leave the car, she was entitled to such damages as the evidence warranted.

3. A rule of a street railway company forbidding the carrying of cumbersome packages into their cars by passengers is reasonable.

4. Where a passenger boarded a street car carrying a cage 2½ ft. high and 2 ft. square, a verdict finding that such package was not cumbersome, within a rule prohibiting passengers from carrying cumbersome packages into the cars cannot be sustained.

5. The decision of the conductor of a street car that a package carried by a passenger was "cumbersome," within a rule of the company prohibiting passengers from carrying cumbersome packages on board the cars, should be sustained unless such determination was unreasonable and willful.—(Ray vs. United Traction Co., 89 N. Y. Supp. 49)

NEW YORK.—Street Railroads—Vehicles—Injuries to Driver—Contributory negligence.

Where plaintiff attempted to drive diagonally across defendant's street car tracks, between street crossings, and placed himself in such a position that a collision was imminent unless the car was stopped to prevent it, plaintiff was guilty of contributory negligence, and could not recover for injuries sustained in such collision.—(Zerr vs. Interurban St. Ry. Co., 88 N. Y. Supp., 353.)

NEW YORK.—Railroads—Person near Track—Negligence—Instructions—Contributory Negligence—Recovery—Sufficiency of Evidence.

1. The engineer of an approaching train, who discovers, in time to stop his train, that a beam which is being hoisted into a building adjacent to the track projects across the track, while a person standing in a window sill at the other end, and endeavoring to adjust the sling on the beam, is placed in a position of peril by the train's approach, is negligent in failing to stop, if he could do so after realizing the gravity of the situation.

2. In an action against a railroad company for injuries to a person standing in the window sill of a building adjacent to the track, and endeavoring to adjust a sling on a beam being hoisted in the building, and projecting over the track, the defendant cannot complain of instructions that such person was a trespasser, and was bound to show by a preponderance of evidence that he was wholly free from contributory negligence, and that the act of defendant's engineer in striking the beam with the locomotive was willfully negligent, and not the result of a mere error of judgment.

3. Where a person standing in a window sill of a building adjacent to a railroad track, and endeavoring to adjust a sling on a beam being hoisted into the building, and which projected across the track, did all that he could reasonably be expected to do to escape injury from an approaching train, the engineer of which had timely notice of his exposed condition, and could have saved him by stopping the train, such person's negligence in being in such dangerous position became remote, and was not contributory to the accident resulting from the engineer's failure to stop.

4. In an action against a railroad company for injuries to a person standing in the window sill of a building adjacent to the track, and endeavoring to adjust a sling on a beam being hoisted into the building, and projecting across the track, the engineer of an approaching train which struck the beam testified that he could have stopped the train within 100 ft., and that he noticed the beam over the track and plaintiff's perilous position, when the front of his locomotive was one building north of J. Street, which he guessed was about 80 or 90 feet away. Actual measurements, however, showed that the distance was 175 ft. Held, that a verdict for plaintiff based on the engineer's negligence, was sustained by the evidence.—(Fitzgibbon vs. Manhattan Ry. Co., 88 N. Y. Supp., 341.)

NEW YORK.—Street Railroads—Collision with Vehicle—Right of Way over Tracks.

The cars of a street surface railroad company have the right of way on the tracks, and it is the duty of a person driving on the tracks to get out of the way of a car coming up, so as not to make it slow down or stop, and if he fails to do so, and is injured, the railroad company is not liable.—(Belford vs. Brooklyn Heights R. Co., 88 N. Y. Supp., 267.)

NEW YORK.—Carriers—Street Railroads—Setting Down Passengers—Defect in Street—Evidence—Similar Occurrences.

In an action against a street railroad company to recover for its negligence in stopping the car at night where there was a deep hole in the street into which a passenger fell when alighting from the car, evidence that another person had previously fallen into the same hole in the same way when alighting was admissible, not to show that the place was in a dangerous condition, but that defendant had notice of its condition.—(Holzhauser vs. Brooklyn Heights R. Co., 88 N. Y. Supp., 269.)

NEW YORK.—Appeal—Findings of Trial Court—Street Railroads—Personal Injuries—Evidence.

1. The Appellate Court will be slow to reverse a judgment of the trial court for defendant where the only evidence was the uncorroborated testimony of the plaintiff.

2. That plaintiff did not bring suit against a street railway company for personal injuries which were alleged to be very serious until several weeks after the accident, though one of the attorneys was plaintiff's nephew, and that the amount demanded was entirely inadequate to the injury alleged, tended to justify a judgment in defendant's favor based on the uncorroborated testimony of the plaintiff.—(Hartman vs. Interurban St. R. Co., 88 N. Y. Supp., 352.)

NEW YORK.—Trial—Instructions—Evidence.

Where, in a suit for personal injuries, the court instructed that plaintiff was entitled to recover compensation for the loss of earnings, but there was no proof in the record as to what were the loss of earnings, a judgment in his favor cannot be permitted to stand. —(Kane vs. Metropolitan St. Ry. Co., 88 N. Y. Supp., 162.)

NEW YORK.—Street Railroads—Collision with Vehicle—Injury to Passenger—Negligence—Question for Jury—Condition of Track—Duty of Street Car Company.

1. Where evidence showed that the street car on which plaintiff was a passenger was moving rapidly at the time of a collision with a truck, and that plaintiff would not have been injured had not the attempt of the driver of the truck to get out of the way of the car been defeated by the wheel of the truck catching in a disused frog in the track, thereby causing the truck to swerve on snow and ice and hit the car, it was a question of fact for the jury whether defendant maintained the street at a point where the frog was in a reasonably safe condition.

2. A street car company, on making use of a public street which was safe prior to that time, is liable to a passenger injured in a collision between the car and a truck, if the cause of the accident was the failure of the company to restore the street to its former safe condition.—(Freeland vs. Brooklyn Heights R. Co., 88 N. Y. Supp., 264.)

NEW YORK.—Appeal—Nonsuit—Consideration of Evidence—Pleadings—Amendment to Conform to Proof—Street Railways—Injuries to Passenger—Res Ipsa Loquitur.

1. On appeal from an involuntary nonsuit, plaintiff is entitled to the most favorable view of the evidence which the jury might properly have taken.

2. Where the complaint in an action against a street railway company for personal injuries alleged that plaintiff, believing herself in great peril, and to save herself, jumped from the car in which she was riding, and fell upon the ground, and the evidence developed that plaintiff did not recollect what occurred, and one of her witnesses testified that she fell on the platform of the car, the evidence did not substantially change her claim, and the pleadings might properly have been deemed amended to conform to the facts, under Code Civ. Proc., section 723, providing that the court may, upon trial, amend any pleading to conform to the proof, where the amendment does not change substantially the claim or defense.

3. Evidence that, while plaintiff was riding in defendant's street car, flames and smoke appeared in various parts of the car, creating a panic, so that while plaintiff was attempting to escape from the car she was injured, was sufficient to justify an inference of negligence, so that it was error to dismiss the complaint.—(Dorff vs. Brooklyn Heights R. Co., 88 N. Y. Supp., 463.)

NEW YORK.—Street Railways—Injury to Passengers—Negligence—Complaint—Amendment to Conform to Proof.

Where the evidence showed that while plaintiff was a passenger on defendant's street car a fuse used in connection with the electrical appliances blew out, and a flame enveloped the front of the car, and passengers shouted, and plaintiff became frightened, and in the melee was pushed from the car—facts authorizing the submission of the question of defendant's negligence on the principle of res ipsa loquitur—plaintiff should be allowed to amend the complaint to conform to the proof, though it alleged the burning of the fuse was caused by negligent management of the car in putting on too heavy a current; it being clear that the defendant could not be prejudiced by such amendment.—(Williams vs, New York & Q. C. Ry. Co., 89 New York Supp., 669.)

NEW YORK.—Railroads—Failure to Fence Track—Statutes—Injuries to Animals—Liability—Construction.

1. A railroad is liable for injuries to animals on its right of way caused by its failure to comply with Laws 1892, p. 1390, c. 676, section 32, requiring every railroad corporation to maintain fences on the sides of its road of height and strength sufficient to prevent cattle, horses, sheep and hogs from going on its road from the adjacent land, etc.

2. Under Laws 1892, p. 1390, c. 676, section 32, requiring every railroad to fence the sides of its road to keep out cattle, horses, sheep, etc., but declaring that no railroad need be fenced when not necessary to prevent horses, cattle, sheep, etc., from going on its track from the adjoining lands, a railroad company was not bound to fence its right of way within the city of New York to keep out horses pastured on certain city blocks, where a public highway intervened between such property and the railroad's right of way.—(Lee vs. Brooklyn Heights R. Co., 89 N. Y. Supp., 652.)

NEW YORK.—Carriers—Street Railroads—Injuries to Passengers—Negligence.

Where plaintiff, a passenger on a street car, was injured by being struck in the eye by the conductor's transfer punch, which fell from his pocket as he hurried through the car to readjust the trolley pole, the railway company was not liable therefor, since it was not a casualty which could reasonably have been anticipated or foreseen.—(Cheyene vs. Van Brunt St. & E. B. R. Co., 89 N. Y. Supp., 626.)

NEW YORK.—Street Railroads—Injury to Pedestrian—Negligence.

Where a fender on the rear of a car fell, and there was no evidenec to show it had not been properly strapped up, nor any to show what caused it to fall, nor that the conductor knew of the same, the railway company is not liable to a traveler on the street injured thereby.—(Klyachko vs. Central Crosstown R. Co., 88 N. Y. Supp.)

NEW YORK.—Trial—Evidence—Cross-Examination—Explanation of Contradiction.

In an action against a street railroad company for personal injuries, the motorman testified on direct examination that he put on the reverse when he struck plaintiff's wagon, so that the car went backward, and on cross-examination stated that near a corner, which from some of the evidence appeared to be the place where the accident happened, he had no power on, because there was a "breaker" there where the power was cut off. On redirect he was asked if there was a "breaker" at or near this corner, and the question was excluded on the ground that he had already testified there was. Held, error; the witness being entitled to explain the seeming contradiction.—(O'Donnell vs. Interurban St. Ry. Co., 88 N. Y. Supp., 1016.)

NEW YORK.—Carriers—Injury to Passenger—Action—Instructions—Contributory Negligence—Action—Evidence—Record of Accident.

1. A cripple, on entering a street car, set down one of his crutches and grasped the jamb of the car door to swing himself into a seat, and the driver closed the door so forcibly as to injure one of the cripple's fingers. There was nothing in the appearance of the passenger to apprise the driver of the car of the manner in which the passenger would attempt to take his seat. In an action for injuries, the court instructed that defendant owed plaintiff a duty, as a common carrier, to see that he got on the car with safety, after the car had been stopped to receive him as a passenger. Held, that the instruction was erroneous, as imposing on defendant not merely the duty of affording the passenger a reasonable opportunity to get on the car, but making it an insurer of the safety of the passenger until he had taken his seat.

2. The passenger was not guilty of contributory negligence.

3. In an action against a street railroad company for injuries sustained by a passenger, it was error to strike out the evidence of dependant to the effect that it had no record of the accident.—(Shadletsky vs. New York City Ry. Co., 88 N. Y. Supp., 1014.)

NEW YORK.—New Trial—Setting Aside Verdicts—Evidence.

Where, on the issue of damage to a dress, resulting from an accident, there was no evidence of the actual value of the dress just before the accident, but only as to its value or cost when new, which was some months before, so that the verdict could only have been in the nature of a guess or compromise, the discretion of the trial justice in setting aside a verdict for damages was not abused.—(Leigh vs. Interurban St. Ry. Co., 88 N. Y. Supp., 959.)

NEW YORK.—Street Railroads—Collisions with Teams—Negligence of Driver.

1. Where both the motorman of a street car and the driver of a truck were at fault in calculating that there was space enough for the car to pass, there could be no recovery for an injury to one of the horses on the truck, caused by a collision of the car with the truck.

2. A driver of a truck, who, when backing it against the curb to unload, did not leave room enough for street cars to pass, but unnecessarily occupied the tracks and left his team with a young boy, who, from lack of judgment or discretion, did nothing to avert a collision when he saw an approaching car, was guilty of negligence, so that for an injury to one of the truck horses, caused by a collision, there could be no recovery.—(Gass vs. New York City Ry. Co., 88 N. Y. Supp., 950.)

NEW YORK.—Carriers of Passengers—Personal Injuries—Street Railways.

Where, in an action for personal injuries received while alighting from defendant's street car, the weight of the testimony is to the effect that the injuries were received by stepping off the car before it stopped, a judgment for plaintiff should not be permitted to stand.—(Lynch vs. Interurban St. Ry. Co., 88 N. Y. Supp., 935.)

NEW YORK.—Street Railroads—Drivers of Teams—Reciprocal Rights.

The drivers of a team and a street car have equal rights and, where the night is dark, and a street car is lighted up, the driver of a wagon cannot impose on a street car company the duty to exercise greater vigilance than the law required of himself, by driving without any lights on his wagon, against recognized custom and regulations, relying on the vigilance of the street car driver.—(Koehler vs. Interurban St. Ry. Co., 88 N. Y. Supp.)

NEW YORK.—Carriers—Injuries to Passengers—Negligence—Sudden Stops.

The mere fact that a street car suddenly stopped, so as to precipitate a passenger through the front window of a car, was not sufficient to show negligence, in the absence of any evidence that the stoppage was more than usually violent, or that there was a greater jerk than the ordinary one incident to the stopping of any car.—(Johnson vs. Interurban St. Ry. Co., 88 N. Y. Supp., 866.)

OHIO.—Carriers—Ejection of Passenger—Assault—Words of Provocation—Damages.

1. Words of provocation may be considered in mitigation of punitive, but not compensatory, damages.

2. In an action for personal tort, the compensatory damages which may be recovered from the principal for the wrongful and unlawful act of its agent are not subject to mitigation, nor is the liability of the principal for such damages defeated, by proof that the act which caused the injury was provoked or induced by abusive language used by the plaintiff to such agent.

3. Where, in such action, the jury, by the direction and instruction of the court, is restricted to the allowance of compensatory damages only, it is not error to refuse to charge "that, in determining the question of compensatory damages to the plaintiff, they may consider, in mitigation thereof, the provocation brought about by the insulting words used by the plaintiff to defendant, if they find such words were used."—(Mahoning Valley Ry. Co. vs. De Pascale, 71 N. E. Rep., 633.)

PENNSYLVANIA.—Street Railroads—Collision—Nonsuit.

Plaintiff, suing a street railroad company to recover for injuries, testified that he was driving a two-horse delivery wagon at night, when he collided at a cross-street with one of defendant's cars. The collision occurred before the wagon reached the tracks. The car was only 40 ft. away when plaintiff looked up the track, and was lighted up in the usual manner. Held, that a nonsuit was properly entered.—(March vs. Traction Co., 57 Atlantic Rep., 1131.)

PENNSYLVANIA.—Street Railways—Release.

On an issue as to the validity of a written release of damages for injuries received on a street railway track four disinterested witnesses, including a physician, testified that plaintiff was conscious at the time the paper was read to him; that he comprehended its contents, accepted the money consideration, and signed it; and it appeared that he used the money weeks afterwards with full knowledge of where it came from, and made no offer to return it before bringing suit. Held, that the release was a bar to an action for the damages.—(Laird vs. Union Traction Co., 57 Atlantic Rep., 987.)

PENNSYLVANIA.—Street Railways—Collision—Evidence.

Evidence in an action to recover for personal injuries caused by a collision between plaintiff's sleigh and a street railway car examined, and held to require the direction of a verdict for defendant.—(Dunkle vs. City Passenger Ry. Co., 58 Atlantic Rep., 268.)

RHODE ISLAND.—Master and Servant—Injuries to Servant—Action—Evidence—Declaration of Manager—Admissibility—Res Gestæ—Instructions.

1. In an action against a street railway for injuries to a conductor owing to the alleged negligence of a motorman, evidence that, on the day following the accident, defendant's general manager, who knew nothing of the accident until that day, stated to the foreman of the car barns that the motorman in question was not a regularly broke-in man and was not competent, was not admissible as res gestæ.

2. In an action against a street railway company for injuries to a conductor owing to the alleged negligence of a motorman, it was competent for plaintiff to prove that the manager of defendant had knowledge of the incompetency of the motorman.

3. In an action against a street railway company for injuries to a conductor owing to the alleged negligence of a motorman, evidence that, on the day after the accident, defendant's general manager, in a conversation with the foreman of the car barns relative to the accident, stated that the motorman in question was not competent, was not admissible on the ground that the statement was made by the manager, acting within the scope of his authority, and was a statement made to a subordinate in the course of conducting the business.

4. Where the charge, as a whole, states the law correctly, it is not error for the court to refuse a particular request already embodied in the charge.

5. In an action against a street railway company for injuries to a conductor owing to the alleged negligence of a motorman, the erroneous admission of declarations made the next day by defendant's general manager to the superintendent of the car barns to the effect that the motorman in question was not competent was prejudicial error.—(Havens vs. Rhode Island Suburban Ry. Co., 58 Atlantic Rep., 247.)

RHODE ISLAND.—Carriers—Passengers—Inception of Relation—Preparation to Board—Assumption of Dangerous Position—Proximate Cause.

1. One who, after signaling an approaching street car which is about to round a curve, places himself in such close proximity to the track that he will inevitably be struck by the overhang of the car when it rounds the curve, assumes the risk incident to the dangerous position which he has taken, and cannot hold the street railroad company liable for his injuries.

2. One who signals an approaching street car which is rounding a curve has no right to assume that the car will stop at any particular point on the curve, and until he is given to understand by some act of the motorman or conductor that he can safely attempt to board the car, or until the conditions are such that he can do so, the street railroad company is under no legal duty to him.

3. The act of one who places himself within the reach of the overhang of a street car as it rounds a curve, and not the subsequent act of the motorman of the car in accelerating its speed, is the proximate cause of injury to such person resulting from being struck with the overhang of the car.—(Garvey vs. Rhode Island Co., 58 Atlantic Rep., 456.)

RHODE ISLAND.—Injuries to Wife—Action by Her—Judgment—Action by Husband—Res Adjudicata—Carriers—Negligence—Instructions.

1. A judgment will not be reversed because the jury credited the testimony of the lesser number of witnesses on a disputed issue of fact.

2. A judgment in favor of defendant in an action by a wife against a carrier for injuries was not a bar to an action by the husband for loss of her services.

3. In an action against a street railway company for injuries sustained by a passenger who was standing in a car, and was thrown down when it rounded a curve, it was proper to refuse to instruct that, if the jury found that the car was not going at an improper speed, they should find for defendant, since the irregular motion might have caused the injury.—(Brierly vs. Union Ry. Co., 58 Atlantic Rep., 451.)

RHODE ISLAND.—Street Railways—Injury to Child—Contributory Negligence.

A child eight years old, accustomed to being on the street alone, who, seeing an approaching street car, starts to run across the street in a diagonal direction, when, to get across the car track ahead of the car, she, if going in the most direct line, must go 16 feet before the car goes 85 feet, at most, is guilty of contributory negligence.—(Poland vs. Union Ry. Co., 58 Atlantic Rep., 653.)

RHODE ISLAND.—Street Railroads—Injuries to Pedestrians—Insane Persons—Duty of Motorman—Presumptions—Guardian—Contributory Negligence.

1. Where a person of full age and apparently possessed of his faculties was seen on the track by a street railway motorman, the latter was entitled to assume that such person was actually of sound mind, and to act on such presumption.

2. In an action for death of plaintiff's husband, who was insane, by his being struck by a street railway car while he was at large and unattended, the fact that he was at large did not necessarily constitute contributory negligence on the part of the custodian.—(Simpson vs. Rhode Island Co., 58 Atlantic Rep., 658.)

RHODE ISLAND.—Street Railways—Injury to Passenger—Negligence—Riding on Platform—Pleading necessity.

The declaration for injury to a passenger on a street car by being thrown from it by a sudden jolt while standing on the rear platform need not show it was necessary for plaintiff to stand there; it not being negligence per se for a passenger on a street car, though it is propelled by electricity, to ride on the platform.—(Brunnchow vs. Rhode Island Co., 58 Atlantic Rep., 656.)

TEXAS.—Street Railroads—Persons on Track—Negligence—Contributory Negligence—Assumption of Risk.

1. One waiting to board an approaching street car, who took a position which was safe with reference to the ordinary cars which the street railroad used, and with which he was familiar, having no notice up to the time he was struck by it that an approaching car was of a greater width than the ordinary cars, was not guilty of contributory negligence.

2. Nor did he assume the risk of such car's striking him.

3. City ordinances required a street railroad to stop cars in the shortest time and space possible on the first appearance of danger to persons on or moving toward the track, and on the approach of danger to any person to give an alarm by blowing a whistle. Defendant's motorman on a car of extraordinary width saw plaintiff assume a position which was in fact dangerous, in view of the width of his car, and knew that persons signaling a car all stopped close to the track. His car was a special one, and had orders not to stop for ordinary passengers, and he proceeded without either stopping or checking the car, or giving the danger signal, until he struck and injured plaintiff. Held, that the jury were warranted in finding that the motorman saw plaintiff's danger and was guilty of negligence, although the motorman stated that he did not know the dimensions of his car, or the reach of the step which struck plaintiff.

4. The rule that an engineer or motorman may act on the theory that a person on or near the track, who sees a train or car approaching, will get out of the way of danger, has no application after it becomes reasonably apparent that this will not be done.—(Denison & S. Ry. Co., vs. Craig et al., 80 Sw. Rep., 865.)

TEXAS.—Carriers—Injuries to Passengers—Contributory Negligence—Question for Jury—Evidence—City Ordinance—Pleadings—Variance.

1. In an action against a street railway for injuries to a passenger attempting to alight, where there was evidence that at the time of the accident the car was within a few feet of the crossing where plaintiff expected to leave the same, and was going at a slow rate of speed, so that it was not dangerous to disembark at that time, a finding that plaintiff, who was injured in consequence of an electric shock which threw him from the car, was not guilty of contributory negligence, was warranted.

2. In an action against a street railway for injuries to a passenger caused by an electric shock which threw him from the car while he was preparing to disembark, the car being within a rew feet of the crossing at which he expected to leave, and moving slowly, it was not error to refuse to admit in evidence a city ordinance making it an offense for a passenger to jump off of a moving street car.

3. Whether a passenger preparing to disembark from a slowly moving street car within a few feet of the crossing at which he expected to leave was guilty of contributory negligence was a question of fact.

4. In an action against a street railway for injuries to a passenger while preparing to alight, where the petition alleged that plaintiff was thrown from the car by reason of an electric shock, and the particular ground of negligence relied on was that defendant permitted the car to become overcharged with electricity, the fact appearing in evidence that plaintiff had one foot on the ground at the time he was thrown did not constitute a variance.—(Denison & S. Ry., Co. vs. Johnson, 81 Southwestern Rep., 780.)

VIRGINIA.—Street Railroads — Negligence — Death — Action — Damages — Instructions — Pleading— Witnesses — Refreshing Memory.

1. Where a declaration is in two counts, and there is evidence to sustain one of them, so that defendant cannot demur to the evidence, and the one not sustained by the evidence is good in form, the court, on request of defendant, should instruct the jury to disregard the count not sustained.

2. Where, in an action against a street railroad for the death of one killed by being run over by a car, the negligence alleged in the declaration was excessive speed, it was error to instruct on failure to give warnings.

3. Code 1887, Section 3384, declares that, where there appears to be a variance between the declaration and proof, there may be an amendment of the declaration, if it will not prejudice the opposite party, or the jury may find the facts, and the court give judgment according to the right of the case. Held that, in case of a variance between the evidence and allegations, the correct practice is to object to the evidence when offered, or move to exclude it; the attention of the court being thereby called to the variance, and an opportunity afforded to meet the emergency under the statute.

4. It is proper to refuse an instruction where there is no evidence to support it.

5. In an action against a street railroad for the death of one run over by a car, an instruction that failure to look for an approaching car by a person about to cross a street railway track, especially at a street crossing, was not negligence, as a matter of law—the street car having no superior right to that of a pedestrian, and the question being whether a prudent person, acting prudently, would have thought it necessary to do so—was erroneous, as misleading.

6. While, generally speaking, one who is about to cross a street railroad should look and listen for cars, it is not an inflexible rule; and the question is whether a prudent man, acting prudently, would have thought it unnecessary to do so.

7. Where, in an action for death, there is no evidence of payment by plaintiff of doctors' bills and burial expenses, an instruction authorizing their recovery is erroneous.

8. In an action for death, evidence that deceased left a family, and followed a trade which gave practically constant employment, is sufficient to warrant an instruction that the jury, in estimating the damages for his death, may take into consideration compensation for the loss of his care, attention, society, and comfort to his family, and for solace to them for the sorrow, suffering, and mental anguish occasioned by his death.

9. In an action against a street railroad for the death of one run over by a car, plaintiff's evidence showed that deceased was walking outside defendant's track, with his back turned to an approaching car, when he attempted to cross the track, and that he had not taken more than two steps when he was struck, and that he was deaf. Defendant requested an instruction that it was the duty of a person approaching a street car track to exercise the care which ordinarily prudent persons would exercise, and make such use of his faculties as ordinarily prudent persons would make use of under the circumstances, and that, if such person were deaf, it was more imcumbent on him to exercise his sight, and that if deceased failed to exercise such care, and his failure contributed to the accident, the jury should find for defendant. The instruction was given, with the addition that if the jury further found that the motorman saw or might have seen deceased go on the track, or approach it with apparent intention to cross it, and thereafter used ordinary care to stop the car, they should find for defendant. Held that defendant was entitled to the instruction, and its modification was error.

10. It was error to refuse the charge that, if deceased stepped in front of a moving car of defendant when the car was so close on him that a collision could not be avoided by the utmost care on the part of defendant's servants, the jury must find for the defendant.

11. In an action for the death of one run over by a street car, it was not error to receive testimony of a witness objected to as giving the rate of speed 80 feet from the scene of the accident.

12. The testimony of the witness was not inadmissable because of the fact that at the time he observed the car he was in his storehouse, 25 feet from the door.

13. A witness may be allowed to refer to the stenographic report of his evidence at a former trial for the purpose of refreshing his memory.

14. Stenographer's notes of testimony on a former trial may not be referred to for the purpose of contradicting a witness.—Portsmouth St. Ry. Co. vs. Peed's Administrator, 47 Southern Rep., 850.)

VIRGINIA..—Street Railroads—Electricity—Trolley Wires—Intersecting Lines—Fire—Liability—Contributory Negligence—Witnesses—Leading Questions—Harmless Error—Expert Testimony—Bill of Exceptions.

1. Where plaintiff's goods were burned by fire caused by an electric current introduced by telephone wires coming in contact with the live wires of an intersecting railway line, the question whether

the defendant railway company used due care in construction of its line, intersecting the telephone line, was for the jury.

2. It was immaterial to plaintiff's right of recovery whether the defendant company or the telephone company had the prior or superior right in erecting their respective wires, as it was the duty of both to exercise due care to see that their wires did not come in contact.

3. Where, in an action against a street railway company for fire caused by the alleged negligent manner in which it constructed its wires at a point where they intersected telephone wires connecting with plaintiff's building, the manner in which the telephone line had been constructed was before the jury, it was not error to refuse to instruct that the law presumed that the telephone company in erecting its line used all ordinary precautions for making its wires safe.

4. Plaintiff was not guilty of contributory negligence in failing to use a device to be attached to telephone wires entering houses to guard against the admission of an unusual and dangerous flow of electricity.

5. When and under what circumstances a leading question may be put is in the discretion of the trial court, and, as a general rule, is a matter which cannot be assigned as error.

6. Any error in permitting a leading question was harmless where the witness had already testified to the matter called for by the question.

7. Evidence showing by which party a witness was summoned is admissible to show that that party thought him worthy of credence.

8. In an action for damages from fire on electric wires, an expert witness was asked whether or not a certain kind of fuse was in common use, and answered that he did not know. On the next day he was called and asked if he had made inquiries about its use, and whether or not he could make any statement in addition to that made the day before. Held that, his knowledge on the subject was not of such a character as to fit him to answer the question.

9. The answer expected to a question which is not permitted to be answered must be shown in the bill of exceptions.—(Richmond & P. Electric Ry. Co., vs. Rubin, 47 Southeastern Rep., 834.)

WASHINGTON.—Carriers—Care Required.

A carrier is not bound to do everything that can be done to insure the safety of its passengers, but need exercise only the highest degree of care consistent with the practical conduct of its business. —(Johnson et ux. vs. Seattle Electric Co., 77 Pacific Rep., 677.

WASHINGTON.—Carriers—Passengers—Inception of Relation—Intending Passengers—Degree of Care Required—Negligence—Contributory Negligence—Assumption of Risk—Instructions Harmless Error.

1. In an action for injuries to one attempting to board a street car, a charge that defendant's servants were not required to exercise the highest degree of care possible to avoid an accident, but only the highest degree of care reasonably practicable under the circumstances, and consistent with the proper discharge of their other duties, and that by the term "highest degree of care" was meant the degree of care which would be exercised under like circumstances by careful and experienced employees, was not open to the objection of reducing the degree of care required of defendant's servants while looking after passengers to that of ordinary care, and of excusing the conductor from looking after plaintiff while he was engaged in performing his duties.

2. A street car company is not an insurer of the safety of its passengers, but, when it exercises towards them the highest degree of care consistent with the practical conduct of its business, it performs towards them its full legal duty, and is not liable even for injuries which might have been foreseen and prevented, if the means required to prevent them would involve a burden amounting to a practical prohibition of its business.

3. In an action against a street railway company, a charge, without further qualification, that the duty of the conductor and motorman towards the passengers on the car is to exercise the highest degree of care consistent with the proper discharge of all their other duties, while incorrect, was not reversible error, where there was no evidence to the effect that the injury to plaintiff was caused by the fact that the conductor or motorman was engaged in the performance of another duty, and therefore could not look out for plaintiff.

4. A motorman who obeys signals given him by the conductor, and who does not see or know that to obey such signals will result, or will be likely to result, in an injury to an intending passenger, is guilty of no negligence.

5. It was negligence for a street car conductor, no matter what other duty he was performing, to start his car at the time an intending passenger was in such a position that he could have seen her in the act of boarding the car, and he looked in her direction.

6. A street car conductor was not negligent in giving the signal to start the car, where he ceased other work while the car was stopped, and looked back to the entrance to ascertain if any one else was entering, or desirous of entering, and saw no one.

7. A person who approached a street car from the rear in a crowded thoroughfare, out of the sight of the conductor, and did not reach it until after the signal to go ahead had been given and the car had started, and then seized the handrail and attempted to board, though others standing by appreciated her danger and sought to warn her by hallooing, was guilty of contributory negligence.

8. Street railway employees are not required to exercise the highest degree of care to ascertain whether or not a particular person walking or standing on a public street desires to become a passenger, but ordinary care is all that is necessary in such cases.

9. One intending to board a street car, who approached it from the rear, and was in a position where the conductor, in looking out for intending passengers, would not ordinarily have seen her, and who was not seen by the conductor, who did look out towards the rear before giving the signal to start, was not a passenger.

10. In an action against a street railway company, the court charged that if the conductor was engaged in collecting fare or making change for a passenger, and, after the car had stopped, and before starting the same, was in a position where he could see the rear entrance of the car, and, before giving the signal to start, looked to see if there were any other persons about to board the car, and exercised reasonable care under the circumstances, and did not see plaintiff approaching the car or attempting to board the same, he was not negligent. Held that, while the matter relating to the making of change for a passenger was not pertinent to the balance of the instruction, nor to any evidence in the case, the instruction was not objectionable as taking from the jury the question as to what is and what is not a proper time to take up fares.

11. The fact that the clause was not pertinent did not necessitate a reversal, as it was not prejudicial.

12. One who came running towards a street car from the rear, and seized the handle bar and attempted to board the car after the signal had been given and the car was starting forward in the usual manner, assumed all the natural risks incident to such an attempt to board the car, and could not hold the street railway company responsible for injuries caused thereby.—(Foster vs. Seattle Electric Co., 76 Pacific Rep., 995.)

WASHINGTON.—Carriers—Passengers—Extent of Contract—Boarding Wrong Car—Expulsion—Evidence—Character of Conductor.

1. Where a street car company operated some of its cars on a certain line from A. to C., and others only from A. to B., a point intermediate between A. and C., and plaintiff, whose destination was C., boarded a car bound only for B., without asking the conductor whether the car went to C. or not, and there was no system of transfers from cars going only to B. to those going beyond to C., and plaintiff did not ask for any such transfer, even if there had been such a system, there was no contract to carry plaintiff beyond B.

2. A statement by the superintendent of the company, who was on the car, after arriving at B., that he would tell the conductor on the car bound for C. to pick plaintiff up, did not constitute a contract to carry plaintiff to C. without additional fare, at least in the absence of evidence of any custom to so transfer passengers without the payment of additional fare.

3. A further statement by the superintendent, made the next day, that he had intended to tell the conductor to pick plaintiff up, but had forgotten to do so, was no part of the original contract, and showed, at most, no more than an intention to authorize gratuitous carriage of plaintiff to C.

4. The expulsion, without excessive force or inexcusable negligence, of one who presents no evidence of a right to free passage, and who does not pay his fare, affords such a one no cause of action.

5. In an action by a passenger for ejection from a street car, evidence as to the general character and disposition of the conductor who ejected plaintiff was properly excluded, as the only subject for inquiry was the character and disposition of the conductor on the particular occasion.

6. Where a complaint for the ejection of a passenger from a street car was based merely on the breach of the contract of carriage, and did not allege the employment of an incompetent conductor, evidence of the general character and disposition of the conductor who ejected plaintiff was properly excluded.

7. Where a street car bound only for B. was boarded by a passenger for C., who made no inquiry as to the destination of the car, it was immaterial, on the question of his contract of carriage, that the car which he boarded left at about the time that the car for C. ordinarily left.—(Braymer vs. Seattle R. & S. Ry. Co., 77 Pacific Rep., 495.)

LONDON LETTER

[*From Our Regular Correspondent.*]

In these columns last month a statement was published to the effect that the London, Brighton & South Coast Railway, acting under the advice of its electrical engineer, Mr. Philip Dawson, had decided to electrify a portion of its suburban service, and that the single-phase high-tension system had been decided upon. There is nothing much to add to that statement, although a good deal has recently appeared in the daily press, as the decision of this railway to use electricity on a portion of its system has elicited a great deal of interest. As already stated, the section of the line to be electrified is between Battersea Park and Peckham Rye, from which two points an extension will later on be made to Victoria Station on the one hand, and London Bridge Station on the other hand, which will complete the loop from station to station.

Mr. Samuel White, the managing director of the Bristol Tramways Company, is naturally interested in the success of the Bristol Royal Infirmary, the more so as his brother, Sir George White, is the president of it. He has just devised an ingenious plan for assisting the Infirmary by placing in all of the Bristol tramcars a box in which contributions can be made for the purpose of wiping out the deficit of that institution. Mr. White reckons that if only a shilling a day is put into each of the boxes, the large sum of £5,000 or £6,000 a year will be raised, a sufficient sum to put the Royal Infirmary in a very comfortable financial position.

The new electric railway operated by the North Eastern Railway Company from between Newcastle and Tynemouth has introduced rather a curious problem to railway managers. This railway company has notified the public that it will not guarantee to supply them with first-class carriages on this particular line. This is, of course, the outcome of the electrification scheme as the North Eastern Railway Company evidently finds it much more convenient to have only one class of carriage on a short line of this kind, as such a plan doubtless assists in the prompt despatch of trains from station to station. This action has given rise, however, to a great deal of discontent among those who are in the habit of traveling first-class, and especially among the holders of first-class annual passes. Meetings have already been held in Newcastle to discuss the matter; one of these meetings being recently presided over by the Duke of Northumberland. A number of resolutions were passed, and strong representations have now been made to the directors of the North Eastern Railway Company on the subject, the special object being to have the words which are now inserted in the first-class contract tickets for 1905 deleted, the words being "This ticket is available in first-class carriages only, if, and when such carriages are provided on the trains." It will be interesting to note the result.

It was recently announced in these columns that the Belfast Corporation Tramways were to be immediately electrified. Messrs. J. G. White & Company having received the contract for the complete scheme of electrification. It will be remembered that the Belfast Tramway system has, up to the present moment, been owned by the Belfast Street Tramways Company, but last year the Belfast Corporation decided to take over the tramways itself and electrify them. The handing over of the tramways to the Corporation was made the occasion of an interesting ceremony, when Mr. J. Barber Glenn, secretary of the company, gave a luncheon to the Lord Mayor and members of the tramways committee. At this luncheon Mr. Glenn handed Sir Samuel Black, Town Clerk, of Belfast, the document authorizing the transfer of the undertaking from the Tramways Company to the Belfast Corporation, and speeches by the Lord Mayor, Sir Samuel Black, Mr. Glenn, Sir Daniel Dixon and others followed congratulating the Corporation on having secured the tramways system, and on the speedy decision to immediately electrify it. It is interesting also to note that Mr. Glenn drove the last car on the Saturday night on which the company's control terminated, as he had driven the first car in 1872.

An interesting feature in the transportation problem of London is the largely increased numbers of petrol omnibuses which are now to be seen in the streets running on various routes from Charing-Cross to the southern districts, and from Oxford Circus out into the northwestern districts. It is too soon yet to be able to give any statistics as to their commercial success, but it would appear from the gradual appreciation of the shares of the two most important omnibus companies of London, that these companies are increasing their traffic receipts to a considerable extent, and these increases are popularly ascribed to the success of the motor omnibuses. These omnibuses are able to carry about twice the number of passengers that the horse omnibuses can convey, and perform their journey in a very much shorter time, so that now that their novelty has worn off they are being well patronized by the public, and are forming a more serious competition to the electric tramways in the south of London. At the same time, the London County Council claims that it is getting its electric service continually into better condition, and expects to show a substantial profit for the year. It will be of great interest to see the next annual statement, as it will be remembered that during the previous year the tramways did not show a very good balance sheet, largely owing, perhaps, to the amount of construction work that was going on at the same time.

It will be remembered that reference has been made to the experiment which the Huddersfield Town Council is making with reference to the carrying of coal on its tramway system. At a recent meeting of the Council it was voted that an agreement be entered into with Messrs. J. H. Sykes & Company, woolen cloth manufacturers, Gosport Mills, Outlane, to convey coal to their mill from the Hillhouse railway sidings at 1s. 9d. per ton.

The members of the Bournemouth Town Council have reason to congratulate themselves in the termination of the arbitration between themselves, representing the tramways, and the Poole & District Electric Traction Company, extending over a period of two years. It is now decided that the Bournemouth Corporation is to pay the company £112,000 plus two agreed sums of £5,500 and £350, respectively, although the company originally claimed a sum from three to four times that amount. The Bournemouth Corporation is now going to commence immediately the construction of considerable tramway track.

Among the private bills recently deposited for the next session of Parliament, there is an important scheme for the supply of electric power in London, more especially in the manufacturing districts which lie along the river, the title being the Administrative County of London and District Electric Power Company. The proposed company has a capital of £5,000,000, and among the promoters mentioned in the bill are Lord Armstrong, Mr. Douglas Vickers (of Vickers & Maxim), Sir James Joicey, M. P., Sir G. T. Taubman-Goldie, Sir Andrew Noble, Mr. A. F. Yarrow, Mr. Eric Hambs, M. P., Mr. Leonard Cunliffe, and Mr. G. F. McCorquodale. The bill authorizes the erection of three central generating stations for the purpose of supplying electric power to large consumers, such as the present local authorities and companies engaged in electric lighting, as well as to railway companies, docks, and large works. The bill, however, does not authorize the company to deal with electric lighting, and that this is not intended is also shown by the fact that the maximum price which can be charged is fixed at 1½d. per unit.

The electric lighting and traction scheme of Kilmarnock Corporation has now been completed. The electrical station and car houses have been erected on the north bank of the river Irvine, at Riccarton. The engineering portion of the work was in the hands of Messrs Kennedy & Jenkin, London, and the station has been equipped with the most up-to-date machinery and plant. The engine room contains four 20-hp Bellis & Morcom engines, coupled to dynamos supplied by Messrs. Dick, Kerr & Co. The jet condensing plant was provided by Messrs. Mirrlees, Watson & Company, Glasgow, and the switch-board was built by Messrs. Cox-Walkers, Darlington. The tramway route consists of half a mile doube line, and 3¾ miles single line. There are two main routes; one from Beansburn to Riccarton, and the other from the railway station to Hurlford. Passing places are arranged about every third of a mile, and where there is only a single line it has been laid as far as possible to one side so as to allow of doubling later on, if required. The opening ceremony of the tramways was performed by Lord Howard de Walden, Lord of the Manor, and created a great amount of public interest.

Recently a special train consisting of forty-two wagons left Dick, Kerr & Company's Preston Works, carrying 250 tons of electrical machinery being shipped in connection with that company's contract for the complete equipment of the Tokyo Densha, Tetsudo Kabushiki Company's tramways. This tramway system when finished will cover over 60 miles of line, and operate some 250 cars. The complete installation is being carried out by Dick, Kerr & Company, under the supervision of a staff of their engineers, and it is surprising to learn that the only effect the war has had on the progress of the work is in connection with the transportation of the machinery from Yokohama to Tokyo, the railway being congested with war material. A. C. S.

Emergency transfer tickets, good for five cents, are being issued to passengers on the Kings County Elevated road in Brooklyn, in case of blocks. The tickets are good on any of the Brooklyn Rapid Transit lines, and if both elevated and surface lines are blocked at the same time the tickets may be redeemed.

PARIS LETTER.

(From Our Regular Correspondent.)

The year 1904 was not at all unfavorable to the majority of French tramways. The principal companies in Paris, Nice, Bordeaux, Algiers, etc., show considerable and even large increases, ranging from $60,000 to $80,000 in the case of the larger concerns. The surface contact companies are not, however, making a good showing, and continue their policy of obtaining concessions for trolley lines wherever possible and replacing surface contacts.

The good fortune of the tramways has not been shared by the Paris General Omnibus Company, whose receipts amount to only Frs. 44,712,936 for the year, a decrease of over a million francs as compared with 1903. The receipts of this company have been going down steadily for several years, and a reorganization of the lines is essential before any improvement can be expected. The Technical Commission, which has been considering the omnibus situation and tramway affairs in Paris, is still busy reporting on the latest propositions made by the government. The former proposals which the commission put forward were returned and have been considerably revised. It is stated in some quarters that the Omnibus Company will benefit by a supplementary concession of thirty years, which will terminate in 1940 instead of 1910, as now. In return for this, the company will probably be asked to reduce fares and establish a system of shorter routes. It has also been stated that the Est Parisian Tramway Company, now operating a very large system in the east of Paris and environs, will have its sphere of influence reduced.

The General Council of the Seine-et-Oise Department has just approved an important electric railway project having a total length of about 150 miles and to cost $3,000,000. The scheme will have to be approved by the government before contracts are made.

About the middle of December a convention was signed between the French and Spanish Governments regarding the establishment of light railway lines across the Pyrenees between the two countries. This has already been noticed in these columns in previous letters. There are three schemes, and electricity is expected to be the motive power. The original projects were made on the basis of steam traction, but with the substitution of electric traction, the cost was reduced considerably in the estimates submitted, owing to the possibility of using heavier grades and smaller radius curves. Ten years are allowed for the work to be completed, and owing to the natural difficulties of the enterprises the time is not excessive.

The new double-truck cars used by the Metropolitan Railway on its new line 3, and described in the STREET RAILWAY JOURNAL for Dec. 31, have given good satisfaction, and the company is considering the question of transforming its existing single-truck cars, which are naturally harder on curves. The receipts of the Metropolitan Railway for 1904 reflect the opening, in October last, of line 3, but in any event they are good as compared with the preceding year. The total number of passengers carried was 117,550,521 (1903, 100,107,619), with total receipts of Frs. 20,348,954 (1903, Frs. 17,296,839). During the last ten days of the year the company carried a daily average of about 500,000 passengers on the 20 miles of lines now open to public service.

In Italy the government is seriously considering the various propositions of "repurchase" of its railways, and the question is arousing quite a deal of interest in traction circles there.

In Spain, the steam lines between Sarria and Barcelona are now being replaced by electric lines, the trolley being used. A new tramway line has been commenced at Barcelona, just now the center of several promising traction and power transmission schemes. Among other important lines about to be commenced are the Baeza-Ubeda, and another, already authorized, between Saragossa and Aragon. M. V.

LORAIN RAILS, ETC., FOR YOKOHAMA

The Yokohama Electric Railway Company has indirectly placed the contract for the rails, crossings, etc., for the construction of its Yokohama-Kanagawa section—about 5 miles long—with the Lorain Steel Company's branch of the United States Steel Corporation.

This will be the first contract of its description which the Lorain people have secured from Japan. The rails—70-lb. girder—will be rolled at Johnstown, Pa., while the Lorain, Ohio, mills will turn out the crossings, etc. Shipment will be made in February and March, overland to the Pacific Coast.

The contract was secured through the British electric engineering and contracting firm of L. J. Healing & Company, of Yokohama, who are represented on this side by Francis A. Cundill, of 96 Wall Street, New York City.

B. R. T. ANNUAL MEETING

At the annual meeting of the stockholders of the Brooklyn Rapid Transit Company on Friday, Jan. 27,, the four directors whose terms had expired were re-elected for three years. They are Edwin W. Winter, Norman B. Ream, Henry Seibert and Timothy S. Williams. Of the 450,000 shares of the company, 264,235 were voted. The election of Mr. Winter as a director means that he will be continued as president of the company at the meeting of the directors, which will be held this week.

The directorate of the Brooklyn Rapid Transit Company, in addition to the four members re-elected, consists of A. N. Brady, A. R. Flower, H. C. DuVal, W. G. Oakman, E. N. Harriman, H. H. Porter, J. G. Jenkins, R. Somers Hayes and D. H. Valentine. The annual meeting of the stockholders of the American Railway Traffic Company was held at the same time as that of the Brooklyn Rapid Transit Company. The American Company has the contract for removing the ashes and rubbish from the city dumps and operates ash cars over the system. The old board of this company was re-elected as follows: E. W. Winter, T. S. Williams, J. F. Calderwood, J. L. Wells and C. D. Meneely.

THE STORM

Last Wednesday's storm was the worst with which electric railway managers have ever had to contend, and for transportation in general was the severest since the blizzard of 1888, with which it seems all comparisons must, of necessity, be made. The storm had its beginning on Tuesday, and before the snow had ceased to fall, at midnight, on Wednesday, it had spent its power over all that territory extending westward from the coast to the Mississippi, and as far south as Tennessee. The amount of snow that fell was not so very large, but the low temperature and particularly the high wind contributed to making it almost impossible for transportation of any kind to be continued.

Early on Wednesday morning reports came from all over the territory affected that trains were delayed, and that trolley lines were, with difficulty, keeping their lines in operation. By 12 m. on Wednesday conditions assumed a serious aspect, especially for those working any considerable distance from their places of business. In New York surface lines had already begun to be abandoned, and the reports from the suburban lines, both steam and electric, indicated that hours would be consumed in making the trip that usually takes only a short time.

Things continued to get worse as the day wore on, and in the evening the problem of how best to get home was the one of greatest concern. Many of those living in the suburbs and who commute on the steam lines, arranged to stay in the city.

In New York the entire system of the New York City Railway Company, operating all the surface lines in Manhattan Borough, was practically at a standstill, for the fine dry snow had drifted into the conduit and so lodged there as to defy all efforts to continue lines in operation. Even on Broadway cars were kept in operation only with the greatest difficulty. The elevated and the subway cared for the overflow of traffic from the surface lines. On the elevated it was a question of combating the storm and caring for additional traffic, while on the subway the problem was one of transporting the additional traffic that sought the shelter of the tube. The appreciation by the public of the service given by the Interborough Company, operating the subway and the elevated lines, has taken that form which public appreciation always takes—acknowledgment through the press.

In Brooklyn the Brooklyn Rapid Transit made a record that has received fitting public acknowledgment. All the "L" lines were kept in operation, and while service had to be abandoned on several of the surface lines, the discontinuance of traffic was announced publicly. The trunk lines were all kept running, and the lines that had to be abandoned were in regular operation again on Thursday. General Manager Calderwood, of the company, did a public service that long will be remembered. He communicated with all the large employers of labor in the city, and requested them to dismiss their help early, because of the uncertainty of the transportation, and so as to lessen the strain on the system that reaches its peak between the hours of five and six o'clock. His request met with a ready response.

In Jersey City and Newark, the service was all that could be expected, considering the territory covered and the possibilities that an open country offers for the piling up of drifts.

The story as regards the rest of the territory affected by the storm is mainly a reiteration of what has been said about the service in the metropolitan district. Abandoned cars on the suburban lines were not infrequent, and where service in cities was not abandoned entirely, the reason, in most cases, is to be found in peculiar local conditions.

ANNUAL MEETING OF THE SOUTH SIDE ELEVATED, CHICAGO

The annual meeting of the stockholders of the South Side Elevated Railroad was held in Chicago, Jan. 26. President Leslie Carter's report showed the following figures on earnings and expenses during the last three years:

EARNINGS

	1904	1903	1902
Passenger	$1,523,421	$1,629,360	$1,433,828
Other earnings	49,898	49,477	48,477
Miscellaneous	1,509	473	1,538
Total	$1,574,829	$1,679,310	$1,483,843

EXPENSES

	1904	1903	1902
Maintenance of way	$64,946	$64,325	$57,443
Maintenance equipment	129,035	132,847	107,145
Conducting transportation	415,478	422,857	364,736
General expenses	153,410	158,160	149,957
Loop rental	207,104	216,183	183,057
Total	$969,975	$994,375	$862,338
Net earnings	$604,853	$684,934	$621,505
Bond interest	33,750	33,750	33,750
Dividends	409,149	409,133	409,124
Surplus for year	$161,954	$242,051	$178,631

The balance sheet as of Dec. 31 compares as follows:

ASSETS

	1904	1903
Cost of property	$12,312,338	$12,350,880
Cost of property, construction and extension	1,313,942	....
Capital stock in treasury	92,400	92,400
Material and supplies on hand	45,084	41,416
Due from individuals and companies	7,978	5,655
Due from agents	5,182	5,627
Current assets	14,500	49,446
Cash on hand	176,085	7,720
Cash on hand, construction and extension	817,578	....
Total	$14,785,091	$12,553,146

LIABILITIES

	1904	1903
Capital stock	$10,323,800	$10,323,800
Funded debt	3,110,000	750,000
Current liabilities	161,377	386,387
Depreciation	50,000	65,000
Reserve	1,139,914	1,027,959
Total	$14,785,091	$12,553,146

The road carried 30,468,424 passengers, or a daily average of 83,247, during the year, as compared with an average of 89,280 in 1903 and 78,566 in 1902. The proportion of expenses to earnings was 61.6 per cent, compared with 59.2 per cent in 1903 and 58.1 per cent in 1902.

President Carter in his report explained the relative decrease in business for the present year.

"In the business of this company," said he, "1903 was a year filled with special occurrences, which brought increased patronage, and consequently large gains in earnings. The year 1904 was in complete contrast, since it was destitute of these special events. In 1903 there were Washington Park races, public parades and celebrations, which attracted travel. Labor troubles on competing lines, which taxed our full resources in November, continued to increase receipts all winter. The year 1904 had none of these. It is in these items that we find the decrease in earnings in comparing the two years. Of course, much of this was expected, as it was apparent that some of the causes for increase in 1903 would not be repeated. It is stated now that it may be made clear to those interested who have not closely followed these events. The regular business continued, notwithstanding the comparative dullness of trade, and this may be shown by comparing the daily average travel of 1902—namely, 78,566 passengers—with the daily average travel of 1904—namely, 83,247 passengers—a gain of between 5 per cent and 6 per cent. The estimates of traffic, on which the new extensions now under construction are recommended, are based on the receipts of 1902, and not on the exceptional receipts of 1903."

Concerning the sale of bonds for the new extensions and the progress of the work, President Carter said:

"Since the last annual meeting you have authorized the execution of a mortgage of $8,000,000 to build and equip the extensions provided for by the ordinance of the Common Council passed in 1903. These bonds were sold to the highest bidder at 97½, the bonds to be delivered, $3,000,000 in August, 1904, $2,500,000 May 1, 1905, and at least $1,500,000 of the remainder May 1, 1906. Your directors took immediate advantage of the temporarily depressed state of manufactures to enter into contracts for steel and cement on favorable terms. The purchase of the necessary real estate has been pushed with all promptness, and most of the right of way has been acquired. Very few condemnation suits will be necessary, and it now seems apparent that the right of way will be ready in ample time for the erection of the steel structure. The foundations for the third track and for the main or east and west line in Englewood are being put in rapidly. The erection of the steel structure will be commenced by March 1, if the weather permits, and it is hoped that the third track, from Forty-Third to Twelfth Street, and the east mile of the Englewood line—that is, to Sixty-Third Street and Harvard Avenue—will be ready for operation in time for the autumn business. The east mile of the Chicago Junction Railroad Line to Lake Avenue and Forty-First Street should be ready to open soon after those just mentioned. The maintenance of structure and equipment has been scrupulously cared for, and these important details are kept in as good condition as at any time in the past. Although the number of passengers was less than during the prior year, the frequency of trains and number of cars were maintained, with the intention of giving our patrons the best service our facilities permit. The thanks of the management are tendered to each and every one who has taken part in the work of a year which was not marred by one unfortunate or unpleasant occurrence."

Chauncey Blair retired from the board of directors and C. H. Hulburd was elected to succeed him. The old officers were re-elected as follows: Leslie Carter, president; T. J. Lefens, vice-president; H. F. Haidy, secretary and treasurer; Marcellus Hopkins, general manager.

THE STREET RAILWAYS OF NEW HAMPSHIRE

The report of the Railroad Commissioners of New Hampshire to the State for the year ending June 30, 1904, says:

"The returns of the electric railway corporations do not disclose the hoped-for improvement in their balance sheets. The reduction of the cost of coal to normal prices, and some economies in operation, which managers have been able to bring about, have, to a small extent, lessened the expenses of some roads; but the fact remains that, excepting the Concord, which has but nominal fixed charges; the Manchester, which serves about 70,000 people, and the Chester & Derry, which is practically owned by a few men who operate it, charging little or nothing for their services, no street railway in New Hampshire earned operating expenses and fixed charges.

"Corporations that operate 18 electric railways made returns to the board as of June 30.

"The Springfield is a New Hampshire terminal of a Vermont road. The Portsmouth, Dover & York is a Maine road, with less than three miles of track in this State. The Claremont is operated in connection with light and power plants, in whose accounting its balance sheet is merged. The Nashua is leased to the Boston & Northern of Massachusetts, operated as a part of that system, and its returns are necessarily estimates which disclose its volume of business and little more. Of the other fourteen, three, as stated above, earned a divisible income, five did not make money enough to pay operating expenses, and six failed to pay for operation and fixed charges.

"The aggregate deficits of these eleven roads for the year was $95,028.17, and the sum of the divisible incomes of the other three was $50,149.10, leaving an excess of deficits of $44,879.07.

"The Manchester street railway stands out conspicuously as the only one in New Hampshire that earns and pays regular dividends, which is mainly due to the fact that there are within reach of its lines about 70,000 people, who contribute an average of $4 per capita to its receipts.

"The condition of electric roads amalgamated under the name of the New Hampshire Traction Company is cited at length, showing a total deficit for two years of $722,490.23. Concerning this corporation the report states 'to arrest this rapid descent into bankruptcy a drastic plan of reorganization has been resorted to. This plan if consummated will wipe out the old stock and floating debts, convert the bonds into stock, and leave the company without interest charge, and, with this relief and the expected increase in business it is hoped it can proceed and work out its solvency."

Commenting in general on the failure of many electric roads to prosper, the commissioners say "our State lacks the populous centers which are the guarantee of the income of an electric road.

"The average community can be relied upon to pay from $3 to $4 per capita for street railway service, and when this will not support a road dependent upon local patronage it cannot prosper."

ST. CATHARINES, NIAGARA & TORONTO ELECTRIC RAILWAY SOLD

MacKenzie & Mann, who own the Canadian Northern Railway, have bought the St. Catharines, Niagara & Toronto Electric Railway. This gives the Canadian Northern a line from Toronto to Niagara Falls. The St. Catharines, Niagara & Toronto Railway formerly was a steam road, called the Niagara Central. As originally constructed, it extended from Niagara Falls to St. Catharines. As it was not very successful it was turned over to another company, which changed the motive power to electricity. A branch line was built to Port Dalhousie, on Lake Ontario, and two large steamers were put on to connect with Toronto. This provided connections with the Niagara Falls Park & River Railway, the Gorge Route, and the Buffalo & Niagara Falls Electric Railway, operating between Buffalo and Niagara Falls. Later the company took over the St. Catharines Street Railway. As the Hamilton, Grimsby & Beamsville Electric Railway, operating east from Hamilton, terminates within 6 miles of the line from St. Catharines to Port Dalhousie, it is the expressed intention to complete this link, thus giving complete connection by electric railway from Hamilton to Buffalo and all points reached by the Buffalo radial lines.

BRILL TEAK CARS FOR MANILA

The Manila Electric Railroad, Light & Power Company—the American capitalized concern—which is building some 45 miles of electric traction system in and around the capital of the Philippines, has placed an order with the J. G. Brill Company, of Philadelphia, for fifteen cars, to be built of teakwood and steel, so as to withstand the ravages of the white ant, which destructive insect is very much in evidence in the Philippine Islands, and, in fact, in all tropical countries.

These cars will be the first of their description to be shipped from the United States. A Belgian concern—La Metallurgique, of Brussels, as noted in the Street Railway Journal at the time—secured the former car contracts let by the Manila Company. The Brill cars will be of convertible type, and are to measure 35 ft. over all. They will be equipped with Westinghouse 40-hp motors. Shipment will be made inside of three months.

ANNUAL MEETING OF NEW ENGLAND STREET RAILWAY CLUB

The annual meeting and banquet of the New England Street Railway Club was held Jan. 26, as announced, at the Brunswick Hotel. The meeting was held in the afternoon and resulted in the election of the following officers:

President—Edward E. Potter, general superintendent, Union Street Railway, New Bedford.

Vice-Presidents—Massachusetts, Paul Winsor, assistant to vice-president, Boston Elevated Railway, Boston; Connecticut, Norman McD. Crawford, manager, Hartford Street Railway, Hartford; New Hampshire, L. N. Wheelock, manager, Claremont Street Railway, Claremont, N. H.; Vermont, A. J. Crosby, superintendent, Springfield Street Railway, Springfield, Vt.; Rhode Island, J. E. Thielsen, superintendent, Providence & Danielson Street Railway, Providence, R. I.; Maine, George E. Macomber, manager, Augusta, Winthrop & Gardiner Railway, Augusta, Maine.

Secretary—John J. Lane, Boston.

Treasurer—N. L. Wood, with C. N. Wood Electric Company, Boston.

Executive Committee—J. H. Neal, chief of department of accounts, Boston Elevated Railway, Boston; H. E. Farrington, superintendent of car repairs, Boston & Northern Street Railway, Chelsea; W. D. Wright, superintendent of equipment, the Rhode Island Company, Providence, R. I.; E. A. Sturgis, superintendent motive power and machinery, Worcester Consolidated Street Railway, Worcester; C. E. Sprague, with General Electric Company, Boston; John C. Bradley, Bradley Car Manufacturing Company, Worcester; F. A. Barbey, street railway supplies, Boston.

Finance Committee—President Potter, James F. Wattles, with Rand Avery Supply Company, Boston; M. C. Brush, general manager, Newton Street Railway, Newton.

Vice-President Winsor presided at the banquet in the evening and Dan Prendergast acted as toastmaster. The speakers included George W. Bishop, of the Massachusetts Railroad Commission; Prof. George F. Swain, of the Boston Transit Commission; Howard F. Grant, of Seattle; Fuller C. Smith, of the Vermont Railroad Commission; Hon. E. P. Shaw; B. F. Chadbourne, of the Maine Railroad Commission, and A. C. Whittemore, of the New Hampshire Railroad Commission.

EXCELLENT SHOWING OF A TEXAS ROAD

The Northern Texas Traction Company, operating in Fort Worth and Dallas, Tex., through the ownership of local systems in those cities, and an interurban electric railway between the cities, has just reported earnings for December, 1904, and for the year ending Dec. 31, 1904, that show not only a remarkable increase over figures for the same periods in 1903, but a growth that ranks the company high as regards successful management. The system comprises a total of 60 miles of track, the gross earnings of which, according to the report for the last year, were at the rate of $9,000 per mile. The increase in gross earnings for the year was $99,316, while the increase in net was $34,472. For December, the increase in gross earnings was $13,095, while the increase in net was $13,578. Operating only about three years, and already on a 3 per cent. dividend basis, the company last year earned more than 5 per cent. Following is the statement for December and for the year:

December—	1904	1903
Gross receipts	$55,165	$42,170
Operating expenses	30,583	31,252
Net earnings	$24,581	$10,917
Fixed charges	9,570	9,484
Surplus	$15,011	1,433
Year ended Dec. 31.		
Gross receipts	$564,710	$465,394
Operating expenses	316,529	261,357
Net earnings	$248,181	$204,037
Fixed charges	121,043	111,370
Surplus	$127,138	$92,667

SEOUL SYSTEM TO BE EXTENDED

The electric traction system in Seoul, the capital of Korea, is to be extended. The equipment, etc., will be purchased in the United States. Seven more miles of road—single track—will be built.

The power house, which at present is equipped with two 120-kw Westinghouse generators, will be further equipped with machines of 500-kw capacity, in two units, and the existing rolling stock, consisting of twelve cars, each having 25-hp Westinghouse motors, will be supplemented with fifteen 28-ft. cars for passenger use, and five freight cars.

The system was built by the Seoul Electric Company, which was recently reorganized under the laws of the State of Connecticut, with a fully paid-up capital of $1,000,000. The name of the concern is now the American-Korean Electric Company. The American contracting firm of Collbran & Bostwick, of Seoul, control one-half of the stock, while the Emperor of Korea owns the balance.

THE APPLEYARD SITUATION

Another of the Appleyard properties in Ohio has been placed in the hands of a receiver. On the application of certain creditors, the Columbus, Grove City & Southwestern Railway was placed in the hands of J. G. Schmidlapp and Myron Wilson, who are receivers for the other properties.

Experts representing the Attorney-General of New York, committees representing the stockholders of the various roads, and experts representing the receivers are all at work endeavoring to untangle the details of the numerous transactions in which A. E. Appleyard was involved. The statement is made in the Dayton Daily "News" that the Ohio directors of the various properties did not authorize the raising of loans from the German Bank, of Buffalo, on the credit of the various lines.

John G. Webb, of Springfield, who was formerly identified with the Appleyard properties, in an interview gives Mr. Appleyard's side of the collapse of the Buffalo Bank. He says that Appleyard purchased the bank stock at $700 a share, and that in a few months he awoke to find that he had lost in the deal $386,000. Mr. Webb asserts that Appleyard has done nothing criminal, and that he has been sinned against. He says that the Dayton, Springfield & Urbana, and the Columbus, London & Springfield bonds, which Mr. Appleyard used as collateral with the German bank, are gilt-edge securities, as the roads were bonded for much less than they cost to build.

A special despatch from Buffalo, dated Tuesday, Jan. 31, says that Mr. Appleyard has been indicted by the Supreme Court Grand Jury for having obtained from the German Bank $50,000 on bonds now said to be worthless.

EXHIBITION AT THE INTERNATIONAL RAILWAY CONGRESS

Arrangements for conducting an exhibit of railway appliances in Washington, D. C., from May 3-14, in connection with the International Railway Congress, have been completed. The exhibit will be held on Monument Grounds, which is part of the Government reservation, but which has been placed at the disposal of the general committee of arrangements by special act of Congress. The committee is proposing to erect a large building for the housing of the smaller and lighter exhibits, in which a charge of 50 cents per square foot will be made. Those exhibits which require power or large space or are excessive in weight will necessarily be housed outside the main building in booths which will be erected by exhibitors, and for the ground so occupied a charge of 10 cents a square foot will be made. The membership fee in the exhibition association required of all companies or individuals making exhibits is $50. Exhibitors proposing to erect their own booths, pavilions or exhibit structures will have access to the ground on and after March 20, 1905. The exhibition building to be erected by the committee is expected to be ready for the installation of exhibits therein by April 15, 1905. All communications in regard to exhibits should be sent to J. Alexander Brown, secretary and director of exhibits, 160 Broadway, New York.

A. L. IDE REPRESENTED IN THE EAST

A. L. Ide & Sons, of Springfield, Ill., have recently given a more important representation to their interests on the Atlantic coast by establishing a large office at the Bowling Green Building, New York City, in charge of J. G. Robertson, who for many years has had successful charge of their Western business from the St. Paul headquarters. Associated with him are S. J. Fuller and G. B. Ferrier. In order that Mr. Robertson and the staff might meet socially the men with whom much of his Eastern business will be transacted, H. L. Ide gave a dinner on Tuesday evening, Jan. 24, at the Hotel Astor, at which some thirty were present. The party included H. L. Ide, J. G. Robertson, S. J. Fuller, G. B. Ferrier, T. Beran, Calvin W. Rice, F. C. Bates, F. H. Larkin, J. M. Wakeman, F. R. Lowe, T. C. Martin, J. D. Andrews, Jr., T. B. Arnold, E. W. T. Gray, W. L. Conwell, F. B. Slocum, C. G. Wingate, A. S. Vance, E. W. Goldschmidt, W. Bigelow, F. B. De Gress, W. S. Rugg, D. H. McDougall, H. W. Rowley, W. L. Fairchild. Brief and felicitous speeches were made by Messrs. Ide and Robertson, the toastmaster being Mr. Martin. The party then were entertained by Mr. Arnold, a celebrated amateur in card tricks.

THE WASHINGTON, BALTIMORE & ANNAPOLIS PROPOSITION

George T. Bishop, of the Bishop-Sherwin syndicate, which has taken up the Washington, Baltimore & Annapolis proposition, announces that subscriptions to the underwriting are coming in at a rate that indicates over-subscription. The construction of the road will be in charge of Mr. Bishop, who has had long experience in such work, and the engineering will be in the hands of the Roberts & Abbott Company, of Cleveland. It is the intention to put the work through as rapidly as possible, and it is expected that the road will be in operation within eighteen months. The main line from Baltimore to Washington will be double-track overhead trolley construction. The present Washington, Berwin & Laurel line will be improved and extended to connect with the Annapolis, Washington & Baltimore, at present a steam road, which is to be equipped with electricity. This will be done this year, giving the company a line from Washington to Annapolis, independent of the main line.

INSTITUTE ANNUAL DINNER

A great deal of interest is being manifested in the annual dinner of the American Institute of Electrical Engineers, to be given at Waldorf-Astoria, in the grand ball room, on Wednesday, Feb. 8, and devoted especially to signalizing the triumphs of electric traction. There will be a number of interesting speakers, and an original menu has been prepared appropriate to the occasion. Two novel features will also be introduced, namely, a mutoscope exhibition of steam and electric railway work and the taking of a picture of the ball room and company by means of special Cooper Hewitt illumination. A great many applications have already been made for tickets, and in order to prevent disappointment it is earnestly requested by the dinner committee that members will send in their requests at once so that there may be no disappointment as to seating.

REMOVAL OF DUST FROM CARS BY MACHINERY

The Central Railroad of New Jersey has recently introduced at its Jersey City yards a vacuum plant for car cleaning. The car-storage tracks for a distance of some 3600 ft. have been equipped with air pipe, from 2 ins. to 5 ins. in diameter, and comprising a total length of about 19,000 ft. At short intervals this pipe is tapped, and from these cocks is run the flexible hose, which may be taken in the car either by door or window. At the foot of the hose is a metal pipe with the usual flat triangular head, through which the dust and dirt is drawn by the vacuum or exhaust fan located a distance away. The operator runs the head over the cushions, carpets, curtains, wood-work, etc., removing all dust. The dust, thus removed, passes first through two dust separators, the first of which clears the air of the heavy particles. The second separator draws the air through water in which corrosive sublimate is used, and completes perfectly the purification.

BROOKLYN COMPANY RECOGNIZES BLIZZARD SERVICES OF MEN

Recognition by the Brooklyn Rapid Transit Company of the efficient service of its employees during last week's storm has taken the substantial form of a contribution from the company to the amount of $250 to the Employees' Benefit Association. Accompanying the contribution was the following short but appreciative note from Vice-President and General Manager Calderwood, of the company, to George W. Edwards, the secretary of the association:

Jan. 28, 1905.

Mr. G. W. Edwards, Secretary, Brooklyn Rapid Transit Employees' Benefit Association, No. 1 Jamaica Avenue, Brooklyn:

My dear Mr. Edwards.—As a slight recognition of the splendid manner in which our employees, especially the trainmen, rose to the occasion during and after the recent blizzard, and by their prompt, efficient and thorough efforts cleared the lines for traffic, we desire, on behalf of this company and its officers, to make a contribution to the Brooklyn Rapid Transit Employees' Benefit Association, and have handed your treasurer a check for $250, receipt for which is enclosed.

Considering the duration and severity of the storm, and the extent of territory involved, the quick lifting of the blockade, permitting the speedy resumption of traffic, was not only a commendable achievement, but a great accommodation to the traveling public. Yours very truly, (Signed) J. F. CALDERWOOD,
Vice-President and General Manager.

NEW PUBLICATIONS

Cyclopædia of Applied Electricity. Published in five volumes containing about 2500 pages, over 3000 illustrations. Bound in three-quarters red leather. List price $30.00; special introductory price $18.00. Published by the American School of Correspondence, at the Armour Institute of Technology, Chicago.

This work is the most comprehensive work on electricity and its practical applications that has yet been published and will prove invaluable to electricians, engineers, engineering students, and others who have occasion to use electricity in any form. To be able to turn quickly to any phase of electricity as used in our great industries is of immense value to both the busy practical man and the engineering student. The text has been prepared by acknowledged authorities, is fully indexed, and written with a view to the needs of the busy practical man. As these books have been designed for text books a great deal of attention has been given to practical examples, and each volume is supplemented with a list of review questions by means of which the reader can test for himself the knowledge which he has acquired of the subjects treated. The scope of the series is well represented by the titles of the several volumes, as follows: Part I., Current Measurements, Wiring, Telegraph; Part II., Dynamos, Motors, Storage Batteries; Part III., Lighting, Railways, Power Stations; Part IV., Alternating Currents, Power Transmission; Part V., Telephony, Index. The third volume is the one which takes up electric railways, and the treatise on this subject is well prepared. In addition to a description of the various appliances employed in electric railway work, and a discussion of their use, a particularly valuable chapter is given on the operation of cars and methods of testing for faults. The subject matter and engravings are well up to date, an important feature in a book of this kind.

PERSONAL MENTION

MR. C. A. MORENO has resigned as chief engineer of the United Railways Company, of St. Louis, to become connected with the Bainbrick-Bates Construction Company, in which he has become financially interested.

MR. A. L. DRUM has resigned as general manager of the Indiana Union Traction Company to become general manager of the Chicago & Milwaukee Electric Railway Company. Mr. Drum will assume the duties of his new position on March 1.

MR. S. S. NEFF has resigned as general superintendent of the Mexico Electric Tramways, Ltd., of Mexico City, Mexico, owing to ill health. The division superintendents are reporting to General Manager W. W. Wheatly, of the company.

MR. RICHARD McCULLOCH, assistant general manager of the United Railways Company, of St. Louis, presented a paper before the Washington University Association, of St. Louis, on Jan. 31, entitled "The Evolution of the Street Railway."

MR. W. B. GRAY, formerly secretary of the Demerara Electric Company, Ltd., of Demerara, British Guiana, has been appointed manager of the company in place of Mr. H. P. Bruce, who has resigned to accept the position of manager of the Cuban Electric Railway Company.

DR. M. W. HISSEY, president of the Southeastern Ohio Railway, Light & Power Company, of Zanesville, Ohio, is laid up with two broken arms. Four weeks ago he fell on the ice, breaking his left arm, and a few days ago he had another fall, which fractured his right arm in two places.

MR. W. B. WATSON, who has been connected with the Virginia Passenger & Power Company, of Richmond, in the auditing department of the company and as cashier for ten years, has resigned from the company to become superintendent of the Norfolk Railway & Light Company, of Norfolk, Va.

MR. T. W. SHELTON, formerly electrical engineer for the Northern Ohio Traction & Light Company, has been appointed general superintendent of the Fort Wayne & Springfield Traction Company. The line from Fort Wayne to Decatur is soon to be placed in operation. It will be one of the first lines in the country to use the single-phase system.

MR. R. J. FLEMING, general manager of the Toronto Railway Company, of Toronto, Ont., is on a visit to some of the cities in the United States in connection with street railway matters. Mr. Fleming, who assumed the position of general manager of the company on Jan. 1, succeeding Mr. E. H. Keating, resigned, was assessment commissioner of Toronto, and for four years was Mayor of the city.

MR. F. C. JOHNSTONE, a young electrical engineer connected with the installation of the tramway system in Manila, P. I., is dead. Mr. Johnstone was a resident of Franklin, Pa. He went to Manila in the employ of J. G. White & Company, of New York, and while there became ill. Returning to the United States, he took up residence in California, thinking to recuperate there. His condition soon became worse, and he finally succumbed to consumption.

MR. CHARLES H. BAKER, who founded the Snoqualmie Falls Power Company, of Seattle and Tacoma, and who since its beginning six years ago has been the active president and chief engineer thereof, and who also, as manager and chief engineer, promoted and planned the White River Power Company, has sold a controlling interest in both companies to a party of capitalists, who have elected Mr. N. H. Latimer, manager of the Dexter Horton Bank, of Seattle, as president. Mr. Baker is planning an early trip to Japan and China for pleasure and business. While in the Orient, he proposes to explore the water power and electrical possibilities of Japan and China, with a view to the development by American capital.

MR. H. P. BRUCE, formerly general manager of the Demerara Electric Company, Ltd., of Demerara, British Guiana, has accepted the position of general manager of the Cuban Electric Railway Company, of Havana. This company operates what is known as the Regla system, and is distinct from the Havana Electric Railway. For some time past the management of the Cuban Electric Railway Company has been in the hands of Mr. George F. Greenwood, general manager of the Havana Electric Railway Company. Mr. Greenwood has found, however, that his duties as manager of the Havana property have been such as to require all of his time, so that a separate manager for the Cuban Electric Railway Company has been necessary.

MR. ELLIS M. BROWN has resigned as electrical engineer of the Philadelphia & Reading Railway Company and the Atlantic City Railroad Company to become general manager of the Brown Engineering Company, of Reading, Pa., consulting and contracting engineers. Mr. Brown was connected with the Reading Company and its allied interests for five years. During that time he was made responsible for some of the most important work carried out by the company. Among other things, he designed and installed the power station and the electrical equipment of the Reading Company's locomotive repair shops at Reading, Pa., and supervised the reconstruction of the Cape May, Delaware Bay & Sewall's Point Electric Railway. To his credit are several features of the electric railway installation that make materially for the success of the road. A graduate of the Worcester Polytechnic Institute, Mr. Brown pursued a post-graduate course at the institute, and has been honored with the degrees of B. S., M. S. and E. E.

MR. CALVERT TOWNLEY, who recently resigned from his duties as general agent of the Westinghouse Electric & Manufacturing Company in New York to become assistant to the president of the New Haven Railroad, was entertained at dinner at the Hotel Astor, New York, on the evening of Friday, Jan. 27, by some of his former associates. The affair was a very informal one, and the feature of the evening, after a brief complimentary speech by Mr. Charles A. Terry and a response by Mr. Townley, was the very remarkable exhibition of card magic and legerdemain given by Mr. Thomas B. Arnold, the Eastern representative of the Latrobe Steel Company, who is described as a veritable wizard in tricks of this nature. Others present were Messrs. Frank H. Taylor, William F. Zimmermann, F. B. H. Paine, E. W. T. Gray, Newcomb Carlton, T. W. Siemon, Paul T. Brady, Seth C. Adams, W. C. Webster, C. B. Humphrey, Charles F. Scott, F. N. Kollock, Jr., E. St. John, D. C. Manson, F. L. Townsend, W. C. Ward, W. E. Drake, H. P. Jones, George E. Miller, J. M. Curtin, W. L. Conwell, W. S. Rugg, O. T. Smith, C. C. Owens, P. R. Owens, Charles Robbins, H. D. Prichard, W. H. MacGregor and J. K. Robinson, of Iquique, Chili. Mr. George Westinghouse sent a telegram regretting his inability to be present.

MR. EDWARD H. MULLIN, of the General Electric Company, whose sudden death was chronicled last week, was widely known in electrical and journalistic circles, where his genial disposition, strong personality and marked literary ability made him extremely popular. Among his other duties, Mr. Mullin had charge of the relations between the General Electric Company and the technical press. In this capacity his newspaper training was of the highest value, and he succeeded in establishing a bureau in New York through which the technical and daily press could secure authentic and prompt information relating to all of the advances in the electrical art accomplished by the General Electric Company. Mr. Mullin also latterly acted as confidential representative of his company in many matters, and was its official host whenever foreign engineers or capitalists desired to visit its works or become acquainted with its methods.

E. H. MULLIN

He was born in Castlederg, Ireland, in 1859, and was graduated with the degree of B. A. in the honor course in Physics and Chemistry by Queen's University, Belfast, in 1881. He then attended Edinburgh University, where he received the degree of M. D., but never practiced medicine. From 1887 to 1895 he was on the editorial staff of the New York Evening "Sun." In 1895 he joined the staff of the New York "Times," where he had charge of all technical reporting, including the X-rays discovery, the articles on which were highly commended by Mr. T. A. Edison, Prof. Rood, of Columbia College, and others. During this and the following three years he was editor of the Bookbuyer, and a contributor to various literary and technical journals, for which he wrote signed and anonymous articles on electrical matters. His services with the General Electric Company commenced on Feb. 1, 1898. Mr. Mullin was elected an associate of the American Institute of Electrical Engineers May 16, 1899, and was elected a manager on the board of directors, May 20, 1902. He was a thirty-second degree Mason, a member of the Engineers', Press, Lotos and Transportation clubs, vice-president of the New York Electrical Society, and vice-president of the Association of American Advertisers. He was buried Jan. 28, from his home in Milburn, N. J.

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. Northern Ohio Tr. & Light Co	1 m., Dec. '04	76,615	41,537	35,078	24,514	10,564
	1 " " '03	71,654	41,290	30,363	23,266	7,098
	12 " " '04	895,731	486,980	408,751	273,664	135,087
	12 " " '03	882,276	482,575	399,701	268,132	131,569
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Dec. '04	38,504	22,467	16,036	9,333	6,703
	1 " " '03	35,583	23,143	12,440	9,256	3,184
	6 " " '04	240,090	130,267	109,823	55,839	53,484
	6 " " '03	242,261	140,030	102,231	55,118	47,112
BELOIT, WIS. Rockford, Beloit & Janesville R. R. Co.	1 m., Dec. '04	8,755	5,230	3,526	2,649	877
	12 " " '04	127,564	74,369	53,195	32,287	20,908
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Dec. '04	20,946	10,414	10,532	......	......
	1 " " '03	19,158	9,669	9,489	......	......
	6 " " '04	137,628	69,873	67,756	41,925	25,830
	6 " " '03	128,187	64,191	63,997	38,141	25,856
BUFFALO, N. Y. International Tr. Co.	1 m., Dec. '04	344,987	196,580	148,407	141,849	6,558
	1 " " '03	325,464	190,073	135,392	134,365	1,027
	6 " " '04	2,252,729	1,149,284	1,103,444	833,341	270,104
	6 " " '03	2,174,765	1,164,777	1,009,988	796,444	213,543
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Dec. '04	30,516	20,010	10,506	......	......
	6 " " '04	267,540	136,475	131,046	......	......
Chicago & Milwaukee Elec. R. R. Co	1 m., Dec. '04	39,427	17,520	21,907	......	......
	1 " " '03	24,085	10,318	13,767	......	......
	12 " " '04	464,655	179,038	285,618	......	......
	12 " " '03	292,247	98,627	193,620	......	......
CLEVELAND, O. Cleveland, Painesville & Eastern, R. R. Co.	1 m., Dec. '04	17,093	10,692	6,401	6,638	†237
	1 " " '03	15,621	10,172	5,449	6,568	†1,120
	12 " " '04	225,751	136,021	89,730	80,250	9,480
	12 " " '03	214,631	127,149	87,482	78,007	9,475
Cleveland & Southwestern Traction Co	1 m., Dec. '04	37,071	22,435	14,636	......	......
	1 " " '03	33,418	21,709	11,709	......	......
	12 " " '04	445,362	293,615	181,746	......	......
	12 " " '03	445,168	264,232	180,936	......	......
Lake Shore Electric Ry. Co	1 m., Nov. '04	54,336	31,967	22,369	20,371	1,998
	1 " " '03	46,819	33,732	13,087	20,371	†7,284
	11 " " '04	605,096	400,267	204,829	224,079	†19,250
	11 " " '03	570,069	360,459	209,610	220,375	†10,764
COVINGTON, KY. Cincinnati, Newport & Covington St. & Tr. Co	1 m., Nov. '04	83,287	46,844	36,443	16,792	19,651
	1 " " '03	80,807	49,452	31,355	16,483	14,872
	11 " " '04	928,177	555,460	372,717	185,051	187,666
	11 " " '03	905,073	534,510	370,563	181,184	189,379
DETROIT, MICH. Detroit United Ry.	1 m., Dec. '04	392,757	*238,690	154,067	93,619	60,448
	1 " " '03	357,029	*227,631	129,398	87,110	42,288
	12 " " '04	4,584,582	*2763092	1,821,490	1,075,786	745,704
	12 " " '03	4,425,836	*2613976	1,811,860	1,000,000	811,860
DULUTH, MINN. Duluth St. Ry. Co	1 m., Dec. '04	53,711	28,119	25,592	21,097	4,495
	1 " " '03	51,467	30,718	20,749	15,834	4,915
	12 " " '04	619,172	326,049	293,123	202,602	90,521
	12 " " '03	622,044	345,327	276,717	186,590	90,127
FORT WORTH, TEX. Northern Texas Traction Co	1 m., Dec. '04	55,165	30,583	24,582	9,571	15,011
	1 " " '03	42,170	31,253	10,918	9,484	1,433
	12 " " '04	564,711	316,529	248,181	121,043	127,138
	12 " " '03	465,394	261,357	204,037	111,371	92,667
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Nov. '04	16,692	10,783	5,909	3,324	2,585
	1 " " '03	15,094	10,391	4,703	2,827	1,875
	12 " " '04	196,189	133,930	62,260	39,809	22,451
	12 " " '03	189,448	121,937	67,511	34,840	32,671
HOUSTON, TEX. Houston Elec. Co	1 m., Nov. '04	42,983	26,246	16,738	8,28	8,454
	1 " " '03	30,736	25,689	5,047	8,10	†3,063
	4 " " '04	139,926	90,289	49,637	33,19	16,442
	4 " " '03	146,472	96,491	49,981	30,03	19,947
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Dec. '04	353,307	136,263	217,044	82,072	134,973
	1 " " '03	327,147	133,956	193,191	75,376	117,815
	12 " " '04	3,285,378	1,592,414	1,692,964	916,460	776,505
	12 " " '03	3,096,324	1,526,910	1,569,414	871,685	697,730
Milwaukee Lt., Ht. & Tr. Co	1 m., Dec. '04	68,242	17,102	51,140	17,949	33,191
	1 " " '03	62,584	18,099	44,485	14,734	29,751
	12 " " '04	492,228	216,964	275,264	203,731	71,533
	12 " " '03	452,931	213,020	239,911	168,990	70,921
MINNEAPOLIS, MINN Twin City R. T. Co.	1 m., Dec. '04	377,650	170,194	207,456	104,446	103,010
	1 " " '03	359,184	157,655	201,528	78,521	123,007
	12 " " '04	4,308,081	2,163,304	2,144,776	1,116,195	1,028,581
	12 " " '03	4,063,938	1,878,051	2,185,888	989,578	1,196,310
MONTREAL, QUE. Montreal St. Ry. Co.	1 m., Dec. '04	211,283	146,821	64,463	18,475	45,988
	1 " " '03	189,266	128,032	61,234	17,273	43,961
	3 " " '04	638,114	402,307	235,808	56,293	179,515
	3 " " '03	585,428	355,350	230,078	52,367	177,711
OAKLAND, CAL. San Francisco, Oakland & San Jose Ry. Co	1 m., Dec. '04	41,840	16,786	25,053	11,560	13,493
	1 " " '03	27,463	13,994	13,469	5,723	7,746
	12 " " '04	419,350	180,409	238,941	111,000	127,940
Oakland Traction Consolidated	1 m., Dec. '04	111,154	60,441	50,713	......	......
	12 " " '04	1,258,136	659,261	598,875	......	......
	12 " " '03	1,137,041	582,065	554,976	......	......
OLEAN, N. Y. Olean St. Ry.	1 m., Dec. '04	8,437	4,013	4,424	2,663	1,761
	1 " " '03	8,250	3,879	4,371	2,452	1,919
	6 " " '04	27,537	13,463	14,074	7,926	6,148
	6 " " '03	27,150	14,090	13,060	7,356	5,703
PEEKSKILL, N. Y. Peekskill Lighting & R. R. Co	1 m., Dec. '04	10,482	6,166	4,316	......	......
	1 " " '03	9,474	6,144	3,237	......	......
	6 " " '04	62,688	34,201	28,487	......	......
	6 " " '03	60,658	33,477	27,181	......	......
PHILADELPHIA, PA. American Rys. Co.	1 m., Dec. '04	119,754	......	......	......	......
	1 " " '03	109,616	......	......	......	......
	6 " " '04	776,946	......	......	......	......
	6 " " '03	752,595	......	......	......	......
ROCHESTER, N. Y. Rochester Ry. Co.	1 m., Dec. '04	142,224	75,535	66,689	26,834	39,855
	1 " " '03	119,949	63,462	56,487	25,117	31,370
	12 " " '04	1,496,593	824,489	672,104	......	......
	12 " " '03	1,280,373	656,071	624,303	......	......
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Dec. '04	572,500	......	......	......	......
	1 " " '03	560,384	......	......	......	......
SAVANNAH, GA. Savannah Electric Co.	1 m., Nov. '04	45,635	26,378	19,257	10,552	8,705
	1 " " '03	44,855	22,760	22,095	10,452	11,643
	12 " " '04	540,833	307,909	232,924	126,024	106,900
	12 " " '03	516,882	307,465	209,417	118,456	90,961
SEATTLE, WASH. Seattle Electric Co.	1 m., Nov. '04	200,607	147,972	52,636	24,974	27,662
	1 " " '03	178,024	142,211	35,813	22,873	12,940
	12 " " '04	2,306,100	1,586,267	719,833	286,500	433,334
	12 " " '03	2,084,625	1,513,597	571,028	287,913	283,115
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Nov. '04	70,096	40,291	29,804	20,337	9,467
	1 " " '03	68,387	38,945	29,442	20,254	9,188
	5 " " '04	361,329	202,932	158,397	101,467	56,930
	5 " " '03	350,993	196,089	154,905	101,460	53,445
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Nov. '04	49,308	29,171	20,137	9,222	10,916
	1 " " '03	41,491	27,400	14,092	8,549	5,543
	12 " " '04	562,883	370,900	191,982	114,132	77,850
	12 " " '03	464,104	305,363	158,741	84,319	74,422
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Dec. '04	165,929	*77,836	88,093	41,693	46,400
	1 " " '03	154,494	*75,336	79,158	39,292	39,866
	12 " " '04	1,752,833	*923,208	829,625	499,874	329,751
	12 " " '03	1,663,794	*856,526	807,268	488,200	319,068

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Locomotive Engineers for Motormen

We recently heard an interesting discussion by a number of prominent operating men over the policy adopted by an important high-speed interurban line of weeding out a number of its old motormen who have advanced from city lines, and hiring in their place men who had had experience as locomotive engineers. The superintendent of the road in question is an old steam road man, and he argues that all locomotive engineers have risen from the lower ranks, and for years have had instilled into them the obedience of orders, extreme watchfulness, and the policy of safe running. There were six experienced interurban men in the party, and all of them disagreed with this superintendent on practically every point. It seemed to be the consensus of opinion that the class of locomotive engineers who could be induced to take positions at the wages offered by interurban roads would be those whose service had not been satisfactory for some reason. They also thought that the average engineer had had locomotive operation so instilled into his mind that he could not be properly educated into the details of the mechanism and the handling of an electric car, and that he would be likely to disregard important rules which applied only to the handling of such cars. Some of them believed that the city motormen who had experience with a lighter class of equipment, and who had learned careful operation in crowded city districts, made the best motormen, while others expressed the opinion that they preferred taking a green man from the country and giving him a thorough breaking-in before permitting him to take a car out alone. But not a man favored the locomotive engineer.

Air Reservoir Pressures

A recent speaker before a State electric railway convention advocated the idea that the air storage reservoir pressure carried on an ordinary interurban car should not be greater than the air pressure which could be applied in the brake cylinder without skidding the wheels. In other words, according to this theory, it would be possible for a motorman to apply the full pressure available to the brakes by throwing the motorman's valve wide open between the storage reservoir and the brake-cylinder without skidding the wheels. This, we believe, is not true in ordinary practice, as the storage reservoir pressure is usually very much more than could be applied to the brake cylinder without skidding the wheels. By thus carrying such a high pressure in the large reservoir, much larger storage capacity can be secured with a given size of storage tank. It must be admitted that, from an operating standpoint, it would be desirable not to carry a greater pressure than would skid the wheels, because, if the storage pressure was kept down to this amount, there would be less opportunity for a rattled motorman to put too much pressure into the brake cylinder in making an emergency stop, and by skidding the wheels, greatly increase the distance at which the car could be stopped. Until, however, companies are willing to put on additional storage capacity, or to introduce auxiliary tanks with reducing valves between the main storage tanks and the auxiliary tanks, the reservoir pressure on interurban cars equipped with motor compressors is likely to be carried considerably above the skidding pressure. In steam raiload practice with automatic air brakes, it is absolutely necessary to limit the maximum pressure that can be applied in the brake cylinders. In interurban railway practice with straight air brakes on a car under the direct control of the motorman, it is not as necessary to limit the pressure, as any experienced motorman can tell when the wheels are skidding. Nevertheless, limitation of the possible brake cylinder pressure, even with a straight air brake, on an interurban car, is desirable, and if it can be accomplished without too much complication, it is worth some consideration by operating and manufacturing companies.

The Reorganization of the American Street Railway Association

The meeting of the executive committees of the American Street Railway Association and its allied associations in New York, last week formed the second step toward the ultimate reorganization of those bodies. The first was taken at St. Louis and was largely an expression of opinion only, on the part of the delegates present, that such a step was advisable. At the meeting at New York last week an actual plan was presented, and the opinions expressed in favor of the general principles of Mr. McCulloch's programme were so favorable that a sub-committee was appointed to examine into the details. The subject is of such vital importance to the street railway industry at large, that we feel confident the extended report of the meeting, published elsewhere in this issue, will be read with a great deal of interest. There were no dissenting voices at St. Louis in favor of a reorganization, but we believe that the arguments advanced at New York toward a unification of all the energies of the street railway companies in their association work will make it even more evident to all that the time has arrived for taking a radical step of this kind, and that those to whom this work has been entrusted are amply competent to provide a satisfactory working plan.

It is true that the need for a change is not quite so apparent in the cases of the affiliated organizations, the Street Railway Accountants' Association, the American Railway Mechanical and Electrical Association and the Claim Agents' Association, as in that of the parent body. The two former have done excellent work in the past, and the Claim Agents' Association, although of recent origin, has a full working organization, and is apparently prepared to carry out its particular work in an efficient manner. Nevertheless, the willingness of these three affiliated associations to co-operate in the general plan proposed indicates, in our opinion, a breadth of view which cannot but be commended by all who have the interests of the street railway industry at heart. Practically the only hesitancy on the part of the two older associations toward entering into the amalgamation proposed, was caused by a possible fear that their identity might be lost and certain features in their organization, by which the subordinate officers or heads of departments in a company now feel at liberty to participate in the meetings, would disappear, and that consequently their usefulness would be impaired. We concur with the general sentiment expressed at the meeting on Feb. 3, that these fears are groundless, and that under the plan proposed the opportunities for discussion at these meetings will not only be just as open as before to those who have contributed to their success in the past, but that the meetings should be much more largely attended and more fruitful even than ever before. Moreover, we believe that the prestige of being a section of such a powerful body as the American Street Railway Association is bound to become, will be much greater than that which an independent and smaller organization could possibly possess.

A great deal remains to be determined as regards the organization of the new body, the arrangement of meetings, the composition of the executive committee and the matter of dues. Whatever is decided upon, we sincerely hope and believe that arrangements will be made by which the technical men among the companies will be encouraged to take part in the meetings of their respective sections, and that the dues will be so arranged that it will be easy for small companies to join and obtain all the benefits possible from the association. There is no doubt that the former arrangement of various organizations, with separate dues, was looked upon as somewhat of a burden by the small companies which sent one or, at most, two men to the conventions; but with one membership fee for all of the sections, as we assume will be the plan, this feature will be eliminated.

One of the most serious problems before the organization committee is the question of a permanent secretary, and whether it will be necessary to have additional secretaries for any of the separate sections. A number of the executive officers of the companies who were present at New York spoke very strongly on the necessity of establishing a general bureau of information in charge of the permanent secretary, and several of the instances cited in its favor indicate the great benefit which such a bureau of this kind could confer. It may be interesting to note in this connection that the German Street Railway Association has recently taken the same step which is being proposed by the American Street Railway Association, and has changed from a secretary, who incidentally conducted this office, to one who devotes all of his time to its service, and whose principal duties are the collection and dissemination of information which is of value to the members. We understand that the results secured in this way have been most satisfactory, and that the establishment of the office has been shown to have been justified by the benefits derived. The qualifications of the permanent secretary were outlined in a very clear way during the discussion, and we believe that if an incumbent for the office could be secured who is able to carry out the work along the lines described, he would be of immense service to the member companies.

Master Mechanics' Records

The master mechanic's daily report of cost of maintaining equipment is the gage glass of success in the electric railway business. If the gage is neglected, or if it fails to indicate promptly fluctuations in the cost of repairs and maintenance, disastrous results are sure to follow sooner or later. There are those who cry "Too much red tape," when systematic detailed shop records are mentioned, but to them we suggest that the right kind of "red tape," properly applied, serves the same use as good insulating tape on an electrical conductor. It stops the leaks. And, although "red tape" may appear to be a trifle expensive, neglected leaks in the work of maintaining equipment are much more expensive, and they lead eventually to a bad "short-circuit" in the company's affairs. As a matter of fact, those who favor systematic records, claim there is no reason why it should cost more to keep up shop records systematically and in minute detail than it does to keep them in a half-hearted and slip-shod manner. After a systematic system of this kind is once established, it takes no more clerk hire to maintain them up in a proper and readily get-at-able shape than it does to keep them in general and unintelligible form.

The Automobile and the Trolley

We do not want to pose as alarmists, and we are far from believing that the automobile is now or is likely immediately to become an active competitor of the trolley car, but the recent races at Ormond raise some very interesting questions. Of course the racing automobile is a dangerous freak at best, bearing about the same relation to ordinary traffic-carrying machines that a torpedo boat does to an ocean liner. Yet it certainly does get over the ground at a most astonishing pace. We wonder what the air resistance wiseacres think of a mile over the beach in less than 33 seconds, and of the 100-mile record, and a few other items of the season's sport. These performances are tremendously interesting as engineering feats, quite aside from all other features connected with them. They need not, however, cause the electric railway man any immediate worry, for if the cost of operation be figured out, it will rise to a sum per motor car mile that is something startling. We believe, however, that the automobile has come to stay, and while it just now represents, in the main, an acute phase of sport, it is steadily becoming more and more a factor in practical transportation. As regards passenger-carrying on a large scale, it has not yet taken a conspicuous place. Those who can afford to run automobiles are not, as a rule, large patrons of the trolley car, and, in fact, the latter probably gains quite as many patrons from those who now hesitate to use 'busses in an automobile-ridden district, as it loses from the automobilists themselves.

Nor is the automobile cab likely, we think, to cut any great figure in passenger transportation. Its uses are practically those of any other cab, supplementing, rather than tending to replace, the ordinary means of transportation. In New York surely the time made by express trains in the Subway is good enough to make even the most ambitious motor cab slip to the rear. There is, nevertheless, a phase of automobilism that may well cause the street railway man some concern. This is the menace that comes from the possibility of fast motor omnibus lines, a menace more moral than physical, perhaps, but still a real one.

A steady effort is undoubtedly being made by automobilists to break down all speed restrictions on the highways for their own particular benefit. They practically ask for a complete monopoly of the public roads, so far as fast running is concerned, and wax furious at any opposition on the part of the average citizen who pays for the roads. Each year the pressure grows heavier for the abrogation of restrictions, and the prospect of success grows brighter. But the electric railway, that runs alongside the highway, and not in it; that runs on a track entirely clear of vehicles, and thus keeps out of the way of ordinary traffic, must hold itself down to the most modest pace. That is, the public that builds the highways must creep along them in trolley cars, while the persons who sport automobiles spin by unrestricted. Now, take the case of that well-known suburb Boodleton-by-the-Sea. The P. & X. electric road has been making strenuous efforts for two years past to get a franchise for an extension to Boodleton for the accommodation of the several thousand people who live out in that direction and are very indifferently served by the steam line thereto. At each hearing the occupants of the villas turn out in force with eminent counsel and oppose. At first they delayed things merely, but now they suggest an automobile 'bus line, and show clearly that they can cut the electric car time down by nearly half. They have not the slightest idea of accommodating the public, and, in fact, do not intend to put on the line at all, but merely to block the trolley. One trolley line, in fact, was compelled a few years ago to make a long detour around Boodleton, and now the imaginary 'bus line serves to keep it there.

And if the denizens of Boodleton really go ahead with their quasi public line, from the present outlook they can run at pretty nearly any speed that suits them. They pay nothing for the use of the road, but a part of the taxes near the terminal, and have almost an exclusive use of it. This is not altogether a fancy case, unfortunately. We could mention divers instances of electric roads blocked in an attempt to do a real public service by just this sort of opposition, and as time goes on there will be more. And beyond this there is possible real competition from motor 'busses monopolizing the highway that is denied to electric cars, and free to run at high speed. If any gentleman wants to set up an automobile and scorch the highways, we would be the last to say him nay, so long as he obeys the rules of the road. But we know of no reason why he should be allowed to run at illegal speeds because he wants to snip a few minutes off the record from Boodleton to New York, or, in fact, for any other purpose. The next time a bill to raise the speed limit comes up, we hope the electric railway men will get out in force and see that it is so amended as to apply to all vehicles, whether they run on tracks or careen promiscuously over the whole width of the highway. There is no reason why the law should allow one class of vehicles the advantage over another, and one that runs on a track and is driven by electric motors should have all the rights that belong to one that runs over the macadam beside it, driven by a gasoline engine. So far as public safety is concerned, one can keep off a railway track without difficulty, but no one, save a mind reader, can tell which way the automobile is going to wobble next. At all events, let us have the same sauce for both the goose and the gander. If it comes to unlimited speed on the good old plan of every one for himself and devil take the hindmost, we rather fancy that in the long run the electric car can give a good rub to anything on wheels.

The Freezing of Compressed Air Apparatus

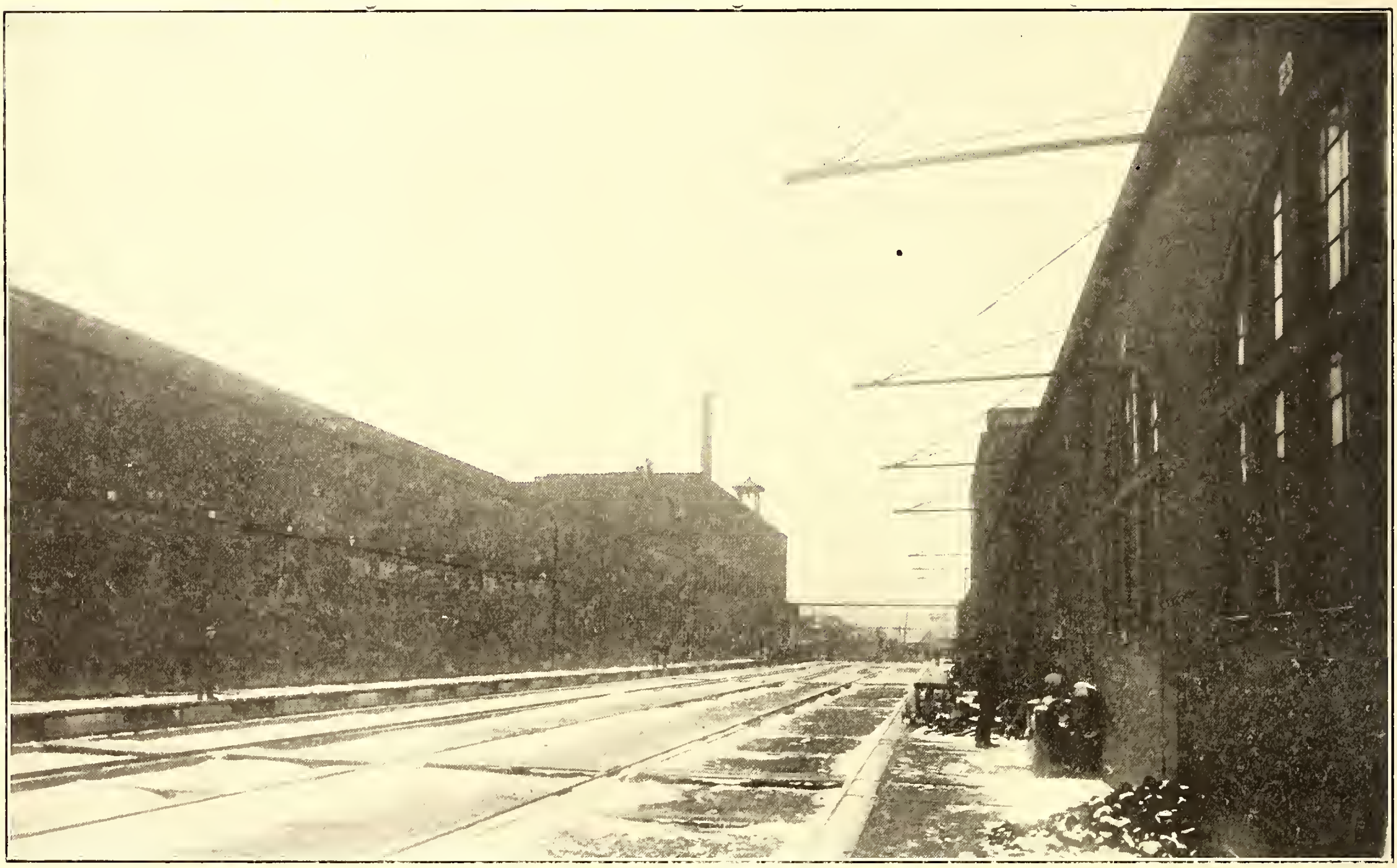
In view of some of the fears that were expressed by some conservative managers as to the working of the storage air-brake system on a large scale, it is gratifying to learn of the small amount of difficulty that has been experienced in the practical operation of this system at St. Louis during the cold weather. The difficulties so far encountered are strikingly similar to some of the small difficulties met in the early days of air-brake apparatus supplied from individual compressors on each car. One of the things which must be guarded against in piping the car, whether for a storage air-brake system or for an individual compressor system, is to avoid as far as possible all places where water will have a chance to collect and freeze so as to obstruct the action of the brakes in cold weather. That a certain amount of moisture will collect in compressed air apparatus is inevitable. The important thing is to see that it gathers where it can be drained off, and, further, to see that it is removed at frequent intervals. In the storage air-brake system, the reducing valve seemed to have been the first point of attack of Jack Frost, and it may be advisable in future installations to put this valve inside the car. In the individual compressor system it was early found that pockets where moisture could collect in pipes without a chance to drain off were to be avoided.

THE NEW REPAIR SHOP PLANT OF THE DETROIT UNITED RAILWAY

Electric railway practice in the city of Detroit, Mich., has, owing to the many important and valuable improvements in the methods of electric railroading originating there, come to be very generally regarded as representative of that which is best and most modern. Many innovations in mechanical branches of electric railway operation have been tried out and perfected by the Detroit United Railway Company which have materially influenced present conditions of street railway operation throughout this country. The storage air-brake system, for instance, originated upon one of the suburban lines now operated by this company, while the new standard style of extended rear platform of the company, so well known as the "Detroit platform," has been adopted for use in a large number of other cities. Also, Detroit is the birthplace of the wooden gear case for motor gears, and many styles of overhead line specialties, as well as also an improved trolley harp, were given to the public by experience there. In view of the interest thus naturally directed toward this progressive electric railway center, an account of the new repair shop installation of the Detroit United system and the methods pursued there will be of interest.

The announcement was made in these columns over two years ago of the purchase by the Detroit United Railway Company of a large passenger car building plant which was lying idle and appeared well adapted to the requirements of the electrical and mechanical work of the company. For several years previous, the mechanical department of the company had labored under the difficulties of inadequate facilities. Previous to the opening of the new shop the major portion of the work had been concentrated at the Jefferson Avenue car house shop, which had been increased in size from time to time, in a temporary manner, to provide for the rapid and unprecedented growth of the work. But as the traffic of the company increased and new lines were acquired, the mechanical work leaped to such proportions that it was realized that a greatly increased repair shop plant would be necessary in order to properly cope with the increased and more exacting requirements of the repair work.

As a result of the progressive and energetic policy of the company in anticipating the ever-changing conditions in this field of work, it was decided in 1902 to make provisions for greatly enlarged quarters for the accommodation of the mechanical department. It seemed to be most favorable to entirely abandon the old Jefferson Avenue shops in favor of a new and more carefully designed plant throughout. The result of investigations made in reference to the site, plan, etc., for a new shop installation was the purchase of the factory site and buildings of a former car building plant, which happened to be conveniently located in the city and, furthermore, was available by purchase. This installation embraced the buildings and grounds occupied by the old Detroit branch of the Pullman Palace Car Company, which, it will be remembered, was the scene of many important developments in railroad car building and the sleeping car service of this country; much of the earliest passenger car building in America was carried out in this old shop, but since the concentration of the work of the Pullman Company at its large plant in Pullman, Ill., active work had been abandoned in the Detroit branch, which had accordingly been standing idle for a number of years. This shop installation, although designed to meet the conditions in the building of heavy cars for steam railroad service and thus apparently not well adapted for repair work upon cars for street railway service, was found easily adaptable, by comparatively slight modifications, to the work in hand.



GENERAL VIEW, LOOKING EAST, IN THE YARD OF THE NEW SHOP PLANT OF THE DETROIT UNITED RAILWAY COMPANY, SHOWING TRANSFER TABLE RUNWAY AND CHARACTER OF BUILDINGS

The character of the new shop organization, as adapted to the governing conditions at the old Pullman plant, is the natural result of a study of the varied and exacting requirements now made upon the mechanical department by the operating forces. With the present equipment of 218 miles of city lines and 318 miles of interurban lines, radiating in all directions from the city, not only a very large but a widely scattered equipment must be taken care of. On account of the length of some of the interurban lines and the importance of conforming to schedule operating conditions, demands are made upon the mechanical department for the maintenance of the equipment in the best possible condition for insuring a minimum of delays.

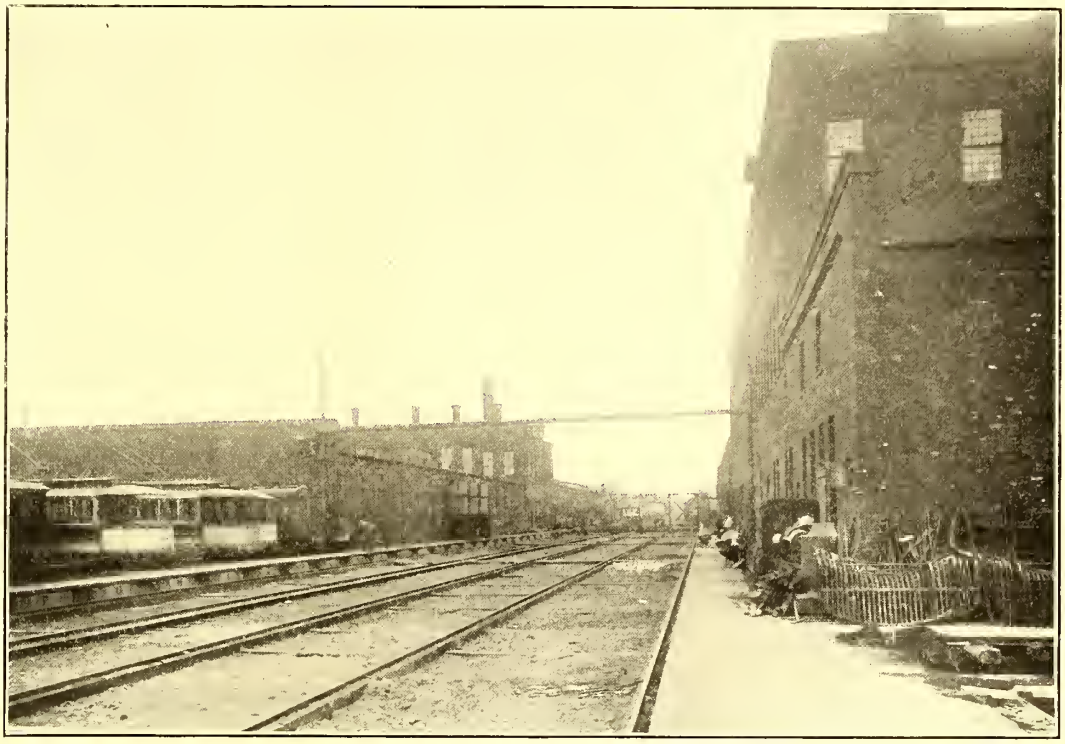
The work required at these shops is somewhat differentiated in character from repair shop work upon other roads, on account of the varied assortment of the apparatus, both electrical and mechanical, which was bequeathed to the present operating company by the various lines which have been absorbed. The electrical equipments of the various component lines embraced many different types of apparatus, and in most cases the equipments of each line differed from those of the others; the result of this condition is that of imposing upon the maintenance department the care of widely varied classes of apparatus, with resulting increase of detail work in the shop and the necessity of maintaining a large supply of repair parts in stock. A similar condition of affairs was found in all mechanical features of the work; many different types of car body construction had formerly been used, while trucks, wheels, fenders and other details were of differing types of construction. The opportunity thus afforded for careful application to detail, and also to the introduction of new interchangeable standards, was found in the nature of almost a dire necessity.

SHOP LAYOUT

The accompanying large plan drawing of the shop buildings and grounds illustrates the arrangement of departments and layout of tracks, etc., which is the result of the study that was made to adapt the requirements of the present mechanical work to the conditions and surroundings as presented in the original Pullman plant. It may perhaps be suggested that the original Pullman shop layout did not offer the most desirable arrangement for electric railway repair shop conditions; yet it will, however, be seen that the shop installation, as originally built, was well adapted for car repair work in particular, especially as it was of the transfer-table type, in favor of which much has been said of late for shops for street railways. The original Pullman shop was built in accordance with the transfer-table layout, which has for many years been in general favor for car shops under steam railroad conditions; this general arrangement of buildings and tracks has many advantages to offer for street railway work, although perhaps its adaptability to the latter class of service may not be shown to the best advantage in this particular case. The result which will be obtained in service with this arrangement will, however, be of interest and value in directing future work.

Perhaps one of the most important features of the transfer table arrangement is the economy of ground required by it for a repair shop plant of a certain capacity. The transfer table, by virtue of the facility with which it is traversed to any of the parallel tracks, eliminates the necessity of long lead tracks, and consequent large yard space which would be required with the longitudinal arrangement of shop buildings with fewer tracks arranged lengthwise. The parallel arrangement of the tracks within the buildings renders every corner of the shop space available for work, and also makes access to the various cars in the shop most easy. Another feature which is worthy of mention is the ease and facility with which a car may be handled to or from any one of the various departments by merely shifting the transfer table opposite the track on which the car is located.

As may be noted from the large layout plan, cars enter the shop grounds by way of a receiving yard at the Monroe Avenue and St. Aubin Avenue corner of the plant. At this end of the yard there are fifteen tracks on the Monroe side and four tracks on the Macomb Street side, which are uncovered and are used for storage purposes, thus providing ample storage space for cars either awaiting repairs or ready to go into service again. Two connections are made with the adjacent street tracks of the company's lines, as shown, the connection running downward upon St. Aubin Avenue being a cross-over connection to the westbound track of the Monroe Avenue loop line, cars passing east upon Monroe Avenue and west upon the street next below. Excellent connections are thus made with the city lines, and thence with the interurban systems. At the De Quindre Street end of the plant there is a side-track connection with the Grand Trunk Railway, which greatly facilitates shipping; freight cars are handled from there into any department of the shop by means of the transfer table.



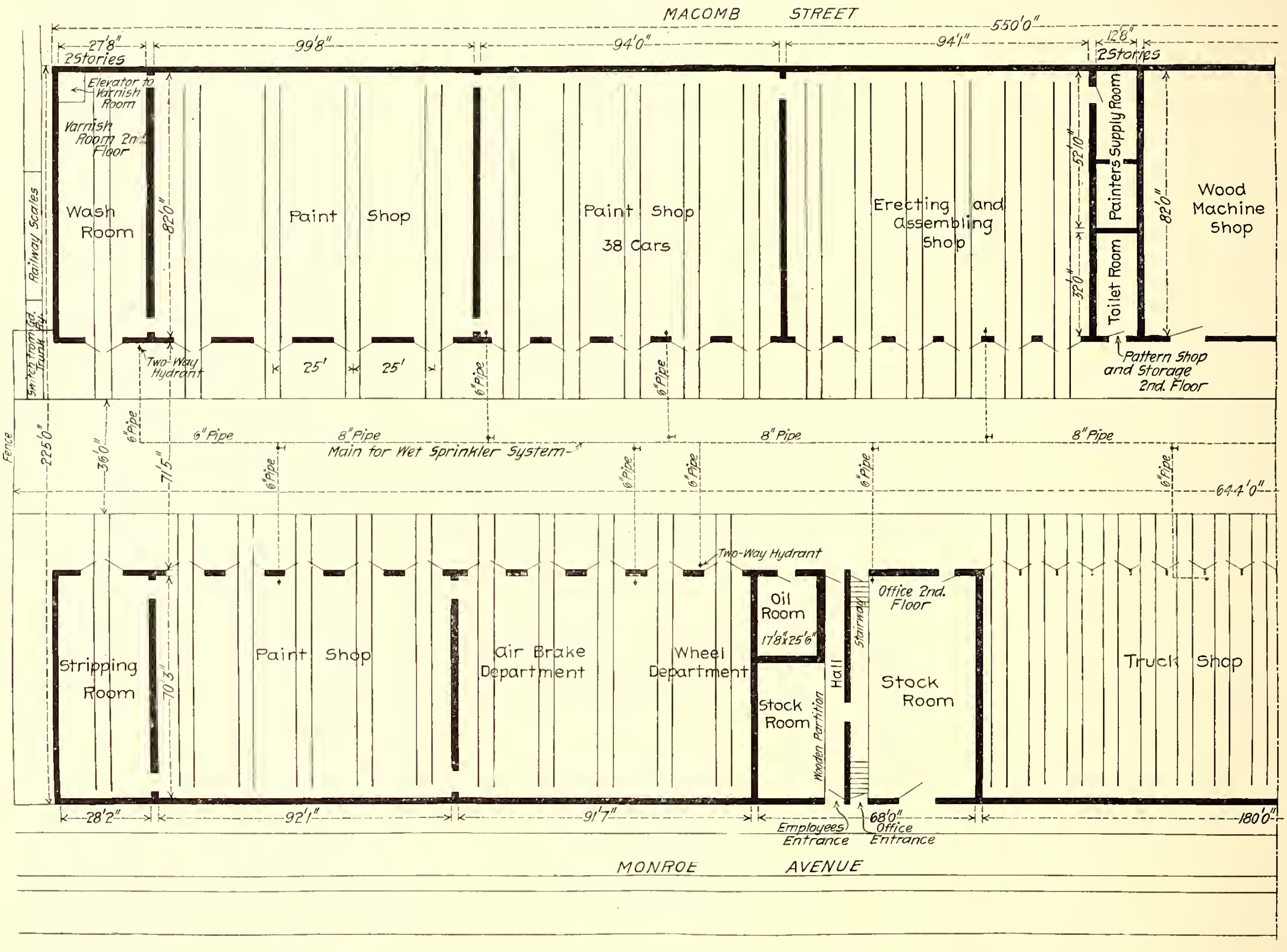
VIEW, LOOKING WESTWARD, IN THE SHOP YARD, SHOWING CAR STORAGE YARD AT THE LEFT

Cars are handled from the storage yard to any one of the various departments of the shop by the transfer table, the pit for which is indicated between the two long lines of the buildings on either side of the property. The transfer table is an electrically operated table, with special housing for the man in charge, as illustrated in the views between the buildings and of the transfer table. It is carried upon five lines of track, each of 60-lb. rail, the total span across the pit being 36 ft. The table has a total travel of 644 ft., reaching thus forty-two parallel tracks which enter the buildings, and sixty-two parallel tracks in all. The table is equipped with one track only, although a space is provided at each side to accommodate trucks, wheelbarrows, etc., across from one side to the other. The current supply for the operation of the transfer-table motors, and also for supplying current to the trolley wire, which is provided upon the table and carried by the frame work shown upon it, is delivered upon a partly enclosed contact wire alongside of one of the longitudinal rail stringers in the pit. The table is of 60 tons capacity, and was built and installed by George P. Nichols & Brother, Chicago, Ill.

Cars may be moved across the table and into the buildings by their own power, if desired, as trolley wires are provided over nearly all of the parallel tracks, and also upon the transfer table, as indicated in the view. There is provided, however, a small electric pusher locomotive for moving disabled cars or those without power, into and out of the shops. This locomotive is shown upon one end of the transfer table. It is a single-truck car, 12 ft. long over all, equipped with two type O "Steel" motors, and is capable of exerting a very heavy draw-bar pull for a car of light weight. It is provided with a cab for protection of the control apparatus and motorman.

The relative arrangement of buildings and open space upon the grounds is indicated in the plan. The building upon the Macomb Street side of the property consists of a structure of a uniform width of 82 ft. and 550 ft. long, while that on the Monroe Avenue side is only 460 ft. long and 70 ft. in width. The space from the truck shop east to St. Aubin Avenue is devoted to storage tracks, and a space of 79 ft. east of the blacksmith shop is devoted to track space and a store house for gears, brake-shoes and other supplies. In this corner of the property is also located a large new underground tank, and also an elevated tower tank for use in connection with the wet sprinkler system, which has recently been installed for more adequate fire protection.

In addition to the property west of St. Aubin Avenue above referred to, the company owns a plat 200 ft. x 95 ft. in area, extending eastward from that street to an adjacent alley, as shown. This plat is made use of for a storage yard, provision being made for storage of oil in one corner and for the storage of kiln-dried lumber in a lumber warehouse at the Macomb Street end. In this yard is also stored all the materials which can be kept out in the open air without detriment, and also the scrap of various kinds which naturally accumulates in works of this size. Both the store yard and the open spaces in the block occupied by the shops are surrounded by high fences or brick walls, the latter being used in nearly all cases. Gates are, of course, provided at the St. Aubin ends for facilitating the transfer of material to and from the store yard.

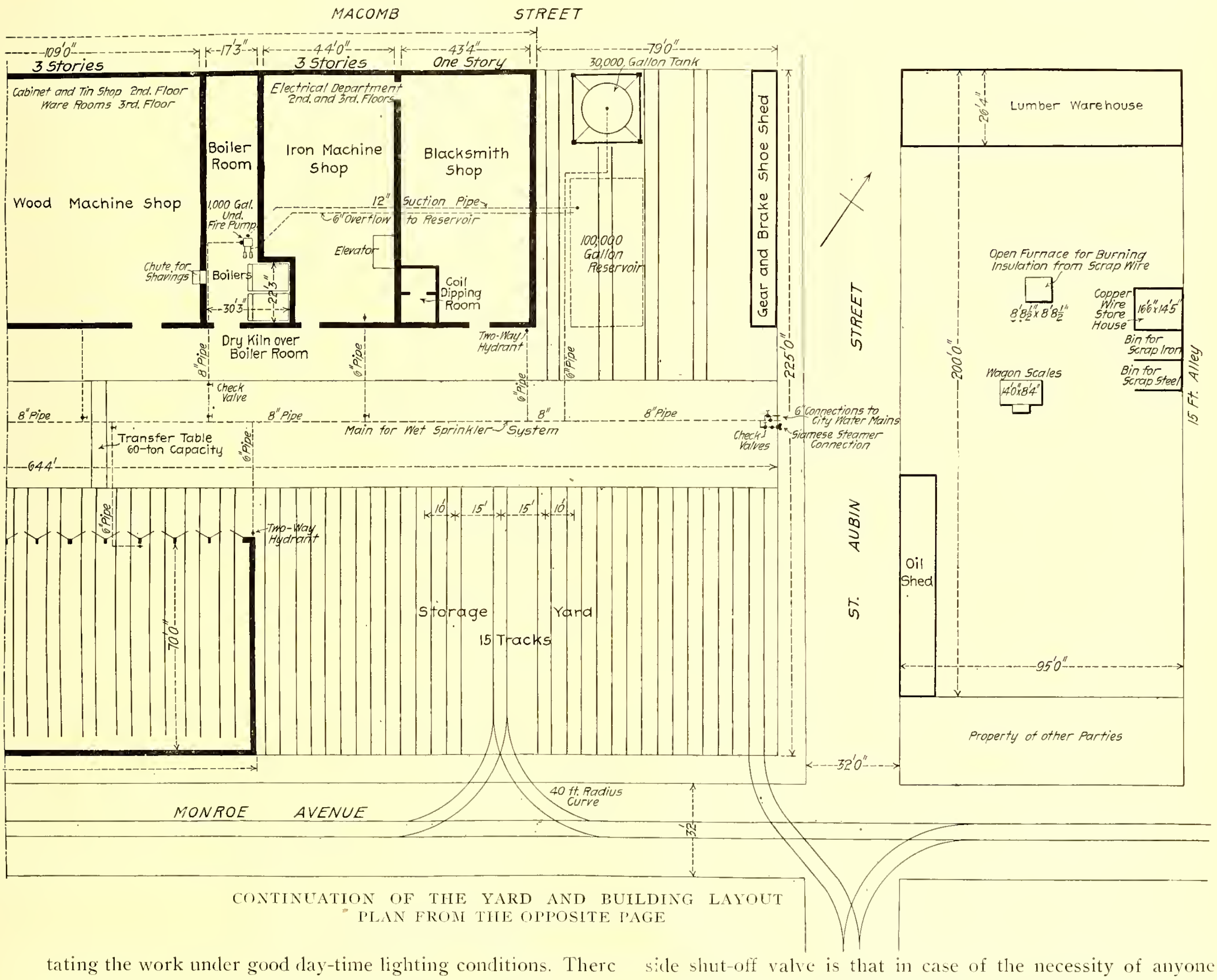


PART YARD AND BUILDING PLAN OF THE NEW MONROE AVENUE REPAIR SHOP INSTALLATION OF THE DETROIT UNITED RAILWAY COMPANY

THE BUILDINGS

Few changes were found necessary in the arrangement or sizes of the buildings from those used by the Pullman Company, the original layout having proven well adapted to the requirements of the present work. Some slight changes in the arrangement of tracks in the truck, wheel and paint shops were made, which merely necessitated the rearranging of the large double doors leading to the transfer table, and also pits were built in several of the truck shop tracks. The blacksmith shop, however, was somewhat reduced in size, a building which formerly extended to the eastward from that department having been removed. Also minor changes in buildings were made in numerous instances to accommodate the particular work in hand, but no sweeping changes were involved.

The buildings are in general one story in height, although in sections they are raised to two and three stories. The offices, for instance, occupy the space above the stock room on the Monroe Avenue side, all of the rest of the building upon this side of the block being one story in height. Upon the Macomb Street side the portion of the building occupied by the wood-working shop and the machine shop is three stories in height, while the sections occupied by the paint supply room and the wash room are two stories in height. All the remainder of the structure upon the Macomb Street side is one story in height. The construction of the building is of the well-known mill type throughout, flat roofs with gravel covering being used in general. Skylights are provided in all of the one-story sections, in addition to the abundant side window lighting, for facilitating the work under good day-time lighting conditions. There is nothing novel in the construction of the shop buildings, although the use of the mill type of construction is of interest on account of its having been found best adapted for meeting the requirements of the insurance underwriters in electric railway car house and shop work.



CONTINUATION OF THE YARD AND BUILDING LAYOUT PLAN FROM THE OPPOSITE PAGE

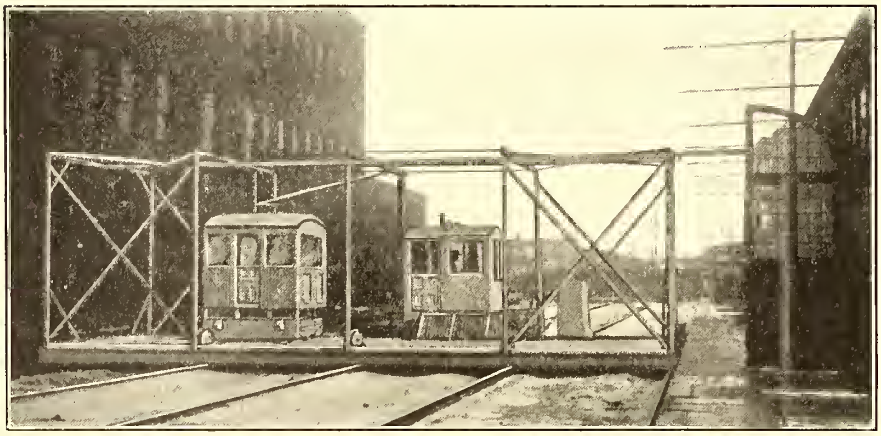
FIRE PROTECTION

In compliance with the recent recommendations of the fire insurance companies, a wet sprinkler system has recently been installed throughout the shop plant, which, it is thought, will reduce the danger of fire to a minimum. As may be noted from recent tests of the wet sprinkler system in car house work, as recorded in the columns of this journal, the wet sprinkler system is, when properly installed, best adapted to the protection of the buildings and rolling stock under the conditions of electric railway operation of any of the protective systems. The installation of the wet sprinkler system is the result of a very careful study which was made of the methods of protection from fire, not only under electric railway conditions, but under all conditions of factory operation, with the result that the prohibitive insurance rates formerly demanded were avoided and, in addition, the benefits of the insurance mutuals acquired. The contract was placed with the General Fire Extinguisher Company, Cleveland department, for the installation of a system of this type of the most improved construction.

The equipment as installed provides for the division of the buildings into eleven distinct and separate systems, each of which is supplied through an outside controlling valve in the shop yard, which may be used to shut off its system independently of the others. The idea of this provision of an outside shut-off valve is that in case of the necessity of anyone attempting to shut off the system in a department owing to a large fire there, they would not be driven away from the valve by fire and smoke, as would be the case if the shut-off valves were located inside the building. The sprinklers are distributed throughout the ceilings of every room and upon all floors of all of the buildings, each sprinkler being arranged to cover an area of about 60 sq. ft. The type of sprinklers used is the Grinnell sprinkler head, which was described on page 53 of the Jan. 7, 1905, issue of this journal.

The sprinkler system is supplied, in connection with the elevated tower tank, by a large steam pump of the fire underwriters' type, which has a capacity of 1000 gals. per minute and is capable of throwing four fire streams, maintaining a pressure of 125 lbs. on each stream. This pump is always kept under steam pressure and is equipped with an automatic governor in the steam supply, which maintains a constant water pressure of the entire sprinkler system and hydrants of about 80 lbs. In case of fire in any part of the plant and the consequent opening of any one of the sprinkler heads, the release of pressure upon the sprinkler system operates through this automatic governor to start the pump in action at once; the pump will then, of course, continue working until water is shut off from the system. At the base of each of the eleven sprinkler supply risers in the various departments there is a special alarm valve which connects with an annunciator in the engine room. In case of fire in any one of the sections and consequent flow of the water, this annunciator operates an alarm gong, immediately notifying the engineer or watchman in charge in what section of the plant the fire is located.

The underwriters' pump takes its supply from the large underground reservoir, shown adjacent to the blacksmith shop, which has a capacity of 100,000 gals. The suction from this reservoir to the pump is through a 12-in. pipe, the pump delivering to the wet sprinkler line through an 8-in. connection, as shown. The immediate connection from the delivery line to the elevated tower tank above mentioned is made near the main reservoir through a 6-in. pipe line, as indicated in shop layout plan. This elevated tank is a wooden tank of 30,000 gals. capacity, located on a 65-ft. tower of structural steel construction. The effect of the pressure from the pump upon the delivery system is to maintain this tank full of water through the connections indicated, which serves as an additional precaution in maintaining pressure upon the delivery system; in case of fire and the flow of the water through the sprinklers, the tank naturally assists the pump in maintaining the pressure, and is, furthermore, obviously an important check upon the system in case of a possible failure of the pump or its steam supply.



VIEW OF THE TRANSFER TABLE USED AT THE DETROIT SHOPS FOR HANDLING CARS, AND ALSO THE SHIFTING LOCOMOTIVE

In addition to the above methods of water supply for the system, there are two 6-in. connections with the city water mains upon St. Aubin Avenue, as indicated at the east end of the transfer-table pit; these are arranged to be easily and conveniently opened in case of failure of water supply elsewhere. A further supply source is provided in the form of a Siamese connection, which projects through the yard wall at St. Aubin Avenue, to which city fire engines can be connected so as to pump directly into the underground delivery system, if desired. This arrangement therefore provides in effect three separate and distinct sources of water supply for the system, with the additional precautionary check upon them in the form of the elevated tank.

An important auxiliary protection is to be noted in the arrangement of outside sprinklers, which are provided over each window on the two floors of the three-story shop building above the woodworking and machine shops. These sprinklers are arranged to be turned on by hand in case of fire in the one-story paint shop building adjoining, in which case they will flood with water each of the windows on this exposed side, and would thus prevent the fire from entering the three-story building on that side. There is also provided one row of similar outside sprinklers on the two-story office building over each of the windows facing adjoining roofs, so that they may also be opened in case of a serious fire in the one-story section on either side.

THE STOCK AND SCRAP MATERIAL YARD

The material yard on the opposite side of St. Aubin Avenue has been referred to above, this plat of ground, 200 ft. x 95 ft. in area, being devoted to the storage of material and supplies of all kinds, and also for all classes of scrap which may accumulate in the shops. As may be noted, at the north end of this yard is located a dry lumber warehouse, 26 ft. x 95 ft. in size, in which is stored all the kiln-dried stock lumber for use in the woodworking shop. This building is a frame structure, one story in height, and is provided with racks for conveniently classifying the various grades and sizes of lumber. It is provided with doors not only into the yard but also opening to the adjacent streets, by which lumber may most easily be handled to the shops.

At the opposite end of the yard is located an oil storage building in which are kept the stock supplies of all classes of lubricating oils, and also the kerosene and gasoline used in the shop work. This stock is kept in a low building of light construction, which is confined to a portion of the yard where a minimum of damage would occur to adjacent property in case of fire. This building is, of course, kept locked at all times, and all possible precautions are taken to prevent this danger.

The scrap bins are located at the east side of the yard, those for iron and steel scrap being of open construction, while that for copper scrap is covered and kept carefully locked. In this connection an interesting practice is in use here of burning all scrap copper wire, field coils, etc., to remove the insulation, so that in selling the scrap exact estimates may be had of the net weight of the copper. This is accomplished in the large open furnace indicated in the drawing at the middle of the yard; this furnace is a low chimney of brick construction, with a large opening on one side, and is arranged with a plain grate upon which to locate the coils and bundles of wire in burning. This practice is found very profitable in the selling of the copper scrap, as the work of burning is very inexpensive, owing to the use of wooden refuse, etc., from the shops; the knowledge of exact weights has been found a source of considerable profit over the former method of estimating the tare allowance for the insulation, which was usually much in favor of the junk dealer. The balance of the yard is devoted to the storage of iron and steel stock of all kinds, and also materials of metal construction which are not injured by outdoor storage, such as couplers, wheels, air-brake tanks, etc.

The excellent facilities which have been provided for the machine, blacksmith and woodworking departments of the plant, as well as also for the electrical repair work, will be referred to in another article to be presented in the following issue. Also some of the interesting operative methods pursued at these shops will be made the subject of an article in a later issue.

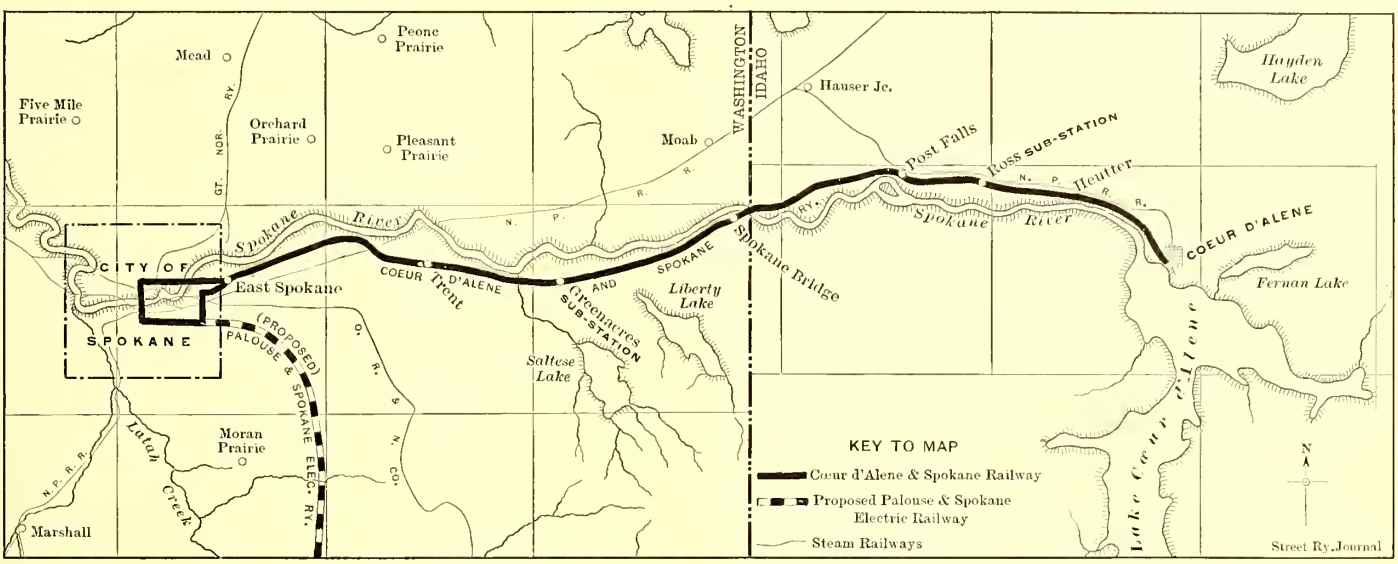
After lauding the Washington Railway & Electric Company, of Washington, D. C., for an expression of appreciation of the services of its employees, that took the substantial form of an increase in wages, the Washington "Post" pays a tribute to the efficient management that has made the system "modern in all respects and a credit to the Capital of the Nation."

THE COEUR D'ALENE & SPOKANE RAILWAY

Interurban railroading in the Western States has naturally not been developed on as extensive a scale as that upon which it has come to be operated throughout the East. The reason obviously is that the West has lacked large cities, small towns close together, and well-settled farming and residence communities, which warrant the heavy investments in this field of electric traction. However, those few interurban railways which have been built west of the Rocky Mountains, have found business profitable, and many more such roads are now projected or are already under construction. The conditions under which each is built are necessarily peculiar to that one, but in most instances the handling of freight plays a very important part in the success of the undertaking.

Such is accordingly true of the railway inaugurated less than a year ago by the Coeur d'Alene & Spokane Railway Company, Limited, to run between Coeur d'Alene, Idaho, and Spokane, Wash., a distance of about 34 miles. Spokane, a very prosperous and growing city, located inland, draws its business chiefly from the great wheat lands in its vicinity, and also from the neighboring mining districts, which are rich. Its population numbers about 60,000, and there are no other cities of this size within a radius of 400 or 500 miles. Coeur d'Alene, the eastern terminus and headquarters of the electric railway, has a population of about 4000, and is beautifully situated at the northern end of Lake Coeur d'Alene. It is the chief shipping point of the Coeur d'Alene mines, with boats running to all parts of the lake as well as up the St. Joe and Coeur d'Alene Rivers. Over sixty steamers of various sizes regularly ply the waters of this lake.

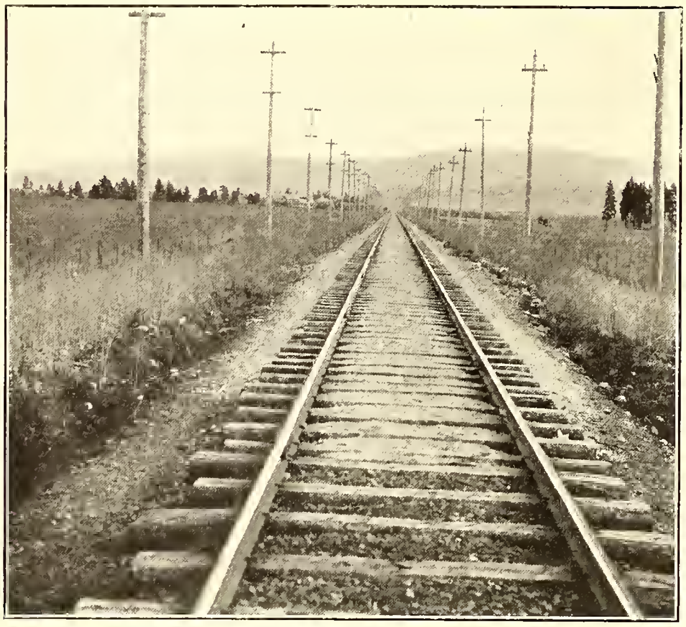
Between the terminal cities of the road there is but little intermediary business that would seem to warrant the building of the line, the land being mostly arid and only partially under irrigation or improved. Post Falls, with a population of 600 and a few mills, is practically the only town on the way. Coeur d'Alene is connected with Spokane also by the Northern Pacific Railroad, through a branch from the main road, but this service seemed to invite rather than to discourage competition. After a thorough study of the situation, and a careful canvass of the probable business, F. A. Blackwell, of Coeur d'Alene, interested some of his Eastern friends in the project and the road was built. That the undertaking was a wise one is indicated by the facts that the operation is successful and that a profitable interest on the investment is already being returned.



MAP SHOWING THE TERRITORY TRAVERSED BY THE CŒUR D'ALENE & SPOKANE RAILWAY

A FOUR-CAR TRAIN ON THE CŒUR D'ALENE & SPOKANE RAILWAY

As shown on the accompanying map, the railway follows the valley of the Spokane River, which is the natural outlet of Lake Coeur d'Alene. About midway between the termini, the road crosses the river, $37\frac{1}{2}$ ft. above the surface of the water, on a 600-ft. wooden truss bridge, and at the same time also crosses the dividing line between the States of Idaho and Washington. The track is of standard gage and is laid with 60-lb. standard A. S. C. E. section T-rail in 30-ft. lengths. The roadbed consists of hewn fir ties 7 ins. x 7 ins. x 8 ft., laid 2-ft. centers, and thoroughly ballasted with rock gravel. This ballast was nearly all taken from the right of way. The rails are connected with angle-iron bars, the joints being suspended, and are bonded throughout with Brown plastic bonds. Whenever necessary, the track is drained with tile laid 8 ins. under the ties.



TANGENT TRACK 3½ MILES LONG, SHOWING BALLAST AND GENERAL APPEARANCE OF TRACK NEAR CARDERS STATION, WASHINGTON

There is a gradual up grade from Spokane to Coeur d'Alene, averaging 0.15 per cent. The heaviest grade is 1.2 per cent, and the maximum curvature is 8 degs.

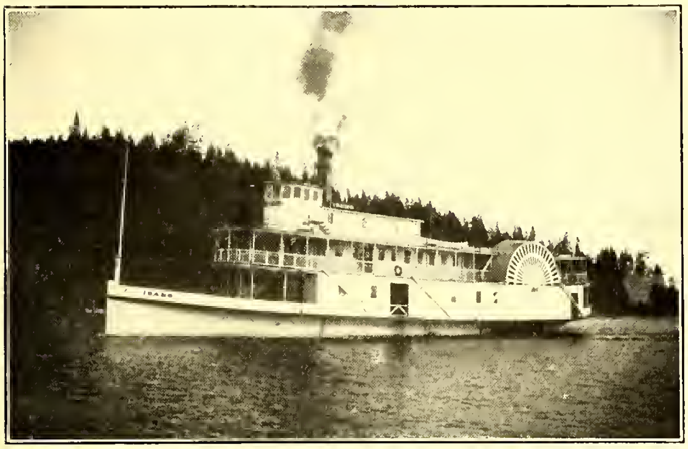
Side-pole overhead construction is used with 35-ft. poles, spaced 100 ft. apart. The trolley wire is No. 0000, figure 8, and is suspended 22 ft. above the track. Power is purchased from the Washington Water Power Company, being transmitted from that company's water-power plant in Spokane to two rotary-converter sub-stations, located at Green Acres and Ross, 14 and 25 miles, respectively, from Spokane. The transmission voltage is 22,000 volts three-phase. The equipment at each sub-station consists of one 200-kw rotary converter and three 100-kw oil-insulated transformers, the rotaries feeding onto the line through No. 000 and No. 0000 feeders. The company's business has grown beyond the capacity of the sub-stations, and there have been ordered two 400-kw rotaries and six 150-kw transformers, it being the intention to add one rotary and three transformers to the equipment of each station. Separate brick houses will be erected for the transformers, as the station buildings are of wood. With the new machinery installed, the large rotaries will be regularly used, the smaller ones being switched in on heavy loads. All the electrical machinery is of Westinghouse manufacture.

The company opened the line for traffic on Dec. 26, 1903, using temporarily two small street cars that were borrowed from the Washington Water Power Company. These cars seated but sixteen people each, but frequently had to carry

BRIDGE CROSSING SPOKANE RIVER; ALSO SHOWING THE IDAHO-WASHINGTON BOUNDARY LINE

The company has a private right of way, ranging from 60 ft. to 200 ft. wide, for 22 miles. Where the line crosses the Northern Pacific, an under-grade crossing is made by means of a concrete subway. Near Post Falls, a fill 51 ft. deep and 300 ft. long was necessary, and at another point, a 35-ft. cut was made.

forty. At that time neither of the sub-stations was completed, and the cars were operated the entire length of the line from railway voltage received at the Spokane end. It is needless to state that the voltage dropped to almost nothing at the eastern end, and the service could hardly be of the best. By the middle of January, the company's own cars were received, and by the 25th of that month, one sub-station was running, so that the service was greatly improved. On the 1st of May the other



STEAMER "IDAHO," ON RED COLLAR LINE, CŒUR D'ALENE LAKE AND ST. JOE RIVER

sub-station was completed, and since that date the operation has been very satisfactory.

The rolling stock of the company comprises five combination passenger and baggage motor cars, two express motor cars and seven passenger trailers. The two larger combination cars are 40 ft. over all, and are equipped with four Westinghouse No. 76 motors and L-4 controllers. Each of the other three has four Westinghouse No. 56 motors and K-14 controllers. The express cars are equipped with two Westinghouse No. 76 motors and K-6 controllers. The combination motors each have a seating capacity of twenty-eight, and the trailers each seat from thirty-two to thirty-six. The cars were built by the American Car Company and are equipped with Westinghouse automatic air brakes. They are heated by Peter Smith hot-water heaters. The cars are always run in trains of two or three for passenger service, and occasionally four-car trains have been operated. The average maximum speed is 50 miles an hour, although a speed of 65 miles an hour is often attained on certain portions of the track. It is now planned to add two additional trains to the rolling stock, each to consist of one motor and two trail cars, to provide for the next summer's traffic. These new cars will be about 52 ft. long.

At Coeur d'Alene, the line terminates at the shore of the lake, where the company owns 20 acres. Here are located the depot and general office building, the freight house, repair shop and car house. Two docks, extending out to deep water, are used for passenger and freight business in connection with the boat lines. At the Spokane end, the cars operate over the lines of the Spokane Traction Company, the depot being in the center of the city.

The regular train schedule provides for six daily passenger trains each way, and three baggage trains which also carry passengers. The passenger trains make the run with regular stops in eighty or ninety minutes, while the baggage trains generally take ten or fifteen minutes longer. There is one limited passenger train, called the "Shoshone Flyer," leaving Spokane at 7:40 a. m. and Coeur d'Alene at 5:30 p. m., which stops at Post Falls only, and makes the run in an hour and ten minutes. On Sundays as many as twenty trains have been operated each way, the service being regulated by the demands of the traffic. At Coeur d'Alene, regular daily connections are made with five boat lines for all points to the south on the lake and rivers.

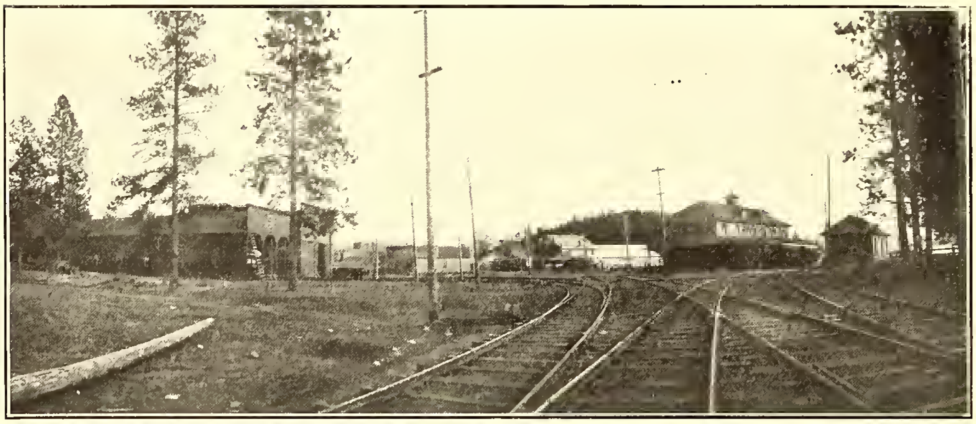
In one of the accompanying illustrations is shown the steamer "Idaho" of the Red Collar Line, one of the six passenger boats plying on Lake Coeur d'Alene and the St. Joe River in connection with the electric railway. The capacity of the "Idaho" is 1000 passengers, and its cost was about $40,000. The passenger business of the electric railway has shown an increase from 8000 carried during January last, to over 33,000 carried last

THE GREEN ACRES SUB-STATION OF THE CŒUR D'ALENE & SPOKANE RAILWAY

July. The company gets practically all the local freight business between Coeur d'Alene and Spokane, on account of its splendid terminal facilities and frequent service. Its earnings from this source are about $100 per day and are steadily increasing. Considerable business is done in hauling carload lots, principally of lumber, as there are several saw mills at Coeur d'Alene. Track connection is made at Spokane with the Oregon Railroad & Navigation Company's lines, and the loaded

DOCKS AT CŒUR D'ALENE. THE TWO ON THE LEFT ARE THE CŒUR D'ALENE & SPOKANE RAILWAY COMPANY'S DOCKS cars are consigned directly to their destination. The heavy freight is handled chiefly at night, steam locomotives being used. The freight equipment of the road comprises two locomotives, twenty box cars and forty flats.

The railway is operated entirely under steam railroad rules and regulations. All motormen and conductors are required to have had three years of steam road practice, and the motormen must have been locomotive drivers. The wages of both motormen and conductors are 30 cents an hour, and this rate is paid from the time the men go to work in the morning until they are off in the afternoon or evening. The actual running time of each man is about six hours, but their day's work is about twelve hours long, the remainder of the time being given up to lay-overs at the terminals. Brakemen are required on the trailers, and they are paid 20 cents an hour. The entire line is operated by means of a telephone despatching system in the usual manner.



PASSENGER DEPOT, FREIGHT HOUSE, CAR HOUSES AND MACHINE SHOPS AT THE TERMINAL YARD OF THE CŒUR D'ALENE & SPOKANE RAILWAY

Among the improvements planned for the new year is the expenditure of about $10,000 in the development of a 20-acre park and pleasure ground which the company owns at Coeur d'Alene. The property includes the site of old Fort Sherman, and is picturesquely located on the shores of the lake. The company is also interested in the erection of a $75,000 hotel at Coeur d'Alene. In the way of extension, a 2-mile line will be built from the east end of the system to Silver Beach on the northern shore of Lake Coeur d'Alene. A branch from a point near Green Acres to Liberty Lake is also a possibility in the near future. At the Spokane terminal, commodious passenger and freight stations are to be erected, the former in conjunction with the Spokane Traction Company.

The Coeur d'Alene & Spokane Railway Company, Limited, is incorporated under the laws of Idaho, with a capital stock of $500,000. Its officers are as follows: President, F. A. Blackwell; first vice-president and general manager, R. F. Blackwell; second vice-president, Jay P. Graves; secretary, C. P. Lindsley; treasurer, William Dollar; assistant secretary and auditor, Ira H. Shallis; chief engineer, J. C. White; general counsel, E. H. Belden; traffic manager, Waldo G. Paine.

Boy bandits, armed to the teeth, recently terrorized Binghamton, N. Y. One of their daring deeds was to emulate the example of the doings of the men who carried out the famous car house robbery in Chicago. Their deed at the car houses of the Binghamton Railway Company was executed in the quiet of the afternoon. They broke into a room and secured tools with which they proceeded to cut through a partition in the supply room of the car house. A lineman discovered them, but he was promptly covered with a gun. The bandits then made good their escape. It was several days before the boys were all captured by the police, and restitution was made of goods stolen from those who had been selected as promising prey.

THE POWER-DISTRIBUTION SYSTEM OF THE LOUISVILLE RAILWAY COMPANY

An extensive polyphase power-distribution system has recently been installed at Louisville, Ky., by the Louisville Railway Company for its own lines, and also for the suburban roads out of the city of the Beargrass Railway Company, which, like the railway company, is controlled by the Louisville Traction Company.

The alternating-current system now in operation is almost completely independent of the direct-current plant. It consists of a power plant and three rotary converter substations. For the accommodation of the alternating-current generating plant an addition was built on the western end of the d. c. power station at Jacobs and Campbell Streets. Six 250-hp Babcock & Wilcox boilers equipped with mechanical stokers are installed in the new boiler room. The new and old boiler room, together containing sixteen 250-hp Babcock & Wilcox boilers, supply the same steam header. There are two 1650-kw a. c. generating units, consisting of Allis-Chalmers engines and Westinghouse generators. The engines are of the cross-compound condensing, vertical type, with cylinders 40 ins. x 78 ins. x 60 ins. The unusually low speed, 63 r. p. m., is the result of a demand for such by the railway company, this being occasioned by the satisfaction obtained from previously installed direct-current units speeded to 60 r. p. m. Barometric condensers are employed, the pumps for these being located on

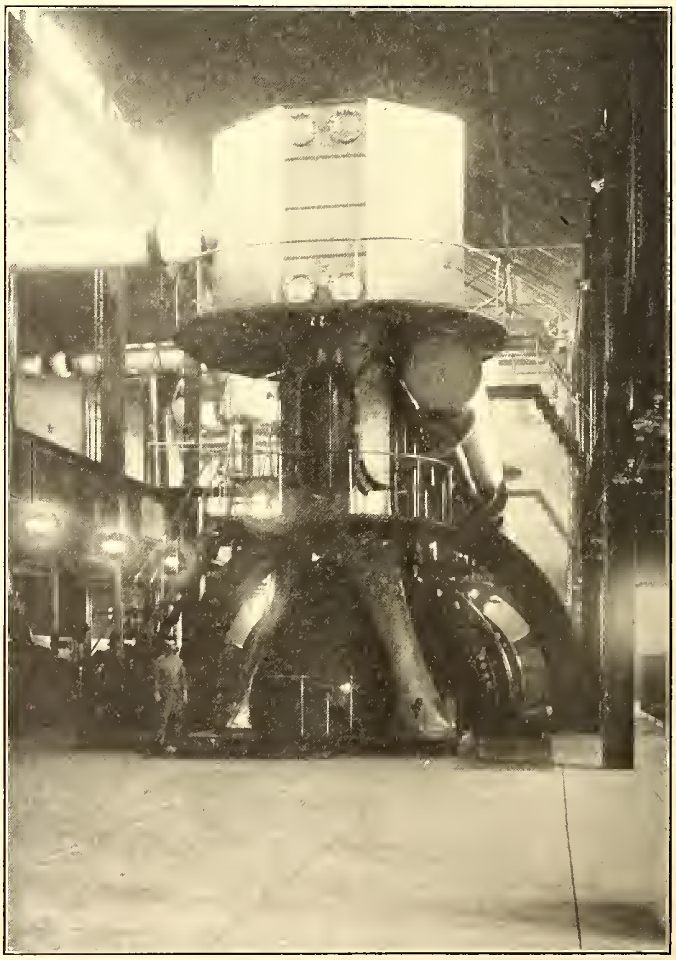


FIG. 1.—THE 13,200-VOLT GENERATOR AND VERTICAL ENGINE

the main engine room floor. The condenser water is obtained, from Bear Grass Creek, near by the station.

The generators deliver three-phase current at 25 cycles and 13,200 volts. Two exciter dynamos, one direct connected to a steam engine, the other driven by an induction motor, supply current to the revolving fields. The switchboard gallery is shown in Fig. 4. The switchboard itself consists of nine panels,

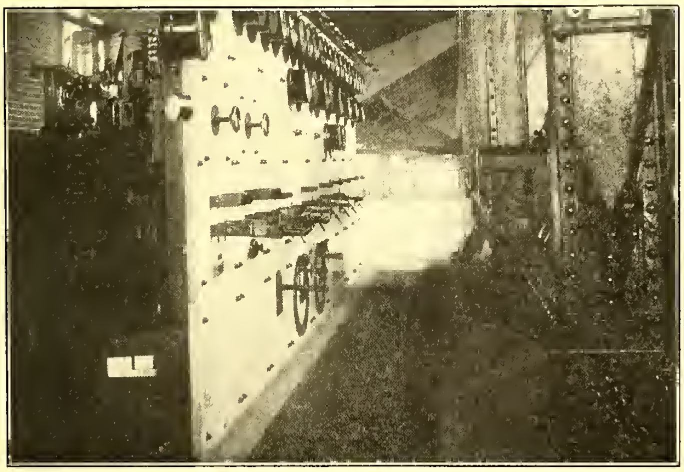


FIG. 2.—SWITCHBOARDS AND GALLERY

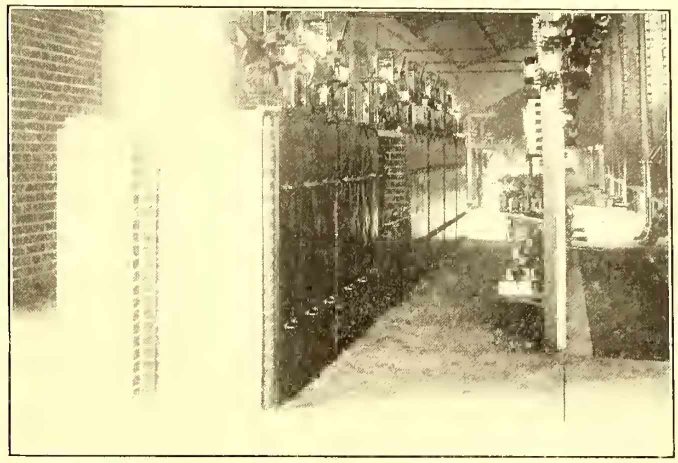


FIG. 3.—OVERLOAD RELAYS AND HIGH-TENSION OIL SWITCHES

two generator panels, three for the exciters and four controlling the transmission lines to the three sub-stations, sub-station No. 3 being supplied by two sets of transmission lines. Behind the switchboard are the overload relays and electrically controlled switches for the high-tension circuits; cut-out switches are placed on either side of the controlling switches.

Of the three sub-stations, the one termed No. 3, located at Twenty-Eighth and Walnut Streets, in the western portion of the city, is nearest the station, it being 4 miles distant. Sub-station No. 2 is 8 miles southwest, while the remaining one is

FIG. 4.—THE SUB-STATION AT JACOBS AND WALNUT STREETS

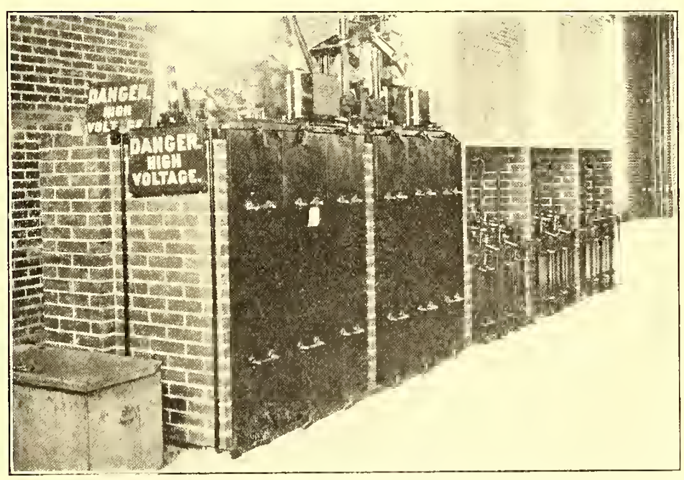


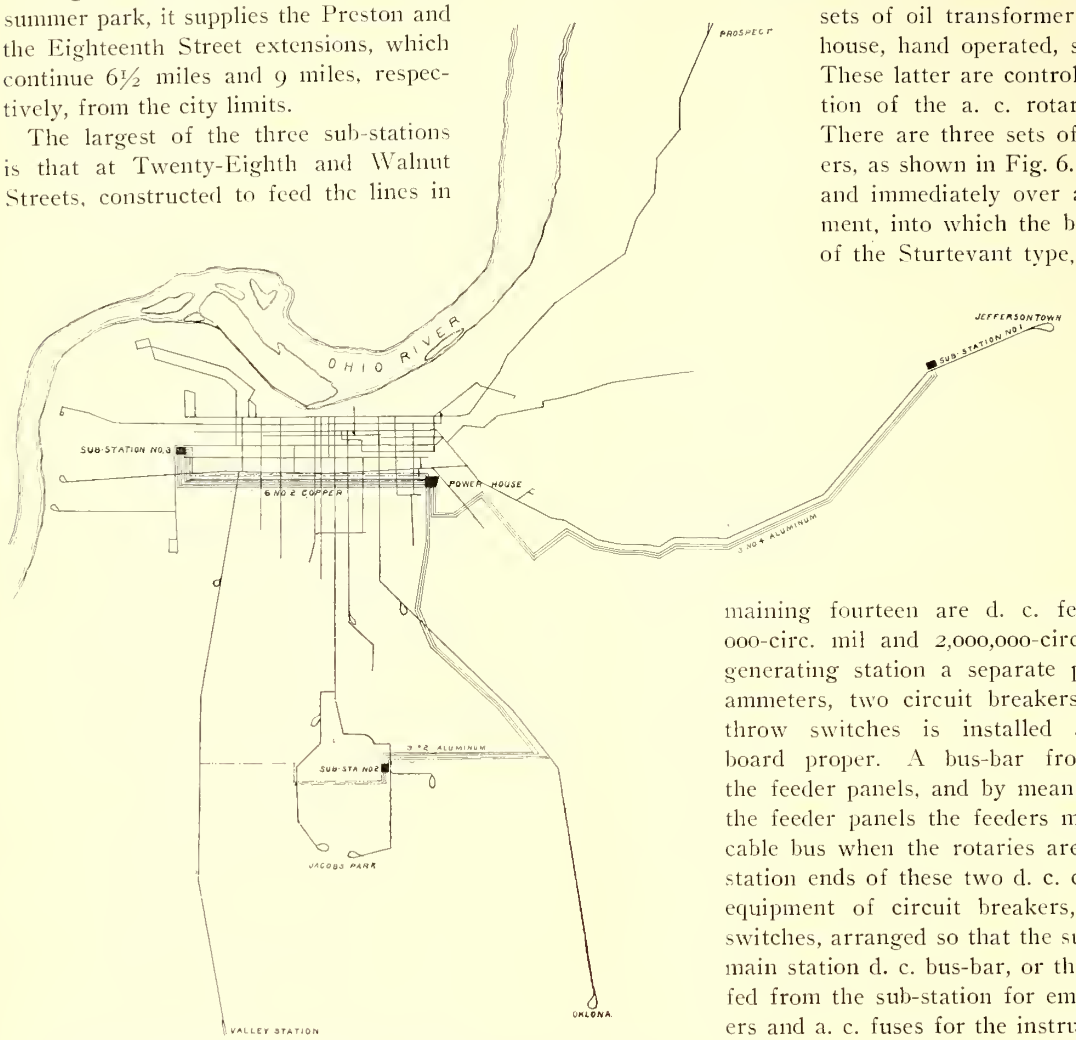
FIG. 5.—OVERLOAD RELAYS AND SWITCHES

east, about 10 miles distant. To the latter two stations the transmission lines are carried overhead on pole lines, sub-station No. 1 being supplied by three No. 4 aluminum cables, No. 2 station by three No. 2 aluminum cables. In supporting these feeders, No. 3 Locke insulators were used. Before being installed the insulators were given a break-down test of 30,000 volts, the company having installed in the power house for insulator testing and other high-voltage cable tests a 50-kw testing transformer capable of variations of voltage up to 50,000 volts.

Between sub-station No. 3, in the western portion of the city and the power station the high-tension wires are carried in an underground circuit. The conduit system, which was constructed by the G. M. Gest Company, has double manholes, one side for high-tension and the other side for low-tension 550-volt d. c. cables, separated from each other by a 6-in. wall of concrete. The conduit system was constructed with a much greater capacity of ducts than is at present demanded. On leaving the station there are six a. c. ducts, only two of which are occupied. There are also thirty-five d. c. ducts, which at present contain two positive cables and four ground return cables of 1,000,000 circ. mil capacity. It is the intention, however, to place all of the d. c. feeders leaving the station underground, and for this reason the large number of ducts were installed. The two a. c. cables in the conduit go to the No. 3 sub-station at Twenty-Eighth and Walnut Streets. Each a. c. cable contains three No. 2 copper conductors. Paper insulation 5-16 in. thick surrounds each conductor, and jute fills the space between the wires. Paper insulation of the same thickness as that around each conductor covers the jute. The whole cable is enclosed in a lead sheath 9-64 in. in thickness. The two direct-current feeders are also carried from the power station to the sub-station at Twenty-Eighth and Walnut Streets, and were installed to supply the sub-station d. c. feeders at times when the load is not great enough to warrant running the a. c. generators and for emergency. One cable is of 1,000,000 circ. mil, the other of 2,000,000 circ. mil capacity. Both are lead sheathed and insulated after the manner of the a. c. cables, with 9-64-in. lead and 6-32-in. paper.

In general design the three sub-stations are similarly constructed. Sub-station No. 1, east of the station, is located on the interurban line to Jeffersontown, 2 miles from the terminal of the road and 10 miles from the generating station. The possibility of future extensions caused its location so near the terminal of the line. The station contains two 200-kw rotary converters, with the necessary auxiliary apparatus. Sub-station No. 2, located on the Third Street line, south of the city limits, contains two 500-kw rotary converters. In addition to feeding the Third and Seventh Street lines to Jacobs Park, a summer park, it supplies the Preston and the Eighteenth Street extensions, which continue 6½ miles and 9 miles, respectively, from the city limits.

The largest of the three sub-stations is that at Twenty-Eighth and Walnut Streets, constructed to feed the lines in



FEEDER DISTRIBUTION SYSTEM OF THE LOUISVILLE RAILWAY COMPANY

the western portion of the city and the three parks, Fontaine Ferry Park, Shawnee Park and Riverview Park, located on

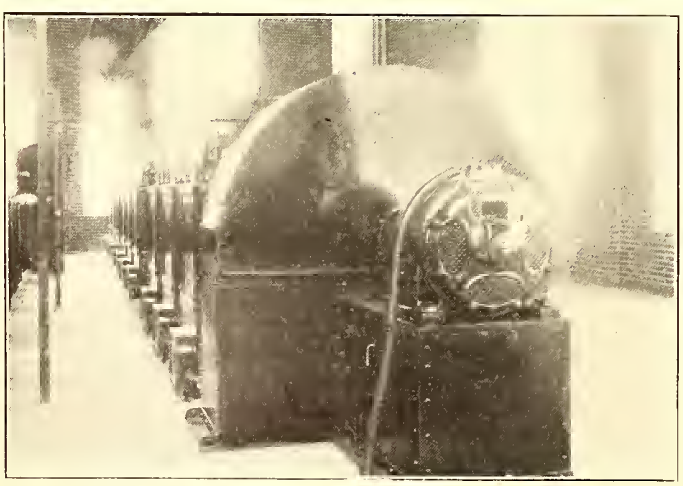


FIG. 6.—TRANSFORMERS COOLED BY BLOWERS DRIVEN BY INDUCTION MOTORS

the river. A description of this sub-station in general applies equally well to the two others, except in that they differ in capacity. The exterior of the building is shown in Fig. 4. It is a one-story fireproof structure, with floors of reinforced concrete. The roof, which is of cinder concrete, covered with slate, is carried on steel trusses. The conduits containing the high-tension cables enter through the basement, and the cables are carried up to the high-tension oil switches provided with overload relays, shown in Fig. 5. They then go to the three sets of oil transformer switches, type "E" Westinghouse, hand operated, shown in the same engraving. These latter are controlled by levers in the lower section of the a. c. rotary panels of the switchboard. There are three sets of 187-kw air-cooled transformers, as shown in Fig. 6. These are arranged in a row and immediately over a closed chamber in the basement, into which the blowers exhaust. The blowers, of the Sturtevant type, are driven by 6-hp induction motors.

The switchboard is made up of twenty-three panels, two of these being for the control of the entering high-tension transmission lines, one for the blower motor and the ground detectors, three control the a. c. side of the rotaries, three others the d. c. side, and the remaining fourteen are d. c. feeder panels. For the 1,000,000-circ. mil and 2,000,000-circ. mil d. c. feeders from the generating station a separate panel carrying two 1500-amp. ammeters, two circuit breakers and two single-pole double-throw switches is installed at one end of the switchboard proper. A bus-bar from these cables runs behind the feeder panels, and by means of double-throw switches on the feeder panels the feeders may be connected direct to the cable bus when the rotaries are not in operation. The main station ends of these two d. c. cables are supplied with a like equipment of circuit breakers, ammeters and double-throw switches, arranged so that the sub-station may be fed from the main station d. c. bus-bar, or the main station bus-bar may be fed from the sub-station for emergencies. All the transformers and a. c. fuses for the instruments are located in the basement.

The three 500-kw rotary converters are shown in Fig. 8. These are served by a 10-ton overhead crane, built by the Northern Engineering Works, of Detroit, Mich. For facilitating the cleaning of the apparatus there has been installed in

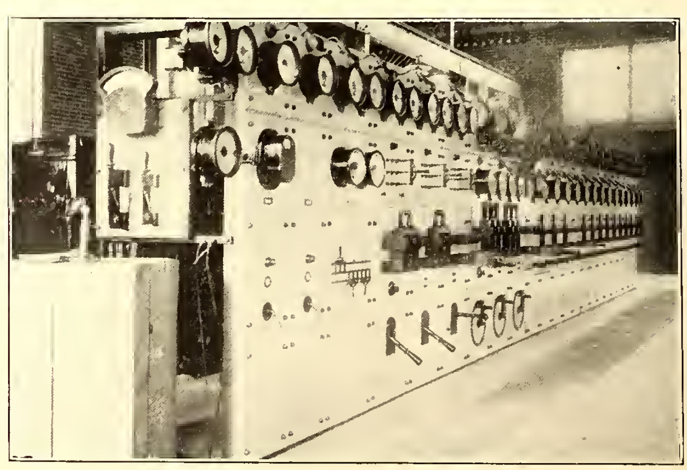


FIG. 7.—SWITCHBOARD IN THE JACOBS AND WALNUT STREETS SUB-STATION

the basement a National Electric Company AA-1 Christensen motor-driven air compressor and an air-storage tank. From the tank a pipe is carried to the upper floor, and to this an air hose is attached when it is desired to blow out the machinery.

While the apparatus of the system was installed by the

Westinghouse Electric & Manufacturing Company, the alternating-current system was designed by the Louisville Traction

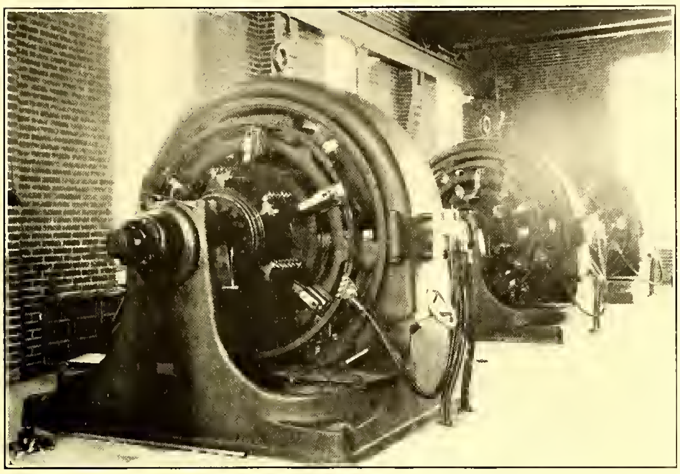


FIG. 8.—500-KW ROTARIES IN THE JACOBS AND WALNUT STREETS SUB-STATION

Company, for which F. H. Miller is superintendent of motive power.

FUEL, ASH AND GAS TESTING: II, APPARATUS

BY J. STANLEY RICHMOND

It is not within the limits of this article to give lists and descriptions of the apparatus required to equip the largest and the medium-sized laboratories before mentioned. For such laboratories would require a more or less competent chemist. And every chemist, naturally enough, prefers to select his own materials. Any company, however, requiring a larger laboratory, but only desiring to engage a college graduate to take charge of it, can easily arrange for some practical chemist to equip such and break the graduate in. The apparatus required for the smallest laboratory can be arranged under three heads—sampling and balance room and laboratory proper.

SAMPLING APPARATUS

Two hammers are required, one an ordinary machinist's chipping hammer and the other a flat-faced 4-lb. hammer with a face about 3 sq. ins. in area. Four sieves will be needed, having, respectively, meshes of ¾ in., ¼ in., ⅛ in. and 1-16 in. One ½-gal. cast-iron mortar and pestle, also one of wedgewood ware and about 6½ ins. in size, are requisite for the final sampling. A few quires of strong but somewhat flexible brown paper sheets also come in very handy. A tapering flat-bottomed scoop with a handle, somewhat similar to those used by grocers, will prove advantageous to the sampler; also one hand-sweeping brush and two or three different sized sash paint brushes. Besides the scales and their accompanying weights, previously mentioned, a set of cheap grain weights will be required; also one 7-in. steel spatula. Two or three gross of round tin cans of such a size that one of them will hold about ½ lb. of coal should be ordered; also a form of sample label gotten up and a few gross ordered from the printer. These cans are for the purpose of storing for a short time the remaining portions of each sample after the laboratory samples have been taken. Two cans should be filled from each sample and wrapped up in paper and sealed with the seal of the sampler. These are in case of any question arising between the buyer and the seller as to the results obtained by the chemist.

BALANCE ROOM APPARATUS

A mistake made by many embryo chemists taking charge of such elementary assay work as that which is to be described is the purchase of a much too sensitive balance. Such mistake, of course, can be traced to the lack of practical laboratory training and the use of balances in colleges which have been obtained by the professors for their very advanced scientific work. Laboratories handling an immense amount of assay work and having all grades of balances use for nearly all their commercial work, even when considerable payments are made on the resulting assays, the least sensitive balance they have. A suitable balance for the smallest laboratory is that known as Becker's, price $48. Such a balance is illustrated in Fig. 5. Inside this should be placed a 2-oz. beaker with a little sulphuric acid in it, and covered with a wire gauze top. This is to absorb the moisture from the air and thus prevent any rapid corrosion of the delicate parts of the instrument. A set of gramme weights graded from 20 grammes to 1 milligramme should be used.

One 8-in. desiccator will be sufficient for the limited amount of work to be undertaken. This should have some sulphuric acid in the bottom of it, and the edge of the glass cover should be greased with a little clean vaseline. Over the dish should be fitted a piece of wire gauze to serve as a rest for samples or assay apparatus. The purpose of the desiccator is to prevent the absorption of moisture by the material enclosed in it. An ordinary plain ruled ledger is suitable to enter the results in first, and they should be transferred afterward to a special ledger containing ruled and printed blanks. Some faddists believe that better work can be obtained with a balance if the weigher is not provided with a stool. This is not the the case, however, for the writer tested this question by using a stool for several months and not using one for a similar time. The results were all in favor of the stool. The library should not be equipped with "Roscoe and Shorlemner" books. Small treatises written by specialists, each treatise on the assay of one material, should be gradually collected as required, due to the perhaps increasing scope of the occupant's work. The desk should be of the roll-top order, for the assayer has to make frequent trips between the laboratory proper and such. He should be able, therefore, to close up his desk without the necessity to straighten out or put anything away. A small 3-in. steel spatula is satisfactory for the work in this branch of the work, and half a dozen camel-hair brushes are necessary. Both these articles are used in the operations connected with the weighing of portions from the samples for assay. In using the balance, matter should not be placed in either pan except when such are resting on the supports, and the final test as to accurate balancing should be made with the front of the balance closed.

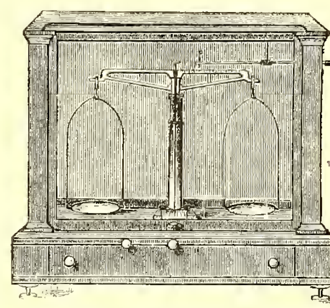


FIG. 5.—BECKER ANALYTICAL BALANCE

On no account should the balance be left with the front open. And just a word of caution at this point. The old-fashioned idea that the value of the work done in a laboratory by a chemist is in proportion to the amount of filth to be found in and about his surroundings is entirely exploded. There is no animal cleaner than the sewer rat. It has to be, if it is to live. The modern operating room of a hospital has to be very clean, if patients are to have a decent chance for their lives. Therefore, as the laboratory is a perfect hot-bed of filth and corrosive action, no chances must be taken—no putting off for even an hour what should be done at the minute; in fact, the laboratory should be like my lady's person, boudoir and reception room—spick and span, neat and trim, sweet and pretty.

LABORATORY PROPER

The water bath consists of a copper box within a larger one, the two being so brazed together that the inner one serves as a small oven with a hinged door, while the outer one is provided on top with circular holes and covers. By removing one of the covers, therefore, a dish can be put in its place over the boiling water contained between the two boxes. Such is known as a double-wall water bath, and a suitable size is 10 ins. x 12 ins. This is heated with a Bunsen burner, with the flame low. The water-distilling apparatus is composed of a 3-gal. copper retort and condenser, as illustrated in Fig. 6, and one heavy 3-ft. flat-base retort stand with an 8-in. supporting ring. The heat should be supplied by a 5-in. ring burner fastened to the rod of the stand by means of a clamp, and the distilled water should be collected and kept in a 5-gal. glass jar. The first portion of the distilled water should not be collected and the

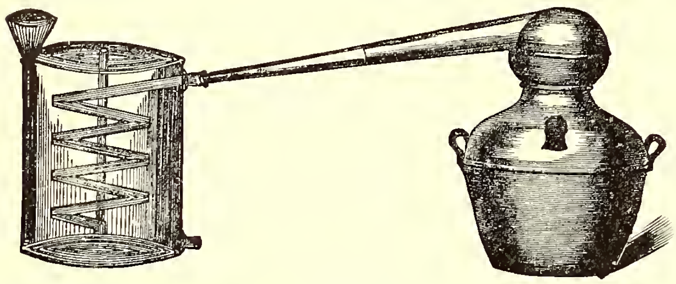


FIG. 6.—COPPER STILL AND CONDENSER

water in the retort should not be allowed to get too low. The jar should be provided with an outlet near to the bottom, which should be fitted with a bored cork. Through the hole in the cork should be forced a piece of glass tubing with a short piece of rubber tubing inserted over its outer end. The rubber tubing should be plugged with a short piece of glass rod which has had its ends rounded in the Bunsen flame.

The furnace for the muffle is of fire clay, and a No. 4 Fletcher will serve all the requirements of the smallest laboratory. After the muffle is inserted, the joint should be made up with a little good fire clay. For this furnace, Fletcher's No. 4 muffles with their accompanying domes are used; and a few spare ones should be kept in stock, especially if the necessary heat is obtained by means of the dental apparatus before mentioned, a suitable size of which is No. 141, with a large tank. The burner placed under the furnace to heat it is of the type known as solid flame, the gas passages consisting of circular slots. The right size will be supplied by the firm from whom the furnace is purchased; also two fire-clay doors, which, when placed one on top of the other, serve to close up the front of the muffle when extra heat without the admission of air becomes necessary.

One dozen 1¾-in. porcelain crucibles and two dozen covers for the same should also be ordered. The extra dozen covers should have the little rings on top of them pinched off with a pair of pinchers, as they are intended for use in the ash determinations. To accelerate the burning of the coal in such determinations, a piece of glass rod, into one end of which, when heated in the Bunsen flame, one end of about 8 ins, of No. 22 B. & S. gage platinum wire has been sealed, is used. The stirring of the burning coal with the free end of the wire permits the free access of air to each and every particle, while the glass rod serves as a handle and prevents the fingers from being burnt. A couple of fire-brick tiles should be placed on the table near to the furnace. On these are placed the porcelain crucibles and covers when first taken out of the furnace, which, when somewhat cooled, are taken to the balance room and placed in the desiccator preparatory to final weighing on the balance. To handle the crucibles and covers, two pair of tongs will be required, which are illustrated in Fig. 7. One of these should be of iron, known as 36-in. cupel tongs; while the other pair should be 8-in. brass crucible tongs. The iron pair is intended for the muffle manipulations, and the brass pair for carrying purposes between the muffle and the balance room.

The absorption apparatus for the gas tests is known as Dr. Elliott's apparatus for rapid gas analysis. This should be ordered complete—that is, the two tubes, the rubber tubing, the two small aspirators and the stand. An illustration of this apparatus will be given under the heading of tests.

One Winchester quart bottle each of ammonia, nitric acid, sulphuric acid and hydrochloric acid will come in handy. For the gas tests, about 2 lbs. of caustic potash (potassic hydrate), 2 ozs. of pyrogallic acid and ½ lb. of cuprous chloride should also be ordered. Six glass-stoppered 16-oz. liquid reagent bottles will be sufficient to start with.

Four cork borers, No. 1, No. 2, No. 3 and No. 4; about 25 ft. of heavy white gas tubing; about 12 ft. of 3-16-in. heavy black rubber tubing; about 1 lb. each of small and medium-sized glass rod and tubing; three Bunsen burners; two earthenware screens to protect the burners; corks to fit all the bottles and a few spare ones; two cast-iron triangles; three nests of beakers,

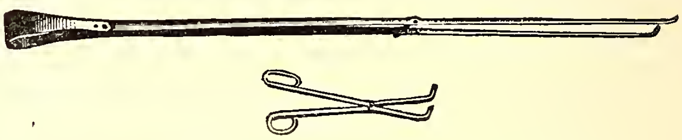


FIG. 7.—CUPEL AND CRUCIBLE TONGS

three in a nest of 2½ ozs. to 7 ozs.; two 20-oz. beakers; six glass covers, and about 2 sq. ft. of copper wire gauze should also be ordered.

A magnifying glass for examination of the coal should also be provided. For convenience, a tabulated list of the apparatus required is given:

One Becker's balance, $48.
One set of gramme weights (20 gms. to 1 m. gm.)
One steel spatula, 3-in.
One desiccator bell cover, 8-in.
One plate for same, 9-in.
One acid dish for same.
Three small camel-hair brushes.
One flat-faced, 4-lb. hammer.
One machinist's hammer.
One tapered flat-bottomed scoop.
Three quires of brown paper.
One hand sweeping-brush.
Three painter's sash brushes.
One well-balanced Fairbanks scale, with pointer.
One set of weights, 5 lbs. down.
One set of cheap grain weights.
One hundred and forty-four ½-lb. round tin cans.
Printed sample labels.
One brass seal.
Sealing wax.
One steel spatula, 7-in.
One Fletcher's No. 4 furnace.
Three spare muffles and dome for same.
Three small fire brick tiles.
One pair of 36-in. cupel tongs.
One pair of 8-in. brass crucible tongs.
Sixteen ins. of No. 22 platinum wire.
One 3-gal. copper still.
One condenser for same.
One 3-ft. heavy, flat-base, retort stand.
One 5-in. ring burner and clamp for same.
One 8-in. ring for same.
One 5-gal. glass bottle, plain bottom outlet.
One 10-in. x 12-in. double-wall water-bath and stand.
Three Bunsen burners.
Two eartherware screens for same.
Two cast-iron triangles for same.
Twelve 1¾-in. porcelain crucibles (R. M.)
Twenty-four porcelain covers for same.
Three 32-oz. Woulff bottles, 2 necks.
One 1-gal. aspirator.
One ½-gal. cast-iron mortar and pestle.
One 6½-in. Wedgewood ware mortar and pestle.
Corks for all bottles.
One bottle of C. P. ammonia.
One bottle of C. P. hydrochloric acid (Sp.G. 1.124.)
One bottle of C. P. nitric acid.
One bottle of sulphuric acid.
Two lbs. of caustic potash.
Two oz. of pyrogallic acid.

Eight oz. of cuprous chloride.
One lb. of small and medium glass tubing.
One lb. of small and medium glass rod.
One set of cork borers, Nos. 1, 2, 3 and 4.
Three nests of beakers (3, 2½ to 7 oz.)
Two beakers, 20 oz.
Twenty-five ft. of heavy gas tubing, ¼-in.
Twelve ft. of heavy back tubing, 3-16 in.
One set of Dr. Elliott's gas apparatus.
Tubing and aspirators for same.
One stand for same.
Six copper dishes, 1 lb. capacity.
Six 32-oz. glass-stoppered liquid reagent bottles.
One magnifying glass.
One 100-c. c. measuring flask.
One 1-pt. graduate.

RATES ON INTERURBAN ROADS

A number of interurban roads in the Central West have started on systematic campaigns for stiffening up their passenger rates. This is particularly true of Ohio roads. In that State no less than ten interurban roads have announced new tariffs taking effect in the near future. These steps are largely the result of informally comparing notes at the meetings of the Ohio Interurban Railway Association. A number of roads have found that they were actually losing money on certain classes of business and that their entire schedule of rates was too low to admit of reasonable profit on their investments. These roads were among the earlier ones, and they started out with rates which did not take into consideration a large number of expenses which modern methods of high-speed service have incurred. In several cases low rates between certain points were guaranteed to property owners and village municipalities by promoters who cared nothing for the future of the road. Certain roads are now confronted with these agreements, and apparently the only method of circumventing this situation is to retain the low local rate and increase the through rate, which, in effect, throws the increase upon the balance of the road.

It is the general sentiment in Ohio that local rates ought to average 2 cents a mile. Steam roads in this district retain the local one-way rate of 3 cents a mile and give a 10 per cent reduction on round-trip tickets. The mileage books of the Central Passenger Association give straight 2 cents a mile under very close restrictions. Compared with this the majority of Ohio roads are now selling the interchangeable coupon books adopted by the association. This gives 16⅔ per cent discount from the local rates, and where the latter are based on 2 cents a mile, it gives a rate of 1¾ cents per mile, which ought to be low enough to attract a great many traveling men.

The roads which have local rates in the neighborhood of 2 cents per mile have not, as a rule, gone below 1¼ cents per mile for commuters, and as these tickets or books are usually limited to sixty days, with no redemption for unused coupons, and as patrons frequently fail to use them up within the required time, it brings the average rate up to a point somewhat better than the rate mentioned.

On the other hand, a number of roads have been basing their local rates on 1½ cents per mile, with mileage books at 1¼ cents per mile and commuters' tickets at 1 cent per mile, and in many cases less than that figure. It is now obvious that no road can give good service and yield a reasonable return on the investment with such rates. Just at present the chief attention seems directed against the 1¼-cent mileage books. In several centers these books have been interchangeable on three or four roads. They have been good for several members of a family, and the restrictions placed against them have been loosely enforced. In the majority of cases it is the intention to replace these books with the standard form of the Ohio Association, giving a somewhat smaller discount and being good only for the owner, who must sign the coupon strip. The advantage offered to the buyer is that the transportation is good over a large number of roads instead of over but two or three. Then, by increasing the local rates, the interchangeable coupon rate is also brought up to a reasonable basis.

The demand for the free checking of baggage is one of the points which has precipitated this campaign for increasing rates. As already outlined in these columns, it is obvious to all that interline business, which is now becoming important, cannot be made uniformly successful without some standard scheme of handling baggage. It will be impossible to develop this business and allow some roads to charge for baggage while others carry baggage free, particularly in view of the fact that all steam roads carry baggage without charge. The roads which have been getting good rates are uniformly the ones which have dropped the charge on baggage and, according to all reports, their business has increased enormously thereby, as they are able to get the business of the traveling men. Incidentally, it is opportune to reiterate that the majority of the most successful roads have reached a point where they are preparing to carry baggage on all cars, particularly on all limited cars. The offer to carry all baggage free of charge, as an offset to increased rates, is an argument which will appeal to many people, particularly when the possibilities for long-distance interline travel at low rates are pointed out to them.

Many managers are dubious about attempting to increase rates because of fierce steam road competition. Few steam roads have openly reduced their one-way local fares, but the scheme of selling round-trip tickets good in either direction, or for two persons going in one direction, at rates equal to or lower than those of electric roads, has become common with certain steam roads. There is little question, however, but that such business is carried at cost, if not at a loss, and it appears that where electric roads have boldy raised their rates the steam roads have speedily followed suit. It may mean a loss of business for a while, but in the long run it will work out satisfactorily, particularly as the electrics are enabled to offer a number of advantages which they did not have a year or two ago.

REMARKABLE STRENGTH OF A DENVER CAR

An accident that occurred in Denver, Col., last month, speaks well for the stability of the reconstructed and spliced cars of the Denver City Railway Company. A car of the company's construction, known as the "39-ft." type, while running at full speed took a switch and into a curve, left the track, mounted the curbing and crashed head-on into a brick building. The wall struck was 13 ins. thick, but the impact was so great that it was completely demolished where the car came into contact with it. No damage was done to the car beyond smashing the fender and breaking a light of glass in the vestibule. The motorman, although the debris was scattered in all directions, escaped injury. As previously stated, the car was built by the company in its own shops. It was made by splicing a 16-ft. closed body to an 18-ft. open trailer. It is 39 ft. 6 ins. over all, with sills of 7-in. I-beams, with oak filler. The forward part of the car is enclosed by a vestibule. The rear end, however, is open. The car bodies were originally built by the Woeber Carriage Company, of Denver.

The city of Canton has employed an expert to report on the number of cars and speed that would be required for the Canton-Akron Railway Company to maintain a given schedule on its city lines. The city is demanding that the company give a twelve-minute schedule, and if it is found that it is necessary it will change the city speed ordinance, enabling the company to operate with a maximum of 12 m.p.h. instead of 8 m.p.h., the present limit.

ANNUAL MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

The Ohio Interurban Railway Association proved itself a young giant of great promise at its annual meeting held at the Algonquin Hotel, Dayton, Jan. 26. Two hundred and fifty members and invited guests participated in a magnificent banquet, at which the guest of honor was Gov. Myron T. Herrick, himself a traction man of long experience. The business meeting was one of the most important yet held, both from standpoints of attendance and interesting facts developed. The annual election resulted in the selection of a list of strong men for officers and executive committee, and the good work which has been started by the organization is bound to continue. The new men are as follows: President, Edward C. Spring, general superintendent, Dayton, Covington & Piqua Traction Company; vice-president, Warren M. Bicknell, president, Lake Shore Electric Railway; secretary, Fred W. Coen, secretary, Lake Shore Electric Railway; treasurer, Ralph E. DeWeese, superintendent, Dayton & Northern Traction Company. Executive committee: F. J. J. Sloat, Cincinnati, Dayton & Toledo Traction Company; F. D. Carpenter, Western Ohio Railway; J. R. Harrigan, Columbus, Buckeye Lake & Newark Traction Company; W. B. Tarkington, Detroit, Monroe & Toledo Short Line, and F. J. Green, Springfield, Troy & Piqua Traction Company; all general managers.

In his greeting at the morning session, President Harrie P. Clegg reviewed the brief history of the organization and stated that the membership and results accomplished had exceeded the fondest expectations of the founders. Eight months ago practically every manager in the State was working by himself, and few had an acquaintance or had been over other roads outside their own immediate neighborhood. Now all are acquainted and are working together with a concrete organization. Business is being interchanged throughout a wide district, and the results of the innovations introduced are now apparent in the earnings of all the roads interested. He said the good work had only been started and he felt sure it would continue.

Edward C. Spring, chairman of the committee on interline baggage, stated that on account of illness the major portion of the work had been turned over to F. J. Green, a member of the committee. Mr. Green was not present, but his views were outlined in a letter. He had had reports from a number of roads giving their views, but as there were such a diversity of opinions, and as all the roads had not been heard from, he requested that the decision of the subject be left open for another meeting. He stated that the roads in the northern part of the State all seemed in favor of carrying baggage free of charge, while the majority of roads in other portions of the State were in favor of making a charge for baggage, claiming that their rates were too low, and that in the majority of cases their cars were not equipped to handle baggage on all trains. He felt, however, that the sentiment in favor of carrying baggage free seemed to be growing. Mr. Green suggested that as a compromise a charge of 25 cents be made for 100 lbs. of baggage for any distance, with an excess charge of 15 cents per hundred over that amount, the receipts on interline business to be divided in proportion to the rates of fare. He thought it undesirable to attempt to carry baggage entirely free of charge, because he felt that the increased amount of this business, due to the growth of interline business, would necessitate having extra men in many of the stations and baggage men on cars, and he thought a slight charge would at least take care of these increased expenses. He suggested a double card check with a brass holder.

The subject was then opened for discussion.

President Clegg stated that while the Dayton & Troy had always charged for handling trunks, it had just arranged for a special train to connect with the Clover Leaf (steam) on business for Toledo and St. Louis, and that on this train baggage would be carried free and checked through to destination, this being necessary to make the rates low enough to compete with steam roads. In Delphos there is a transfer of several blocks and a truckman is paid 5 cents a piece for transferring, the expense being divided between the roads interested. At Troy, where another connection necessitates a transfer, there is a similar arrangement with another road. There are four traction stations in Dayton, and the question of who shall pay for transferring baggage has never been adjusted, and the passenger was charged with it. The receipts from baggage amount to $8 to $10 per day on this road. Mr. Clegg thought the charge was a detriment in a good many cases. For instance, it had been found that traveling men had figured out that it was cheaper to pay them 25 cents on heavy trunks than to pay the excess on the steam road, and that they were shipping their trunks by electric line and then riding on the steam road themselves. He thought it a poor plan to take trunks under any consideration unless a passenger had a ticket, and that it should be charged against him on the ticket. The parallel steam road sells certain limited tickets, meeting the rates of the electric, but does not carry baggage on these tickets. His road is rebuilding all its cars to provide facilities for carrying baggage. He thought one of the most important points to be settled in connection with handling baggage, particularly interline baggage, was that all agents and conductors should have receipts and report blanks, so that baggage could be traced and liability placed in case baggage is carried past its destination. Each man who handles baggage should receive a receipt showing number of the check and time it was delivered. Few roads have such systems at present, and he said that all these points must be covered to make the interline business a success.

F. W. Coen, of the Lake Shore Electric, said they had always carried baggage free and on practically all cars. The steam roads between Cleveland and Toledo are selling certain classes of tickets at 2 cents a mile, or $2.18 for the through trip, and charge for baggage. Their rate of $1.75, with free baggage, solved the problem for them. During 1904 they carried 2,691,000 interurban passengers and checked 19,244 pieces of baggage, not taking into consideration a large number of pieces on which excess was charged. This represents one piece to every 139 passengers, or 1604 pieces per month carried free. In Toledo, where baggage is transferred, they pay the transfer on baggage which they deliver to other roads, and other roads do the same on baggage delivered to them. This applies to steam as well as electric roads. He said that in his opinion baggage must be carried and transferred without expense to the passenger to make interline business a success.

J. O. Wilson, of the Cleveland & Southwestern Traction Company, said they handled about 700 pieces of baggage a month free of charge. He said he felt satisfied they would lose a great deal of business if they attempted to charge. They interline with the Lake Shore Electric, and they frequently check baggage from Wooster to Toledo, 150 miles. H. A. Nicholl, of the same company, said he was fitting all cars with baggage compartments. While they give good service with three express runs and baggage compartments on every other car, he thought all cars should have facilities for handling trunks. He thought that the steam road practice of giving and taking receipts and keeping a record of all baggage handled should be put into force.

E. C. Spring, of the Dayton, Covington & Piqua, said his road charged 15 cents for handling trunks, and he said that they carried a large number. This charge is to cover transfers very largely, and in Dayton they transfer to other roads. He said his express compartments were so small that they could not afford to fill them up with a lot of free baggage and perhaps crowd out a lot of express matter upon which they received good rates.

S. S. Bradley, of the Scioto Valley, said that they had no combination cars, but that they carried many small pieces on their platforms and handled trunks on freight cars. Baggage is carried free.

C. C. Collins, of the Appleyard lines, said that they had combination cars on certain runs and carried trunks on freight cars at other times. On through baggage from Columbus to Dayton, where it goes over two roads, the same charge is made and the money is pro rated between the two roads. The agent at Springfield makes the transfer and the conductors are relieved of any responsibility. He thought that conductors had enough to do to take care of passengers and should not be compelled to keep a record of baggage and issue receipts.

Daniel Royse said that the Indianapolis & Northwestern handled baggage on limited cars and made a charge of 25 cents.

C. E. Hooven, of the Cincinnati, Lawrenceburg & Aurora, said that his road did not handle trunks. He admitted that there was some demand for such service.

A traction man who was a member of the United Association of Commercial Travelers said they had 350 members in Dayton. At several meetings of late they have discussed the use of interurban lines, and that the greatest objection to a wider use of such lines was that there was no uniformity in the matter of handling baggage. He thought the association would formulate a resolution asking that the interurbans carry baggage free on all trains.

Representatives of several roads stated that the standard interline tickets adopted at the Canton meeting in December were on sale and were working out most satisfactorily. The Clover Leaf (steam), which interlines with a number of the roads, has agreed to accept them with a slight alteration to provide for first and second-class tickets. One manager suggested that it would relieve agents of much work and guard against errors and possible dishonesty if the selling company would have its destination points printed on its tickets, leaving only the points on the foreign roads to be filled out by agents.

The secretary reported that the guide published by the Central States Guide Company, of Norwalk, Ohio, had been ordered by a number of roads for distribution among their conductors and agents. It is of great convenience for laying out routes and schedules for interline ticketing and for general information.

Mr. Clegg, for the committee on standard operating rules, stated that the new rule book recently adopted by the Dayton & Troy had been recommended and that sample copies were being sent to all members.

Mr. Spring proposed to amend the constitution to provide that the executive committee be composed of ten men, including the president, the past president, the vice-president, secretary, treasurer and three men to be chosen for two years and two men to be chosen for one year. This will be acted upon at the next meeting.

Twenty-five new members were admitted.

"Steam Power" was the subject for discussion at the afternoon session. Prof. E. P. Roberts, of the Roberts & Abbott Company, Cleveland, introduced the subject with a paper. He spoke from the standpoint of a consulting engineer, and brought out that a steam plant should be carefully designed to meet the special requirements of the road, and he mentioned several instances in which plants having excellent equipment, from a mechanical standpoint, were inefficient and expensive because they were not well balanced and were not designed for the work which they were expected to perform. His paper is referred to more fully in another part of this issue.

Hans Holzwarth, of the Hooven, Owens, Rentschler Company, of Hamilton, gave an interesting detailed description, illustrated with blue prints, of the features of the Hamilton-Holzwarth multiple-expansion steam turbine. This turbine was fully described and illustrated in a recent issue of this paper.

C. H. Weeks, of the Buckeye Engine Company, outlined some of the troubles of the engine builder. He said it did little good for a railway to buy expensive equipment and expect it to run itself. Too many roads pay large salaries for men to manage their properties and leave their power houses in the hands of inexperienced and inefficient engineers. Put brains behind your shovels and you will make money. Too many roads install just enough equipment to move their cars and keep their engines constantly overloaded. Others go to the other extreme and install equipment which is out of proportion to their requirements. If you have too much grate surface you must keep it covered or you will not secure the best results. Again, if you do have excessive grate surface and keep it covered, you burn up coal for which you do not get results. Such difficulties can only be taken care of by proper engineering. Again, we are troubled with too much engineering. Engineers send us specifications and require us to follow them, and expect us to guarantee the machinery and be responsible for it if it does not work out satisfactorily. A great many engineers make the mistake of fixing the ratio of the cylinders. If you make high ratio between the cylinders you are bound to cut down the rating. Recently he had a case where an engineer wanted an engine having a rating at economical point of 550 hp and maximum rating of 900 hp, and he demanded a ratio of 5 to 1 for the cylinders. It was a ridiculous proposition, which could not be met by any engine builder. Mr. Weeks reviewed the development of the direct-connected steam engine and said that the first direct-connected railway units were installed in Cincinnati and the second installation was in Dayton in 1893. Old engineers claimed that they would not be practical; that there was no elasticity in the method.

The election of officers which followed resulted as stated above.

The first annual banquet of the association, held in the banquet hall at the Algonquin, was a function which would have been a credit to a national organization. From 6:30 to 7 there was a reception to Gov. Herrick. The banquet hall presented a unique and beautiful scene. The tables, richly laden with flowers, were arranged in the shape of a huge star around a fountain, which was banked with palms.

Past President Harrie P. Clegg acted as toastmaster, and adjoining him were Gov. Herrick, President Spring, other officers of the association and some thirty invited guests, representing the leading electric railway associations of the country, officials of prominent city lines and a number of local and State public officials.

President Spring spoke, in part, as follows: "It is with feelings of appreciation that I speak to-night, as I am deeply sensible of the honor that has been extended to me. Of course, I realize that in my position it is incumbent upon me to take the organization practically in its infancy, as the retiring president, Mr. Clegg, slid out just in time to evade the duties of the future.

"Gentlemen, the traction interests of this State are about to turn over a new leaf. On Feb. 29 of last year a few hardy spirits gathered at the Hotel Phillips, of this city, and organized what has become the local end of the organization. It was no sinecure to perfect an organization of this kind, but strong in the faith, those pioneers proceeded along the lines that recent events have proved most satisfactory. By individual effort alone that embryonic body has become the foremost in the United States. In this, the greatest traction State of the country, there has been invested the sum of $250,000,000, and it is in the making or breaking of those securities that we are banded together for weal or woe.

"I believe that the press and the public are bound together with indissoluble ties—that the interests of one are identical with the other. The public's interests are served by the newspapers, and vice versa. To this end, then, our efforts should be directed. But a few years past the public regarded the traction road as an evil—as the grouping together of bandits and robbers whose interests would be best subserved by keeping the public blinded as to their best interests.

"Now, all this has changed, for the public has gained confidence in these great arteries of commerce, whose lines penetrate the innermost village and hamlet, which now find ready sale for their produce. The public has gained confidence, and instead of repelling the traction road as an evil unmitigated, now encourage the industry and buy stock. Let the traction road stop and everything ceases, for the traction road is an essential factor of our growth. Let us continue to keep the people alive to their interests, which are our own, and we will stand right.

"Before I close I must again voice my appreciation of the great honor that has been conferred upon me, and further bear witness to the acknowledgment that awaits Mr. Clegg for his interest in and devotion to the association during the time he acted as its chief executive. In behalf of his associate members and in recognition of his worth as an eminent chief executive, as a substantial tribute to his good offices and efforts that have had so much weight in making the Ohio Interurban Railway Association what it is, I present to him, on behalf of the organization, this loving cup, as a token of faith in his ability and integrity, the true worth he has shown to his office as president of the association."

Gov. Herrick said he desired to speak first as a business man who had been identified with electric lines for a number of years. He reviewed briefly the history of steam road building in this country, and said that previous to the panic of 1893 the large majority of railway propositions had been floated in European money centers. It has only been within the past fifteen years that banks and conservative financiers of this country have been willing to take the bonds of steam roads. Now, however, they are recognized as among the best securities. Traction securities, he said, were improving, but the industry would have to go through the same transition that the steam roads have experienced before their securities would be on a par with those of the better steam roads. He said there was too much of a tendency to bond traction properties for more than they were worth and hold out stock as a bait to investors. "A better plan," he said, "is to bond them for half what they cost and put in some of your own money, and you will have better properties. I know whereof I speak, for I have been through the mill. I know that a traction system properly financed and properly managed is a profitable proposition."

Looking at the situation from a legal standpoint, Gov. Herrick said that he felt that certain legislation for the benefit of electric roads was most desirable, and as he did not wish to be misrepresented, he presented a written paper covering these points. Despite this precaution, however, Gov. Herrick was grossly misquoted by daily papers, and was said to have stated that he favored a State Railroad Commission to govern the affairs of interurban roads, something that he did not say, and something that the majority of interurban managers do not favor. In part, Gov. Herrick said:

"Interurban electric railways are getting closer and closer every day to the status, the business and the characteristics of commercial steam railways. In a number of recent cases the courts of Ohio have found it difficult to distinguish between these two classes of common carriers. In the early days of the horse cars, and even later, when electricity as a motive power was first introduced, street railroads were looked upon as conveniences for the cities alone. They were purely municipal institutions, and no one thought of carrying their work beyond the public streets. But within recent years the business of street railroads has been revolutionized. The urban has become the interurban. So far as the business of these companies is concerned, municipal boundary lines have become obliterated. There is scarcely a street railroad line in Ohio that does not run into two or more municipalities; and if to-day we should seriously consider municipal ownership, the first question that would be asked with respect to nine out of ten of the street railroads in Ohio would be, 'What municipality shall own them?' So fast indeed has this business grown, and so active has been the genius and enterprise engaged in it, that the very growth it has enjoyed has perhaps settled for the present, at least, the question of retarding it by appropriation; for the number of cities and villages now reached by the interurban roads is so great that municipal ownership would only serve the purpose of destroying the continuity of the lines.

"But the progress of the business has gone even further. It has not only obliterated the boundaries of municipal corporatons, but it has crossed with its network of tracks throughout the country the lines of counties and States. The interurban railroad has become the short-haul carrier for the people.

"Manifestly, therefore, we have lived past the day when these companies may be regarded as purely local conveniences and controlled solely by local authorities. The Legislature of Ohio in recent years has been recognizing with increasing assurance and conviction the ultimate sameness of all railroad companies, whether operated by steam or electricity, whether operated upon the highways or upon private rights of way, or whether called by one name or another. The General Assembly of 1902 granted to the interurban companies the power of eminent domain outside of municipalities. The General Assembly of 1904 granted the street and interurban railways, under certain conditions, the right of eminent domain within municipalities, and the same Legislature last winter provided for the taxation of property of interurban electric railway companies by a method identical with that in force with respect to the steam railway companies. Thus the two kinds of railways are coming closer and closer to mean one and the same thing. Peering into the future, it does not require mental field glasses to see the day when in fact as well as in law there will be one kind of railroad in this country, and when electricity, which is now coming more and more into use in the subways and by steam roads, will be the only motive power for all.

"Now, what does all this mean? Certainly I am not one of those who believe in taking away from the municipalities of the State the inherent right of home rule; and certainly I would not advocate any plan that would destroy the principle of local government in so far as it is necessary to protect local interests. But in so far as interurban railways have ceased to be the concern of a single city or a single locality, and have come to be the concern of the State at large, I believe the business in which they are engaged ought to be regulated and controlled by the State. As interstate commerce is the concern of the Nation at large, so intrastate commerce is the concern of the State at large; and any agency which thus unites, by bands of steel, the interests of urban and rural communities, and conducts a passenger, freight and mail traffic between different sections of the State, should be directed and controlled by some authority which would see that equal justice is done between all patrons of the lines, whether they live in the city or the country. Nothing has seemed to me more obstructive of general progress than the spectacle of an interurban railway line being, on the one hand, retarded in its work by the caprice or cupidity of local authorities, or, on the other, practicing discrimination in favor of the people of one community against those of another. I am not willing to take from the people of our municipalities the control of their streets or deprive them of the just return which should be made by those who use the streets for any public service business. But with respect to interurban railway lines, which run through a number of municipalities as well as counties, I believe that, for the protection of the people and for their safety and convenience, as well as for the protection of investors in these enterprises, some just and equitable method should be devised for their control which will avoid the confusion that conflicting interests always entail."

J. Sprigg McMahon, a prominent attorney who represents a number of Dayton roads, said that Gov. Herrick's remarks about legislation were seconded by every traction lawyer in the State. What is needed is legislation to codify and simplify the existing laws. The Ohio statutes have laws governing electric railroads, street railroads, interurban street railways and several other classifications. They are contradictory and confusing, and there are dozens of cases hanging fire which it seems almost impossible to settle under existing conditions. The steam roads appreciate these facts, and they obstruct and delay us on numerous points. Dozens of cases have been carried to the Supreme Court of the State, and in nearly every instance the cases have been affirmed without report. He said he was looking for the man who has the nerve to force the Legislature to codify the laws so we will know where we are at. This association can accomplish great good in this direction if it takes the proper steps.

F. J. J. Sloat, general manager of the Cincinnati, Dayton & Toledo, said that a number of roads needed rehabilitating to bring them up to the standard of the fine high-speed lines that are now going after long-distance business. He thought the members would be interested in knowing that on that day his company had decided to spend $1,500,000 in rebuilding their system. This is one of the pioneer properties of the State. It is carrying more than 5,000,000 passengers a year, and its earnings per track-mile exceed those of many city lines. Mr. Sloat touched on the enormous coal consumption of electric roads. With about 64,000 kw of railway generating apparatus in the State, and with an average of 5 lbs. of coal per kw-hour, it meant 320,000 lbs. per hour, 5,760,000 lbs. per day, 86,400 tons per month or 1,036,800 tons per year, representing 11,052 trains of thirty-two cars each.

Judge Dennis Dwyer, a pioneer who built several of the electric roads radiating from Dayton, told of the transportation facilities sixty years ago, when he came to this section. Then it took two days to go from Dayton to Cincinnati by canal boat.

EDWARD C. SPRING WARREN M. BICKNELL

THE NEW PRESIDENT AND VICE-PRESIDENT OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

Dr. J. E. Lowes, another pioneer, told of his experiences with the old Vandepoele system of electric operation.

Gen. W. P. Orr, who built the Miami Valley, the second interurban line in the State, said it was built without a dollar of securities, that it had always made money and was now part of one of the best systems in the State.

Capt. George Wood, aide to Gov. Herrick, and who recently returned from the Philippines, told something about the street railway lines of Manila. He thought that the islands presented some excellent opportunities for the foundation of interurban and city lines.

E. B. Grimes, of the Ohmer Fare Register Company, who has been dubbed the poet laureate of the association, read an original poem, in which fact, fiction, fancy and humor were admirably blended, and in which practically every prominent traction man in Ohio was referred to.

The New England Street Railway Club wired congratulations to Ohio on the election of Mr. Spring as president. He was formerly prominently identified with that body.

F. W. COEN RALPH E. DE WEESE

THE NEW SECRETARY AND TREASURER OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

A party of twenty-five or more members from the northern part of the State came down from Lima on the parlor car "Theodore," through the courtesy of the Holland Palace Car Company. This car has recently been improved by the introduction of very comfortable reclining chairs.

The success of the banquet was due primarily to the work of John F. Ohmer, of the Ohmer Fare Register Company, who, as chairman of the supply men's committee, arranged for the entertainment of the members.

The details of the programme and entertainment were in the hands of Ralph DeWeese, superintendent of the Dayton & Northern Traction Company, and the complete success of all features of the meeting were generally commented upon.

THE NEW PRESIDENT

Edward C. Spring, the newly elected president of the Ohio Interurban Railway Association, is one of the most popular street railway men in Ohio. At the present time he is general superintendent of the Dayton, Covington & Piqua Traction Company of Ohio, and has held similar positions with the Newton & Boston Street Railway Company, the Wellesley & Boston Street Railway Company, the Norfolk Suburban, Norfolk Western, and Medfield & Medway Street Railway Companies of Massachusetts.

His experience in electrical work, extending over a period of seventeen years, starting with the Thomson-Houston Electric Company, has brought him in close contact with the electrical fraternity of the East and the Middle West. Mr. Spring has held the position of president of the New England Street Railway Club, and after moving to Ohio formed the Ohio Interurban Railway Association, and was its first vice-president. With Mr. Spring's energy and push, the association should have a most prosperous year.

Mr. Spring is a Boston boy, having received his education in the public schools and the Latin School of that city. His practical experience with electric railway work places him in the front ranks of operating street railway men, he having worked up to his present position from a motorman and conductor.

STEAM POWER*

BY E. P. ROBERTS

In taking up the matter of "Steam Power" it is evidently necessary to consider: First, What is needed? Second, What is best for the conditions? I will follow this logical order therefore, and although, at the start, the reason for the first may not be apparent, I think it will be before the completion of the presentation of the second.

As this audience is mainly composed of men interested in the operating and financial, rather than the technical end, my talk will not be relative to technical features from the technical standpoint, but from the standpoint of the effect of modifications of such features upon financial results.

POWER FOR INTERURBAN ELECTRIC RAILWAYS

In Ohio, the prime mover is usually a reciprocating steam engine, although, in a few instances, a steam turbine is used. In some portions of the United States water-power is being largely utilized as the prime mover, but there are few, if any, economically desirable properties of such kind available in Ohio. Owing, however, to the recent developments in the line of gas and oil engines, there are situations where these engines should receive consideration.

To decide what prime mover is best for a specific case, considering type, number of units and size of each, all the factors affecting the case must be considered, and, generally speaking, in the following order:

First—Predetermination of the operating conditions.

Second—Estimate of first cost.

Third—Estimate of operating expenses, including financial charges.

Fourth—Comparative reliability, depreciation and repair account, and other matters which are largely questions of judgment.

Fifth—Combination of all the above, considered for each type of power plant, and a comparison of the results.

FIRST—PREDETERMINATION OF OPERATING CONDITIONS

This necessitates a decision as to the location of the track, and the curves and grades most economically desirable, and the predetermination includes the following:

A certain location of the road is taken as the standard for comparison, being generally that which will give excellent, though not necessarily the greatest, accessibility on the part of the public, and having such grades and curves as a general knowledge of the proposition indicates would be good practice. The size of cars and number of trains necessary to handle the anticipated passenger travel is decided, and train schedules and train sheets are prepared which show the schedule time between the terminal points, based on a stated average schedule speed in the cities and towns, and a stated average speed while the car is in motion in the country, with deduction from the latter on account of country stops, thereby obtaining the schedule speed in the country. The train sheet shows the trains in service at any moment and the location of such trains. The size of motors necessary to handle a car or train of the assured weight and speed is then calculated.

A study of the results as above obtained may indicate that it is preferable to employ a slightly greater schedule speed between the terminal points, so that, when operating on an hourly headway, the layover at the end be not too long. For example: The time of the tentative run may be two hours and ten minutes, which would necessitate a layover of twenty minutes when the cars are operated on hourly headway (starting from one end on the hour and from the other on the half-hour). This would require five cars in operation, whereas if the cars could make their run in one hour and fifty-five minutes, only four cars would be needed. Such a reduction in the number of cars would reduce the expense of the train crews 20 per cent, and the greater schedule speed between termini would be attractive to the traveling public.

To accomplish such higher schedule speed, one or more of the following factors must be changed:

(1) Higher schedule speed in the cities and towns. This may not be practicable.

(2) Higher speed when in motion in the country. This would require larger motors and greater rapidity of acceleration, which would increase the first cost, not only of the rolling stock, but also of the entire power generation and distribution system, and it is the resulting increase in maximum and average power requirements which to-day especially interests us.

(3) Reduction in number of country stops. This may reduce the income, and whether it is advisable depends largely upon the character of the proposition, and also whether or not "limited" trains will be operated. Consideration must also be given to the time made by competitors, more especially between distant points.

(4) Change of location in the road so as to shorten the distance. This may necessitate giving lessened facilities to some localities, or may necessitate more expensive construction, or both.

(5) Such change of location as will allow higher schedule speed. This may be done by reducing the lengths of the runs on streets, or if the right of way is by the side of the highway and in front of buildings, changing same so that it is back of the buildings. Sometimes the best location is adjacent to a steam road.

(6) Reducing grades and curves.

Consideration of the above factors, individually and collectively, also necessitates consideration of comparative first cost and operating expense, and comparative gross and net income, and the study of all the conditions may result in a decision to operate at a slower schedule speed, and change one or more of the above factors in the opposite direction from that required to increase the schedule speed. If "limited" trains are to be operated this fact must also be considered.

The above relates to passenger service, but, in addition, express and baggage service may require consideration, as may also freight, using this word to mean the same as when applied to steam roads.

A specialist in the predetermination of what is the most desirable construction and equipment for any given proposition, may not, and possibly will not, work out in detail and with all possible modifications all these factors, but he will consider them, even though, to some degree, it may be unconsciously. The results obtained are frequently a surprise even to those who make it their business and who might be supposed to be able to state "off hand" what would be most desirable for any given proposition.

A striking proof of the lessening of the amount of power required, obtained by increased care in design, is shown by a statement made by A. S. Richey, in a paper read by him before the Indiana Electric Railway Association, Jan. 12, 1905,* in which he states that the same cars are used on the northern division of the Indiana Union Traction Company as on the other divisions, and power is furnished for the entire system from one power house; that the average distance of the substations on the northern division is 46 miles from the generators, and on the others 15 miles; also that 12 per cent of the power used on the other divisions is delivered directly from the power station without a. c. transformer or transmission losses. Nevertheless, the power for the northern division, measured at the power house, is only 33 per cent of the total, although it represents 42 per cent of the total car mileage. He also states that the average schedule speed is slightly greater on the northern

* Paper read at a meeting of the Ohio Interurban Railway Association, at Dayton, Jan. 26.

* See STREET RAILWAY JOURNAL, Jan. 21, 1905.

division than on the balance, and that the result illustrates: "The general effect of a careful consideration of operating features in the engineering design and construction of a road, such as reducing curves and grades to a practical minimum, careful location of sub-stations with respect to their loads, and the economical distribution of copper."

The subject of this talk being "Steam Power," it may seem as though I had wandered far from the path, but all the parts of an electric road are so interconnected, financially and physically, that a proper decision as to steam power mechanisms can only be made after a study of the entire proposition, and in more or less detail depending upon its special features. For example: If power is very expensive, measured at the motors on the car, then, from this standpoint, a reduction of grades is economically advisable, as well as a reduction in the size, number and speed of cars; whereas, if power is cheap, the reverse is preferable.

All these factors are so interconnected that, in order to obtain the best plan for the given conditions, a tentative plan must first be prepared which will be in accordance with the engineer's best judgment, based upon a preliminary study of the general and special conditions, and then such plan must be modified and the effect of such modifications considered from every standpoint—first cost, operating expense and effect on gross and net income.

It is therefore evident that the decision as to the power plant necessitates predetermination, within a reasonably close limit, of the average output which will be required at different hours of the normal operating day and the maximum which may be required for any considerable period, and also the momentary maximum, the excess being taken care of by the momentum of the fly-wheel. It also necessitates a decision as to similar features on days other than normal, for example: Saturdays, Sundays, holidays, etc.

It may seem that the above is what is frequently termed "not practical," or, looking at it from another standpoint, that it is "impracticable," and for the reason that operating conditions vary so greatly from day to day that it might be considered impossible to predetermine all of them with such degree of approximate accuracy as to obtain results of any value. There is not now time for elaborate presentation of proof that careful and skilled predetermination of operating conditions pays, and, in fact, pays better than an equal amount expended in any other manner. I will merely present as an interesting example the comparative results obtained by two power houses, each using the same make of water-tube boilers, stokers and compound condensing engines, and the one obtaining the poorer results having generators of one of the best makes, and the other having old style Siemens & Halske generators, which were probably somewhat less efficient than the other. The generators were direct connected, and both plants furnished direct current and used the same quality of coal at the same cost per ton.

The plant obtaining the poorer results did not have the conditions predetermined, and the result was that the various units were not of the best proportion for their operating conditions, considered as a whole and in relation to each other. In the other case the character of the output was predetermined and the sizes of units considered with reference to each other, and although the load for this power house was more fluctuating than for the other, the coal and the cost per kw-hour output was materially less.

On the other hand, there is, of course, a difference between what may be termed calculations for commercial purposes and those made for scientific reasons. The basis of the former is generally only approximate and that of the latter is presumably exact, and it is evidently absurd to carry out calculations into fractions of 1 per cent when the basis is not known within 5 per cent, or, to use a mathematical simile, to "use eight-place logarithms on four-place data."

Having predetermined the average maximum power required from the engine, or engines, when operating on regular schedule, and also for special days, a tentative decision is made as to the number of units and the size of each, based on capacity.

The condition of operation of engines furnishing power to an interurban electric road is, except when storage batteries are used, one of rapid and excessive fluctuations of load, usually ranging from 25 per cent to 125 per cent of the rated capacity of the engine, and often from 0 per cent to 150 per cent, and sometimes momentarily up to 200 per cent.

I present the following as statements of facts:

For any engine supplied with steam at a definite pressure and quality and with a definite vacuum, there is a definite load at which it will operate at its greatest economy. Increasing the steam pressure, or superheating the steam, or increasing the vacuum will increase the maximum obtainable horse-power and, generally speaking and within limitations, the efficiency of the engine as a converter of heat energy into mechanical energy, but, considering the increased energy required by the engine auxiliaries, it will not necessarily increase the heat-energy efficiency, considered as a whole, and, even more important, it may even decrease the "dollar efficiency." The latter efficiency includes first cost and operating expense, and it is upon this efficiency, considering the entire road, that either dividends or assessments are declared.

We will now consider a few curves:

One of these shows the variation of coal per kw-hour with a varying load factor in a certain station. This curve is based on the daily records obtained during one year. The power house is the Avon Beach power house of the Lake Shore Electric. The results are old and were published several years ago, and I would apologize for presenting old material if it were not for the fact that I have not results from any plant in which the coal has been weighed daily for such a long period and under such variation of percentage of rated load. It should also be noted that at rated load the test showed 3.2 lbs. per kw-hour, which, for this station, may be considered as the theoretical limit. It should also be noted that a change of proportion of the individual mechanisms and of the size of such mechanisms relative to each other could have been so made as to have obtained better results at rated load of the generator, but inferior economic results under the average operating conditions.

The next shows the effect of grades on the fluctuating demand for power and the effect of a schedule requiring the simultaneous climbing of grades by several cars. In this connection it might be noted that a schedule which will allow climbing of grades with motors "in series" is much better for the power house than one which requires "hustle" from start to finish; but, of course, this is not the only standpoint, and there are too many interconnected factors now to follow up this train of thought.

Other curves are presented showing the probable approximate amount of water per indicated horse-power for various types of engines and at various loads, and similar curves for boiler horse-power.

The curves presented are old and should be considered only on account of their general features and not for the specific values shown. Nevertheless, they admirably illustrate the points to which I desire to call especial attention, which are:

(1) Comparative water consumption on rating is not the proper basis for decision when operating on variable load.

(2) Comparative values obtained by comparing results for indicated horse-power are not the same as for boiler horse-power.

The statement has already been made that engines for interurban electric railways normally operate with loads varying from friction load to 100 per cent overload, but it should also be noted that the average load is generally, and practically always, below rating. Because of this, it follows that an engine should be mechanically designed so as to carry with safety excess loads, and, from the steam standpoint, so designed as to give maximum economy at a point below that which is ordinarily considered as its rating. The valve operating mechanism should permit the entrance of steam for as large a percentage of the stroke as is practicable, and the steam passages should be of as great cross section and freedom from bends as practicable in order that the steam may flow with the minimum drop in pressure. The cylinder, or cylinders, should not be any larger than necessary to give the required maximum of sustained power under the assumed conditions of steam pressure and quality, and of vacuum, including allowance for lessened pressure and vacuum when having a sustained load which is in excess of the normal.

Please note that I have here used the term "load in excess of the term normal," the common and more convenient term is "overload," but the latter term tends to convey the impression that the load is greater than that for which the apparatus is designed and that such load is injurious, which, for the case considered, is not only erroneous, but directly contrary to the fact.

What cylinder proportions, for any given case, are most desirable depends upon steam pressure, vacuum, etc., as well as ratio of average to minimum load, and in a paper presented by me at the New York meeting (December, 1903) of the Engine Builders' Association of the United States, I especially referred to the question of ratio of cylinder, diameters of compound condensing engine under variable load, and the advisability of reduction of such ratio as the percentage of maximum to average increases.

Evidently, for any given proposition, it is necessary to ascertain what will be the water consumption of the various engines it is desired to consider, and not only at rated load, but over a large range of load. This information for any given engine must be obtained from the manufacturer, but, unfortunately, statements sometimes made require investigation before being accepted.

Some engine builders know what the engine on which they submit a bid will do at rating and with stated steam pressure, quality of steam and vacuum. Fewer know the result which will be obtained at fractional loads. The engine builder does not know what will be the degree of variability of the load, nor the average load; it is his duty to furnish a certain mechanism to accomplish certain agreed upon results, but whether the operating conditions will allow such results to be obtained in practice he does not, and generally cannot, know. The actual result is often unfair to the builder and uneconomical for the purchaser.

As an example of the unreliability of data in bids, I present the following, which are taken from bids in our office:

Our specifications stated the steam pressure and quality of steam to be delivered at the engine throttle, the vacuum at engine exhaust, revolutions per minute, desired average indicated horse-power (ihp), desired lower limit of maximum sustained horse-power at stated steam pressure and vacuum (slightly less than specified for the average), and specified a maximum limit for the piston speed, and a maximum and minimum ratio of diameters of high to low-pressure cylinders. Fifteen manufacturers were invited to render bids, and there was considerable difference in stroke, cylinder diameters, etc., and a comparison of all brought to the same basis necessitates too complicated calculations and too many considerations to present to a non-technical audience. I have therefore merely chosen data from the bids from four Corliss engine builders, of better than the average standing, each of whom happened to choose the same diameters of cylinders and length of stroke, therefore making the steam conditions the same for all except as modified by steam passages, clearance and control of steam by the valves. The comparison of all the bids showed differences far in excess of those here presented:

BIDDERS' STATEMENTS

Point of Maximum Cut off of Steam	Maximum Sustained Horse-Power, which I present as a Percentage of the Greatest
.75	79
.75	84
.75	72
.60	100

The lowest was approximately the limit stated in our specifications.

There might be a slight difference in the maximum horse-power obtainable, but that the engine having a maximum cut-off of .6 would give one-third more maximum power than the one cutting off at .75 is evidently impossible.

The importance of maximum obtainable power has already been stated.

We will next consider the difference of efficiency guarantees for the above four engines, and all on the same basis as to steam and vacuum. The order is changed from that in the previous table:

PERCENTAGE RATING

	50	100	150
No. 1	13.75	12.50	13.25
No. 2	12.75	12.50	13.50
No. 3	14.00	13.00	14.00
No. 4	15.00	12.75	14.00

If the above stated water consumptions are correct, and if, for this comparison, we consider the gross amount to be allowed annually for depreciation and repairs to be the same for all engines, then it is evident that the No. 1 engine is the best if the average load is above rating, and No. 2 if it is below rating.

How much more, based on cost of fuel, can we afford to pay for No. 2 than for No. 4 engine?

If the load for one-half of the time is approximately one-half of the load (for one-quarter of the time is approximately rated of the load), and for the final one-quarter of the time is approximately one and one-half of the load, or, say, an average of 88 per cent (and this is a very high average load for an interurban railway not using storage batteries), and the daily run is twenty hours, and the additional (not pro rata) evaporation be 8 lbs. of water per 1 lb. of coal, then the annual saving of No. 2 will be:

PER I. H. P. DAILY

10 hours at 2.25, equals	22.50
5 " .25, "	1.25
5 " .50, "	2.50
Total	26.25 lbs.

If the average indicated horse-power is 1000 hp then the pounds of steam saved annually is, in round numbers, 9,600,000 lbs.

Evaporation 8 to 1—Coal equals 1,200,000 lbs.

Tons equals 600 lbs.

At $2 coal, we save each year $1,200 (A).

At $3 coal, we save each year $1,800 (B).

Capitalizing "A" at 6 per cent, equals $20,000.

Capitalizing "B" at 6 per cent, equals $30,000.

It is natural to hesitate at paying $20,000 or $30,000 more for one 1200-hp engine than for another, nevertheless, on the guarantees, we could afford to do so. If the engine guaranteed as the more economical as to fuel is also better designed and manufactured, there is an additional reason for purchasing such engine even at a greater first cost, but how nearly do the guarantees represent the facts? The answer can only be a matter for the exercise of judgment, and considering technical features, standing of the bidder and proven results.

The foregoing shows the results which may be obtained by the investigation of only one feature, and also the importance of making comparisons on the basis of operating conditions, which latter, if not existing, must be predetermined.

The average load above considered is a high percentage of the rating, and if, in order to make the comparison over a greater range, we consider that No. 2 engine at 0.3 load would take 14 lbs. and No. 4 17 lbs., and that the load for

¼ time is approximately .3 load.
½ " " " .5 "
⅛ " " " rated "
⅛ " " " 1.5 "

The daily difference in pounds of steam per indicated horsepower will be:

$$5 \times 3 = 15$$
$$10 \times 2.25 = 22.5$$
$$2.5 \times .25 = .62$$
$$2.5 \times .5 = 1.25$$

Total...... 39.4 lbs.

which is 50 per cent more than the previous result, making

For $2.00 coal..................... $30,000.00
For $3.00 coal..................... $45,000.00

Probably there would be not less than two engines, and for the greater portion of the time only one would be in operation, if the average time of operation of two engines be simultaneously only one-fifth of that of one engine (one engine sixteen hours, two engines four hours), and the load conditions for each engine be considered as unchanged, then the total additional amount which we could afford to pay for the two more economical engines would be six-fifths of that for one, or at $2 coal, $36,000, and at $3 coal, $54,000.

If the comparisons were made at rated load, then the annual saving would be approximately one-fifth of that on the first assumption, the difference in value being only, for $2 coal, $4,000, and for $3 coal, $6,000.

The foregoing also shows that a consideration of comparative values must include the cost of coal; this fact is not always appreciated.

STEAM TURBINES VS. RECIPROCATING STEAM ENGINES

The same general considerations apply to the question of the comparative advisability of installing steam engines or steam turbines, as have been mentioned in connection with various engines, and there are some additional considerations, such as comparative space, cost of foundations, etc.

The writer should state at the outset, however, that he believes as good "coal per kw-hour results" can be obtained by using the highest grade of reciprocating engines, properly proportioned to the work, as can now be obtained by the use of turbines, and that, to a considerable degree, the better results reported where turbines have been installed are because the turbine plants have been of a higher grade than the engine plants with which they have been compared. Turbine plants generally have superheated steam, frequently at a higher pressure than the average reciprocating engine, and also with higher vacuum, and they do obtain better efficiency from the standpoint of water per kw-hour than the majority of the engine plants in interurban power houses. But it does not necessarily follow that reciprocating engine plants could not have been so designed as to have obtained equally high efficiency, nor does it follow that the plant which is most efficient from the standpoint of fuel is the most economical, everything considered. I believe in the steam turbine, but do not consider that it has the field to itself, but rather that each case must be considered on its own merits.

Many comparisons which have been published are misleading. For example: Some comparisons are made on the basis of rated load, which have been shown to be inaccurate when applied to a variable load; others are based on pounds of steam per kw-hour taken by the turbine or the engine, and without making allowance for the additional heat energy required to obtain the higher vacuum for the turbine. In this connection it should be noted that the efficiency of the turbine is materially increased by an increased vacuum, whereas this is much less the case for an engine built on commercial lines. For the turbine it is wise to obtain high vacuum, but the cost must not be overlooked.

The steam for the turbine is also usually superheated, and, if the comparison is based on a difference in pounds of steam, it is evident that consideration should be given to the additional heat units in the steam and the cost of supplying such additional heat energy. When considering fuel economy the proper basis of comparison is the per cent of heat energy transformed into mechanical energy delivered by the mechanism, including the amount of energy required for the auxiliaries.

On this basis a recent comparison, which I made, between the guarantees of a turbine manufacturer and those of an exceptionally high-grade engine, showed such an exceedingly slight difference as to be practically negligible, and a comparatively small difference in operating conditions would throw the balance one way or the other, as would also a slight difference between guaranteed and obtained results. The difference, as tabulated, was slightly in favor of the turbine, with temperature of condensing water at 60 degs., and with 26 ins. vacuum for the engine and 28 ins. for the turbine, and with barometer at 30 ins., but if the condensing water was at a higher, though probable summer temperature, it would not be found economically desirable to endeavor to obtain at such time so high a vacuum, and therefore, during such time as this condition might exist, the result would be in favor of the engine. Assuming other conditions of operation, there would be a greater difference, and in favor of one or the other, depending upon the assumptions. Therefore for this case decision must be based on other grounds than comparative fuel economy.

A comparison should include at least the following:

(1) First cost, including engine, turbine, generators for each of same, foundations, buildings, traveling crane, sometimes ground, piping, condensing system, superheaters.

(2) Operating expenses, including fuel, oil, labor, repairs and depreciation.

(3) Reliability.

The items under (1) and fuel and oil under (2) can be predetermined with sufficient accuracy for a decision. The other items under (2) and (3) are, for the present at least, largely questions for the exercise of judgment.

OPENING OF UNION INTERURBAN STATION IN LOS ANGELES

Without a moment's delay and with the time schedule running smoothly, the magnificent new station of the Pacific Electric Railway Company and the Los Angeles Interurban Railway Company, in the Huntington Building, Los Angeles, was put into operation on the forenoon of Jan. 15. Thousands of passengers passed through the station during the day. To prevent confusion and injury to those not acquainted with the change of stations, a uniformed guard has been placed at the main entrance of the building near the tracks to warn the public of danger and to notify them where to get on and off the cars.

The suggestion of General Manager Schindler, of the Pacific Electric Railway Company, has been accepted by the Pacific Railway Amusement Company, that the summer resort which the latter corporation proposes building at beautiful Alamitos Bay be called Villa Carreta, meaning "village of little cars." There already have been established twenty-five of the old cable cars in use in Los Angeles several years ago. These cars have been made into houseboats, and are to be lighted with electricity and heated with gas.

MEETING OF THE EXECUTIVE COMMITTEES OF THE STREET RAILWAY ASSOCIATIONS

Important meetings of the executive committees of the American Street Railway Association and of its allied associations, the Street Railway Accountants' Association and the American Railway Mechanical and Electrical Association, were held at the Holland House, New York, on Feb. 3 and 4. As had been anticipated from the preliminary steps taken at St. Louis, the subject of the reorganization of the various associations was very fully discussed and a satisfactory arrangement was reached in referring the subject to a sub-committee.

Preliminary meetings of the executive committees of the Accountants' and Mechanical associations were held Friday morning, but were adjourned at 12 o'clock so that the delegates could attend the union meeting with the executive committee of the American Street Railway Association. Representatives of the Claim Agents' Association and of the American Street Railway Manufacturers' Association were also in attendance. Altogether the following gentlemen were present:

Representing the American Street Railway Association—W. Caryl Ely, Richard McCulloch, Howard F. Grant, Calvin G. Goodrich, Frank G. Jones, T. C. Penington and Walter E. Harrington.

Representing the Street Railway Accountants' Association—W. G. Ross, F. R. Henry, P. S. Young, J. W. Lester, Isaac McQuilkin and E. M. White.

Representing the American Railway Mechanical and Electrical Association—H. H. Adams, C. F. Baker, John Millar, S. W. Mower, J. S. Doyle and D. F. Carver.

Representing the Claim Agents' Association—W. A. Dibbs.

Representing the American Street Railway Manufacturers' Association—D. M. Brady, J. H. McGraw, W. H. Heulings, Jr., F. C. Randall, E. H. Baker, C. C. Peirce, William Wharton, Jr., Newcomb Carlton and F. S. Kenfield.

There were also present H. H. Vreeland, James F. Shaw, Prof. W. E. Goldsborough, Walton H. Holmes and a few others.

W. Caryl Ely, president of the American Street Railway Association, called the meeting to order on Friday at 12 o'clock sharp, and said that it had been considered desirable to assemble in a sort of general meeting to discuss the matters which interest all of the associations before taking these matters up in the respective committees. In order that all could have an understanding of the existing condition, Mr. Ely briefly referred to what had occurred during the last year, and especially to what had been decided at the St. Louis meeting, with regard to the reformation of the lines of work of the American Association and the different affiliated associations.

At the last convention at St. Louis, Mr. Ely said, a great deal of the time was taken up in discussing this matter of reorganization and reformation. The resolutions and remarks which are contained in the report of the proceedings of that convention, and the report of the committee on nominations, show conclusively not only a desire on the part of every one for a different form of organization, different lines of work and a raising up and broadening out of the work of the associations, but also a feeling that such a step is necessary. A most cursory examination of the proceedings of the convention also show that something had been committed to all present to be done and to be worked out.

Mr. Ely said that a year ago last fall he had been chosen president of the association at the meeting at Saratoga Springs, and that last fall, at St. Louis, after a year of talk and general agitation, and after the convention had been held at which ideas had been discussed and presented and new policies hinted at, he was re-elected president. It seemed to him that his election was not for the purpose of honoring him, nor for the purpose of establishing a new precedent, but that it was an expression, a unanimous expression on the part of those assembled there, that it was time something should be done, and that as the work had come to a head at that time, the re-election of the then existing president, no matter who he might have been, was the most significant manner and the most emphatic way of expressing the desire for a change.

Every one has been made conversant with the situation. To change things that have been growing for almost twenty-five years is a thing that is not without difficulty, and it will have to be proceeded with with great care and deliberation and in the broadest possible way; all must work together, and there must be a giving and taking. There are organizations to be dealt with that have done good work; they have officers, presidents, secretaries and executive committees, and in making changes due regard must be had for all the questions involved; but all, it seemed to him, must approach the proposition in the broadest possible way, with an open mind, so that the result which shall be the outcome of the deliberations will commend itself to every one. A great many of the men who are identified with some of the largest street railway companies in the country have expressed themselves as feeling that the present line and method of work did not justify their taking an active interest in the affairs of the association. The thing to do is to adopt some kind of a programme that will enlarge the field of work, give greater value to it, and commend itself to all to such an extent that the number of members and the revenues will be largely increased, so that skilled minds may be brought to the continuous discharge of the work throughout the year. In that way, and in that way only, will it be possible to get an organization that will produce such results as the leading technical societies bring about. With all the capital and all the brains that there are in the street railway business in this country, there ought to be an association second to none in the value of its work, and certainly there are great problems before the street railway managers of the country and all who are connected with street railway work. If the present association and its subsidiary organizations are properly organized in their relations to each other, and the method in which their work is conducted, so that the combined work of all the associations could be handled in the proper way, every one ought to get great value from this work.

Coming down to the real practical work that is before the executive committees, Mr. Ely said that his mind was entirely open in regard to the proper method to pursue. Nevertheless, he had certain concrete ideas that had been formulated during the past year and which he would like to elaborate. Of course, all know that it will be impossible for a large number of individuals to prepare the new lines along which the reorganization must be worked out, in such concrete form that they may be presented throughout the country to the managing officers of street railway properties and others who are interested in this work, for suggestion and criticism. It would seem that after full and free discussion, in which representatives of the different associations would take part, the real work should then be committed to a small sub-committee. It would also seem desirable that this sub-committee ought to have the assistance of some person of high standing, technical education, a ready writer, a man of good address, one entirely competent in every way to be of the utmost possible assistance. The procuring of such an assistant was authorized by resolution passed at the last convention, whereby the executive committee of the parent association was authorized to employ expert assistance and to fix the compensation therefor. Now, with a sub-committee properly constituted, with such an assistant, with the proper promulgation of the ideas that underlie the work, with a gathering in of suggestions and criticisms from prominent men and from all who are interested in our work throughout the country, that sub-committee ought to be able, within a reasonable time—because it should enter upon its work at once—to send out and give general circulation to some kind of a plan. That plan would then be worked over again by the committee, and then after being submitted to the executive committees of the different associations and adopted, within a very few months, could be presented to the next convention. Then, if all were satisfied and the general opinion was favorable to the plan, possibly the next convention might be held along these lines, and at the next convention a redrafted constitution and by-laws could be adopted, and it would be possible to hand over to the association at the end of this year a completed plan and a going concern.

That was the line of action which had shaped itself in his mind, and he offered it merely as a suggestion and invited the presentation of the views of the gentlemen present. Of course, there is the American Street Railway Association, which is called the parent association; then there are the Accountants' Association and the American Railway Mechanical and Electrical Association, both of which have been formally recognized. Then there is the correlated association, the Manufacturers' Association, which has been organized within the last year, and which has also been recognized. Finally, there is the Claim Agents' Association, whose status he did not exactly know, but which ought also to be dealt with. These are the elements which must be considered. The questions that will come up to be finally determined were present to the minds of every one. He had sent out to all those whom he thought would be in attendance at this meeting, a suggestion of Richard McCulloch, of St. Louis, which had commended itself to his mind at the time of going over it as a very reasonable thing and one well calculated to meet the wants of all. Mr. McCulloch's suggestion follows:

MR. McCULLOCH'S PROPOSED PLAN

Before street railways attained their present importance, the president, manager, superintendent or operating head of the railway directed its every detail and was interested in every part of the work, from the care of horses and the construction of track to the accounting and financial problems. At that time he took part in the discussions at the general meetings of the American Street Railway Association because he felt familiar with all the questions there presented.

With the growth in size, importance and wealth of street railways, however, these conditions have changed, the different departments now being under the direction of specialists. The superintendent of transportation is no longer interested in accounting propositions, and the master mechanic does not care to sit through a discussion on transfers. This is shown by the fact that for several years there has been a poor attendance, a general listlessness, inattention and lack of discussion at the general meetings of the main association, while quite the reverse has been the case at the meetings of the accountants and mechanics.

To prevent the breaking up of the association by the further secession of organizations of specialists, and to enable the association to perform the good of which it is capable, the following plan of organization and meeting is proposed:

(1) The annual conventions shall combine general meetings of the American Street Railway Association together with meetings of certain sections to which the consideration and discussion of papers and technical questions shall be allotted. The following sections are suggested.

(A) FINANCE, POLICY, ORGANIZATION, LEGISLATION

It is presumed that the presidents, managers, directors, etc., would attend the meetings of this section, and if deemed advisable its meetings could be held in executive session.

(B) TRANSPORTATION

This section is for superintendents, and such questions as transfers, time-tables, inspection, etc., would naturally come before it.

(C) ACCOUNTING

This section would perform the work now done by the Accountants' Association.

(D) ROLLING STOCK AND CAR EQUIPMENT

This section would consider questions relating to the construction and maintenance of cars, trucks, motors, etc., which are now taken up by the Mechanical and Electrical Association.

(E) POWER PLANT AND POWER DISTRIBUTION

Matters regarding the construction and maintenance of power plants, high-tension distribution, low-tension feeders, overhead construction, together with the consideration of new systems for the supply of power would come before this section.

(F) BUILDINGS AND ROADWAY

This section would discuss building and track problems.

(G) CLAIMS AND DAMAGES

In the meetings of this section, those interested with the settlement of damage claims could get together and compare notes.

(2) The necessary changes in the constitution and by-laws of the association shall be made that the officers of the association shall consist of a president, vice-president, permanent secretary and treasurer. The permanent secretary shall be the executive officer, statistician, keeper of records, etc., performing similar duties to the secretaries of the various engineering societies.

The executive committee shall consist of the president, vice-president and treasurer of the general organization, together with the presidents of the different sections. This executive committee shall perform the work of the present executive committee and shall have the power to increase or diminish the number and scope of the various sections as it may deem advisable.

(3) Simultaneous meetings of the various sections may be held at the annual conventions, but meetings of related sections should be so arranged that a delegate who is interested in questions coming before more than one section may have the opportunity of attending the meetings of several sections. For instance, the manager who would attend the meetings of Section "A" should have his choice of the other sections. The meetings of the superintendents and roadmasters should be held at different times so that one delegate may attend both sections. The same arrangement should be made for the master mechanics and the power plant men, and for the accountants and claim agents.

A printed programme of the meetings of the various sections, together with the papers and topics to be brought up at each meeting, should be distributed in advance of the annual convention, *and this programme should be strictly followed*, so that a delegate may come to the convention knowing what questions he wishes to discuss and how to dispose of his time to the best advantage. There is no reason why the meetings of the sections should not begin at 9 a. m. and continue, with a recess for lunch, until 5 p. m., and if the business cannot be completed during the day sessions there is no reason why a certain section may not hold a night session.

There will be ample time for a delegate to examine the exhibits when his particular section is not in session, or the executive committee may assign a day for this purpose.

In order to illustrate the application of the scheme thus outlined, the following programme for the year 1905 is mapped out, the dates being chosen at random:

ANNUAL CONVENTION, A. S. R. A., 1905

Tuesday, Oct. 10, 1905

9 a. m. to 12 m. General Meeting of the Association.
- Call to Order.
- Address of Welcome.
- President's Address.
- Abstract of reports of Secretary, Treasurer and Executive Committee.
- Reports of Committees.
- General Business of the Association.
- Appointment of Nominating Committees.

2 p. m. to 5 p. m.
- Meeting of Section "B" (Transportation.)
- " " " "C" (Accounting.)
- " " " "D" (Rolling Stock.)

Wednesday, Oct. 11, 1905

9 a. m. to 12 m.
- Meeting of Section "F" (Roadway.)
- " " " "C" (Accounting.)
- " " " "E" (Power Plants.)

2 p. m. to 5 p. m.
- Meeting of Section "B" (Transportation.)
- " " " "G" (Claims.)
- " " " "D" (Rolling Stock.)

Thursday, Oct. 12, 1905

9 a. m. to 12 m.
- Meeting of Section "A" (Finance, Legislation, etc.)

2 p. m. to 5 p. m.
- General Meeting of the Association.
- Unfinished Business.
- Report of Nominating Committee.
- Election of Officers.
- Adjournment.

The following is a resumé of the allotment of time:

Section "A"—Finance, Legislation, Organization, etc.	3	hours
" "B"—Transportation	6	"
" "C"—Accounting	6	"
" "D"—Rolling Stock and Car Equipment	6	"
" "E"—Power Plant and Power Distribution	3	"
" "F"—Buildings and Roadway	3	"
" "G"—Claims and Damages	3	"
Total time spent in meetings of sections	30	hours
Time allotted for general meetings of association	6	"

This division of work will give thirty (30) hours of section work during a three days' session of the convention, and allowing one hour and thirty minutes for the discussion of each topic or paper. There is time for the discussion of twenty (20) subjects, which about quadruples the capacity of the present organization. It is unnecessary to dwell on the fact that the topics would be discussed by men who are interested in the questions and that, as the meetings would be smaller, discussion is apt to be freer. The above outline is merely given as an illustration of what might be done under this scheme and without any intention to limit the sections to the time allotted to them, or to establish any arbitrary limit to the number and scope of the sections. This should be established by the executive committee of the association from time to time.

Precedents for this method of disposing of the business of large conventions exist among the educational associations, notably the American Association for the Advancement of Science, which has for a number of years conducted very successful meetings on this basis.

Continuing, Mr. Ely said that since the receipt of Mr. McCulloch's suggestion he had given the subject still further study, and that he had brought to the meeting a printed copy of a programme of the last annual meeting of the American Association for the Advancement of Science. A most cursory examination of this programme will show that that association is able, by its methods of procedure, to do about as much work in one year as the American Street Railway Association would do in five years. This plan of Mr. McCulloch seemed to him to be an excellent thing to serve as a basis to work from. If he should say that he thought it was all right, and that it was what was wanted, it would be entirely contradictory of his first announcement, which was that his mind is wide open. It is wide open, and is not committed to any plan. Whatever is offered as a basis would, of course, be lacking in certain details. The National Electric Light Association has made great advancement in the last few years, and a very excellent provision has recently been adopted in that association, namely, that of creating associate memberships and also individual memberships. It struck him that that feature would be worthy of consideration in reforming the American Street Railway Association. It appears too bad that a man who has been the managing officer of a company should lose his membership in any one of the street railway associations simply because he went out of the street railway business, and this applies, of course, equally well to the members of the affiliated organizations. It is unfortunate that one who has occupied a prominent position in the association should not be able to retain membership in the association, and in that way keep in touch with its progress, should be so desire. If arrangements were to cover this feature, an additional source of revenue would also be provided. There are many things like that which will come up. He then said that he would be glad to hear from any one in regard to the general subject, and suggested that some one connected with the Accountants' Association might make some remarks.

W. G. Ross said that he would like to hear first from some of the members of the executive committee of the parent association, if it made no difference, although the Accountants were prepared to speak if that was the general wish.

Chairman Ely then called upon Richard McCulloch.

Mr. McCulloch said that he did not want to impose his views, but that it might be of interest to discuss in general terms the plan which he had proposed to Mr. Ely. It was founded upon the plan which the American Society for the Advancement of Science pursues in its meetings. This association is composed very largely of college professors and people interested in university matters. They are men who in the present day tend to give their attention largely to specialties. There will be one professor who is interested in physics, another in mathematics, another in astronomy, etc. In the smaller colleges, some of these professors are also interested in and teach several of the different branches, so that in their meetings they have arranged a plan by which men can attend meetings of the sections in which they are interested, and they have also arranged so that sections in which subjects that are correlated are considered, meet at different times, so that a man interested in physics and mathematics also can attend the meetings of the two sections, or as many sections as are related to each other.

Mr. McCulloch said that he had sketched out in a general way the different branches into which the specialties in the street railway business might be divided up; for instance, we might start with the heads of the companies, the presidents, directors and managers, of whom, it might be said, as an illustration, that they are more particularly interested in finance, organization, legislation and things of that sort. Then there are the accountants, who have a specialty. Then there are the men who attend to the transportation—the superintendents and their assistants. Then there are the men who attend to car repairs and the electrical repairs. Then there are the men who attend to the power plants and the transmission lines. Then there are the engineers who attend to the track, and perhaps the buildings and bridges. Finally, there are the claim agents, who are interested in claims and damages. These could be divided up into a number of different sections and the meetings so arranged that in a small road the man who perhaps was the superintendent might attend the meetings of the Transportation Section and also the Track and Roadway Section. Again, on some of the small roads one man is the head of the repair shops and also of the power plant. The meetings of these sections might be arranged so that one man could attend both. It would be largely a matter of arranging the hours at which the sections met, so that they would not conflict.

The general plan which he had proposed was that the parent organization should be the leader in all these matters; that when the conventions were called to order there should be first a meeting of the general association, at which there should be the president's address, the address of welcome from the Mayor, the report of the secretary and treasurer, the reports of committees on subjects relating to the business of the association and the appointment of a nominating committee, and that all the general business could be transacted in the morning session, perhaps between the hours of 9 and 12 o'clock. Immediately after that, the various sections should have their meetings, and they should meet morning and afternoon for perhaps two days. On the third day the parent organization could meet again and finish up whatever business there was before it.

As to the details of the management of the association, that would involve changes in the constitution and by-laws, which he had not attempted to figure out. That probably would have to be done by the executive committee. The general arrangement would be that the organization should consist of a president, vice-president, a treasurer and a secretary, which latter official should be a permanent officer and should be the executive member of the organization and do the work which is usually done by the secretaries of the technical societies. They should constitute the members from the general organization. The different sections, of course, should have some representation on the executive committee of the general association. His idea was that the president of each of the sections should be a member of the general executive committee. As stated, he had not figured out these details, but he had no doubt that something of the sort could be done. He had sketched out the amount of business that could be transacted in a three days' meeting, which is the time now devoted to the meeting, and found that under this arrangement there could be six hours for meetings of the general association and thirty hours for meetings of the sections. Calculating one and one-half hours for the reading and discussion of a paper, time would be provided for the discussion of at least twenty papers, which is four or five times greater than the volume of work which is now accomplished.

Chairman Ely then called upon W. E. Harrington.

Mr. Harrington said that he had read Mr. McCulloch's suggestion very carefully. As a plan of organization, he thought that without any question it approaches as nearly to that which is in the minds of different members with whom he has spoken in regard to the matter as any plan he has seen presented. The plan of the American Association for the Advancement of Science is one that is very complete, but hardly applies in its essential details to the requirements of the street railway associations. The plan that Mr. McCulloch has advanced has taken the best elements of the programme of the American Association for the Advancement of Science, and the matter now seems to resolve itself into the adjustment of detail, which could only be done by the committee as proposed by the president. The arrangement of the detail is the essential work before the association, following out Mr. McCulloch's plan, and Mr. Harrington said that he could only voice the sentiment of the chairman, that the matter be referred to a sub-committee to work out the details.

Howard F. Grant, upon being called upon, said that being a new member of the executive committee, he had come to the meeting in the same state of mind as the chairman, absolutely receptive. He had had time to give but very little thought to the details of the proposed organization, but had been very much interested in listening to Mr. McCulloch's outline of a plan. It seemed to him that if the association and the allied associations are to be of the greatest value to the companies represented in the associations, it is very necessary to have some sort of an organization along the lines suggested, and that as soon as possible. It also seemed that the association should be so organized that there would be a man at headquarters, an executive officer, who would gather all manner of detail in relation to the business, having it on file, getting it from the best authorities and the best practice, and that that data would be available for all members of the association and the allied associations. He would like to hear the matter discussed by gentlemen present who had had greater experience than himself, and who had given more thought to this matter than he had done. He thought that it was necessary to appoint a sub-committee to take up these matters in detail, thresh them out and make recommendations covering the proposed reorganization. If it was possible to get an expression from the gentlemen who had had experience in controlling the other associations, it ought to assist very materially in bringing about a good working organization.

Chairman Ely said that he had invited Mr. Vreeland, James F. Shaw and several other gentlemen who had been officially connected with the association in the past to attend this meeting, because they had given quite a good deal of attention to the matter and were thoroughly in touch with the situation; but he would call upon them for the summing up. He then asked W. G. Ross, of Montreal, president of the Accountants' Association, to address the meeting.

Mr. Ross said that the accountants think that Mr. McCulloch's plan has a good many features of value, but that they were opposed to any change whereby their association would lose its identity or its name. The Accountants' Association has been in existence since 1897, and its members think that it has accomplished a great deal of good work. The accounting methods at the time of its organization were in a very crude condition, but are now very complete. The association still has many important questions before it for discussion, the latest being the question of accounts for interurban electric railways, and there are many others. The Accountants' Association has also accomplished excellent work in connection with the State Railroad Commissioners. He did not think anything should be done which would offset the position which has thus been reached. He quite agreed with Mr. Ely that the subjects at the meetings are not followed as closely as they might be, on account of subjects coming up which do not interest every one who is at the meeting. The street railway business has reached the stage now where it is necessary to have associations to take up the different departmental work in the street railway field and discuss the questions in connection therewith more thoroughly than has been done in the past. Many believe that the American Street Railway Association should deal with subjects which relate to the management of the company rather than the practical operation of the road. Mr. McCulloch's outline in that respect is very good. Mr. Ross, however, did not agree with Mr. McCulloch as regard the general secretary having full control of all the sections of the association, because there is a great deal of work in each section; this is certainly true as far as the Accountants' Association is concerned. In fact, in that association there is just as much work for the secretary as one man can handle, and he doubted if it would be a success to have one secretary for six or seven sub-associations or sections. In the Accountants' Association there is first the general work of the secretary; then the association has exhibits of forms and blanks, which are continually sent all over the country. To keep track of these forms and keep them up to date entails a great deal of work. Then there is the question of subscriptions for the purpose of maintaining these associations. Of course, it will be necessary, if the associations are changed into sections, being part of a general association, that there will be only one subscription. While there are many advantages in this plan, there are, at the same time, certain disadvantages, and one is that the subscription might have to be so large that it would keep out a great many of the smaller companies, and there might be a loss, instead of an increase, of members. Another important matter to be taken into consideration is the question of individual membership. Mr. Ross approved of the suggestion that a sub-committee be formed to study the matter further and submit a satisfactory plan.

Chairman Ely suggested that in regard to the different classes of membership and the question of dues, it might be possible to have a graduated scale of dues. This plan is followed in the New York State Street Railway Association, so that small companies can become members at a much lower fee than the large companies. He believed this matter could be adjusted in such a way as to increase the membership and revenues of the association very largely. It seemed to him that if the work of the association commended itself to the great corporations in New York, Boston, Chicago, in fact, to the street railway corporations generally of the country, those in charge of these corporations, recognizing the benefits, would be willing to pay more than they do at the present time, and that the lowest admission fee could be adjusted at such an amount as to make it very desirable even to the smallest street railway company in the country to become a member of the association.

Frank R. Henry, upon being called upon as another representative of the Accountants' Association, said that he agreed with Mr. Ross. The accountants all feel that, on account of the good work they have done in the last seven years, they do not wish to have the value of their work imperiled. He thought the accountants could do better work if some scheme could be devised whereby the individuality of the association could be maintained. That was the primary thing they had in mind. The other matters of details could be worked out altogether satisfactorily.

Chairman Ely then asked some of the mechanical engineers to express their views.

C. F. Baker said that the Mechanics' Association differs from the parent association or the Accountants' Association, in that it is more an association of engineers, independent in a way from the parent association. The Mechanics' Association, although a little over a year old, is almost self-supporting, but it needs more assistance to make it the benefit the members would like to see it to the railroad companies and to its members. All the members of the association, of whatever class, are assessed, and the dues at present are as large as is consistent with the income of the average railroad man. Most of the members belong to other organizations, so that the members are taxed for dues, reports, etc., about as much as they can stand. The association, like the Accountants' Association, wants to keep its identity; it wants its own secretary, and this secretary should be a technical man, familiar with the lines of work dealt with by the Mechanical Association, and should give his undivided time and attention to its work. A president, holding office for one year, cannot give the association the time necessary to make it what it should be, and the work will necessarily devolve largely on the secretary. He agreed with the other speakers in the desirability of referring the matter to a smaller committee.

H. H. Adams, also a member of the Mechanical Association, brought out one point in connection with the days of the session. Mr. McCulloch's plan called for the sessions being held during three days. Mr. Adams recalled the fact that at the last two conventions the Mechanical Association met two days in advance of the main association. This seemed desirable, in connection with the number of men who can get away from a road at one time. It is often impossible, on some of the smaller roads, for all the heads of departments to be away at the same time. For that reason the Mechanical Association set its meetings two days in advance of the main association, so that its members could attend the meetings and get back to their work, if necessary, before the president or general manager was obliged to leave for the meeting of the main association. As Mr. Baker suggested, the Mechanical Association is in a position where, if it had a greater revenue, it could increase the value of its work, and one of the principal efforts of the association has been to increase the revenues. If any financial plan could be put forth to put the association on a better basis it would be of great assistance. In connection with the suggestion made by the chairman about grading the dues, Mr. Adams said that one of the principal objects in forming the Mechanical Association was to let the small man have his say. The idea was to let the foreman, if necessary, get up in the meetings and give his experience, without having him feel that he had his general manager around and did not want to talk; and the dues have been kept very low, and there are several grades of dues. The members feel that the association should maintain its individuality in order to accomplish the things which they started out to do. One of their principal objects is to have their association opened to every man who is employed in the mechanical or electrical department of a street railway company.

Chairman Ely said that these remarks were all interesting and to the point. They show what is to be dealt with, and he said that he would be glad to have the presentation of views go on. He then called upon a representative of the Claim Agents' Association to state his views.

W. A. Dibbs, who represented that association at the meeting, said that it was formed in October, and has a president, vice-president, secretary and treasurer, and an executive committee. There are so far between forty and fifty members. The dues are small. One of the principal objects of the association is to help the members in detecting "repeaters," who go around the country and make it a business to mulct the roads wherever they get an opportunity. The secretary of the association is advised by any member who comes across a case of that kind. The secretary has a pamphlet printed, which is sent to the different members, advising them to look out for such persons. The association so far has had several of these cases, and has saved its members a great deal of money. Another feature of the work of the association is to assist the members with their out-of-town cases, such as if facts or a witness are to be looked up, or an examination made. Mr. Dibbs said further that he had not had an opportunity of consulting any of the other members of the association on the subject under consideration and therefore could not give any expression of their views. He was quite sure, however, that the members did not want the association to lose its individuality.

H. H. Adams called attention to the arrangement of dues in the Mechanical Association. There is first an associate membeship which consists of the membership of the roads themselves. They pay $20 a year. Then there is the active membership of the heads of departments, who pay $5 a year. Then there is a junior membership, which takes in such men as foremen and mechanical and electrical workers generally, and they pay $3 a year. He brought out these points as illustrating a method which might be pursued in the financial arrangement of the new body, if it should seem desirable.

Chairman Ely said that while many of the matters which had been discussed related to details which would naturally work themselves out, it was very desirable to have them presented at this time, so that all could get an idea of the things that are to be met and could offer suggestions as to the manner in which to meet them. It was obvious, he said, that if the companies recognize the value of the work, it being taken for granted that what shall be produced will be valuable to the companies, the burden of the support of the aggregate association should rest primarily on the companies. That would relieve just such situations as had been mentioned. Then an arrangement of associate membership would provide for individuals, and those membership fees need not be any greater than those described. If the street railway interests of the country would come forward and take up the association as a valuable adjunct in their work and ally themselves with it, the revenues which would be derived would be sufficient to carry on the work in the very best possible way, according to the estimates he had made. He then invited D. M. Brady, president of the American Street Railway Manufacturers' Association, to discuss the question.

Mr. Brady said that the welfare of all the organizations connected with the street railway business was a matter of great interest to his association. As manufacturers, it is their first duty to be pleasant to all their patrons. His association would be glad of the privilege of being represented in whatever organization was decided upon, and he suggested that if they were given representation on the executive committee their representation might be made that of associate members. He meant by this that they would have no vote on the question of the expenditures of money, or the standardization of the properties, but on all questions which pertained to exhibits and other matters of detail in connection with conventions, they would be fittingly represented. Mr. Brady said that from 1877 to 1883 he had been the secretary of the Master Car Builders' Association. That was during the period in which the present association was built up. That association has what is known as a road membership; each road pays $5 per year for each 1000 cars, or the major part of 1000 cars, which it may own. For example, if the Pennsylvania Railroad Company owns 100,000 cars, or 99,600 cars, it pays a membership fee of $500 per year. In addition to that, the individual members pay an annual fee of $5. All of that money is expended for the legitimate purposes of forwarding the work of the association. As is generally known, they have a secretary who is a man of considerable capacity, who devotes his entire time to the work of the society, and there is no doubt but that in the matter of the interchange of cars and the matter of standardization of equipment they have saved the steam railroads of this country in the last twenty-five or twenty-six years many millions of dollars. In the year 1874 it was not possible for a freight car to leave the city of Boston, en route for Chicago, and arrive in Chicago without passing twenty-one different sets of inspectors. It is easy to imagine what a constant snarl the interchange of cars was in those days. To-day there is a joint inspector at Albany, Buffalo, Detroit and at every important point, who represents all the companies, and there is not the slightest difficulty under this present system in shipping freight from an extreme Eastern point to an extreme Western point. He commended the proposed plan of Mr. McCulloch, although he suggested that more time might be necessary than that allowed in Mr. McCulloch's programme.

Chairman Ely then called upon James H. McGraw, of the STREET RAILWAY JOURNAL.

Mr. McGraw said that he considered that the psychological moment for reorganization in the history of the American Street Railway Association and the allied associations had arrived. He said the question of reorganization had been discussed for about four or five years, quite strenuously in some quarters. The first efforts of this kind were at the Montreal convention, in 1895; and the thought of making changes in the methods of work of the association has been uppermost in the minds of some of its members for at least five or six years past. As the chairman had very truly said, the men who manage the railways of this country have brains and ability, and it is simply a question of their rising to the opportunity which now presents itself. In his opinion, the American Street Railway Association ought to be one of the foremost, if not the foremost, among the technical and scientific bodies in the United States. There was no reason why it should not be, and the time had come to put the methods into operation which will bring that about. There was a need for it; there was a great work to be accomplished, and he believed that the association was now finally on the right lines to bring about these results. Of course, the work would have to be done in a broad-gaged way, but the foundations had already been laid. The association has a history behind it now of some twenty-one or twenty-two years, and a great deal of good work has been accomplished as a whole. Of course, the conditions in the street railway business have entirely changed in the last ten years. It is true that there have been some conventions that were not up to the mark set by other conventions, but at the same time much good has been accomplished, and the foundation is here now upon which to build a superstructure, and that superstructure should now be built. He had not gone into the matter as to how the plan should be worked out in detail, but he had read with much interest the suggestions in the paper of Mr. McCulloch, and they seemed to him to be along right lines. It seemed to him, also, that it was not necessary for the Accountants' Association, the Mechanical Association and the Claim Agents' Association to lose their identity in becoming a section or integral part of the American Street Railway Association. He felt sure that the committee, which had been suggested by the chairman, when it is appointed, could so work out a plan that the different allied associations will be perfectly satisfied. He would not for a moment think it wise to curtail the work of the very important Accountants' Association or that of the Mechanical Association or the Claim Agents' Association. They have done most excellent work. The Accountants' Association is to-day recognized throughout the whole country as having done a work in systematizing and putting in shape the accounts of the street railroads of the country, which is of the very greatest value. These accounts are now kept in very different and very much better shape than they were when that organization was brought into existence. He felt that these matters of reorganization could safely be left with the committee which it was proposed to appoint, and said that the technical press would be glad to do all it could in the way of co-operation to the end sought. As a member of the executive committee of the Manufacturers' Association, he said that, as this association was simply one of the aides to the American Street Railway Association, the policy laid down by the latter would, of course, be followed by the former body.

William Wharton, Jr., and C. C. Peirce also spoke briefly for the Manufacturers' Association.

Chairman Ely then invited Mr. Vreeland to speak.

Mr. Vreeland first asked Mr. McCulloch if it was his intention that there should be any loss of identity by the various affiliated associations. Mr. McCulloch replied that that was not contemplated in his plan.

Mr. Vreeland then said that he had discussed the broad proposition of reorganization with different members of the executive committee of the association for a number of years. He thought the present work of the association was not of such a character as to be of the most value to the members. He had once said that street railway companies had departed from horse car methods in their business, but not in their association —that there had been no change in the method of conducting the business of the association since its organization. One great need is to have a center of information in connection with the operation of the street railways of the country. As an instance, Mr. Vreeland said, he would receive one day a typewritten form from the West, on which a request was made that certain statistics should be given. It would be referred to one of his departments and the information would be sent. The following day he might receive a request from the East for information bearing upon the same subject, and the next day he might get a similar request from Canada. These requests for information relate to the subject of transfers, general mechanical questions, the use of steel wheels and topics of that character. That is something that never occurs in connection with steam railroad work, for the reason that steam railroads have a center of information where such questions can be answered officially. That was his first recommendation in connection with the work of the association—that there should be some central point, with a secretary who was properly equipped technically, and had a statistical turn of mind, to gather this information instead of the railroads writing all over the country and asking for it, and frequently telegraphing for it. He had had a man telegraph to him a "rush" message, answer at his expense, from the West, as follows: "Common Council meets to-night; do you advise that we go into a general transfer system? Answer quick." Within the last two weeks he had received another telegram about as follows: "We are about placing an order for wheels. Will you please say whether we shall adopt steel-tired or the chilled wheel? Answer at our expense at once." Questions of that kind coming up in connection with this business impressed upon him the necessity of there being some central point for this information.

So far as the question of how this new method shall be proceeded with and how it shall be worked out, he did not see where there is any danger of any of these various organizations that now have a separate identity losing anything they have by an arrangement of this character. There is nothing novel in the idea. One of the greatest organizations ever formed in the history of labor is based exactly on this plan, and in its formation the organizers acted upon the advice of some of the most expert men in the United States. There is one central organization, which is the executive head, and there are any number of branches. Mr. Vreeland said he, himself, was chairman of a branch that takes in practically the whole of the United States —it has its own name, but it is a branch of the main organization. There are now five branches throughout the United States, every one of them a part of the main organization; they are presided over by chairmen, and each one of the chairmen is a member of the executive committee of the main association. The same thing is true about steam railroad work. Does any one who has any knowledge of the workings of the Master Mechanics' or Master Car Builders' Association think there is any loss of identity in their case because they are known as a part of the American Railway Association? There could not be any loss of identity of the street railway allied organizations, in his opinion, through a closer affiliation with the parent association, and it seemed to him that unless some method was devised by which the contributions of the railroad companies should be given to a central organization rather than a number of independent organizations, there was a possibility of the railroad companies drawing the line at one association and saying that if their men want to be members of various organizations they will have to take such membership as individuals, independently of the railroad company.

Mr. Vreeland said that he had thought a great deal on this subject and had discussed the matter with a number of gentlemen many times during the last three or four years, and that he felt that the time had come in the history of the American Street Railway Association when it either had got to go forward or backward. In his opinion, the committee which it is proposed to appoint can arrange a satisfactory scheme of organization through which the American Street Railway Association will be the principal body, but these branch associations, departments or sections, or whatever they are called, will preserve their identity exactly as they have existed in the past few years. In fact, they will have a great deal better standing among the railways of the United States because they are a part of the American Street Railway Association rather than independent organizations. He did not think that he would care to devote his time, or have the men connected with the technical departments of his company devote their time, in going on with the American Street Railway Association unless there was to be a complete change in its methods of handling its business; nor did he think he would care to have the mechanical and technical organizations with which the heads of departments of his company were connected split up into independent bodies, each working on its own hook, any more than he would care to have all the departments of his company working independently of the president of the company.

Chairman Ely then invited James F. Shaw to discuss the subject.

Mr. Shaw said that he had listened with a great deal of interest to the remarks which had been made, and that it seemed to him that there was an air of business about the meeting which he had never seen before, either in a meeting of the executive committee or of the association. He had read with a great deal of interest the plan outlined by Mr. McCulloch, and thought it had a great deal of merit. He also thought that the views as expressed by the members representing the several auxiliary associations were entitled to a great deal of consideration. He believed that the plan suggested by the chairman, in having this matter referred to a sub-committee, would be the means of working out something which will be satisfactory to all interests and bring forth the results which all are looking for—that is, that which is for the best good of the operating companies.

Chairman Ely said that he had received a letter bearing upon the subject which showed how deep the feeling is that there is need for a change in the association methods. He believed that everybody considers, as Mr. McGraw said, that the psychological moment has arrived when the change should be made. He thought that all were fully impressed with the importance of the situation, and he was sure that some plan would be evolved that would meet with the approval of all concerned. He then referred to the letter on this subject which he had received, and which he said was from one of the most eminent men in the business. He read some extracts from the letter, as follows:

"With many others, I have been entirely dissatisfied with the general results obtained during the last few years and cordially welcomed at St. Louis any suggestion which seemed to point towards reorganization.

"In the first place: I think the organization of so many associations—such as the Mechanics' Association, the proposed Maintenance of Way Association, the Claim Agents' Association, the Accountants' Association as it now stands—is unnecessary and unfortunate. It diverts attention and time from the main work of the association at its annual convention, and it creates a burden for support in the dues of the several organizations and the expense of delegates, which few companies can afford. When all is said and done, the conventions resolve themselves into a half-hearted attendance, combined with whole-hearted spirit of junket; a presentation and discussion of papers of no more importance, and frequently of much less importance than similar discussions and papers presented at other street railway associations, such as the New York State Street Railway Association, the New England Street Railway Club, and many others.

"My thought in regard to the association is that it should really be a National Association, that it should foster the growth of the local associations of merit of whatever kind and wherever located in the United States or Canada; that its secretary—in accordance with the new plan which was adopted at St. Louis—should be a custodian and disseminator of information upon the papers and discussions of these numerous local associations, his office a bureau of information to which all members of the association could apply. Our national annual convention should perhaps not be devoted at all to papers and their discussions, of the sort heretofore undertaken. If, however, such discussions are deemed necessary, could they not in some sense represent the cream of the year's work of the local associations, so as in a manner to centralize the work of the year and bring forward its most useful results for the consideration of the convention?

Mr. Ely then said that he thought there had been enough discussion upon the question, as it was apparent that all were substantially in accord. He then recommended the appointment of a committee which, while large enough to be representative, should be small enough to do business, and thought that the members of the committee should be located territorially so as to admit of their being gotten together with the least expense.

After some discussion it was decided to appoint four members from the parent association and one from each of the other associations, the latter committeemen to have an alternate to attend in case the regular member found it impossible to be present. In conformity with this motion, the following gentlemen were announced as composing the sub-committee to devise ways and means for the reorganization of the American Street Railway Association and to determine the manner in which the subsidiary organizations should be affiliated, the committee to report later:

For the American Street Railway Association—E. C. Foster, New Orleans; Richard McCulloch, St. Louis; C. G. Goodrich, St. Paul; W. E. Harrington, Camden, N. J.

For the Accountants' Association—W. G. Ross, Montreal, and Frank R. Henry, St. Louis, alternate.

For the Mechanical Association—H. H. Adams, Baltimore, and E. W. Olds, Milwaukee, alternate.

For the Claim Agents' Association—W. A. Dibbs, New York, and W. H. Renaud, New Orleans, alternate.

For the Manufacturers' Association—W. H. Heulings, Jr., Philadelphia, and William Wharton, Jr., Philadelphia, alternate.

On motion, Mr. Ely, president of the American Street Railway Association, was requested to act as chairman of the joint committee, ex-officio.

On motion, the matter of making arrangements for expert assistance, to serve the committee, was referred to Mr. Ely.

On motion the meeting then adjourned.

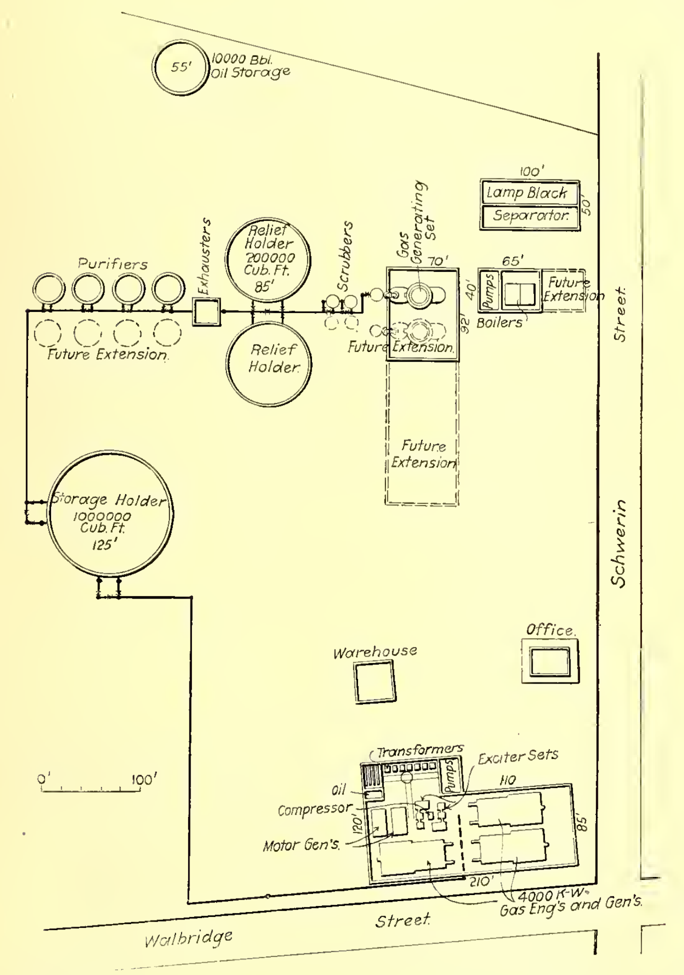
Friday evening, upon invitation of Mr. Ely, the gentlemen in attendance were entertained at dinner at the Manhattan Club, and afterward attended the theater in a body.

PHILADELPHIA AS THE MEETING PLACE

At a meeting of the executive committee of the American Street Railway Association, held on Saturday, Feb. 4, it was decided to hold the next convention at Philadelphia during the week commencing Sept. 24. The Bellevue-Stratford was selected as the headquarters, and W. E. Harrington and W. H. Heulings, Jr., with the president and secretary, were appointed a committee of arrangement. A committee on membership was also appointed, but the names of its members were not made public.

THE SAN FRANCISCO GAS-ENGINE ELECTRIC PLANT

As already announced in this paper, the California Gas & Electric Corporation, which owns and operates the Bay Counties electric power transmission line, which is the longest in the world, has recently entered into a contract with the United Railways Company, of San Francisco, to supply the electricity for running the entire street railway system under the control of that company. Current will be supplied normally from the



PLAN SHOWING GENERAL ARRANGEMENT OF SAN FRANCISCO GAS ENGINE—ELECTRIC PLANT

hydro-electric transmission system, but to provide against interruption of service, it was considered desirable to arrange for the installation of an auxiliary power plant to pick up the load quickly, if necessary, and so insure constant service to the street railway company.

Steam engines and steam turbines were considered, but the fact that they require that their boilers shall be under constant fire for immediate operation was considered to involve too much attendant expense. The engineers, therefore, decided upon the introduction of large gas engine units, which are ready for instant use, and with which the interest on the cost of the engine plant is the only fixed expense.

The California Gas & Electric Corporation, in addition to its other work, has been the pioneer in California in the manufacture of an excellent quality of low cost oil gas, and is now proposing to introduce the largest gas engines that have ever been constructed in the United States to be used directly connected to alternating-current generators operating in parallel. The engines, of 5333 hp each, three in number, will be constructed by the Snow Steam Pump Works, of Buffalo, N. Y., and are known as the Snow gas engines.

The Snow engine is of the 4-cycle, horizontal twin-tandem, double-acting type, giving two impulses to each crank per revolution. The equipment of the station for the present is to consist of three of these engines. They will be of 5333 hp each, will run at 88 r. p. m., and will each be directly connected to a three-phase, 4000-kw, 25-cycle alternator, manufactured by the Crocker-Wheeler Company. There will also be two motor-generator frequency changers, built by the Stanley Company, having an output of 4000 kw each, and designed to run at 300 r. p. m. These frequency changers will take 60-cycle, three-phase current at 11,000 volts and deliver three-phase, 25-cycle current at 13,200 volts. Connected with these machines will be two banks of 60-cycle transformers of 1500 kw each, with a spare transformer, making a total capacity installed in transformers of 10,500 kw for transforming from 50,000 volts or 60,000 volts to 11,000 volts for the motor-generator frequency changers. The exciter for the motor end of the frequency changers will be equipped with a special regulating device, so that changes in the railroad load will not affect the main line pressure of the transmission lines.

To furnish exciting current for the 25-cycle generators there will be two 340-kw motor-generator exciter sets, either one of which is large enough to excite the entire station. Each of these exciter sets will have a pulley, from which may be driven compressors which will supply air to storage tanks for starting the gas engines. There will also be a storage battery for emergency exciting current.

High-tension switches for the two 60,000-volt transmission lines which will enter the station will be installed in fireproof compartments. A fireproof compartment construction will also be used for the 11,000-volt, 60-cycle switches and the 25-cycle, 13,200-volt switches. The 25-cycle switches will be in duplicate, there being a duplicate set of bus-bars arranged so that any feeder or any machine may be worked on either set. This will give ample facility for keeping everything in first-class shape.

The main building of the power station will be 200 ft. in length x 90 ft. in width. This will accommodate three engines, motor generators and exciter sets, and will also give room at one end for a machine shop, tool room and office rooms, etc. On one side of the main building there will be an addition 36 ft. wide x 80 ft. long, in which will be installed on the first floor a storage battery, high-tension transformers and pumping apparatus for cooling water for the gas engines; on the second floor the 60,000-volt switches, all of the 11,000-volt and 13,000-volt switches, and also the general operating switchboard of the station.

Outside of the main building there will be arranged storage tanks, cooling tanks and other apparatus for the cooling water of the engines.

In connection with the gas engine station, there will be a thoroughly modern oil gas plant, consisting of generators 16 ft. in diameter x 18 ft. in height, connected to superheaters 16 ft. in diameter x 40 ft. in height, and especially designed wash boxes for removing the by-product, lamp black. The works will be fitted with modern scrubbers for washing the gas, and two relief gas holders having a capacity of 200,000 cu. ft. each. There will be four cylindrical purifiers 30 ft. in diameter and a storage gas holder of 1,000,000 cu. ft. capacity.

The plans of the works are now finished, construction work is about to begin, and it is anticipated that this plant will be the most modern and economical of its kind in existence.

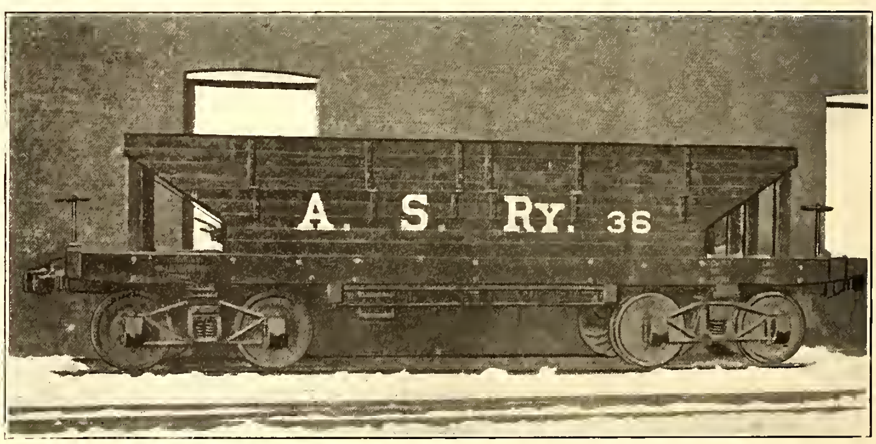
The low cost of crude petroleum of California makes it possible to produce a gas of high heating value at a cost which is impossible in other parts of the country. It is the endeavor of the corporation to complete the gas plant by Sept. 1, 1905, and the managers hope to have one of the engines installed at that time and that the complete installation will be finished before Jan. 1, 1906.

The accompanying ground plan of the power generating and gas generating plant will afford some idea of the general locations of the buildings and their particular arrangement, by which economy and space has been gained for present operation, with advantages of extensions in the future. The site selected is in San Mateo County, a distance of about 4½ miles from the center of the business district of the city of San Francisco, and is particularly ideal, being located upon the bay of San Francisco, where oil can be readily delivered, and where salt water for all purposes in the manufacture of gas can be obtained in unlimited quantities.

The construction of the power plant, including buildings, and the gas engine units, together with the high-potential transmission lines, which will connect the power station with the seven water-power plants of the corporation, will be in charge of F. G. Baum, transmission engineer of the corporation, who has achieved a wide reputation for his knowledge in this branch of electrical science. The erection of all of the gas plants and all of their equipment will be in immediate charge of E. C. Jones, gas engineer of the corporation, who is a well-known authority on the construction of gas works and in their economic operation.

GABLE-BOTTOM COAL CAR FOR THE ATLANTIC SHORE LINE RAILWAY COMPANY

As a number of electric railways are now operating coal cars and others are contemplating like action, a description of the type used on the Atlantic Shore Line Railway, Kennebunk, Maine, may prove of some value. This car, which has a capacity of 17 tons steam coal, was built for the railway company by the Laconia Car Company Works, Boston, Mass. It is self-dumping through the bottom; there is a suitable slant both from the ends and from the center to two traps, one on each side, between the outside and intermediate sills, 18 ins. wide and 9 ft. 6 ins. long. In raising the traps, they are operated by the Laconia pump-handle motion attachment which winds onto a 2-in. rod, two cable chains to each trap. Chains are attached to the rod and to the trap by eye bolts. Each trap is operated independently. To drop the trap the lock weight has to be raised and the panel lifted to allow the ratchet wheel to revolve, the trap then dropping to allow the car to unload by gravity.



SIDE VIEW OF COAL CAR USED BY THE ATLANTIC SHORE LINE RAILWAY COMPANY

The draw-gear is of the Laconia Car Company Works standard M. C. B. type, and the couplers have flexible heads. The car is equipped with hand brakes operating on all the wheels of both sets of trucks. There is a brake wheel at each end of car. The trucks are of the diamond frame, and the bolsters are of the sandwich type, made of wood and steel plates. The wheels are Laconia double plate, 33 ins. in diameter, weighing 550 lbs. each. The brake beams are inside hung.

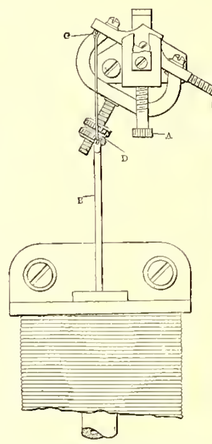
The main dimensions of this car are as follows: Length over sills, 28 ft.; length over body, 24 ft.; width over side sills, 8 ft.; width inside, 7 ft. 9½ ins.; height above floor, 4 ft.; height top of rail to top of floor, 4 ft. 1¼ ins.; bolster centers, 19 ft.

It is interesting to see from the foregoing that the use of special cars is increasing to such an extent that railways find it worth while to have them constructed by car companies rather than to build such cars themselves of old material.

NEW TYPE OF VOLTMETERS AND AMMETERS

There has been a strong demand upon makers of electrical instruments for reliable voltmeters and ammeters for switchboard work that could be supplied at a price in keeping with that of the other apparatus. To fulfil this demand the Westinghouse Electric & Manufacturing Company offers a new line of instruments known as the type K for use upon either direct or alternating currents. This is a development of one of the Lord Kelvin patents controlled by the Westinghouse Company, and the construction is strictly modern to satisfy the most exacting requirements of present practice.

In shape, size, finish and general appearance the type K instruments harmonize with the other round pattern switchboard types of the Westinghouse manufacture. The face has a matted surface with raised letters and a pleasing ornamental design in low relief, the entire case being finished in black enamel. Their principal distinguishing characteristic is the



DETAIL VIEW SHOWING ADJUSTING WEIGHTS

TYPE K AMMETER IN CASE

simplicity of their construction. There are but few parts, none of which are complicated, and the adjustments are easily made. In effect, the mechanism consists of a stationary coil, through which the measured current flows, the voltmeter measuring the current which flows through a high resistance. The coil acts on a movable core or plunger, which is connected with a steel beam mounted upon knife bearings and carrying the indicating pointer. There are no springs, the action being controlled by gravity.

In other instruments in which a solenoid is employed, the residual magnetism has seriously affected their accuracy. In the type K the core is so constructed that it is saturated with a very small amount of magnetic energy, such as that of one-twentieth full scale deflection, and thus for any load the attraction upon the plunger is directly proportional to the current, making the error due to residual magnetism commercially negligible and the scale almost uniform, commencing with zero. On alternating currents its action is not appreciably affected by changes in frequency. External fields do not influence the performance and temperature errors are negligible.

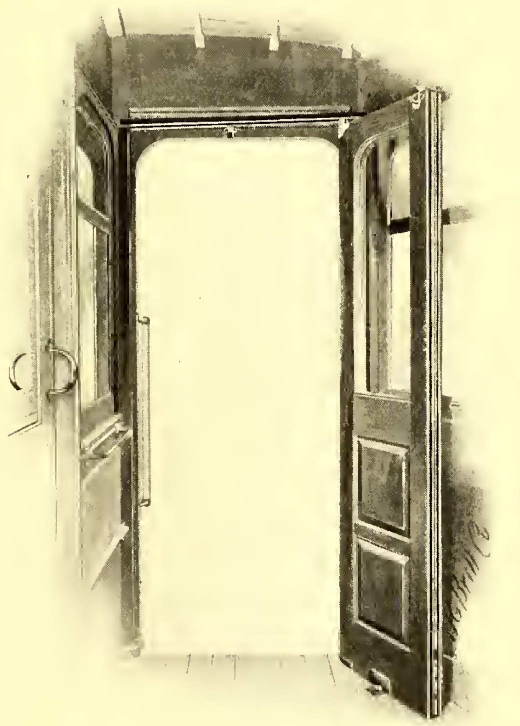
The instruments are dead beat in their indications, the steadying effects of a dash pot being obtained by inserting the lower end of the plunger in a glass tube filled with oil. The opening in the solenoid is made small and the plunger is a piece of fine iron wire, flexibly connected to the movement by means of a strong silk cord. The only point where friction could be looked for is at the two knife edge bearings which support the beam, but, in fact, no frictional effects are perceptible, as the weight is exceedingly light and the controlling force very great. Movable weights, shown at D and E in the accompanying illustration, afford a means for adjustment. The scale has large open divisions, which are practically uniform in size and legible at all points. The sector illustrated at A corrects inequalities by keeping the leverage the same in all positions. It will be seen that the simplicity of construction gives the type K instruments an unusual degree of strength, coupled with exceedingly accurate performance. There is nothing in their mechanism to affect the permanence of calibration, and they are easily repaired and adjusted.

Ammeters are regularly made of capacities to and including 1000 amps and voltmeters to 750 volts for use without transformers. For larger capacities, transformers are supplied. Switchboard builders find them of decided advantage in connection with moderate priced panels where high accuracy is desired, such as combination panels for a single generator with its feeders and small boards for isolated plants.

The Frisco Railroad and the Southwest Missouri Electric Railway, which compete for interurban passenger business between Carthage and Webb City, Joplin, Mo., and Galena, Kan., have announced advances in fares. Since 1898 the fare between Carthage and Joplin has been 20 cents. The new rate will be 25 cents and 30 cents, according to destination.

A NEW DEVICE WHICH CONTROLS THE SWING OF VESTIBULE FOLDING DOORS

The close attention to every detail of car construction and the constant watchfulness to improve every part to the smallest accessory has always been a notable characteristic of the J. G. Brill Company. To the long list of patented specialties invented and manufactured by the company has recently been added a device for controlling the movement of folding doors of car vestibules, two positions of which are shown in the accompanying illustrations. The device consists of a roller mounted vertically on the upper corner of the outer leaf of the folding door, and which moves between a guide rail attached to the middle of the door and a guide rail parallel to it. A spring catch at the top of the door near the center locks it in its closed position, and when released the spring hinges open the door part way, and with a light push with one hand it is folded back and held by neat clasps, the lower one having a spring buffer and the upper utilizing the same spring lock which fastens the door when closed. To close the door, the spring lock at the top is drawn down and the lower catch is pressed down by a small toe piece. The Brill Company is using the device on all of its cars having vestibules with folding doors, and in every case it has met with great favor.



OPEN AND CLOSED POSITIONS OF VESTIBULE FOLDING DOORS CONTROLLED BY ROLLER AND SPRING LATCH

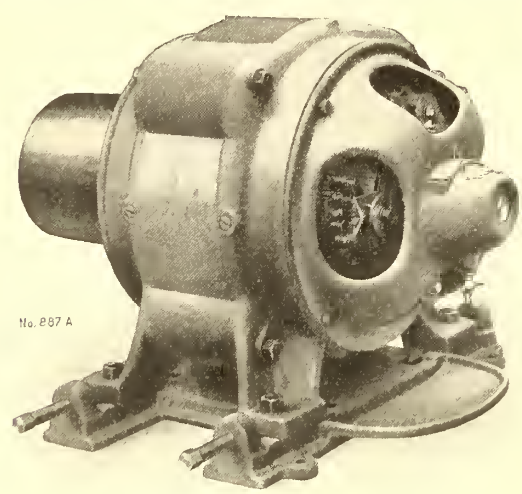
One can readily appreciate the advantage over the former method of allowing the folding doors to swing free with liability of striking against passengers, and by a sudden movement of the car be violently closed or opened, resulting in broken glass and wrenched frame. The extensive use of the dividing rail on vestibule Detroit platforms makes such a device absolutely necessary to prevent defacement of the woodwork of the door by swinging against the railing. The manufacturer believes it to be a simple and efficient arrangement that is destined to be widely used.

A meeting is to be held of representatives of the United Railroad of San Francisco and a committee of the union of employees to settle the question of whether the present working agreement between the company and the men shall be renewed for one or two years.

A RECENT DEVELOPMENT IN DIRECT-CURRENT MOTOR CONSTRUCTION

The National Electric Company, of Milwaukee, has brought out a new line of Lundell motors whose entry in the direct-current field is coincident with a radical development in the art of construction. It will be quickly realized from the following description that the component parts have been proportioned and combined to produce motors remarkable for their efficiency, low temperatures, compactness and rigidity of structure.

The cast-iron frames or housings, which contain the lami-



VIEW OF MOTOR READY FOR SERVICE

nated yoke rings and support the bearing brackets, consist of a rigid open casing made in two parts (front and rear). The rear has four hollow extension arms of strong cross section, accurately bored to engage and support the laminations assembled therein. The front frame is identical with the rear frame, except that the extending arms are omitted. Bolts pass through these arms, securing the frames together, insuring the most rigid construction. These frames or housings, when bolted together, possess exceptional stiffness, which is in no way dependent upon the use of the laminations; in fact, it makes no difference to the stability and perfect alignment of the machine whether the yoke laminations are in or not. At the same time, the over-all dimensions (height and width) of the magnet yoke are not exceeded, an objectionable feature to be found in all previous attempts at making a rigid laminated yoke motor.

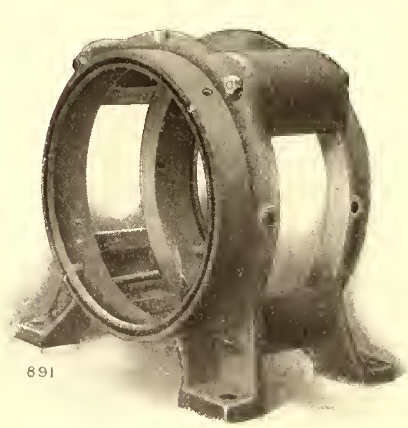
It has long been desired to use laminated yokes in direct-current motors and generators, as this insures an absolute uniformity of the magnetic circuits, a greater flexibility of speed control, quick field regulation and a more compact structure. In fact, it represents the finality of design, because laminated mild steel for the entire magnetic circuit in yoke, pole pieces and armature and armature body, and copper for the conductors, embody the most desirable materials for their respective purposes. The Lundell laminated yoke is built up of punched mild steel rings secured and accurately centered in the rigid frame just described. The outer and inner diameter of these rings are absolutely concentric.

The pole pieces are separately punched from the same material as the yoke rings. These pole pieces are provided with end plates so constructed as to provide ventilating ducts to carry off the heat generated in the field coils. Ordinarily this idle space has not been made use of. These end plates are tapped and retaining bolts pass through the frames, accurately seating the pole pieces, causing the same to make perfect contact with the inner diameter of the yoke rings. By removing these bolts the pole pieces and field coils can then be readily taken off.

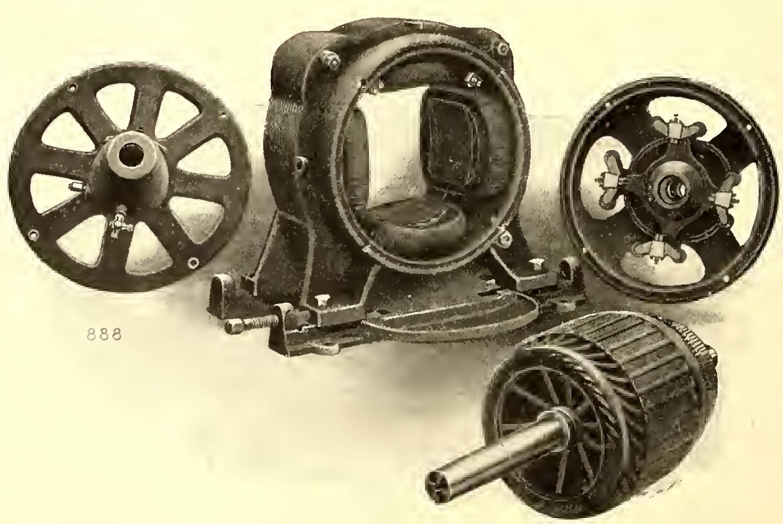
In machines up to 60 hp it is not necessary to introduce ventilation into the center of the armature, as the losses are exceptionally low in this new line of machines. The foregoing is peculiar to the Lundell universal motors, which save the space, while other types have to provide for these ducts in the length of the armature core. The extremely low losses make it possible to enclose these motors at lower temperature rises than is possible with other motors in which the losses are greater, and consequently the temperature higher, unless additional ventilation is relied upon in order to bring the temperature within established limits. The armature coils are all form wound and are separately insulated independently of slot insulation, the insulation of the coils being assured from the start. These coils are of standard proportions and provide for ample room at both the back and the front ends. Supporting rings cast in one piece with the end plates of the core serve to hold the ends of the armature coils firmly in place.

The commutators are built on the lines of standard street railway practice, giving a rigid support to the bars, which are made of hard-drawn copper insulated by selected mica. The commutator shells are ventilated through their centers, which construction aids in bringing about the remarkably cool running of the commutators.

A new principle is involved in the brush device of this apparatus. It has not only important commutation features, but has an operative bearing upon the running of the brush, securing a performance never before equaled. In the past it has been customary to see the brushes on a stud placed side by side



THE FRAME SKELETON



DETAIL PARTS ILLUSTRATING SIMPLICITY OF CONSTRUCTION in a line parallel to the commutator bars and mica. With this apparatus, one brush is placed directly in front of the other (in tandem). The total brush surface is the same as is the commutator space occupied by the side-by-side brushes, and each brush has its independent tension spring. With the old style brushes any irregularity of the commutator surface causes both brushes to jump together. This instantaneously opens the circuit at that point as each irregularity passes a brush-stud. With the Lundell tandem brush the irregularity (if there should possibly be any) strikes only one brush of a stud at a time, so that while one may rise its mate is making contact and the circuit is always closed for that stud. In practice it has been found that this one fact materially reduces the temperature of the commutator and gives it a much better surface, as well as an excellent bearing surface to the brushes themselves. Where field control is used to obtain broad ranges required by variable speed work, or where conditions of service call for special commutating conditions, the brush at the leaving edge is made of high resistance carbon to take care of the sparking conditions, and the other brush of high conductivity to carry the current. In this manner both conditions of service, which are ordinarily opposed to each other, are successfully performed by this dual brush in a manner not possible with the single brush.

The magnetization losses in the iron, and resistance losses in the winding, commutator and brushes are so low, due to the economical proportioning of these parts, that the motors run cool independent of forced ventilation. The proof of this is to be found in their performance. When running under full load continuously, the temperature rise is so low that the quality of the insulation is not impaired in the least. In fact, the motors have such ample temperature margins as to permit of heavy overloads being carried for long periods without injury. Full loads are carried continuously without sparking, and because of the peculiarities of the Lundell tandem brushes, heavy overloads are carried without injury to the commutator or the brushes. One important feature of this type of brush holder is that the commutator is given a fine high polish, while the face of the brushes is always worn down to a true bearing surface. Pig tails are not necessary to carry off the current from the Lundell laminated brushes because they have twice as much contact surface against the holder as the ordinary solid brush. Because of the high class material used throughout and the economy secured by the design, it is possible to obtain the highest efficiencies for these motors.

LAMINATED YOKE CONSTRUCTER

Variable speeds of standard fixed speed motors, obtained by field control, are permissible within certain limits. For broad ranges of speed, motors of properly selected capacities are used. A range of speed, the lowest and highest points of which are represented by a ratio of 3 to 1, meets most practical cases, and is recommended as the ratio of speed to be obtained by field control. These variable-speed motors are remarkably compact and have ample margins for carrying overloads even when working under most difficult conditions of commutation.

These motors are particularly short between bearings, because of the high quality of the material itself and the ingenious design. The armature shaft is made of cold rolled steel, and is of large diameter, combining stiffness and strength, particularly because of the short distance between bearings. The bearings are of large area, and oil rings are provided to conduct the oil from the wells to the armature shaft. Cast-iron covers of liberal dimensions, directly over the rings, permit of inspection, and a special oil plug prevents an overflow of oil into the motor when the bearing boxes are filled.

POWERFUL LOCOMOTIVE AND BAGGAGE CAR FOR JOLIET, PLAINFIELD & AURORA RAILROAD

The American Car Company, of St. Louis, has lately delivered to the Joliet, Plainfield & Aurora Railroad Company the baggage and express car shown in the illustration, which was ordered by the Fisher Construction Company, the engineers and contractors. Passenger cars for this line built by the American Car Company were described in this journal of Dec. 10, 1904. The lines which were opened last year have had a good paying business from the start, and there has been a pressing demand for facilities for handling baggage and express, to meet which the company has ordered this fine car. The latter is mounted on 27-E trucks, capable of very fast service.

THE JOLIET, PLAINFIELD & AURORA RAILROAD COMPANY'S NEW EXPRESS CAR

The car is divided into two compartments, one 14 ft. 1½ ins., and the other, 29 ft. 10½ ins. Its length over the crown pieces is 44 ft.; over the bumpers, 46 ft., and the width over sides, 8 ft. 10 ins. Two 4-ft. 6-in. sliding doors are on each side of the car. The longitudinal slat seats, seen in the illustration, are arranged to fold up. The interior is sheathed and painted, and the ceilings are carline finish. As the car is intended for carrying very heavy loads, the bottom framing is unusually substantial, and includes four 6-in. channel iron center sills, and the side sills are 5 ins. x 7¾ ins. The angle-iron bumpers, gongs, sand boxes and brake wheels are of Brill manufacture, and the signal bells, pilots and other furnishings are of the builder's make. The wheel base of the trucks is 6 ft., and the wheel diameter, 33 ins. Heavy couplers of M. C. B. type are at either end, in addition to radial channel iron couplers, and enable the car to be used as a locomotive for drawing trains of freight cars from steam roads.

Two bills have been introduced in the Indiana Legislature to do away with the issuing of gratuitous transportation to officials. One bill makes it unlawful for a State, county or city official, or legislator or judge of a court to accept a pass over a steam or interurban road. The other bill makes it unlawful for a railroad or interurban company to issue passes to the above named officials, and adds penalties for violation.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 8, 1905.

The Money Market

There was no appreciable change in the money market this week, despite the losses in cash sustained by the banks as a result of the recent heavy exports of gold and the preparations making for the flotation of the various new issues of railway bonds. The demand for funds was somewhat larger than in the preceding weeks, but the supply of money was at all times in excess of the inquiry. Consequently, borrowers experienced no difficulty in obtaining necessary requirements at the low rates recently quoted. The only activity was displayed in the call money department, a fairly large business being transacted at rates ranging from 2 to $2\frac{1}{2}$ per cent, the average being about $2\frac{1}{4}$ per cent. A very moderate business was reported in the time loan branch. In the absence of offerings by Western institutions, local lenders were inclined to hold rates firm on the basis of $3\frac{1}{2}$ per cent, but the amount of money placed at that figure was extremely small, borrowers generally declining to make contracts at that figure. In some instances maturing loans were liquidated. Toward the close of the week, however, the tendency became easier, and offerings were quite liberal at $3\frac{1}{4}$ per cent for four and five months' maturities. Mercantile paper was fairly active, the inquiry for high-grade material being largely in excess of the supply. Prime endorsed bills were readily discounted at $3\frac{3}{4}$ to 4 per cent, while choice single names found a ready market at 4 to $4\frac{1}{4}$ per cent. A feature of the week was the sharp advance in the price of sterling exchange at Paris to 25 francs 18 centimes, and a decline of 30 points in sterling here, which puts shipments of gold coin to that center out of the question, at least for the present. The exports of gold bars, however, are likely to continue on a small scale for some time to come. In addition to the consignments to Paris, substantial amounts are center out of the question, at least for the present. The exports of gold bars, however, are likely to continue for some time to addition to the consignments to Paris, substantial amounts are likely to be sent to Cuba in payment of the last instalments due on the Cuban bonds, and to Argentina. The bank statement published last Saturday was about as expected. The loss in cash, amounting to $5,349,700, was due largely to the heavy gold exports. The increase of $12,443,600 in loans reflected the syndicate operations in connection with the Southern Pacific bond issue. Deposits increased $7,151,700, resulting in a decrease in the surplus reserve of $7,137,625. The surplus is now $19,841,925, as against $21,842,775 in the corresponding week of last year, $18,545,675 in 1903, $17,896,225 in 1902, $20,362,625 in 1901, and $27,897,575 in 1900. There was no material change in the discount rates at the principal European centers. At London the rate was $2\frac{1}{2}$ per cent, at Paris 2 5-16 per cent, and at Berlin 2 per cent. At the close the situation was free from disturbing factors, and indications point to a continuance of the present easy conditions for some time to come. It is pointed out that while the demands upon the local institutions will be heavy in the near future, on account of the various railway and municipal bond issues, the banks are in an extremely strong position, and are well able to meet all demands without causing any material hardening in money rates. Gold exports are also likely to be made upon a much smaller scale after the present week.

The Stock Market

Considerable activity developed in the stock market this week, and although the dealings were accompanied by more or less irregularity, as the result of profit-taking sales, the general tone of the market was strong. The overshadowing feature of the week has been the large and constant demand for investment securities, resulting largely from the remarkable ease in the money market. In fact, investment bonds have not been in equally good demand in many years. At the close of last week $75,000,000 Southern Pacific refunding 4 per cent bonds were brought out, and it is understood that orders in advance for them exceeded the entire amount before the subscription books were opened. The flotation of this issue was all the more remarkable in view of the fact that the exports of gold coin to Europe last week were the largest in any single week, and the loss of bar gold promises to be unusually heavy during the present week. The demand for high-grade stocks from investors was also extremely heavy. This condition of affairs more than offset the thorough dissatisfaction in railroad circles over the insistance on the part of the President in the face of Congressional opposition, to the passage of a law that would give to the Federal Government the right to make railroad freight rates. On Tuesday trustworthy information from Washington was to the effect that there would be no legislation in this matter at the present session of Congress, and prices advanced sharply. There were renewed rumors of peace negotiations between Japan and Russia, and, although this was a minor influence, it helped to maintain prices.

The local traction stocks were active and strong on persistent rumors of a merger of the various lines in New York City. Metropolitan Securities and Metropolitan Street Railway were conspicuously strong, the first-named closing at $83\frac{3}{8}$, a net gain of $4\frac{1}{2}$, while the latter ended the week at $122\frac{1}{8}$, an advance of $6\frac{1}{4}$ points. Brooklyn Rapid Transit and Manhattan Railway also scored substantial gains.

Philadelphia

The Philadelphia Company has declared a dividend of $2\frac{1}{2}$ per cent on the preferred stock, payable on March 1, to stockholders of record on Feb. 10. The company has also sold $1,500,000 5 per cent serial notes, the proceeds to be used upon extension of pipe lines in West Virginia, which will considerably increase the company's supply of gas. The notes will be paid off out of current earnings, at the rate of $300,000 per year.

Announcement is made that the Philadelphia Rapid Transit Company has sold $10,000,000 bonds of the Market Street Elevated Railroad Company to Drexel & Company at par. The bonds, which are 4 per cents, mature in fifty years. They are secured by a first mortgage upon the property of the Market Street Elevated Railroad, and are guaranteed by the Philadelphia Rapid Transit Company. Of the total amount only $5,000,000 will be called for at once, the balance to be drawn upon from year to year, as it is wanted, for the building of extensions to its properties. Announcement is also made that work upon the Market Street Elevated road and upon the underground system will be pushed as rapidly as possible.

Dealings in the traction shares were fairly active, and prices generally ruled firm. United Gas and Improvement was the active feature, several thousand shares changing hands at from $108\frac{3}{4}$ to $108\frac{3}{8}$. American Railways advanced $1\frac{1}{4}$ points to $49\frac{3}{4}$, on the exchange of odd lots, and Railways General sold at 3 15-16 to $3\frac{7}{8}$. Philadelphia Traction rose a point to 101, but subsequently the price eased off to $100\frac{1}{2}$. Philadelphia Company Common rose $\frac{3}{8}$ to $41\frac{1}{2}$, while the preferred brought 47. Philadelphia Rapid Transit was active and firm, with all transactions at $24\frac{7}{8}$ and 25. Union Traction brought 59 to $58\frac{7}{8}$, United Companies of New Jersey $273\frac{1}{2}$, and Union Railway $74\frac{5}{8}$.

Chicago

All indications point to a speedy unraveling of the local street railway tangle. The deposits of City Railroad stock during the past week have exceeded the expectations of the members of the syndicate, and it is expected that by Feb. 15, the time limit for receiving deposits, practically the entire outstanding stock of the company will have been deposited. At the close of business on last Saturday, 124,000 shares of stock had been turned in, or 33,000 shares more than a majority. Since then considerable more stock has been turned in, the smaller holders evidently not being inclined to constitute a minority interest.

It is said that the new interest in the company will make decided improvements in the public service. The improvements will of necessity be limited on account of complicated conditions of the franchise rights, but efforts will be made to give the patrons of the South Side system a much better service in every respect. John Spoor is said to be slated for the presidency of the City Railway. The franchise question is receiving more or less consideration at the present time. Mayor Harrison early in the week sent a communication to the City Council recommending that no traction legislation be passed until after the April election. Traction interests, however, are awaiting the decree of the court in the franchise case, which is expected in the coming week, and it is said that according to the present plans no further important developments in the local traction situation need be expected until the court's decision is handed down. If the decree is favorable to the Chicago Union Traction

Company, it is probable that rapid progress will be made in working out the entire traction problem.

The committee of the City Council is considering an ordinance permitting the Metropolitan Elevated to build two new tracks on the Barfield branch, and permitting the Aurora, Elgin & Chicago cars to come over the Metropolitan tracks down town.

The traction stocks were active and strong, prices generally responding to the progress made in the plans to consolidate the various street railway properties. Chicago City Railway sold at 199. Chicago Union Traction common rose 1⅜ to 13⅞, while the preferred sold at 51 to 50. North Chicago advanced sharply to 99, while West Chicago jumped from 66 to 72 on moderate purchases. The Elevated Railway issues were comparatively quiet but firm, especially Metropolitan Elevated, which advanced to 64, despite the reported intention of the directors to defer the resumption of dividends on the stock until after the close of the fiscal year. They sold at 22. Chicago & Oak Park common sold at 6½, and the preferred at 24. South Side advanced nearly 2 points to 95¼, and Northwestern sold at 24⅜.

Other Traction Securities

The Boston market was extremely dull and devoid of noteworthy features. Boston Elevated was not materially changed as to price, several hundred shares being transferred at prices ranging from 155 to 155¾, the final transactions taking place at 155½. Massachusetts Electric common was strong with sales at from 14¾ to 15⅛, but the preferred lost a point to 60. West End stocks were irregular. Early in the week the common dropped 2 points to 94, but rallied at the close to 95¾; the perferred advanced a point to 115. The feature of the Baltimore market was the activity and strength in United Railway incomes, about $300,000 selling at from 52 to 55¾. There was no news to explain the rise in this issue. The 4 per cent bonds were quiet at 95, while the stock was practically neglected, about 1000 shares bringing 14¾. Other transactions included Norfolk Railway & Light 5s at 95¾ to 95½. Washington City & Suburban 5s at 105¾ to 106. Baltimore City Passenger 5s at 107¼. Macon Railway & Light 5s at 98½ and 99. On the New York curb Interborough Rapid Transit continued its erratic movement upon an extremely heavy volume of business. Upward of 22,000 shares were dealt in at from 202½ to 225, an extreme gain of 22½ points for the week. Just at the close there was considerable profit-taking, which carried the price off sharply to 215. Stop loss orders were uncovered at the way down; the close was at 217. There was absolutely no news to account for the sharp advance in price. Numerous rumors were in circulation, but all of them lacked official confirmation. Washington Railway & Electric preferred sold at 87, and American Light & Traction preferred brought 101. In bonds the trading was fairly active and included $60,000 Jersey City, Hoboken & Paterson 5s at 79¾ to 80, $100,000 United Electric of New Jersey 4s at 77⅞ to 78⅛, $20,000 North Jersey Street Railway 4s at 80½, and $50,000 Public Service 5 per cent notes at 97½ and interest.

Security Quotations

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

	Feb. 1	Feb. 8
American Railways	49	50½
Aurora, Elgin & Chicago (preferred)	--	—
Boston Elevated	155½	155
Brooklyn Rapid Transit	61¼	62⅛
Buffalo Con. 5s	—	109
Buffalo Deb. 6s	—	104
Chicago City	—	198
Chicago Union Traction (common)	13	12¾
Chicago Union Traction (preferred)	—	51
Cleveland Electric	—	81
Consolidated Traction of New Jersey	80	80
Consolidated Traction of New Jersey 5s	109	109
Detroit United	77	77½
Interborough Rapid Transit	208¼	217½
Lake Street Elevated	—	--
Manhattan Railway	169¾	171¼
Massachusetts Electric Cos. (common)	15⅛	15
Massachusetts Electric Cos. (preferred)	60½	59½
Metropolitan Elevated, Chicago (common)	21	21⅛
Metropolitan Elevated, Chicago (preferred)	59¾	60
Metropolitan Street	117¼	120½
Metropolitan Securities	78¾	81⅞
New Orleans Railways (common)	3½	3¼
New Orleans Railway (preferred)	12	13
New Orleans Railways, 4½s	76	79
North American	103½	103¼
Northern Ohio Traction & Light	—	—
North Jersey Street Railway	—	22
Philadelphia Company (common)	41¾	41¾
Philadelphia Rapid Transit	24⅞	25⅜
Philadelphia Traction	100½	100
South Side Elevated (Chicago)	—	94½
Third Avenue	125	130
Twin City, Minneapolis (common)	105½	105⅜
Union Traction (Philadelphia)	58⅞	58¾
West End (common)	94½	95¼
West End (preferred)	114	115

Iron and Steel

The "Iron Age" says that the monthly blast furnace statistics show that in January the production of the works in the United States beat all records, having been 1,776,000 tons, exclusive of charcoal iron, which would carry the production close to 1,800,000 tons, or at the rate of 20,700,000 tons per annum. Yet the furnaces have not been in full swing in January, since the weekly capacity has advanced from 377,879 tons per week on Jan. 1, to 404,292 tons on Feb. 1. In spite of the heavy production, the stocks of merchant furnaces declined from 403,000 tons on Jan. 1, to 372,000 tons on Feb. 1, thus indicating a rate of consumption of fully 21,000,000 tons a year. That such figures should be reached in mid-winter is astounding.

THE CHICAGO CITY RAILWAY COMPANY CHANGES HANDS

The Chicago City Railway Company on Feb. 3 passed into the control of a syndicate headed by J. P. Morgan & Company and represented in Chicago by Marshall Field, P. A. Valentine and John J. Mitchell. The syndicate has offered for some time to purchase Chicago City Railway stock at $200 per share, provided enough stock could be secured to assure control of the company. Under this proposition, stockholders depositing their stock with the syndicate were to have received pay after March 31, but enough stock having been deposited to secure control, payment has been made in full. The change in the control of the company is the first step toward the unification of the Chicago City Railway Company and the Chicago Union Traction Company.

WHAT THE LAKE SHORE & MICHIGAN SOUTHERN IS DOING WITH GASOLINE—AN OFFICIAL STATEMENT TO THE STREET RAILWAY JOURNAL

Reports have been published in newspapers that the Lake Shore & Michigan Southern Railway Company had been experimenting with gasoline cars, and that contracts had been placed for 100 equipments with the intention of placing gasoline cars in operation on branch lines in competition with electric cars. A STREET RAILWAY JOURNAL representative called on W. H. Marshall, genaral manager of the Lake Shore, relative to the matter, and was referred by Mr. Marshall to H. F. Ball, superintendent of motive power. Mr. Ball stated that his company is interested in the subject of gasoline cars, and that it has seen a number of experimental machines, but thus far it has not found anything that it considers would meet the requirements. He denied that any order for such cars had been placed, or that such a thing had even been considered. He said he thought such a car might be made serviceable for short branch lines, but he did not think it could compete with modern high-power electric cars. Mr. Ball is of the opinion that the most satisfactory scheme for designing such a car would be to generate electricity by means of a gas engine and mount motors on the trucks, thus operating the car electrically.

WESTINGHOUSE SALES MEETING

The annual meeting of the traveling salesmen of the electric railway and lighting department of the Westinghouse Electric & Manufacturing Company drew about seventy-five representatives to Pittsburg during the past week, one of the largest gatherings being at the dinner at the Hotel Schenley on Thursday evening. C. S. Cook, manager of the railway and lighting department, acted as chairman at the various meetings. The general sentiment of the convention was that there were busy days ahead in the electric railway field, the successful introduction of the electric motor into suburban traction service in the past few years having brought many of the great railroad companies to an appreciation of the future of the electric railway in interurban traffic. The meeting of the past week at Pittsburg was particularly valuable in the opportunity afforded not only for a close study of the latest shop developments in new motor types, but also for the discussion of the conditions and problems that have recently been encountered and solved in many important long-distance installations.

McKINLEY INTERESTS BUY ILLINOIS COAL COMPANY

The McKinley syndicate, which has such large city and interurban railway interests in Illinois, has purchased the Kelly Coal Company, one of the largest coal mining companies in the vicinity of Danville, Ill. The move is an important one, as with the aid of its interurban lines the syndicate is now in a position to mine and sell its own coal at Danville, Champaign, Urbana and intermediate points. Several 25-ton capacity coal cars have been purchased, and an electric locomotive has been built for hauling coal from the Danville mines to Urbana and Champaign, for use in the company's power house and for general sale in those places.

A HIGH-SPEED LINE BETWEEN PATERSON AND WEEHAWKEN

The announcement was made in New York the latter part of last week that a company had been organized to build a high-speed electric railway from Weehawken to Paterson, N. J., which is about 17 miles northwest of New York. The company that will carry out the project will be known as New York & North Jersey Rapid Transit Company, and according to information given to the STREET RAILWAY JOURNAL by one of the officers, the plans for building are pretty well matured.

To be exact, the line will be 13.6 miles long, extending from Paterson, through Passaic and Rutherford, to Wehawken at a point near the West Shore Railroad ferries in that place. In construction the road will be an air line. Its 13.6 miles of track will compare to advantage with both the Erie and the New York, Susquehanna & Western mileage between New York and Paterson, the distance by the former being 17 miles and by the latter 23 miles. The present electric routes compare quite as unfavorably with the proposed line, and they, of course, are not to be considered as a means of rapid transit.

The construction will follow closely the standard set in interurban railway work by the Lackawana & Wyoming Valley Railway, a third-rail line whose plant and equipment were described in detail in the STREET RAILWAY JOURNAL of June 13, 1903. The car equipment will, however, differ materially from that of the Lackawanna road, chiefly because conditions of service will not be the same. In this detail it has been decided to follow the practice of the Interborough Rapid Transit Company, operating the elevated and the subway lines in New York, whose subway car will be used as a model by the new road. Service will be given by multiple unit trains of six cars each. Both local and express trains will be operated. The running time of the express trains is estimated at 20 minutes, while that of the locals is placed at 30 minutes. One hour and one-half is the time it takes to make the trip from the Weehawken ferry to Paterson by trolley.

The terminal of the road in Paterson will be within one block of the City Hall, on private property which has already been acquired. From that terminal through Paterson the line will be elevated. It will also be elevated through Passaic and through Rutherford. Grade crossings through the country between these places will be entirely eliminated. In building from Rutherford across the meadows the company will follow the practice of the steam railroads operating in the same territory. A double-track tunnel will be driven through Bergen Hill for a distance of 4700 feet.

The decision of the company in determining to build to Forty-Second Street, New York, is strictly in keeping with the knowledge that has come of recent years, that the center of New York no longer is "down-town."

The population immediately along the line of the road is approximately 225,000, and within the 3-mile limit at which earnings per mile are usually based, the population is 600,000. There must, of course, be added to these figures the population of the terminal city, New York, with its 3,500,000 persons.

Connected with the company are railway men known the country over, and financiers whose prestige would assure the success of any enterprise with which they might become identified. Foremost among them is William Barbour, president of the company, who also is president of the Linen Thread Company. Mr. Barbour is a man experienced in electric railway work. He formerly was the principal owner and the vice-president of the Paterson Railway Company, which property he and his associates sold to the North Jersey Street Railway Company. M. R. McAdoo is the vice-president of the company. Mr. McAdoo is well known to the street railway world. He was associated with Mr. Barbour in the conduct of the Paterson Railway Company, being at one time general manager of the property. The executive committee of the company is William Barbour, M. R. McAdoo and the Hon. John W. Griggs, ex-attorney-general of the United States, and ex-governor of New Jersey.

A PETITION TO LEGISLATURE FOR A BOSTON SUBWAY

A petition to the Legislature, backed by H. P. Bowditch, H. L. Higginson, Lawrence Minot, A. T. Lyman, C. S. Packermann, R. H. Dana, E. H. Gay, and about one hundred other citizens or taxpayers of Boston has recently been drawn up, with the object of securing an enactment authorizing a rapid transit subway under Beacon Hill from Scollay Square to Massachusetts Avenue. The proposed route is under the Charles River embankment, Mount Vernon Street, Ashburton Place, and Pemberton Square to Scollay Square, connecting at grade with the East Boston Tunnel. Stations have been suggested at Dartmouth Street, between Brimmer and Charles Streets, at Louisburg Square, and at the State House. The advocates of the measure claim that the rapid transit facilities of the Back Bay, Allston, Brighton and the Newtons would gain much by such a subway; that a tunnel under Beacon Hill can be built under favorable conditions, owing to the slope of the hill, the depth of the tunnel and the sub-structure of blue clay which is easy to work and sufficiently firm to withstand pressure from above; that quicker time could be made between the Back Bay and the north and south stations than by present methods, and that the cost of such a subway and tunnel would not be over $3,000,000.

The object of pressing the matter at the present time is stated to be the desirability of locating such a subway under the Charles River embankment, before the space is laid out with shade trees and filled with pipes and conduits, coincident with the progress of the work on the Charles River Basin. The route is now being surveyed, and detailed plans will be presented to the Legislature when the matter comes up for a hearing.

INDIANA INTERURBAN MEN PROTEST AGAINST THE CODIFICATION BILL—THE RAILROAD COMMISSION BILL

A large number of interurban men appeared before the legislative committee of the Indiana Legislature last week and protested against the passage of the bill on municipal corporations. Their chief objection is to the provision which grants City Councils power to condemn city railroads, the contention being that such power will also permit cities to condemn interurban lines within city limits. They pointed out the predicament in which their systems would be left by the condemnation of their property in one or more cities as the limitations expired. They said it was possible to be left with various disconnected strips of rails which would be valueless, and insisted that the twenty-five-year limit to city franchises is unfair to interurban companies because they are expected to compete with steam roads, which hold their rights in perpetuity. Such a provision would defeat competition and work directly to the disadvantage of the public.

A committee representing the same interests, headed by A. W. Brady, president of the Indiana Union Traction Company, appeared before the legislative committee and complained that the Railroad Commission bill, as amended, ought not to become a law for the reason that it contained no provision by which the proposed commission would have power to compel steam roads to turn over loaded freight cars to electric lines. Mr. Brady claimed that it had been the understanding that the commission would have this power, and for this reason the electric lines had favored a railroad commission. Mr. Brady admitted that the traction interests preferred to be left out of the commission entirely. He said that the interurban business in the State is now in the experimental stage, and that it is not pleasant to contemplate the possibility of having developments and investments hampered by rules of the commission without corresponding advantages. He insisted that if the Legislature give the railroad commission power of supervision over the traction lines, it would be at least fair to give the commission power to compel steam roads to turn over loaded cars to the electric lines when, in the judgment of the commission, it is necessary and equitable for them to do so. Mr. Brady said the electric lines were not asking for unconditional exchange of freight between steam and traction lines. "We are not ready for that," he said. "But there are times when we need loaded cars on the steam lines, consigned to points on our lines, and at such times the commission should have power to compel the interchange of traffic. If you leave traction lines out of the bill entirely we will not complain, but if you do include them, then do not leave them without the advantages of interchange with the steam lines under proper conditions."

Both the interurban and the steam line interests appear quite willing to leave the interurban roads out of the jurisdiction of the bill, but the Legislature is not likely to acquiesce in this. Since the steam roads oppose the compulsory interchange of freight between the steam and interurban lines and the latter insist on the commission having power to compel such interchange, the passage of the bill may be delayed.

CINCINNATI, DAYTON & TOLEDO LEASED

Reference was made in a recent issue of the STREET RAILWAY JOURNAL to the terms of a proposed plan for leasing the Cincinnati, Dayton & Toledo Traction Company to the so-called Widener-Elkins syndicate, which controls the Cincinnati Traction Company and other Ohio properties. This lease was effected under the terms outlined at a recent meeting of the stockholders of the Cincinnati, Dayton & Toledo Company. The leasing company, known as the Cincinnati Northern Traction Company, has been incorporated with W. Kesley Schoepf as president. The capital stock is $500,000. Under the conditions of the lease, the new company is to spend $1,500,000 in improvements within two years, which means the practical rehabilitation of the property, bringing it to high-speed standards. Five hundred thousand dollars will be spent in the erection of a central power station at Hamilton, thus eliminating the four direct-current stations with which the road is now operated. F. J. J. Sloat, general manager of the company, who will continue actively in charge of the property, states that while the matter has not been definitely decided, it is not likely that the much-talked-about single-phase system of transmission and car propulsion will be adopted.

ST. LOUIS & SUBURBAN CHANGES

The St. Louis & Suburban Railroad has called a special stockholders' meeting for Feb. 9, to elect six additional directors and change the by-laws of the company. The increase in the membership and the contemplated changes are a part of the general plan providing for an increase of $1,500,000 in the capital stock voted at the annual meeting, Jan. 9. The new stock issue is being marketed through a construction company, organized to take over the stock in payment for extensive improvements to be made next summer. A syndicate composed of twenty of the principal stockholders has underwritten the new issue at $60 per share.

The board of directors announce that a complete revision of the existing by-laws will be followed by the adoption of new by-laws better adapted to the present needs of the company. The stockholders will first vote on the proposition to increase the board, and will then elect the new members. These will be members of the underwriting syndicates who have not heretofore figured prominently in the affairs of the company. The old directors were re-elected at the recent annual meeting. There was some opposition from minority stockholders at this meeting, who voted against the majority programme, but the opposition vote was small.

The period for subscriptions to the stock issue expired Feb. 1. The officers state that the issue has been oversubscribed at the $60 figure. A small amount of the stock is scattered, it is stated, but the bulk of it is in the hands of the syndicate members. The terms are a payment of $15 down and the balance at intervals to Sept. 15, 1905, to the Mississippi Valley Trust Company, as agent of the construction company. The terms of subscription provide that all stock must be deposited under the suburban voting trust agreement, made June 25, 1902, and trust certificates will be issued in lieu of the stock.

As previously mentioned in the STREET RAILWAY JOURNAL, the Florissant Construction, Real Estate & Investment Company has been organized to take the improvement contract, with a capital stock of $5,000. The improvements are to cost about $900,000, it is stated, and will consist chiefly of double-tracking the suburban lines in St. Louis County and building new car sheds on Manchester Avenue. H. S. Ames, president of the St. Louis & Meramec, a part of the suburban system, is also president of the construction company, and holds forty-eight of the fifty shares of stock.

TRACTION MATTERS IN NEW YORK

Traction matters in New York received considerable attention from the municipal authorities and the public of the city last week. On Feb. 1 there was a hearing in the Kings County Court House, Brooklyn, by the State Railroad Commissioners on transportation in Brooklyn. Commissioners Dickey and Baker were present; Mr. Dunn, of the commission, being kept away through illness. A general statement was made by the company of betterments, since the recommendations of the commission about 2 years ago. Practically all of these improvements have been described in detail in the STREET RAILWAY JOURNAL. Suggestions were offered by various trade organizations and citizens in the interest of the public weal. President Littleton, of Brooklyn Borough, said he thought a solution of the problem of relieving the congestion of traffic lay in the proper utilization of the two bridges. He favors the plan of building the proposed elevated loop between the Manhattan terminals. As a means of immediate relief he suggested allowing people to cross the ferries free in the rush hour and making an allowance to the ferry companies for that service from the money they owe to the city. Commissioner of Public Works Brackenridge expressed the same ideas as Borough President Littleton regarding the loop. The hearing was continued Tuesday afternoon and evening, without important developments. Meanwhile the Brooklyn Rapid Transit Company officially put itself on record as favoring the elevated line between the terminals of the Brooklyn and the Williamsburg bridges in New York. The estimated cost of this structure is $3,000,000. The company has agreed to bid for the construction and operation of this structure, and to pay 4½ per cent required by law.

On Thursday, Feb. 3, the Rapid Transit Commissioners held a hearing on subway matters. The most important thing brought out at the meeting was the offer, on behalf of a number of capitalists in the Gates Avenue section of Brooklyn, including the Bedford, Stuyvesant, Bushwick and Brownsville districts, to lease and operate a Gates Avenue subway, providing a franchise was granted, for a fare of three cents. A. Stewart Walsh made the proposition. The proposed line would start from Flatbush Avenue and Fulton Street, where connections could be made with the subway now building under the East River to Brooklyn, and run through Gates Avenue to Broadway, and thence to East New York, ending at some point in the Brownsville district, probably Belmont Avenue.

The plan for this extension was worked out by Peter A. Nostrand, a Brooklyn engineer, who estimated the cost of construction and equipment, ready for operation, at between seven and eight million dollars. The route, he said, would accommodate about one-third of all the inhabitants of the present borough of Brooklyn. It would be through a thoroughly built-up district, serving actual residents in a district where there is scarcely a plot of vacant land. He thought that if a spur was built from this line down Broadway to the Williamsburg bridge, and possibly extended further out toward Brownsville, it would make a perfect line for connection between the Williamsburg bridge and Jamaica, if extension into Queens Borough should be deemed desirable.

On Tuesday, Feb. 7, the Aldermen passed an ordinance for a franchise for the construction of the proposed tunnel in Sixth Avenue, New York. The New York & New Jersey Railway Company is to build this line as an extension of the road it is constructing between New York and New Jersey, under the Hudson River.

IMPORTANT CHANGES IN ALLIS-CHALMERS SALES OFFICES

The Allis-Chalmers Company is making important changes in the organization of its sales offices throughout the country. These changes are brought about because of the broadened scope of the company's operations since it acquired the Bullock Electric Manufacturing Company, of Cincinnati, which has now become the electrical department of the Allis-Chalmers Company. Hereafter the rule will be that each Allis-Chalmers district sales office will represent all the company's lines of manufacture in prime movers, as well as in saw mill, flour mill, mining, crushing, cement and other machinery and the electrical interests. This policy involves the opening of a considerable number of new Allis-Chalmers offices, and in many places the consolidation with those of the Bullock offices heretofore maintained in the same centers. Some recent changes brought about by following out this policy are as follows:

St. Louis, Mo.—An Allis-Chalmers district sales office has been opened in St. Louis in the Chemical Building. The Bullock Electric Manufacturing Company's offices, formerly in the same building, have been consolidated with them. H. P. Hill, formerly district manager for the Bullock Company, is the manager for the consolidated offices.

Cleveland, Ohio.—An Allis-Chalmers Company district sales office has been established in Cleveland, in the New England Building, where the Bullock offices formerly were, and the two offices have been consolidated under the management of Franklin Wharton, formerly district manager for the Bullock Company.

Pittsburg, Pa.—A Bullock office has been opened in the Frick Building, in Pittsburg, and consolidated with the Allis-Chalmers office under the management of H. Wiedeman Murray, who has for years represented the Allis-Chalmers Company in that district.

Kansas City, Mo.—The Allis-Chalmers Company has established a new office in Kansas City in the Dwight Building. George W. Mattison, who has been connected with the company for a considerable time in other capacities, is in charge.

Buffalo, N. Y.—An Allis-Chalmers district office, with temporary headquarters in the Ellicott Square Building, has been opened in Buffalo, under the management of George W. Pulver. Mr. Pulver is well known throughout the district of which Buffalo is the center, having been for a number of years with the Westinghouse Electric & Manufacturing Company at its Syracuse office, and acting manager of that office until recently.

MORE ROADS JOIN THE CLOVER LEAF

In an article on "Limited Service and Interline Business," which appeared in the STREET RAILWAY JOURNAL of Feb. 4, considerable space was devoted to the manner in which the Clover Leaf Railroad (steam) is interlining business with the electric railway of Michigan, Ohio and Indiana. This road extends from Toledo to St. Louis and heretofore it has been one of the weak roads so far as passenger business is concerned. Lately, in open defiance to the roads in the Central Passenger Association, which refuses to recognize electric roads, it has made alliances with nearly all the electric railways in the States mentioned. Tickets for St. Louis are being sold by electric railways as far east as Zanesville and Cleveland, while roads in southern and western Ohio and all over Indiana are selling to both St. Louis and Toledo. Similar arrangements with Michigan roads bring Detroit and numerous other Michigan cities into the Clover Leaf's field. The low rates of the electric railways make the through rates considerably lower than by all steam routes. A recent report of the Clover Leaf indicates that its passenger business has increased about 100 per cent, largely the result of these alliances. The company has changed the time of its best train for St. Louis so that it now makes connection with a limited from Cleveland over the Lake Shore Electric. This renders it possible for a passenger to leave Cleveland at 1:30 p. m. and reach St. Louis early the following morning. A remarkable example of the possibilities for such service was shown last week when the Lake Shore electric agent at Cleveland sold a ticket for Denver, Col., over this route, the rate being lower than could be made by any of the steam roads.

Mention was made in the last issue of the special service instituted by western Ohio roads for business between Dayton, Toledo and St. Louis. The Springfield, Troy & Piqua Traction Company, which connects with the Dayton & Troy at Troy, is now a party to this arrangement, and is selling tickets from Springfield to all points on the Clover Leaf. It has a car which makes close connections in both directions with the Dayton & Troy "Clover Leaf Special," giving Springfield and surrounding towns practically the same service and rates as are given from Dayton. A situation has been created by the Clover Leaf which seems likely to break the embargo placed against electric railways by the steam railroads.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 24, 1905

780,496. Resilient Link; Karl E. Elers, Pittsburg, Pa. App. filed May 18, 1904. A link for connecting a railway-motor armature with one of the truckwheels which comprises a coil-spring, a sheath having an attachment device at one end and a connecting rod having an attachment device at the opposite end, said parts acting to compress the spring when the attachment devices are forced away from each other and also when they are forced toward each other.

780,502. Third Rail; Alfred H. Hopkins, Chicago, Ill. App. filed Nov. 18, 1904. An inverted T-rail supported at the upper end of a bracket by bolts passing through the web.

780,531. Car Wheel; Isidore H. Sampers, New York, N. Y. App. filed Sept. 26, 1903. The wheel is provided with an elastic tire of greater width than the bearing face of the rail, and a keeper for the tire fastened to the rim, extending down the outer side of the tire and curved inwardly over the outer edge therof.

780,541. Car Wheel; Romeo P. Tomassek and Isidore H. Sampers, New York, N. Y. App. filed Dec. 16, 1903. A car wheel provided with elastic tires located upon opposite side of its guard flange.

780,542. Car Wheel; Romeo P. Tomassek and Isidore H. Sampers, New York, N. Y. App. filed May 25, 1904. A wheel having an elastic tire on its rim in which is moulded a holding-flange, the flange being radially disposed with respect to the face of the wheel and the tire normally projecting outwardly beyond the periphery of the holding-flange.

780,568. Method of Controlling Electric Railroad Brakes; John S. Lockwood, Kansas City, Mo. App. filed April 16, 1903. An electro-magnetic brake in which the magnetic field is rapidly and successively increased and decreased, to prevent locking of the wheels.

780,620. Trolley Wire Finder; Joseph P. Reed, Muncie, Ind. App. filed Sept. 17, 1904. Details.

780,698. Electric Railway; Frank Anstett, Wilkesbarre, Pa. App. filed Aug. 9, 1904. The third rail is of L-shaped construction and is engaged by an upwardly spring-pressed contact shoe.

780,767. Electric Railway Trolley; Russia R. Weeks, Cincinnati, Ohio. App. filed April 14, 1904. The upper ends of the arms of the harp are turned inward to form guard fingers.

780,852. Station Signal; John L. Wrenn, Washington, D. C. App. filed Nov. 24, 1903. A signal to be set by a prospective passenger, the signal being automatically restored after a given time by an hour-glass arrangement.

UNITED STATES PATENTS ISSUED JAN. 31, 1905

780,977. Trolley; George J. Cook, Pittsburg, Pa. App. filed Aug. 3, 1904. Retaining arms on either side of the trolley wheel having flanges overlaping the wire in the groove of the wheel, the arms being spring mounted.

781,134. Interlocking Device for Controllers; Edward H. Dewson, Edgewood Park, Pa. App. filed June 9, 1903. Where the "running" and "braking" controllers are separate, a connection is provided between them to operate the interlocking devices and which permits the controllers to be set at odd positions with respect to each other.

781,151. Street Railway Switch; Leon B. Murray, Williamstown, Mass. App. filed March 29, 1904. A locking device for the free end of the switch tongue, consisting of a gravity pin adapted to enegage the bed-plate when moved to operative position.

781,268. Underground or Conduit System for Electric Railways; William Cope, Birmingham, England. App. filed May 24, 1904. Details.

781,316. Guard and Finder for Trolley Poles; William P. Underhill, Brooklyn, N. Y. App. filed May 21, 1904. Comprises means for securing the head to the upper end of the trolley pole, and means on which the wheel and finders are journaled.

781,359. Trolley; Leonard O. Pullen, Augusta, Me. App. filed March 26, 1904. A pawl and ratchet arrangement controls the pole when it leaves the wire.

781,390. Fender Support; Peter Best, Elizabeth, N. J. App. filed Feb. 26, 1904. Provides a support that is adjustable vertically to raise and lower the end of the fender from or to the rail, and one in which there is also a tilting mechanism, so that the angle of the fender can be altered at will.

781,404. Trolley Pole Support; Thomas J. Cope, Philadelphia, Pa. App. filed Oct. 29, 1904. Details.

781,431. Electric Railway System; Frank E. Kinsman, Plainfield, N. J. App. filed Dec. 8, 1903. For purposes of safety the track rail furthest removed from the third-rail conductor, is the only one that carries the return current, the other track rail being divided up into disconnected insulated sections.

781,623. Railway Switch; Wilber K. Smith, Denver, Col. App. filed April 28, 1904. A boxing arranged between the track rails and having a slot through its top, a rod arranged in the boxing and having connection with the switch-tongue, a plate mounted to slide on the boxing and having connection with said rod and divergent ribs on opposite sides of said sliding plate, the edges of the plate being sharpened.

PERSONAL MENTION

MR. L. S. WELLS has been appointed electrical superintendent of the Long Island Railroad by Mr. W. F. Potter, who succeeded the late Mr. Baldwin as president of the company.

MR. PERCY CLIFF, formerly master mechanic of the Washington, Alexandria & Mount Vernon Electric Railway Company, of Washington, D. C., has been appointed assistant superintendent of the company. Mr. Edward Groves will succeed Mr. Cliff as master mechanic.

MAYOR TOM L. JOHNSON, of Cleveland, who has been seriously ill with grip and who was threatened with pneumonia, has been unable personally to observe the results of the three-cent fare zone plan of operation which was experimented with by the Cleveland Electric Railway at his instigation.

MR. JOHN BLAIR MACAFEE has been elected general manager of the Pottstown & Reading Street Railway Company, of Pottstown, Pa. This company has recently leased the Pottstown Passenger Railway Company, which it is now operating. Arrangements have been perfected and franchises procured for the building of about 30 miles of additional road this spring. Work will be begun as soon as the frost is out of the ground. Mr. John P. Pope, of Mr. MacAfee's staff, has been made acting superintendent of the company.

MR. ROBERT T. GUNN has resigned as general superintendent of the Norfolk Railway & Light Company, of Norfolk, Va., to become general manager of the Lexington Railway Company, of Lexington, Ky., with which he formerly was connected. At Lexington Mr. Gunn will succeed Mr. T. J. Fitzgerald, who has accepted the position of first assistant to the vice-president of the Cincinnati Traction Company. Mr. Gunn, as general manager of the Lexington Street Railway Company, will be in control of all the public utilities of that city, which are under one management.

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The Man Behind the Transit

We have before called attention to the folly of hasty or careless work in the location of interurban electric roads. It is equally important that the civil engineers engaged in this work be men of experience and good judgment. A civil engineer of our acquaintance who has been watching the game for a good many years ventures to suggest that the mere fact that the county surveyor has offered to do the work proposed for about one-third the fees asked by an engineer who has given up many years to this branch of engineering should not carry any weight with the promoters of such enterprises. The experienced engineer in question may not know just where the corner of Brown's east 80 comes, but he knows a whole lot more than that. He knows that if the road does go through that east 80 he will avoid making a 20-deg. curve on a 3 per cent grade, and that is just the kind of knowledge he is charging his price for. There are no doubt meritorious projects which have found their graveyard in the offices of the banker and bond broker that would have gone through had the promoters been far-sighted enough to ignore the "east 80 man." Railroad location is a fine art acquired only by years of experience. Interurban electric railway location is a special branch of this art, and can best be handled by specialists in that line. A location man who constantly has in mind the kind of a compromise that the interurban railway must be between the steam railroad and a street railway is the best man for the work. To be sure, the local surveyor cannot be blamed for not knowing these things, and it would be rather difficult in the intervals between locating a new drainage ditch and finding the boundary lines of 20-acre tracts to acquire a knowledge of a special nature which others devote all their time to. Furthermore, the local surveyor's personal acquaintance through the country is likely to be a drawback rather than a help in his work, as his knowledge of who owns various tracts of lands may lead him to select routes avoiding certain tracts, to the everlasting detriment of the operating account of the road. Location work cannot be too good; the total cost in any event is so small a per cent of the cost of the work.

Interurban Traffic Figures

The paper read by L. J. Shlesinger, superintendent of the Muncie, Hartford & Fort Wayne Railway Company, before the February meeting of the Indiana Electric Railway Association, is a very valuable addition to the gradually increasing fund of generally available knowledge of traffic figures on interurban roads. Every interurban railway company which is figuring on extensions, and every engineer who is called upon to report on proposed roads, is seeking all the information possible to aid in making an intelligent guess as to probable revenue. Mr. Shlesinger's paper is chiefly valuable because of the minute analysis which has been made by his company of the passenger traffic from various portions of the road, which, by the way, is a purely interurban proposition in which city traffic cuts no figure whatever. These conditions as they exist on this road are described very fully, in order that an intelligent use can be made of the figures on traffic from different portions of it given in the latter part of his paper. Mr. Shlesinger's road makes a showing of track-mile earnings per annum somewhat better than the average of the thirty-two purely interurban roads of Ohio given in an editorial in these columns Jan. 28 last. The road earned $4,335 per mile of track, while the Ohio average was $3,960. The car-mile earnings of the road under consideration will be looked upon with envy by many interurban managers, as they amount to over 32 cents. The road is evidently one which serves short-distance riders, the 15-cent fares proving the most profitable and, with the exception of the 5-cent fares, the most numerous. In this respect this road will differ considerably from many other interurban roads. One of the most interesting things about the paper is the information about the relative amount of traffic furnished by the rural population as compared to the population located in the towns along the line. According to these figures, the rural population yields a revenue of $6.27 per capita per annum, while the average for the entire road is only $2.95 per capita per annum. Leaving out of account the terminal city Muncie, the per capita earnings are $6.14. There has been considerable speculation as to what revenue would be yielded by a rural population, the general impression being that, since the farmers along the line of an interurban road are dependent entirely upon the interurban road for transportation, they will furnish a much greater revenue per capita than the people in the towns along the line. Mr. Shlesinger's figures show that this impression is correct as regards the whole road, counting in the population of the terminal city. An inspection of the figures on a basis of per capita revenue from different towns along the line, however, shows that the smaller towns run away above the rural population as well as above the larger towns, in revenue per capita per annum. This is probably due in part to the fact that some of the road runs through an oil field, which causes considerable riding from small towns not having a very great resident population. We are inclined to think, however, that a great deal of revenue for which the smaller towns get the credit in reality comes from the rural population surrounding these smaller towns. It is a custom for farmers to drive into these smaller towns and leave their teams at livery stables there, taking the cars to the larger county seat towns along the road, to do shopping or attend to business at the county seat. The amount of this kind of business is best illustrated by a case which came under our notice on a neighboring road in Indiana, and which has probably been duplicated many times in that and other States: The livery stable keeper in a small town through which an interurban was to pass opposed the granting of the franchise vigorously because he supposed it would ruin his business. Since the interurban road has been built he has had to enlarge his quarters and never has had anything like the business he is enjoying now, for the simple reason that his town has become a small center into which farmers drive to take interurban cars for larger towns, leaving their teams at the livery stable. Then, too, those coming out from Indianapolis and other towns to visit farmer relatives along the line must patronize the livery stable in order to get to their destination.

Interurban Way Stations

The development of passenger stations in interurban railway work has thus far been largely in the direction of city terminal buildings, and in many parts of the country the interurban way station has received but inadequate consideration. There are, of course, notable exceptions to this policy of letting would-be passengers at rural points shift for themselves while waiting for the cars; but, in general, there is little appreciation of the part a comfortable waiting place carries in preventing the desertion of the passenger to the nearest steam road in severe weather. Considering the small expense of putting up a suitable way station, it is singular that so many roads have failed to take advantage of this opportunity to offset the inducements of the steam railroad passenger agent.

While there is no specific limit to the amount of money which it is possible for a road to spend on way stations, provided that ample capital is available, it is, fortunately, a very simple matter to satisfy the requirements, and this without the expenditure of over two or three hundred dollars per station in the vast majority of cases arising in rural districts. First of all, it is necessary that passengers be protected from the direct force of the storm and wind. Secondly, it is advisable that comfortable seats be provided, and of equal importance is the question of illumination. Cleanliness should go without saying—which it seldom does, however—and finally, the matter of heating deserves consideration. In fact, some roads have gone to the point of providing all these features, with toilet facilities in addition. Cases of this kind, however, generally include some sort of operating offices as a part of the premises, and enable the necessary oversight of the station to be maintained without much additional expense.

The working up of way station details is a matter which must be solved by each road on the spot. Certainly every such station should be swept and cleaned once a day; there should always be a printed time-table of the company's cars on the inside wall, and tramps should be vigorously discouraged from turning them into cosy corners at night. A small wooden platform should always be put down, unless, in more extensive work, concrete is used, and the lighting arrangements made secure from tampering. A single series of five 16-cp lamps is admirably adapted to light both the platform and the interior of the average way station. In locations exposed to very severe weather it doubtless pays to install one or two electric car heaters for operation during the coldest months of the year. Both the heaters and the lighting circuits can readily be attended to by the conductors of the cars. A self-closing door is a prime necessity, and in localities exposed to the activities of rowdies, the use of stout wire netting on the outside of the windows affords considerable protection.

The day is yet to come, in the interurban railway field as a whole, when it will pay to maintain employees at the different way stations along the route. At the same time, it is important for electric railway managers to realize that if traffic is to be secured and held, in the face of steam railway competition with its comfortable stations and conveniences, more thought must be taken to insure the reasonable physical contentment of their passengers. In the summer time the electric road has everything on its side which tends to produce enjoyment of travel—cool breezes, frequent service, good ventilation, absence of smoke, cinders and the like—but in the winter season cross-country electric railroading often is beset by great discomfort, particularly at waiting points, and sometimes in poorly heated and ill-ventilated cars. More and more does interurban electric railway practice advance to the standards of speed and responsibility to passengers maintained by steam railroads. With the increasing demand for frequent high-speed service, with heavier cars and higher powered motors than the past decade considered standard—in short, with the whole standard of service raised, it becomes all the more important not to lose a single passenger. To this end, therefore, are certain to come improvements, not only in rolling stock and roadbed, track and power stations, but in that department of the business which is still in its infancy—the department of creating passenger traffic. Finally, as freight and express traffic develops—and has developed on some roads already—the way station will grow in consequence, under the oversight of a responsible agent, until it bears much the same relation to the interurban railway as the present steam railroad way station bears to its system as a whole.

Four-Motor Equipments

The development of electric railway rolling stock within the past decade has witnessed many noteworthy changes in design. In a few words, these changes have practically all been made with one or more of three objects in view—increased speed, greater comfort and added reliability of service. So far as each design contributed to these requirements, to just that extent has it been a permanent influence in electric transportation.

In connection with the maintenance of schedules under trying conditions of traffic congestion and poor adhesion between wheels and rails, as well as in relation to the adoption of heavier cars and higher speeds, the advantages of four-motor as against two-motor equipments are constantly becoming better appreciated by railway managers. At the same time, there is no doubt that a choice often exists between the two. Long as is the list of sales of quadruple equipment to operating roads, the two-motor outfit is still in favor in many localities. It is a fair question, however, if the general use of double-trucked cars of more than double the weight and about three times the cost of those standard seven or eight years ago is not rapidly giving the lead to the four-motor equipment in fast interurban and suburban service.

When through interurban cars are to be operated at the city ends of their journey over densely crowded streets, it is true that the advantages of the quadruple equipment often seem of little value. In fact, a special commutating switch often has to be installed, so that the motors may be thrown all four in series in starting, to keep down the speed. Sixteen horse-power per ton of car weight fits with difficulty into the motive power requirements of a city track populated by an intricate procession of delivery vans, trucks, automobiles, pedestrians and local street cars making a schedule speed of 6 m.p.h. on fifteen-second headway. The saving clause is, of course, the freedom of running possible outside the city. Hence the importance of studying with particular care the conditions along the route, not so much of interurban lines, but of city and suburban lines, before changing from two to four-motor equipments. Here enters a distinction between the true interurban line, connecting two or more cities, and the often misnamed "interurban," but actually "suburban," line, operating over a large percentage of city streets with but a short run over private rights of way. From the standpoint of good service there is much question as to the practicability of substituting four-motor for two-motor city equipments for operation on very crowded thoroughfares where the superior acceleration qualities of the former cannot have full play. Under such conditions the acceleration obtained from a two-motor outfit is often as useful as the quicker but unavailable acceleration power of its competitor. On the other hand, a hilly road, either city or suburban, of course, demands every axle equipped.

It is interesting to sum up the advantages of the four-motor equipment in the interurban, suburban and thinly settled city territory where its characteristics find full opportunity for development. Proper comparisons can only be made between a double-motor and a four-motor equipment aggregating the same rated horse-power and propelling the same weight and style of car body, load and truck, including, of course, equal gear ratios. In the same way the relative energy consumption, motor heating and cost of maintenance of two and four-motor equipments must be determined upon the basis of equal schedule speeds and stops if a fair comparison is to be obtained from the engineering standpoint.

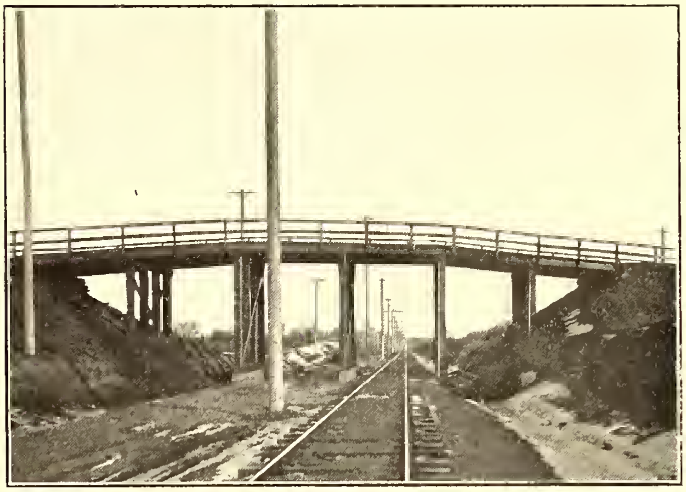
Given a car weighing in body, passengers and trucks, without motors, 20 tons, let us equip it first with two 75-hp motors, and second, with four 38-hp motors. Allowing 11,600 lbs. and 9700 lbs. as the individual weights of the larger and smaller equipments, respectively, the total weight of the two-motor car figures 49,700 lbs., and that of the four-motor car, 51,600 lbs. In the former case the total weight available for adhesion is 29,000 lbs., or 58 per cent of the car weight, and in the latter case, 30,600 lbs., or 100 per cent. The weight per driving wheel is 7250 lbs. in one case and 6200 lbs. in the other. With the track in very poor condition, giving, say, 10 per cent adhesion, the weight available for acceleration in the case of the four-motor equipment is sufficient to permit nearly as high a tractive effort without wheel slippage as in the case of the two-motor car under the favorable conditions of track represented by 20 per cent adhesion. Although in practice the motors could not be permitted to work up to such high accelerations as the above limits specify, the comparison shows what a large margin exists in favor of the four-motor outfit. Thus, high schedule speed is secured without the heavy consumption of energy which rapid acceleration invariably requires with two-motor equipments, thanks to the larger percentage of coasting possible with the four-motor equipment.

The increase in car weight of the four-motor equipment is but 3.8 per cent, and the loss in efficiency, say a maximum of 3 per cent, is not a serious matter. Quarter a cent per car-mile would seem to be a liberal allowance for the additional cost of power, taking both these factors into account, and in some cases it is reasonable to expect that the four-motor outfit will actually show a lower operating cost for the same schedule on account of the coasting possibilities which it enjoys. The difference is so slight that the personal equations of two motormen may easily throw the balance one way or the other.

As a matter of fact, the work required of four-motor equipments which have replaced two-motor outfits in a given service is often much in excess of the schedule requirements imposed upon the latter. Either the schedule time is cut down or, as is less frequently the case, the number of stops per mile is increased, the old schedule remaining fixed in its total running time. In general, the additional traffic capacity thus secured far offsets the net increase in power cost which the faster schedule brings about. Motor heating for a given service should be less with the four-motor equipment, on account of the greater radiating surface, which more than makes up for the greater losses which take place in the motors themselves. This point is of much influence in determining the question of maintenance, which is reasonably calculated to be at least as low with four motors as with two. In the repair shop and car house the lighter motors can be handled with greater facility, and the reduced strains for a given service on gears, axles, bearings and trucks are all favorable points, both in reference to track wear and car equipment up-keep. In the matter of keeping up continuous service the four-motor equipment has a strong advantage. The chances of being able to run a disabled car into the car house when one or two of its motors break down on the line, without seriously interrupting traffic, are often of great value, especially in interurban service. Then, too, the increased clearance between the track and the motor frame or between the motor and the car body is an advantage of note, enabling the use of a single step in cases where two car steps are undesirable. In regard to first cost, there is little to choose between the two equipments; but it would be most useful if figures could be obtained and published by operating companies in regard to the exact cost of maintenance and depreciation in the same service of four and two-motor equipments of various capacities.

OPENING OF THE INDIANAPOLIS & CINCINNATI SINGLE-PHASE LINE

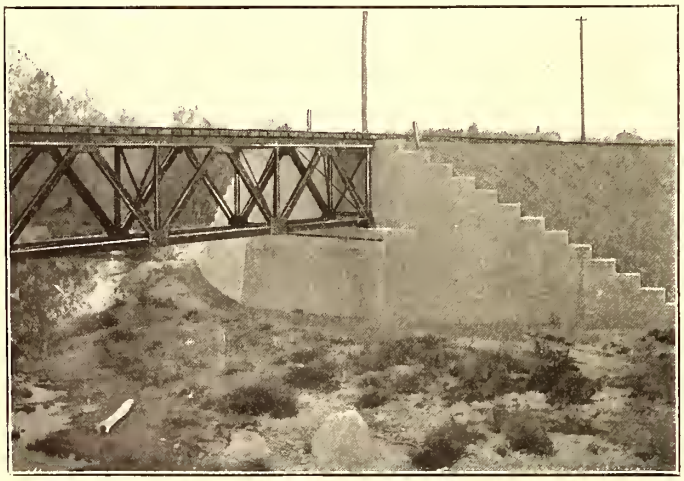
The interest taken in the Westinghouse single-phase electric railway system is so great that the inauguration of the service on the Indianapolis & Cincinnati Traction Company will attract more than ordinary attention. The first car was put in service on Dec. 30, 1904, and, as announced in this paper for Jan. 28, regular operation was commenced between Rushville and Morristown, 16 miles distant, on Jan. 21.



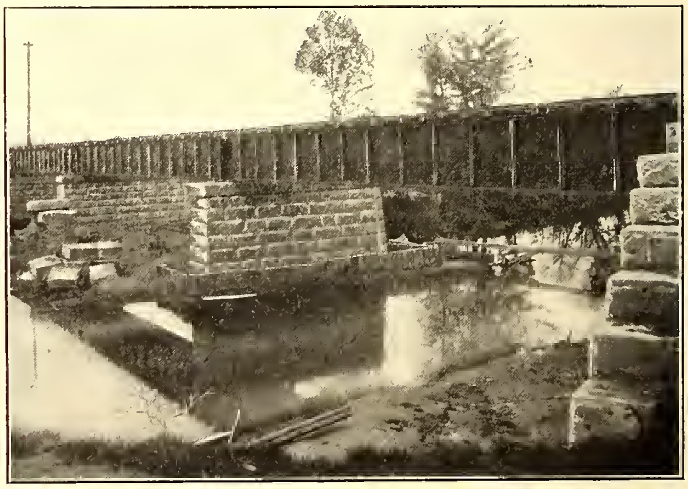
OVERHEAD CROSSING NEAR PALESTINE, IND.

OVERHEAD CROSSING OF THE CINCINNATI, HAMILTON & DAYTON RAILROAD

The Indianapolis & Cincinnati Traction Company was organized on Feb. 4, 1903, under the laws of Indiana, to construct a line from the city of Indianapolis via Rushville and Connorsville, Ind., and Hamilton, Ohio, to Cincinnati. The affairs of the company are managed by a board of directors, constituted as follows: Charles L. Henry, of Indianapolis, and formerly general manager of the Union Traction Company of Indiana, president and general manager; Ephraim Marsh, vice-president; Wm. L. Taylor, secretary; Endorus M. Johnson, treasurer; James W. Fesler, Theodore F. Rose and Wm. M. Frazee.



BRIDGE 105 FT. LONG OVER BIG SUGAR CREEK, NEAR NEW PALESTINE, IND.



BRIDGE OVER BLUE RIVER, NEAR MORRISTOWN, IND.

The dominant idea in the minds of the originators of this company was to build a double-track through line from Indianapolis to Cincinnati, which would take care of the traffic between these two cities in a more satisfactory way than is now done by the steam roads. To this end the company has secured a most desirable private right of way. Where the land is level and there are no considerable fills or cuts, a right of way 4 rods wide has been purchased, but wherever a considerable fill or cut has been necessary, additional width of right of way has been secured. In all the smaller towns a private right of way has been continued through, and the road is not constructed upon streets or highways except in cities or towns of such size as to make it necessary. In all cases sharp curves are avoided, and such an alignment has been secured between cities and towns as will permit of very rapid running, with entire safety to passengers and equipment. In most instances the right of way is protected by a woven-wire fence, erected under an agreement with the land owner, whereby the land owner maintains the fence and keeps all its gates closed. Wherever such an agreement was not secured the right of way is fenced with barbed wire.

Under the provision of the franchise of the Indianapolis Traction & Terminal Company, interurban lines are allowed to enter the city over the tracks of the city company by such routes as the city designates, upon payment to the city company of an agreed or ascertained compensation. The Indianapolis Traction & Terminal Company has made a uniform agreement with interurban roads for entrance into the city over its tracks, whereby interurban roads pay 4 cents for each passenger carried on the interurban cars while on the city lines, and this entitles them to all of the privileges of the terminal station.

The line has already been constructed between Indianapolis and Rushville, a distance of 41 miles, and a through service between those cities has been established. At an early date the road will be extended to Connorsville.

ROADWAY

The construction of the roadway is thoroughly first-class and steam railroad standards are used. Between Indianapolis and a point 8 miles east of Rushville—a distance of nearly 50 miles—there is no grade exceeding 1½ per cent. From that point on toward Cincinnati the country is less level, and in some cases straight lines have been preferred, even at the expense of some increase in grade; but with the alignment and grade considered together, greater speed can be obtained, with comfort and safety to passengers, than on any steam road now running between Indianapolis and Cincinnati. So far as the profile of the road has been as yet determined, the heaviest grade will be 4 per cent, and it is believed that no greater grade will be necessary on the entire line. The roadbed is graded 28 ft. wide on top for a double track, with slopes on fills and in cuts of 1½ to 1, and upon a grade line that puts the track in most instances above the level of adjacent lands, so as to avoid trouble on account of snow.

BRIDGES

The bridges across all streams are constructed either with concrete arches or steel girders with stone abutments. The upper structures are built of the very best steel construction by the Indiana Bridge Company, of Muncie, Ind., of a capacity sufficient to carry a train of cars with a gross weight of 100 tons for each car. All abutments are built for double track; the superstructures at this time are laid for one track only. It will be noted that provision is made for the increased demand for size of cars and length of trains likely to come in the near future.

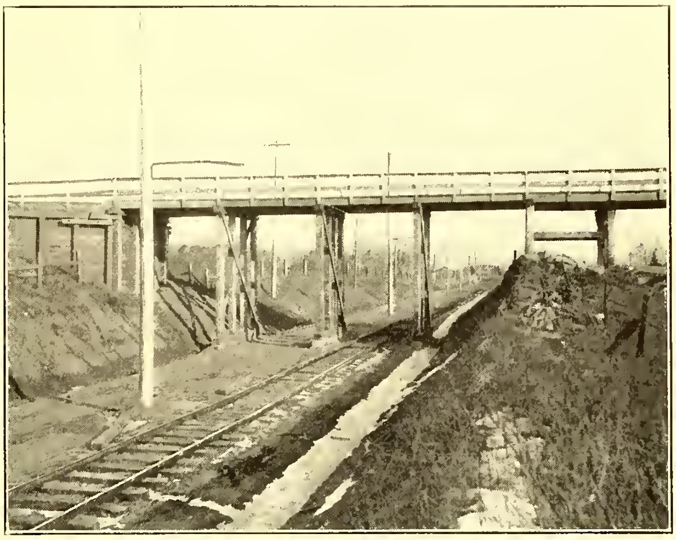
TRACK

The road is laid with double track in the city of Rushville and on all highways; but on the private right of way, while the grade is prepared for double track, only one has been laid, as a second track can be more conveniently and economically put down later, when a sufficient portion of the road is in operation to require a double track. All ties used are first-class—no culls or seconds—white oak, burr oak and a few chestnuts, 6 ins. x 8 ins. x 8 ft. long, 3280 to the mile. The bridge ties are of long leaf yellow pine.

CURVE AT CORNER OF THIRD STREET AND MORGAN STREET, RUSHVILLE, IND.

The track is laid with 70-lb. T-rail, in 60-ft. lengths, connected with Weber rail-joints, and bonded at the joints with No. 0000 10-in. copper bonds, with ⅞-in. terminals under the plate so as not to be exposed. Cross bonds are put in every half mile and long bonds under all special work. The switches and other special work have been furnished by the Buda Foundry & Manufacturing Company, of Chicago, and are built according to steam railway standards. Turn-outs and cross-overs are constructed so as to avoid danger of open switches.

The company has secured a fine gravel pit, located within ½ mile of its main line at Morristown, Ind. The first layer of ballast has been put on the roads from Rushville to Indianapolis, and the work will be completed as soon as the weather permits.



OVERHEAD CROSSING NEAR JULIETTA, IND.

The road is to be ballasted with gravel 8 ins. under the ties and level with the top of the rail. In the streets of Rushville an 8-in. layer of broken stone was placed under the ties.

TROLLEY CONSTRUCTION

The trolley wire is suspended along the private right of way from poles set in the center of the grade 100 ft. apart, with a bracket made of angle iron looped at the end, so as to carry a large flat porcelain insulator, from the top of which is run a 7-16-in. steel strand cable or "messenger" wire. The No. 000 grooved copper trolley wire is carried 8 ins. under the messenger cable, to which it is attached every 10 ft. with specially made steel clamps, a construction known as the catenary suspension. The steel messenger wire is drawn tight. With this construction, danger from trolley breaks is reduced to a minimum. The insulators are large and strong, and are not likely to break, but if they should the steel cable would remain suspended from the top of the bracket. As the trolley is attached to the steel cable every 10 ft., breaks will be very infrequent, and if one should occur not more than 10 ft. of the trolley would be loose. The catenary construction provides a practically level trolley with no sudden bends at the insulators, as is found with the ordinary suspension, a point which is of great advantage to fast-running cars. The trolley wire is suspended 18 ft. above the top of the rail.

Where the tracks are in the streets the poles are set on the sides of the streets and the trolley is suspended from span wires. Otherwise the construction is the same as along the private right of way. The overhead material for the entire line construction was supplied by the Westinghouse Electric & Manufacturing Company, according to the design of Sargent & Lundy, consulting engineers.

HIGH-VOLTAGE LINES

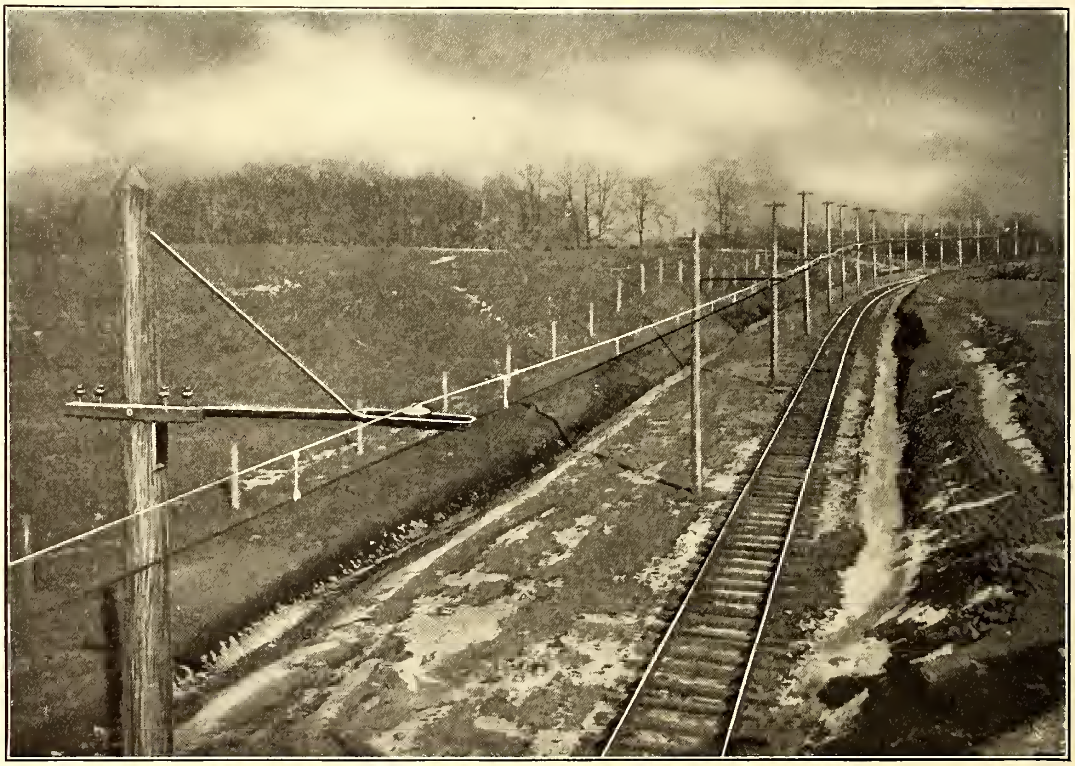
The system of electrical distribution requires transformer stations about 10 miles or 12 miles apart, and the alternating current is transmitted from the power house to these transformer stations at 33,000 volts, single-phase, 25 cycles per sec-

MOTOR AND GEAR CASE COMPLETE

ond, and is reduced and fed into the trolley at a potential of 3300 volts. The high-tension current is carried from the central power station to the transformer stations on No. 4 bare copper wires, two wires to each transformer station. They make a complete circuit and permit the placing of the circuit breakers and switches at the central power house, so as to do away with the necessity of attendants at the transformer stations. The high-tension lines are carried on a separate line of poles set near the edge of the right of way, provided with carefully and strongly constructed cross-arms and equipped with large porcelain insulators on iron pins.

TELEPHONE LINES

The entire system is provided with two metallic circuit (four copper wires) telephone lines, one of which is used exclusively by the train despatcher. The other line is used for general company business. Each car is provided with a telephone, by means of which the conductor can talk with the despatcher at fixed points. Jack boxes are placed on the poles at intervals of 2000 ft., from any of which the conductor of a car or any one else with a telephone can call up to report an accident or for any other purpose.



VIEW ILLUSTRATING THE CATENARY SUSPENSION ADOPTED ON THE INDIANAPOLIS & CINCINNATI SINGLE-PHASE LINE

The four telephone wires are carried by porcelain insulators on cross-arms near the top of the trolley poles, and are thus far removed from the high-tension lines. The wires are transposed every 500 ft. in order to avoid disturbances from the current in the transmission lines.

POLES

The poles are all of select white cedar. Those for the center trolley construction are 40 ft. long, with 7-in. top. The side poles for the high-tension lines are 35 ft. long, with 7-in. top. All are set 6 ft. in the ground and are carefully tamped. Along streets on the side where there are no feed wires and the poles are used only to support the span wire, 30-ft. poles are used, while on the other side, where the high-tension line runs, the poles are of varying height from 40 ft. to 60 ft., so as to carry the feed wires above the shade trees. All of the side poles along the streets are neatly shaved and painted and are set in concrete. The tall 60-ft. poles are of Idaho cedar—beautiful, smooth and straight, as if turned in a lathe. The entire pole line was constructed under the direction of A. A. Anderson, general superintendent of the Indianapolis & Cincinnati Traction Company, and under the immediate supervision of Foreman Oscar D. Emery. The work is of such excellent character throughout as to attract the attention of even casual observers, and among experienced linemen it is conceded to be equal to if not superior in its substantial character and artistic appearance to any other line in the country.

TROLLEY VOLTAGE

Within the limits of the city of Indianapolis, a distance of approximately 3 miles, the cars will be run over already existing lines, and will be operated by direct current at 550 volts. Within the limits of the city of Rushville, they will be operated by alternating current at the same potential; on intervening sections the trolley will be fed by alternating current at 3300 volts, 25 cycles per second, single-phase. Thus the first single-phase railway exemplifies the possibility of operating the same equipment from both direct and alternating-current lines, and illustrates the voltage flexibility of the system, one of its most advantageous features.

The power station from which it is intended to operate the entire road is located at Rushville. From this plant 33,000-volt transmission circuits are run to the points of transformation and there reduced to 3300 volts before connection to the trolley.

TRANSFORMER STATIONS

As has been stated, the road is divided into sections of 10 miles and 12 miles, each of which is supplied with current from a transformer station. Three such stations have been erected between Indianapolis and Rushville by Pulse & Porter, contractors of Greensburg, Ind. The transformer houses are very small, measuring but 21 ft. x 23 ft., but are carefully and substantially built. The foundations are of concrete; the walls are of brick laid in cement mortar, and the floors for both the first and second stories are of concrete upon steel beams. The roof is built upon concrete base. The doors and windows are provided with steel shutters, and the whole structure is made thoroughly fireproof and can be closed and left alone with safety.

In each of the transformer stations there are at present installed two 300-kw oil-insulated step-down transformers, 33,000 volts to 3300 volts. Space has been provided for an additional transformer of the same capacity. On the second floor of each transformer station there are installed the lightning arresters and disconnecting switches. There are no automatic switches of any type in these stations, as they are controlled only through the switchboard in the power station. There is nothing at the station which requires constant attention and only occasional inspection will be necessary. This does away entirely with the expense usually incident to the rotary sub-station of other systems, which, if three men are employed, would aggregate about $6 per day. The annual saving in wages on the three transformer stations between Indianapolis and Rushville made possible by the alternating-current system on this basis, would amount therefore to $6,570, or a total annual saving on the ten transformer stations between Indianapolis and Cincinnati in wages alone of $21,900.

The entire electrical equipment of the transformer stations was furnished by the Westinghouse Electric & Manufacturing

TRANSFORMER STATION AT REEDVILLE, IND.

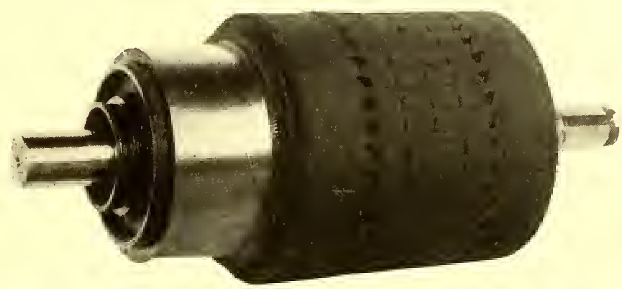
Company, and was installed under the supervision of Sargent & Lundy. The disconnecting switches were made from a design specially prepared for this service by these engineers.

The power house serves as an additional transformer station, and contains two 300-kw lowering transformers, wound for 3300 volts primary and 550 volts secondary circuits, which are used to feed that portion of trolley included within the limits of the city of Rushville.

The diagram on page 305 illustrates schematically the general arrangement of apparatus and circuits. The two-phase power circuit indicated is a provision for a four-wire power circuit, which it is proposed to run from the power house in Rushville to the electric line between Indianapolis and Shelbyville, which is at present operated by direct current from its own power house through rotary converter sub-stations and direct-current railway motors. It is expected at an early date to operate this branch also from the central power station in Rushville.

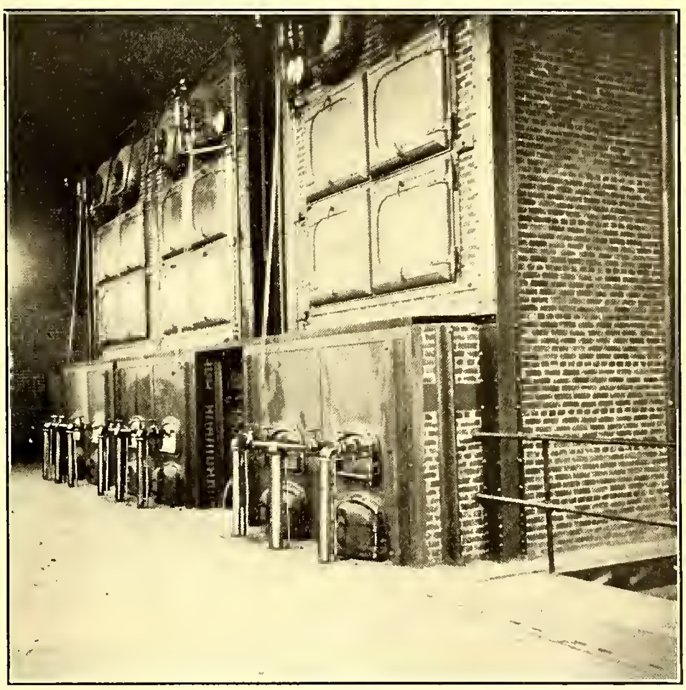
POWER STATION

The power house which is located at Rushville, Ind., is a strictly fireproof building of brick, concrete and steel, with



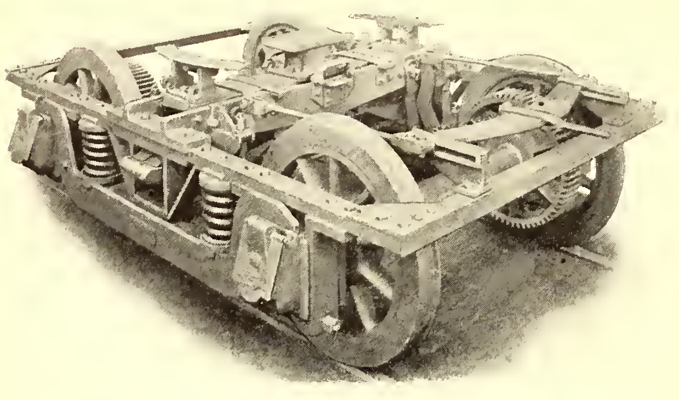
ARMATURE AND COMMUTATOR OF SINGLE-PHASE MOTOR

rooms well lighted and skilfully arranged for future addition and enlargement. The site is adjacent to the Cincinnati, Hamilton & Dayton Railway, with a connecting track from that road to the company's track alongside of the power station. The boiler room occupies one side of the building, and is at present equipped with three 350-hp Babcock & Wilcox boilers. Natural gas is now being used for fuel, but provision is made for the burning of coal, if at any time the supply of gas be-



BOILER ROOM, SHOWING OIL BURNERS

comes insufficient. The engine room occupies the other side of the building, and is separated into two parts by a heavy brick partition. In the main room are installed the two generator units, which consist of a 500-kw Westinghouse revolving field alternator, 25 cycles per second, direct connected to a 700-hp Corliss type, cross-compound, condensing engine, built by the Fulton Iron Works, of St. Louis, Mo. Both engines and generators are designed for an overload capacity of 50 per cent. Each engine is equipped with an independent jet condenser, made by the Dean Brothers Steam Pump Works, of Indianapolis, which takes its water from an underground tunnel connecting to a large mill race. Two pairs of 250-kw air-blast transformers are arranged to change the current which comes from the generator at 2300 volts, three-phase, to 33,000 volts, two-phase, for transmission to the transformer station along the line. Air for these transformers is supplied by two motor-driven blowers. The generator field is excited by direct-current



STANDARD TRUCK USED FOR THE CARS OF THE INDIANAPOLIS & CINCINNATI SINGLE-PHASE LINE

generators, one of which is direct connected to an alternating-current type C Westinghouse induction motor; the other to a Westinghouse compound steam engine. The marble switchboard controlling panels are also located in this main engine room, and the controlling apparatus is installed in the other portion of the building, which is known as the high-tension chamber. The main bus-bars are located in the basement and are supported upon a masonry structure and separated by barriers of alberine stone.

CAR SHOPS

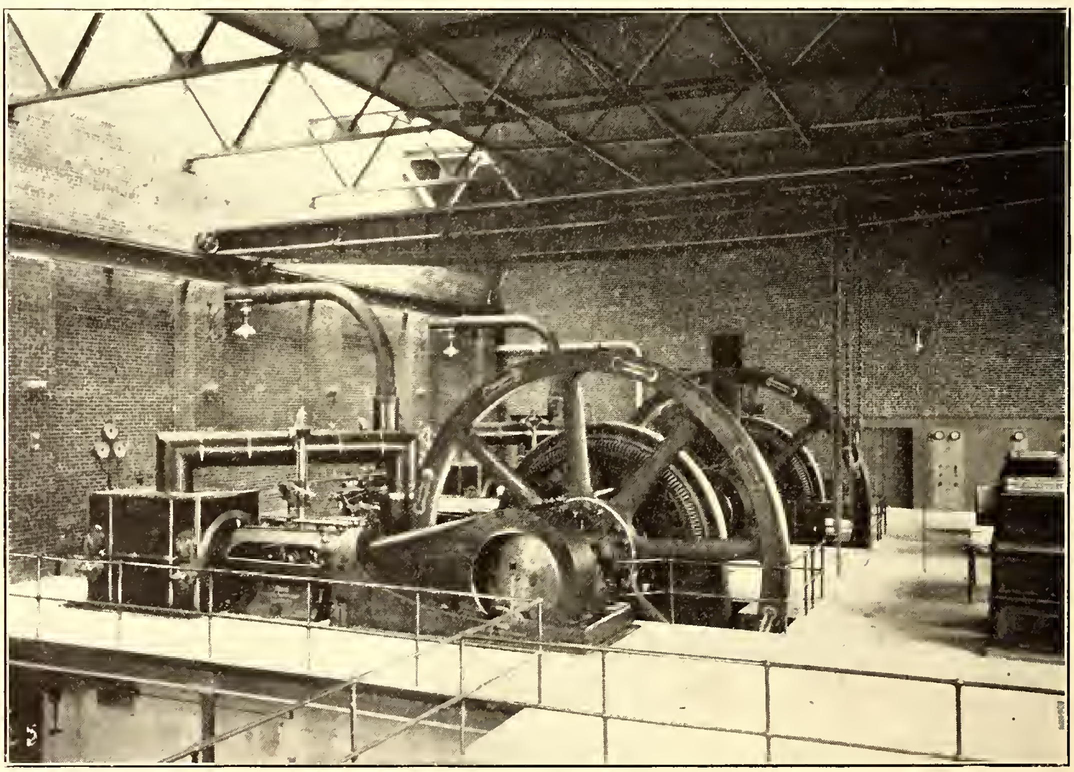
The car shops are located near the power station. The entire building is 205 ft. x 104 ft., and is divided as follows: Offices and waiting room for train crews, store room, blacksmith shop, car wash room, machine shop, truck repair shop, room for winding and drying armature and field coils and for other electrical work, paint shop and carpenter shop. Six tracks enter the building, each of which is provided with a working pit. A transfer track runs across the center of the building. The construction of the building is fireproof throughout, with concrete foundations and floors, brick walls and steel framing. The roofs are made of asphalt gravel laid upon a cinder and concrete base, with louveres and skylights, all in steel frames. Concrete partitions are used where brick walls have not been constructed, and there is a Kinnear rolling iron door over every track. The machine shop is supplied with a full equipment of modern tools. Provision is made in the center for a traveling crane to run the entire length of the building.

CARS

The present equipment of the company consists of ten passenger cars, constructed by the St. Louis Car Company. The framing of these cars was illustrated on page 173 of the STREET RAILWAY JOURNAL for Jan. 28. Each car measures 55 ft. over all, and is divided into three compartments. The first compartment is 9 ft. 10 ins. long, and is intended to carry baggage. It is provided with doors opening on either side. The cars are intended for single-end operation, and space for the motorman is provided in the front of the baggage compartment, from which it is separated by a strong railing made of pipe. The middle compartment has a seating capacity of sixteen people and is intended for gentlemen desiring to smoke. The third compartment occupies the remaining portion of the car, and has a seating capacity for thirty-eight people.

The car is finely finished in mahogany, has plate glass in the windows and art glass in the ventilators and upper part of the sash. The trucks were built at the Baldwin Locomotive Works and are of the regular double-bar equalized M. C. B. type. The side frames are of wrought iron 4-in. x 2-in. section, and the end frames of angle iron reinforced, at the corners, with gusset plates. The transoms are hammered iron forgings and the transom of each truck is in one piece. The wheels were made by the Standard Steel Works, are 37¼ ins. in diameter, with steel tires and cast steel centers. They are mounted on axles of locomotive driving axle steel 6½ ins. in diameter, with 5-in. x 9-in. journals. The bolsters are of the built-up type, formed of channels and plates. The weight of each truck, exclusive of motors, is 11,670 lbs. Each truck is equipped with two 75-hp single-phase alternating-current Westinghouse motors.

The cars are equipped with the Westinghouse unit switch system of multiple control, and so may be operated either singly or in trains. The motors are controlled by the rheostatic system, and may be operated on either alternating or direct current. Both straight and automatic air brakes are provided on each car, the straight being used when the cars are run singly, the automatic system when the cars are run in trains. The motors on the present car equipment are geared for a maximum speed of 45 m.p.h. for local service.



500-KW ALTERNATORS IN POWER STATION, DIRECT CONNECTED TO HORIZONTAL ENGINES

Each car is equipped with two trolleys, one of the Union Standard type, with trolley wheel, to be used when operating from the direct-current lines in Indianapolis, or from the low-

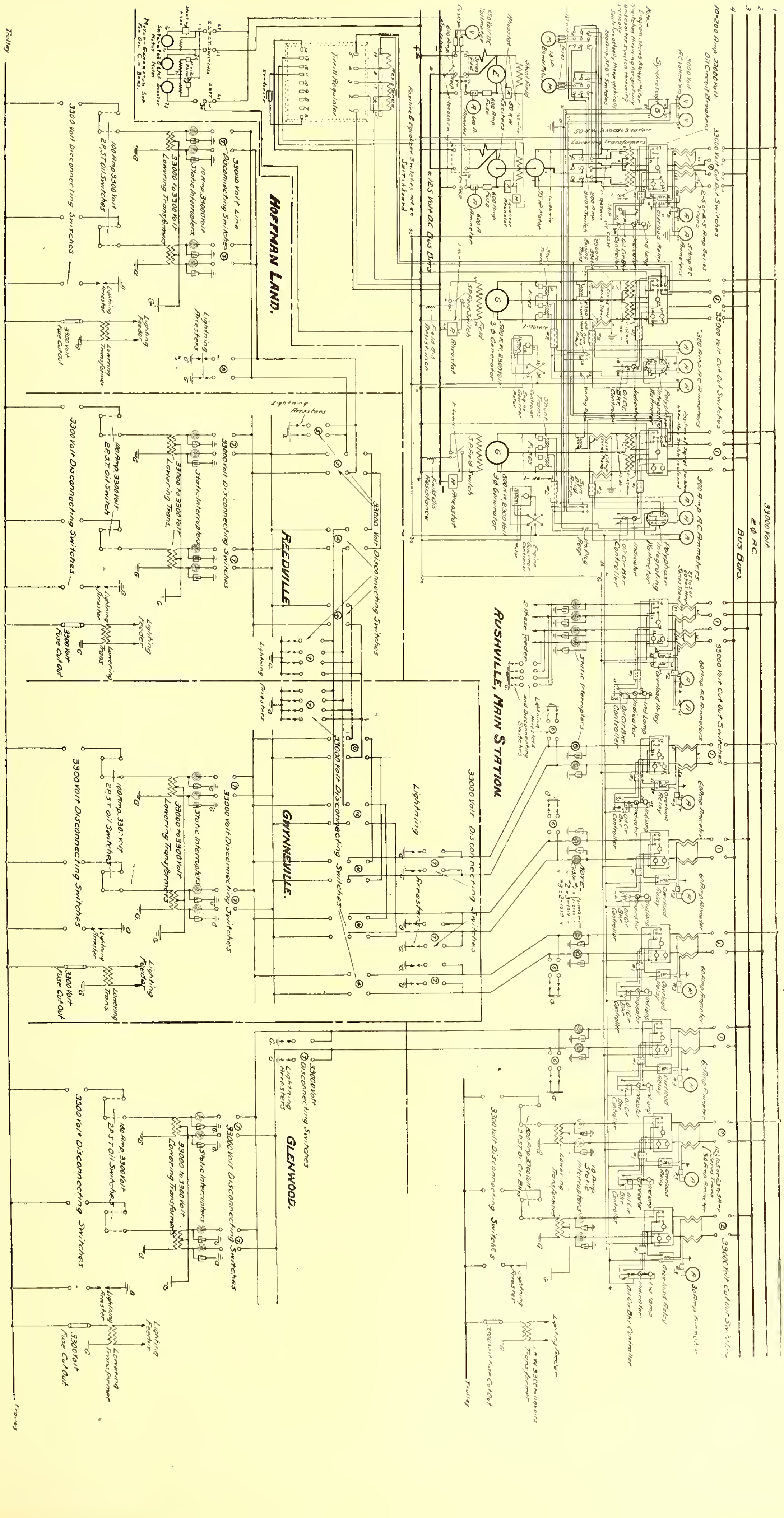


DIAGRAM OF CONNECTIONS FOR MAIN POWER-STATION AND SUB-STATION SWITCHBOARDS FOR INDIANAPOLIS & CINCINNATI SINGLE-PHASE RAILWAY voltage alternating-current lines in Rushville; the second trolley is of the bow, high-speed type, and has been designed for service at 3300 volts, alternating current.

GENERAL OFFICE

The general offices of the Indianapolis & Cincinnati Traction Company are located at Rushville. The office building is a three-story frame structure, with slate roof; it is equipped with fireproof vaults, steam heat, electric light and a complete interior telephone system connected with the company's own lines and the commercial line. The building also contains waiting rooms and baggage rooms. The executive offices of the company are located in the Traction Terminal Building at Indianapolis.

OPERATION

Local cars are operated each way every hour, making stops upon signals at all of the cities and towns and at the principal highway crossings in the country. These cars are all provided with compartments in which baggage and light express matter may be carried. They are designed to run at a schedule speed of 30 m.p.h. To properly take care of the through service, additional "limited" cars will be put on the line; each of these will be equipped with four 150-hp motors, designed to operate at a schedule speed of 50 m.p.h. or 60 m.p.h., as under the provisions of the various franchises they will not have to make any stops in the country or at any of the smaller towns, and will only be required to make one stop at each of the larger intervening cities. It is expected that when the road is completed from Indianapolis to Cincinnati these "limited" cars will be able to make the trip from the center of one city to the center of the other in three hours' time. It is the intention at a later date to run two express cars per day in each direction, taking care of the light freight and express business.

This road has been built in every detail with a view to the handling of heavy freight, even to the extent of carrying it in long trains. Whenever, in the intervening cities, short radius curves could not be otherwise avoided, the private property of the inside corner has been purchased and the sidewalks and curbs set back so as to make easy curves and permit the handling of heavy trains.

FARES

An average fare of 1½ cents per mile is charged by the company for carrying passengers, the road being divided into 5-cent sections; no fare less than 5 cents is charged for any ride. A school children's ticket is issued, good for use one hour before or after school hours. A mileage or sectional ticket is also issued at a reduced rate, giving 160 5-cent rides for $7, a reduction of 12 per cent from the ordinary fare. No other tickets are sold and cash fares are collected on the car.

John W. Moore, chief engineer of the Indianapolis & Cincinnati Traction Company, has been particularly active in the construction of the roadway, bridges and track work. Arthur A. Anderson, general superintendent of the company, has carefully supervised the entire work of construction and operation. His past experience with the Indianapolis Street Railway and the Mahoning Valley Railway Company, of Youngstown, Ohio, has fitted him in a peculiar way for his present duties.

It is understood that about two years will be required for the Boston Elevated Railway Company to build its extension of elevated structure from Guild Street, Roxbury, to Forest Hills. According to present knowledge, elevated trains will be running between the city proper and the latter point by Jan. 1, 1907. The company has taken up the matter of express trains, and has decided that under existing conditions it will be out of the question to operate such a service. There will probably be several stations between Dudley Street terminal and Forest Hills, all trains stopping at all stations.

TRACK CONSTRUCTION ON CONCRETE IN CINCINNATI

At a recent meeting in Columbus of the Ohio Society of Engineers, J. M. Harper, chief engineer of the Interurban Railway & Terminal Company, of that city, read a paper descriptive of the track construction on concrete in that city. The rail used was the Lorain Trilby girder section, 60 ft. long, 9 ins. deep, and weighing 109 lbs. to the yard. The trenches were taken out 18 ins. below grade, and the rails cribbed up so as to permit 9 ins. of concrete to be tamped under the base of the rail. The form of girder was that of a longitudinal truncated pyramid shape, being 18 ins. at the base, 16 ins. on top and 15½ ins. high, leaving 2½ ins. between the top of the concrete girder and top of the rail. This space was filled with asphalt, the entire roadway of the street proper being paved with this material. Ties 6 ins. x 8 ins. x 8 ft. were placed every 12 ft., and tie-rods were introduced every 6 ft. The forms were held together at the top by U-shaped iron bands.

The proportions used in the concrete were 1, 3 and 5, the stone being crushed to the usual size, unscreened, and the cement Portland. The concrete was permitted to set for ten days, and traffic was switched from one track to the other of the uncompleted to the completed sections by temporary portable cross-overs.

According to Mr. Harper, this construction has been carrying the travel for some seven months and no breaks in the pavement next the rails or at other places have occurred, except at one point, where for some 60 ft. under one rail it exhibits small openings. It is supposed that here the girder has settled and fractured, due to the presence of springs that failed to develop during the progress of the work. The cost of this double-track construction, exclusive of rails and ties, was $3 per lineal foot.

On another highway, paved with granite, shallow rails had to be used on account of quick delivery. To provide sufficient space for the vertical section of the granite blocks, seasoned oak strips were placed upon top of the ties, which were 6 ins. x 8 ins. x 8 ft., and were spaced 2 ft., sometimes more, apart. These strips were immersed in hot creosote oil and then coated with tar. The granite blocks stand flush with the top of the rail and a space 1¼ ins. wide was left between the side of the rail and the granite block. This opening extends down to the concrete foundation and is filled with pebbles ranging in size from a pea to a hazel nut, and the voids are completely filled with Portland cement grout. Not less than seven days must elapse before traffic is permitted on any part of the completed line. Mr. Harper states that certain portions of the tracks (it is a double line) have been operated over now for six months and no breaks or openings next the rails have developed. He attributes this condition almost wholly, however, to the very severe and rigid inspection to which the material and workmanship was subjected.

A party of Cleveland gentlemen, composed of Henry A. Everett, Charles Wason, Will Christy, Warren M. Bicknell, Luther Allen, F. C. McMillan and Louis E. Beilstein, representing a number of Northern Ohio properties, made a trip of inspection a few days ago over the Lake Shore Electric, Toledo & Western, Western Ohio and Dayton & Troy roads. From Dayton the party went to Indianapolis on the "Interstate Limited," and spent a day going over some of the roads out of Indianapolis. The object of the trip was to inspect all these roads and to study the new Indianapolis terminal station, in which the Cleveland managers are greatly interested. It is said in Cleveland that the local roads may build a passenger terminal station in the city in connection with the freight station which they now operate.

THE TOKIO TRAMWAY COMPANY

BY E. A. BALDWIN

The activity of the Japanese in taking advantage of the modern improvements of Western civilization is nowhere more evident than in the extensive adoption of electricity on the various street railway systems of the Empire. While electric cars are still a novelty in Japan, there is already a large and growing investment in electric street railway systems and a considerable mileage is under operation.

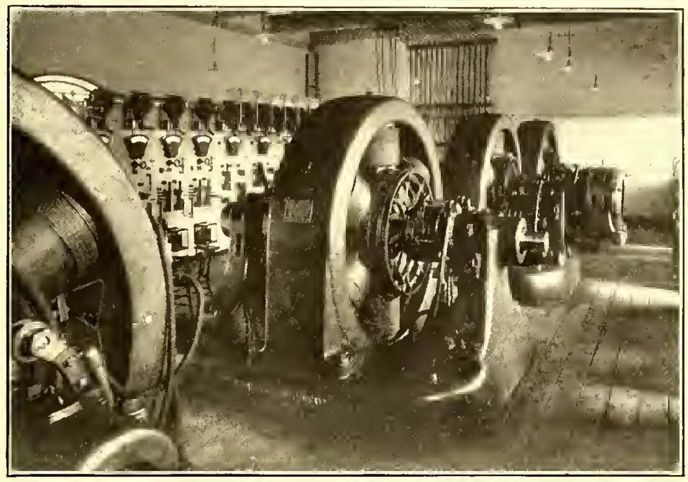
One of the first street railway systems of Japan to adopt electrical operation on a large scale was the Tokio Tramway Company (Tokio Densha Tetsudo Kabushiki Kwaisha), which has now over 250 car equipments in operation. This was the first street railway of any description in the country and was inaugurated about fifteen years ago as a horse railway. The road was then capitalized at $850,000. When it was decided to change to electric traction, in 1901, the capital was increased to $2,500,000, divided into 100,000 shares of $25 each, and an inclusive contract was entered into with the General Electric Company for the supply of the entire new equipment, both steam and electrical, necessary for the complete outfitting of the railway. In view of the fact that extensions to this line are to be made, some particulars of the present equipment may be of interest.

The franchise of the road covers 13 miles of streets, all

AN EXTERIOR VIEW OF THE POWER STATION

within the city. About 10 miles of the line is on the Ginza, the "Broadway" of Tokio, extending through Uyeno Park to Shinagawa, the next city below Tokio, where the power station is located. A branch line runs out to another section of the city known as Asakusa.

To handle the service on these lines the company installed a system of electric generation and distribution conforming to the latest American practice. The generating station, shown in two of the accompanying views, contains three 1200-kw units, each consisting of a 28-pole, 6600-volt, 25-cycle, direct-connected, three-phase generator driven at 107 r. p. m. by a horizontal cross-compound engine. These engines were built by McIntosh & Seymour, of Auburn, N. Y., and have cylinders 30 ins. and 62 ins. x 42 ins., designed for 140 lbs. initial pressure. Two of these units are normally in use, the third being



ROTARY CONVERTERS AND SWITCHBOARD IN THE IMAGAWABASHI SUB-STATION

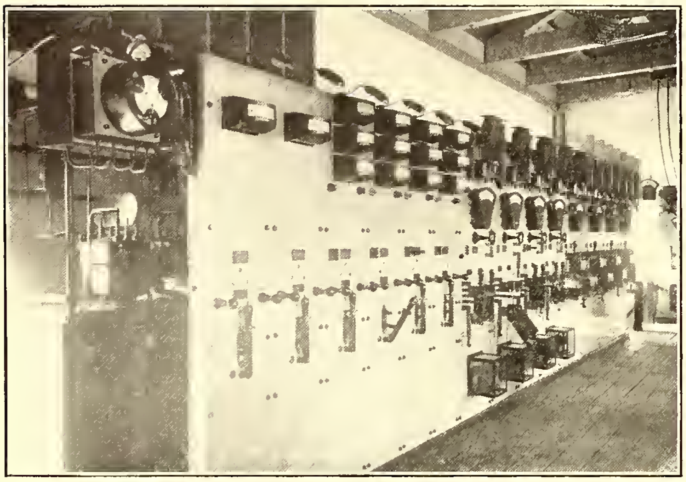
held in reserve. The excitation is furnished by two MP 6-pole, 100-kw, 125-volt generators direct driven at 225 r. p. m. by McIntosh & Seymour tandem-compound 9½-in. and 19-in. x 15-in. engines, either unit being of sufficient size to excite all three alternators, with a liberal margin besides for the supply of station lighting.

The engine room is served by a 20-ton, 50-ft. span, three-motor Morgan crane, equipped with General Electric motors and controllers.

Jet condensers and air pumps of the Blake-Knowles Steam Pump Works' make are used for the main and exciter engines. The equipment of the boiler room consists of four batteries of Babcock & Wilcox boilers, each comprising two 350-hp boilers generating steam at 150 lbs. The ordinary feed-pumps are in duplicate, and are further supplemented by a small automatic pump, which, acting in connection with a receiver, delivers to the boiler feed system the water of condensation drained from the high-pressure piping. Primary feed-water heaters of the Wainwright type are used with each of the main engines, and in addition one secondary heater is used through which passes the exhaust from the auxiliaries.

The three-phase 6600-volt current from the main generators is carried to a standard General Electric high-tension switchboard (shown in the middle of the interior view herewith), equipped with motor operated form H oil switches. From this switchboard the current is distributed over triple-conductor, paper-insulated, lead-covered cables to the two sub-stations known as Imagawabashi and Hamamatsu Cho. These cables have an aggregate length of about 20 miles, and being laid directly in trench work without conduit are protected from external injury by heavy wrappings of tarred jute and band steel armor.

The Imagawabashi sub-station, illustrated herewith, is the larger of the two and contains four General Electric 6-pole, 400-kw, 500-r. p. m., three-phase rotary converters, compound-wound for 550 volts no load, 575 volts full load. Each rotary is fed from a bank of three 150-kw single-phase air-blast transformers. Three-phase air-blast reactances of 60-kva capacity are placed between the transformer secondaries and the rotaries for the purpose of automatic voltage regulation by phase control. The transformers are equipped with half-voltage taps in the secondary which, by means of triple-pole, double-throw switches, permit the rotaries to be started from the a. c. side. The rotaries are always started by this method, which from its



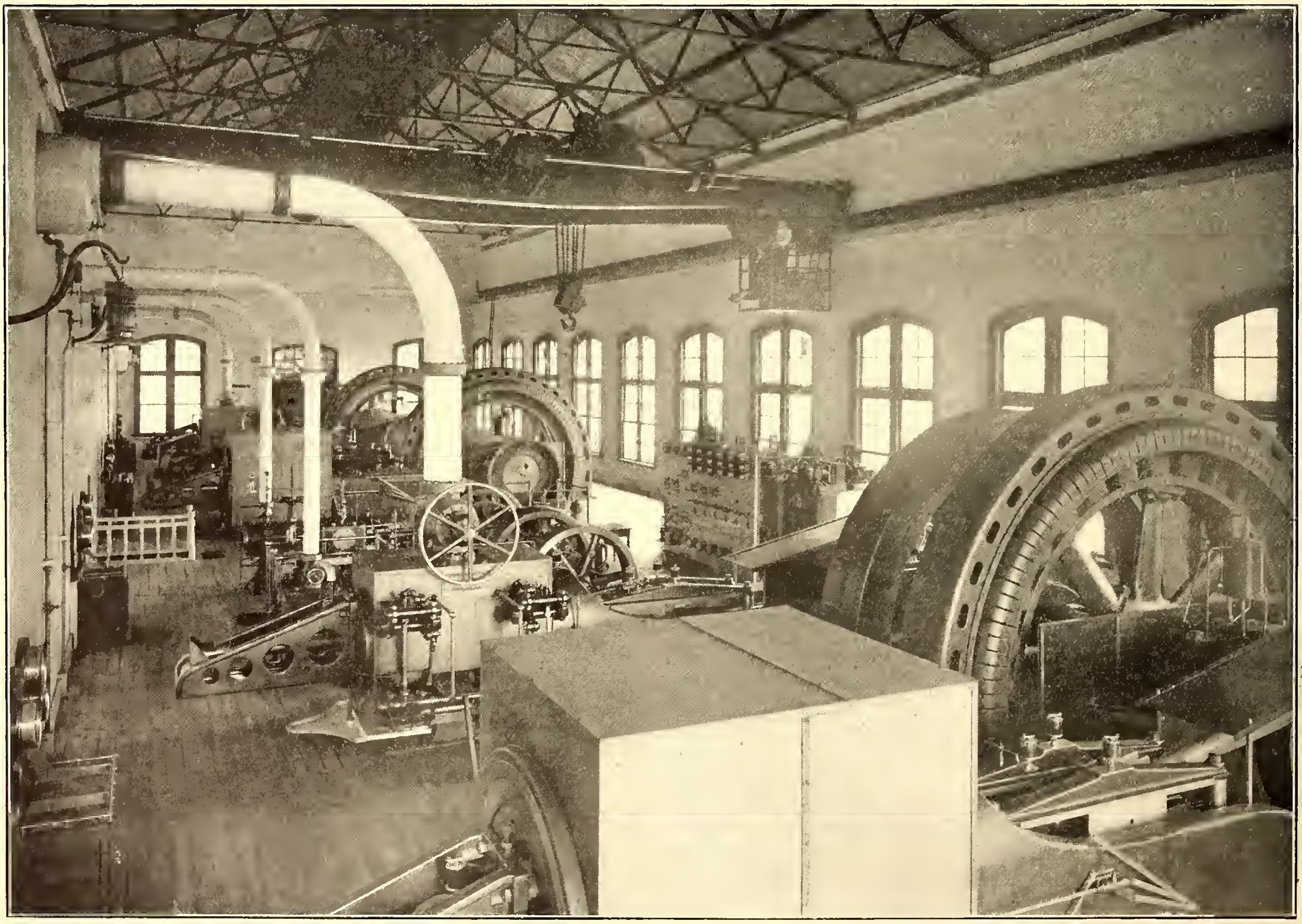
VIEW OF MAIN SWITCHBOARD WITH THREE-PHASE GROUND DETECTOR AT THE LEFT

simplicity and convenience is preferred by the sub-station attendants. However, as the Japanese engineers expressed some doubts of the success of this method at the time the contract was executed, one rotary in each station was equipped with a switchboard, which, it will be noted by inspection of the accompanying view of the Imagawabashi board, is double-pole, the feeder panels being equipped with double-throw switches. This arrangement was necessitated by the fact that a government regulation prohibits the use of rail return circuits. The double-trolley system is therefore used, and the feeder switches are made double-throw for the purpose of changing the polarity of any section of the trolley wire in case grounds should occur simultaneously on two sections normally of opposite polarity.

The equipment of the Hamamatsu Cho sub-station is similar to that of the station described, except that it contains two rotaries instead of four.

Included also in the General Electric Company's contract were trolley wire and overhead line material for 10 miles of double track, together with 250 cantilever motor trucks built by the Peckham Manufacturing Company and equipped with GE 1000 motors. The car bodies were built in Japan, and are of light construction, so that single-motor equipments were found to be of sufficient capacity. The cars are housed in a commodious car house, containing a transfer table, which is also operated by GE 1000 motors.

The electric service was inaugurated on March 17, 1904, and it is of interest to note that the entire work of installation and operation has been exclusively in the hands of native engineers, without direct assistance of any kind from the manufacturing company which supplied the apparatus. The manner in which this work has been carried out, as shown by the accompanying



INTERIOR OF POWER STATION, SHOWING MAIN GENERATING SETS, PIPING, SWITCHBOARD AND CRANE

direct-connected starting motor and all of the rotaries with switchboard arrangements for starting from the d. c. side.

The sub-station switchboards are in accordance with recent practice for this class of work and include no features of novelty. Attention may be called, however, to the direct-current views, is a distinct compliment to the skill and thoroughness of those in charge.

The president of the railway is G. Mudaguchi, and the technical department is in charge of M. Enya, chief engineer, who also directed the entire work of installation.

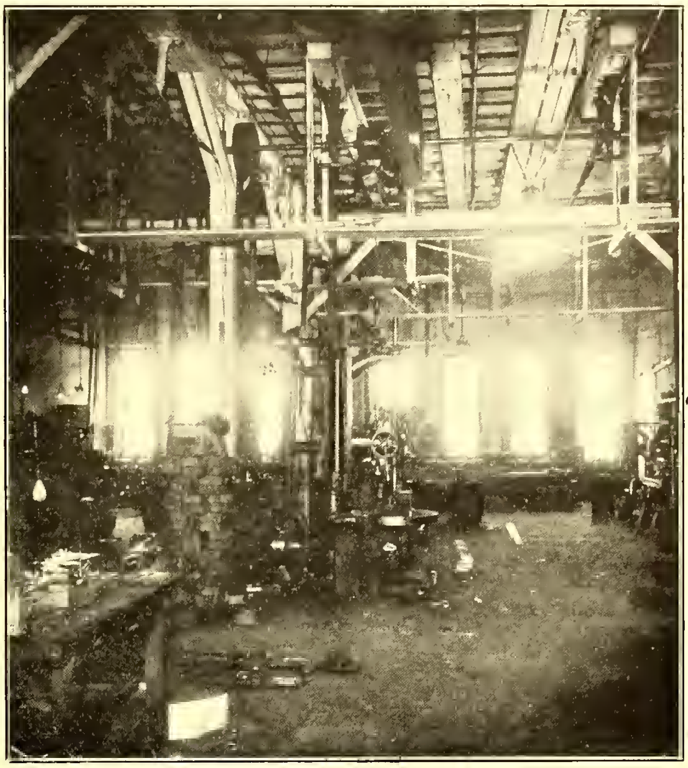
SHOP EQUIPMENT OF THE NEW REPAIR SHOPS INSTALLATION OF THE DETROIT UNITED RAILWAY COMPANY

In an article in the preceding issue a description was presented of the shop layout, with details of building arrangement and equipment, of the new repair shop installation recently placed in service by the Detroit United Railway Company, Detroit, Mich. This shop plant, which has been provided by the company as a result of its greatly increased traffic and consequently enlarged problem of rolling stock maintenance, is one of the largest and best equipped shops devoted to electric railway work in this country. On account of the extensive character and completeness of detail of these shops and their equipment—owing to the desire of the company to keep the standard of its mechanical work in advance of the requirements—an account of some of the more important features of the mechanical equipment, as well as the operative methods there, will be of interest to those having to do with the mechanical problems of electric railway systems.

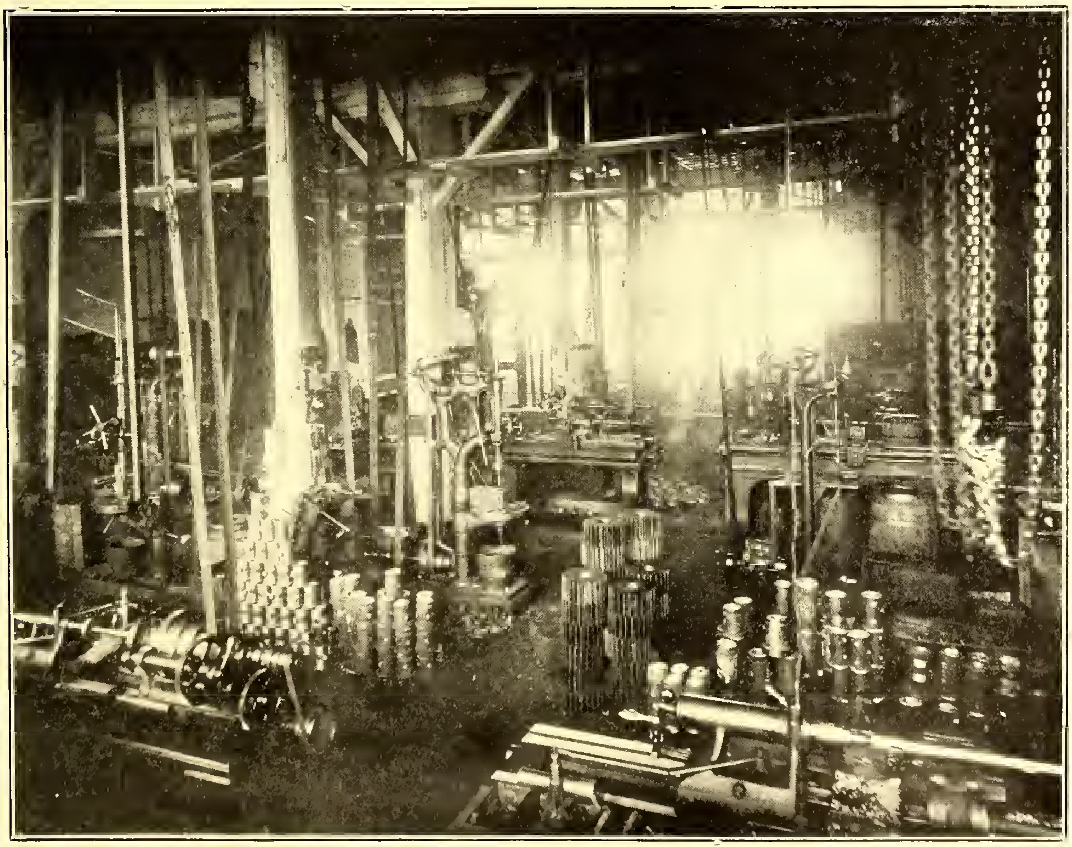
SHOP EQUIPMENT

While careful attention was devoted to all features of this repair shop problem, it is interesting to note in particular that very complete preparations were made for the manufacturing facilities which should be necessary in connection with the repair work. Large and very completely equipped machine, blacksmith and woodworking shops have been provided, and are found of great value in the work of providing repair material and parts for use not only at the main shop but at the various car houses upon the system for light running repairs. The importance of this factor of repair shop work and the necessity of maintaining the adequate manufacturing equipment were thoroughly appreciated by the management, and the results in practice are very gratifying.

As may be noted from the shop plan, the machine, blacksmith and woodworking shops are located in a row upon the north, or Macomb Street, side of the plant. It may also be noted in this connection that direct access is provided from this side of the transfer table pit to the stores, not only in the gear and brakeshoe shed adjacent to the blacksmith shop, but also to the stockyard on the east side of St. Aubin Avenue without necessitating the crossing of the transfer-table pit. Another fortunate feature of the arrangement of these departments may be noted in that the greater part of the heavy work of repairs upon cars is carried out in the erecting shop, which is adjacent to the woodworking shop, thus minimizing the amount of handling required in transferring materials to that department from the machine and woodworking shops.



GENERAL VIEW IN THE MACHINE SHOP OF THE NEW DETROIT UNITED RAILWAY REPAIR SHOPS



VIEW IN THE LATHE SECTION OF THE MACHINE SHOP DEPARTMENT OF THE DETROIT SHOPS

The wheel department of the machine shop is, however, located on the opposite side of the transfer-table runway, in a section of the truck shop which was obviously the most desirable location on account of the fact that truck work is taken care of exclusively on that side of the plant. In this way the wheel work may be taken care of adjacent to the work upon the trucks themselves, thus minimizing the amount of handling of material necessary in this department. In general, it may be stated that, owing to the carefully planned arrangement of the various departments, the most serious objection to the transfer-table arrangement of repair shops, namely, in regard to the difficulty of handling material across the transfer-table pit, is thereby avoided almost entirely.

THE MACHINE SHOP

The machine shop is a very important feature of the shop work, thirty-three men being employed in this department. It occupies a space of 44 ft. x 82 ft. upon the lowest floor of the three-story section of the building upon the Macomb Street side. As it is adjacent to the blacksmith shop it is evident that forgings which must be machined will be most easily delivered to the machine shop. This department is well lighted, excellent window lighting facilities being provided upon both sides. The southeast corner of the department is devoted to a large and well arranged tool room, in which are kept all the small tools, such as drills, reamers, taps, dies, etc., and other machine supplies for use in this department, as well as also a limited amount of raw stock for the various machining purposes. Considerable storage space is left free adjacent to the tool room, the machine tools being located upon the Macomb Street side of the room. A very liberal machine-tool equipment has also been provided for the work in this department; tools of all classes are in use, with the exception of perhaps the planer. Lathes, drills, shapers and even turret lathes and bolt cutters are in evidence, as well as also the milling machine and cutter grinder. The complete tool equipment is presented in the accompanying table, in which may be noted the sizes of the various tools:

MACHINE-TOOL EQUIPMENT—DETROIT SHOPS

No.	Tool	Size	Maker
2	Engine Lathes	16 inch	F. E. Reed Co.
1	"	20 "	Lodge & Shipley Mach T. Co.
1	"	20 "	Putnam Machine Co.
1	Heavy Engine Lathes	28 "	Pond Mach. Tool Works
1	Turret Lathe	15 "	Warner & Swasey Co
4	Drill Presses	16 to 24 ins.	W. F. & J. Barnes Co.
1	Sensitive Drill	Four Spindle	" "
1	"	Single Spindle	" "
1	Upright Drill	No. 5	New Haven Mfg. Co.
1	Shaper	24 inch	Cincinnati Shaper Co.
1	Milling Machine	No. 9 Plain	Cincinnati Milling Mach. Co.
1	Bolt Cutter	1½ inch Head	Acme Machinery Co
1	Emery Wheel Stand	--------	Leland & Faulconer
1	Universal Tool Grinder	Tool Room	Cincinnati Milling Machine Co.
1	Upright Drill Grinder	Tool Room	Wilmarth & Norman Co.
1	Axle Lathe, 36″	Wheel Shop	Niles Tool Works
2	Wheel Borers, 36″	Wheel Shop	" "
1	Wheel Press, 100 ton	Wheel Shop	" "

Much of the work in this department is of an interesting nature; special methods of machining have been devised in many cases, and jigs are used to facilitate drilling, boring, etc. Armature bearings are bored in a special jig of novel design, which is arranged for mounting upon the carriage of one of the lathes; provisions are made for quickly centering the box in relation to the cutter, which is mounted in a boring bar between the lathe centers, and the boring is then accomplished by merely throwing in the carriage feed and allowing the box and all to traverse as the boring bar revolves. This has proven a very rapid and economical method of handling this work.

Many small parts used in the electrical department and elsewhere are machined to great advantage in the Warner & Swazey turret lathe, while the milling machine is also found a very convenient tool for the duplication of small parts in connection with jigs. Trolley wheels are being finished in quantities from rough castings by special form cutters in the turret lathe, while brush holders are very successfully machined from rough brass castings in the latter tool, in connection with jigs and special cutters; they are made in large quantities in this way very easily and with a minimum of labor cost.

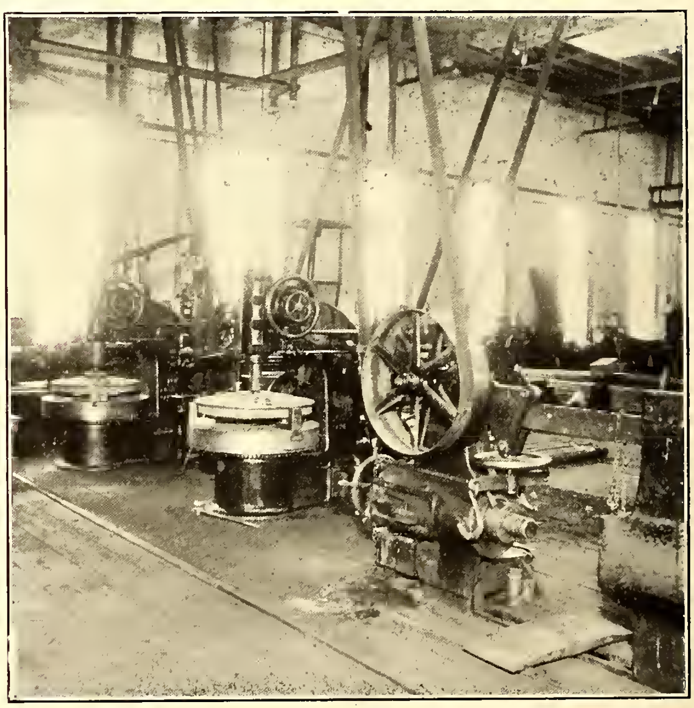
The tool-room equipment consists of the well-known Cincinnati universal tool grinder, and also a Yankee drill grinder of wide range. In the former tool all milling machine and special cutters are ground to advantage, while the grinding of drills and of all lathe and shaper tools are carried out upon the latter tool. These cutting tools are kept in stock in the tool room and supplied to the tool operators as required, the grinding being in charge of the tool room machinist, who is thereby enabled to maintain the cutting edges of all tools at the proper angles for the best results.

As stated before, the tools used for the machining of wheels and axles and for pressing wheels onto and off of axles, are located in the wheel section of the truck shop, as in this place they are most convenient to the work in hand. As may be noted from the view in this department, the tools used include a 36-in. Niles axle lathe, two 36-in. Niles wheel borers and a 100-ton Niles hydrostatic wheel press. These tools will cover a wide range of work and are ample to provide for the maximum requirements in this line from the entire system; the best and most modern tools were secured on account of the importance of the work, and also of the greater capacities thus made available.

The tools are conveniently located between two shop tracks at the east end of the room, which thus facilitates the delivery of wheels and axles by cars direct. Here again an important advantage of the transfer table is emphasized; it permits the delivery of wheels or axles to the shop in carload lots direct from the steam railroad, at one side, without reloading or second handling; also refitted wheels may be loaded here directly onto the material or supply cars which are to deliver them to distant car houses or auxiliary shops. A jib crane of 12-ft. radius swings from an adjacent wall so as to conveniently handle work to the wheel borers and axle lathe, while each of the Niles wheel borers has the auxiliary hoists supplied with them for lifting wheels onto the table chuck and off.

THE BLACKSMITH SHOP

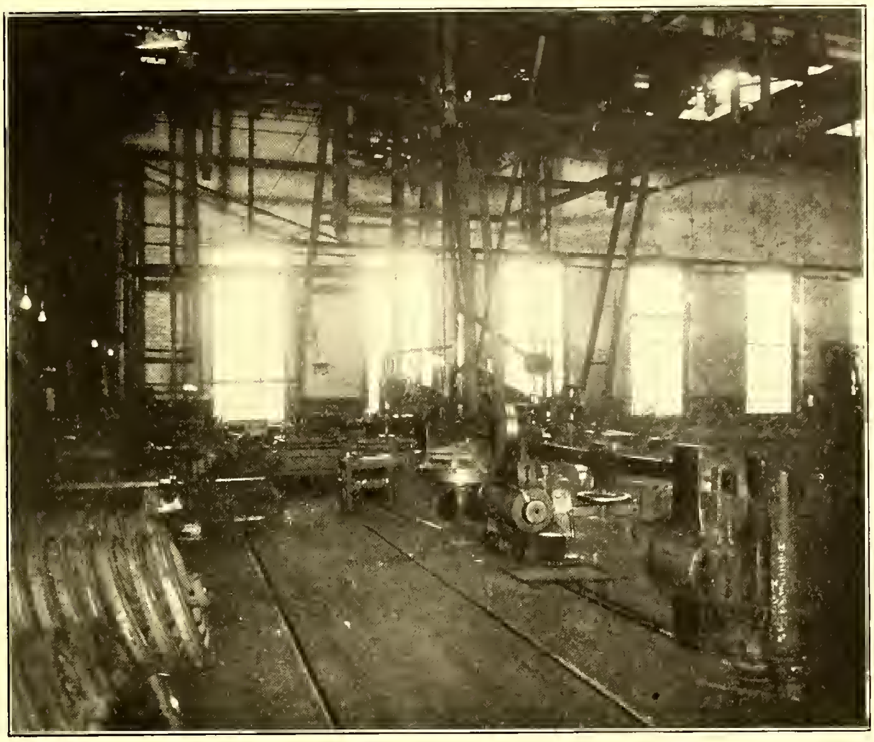
The blacksmith shop, which has a floor area of 44 ft. x 82 ft., occupies the one-story section of the building to the east of the machine shop, this extension having been originally designed especially for this class of work. The roof is amply supplied with ventilators for the removal of the smoke and gases from the forge fires, and, furthermore, the building has the advantage of window lighting upon three sides, in addition to the skylighting; good light, which is so valuable a feature in a smith shop, on account of the very important nature of the work in hand, is thus afforded.



DETAIL VIEW OF THE WHEEL-BORING MACHINES IN THE WHEEL SHOP

The shop contains seven forge fires, which are conveniently arranged not only for access to the individual anvils and forging clamps and jigs, but also to the power hammers. The forges are home-made, having been built up of No. 10 sheet iron, with angles riveted to the tops for stiffness; each is 3½ ft. square and sets 2½ ft. high above the shop floor, the top of the tuyere being 10 ins. below the top level of the forge casing. The block method of building up fires is used throughout with excellent results; very clean fires are obtained, and quick and even heating is the result. All of the forges are served with exhauster connections for the removal of the greater part of the smoke from the forge fires through the hoods above them; the exhauster blower is mounted upon a platform beneath the roof and exhausts directly into a stack rising above the top of the adjacent buildings.

In addition to the very complete equipment of jigs, forming plates and forging clamps that are provided for facilitating smith work, there is also provided a Hackney power hammer, which was supplied by the Walker Manufacturing Company, of Cleveland, Ohio; this hammer operates through the agency of an air-cushion cylinder, the hammer piston floating in a practically closed cylinder, which is itself reciprocated by power. A large steam hammer has recently been installed in this shop which will take care of the heavier work of forging; the steam hammer is a Chambersburg hammer of 1250 lbs. capacity, the steam for which is supplied by one of the boilers in the heating plant. The tool equipment of the smith shop consists of a 4-ft. plate roll for the rolling of bumper plates and other heavy rolled work of similar nature; this roll is also a home-made tool, the rolls having been machined from steam locomotive axles. There are in addition two punches in use in the smith shop, one a No. 3 combined punch and shear, furnished by the Long & Allstatter Company, which has a capacity of shearing 5-in. x 1-in. bar or 1½-in. round stock, and punching 1¼-in. holes in the steel plate. The other punch is a small Stiles punch, which is used for lighter work. Twenty-two men are employed in this shop, ten of which are at present kept solely on fender work, embracing not only the repairing of fenders, but also the building of new ones. The machinery in this shop is driven through shafting by a 250-hp Westinghouse motor located in the wood shop, which also drives the line shafts in both the machine and woodworking shops.



THE WHEEL-SHOP SECTION OF THE TRUCK DEPARTMENT OF THE SHOPS, SHOWING ARRANGEMENT OF HOISTING FACILITIES

GENERAL VIEW IN THE BLACKSMITH-SHOP DEPARTMENT OF THE SHOPS, SHOWING ROLLS, PUNCHING MACHINERY AND POWER HAMMER

WOODWORKING SHOP

A large woodworking-tool equipment is provided, and also adequate space is available in the woodworking department to provide for the maximum demands in this line. This shop occupies the west end of the lower floor in the three-story section adjacent to the machine shop. It also is well lighted by windows upon both sides of the building. Excellent bench-work facilities are provided on the north side of the room, while the tools occupy the central portion of the room. The tool equipment was selected to provide for the handling of the repair work in the most effective and economical manner; while the majority of them were moved to the new shop from the old one, still a number of the more important ones are entirely new, having been installed upon the completion of the new shop.

The cabinet shop occupies a part of the floor above the woodworking shop and is equipped with a few special tools for facilitating work of this nature. In this shop all new work as well as repairing, in the line of car furniture and furniture supplies for the system, is carried out. This work is supplemented also by a pattern shop and storage room in a fireproof room adjacent, over a portion of the one-story section occupied by the paint supply room, fireproofing having been considered of special importance here on account of the great value of many of the patterns. This shop is also provided with a few special tools, including a wood lathe, jig saw, saw bench, etc., for facilitating this particular class of work.

THE CARPENTER-SHOP DEPARTMENT OF THE DETROIT SHOPS

The following is a list of the woodworking department tool equipment:

WOODWORKING TOOL EQUIPMENT—DETROIT SHOPS

Number	Type of Tool	Maker
1	Heavy Wood Planer	Frank H. Clement
1	"	Baxter D. Whitney
1	Universal Wood-worker, with Boring Attachment	J. Fay & Egan Co.
1	Hand Surfacer or Jointer	" "
2	Mortisers, with Boring Attachments	" "
1	Sticker	Schmidt
1	Tenoner	Frank H. Clement
1	No. 2 Two-head Shaper	" "
1	Single-head Shaper	" "
3	Table Saws	J. Fay & Egan Co.
1	Band Saw	" "
1	Band Saw Filer	Chas. E. Wright
1	Swing Cut-off Saw	J. Fay Egan & Co.
1	Jig Saw	" "
1	Sandpapering Mach.	Berlin Machine Works
....	Grindstone and Emery Wheels	....

ELECTRICAL DEPARTMENT

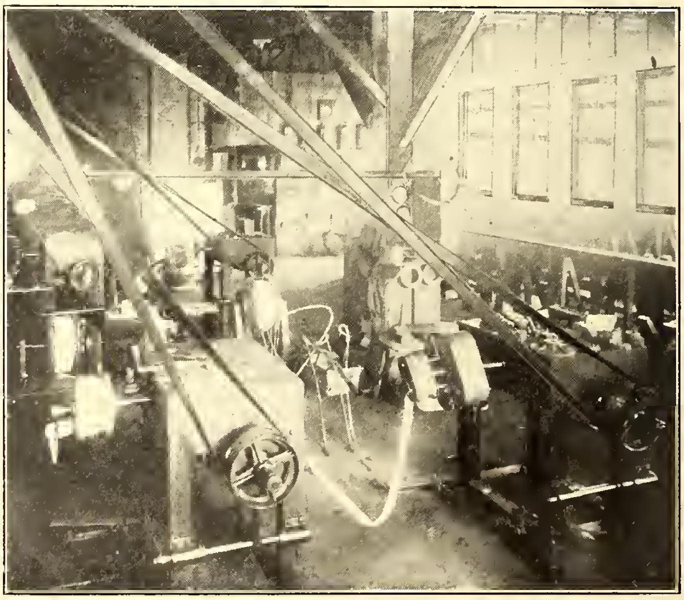
The electrical repair work is carried on upon the two upper floors of the three-story section of the building above the machine shop. Thus an area of 44 ft. x 82 ft. is provided upon each floor, and the advantages of excellent lighting, which is so necessary in this work, are obtained; upon the upper floor skylighting is also provided. Easy access to either of the two upper floors is afforded by a hydraulic freight elevator which is entered through the machine shop on the ground floor. Material, as well as armatures, motor fields, etc., are transported to and from this department by trucks, which are thus easily handled on the elevator and across the transfer table. Accompanying engravings illustrate the facilities, as well as also the character of the work in various sections of this department.

Special attention is given to the winding of fields and armatures, a very complete equipment having been installed for this work and, in particular, for the winding of formed armature coils. Power operated winding machines are used, the mechanism of which embraces the usual worm-gear drive through a friction clutch, operated by a foot pedal, for starting and stopping. One of the illustrations on this page shows a group of four winding machines, from which a general idea of their construction may be obtained. The mechanism is in each case mounted upon a heavy wooden framework, the top of which is covered with a boxing that serves as a very convenient table; this box cover also effectually keeps out dust and dirt from the worm gearing. The friction clutch is located within the driving pulley at the front side and is operated by levers from the foot pedal, shown below the winding shaft.

The two forward machines are shown as arranged for winding field coils, the field-forming frames being mounted upon the worm-driven shaft extending out from the box to the left, as shown. For armature coil winding these coils are replaced by the special collapsible or sectioned winding forms of the usual types, which are thus driven by power with correspondingly increased production. The stock of winding forms provided embraces every type of coil, both armature and field, that is used upon any part of the system, so that any style of armature may be repaired upon short notice.

In another portion of this department, apparatus is provided for the taping of the formed armature coils, and afterward for pressing them to shape after the insulating board has been glued on. The taping machines are of the usual well-known type of construction for this work, the coil of the tape being made to revolve in a "ring path" around the armature coil which is held within the hollow space. These machines are shown mounted upon a table at the right hand of the above-mentioned view, there being three of the machines upon either side. The machines are driven from countershafts beneath the table, each being controlled by a separate foot pedal for starting and stopping, as desired. They are, as is well known, very rapid in action and very effective, permitting a very much greater production than is possible with any other method.

The presses for shaping and setting the insulating board when glued upon the form coils are shown mounted upon tables at the left in the view. There are eight of these air operated



VIEW OF THE COIL-WINDING MACHINES IN THE ELECTRICAL DEPARTMENT

presses, which accomplish their purpose by gripping the side portion of an armature coil where it is to be dropped into the slot in an armature core; this results in pressing the insulating board to shape and holding it firmly until the glue has properly set. Each press is operated by an individual Christensen straight-air brake valve, located at the right of the cylinder, as shown, by which air is admitted and released from the cylinder;

the piston in the air cylinder is raised to release position by internally arranged springs, as in air-brake cylinder construction. It is found that coils stand up very much better in service when finished in this way than by former methods; it is also found that the operation of compressing is very rapid and effective, little extra time being required for this portion of the work.

Two other interesting operations are carried on in this portion of the electrical department, namely, stripping the leads from the armature coils and tinning them. All armature coils when completed are brought to the corner of this room at the rear of the air press table and there put through this process. First the leads from each armature coil are run through a tinsmith's roll, the rolls of which have been spaced so as to tightly press the wire. The wire leads are run through a distance of 2 ins., or as far as it is desired to strip the insulation, after which it is found that the insulation is practically cut off on both sides so that it may be easily picked off by hand. Care must be taken, of course, in this operation to not flatten the wire, as by placing too much pressure on the rolls the wire may be seriously flattened; but by properly gaging the pressure of the rolls the insulation may be cut by the mere action of the pressure, with scarcely any effect of flattening of the wire. The tinning of the leads is then carried out in the usual manner, the ends being dipped in a cleaning and fluxing solution and then dipped into a pot of hot solder; the latter operation is very rapid, as the coils are dipped and tinned in lots of twelve in a bunch. The entire process of stripping and tinning is very simple, and one boy, experienced in the work, can handle the entire daily output of the department in a very few hours.

THE COIL-TAPING MACHINES AND AIR PRESSING MACHINES FOR FINISHING ARMATURE COILS

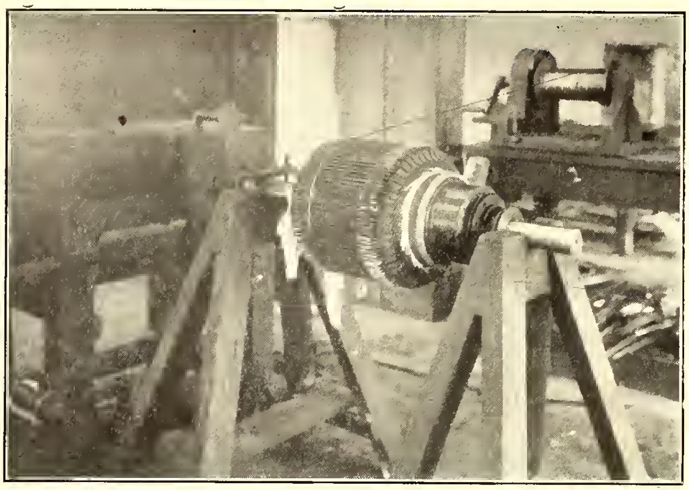
THE STOCK ROOM OF THE ELECTRICAL REPAIR DEPARTMENT

An accompanying view of the electrical store room shows the method of storing the armature coils of the various types in accordance with the practice at Detroit. The coils when completed are delivered to this stock room and are thereafter issued to the armature winders only upon requisitions. Careful records are kept of the number of coils made and those delivered for rewinding, so that an accurate account of the costs of this feature of the work may be kept. A large number of coils are kept for each type of armature in use upon the system, so that the least possible delay will be experienced in rewinding armatures. The scope of this stock room is also extended to include all other supplies which are used in the electrical department, including the insulating paints, mica insulation, etc., down to machine screws and bolts. The armature storage scheme is shown at the left in the view of the testing department.

A detail view is presented of the arrangement which is used for banding rewound armatures. The completed armature is, as indicated, mounted upon adjustable horses with the armature shaft in line with the driving crank upon one of the abovementioned coil-winding machines. This winding machine is identical in construction with those illustrated upon page 312, with the exception that a crank protrudes from the opposite side of the worm-driven shaft, from which the coil form is usually carried. Then, by merely clamping a projecting strut upon the gear-seat end of the armature shaft and bringing this in contact with the projecting driving crank, the arrangement is complete and ready for operation. The banding wire is carried in a coil upon a nearby table, this coil being arranged with a retarding band brake, which may be tightened or loosened so as to give any desired strain upon the wire in banding. The armature shown in the view is in the process of being banded, from which an excellent idea of the scheme may be had. The arrangement is very simple and effective, and excellent results are obtained by its use.

In another illustration is shown the testing corner of the electrical department, in which field coils, armatures, circuit breakers and all other electrical apparatus is tested for insulation resistance and ground. This department is upon the top floor adjacent to the armature storage section, and is served by a traveling hoist arrangement, which facilitates the delivering of armatures to and from the testing block. All armatures, coils, etc., are here tested and tagged to show their condition and to provide for the records which are kept of the service.

The testing transformer consists of a special semi-circular core with a field winding so arranged as to set up an alternating-current field which will locate short-circuited coils upon armatures. The transformer is of a type of construction which has been very much used for this work and will therefore not necessitate detailed illustration. In use the armature is dropped into the semi-circular opening, which is of a size near to that of the average size of armature. Then when alternating current is turned into the field coil a strong alternating-current field will be set up in the armature, which will indicate at once the presence of a short-circuited coil by its heating effect upon that coil. Current is supplied to the transformer by means of a special motor-generator supplied by the Commercial Electric Company, which operates upon 500-volt direct current and delivers single-phase alternating current for the above work



DETAIL VIEW OF THE ARMATURE-BANDING MACHINE

and testing for grounds. A special detachable secondary is used in connection with the armature tester, which is set across the gap of the semi-circular alternating field core in place of the armature. This secondary has several windings which may be connected in different combinations so as to deliver either 1200 volts, 1400 volts or 1600 volts alternating current for high-voltage testing.

Armatures are also tested very largely at present here by the millivolt drop method; the armature shown in the illustration of the testing corner is undergoing such a test. The armature is placed in a special supporting cradle, which has brush holders mounted upon the arms so as to be located at an angle of 90 degs. apart upon the commutator. Then a 500-volt current is impressed upon the brushes and the drop read across each combination of bars by means of a millivolt meter. This method has been found to be preferable in many ways to the alternating-current method of testing, as it gives a more accurate knowledge of the conditions present in the armature.

The testing of circuit breakers is carried out by the usual water rheostat method, the water rheostat being shown at the right in the testing corner. The circuit breakers are mounted upon the projecting partition and are calibrated by passing definite amounts of current through them, as indicated by an ammeter in the testing circuit. The water rheostat permits ready adjustment of the current values, which may, of course, be easily determined by the ammeter. The breakers are tested repeatedly and are thereby brought to the best condition of repair, so that they may go out with an assurance of being in proper condition; all necessary repairs to the breakers are also made at this time.

An interesting work is being carried out at Detroit in the rebuilding of the old type of controllers which were formerly used in connection with the "steel" motors manufactured by the Lorain Steel Company. A large number of these equipments were in use upon one of the former systems in Detroit, and these controllers are being rebuilt and retained in service. The old form of drum with large round disc separating and deflector plates is being replaced by controller drums of modern construction, using hardwood mountings for the staff upon which the plates are fastened. The entire controller is rebuilt for this purpose and the magnetic blow-out arrangement changed so that very satisfactory operating results are obtained.

Each department of the shop is in the charge of a foreman, who reports directly to the master mechanic, S. Potter. The foremen of the above departments are as follows: Machine shop, N. McCuen; smith shop, Louis Zinke; wood shop, John St. Amour, and electrical department, James Ulley. The further details of equipment and operative methods in the other departments of this interesting shop, a description of which is here prohibited by lack of space, will appear in an article to follow in the succeeding issue.

The formal opening of the new club rooms and gymnasium provided by the management of the Oakland Traction Company for the use of the car men employed on its Oakland, Alameda & Berkeley system and those on the lines of the San Francisco, Oakland & San Jose Railway took place recently. The new quarters, which have been completely furnished by the company, are in the headquarters building at the corner of San Pablo Avenue and Jones Street, Oakland. They include a spacious gymnasium, fitted throughout with modern apparatus, a splendid bowling alley, billiard, card and reading rooms, tub and shower baths and a locker room. All the work of fitting up the club has been done by the management of the Oakland Traction Company, and the rooms, light, water and fuel will be provided without cost to the club members. An interesting programme was arranged for the opening night, when the quarters were turned over to the men by General Manager W. F. Kelly. Addresses were also made by Assistant General Manager J. Q. Brown, Superintendent J. P. Potter and C. E. Parsons, president of the Oakland Traction Club.

VIEW IN TESTING CORNER OF THE ELECTRICAL REPAIR DEPARTMENT, SHOWING ALSO SCHEME OF ARMATURE STORAGE IN USE

FUEL, ASH AND GAS TESTING: III, SAMPLING AND TESTS

BY J. STANLEY RICHMOND

OUTSIDE SAMPLING

The value of any chemical test, however correct the results may be, is absolutely dependent on the correctness with which the sampling is carried out. When coal is being unloaded, a spadeful should be thrown every few minutes to one side on some boards or in a box reserved for such purpose. When all the coal has been unloaded, the sample which has been collected should be well mixed and then divided by a cross into four quarters, as shown in Fig. 8. *A* and *D* or *B* and *C* should then be thrown away and the remaining two quarters be again mixed, quartered and two of the quarters thrown away. When the pile is reduced by this method to a quantity which will about fill three buckets, the sample is taken to the laboratory for the inside sampling. In the outside sampling of ash, the same method is adopted. In sampling furnace gases from the stack, the apparatus required is as shown in Fig. 9; in which *A*, *B* and *C* are three bottles, having about 1 quart capacity each, which are fitted with corks and bent glass tubes. *D* is a fourth bottle fitted with two corks (one near the bottom and the other at the top) and glass tubes. The glass tubes *F* and *E* are provided with short pieces of rubber tubing and pinch-cocks *G* and *H*. To take the sample, *A*, *B* and *C* are filled with distilled water, and *D* with ordinary water. *F* is then connected to a metal tube which has been driven through the smokestack wall, and the two pinch-cocks are opened, care being taken that the bottle *D* is lower than the three other ones. As a result, the water in *A*, *B* and *C* will be drawn off by *D*, and will be replaced by gas from the stack. The pinch-cocks should then be closed and the apparatus disconnected and taken to the laboratory. The sample in *C* should not be used, and that in *B* be only used if that in *A* is not sufficient. The pinch-cocks *I* and *J* are for the purpose of separating *A*, *B* and *C* without spoiling the samples.

INSIDE SAMPLING

The outside sampling completed, preferably in the afternoon, the sample of coal is taken to the laboratory and emptied into a ½-in. or ¾-in. mesh sieve placed on the lead-covered floor of the sampling room. The lumps remaining in the sieve are then thrown on the sampling table and broken up with the flat-faced hammer so that they will pass through the mesh of the sieve. The sample on the floor is then well mixed—kid gloves are not wanted in the laboratory, for hands often serve as the best mixers—and the sample is then spread out and quartered. Two quarters are then thrown away and the remaining ones again mixed and quartered, two of the quarters being thrown into another sieve having about ¼-in. mesh, and the other two quarters are thrown away. The lumps which will not pass through the sieve are broken up on the sampling table until all the sample is sifted, when it is well mixed, and a copper dish is filled with about 1 lb. of it, taken in small quantities from different parts of the sample. The dish with the sample is then placed on one side of the scale and a 1-lb. weight and a counterweight to the dish are placed on the other side of the scale. When an accurate pound of the sample is thus weighed out, the dish and its contents are placed in the water bath and left there over night. The inside sampling of ash is carried out on similar lines.

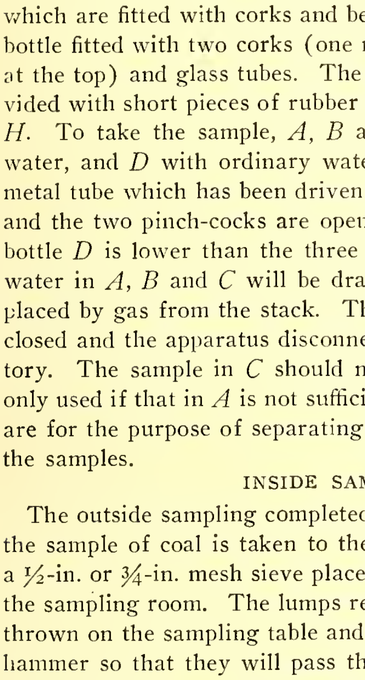


FIG. 8.—SAMPLE, SPREAD OUT AND QUARTERED

The first operation when the laboratory is opened in the morning is to open the water bath and take out the samples of coal and ash. These are then taken to the sampling room and allowed to cool, when they are weighed and the loss due to the evaporation of the water is calculated and worked up on a percentage basis. The sample is then placed in a large cast-iron mortar and the bigger lumps crushed, after which it is emptied out on a sheet of coarse brown paper, quartered and two quarters thrown away. The remaining two quarters are again crushed in the mortar until reduced to the size of coarse-grained gunpowder. The sample is then well mixed on the brown paper, spread out and portions taken from different parts of it with the spatula. About 2 ozs. should be taken and wrapped up in a sample paper, similar to the way in which seidlitz powders are put up. The outside of the package should be marked with the name and date and percentage of water found in the sample. The package, after being placed in the water bath for a few minutes, is then enclosed in a desiccator to cool, preparatory to weighing out portions on the balance for the tests.

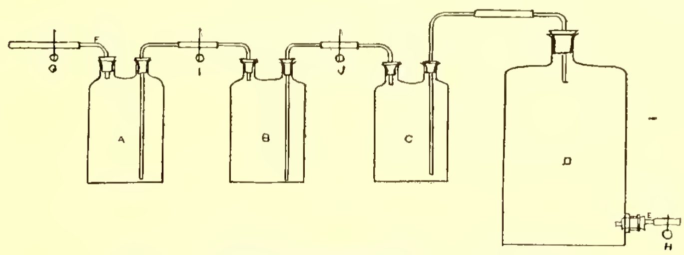


FIG. 9.—FLUE-GAS SAMPLING APPARATUS

TESTS

The furnace having been lighted, 2 grammes of the coal or ash is weighed out on the balance and transferred with the aid of one of the camel-hair brushes to one of the porcelain crucible covers which has had the ring pinched off. The cover with its contents is then taken to the furnace, and, when the doors have been removed, is placed in front of the muffle near to its mouth. As the contents of the cover gradually heat up, the cover is little by little pushed forward until it is well within the muffle entrance, where the heat, combined with the freely entering air, gradually burns all the carbonaceous matter and leaves nothing but the true ash. This operation is accelerated by stirring the coal now and again with the platinum wire before described. That the cover is not introduced into the muffle at the start is due to the fact that the escape of the volatile matter in the commencement of the operation, if allowed to take place too rapidly, causes spitting and, thereby, inaccuracy of the determination. Owing to the inexperience of the novice, the first few tests which he commences will prove, owing to this fact, a case of "love's labor lost," but, with a little patience, he will soon meet with success. When the carbonaceous matter is all burnt, the doors are removed from the front of the muffle and the cover and its contents taken out by the aid of the cupel tongs and placed for two or three minutes on one of the fire-brick tiles on the furnace table. It is then picked up with the crucible tongs and taken to the balance room, where it is placed inside of the desiccator to cool. When the ash is cool, it is transferred to the balance pan and weighed. The weight of such ash in grammes multiplied by fifty will give the percentage of ash in the dry sample.

While the ash is being obtained in the muffle, 5 grammes of the sample are weighed out on the balance in one of the porcelain crucibles. The crucible and its cover, which should always be kept in the desiccator, has, of course, to be first balanced on the balance. The cover is then placed on the crucible and the cupel tongs used to introduce such into the muffle, the front of which is immediately closed with the doors. This can be done while the ash determination is going on. When three minutes have elapsed, the doors are taken away and the crucible placed for a couple of minutes on one of the small fire bricks to partially cool. It is then removed with the crucible tongs to the desiccator and given twenty minutes to cool. The crucible with its cover and contents is then reweighed on the balance and the loss in grammes multiplied by twenty will give the percentage of volatile matter in the dry sample.

In working up the results obtained, the embryo chemist should remember that the engineer requires information in regard to the material as handled in the boiler room. Using arbitrary figures, allow that the percentage of the water in the original sample as taken is 5 per cent, and that the percentages of both the volatile matter and the ash in the dry sample is also 5 per cent in each case. As a result, there are only 95 parts of coal in every 100 parts of the original sample. The percentage of ash in the coal as received will be, therefore, $5 \times \frac{95}{100} =$ 4.75 per cent, and will give the following on analysis:

	Per Cent
Water	5.00
Ash	4.75
Volatile matter	4.75
Carbon (by difference)	85.50
Total	100.00

Allowing that the volatile matter is considered on the same basis as carbon, which is not always done, the engineer should only pay for 90¼ tons of the 100 tons gross weight of coal received, and, at $2 a ton, he will save, by paying for such on the basis of composition, $(100 \times 2) - (90\frac{1}{4} \times 2) = 200 - 180.50 = \$19.50$.

The determination of the composition of the ash is undertaken with a view to check the firemen. For no good engineer cares to have his firing so carried out that the ash contains more than a negligible amount of carbonaceous matter.

Each and every sample should also be examined with the naked eye and with the magnifying glass, and it will soon become easy to pass a fairly accurate opinion on the coal received by simply making a superficial examination of it.

Gas analysis is undertaken in order to find out if the amount of air admitted to the boiler furnaces is excessive, insufficient or approximately correct. As combustion is the combination of the oxygen of the air with the carbon of the fuel, and as carbon forms two oxides with oxygen (carbon monoxide, CO, or, as sometimes termed, carbonic oxide; and carbon dioxide, CO_2, or, as sometimes termed, carbonic acid), it follows that the composition of the flue gas, if the combustion has been perfect and the amount of the air admitted has been correct, should contain very little oxygen or carbon monoxide. As to whether carbonaceous matter is or is not being wasted, such can be determined by watching the escape of the gases from the top of the stack.

The first operation is to make up the necessary solutions. Six ounces of caustic potash (not purified by alcohol) should be dissolved in about 12 or 14 liquid ounces of distilled water and the solution be placed in one of the glass stoppered bottles, the stopper of which has been greased with vaseline. The potassium pyrogallate solution is made up as required. Two grammes of pyrogallic acid is dissolved in about three times its weight of distilled water, and the solution is mixed with eight times its volume of the caustic potash solution. The cuprous chloride solution is made by placing about 60 grammes of cuprous chloride in one of the glass stoppered bottles and pouring on it about 300 cu. cm of concentrated hydrochloric acid (1.124 specific gravity). The contents in the bottle are then well shaken and, when the chloride is dissolved, a copper spiral (copper turning) long enough to extend from the bottom to the top of the solution is placed in the bottle. The solution will be dark at first, but will finally become colorless and clear. The solutions having been made are placed on a shelf at the back of the gas apparatus. The shelf should be located about the middle of the two tubes, and should be long enough to also hold the gas sampling apparatus before mentioned. This permits the sample of gas and the solutions to acquire a temperature about equal to that of the water in the gas apparatus. This apparatus is illustrated in Fig. 10, in which the burette to the right is the working tube and the graduated one to the left is the measuring tube, the zero being on the bottom end, the 100 c. c. mark being to the left of the stop-cock on the capillary tube between the two bulbs. The top of the working tube is provided with a stop-cock and a glass funnel, while the bottom of it is arranged with a stop-cock which can be closed, or permit the liquid in the tube to run into a beaker placed below the stop-cock, or permit water to run from the right-hand aspirator bottle into the tube. To prepare the apparatus for the tests, all the stop-cocks are opened and the distilled water in the two aspirator bottles is permitted to run into the tubes until they are full and the water rises in the funnel. The stop-cocks are then all closed and the funnel is removed. The first of the three gas sample bottles is then connected to the top of the working tube, and the third bottle, having been disconnected and filled with distilled water, is reconnected to the second bottle, but reversed. The right-hand aspirator bottle is then lowered and the stop-cocks at the top and bottom of the working tube are opened. The water in the tube will then run into the aspirator bottle and will be replaced by gas. When the tube is nearly full of gas, both stop-cocks are closed and, the gas sample bottle connection having been removed, the funnel is replaced. The aspirator bottle on the left is then lowered, while the one on the right is raised, and, by opening the stop-cock between the tubes and the one at the bottom of the working tube, the gas will be transferred to the graduated burette. To measure off an accurate amount of the gas, the aspirator bottles are held at such a height that the level of the water in each of them is the same as in its corresponding tube. The stop-cock between the tubes is then closed and the funnel one opened, when, by raising the right-hand aspirator bottle, the remaining gas in the working tube is driven out. When the water appears in the funnel, its stop-cock is closed, the right-hand aspirator is lowered, the left one raised and the stop-cock between the tubes opened, when the gas will return to the working tube. All the stop-cocks being closed, the funnel is filled with some of the caustic potash solution and its stop-cock then slightly opened. The solution will then trickle slowly down the sides of the working tube and absorb the carbon dioxide. Great care should be taken to prevent the liquid in the funnel from getting too low and thus allow the gas to escape through the funnel. When the absorption is completed, the gas is retransferred to the graduated burette and the loss by absorption measured. By closing the stop-cock between the tubes and by opening the other two, the liquid in the working tube will run out of the second passage in the bottom stop-cock into a beaker placed below it. The funnel is then filled two or three times with distilled water, which is allowed to run freely down the sides of the tube, and thus wash it free from the chemicals. The gas is then again

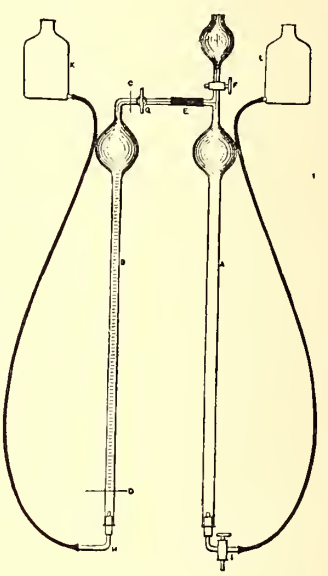


FIG. 10.—DR. ELLIOTT'S ABSORPTION APPARATUS FOR GAS TESTS

returned to the working tube and the oxygen in it is absorbed with some of the potassium pyrogallate solution. The gas is then again measured and the further loss calculated, and, after the working tube has been rewashed, it is returned for the absorption of the carbon monoxide. The cuprous chloride solution is used for this purpose, and it should only be allowed to trickle very slowly into the working tube. This absorption will take from ten to twenty minutes, when the gas is again measured in the graduated burette and the still further loss calculated.

While the above description of absorption work appears to be somewhat complicated, it will be found in actual practice that a little experience will soon enable the operator to run through the manipulations smoothly and rapidly. This experience can be gained by practice with air and water only.

DISCUSSION ON OVERHEAD LINE CONSTRUCTION

The discussion on the paper read by H. M. Sayers before the Tramways and Light Railways' Association, of London, and published in this paper for Feb. 4, brought out a number of interesting points.

W. M. Mordey spoke highly of the V or horn lightning arrester which is used in South Africa, where lightning discharges are frequent and severe. With this arrester he had counted twenty-three flashes in one minute successfully carried to the ground. A. J. Lawson believed that pole No. 1, recommended in the paper, was too light; he thought that the medium weight pole should be No. 1 pole, and that a pole weighing about 1270 lbs., with diameters 8 ins., 9 ins. and 10 ins., should be the No. 3 pole. He also advocated the discontinuance of the lap at the end of the ear, and believed that the ear should be cut back to the point where it is strengthened by the back rib. He also advocated the abolition of the use of iron scroll work on bracket poles.

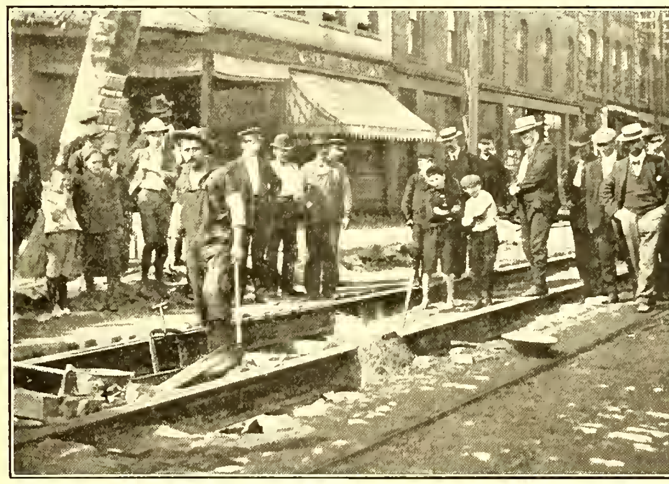
A. L. C. Fell recommended the use of a larger copper trolley wire than No. 0, or else the installation of bronze or other special wire. While believing that span-wire construction is the best system to use, he did not think there was any danger in long bracket arms, and had employed them up to 22 ft. in length. He pointed out that sectional poles were much more convenient than tapered poles, because the cross pieces can easily be raised or lowered to take up variations of the roadway, whereas on tapered poles the cross-arms must fit the poles. He also recommended larger span wire than that generally in use, and mechanical ears. He believed the latter better than soldered ears, first, because it is difficult to make a good soldered connection without injuring the temper of the wire; and second, because there is no temptation for the wiremen to mark the trolley wire where the ears have to be attached to it, and thus cause a weakness which later might cause a broken wire.

Mr. Sayers, in replying to these remarks, stated that moderate lightning potentials and discharges, such as encountered in these latitudes, could not be so satisfactorily cared for with the horn lightning arrester as with the types mentioned in his paper. While heavier poles might be desirable, he thought it better to secure the additional metal by making the metal in the poles thicker rather than by using larger diameter, as the poles would thereby be more conspicuous. As regards internal corrosion of poles, he suggested that it might be desirable to fill the inside with weak Portland cement, which would also give it additional strength. He believed a tightly strung overhead system was less liable to disturbances by wind or blows than a slack system. As regards solder, he had found that the hotter the soldering iron the less heated the wire becomes and the less softening takes place. He believed that the No. 0 wire was amply large enough, as it had a larger margin of safety, as regards breaking, than the supporting structure.

THERMIT RAIL WELDING IN HOLYOKE

G. E. Pellissier, civil engineer of the Holyoke Street Railway Company, presented on Jan. 27 a paper before the Civil Engineers' Society of the Worcester Polytechnic Institute on thermit welding. The following is a resume of his paper, together with additional matter furnished especially to this journal. Before taking up the main subject, Mr. Pellissier reviewed briefly the various types of mechanical and welded joints which are now in use.

When the thermit process was introduced in the United States the Holyoke Street Railway Company decided to try it on a mile of track which was about to be reconstructed, and accordingly an order for 160 joints was placed with the Goldschmidt Thermit Company and preparations made to do the work. All of the apparatus except the crucibles was made at the company's shops by its own men, the molds being manufactured at the power house and dried on top of the boilers. Later, however, some of the molds were made at a local foundry, as



WELDING STREET TRACK IN HOLYOKE

the facilities for drying them in the manner described were not sufficient to keep pace with the work. The welding was commenced on Aug. 8, 1904. The section welded consists of 1 mile of single track on Main Street, Holyoke. The rails are of the 9-in. grooved girder type, the section being similar to that used by the New York City Railway Company. The rails are laid on kyanized ties placed 28 ins. on centers, with white sand as a foundation, the same material being used also to fill in between the ties. No tie-rods were used, malleable cast-iron braces placed on every third tie taking their place and interfering less with the paving. The joints are suspended.

The track was first laid, spiked and brought approximately to line of grade, the joints being made temporarily with fish-plates, one bolt in each end sufficing to hold the rail in position until the welding gang came along. This gang was composed of three or four of the company's workmen, who did the work under Mr. Pellissier's supervision. One man removed the fish-plates, cleaned the sand off the rails with a wire brush, dried them off with the torch and removed the molds from the joints already made. The other two brought the ends of the rail into exact alignment, put on the molds, banked them up with sand and poured the joint. Where the entire section of the rail is welded, the top of the rail is also painted with a thin paste of clay and water, which, when dry, prevents the slag and iron from adhering to the top of the rail. It has been found sufficient, however, to weld only the base and web of the rail. From eight to fifteen joints were made a day, the smaller number being due to the fact that the laying gang could not put down more rails on some days, particularly when special work was being put in. All joints were welded except those around the special work, it not being deemed advisable to do this around the latter on account of the difficulty of making the repairs or renewals in case of the breaking of a frog or switch. The work, with the exception of the paving, was practically completed in eighteen days, and was the first piece of track in the United States laid with thermit joints. Two joints were faulty and had to be repoured. This occurred while the work was in progress, and Mr. Pellissier believes that it was due more to the "innate cussedness of inanimate objects" than to any fault of the process or awkwardness on the part of the workmen, as about 100 joints had already been successfully poured. No breaks have occurred since the completion of the work, although the welding was done in August. As may be seen from the illustrations, no trouble was experienced with spattering. No slip joints were left, as in Mr. Pellissier's opinion these are not

PREPARING TO SET OFF THE IGNITION POWDER

necessary where the tracks are buried in the pavement. The longest piece welded continuously is about 2500 ft., and both ends are bolted tightly to the special work. These bolted joints have not been opened at all since they were put in, showing that whatever contraction has taken place has been neutralized by the elasticity of the metal.

The cost of the joints was as follows:

Thermit	$4.98
Molds per pair	.35
Labor	.40
Supervision	.20
Crucibles per joint	.25
Incidentals (shims, gasoline, etc.)	.05
Total	$6.23

With the experience obtained and a little better equipment for making the molds on a larger scale, it is believed that the molds can be made for considerably less than the sum mentioned. The flasks used in Holyoke for this work cost $1.50 each and are made of sheet iron. This material is preferred to cast iron, despite its higher cost, on account of the rough usage to which the flasks are subjected by the track men.

Tests of the joint with a Conant bond tester show that the conductivity of the joint is equal to that of any other part of the rail. Mechanically the joints seem to be perfect. To determine this quality, Mr. Pellissier subjected a sample joint to the following test: A section of rail 13 ft. long, with the joint in the middle, was placed in the track on two ties, distant center to center of bearing, 12 ft. 6 ins., and three loaded double-truck cars weighing about 20 tons each allowed to pass over it. The joint suffered no harm, but a crack developed between two bolt holes. The rail was then taken out and broken; the fracture extended from the top of the joint, where the rail is not welded, diagonally through the bolt holes to a point on the face of the rail about 6 ins. from the joint. A chemical analysis of the joint metal indicates that it compares very favorably with the ordinary steel rail in toughness and ductility.

None of the joints put in last fall has yet failed, although the temperature has been as low as 10 degs. below zero, F., while the welding was done when the temperature was between 80 degs. and 90 degs. in the shade. Although it is not anticipated that they will pass through the winter without a single break, nor that perfection has been attained in the first attempt on an entirely new kind of work, it is thought that the percentage of breaks will be so small as to be negligible. From what experience Mr. Pellissier has had with this joint and from reports he has received from other sources, it seems to him that it comes nearer to fulfilling the requirements of street railway service than any other heretofore used, and that it is destined to occupy a very prominent place in permanent way construc-

THERMIT REACTION IN PROGRESS

tion in the future. Mr. Pellissier says that, granting the results obtained are not superior to those secured from electric or cast-welding (which he will hardly admit), the lack of expensive apparatus, the simplicity of the process and its adaptability to repairs and construction on moderate-sized systems are bound to give it a commanding position.

In conclusion, some interesting figures were given in regard to the saving which the continuous rail represents. Assuming the additional life of track to be five years, which experience has proven to be a low estimate, this item alone represents between $5,000 and $10,000 per mile of single track. Next, taking the loss of energy due to a poor return circuit, figures were quoted by Mr. Pellissier from Dr. Louis Bell's "Power Distribution for Electric Railroads," from which it is shown that assuming a 90-lb. rail with an average of 90 amps. flow and bond resistances of .002 ohms each represents about $500 per mile of single track per year, "and this represents not at all an extremely bad case, but a very common one." When, in addition to this, is considered the saving in car repairs and the additional comfort to passengers, the value of a process of this kind may readily be seen. Mr. Pellissier remarked that he had said nothing about electrolysis damages for which his company had not yet been obliged to pay, but he felt that the day was coming when city railways would have to give more attention to that phase of the subject.

A unique organization, known as the Trolley Club of the Sons of Veterans, has just been formed at Boston, with headquarters at Chelsea. The club is arranging a schedule of trolley trips to the various Sons of Veterans' Camps accessible by electric railways in Eastern Massachusetts. Five experimental trips were taken before a permanent organization was formed. F. E. Warren, of Somerville, is secretary and treasurer of the club.

THE QUESTION BOX

Some weeks ago announcement was made in these columns that the Street Railway Journal had decided to introduce a question box as a regular feature of the paper. In line with this decision, preliminary sets of questions were made up and sent broadcast over the country; these questions were also printed in the columns of this paper for Jan. 14, page 85, and Jan. 21, page 120. Judging from the number and nature of answers received, this question-box idea has met with the entire approval of street railway men in all departments of electric traction work, and this opportunity is taken for thanking all those who have sent in answers and suggestions.

It is earnestly hoped that this section of the paper will form a convenient department for a free discussion and exchange of ideas and suggestions on all topics relating to electric railways. Every man connected with the traction industry is called upon to settle a thousand and one perplexing questions in the course of his work, and undoubtedly every man at one time or another has had the feeling that he would like to know what someone else is doing or what somebody else thinks about a particular problem. It is to fill this desire that the question box has been started. Every reader of the paper is invited to make his wants known through the medium of this department, and the editors will endeavor, so far as it is possible, to obtain answers to all questions submitted.

The success of the question box will, of course, depend entirely upon the co-operation extended to the editors by the readers in the matter of answering the questions. It is not asked or expected that any one man will take the time necessary to answer all the questions or any large number of them, but among so many topics and in so diversified a collection of questions as will appear from week to week in these columns, there will be some questions that will appeal directly to every man as being in direct line with his work or investigation. Replies, therefore, are requested from any or all of the readers of this paper who can shed light or offer suggestions on any topic concerning which inquiries are made. Oftentimes the answers themselves as printed will suggest replies, and these additional answers are invited and will be printed in succeeding issues. It is therefore to be understood that a free and open discussion, both of questions and answers, is invited and desired. There is but one restriction. Statements of an advertising nature relating to manufacturers' specialties and patented articles cannot be published in the question box; otherwise these columns are open to any and all of the readers of this paper, whether they be representatives of operating companies, independent engineers or supply men.

For the present, the question box will be a regular feature of each week's issue. In publishing the questions and answers no regular order will be attempted, except that when questions pertaining to any one topic are published, an endeavor will be made to publish all the answers to those questions that may be on hand at that time. However, because a question and its answers have appeared once it does not mean that that particular topic is closed, but, as before stated, additional answers to the same question will be welcomed and will be published in subsequent issues.

A.—GENERAL

A 6.—Several electric railway companies are publishing regular leaflets or periodicals for public distribution, with the idea of bringing about a better relation between the company and the public. What do you think of this suggestion? Have you ever tried the suggestion of publishing such a periodical? What were the results?

The "Detroit United Weekly," published by this company is issued on Thursday of each week. We furnish the printing office a regular list of how many are to be sent to each of our distributing points. The printers then put them up in packages according to our list furnished them, addressed as we direct, and indicating the number of weeklies in each package. These are delivered on Thursday afternoon to our general office, and from this office are distributed on that evening to all the car houses, etc., of our system, both city and interurban. Before the cars start out the following morning, the car house foremen see that every car is supplied with a sufficient number of copies of the paper. Each car contains two small boxes or racks and the papers are placed in them, one being at each end of the car, on the inside. From day to day as the supply is exhausted the car house men are under instructions to see that the boxes are kept filled as long as their supply continues. We print an edition each week of 37,500. Each edition costs for printing, paper, general supervision, etc., about $45 per week. No outside advertising is accepted for the paper. We are now upon our third year, the first number having appeared on Thursday, June 26, 1902. Each issue contains a digest of our interurban time-tables, and all the principal events that are to occur in the way of theaters, special entertainments, etc., during the week following. This gives us opportunity to call special attention to attractions that take place during the different seasons of the year. It enables us to keep before the people our own lines, attractions along the same, and the advantages that the public receive from the operation of these lines. We can talk to the people more clearly regarding the rules and regulations of the company, and call attention to matters of interest to us and our patrons in the way of educating the public, far better by this means than we can through any other channel, as there are frequently matters in connection with the operation of our system that we often want to talk about. For example, we are now running on our rapid railway system, what we call the Detroit-Port Huron Specials, making few stops and rapid time between Detroit and Port Huron. Nearly every week, along different lines, we write about these specials and keep them before the people. The above are a few of the advantages that a publication of this kind gives to a street railway company like our own. I am not able to state just to what extent it encourages travel, but believe it is a very helpful medium in that direction.

J. H. Fry, Asst. Gen. Pass. Agt.,
Detroit United Ry. Co.

[The "Detroit United Weekly" is probably the most pretentious effort along the line of a company periodical in this country. As stated by Mr. Fry, the paper is in its third year, and the weekly edition has grown to 37,500 copies. The weekly is a four-page leaflet, 5¾ ins. x 4 ins., printed on ordinary newspaper. One means that has been taken for creating interest in the paper and in street railway matters, has been the holding of popular contests. Last year the Detroit United Railway offered through the "Weekly" cash prizes aggregating several hundred dollars for the best designs and verses to be used as posters for advertising the street railway business. This year the company is offering a prize of $200 in cash, for the best "Trolley Song," taking into account the merit of the music and appropriateness of the words. This contest has attracted attention in musical circles all over the country, and it is stated that some of the best known writers of popular songs have taken the trouble to compete for the prize.] Editors.

We publish a little periodical known as "Trolley Talk." It is issued monthly, and the edition runs from 3000 to 4000 copies. In each car is placed four small racks made to fit the size of the paper when folded. At the stations also "Trolley Talk" is distributed. These are the only means used to put it in circulation. As to what benefits accrue, we find that during the past summer season our special car business increased very considerably, and as it was advertised and made a feature of "Trolley Talk" we feel justified in saying that a considerable amount of this business originated through this medium of advertising. Another benefit which we feel has accrued from "Trolly Talk," has been a greater interest taken in the road and its operation by the traveling public and a more kindly feeling towards it. As to the cost of getting this little paper out, it has been very modest in its get-up and consequently has not been expensive. The cost of printing is $2.50 per thousand. As for the articles, that work is done principally by myself at odd moments, and by jotting down little points of interest, and clipping here and there for bits of humor. We have not, so far, had to expend any money other than the actual printing. Illustrations are generally views of some of the points along the line or in the parks and are made from cuts already in stock, which have been used at other times in advertising Olympia Park.

J. W. Brown, Supt. Trans.,
Pittsburg, McKeesport & Connellsville Ry. Co.

["Trolley Talk" is a four-page leaflet, 8-in. x 6-in., printed on good paper, without alien advertising. The "educational" feature consists of a cleverly written "sermon" to the public, the text for each issue being a topic of mutual interest to the public and the street railway employees.] Editors.

An article by the undersigned in the Street Railway Journal for Aug. 13, 1904, page 236, gave a complete description of methods of advertising used by this company.

As stated in that article, we believe the best method of advertising is a publication of our own called "Street Railway Chat." This is a little three-section folder, folding to 2¾ ins. x 6 ins. It is published twice a week, on Wednesday and Sunday mornings. The pamphlets are delivered at the car house on Tuesday and Saturday nights, and placed in holders in the cars for distribution next morning. The value of the publication lies largely in the method of distribution. By placing the pamphlets in holders in the cars we get them directly into the hands of the street railway passengers, the very persons we wish to reach. It may be well to state that numerous offers have been made for advertising space by local business houses, but these offers have been refused in every instance, as it has been deemed best to keep it strictly a street railway publication. As to the cost of publishing the paper, will say that we issue 7500 a week, 3500 on Wednesday morning and 4000 on Sunday morning, the two editions, of course, being different issues. They cost us for printing, etc., $3 per thousand. The cost of getting out this publication is divided between the railway, lighting and gas departments, the railway using the major part in summer time, the lighting departments using more in winter time.

As to the nature of the reading matter used, might say that this is made up of announcements and short articles calling attention to changes in schedule or service, and anything in the nature of improvements to car equipment, or any part of the business. We use a cut on the first page of each issue, the folder being placed in the brass holder in the car in such a manner that the front of the box makes a frame for the picture. Pictures of actors and actresses at the local theaters are used in winter time, and cuts of summer resorts or features to which particular attention is called in summer time. As showing what I think of the value of a publication of this kind, will say that I am about to take charge of the Lexington Railway Company, at Lexington, Ky., as general manager, and as soon as I arrive there I expect to start a similar publication for that company, covering the electric light, street railway, gas and ice making departments. R. T. GUNN, Gen. Supt.,
Norfolk Ry. & Lt. Co.

For the past three or four years the Rochester Railway Company has put out weekly during the summer months a little paper which we call "The Four Corners." (The intersection of Main and State Streets in the city of Rochester is the meeting place for all cars and forms the business center of the city. This intersection is commonly referred to as "The Four Corners"; hence the appropriateness of the name for the paper.) We usually publish from 3000 to 5000 copies each week, and it cost us at one time from $15 to $25 for each issue. We have scaled this down, however, so that now we get the paper for practically nothing, letting the contract for editing, publishing, etc., to one concern, and they get what they can out of it from the advertisements inserted. We have a boy distribute the papers on the cars. He boards each car and walks through, handing a copy to each passenger or leaving a few scattered on the seats. When we have gotten out a 10,000 edition (on some special day) we have had same distributed from door to door by a distributing agency. Of course, in this case it cost us a small amount. We think it pays for itself (even when we are at some expense), as it brings to the passenger's notice, whether or not he desires it, the fact that certain events of interest take place at certain places on certain dates. It gives him a handy time-table which he can stick in his hat for reference; it keeps him posted as to special excursions and gives information regarding the kind of ticket to use for certain popular trolley outings and combination steamer and trolley trips; it also advertises band concerts in the parks, and in fact aims to keep the public posted about things and places of interest which are reached by the trolley cars. We do a small amount of newspaper advertising, some of this being necessary; but the bulk of this business is done through our own medium, "The Four Corners." We hope to have something better this year, but it will be the same idea only in a somewhat better dress.
G. G. MOREHOUSE, Sec., Rochester Ry. Co.

["The Four Corners," as published by the Rochester Railway Company last season, consisted of a sheet 8½ ins. x 16 ins., printed on both sides and folded to 8½ ins. x 4-in. size. The front page contains the title with a line below reading "A Guide to the Pleasure Seeker." Below this appears an appropriate engraving which was changed for each issue. One issue gave a picture of a sailing party; another a humorous sketch of a small boy going fishing; and so on. At the bottom is printed a list of the parks and pleasure resorts reached by the lines of the Rochester Railway Company. The remainder of the pages was given over each issue to announcements of current attractions at the pleasure resorts; time tables for all through lines; and advertisements of local firms; the whole enlivened with well-selected humorous anecdotes and sayings.]
EDITORS.

At the present time the New Orleans Railways Company does not publish a periodical, but several years ago, I am informed, one was published by the New Orleans & Carrollton Railway, Light & Power Company. The company had several thousand copies printed weekly and placed them in the cars, inviting the passengers to take them. The cost was $7.50 per week. It was thought by the management at the time they were issued that they were of considerable benefit, and I can readily see, where there is competition as it existed at that time, that it might be of very material interest to the company to publish it. But where the entire system in a city is controlled by one company, it does not seem to me that any material benefit would accrue from its publication and distribution, as there are many other ways of advertisement which I think appeal to the people equally as well. To my mind, the best advertisement any corporation can have is that of rendering good service and catering to the wants of its patrons. I do not wish to convey the idea that I am opposed to this method of advertising, for under some circumstances, no doubt, it would be very valuable.
E. C. FOSTER, Rec., New Orleans Rys. Co.

I think the publishing of regular leaflets for distribution would certainly bring about a better relation between the company and the public, and while the Boston & Northern and Old Colony Street Railway Companies have not, up to the present time done anything in this way, the matter has been favorably considered, and we expect during the coming summer to be in a position to issue a regular magazine. Each number should have a detailed description with illustrations of some particular lines or places, and in addition, other general information of interest to the public. To sum the matter up, the street railroad, like the department store, must have the goods to advertise, and should adopt all reasonable agencies for making these attractions known to the public. The most valuable advertising is to be talked about favorably, and if a company treats its patrons well and advertises liberally, it will find itself more largely advertised "by its loving friends."
ROBERT H. DERRAH, Pass. and Adv. Agt.,
Old Colony St. Ry. and Boston & Northern St. Ry.

We do not issue a periodical of the kind mentioned. Our employees, however, publish a paper called "Street Railway News." The company has nothing to do with its publication, and does not attempt in any way to dictate its policy. We are familiar with the leaflets published by the Detroit United Railway and the United Railways of San Francisco, and believe that their influence upon public sentiment must be good. H. J. DAVIES, Sec.,
Cleveland Elec. Ry. Co.

While this company does not print a periodical of its own in the sense referred to, we print a programme which is used twelve weeks during each season at our park, and in the programme we occasionally enlighten the people in regard to some things they do not understand about street railway operation.
FITCHBURG & LEOMINSTER ST. RY. CO.

[The programme referred to in the above letter is printed in the form of a four-page folder, 6¼ ins. x 9½ ins. It is called "Whalom Breeze," and consists largely of announcements concerning Whalom Park, which is owned by the Fitchburg & Leominster Street Railway Company. A limited number of local advertisements are accepted for the programme. It is issued once a week during the park season.] EDITORS.

I believe the best way to get at the public is by means of articles appearing as reading matter in the local papers. It need not be known that these articles come from the street railway company.
H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

A few companies may make a success of publishing periodicals, but I do not think the many would.
THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

We believe the idea a good one if you can make the venture self-sustaining, or nearly so by selling advertising space. We expect to start a publication of this kind this coming spring.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

A 36.—In making up a schedule of fares for an interurban road, is it better to base rates on mileage or with reference to municipal boundaries? What is your practice?

We have made up the schedule on our interurban road so that we shall get 1½ cents a mile per passenger. In some of the towns and cities where the franchises were made to carry a person from one part of the town to the other for a 5-cent fare this schedule could not be followed. H. C. PAGE, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

Based on mileage, subject to occasional restrictions.
THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

On mileage. W. T. NARY, Supt., Hoosac Valley St. Ry. Co., North Adams, Mass.

Our practice is with reference to mileage and taking into consideration the municipalities also. For instance, should we have a town that contributes liberally, we concede a little to them in the way of mileage; in other words, make the fare proportionately a little less. J. R. HARRIGAN, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

A 42.—Information is requested as to the best ways of handling the snow-removing problem. Please state in detail your snow-fighting methods. Please give all the steps taken from the time the first flurry of snow appears until the battle has been won and schedules restored.

Our method of handling snow is as follows: We run large double-truck plows. We also have a rotary. As soon as it commences to snow we have men assigned to the plows, and put out the plows as needed. Each plow in a heavy storm is given a certain section to handle, and the crew on this plow are held responsible for keeping their section open. Each plow covers about 15 miles straight-away. In a heavy storm the plows are kept running ahead of each regular car, and schedule time is made by the plows the same as the cars. We do all the leveling of the snow with the plow; that is, with a long wing, leveling down the ridges. We do not haul off any snow, the cities and towns doing the hauling and we doing the leveling.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

In Ohio we do not experience much difficulty with snow. We keep a Taunton snow plow to handle the snow on the interurban road, and a rotary sweeper to handle the snow on the city tracks. As soon as it is designated that it is necessary to use the snow plow we run it over the city tracks with the regular cars. On the interurban tracks where the road runs east and west we do not need the use of a snow plow very often, unless the snow is drifted. The horse-power capacity of the motors under our heavy interurban cars is such that they can go through most any snow storm in Ohio. J. R. HARRIGAN, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

tographs or drawings.) Give particulars as to how and where fences are placed. What do you do with the fences in summer? How much do the fences cost to build?

We use a simplified form of the New York Central snow fence. The sections are in 14-ft. lengths instead of 16-ft. The following is a statement of the cost of a section:

10 pieces 1-in x 6 ins. x 14 ft	$1.33
3 pieces 2 ins. x 6 ins. x 8 ft	.46
3 pieces 2 ins. x 6 ins. x 7 ft	.38
3 pieces ¾-in. x 5-in. bolts with 2 flat washers	.04
Nails	.02
Cost of materials	$2.23
Labor to build and erect	.60
Total cost per length	$2.83

Total cost per foot of fence, $0.20.

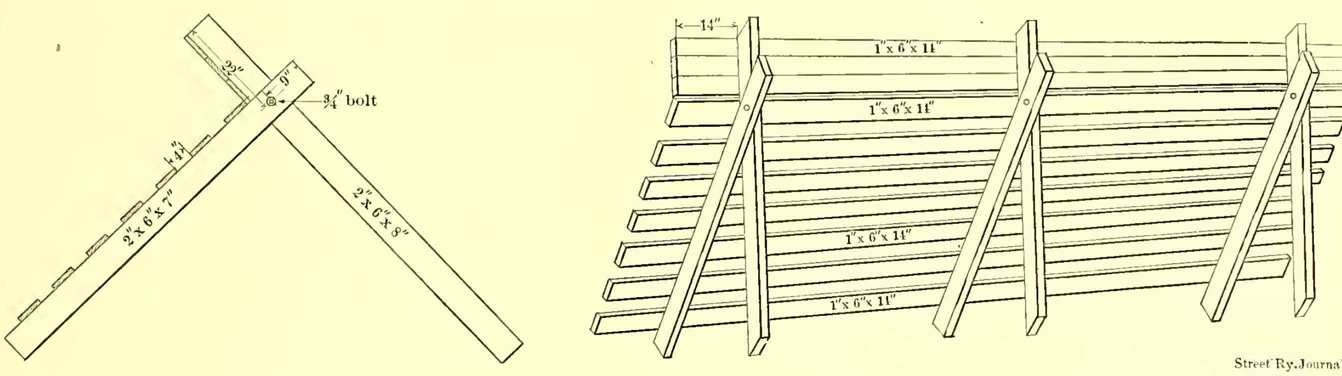
The fences are placed from 100 ft. to 150ft. from the track.

E. J. WILCOXEN, Supt., Rochester & Sodus Bay Ry. Co.

Snow fences for a country road are the best kind of an investment. We use a six-board fence made saw-horse fashion, so it is braced from both sides. Fences should be placed wherever drifts are likely to form, so that snow when drifting will strike the fence and fall short of the track. In summer the fences are taken down and stored away for use the following winter. The cost of snow fences will of course depend upon quality of lumber. We pay for 4 in. x 4 in. stuff $22 per thousand, and for boards 1-in. x 8 ins. x 12 ft., $20 per thousand. W. T. NARY, Supt., Hoosac Valley St. Ry. Co., North Adams, Mass.

We put our snow fence about 150 ft. from the track, putting up a four-rail fence, each rail 6 ins. wide, making the fence so as to have the drifts between it and track, rather than to stop the snow from coming over the fence. The fence is made in sections 16 ft. long. The sections are set up and a stake is driven in the ground with a board running from the stake to the top of the fence and nailed securely. The fence is taken down in the spring of the year and stored, if possible, under cover. This kind of a fence costs to build about $2.75 per 16-ft. section.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.



SNOW FENCE USED ON ROCHESTER & SODUS BAY RAILWAY

Interurban lines in this section have almost no trouble from snow, except where the tracks traverse city streets, and if there is any depth of snow, we try to get the tracks in the best possible condition before cars start in the morning, by sweeping the snow away at either side so that it will not fill into the grooves. We operate the sweepers at night to avoid accidents, and to avoid overtaxing the power stations in the daytime.

THEODORE STEBBINS, Gen. Mgr. for Receivers, The Appleyard Lines in Ohio, Columbus, Ohio.

A 43.—What is the most effective form of snow-plow?

We find the snow-plows which we are using the most effective in this country, and would recommend the rotary sweeper for all city tracks. J. R. HARRIGAN, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

We use a nose plow entirely, as ours is a single-track road. A four-motor plow is the most effective plow, with proper sized motors, according to the weight of the plow and the severity of the storms.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

A 44.—Do you use snow fences? Are they effective? What form of fence do you use? (Please give description with pho-

In reply to your inquiry regarding snow fences I take pleasure in handing you drawings illustrating the New York Central standard snow fences. H. FERNSTROM, Chief Engineer, New York Central & Hudson River R. R.

[The drawings refered to by Mr. Fernstrom are reproduced herewith. They are self-explanatory and give all the dimensions. The list of materials for one complete 16-ft. panel of the portable type is as follows:

10 pieces, 1-in. x 6 ins. x 16 ft.
2 pieces, 1-in. x 6 ins. x 10 ft. 3 ins.
3 pieces, 1-in. x 6 ins. x 7 ft. 6 ins.
3 pieces, 2 ins. x 6 ins. x 8 ft.
3 pieces, 2 ins. x 6 ins. x 7 ft.

Total lumber board measure, 146.5 ft.

Nails and bolts: 60 tenpenny common nails; 106 eightpenny clinch nails; 3 ¾-in. machine bolts 5½-in. under head; 6 ¼-in. x 2-in. diameter wrought-iron washers.

In placing the portable fence the panels are set with the boarded side facing the direction from which blow the prevailing winds, the idea being that the large angle made by the top piece and the boarded side will tend to deflect the wind so that the driving snow will be deposited close to the fence on the leeward side. The fences are placed to windward of the tracks and far enough away from the track so that the drift will form before the snow reaches the line of the road.] EDITORS.

A 45.—What arrangements does your company make with the municipalities for removing snow?

We have a State law in Massachusetts that requires the companies to level all snow satisfactory to the town authorities, and for the excise tax we pay to the towns and cities, they are supposed to haul all snow. This is an open question still to be decided by the courts, whether or not the companies should haul the snow away. On our road we do not haul any snow with teams.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

E.—MASTER MECHANIC'S DEPARTMENT

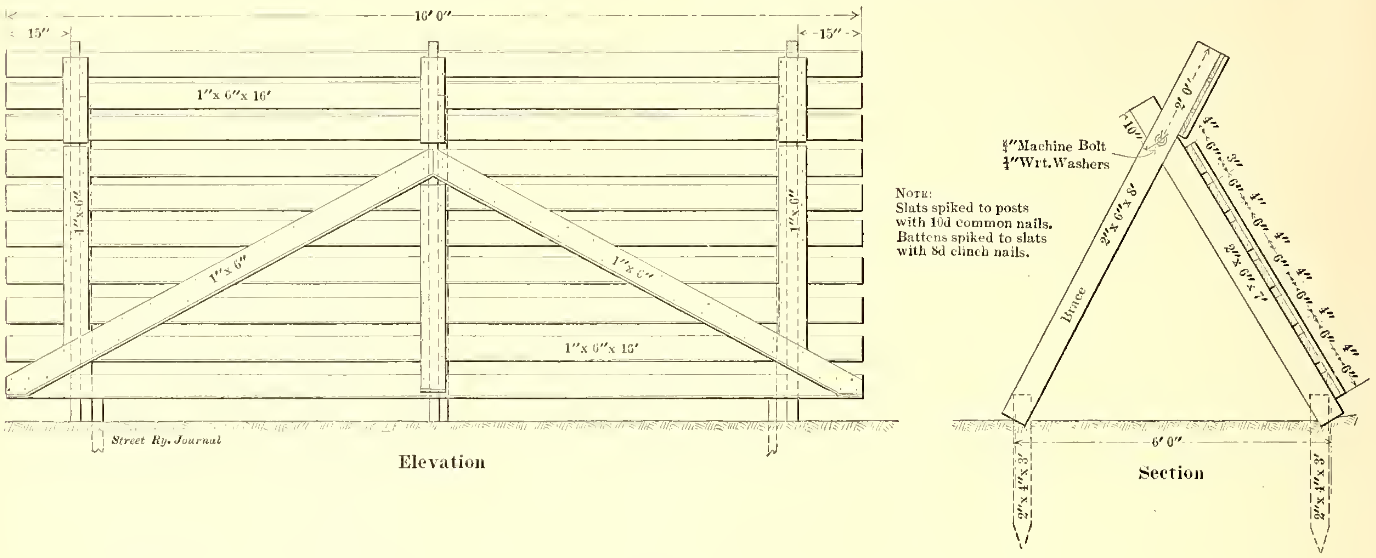
E 1.—What do you consider the essential features of a satisfactory set of car specifications?

Specifications should be as complete as possible, and should admit of competition between the manufacturers from whom the car builder buys his supplies, to as great lengths as possible. They should give all general dimensions and all special ones which are different from usual practice; also, all special appliances and furnishings which are wanted, including those which are not made in car-building shops. They should also give motor and truck information. Complete general plans and, where possible, photographs accompanying are of great help. The most satisfactory specifications are those which go into detail fully.

D. F. CARVER.

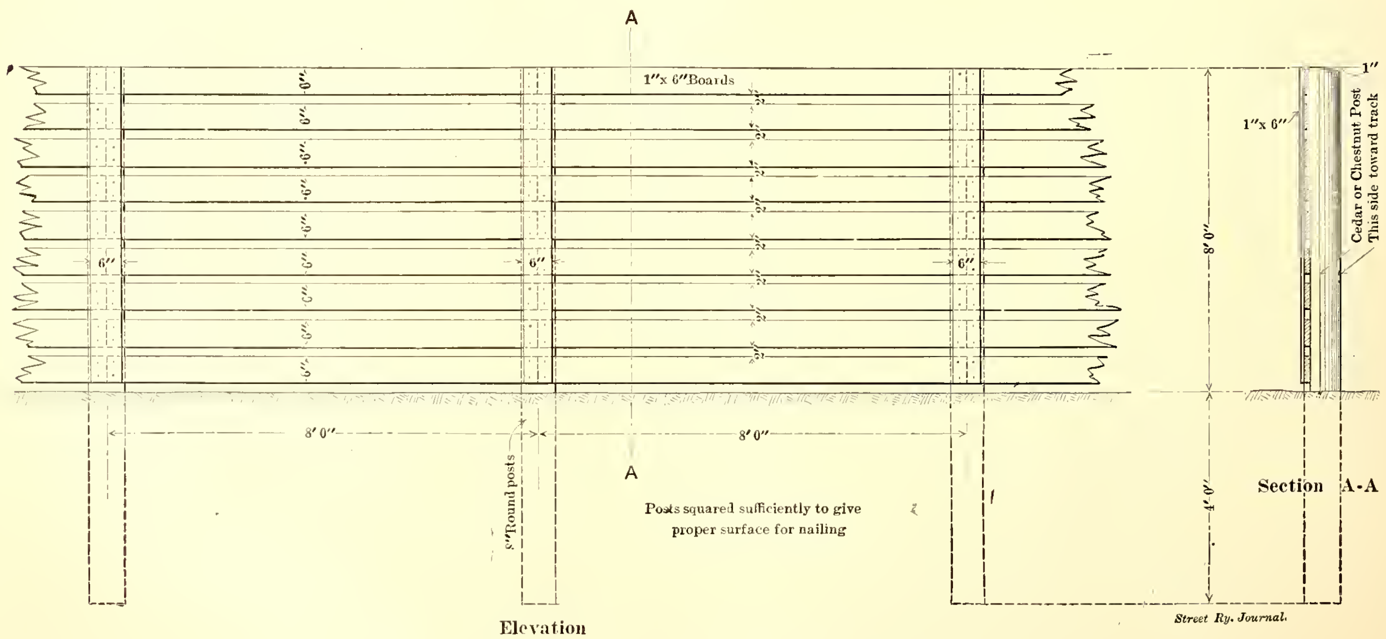
E 14.—What is the best form of flooring for the inside of cars?

The specifications for the new 4000-type car for the International Railway Company, of Buffalo, designate that floors are to be of yellow pine 13-16-in. thick, tongued and grooved, the under floor laid transversely, upper floor longitudinally with best heavy felt paper between. Maple strips in aisle to be ¾ in. wide at base, tapering to ⅝ in. at top, and ½ in. high, and placed ⅝ in. apart at base, and securely screwed to floor with 1¼-in., No. 10 flat head, bright screws, spaced about 12 ins. apart. EDITORS.



NEW YORK CENTRAL STANDARD SNOW FENCE—PORTABLE TYPE

E 139.—Is it practicable and economical to use air-brake compressors on cars for furnishing compressed air to clean cars and for other shop purposes?



NEW YORK CENTRAL STANDARD SNOW FENCE—FIXED TYPE

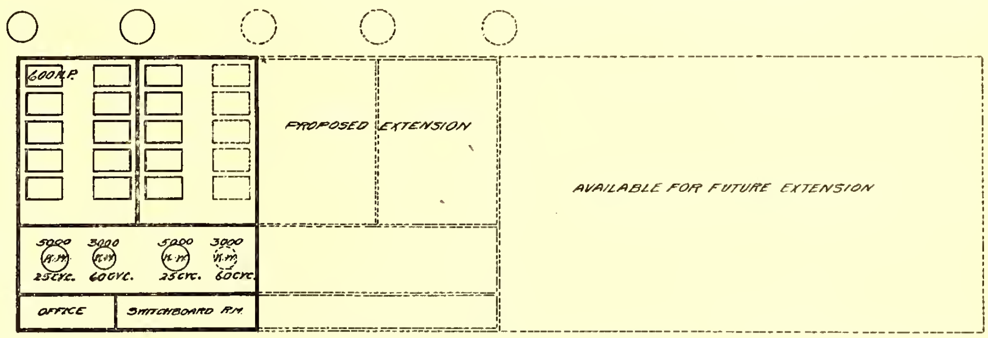
It is quick and convenient to use the air-brake compressing outfit on an air-brake car to drive small tools used in making small repairs to individual cars, especially if the pits are not piped for air from a stationary compressor. The capacity of an air-brake compressor is, however, too limited to use economically on extensive work.

D. F. CARVER.

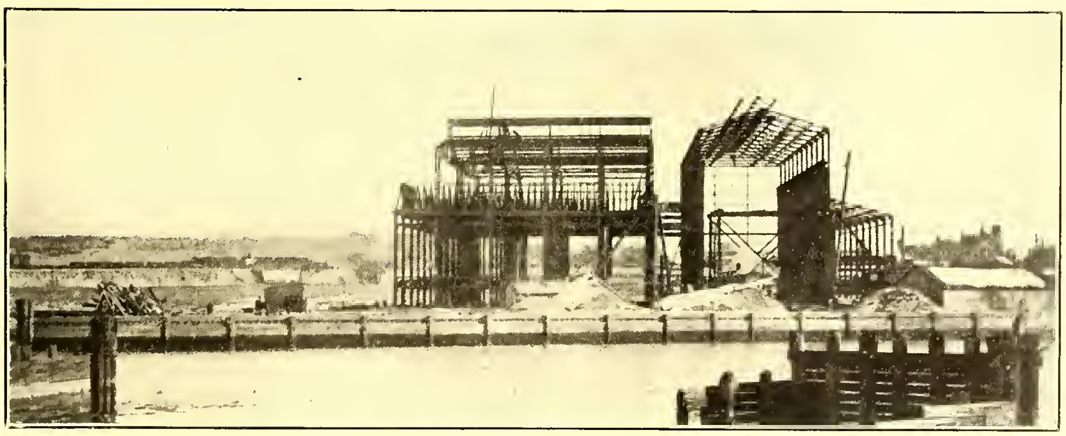
THE NEW STEAM TURBINE PLANT OF THE PUBLIC SERVICE CORPORATION

Probably no electric railway system in this country has experienced more rapid development of the power supply problem than has the street railway department of the Public Service Corporation of New Jersey. The railway development in New Jersey has been very rapid during the past few years and has assumed great magnitude, causing greatly increased consumption of power and bringing very heavy overloads upon the power stations. Many extensions of lines have been made, and the increases in service and the use of the heavier double-truck cars have combined to make the railway power loads especially severe.

During 1903 and 1904, a large addition was made to the Coal Street station in Newark, bringing the total generating capacity of the new addition of the station up to 14,800 kw. But even with this, it was foreseen that, with the present rapid rate of development, the large Coal Street station would soon be outgrown, and, accordingly, a careful study of the problem was instituted, with special reference to the present tendency of development and the probable requirements for several years in the future. The result was a decision to provide for extensive additions to the present power-generating facilities in the eastern districts operated, but on account of the large size of the present central station at Newark, amounting to 23,000 kw, including the adjoining lighting station, it was deemed advisable to arrange for an entirely new and distinct plant to be installed at a different location from that of the Newark plant, as the location for such a plant could be selected with particular reference to facilitating further growth, and also proximity to the best water and coal supplies. It was further seen that, by the use of "tie" lines between the new and old stations, each plant would be able to use to the reserve capacity of the other, thus cutting down to a large extent the amount of reserve apparatus that would otherwise be required in a single very large station.



PLAN OF THE NEW TURBINE POWER PLANT OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY, SHOWING EXTENSIONS PROVIDED FOR



GENERAL VIEW OF THE SITE OF THE NEW TURBINE POWER PLANT, FROM THE OPPOSITE SIDE OF THE HACKENSACK RIVER, SHOWING EXCELLENT DOCKAGE FACILITIES

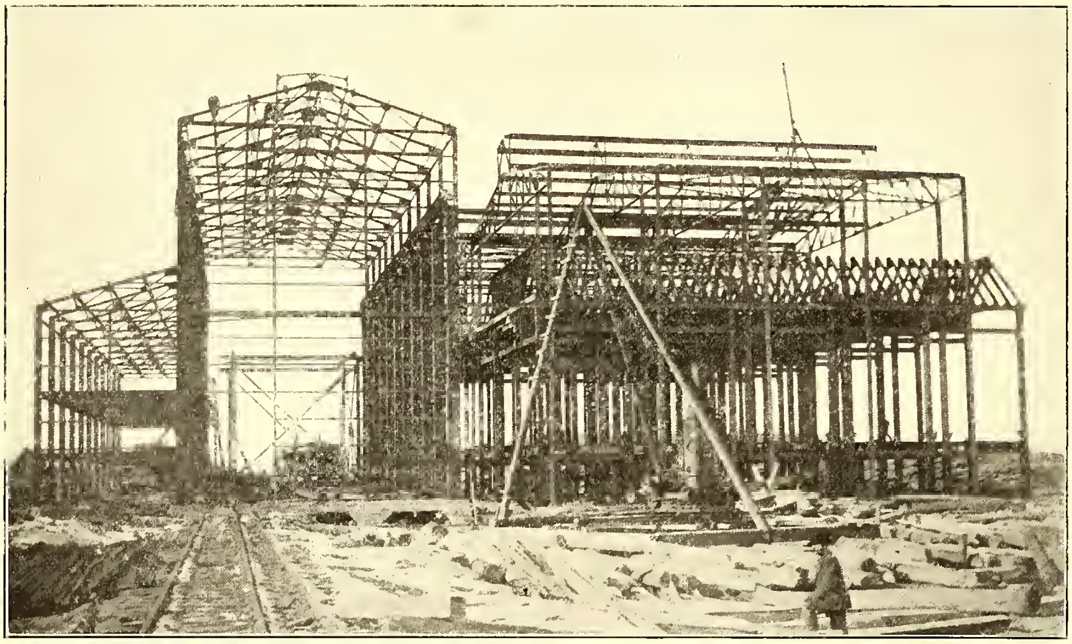
The scope of the plant that has been provided for and is now under construction is comprehensive and far-reaching, and is very interesting in its relation to power-plant development. A careful study of the question of prime movers has resulted in the adoption of the steam turbine to the exclusion of reciprocating engines. This has made it possible to cut down the floor space by taking full advantage of these possibilities and not providing for any contingency where reciprocating engines would have to be used. The location selected is also advantageous on account of the valuable facilities secured; it is located upon the east side of the Jersey "meadows," in close proximity to Jersey City, so as to be convenient to the large power consumption districts on the New York side of this territory. In this location ample real estate for the maximum desirable extension was secured, as well as also excellent dockage facilities upon the river. The dock shown in the view of the building from the river has a length of 230 ft. and width of 20 ft. A good stage of water is always available here, as at low tide there is still a depth at the dock of about 20 ft.

The site chosen is upon the east shore of the Hackensack River, in a section of Jersey City known as Marion. It is conveniently located for shipping connections by railroad, being close to and between the main lines of the Erie and Delaware, Lackawanna & Western Railroads where they approach their Hudson River terminals; this, together with shipping facilities by water via New York Bay and the Hackensack River, renders the site easily approachable for all classes of freight. This site was also found to be very convenient for the transmission system connections, and in addition, it offers excellent provisions for extension as is necessary for further growth.

The plant is laid out for an ultimate capacity of 64,000 kw, which will give it, when completed, an important place among the large power plants recently built. At the present, however, only a portion of the equipment will be installed, one-quarter of the proposed structure being under construction. The building has been planned in sections of 8000-kw capacity each, which are repetitions of each other, thus permitting additions to be made to the present structure in small sections, if desired, without alteration of the initial installation.

As may be noted from the accompanying plan, the general scheme involves a large longitudinal operating room for the turbines, with separate individual boiler rooms for each two turbines, which may thus be extended to any distance as required for the 8000-kw turbine capacity; this arrangement is in accordance with the most approved practice in turbine plant construction, being similar in general detail to both the Fiske Street turbine station of the Chicago Edison Company and the new turbine plant of the Boston Edison Company. The two accompanying half-tone views show this general arrangement, and also indicate the present condition of progress upon the building construction; the steel work has been completed and the construction is now being pushed rapidly to completion. It may here be stated that the architectural features of the building will be very plain, although, while ornamentation is absent, still the general effect will be that of great strength and stability.

Each individual steam plant, which will supply one of the 8000-kw sections, will embrace ten 600-hp Babcock & Wilcox boilers of the horizontal water-tube type. They will operate at 175 lbs. pressure, being fitted with Babcock & Wilcox superheaters for raising the temperature of the steam to 150 degs. F. above temperature of saturation. The boilers will be operated under natural draft, 225-ft. Custodis stacks being provided between each double row of boilers, as indicated in the plan. These stacks are located directly in line with the rear walls of the boilers, so that the flue connections may be straight and most direct; ordinarily each stack will serve ten boilers, although the stack at the west end of the building is, on account of its peculiar arrangement, of smaller diameter and will serve only five. Elevated coal hoppers are provided for above the boilers, from which coal will be delivered directly to the boiler room floor by chutes. Coal will be delivered to the bunkers by a belt conveyor, while ashes will be removed from the ash bins beneath the furnaces by cars upon a narrow-gage industrial railroad operated by a trolley locomotive. No economizers or stokers will be used.



DETAIL VIEW OF PROGRESS UPON THE STEEL STRUCTURE FOR THE NEW POWER PLANT FOR THE PUBLIC SERVICE CORPORATION

The turbines will be of the Curtis vertical type, furnished by the General Electric Company, and will be installed in the plant in two different sizes, on account of peculiar requirements of the service, the first and third, of 5000 kw, to deliver current at 25 cycles, while the second and fourth turbines will be of 3000-kw capacity, delivering at 60 cycles. At present, however, only the first three turbines will be installed, the fourth, of 3000-kw capacity, as well as the corresponding one-half of the boilers in the second boiler room, being omitted until required by further development.

The condensers will be of the surface type, supplied by the Wheeler Condenser & Engineering Company, and will have steam-driven pumps. The other power station auxiliaries, including the boiler feed-pumps and the exciter units, will also be steam-driven. The arrangement of condensers will be two condensers for each of the 5000-kw turbines and one for each of the 3000-kw machines. Ample circulating water will be available for condensing purposes, as the river at this point is between 300 ft. and 400 ft. wide and ranges from 50 ft. to 60 ft. deep; furthermore, the supply will be clean, as no large cities are drained by the Hackensack. In addition to the exciter equipment, there will be one motor-generator set, which may be operated as a spare exciter, if needed, and also to supply current to auxiliary motor-driven machinery of various types in the plant.

The turbo-generators will deliver three-phase alternating current at a potential of 13,200 volts, which is the transmission voltage for the lines of the company. Both 25-cycle and 60-cycle current will be generated, as this station will, like the Coal Street (Newark) plant, supply power for lighting as well as also for railway power purposes. The 25-cycle generators will be used for the operation of the railway power loads.

All the switching and controlling apparatus will be located in the "lean-to" addition on the opposite side of the operating room from the boiler rooms. This "lean-to" will have three stories, the two lower of which will be devoted to the bus-bar compartments and high-voltage apparatus for the 25-cycle and the 60-cycle systems. Upon the top floor will be located the controlling switchboards and the station office. The "lean-to" will be finished as a separate building, with a brick wall partition, although at a point in front of the controlling board proper, upon the third floor, windows will be inserted so that the switchboard operators may have a view of the turbines and generating apparatus in the operating room below.

ELECTRIC EQUIPMENT OF CLIFF LINE, SAN FRANCISCO

Shortly after the first of the new year, the United Railroads of San Francisco obtained a franchise from the city to change the motive power of the California Street & Cliff steam line from steam to electricity. The steam line, now the property of the United Railroads for about three years, ran from the terminus of the California Street Cable Railroad Company to California Street, and via private right of way along the cliffs overlooking the bay and the Golden Gate to the Cliff House, and is one of the most picturesque trips obtainable in the vicinity of this city.

The change of equipment necessitated double-tracking and widening the roadbed on the later portion of the line, and the company decided to replace the old wooden tunnel, 100 ft. long, situated near Land's End, by an open cut. Work on the new cut was commenced on Jan. 13 last, but owing to recent rains the ground was in a very unstable condition and required but little disturbance to cause it to slide, so that shortly after work had commenced a landslide occurred, engulfing about 25 ft. of the tunnel, and on resuming work the attempt to remove the debris caused another slide of greater magnitude than the former, filling up fully one-half the tunnel with about 3000 cu. yds. of loose rock and earth. The work of clearing away the debris and constructing an open cut is now, however, well under way.

CORRESPONDENCE

STORAGE CAR HOUSES VS. OPERATING BARNS

Troy, N. Y., Feb. 10, 1905.

Editors Street Railway Journal:

The article by D. F. Carver, "Car Storage Houses vs. Operating Barns," has been read by me with great interest, principally perhaps because it advocates the type of car barn construction which I designed and first built some ten years ago. The first of these barns was built at Stillwater, N. Y., and is almost an exact duplicate of the type of barn advocated in the article, being a two-compartment barn with fire wall between, and the pilasters spaced 9 ft. apart, but varying somewhat in the type of roof construction. In the Stillwater barn the pilaster was built out to a bracket, capped by a stone, and the roof was supported by 15-in. I-beams spaced 9 ft. apart, on top of which was laid a 3-in. loose tongue hemlock plank roof placed upon spiking pieces attached to the top of the I-beams and covered with the ordinary tar and gravel roof above. A pitch of ⅝ in. to the foot was given for drainage. The compartments were not built "en echelon," which strikes me as being a good idea. No openings were allowed between the compartments, and, of course, on this first barn no provision was made for carrying off roof drainage, except by extending the 3-in. plank roof slightly over the eaves of the building. The building was lighted by windows at the side. The walls were 12 ins. thick, built of brick, with a 4-in. pilaster on each side of the center wall and 8-in. pilasters inside on the outer walls. The I-beams were not built into the walls, but merely allowed to project into a recess 4 ins. deep, so that in case the roof was burned through and fell in, the fire wall would not be destroyed.

A car barn of the same type with four compartments was afterward built by the writer at Burlington, Vt. Each of these barns had three tracks in each compartment. At Burlington the car barn was about 100 ft. deep and a slight slope was allowed on the flat roof at the rear of the building to allow for drainage. Of course, the tar and gravel roof was properly flashed into the brick work. It strikes me that the type of roof advocated is in no wise an improvement upon the simpler design mentioned in the foregoing. If roof trusses are to be used it would be much better to place them 8 ft. or 9 ft. apart and to lay the 3-in. plank directly on the roof boards, and do away with the 6 x 8-in. yellow pine purlins. But there is really no reason in a storage barn either for ventilation or for light, and an absolutely closed roof is a much better protection against fire, and for the few occasions when it is necessary to visit these car barns a few incandescent lights will give all the necessary lighting at nominal expense.

The writer has been talking this type of barn to the insurance people for ten years past, and he is glad that someone has been able to make them see the benefits of a sensible form of car barn construction at last. Storing of a great number of cars under one roof has always seemed to me to approach criminal negligence. Cars are always extremely combustible and a fire once started will spread with great rapidity, providing sufficient air to support combustion can get in. No fire department can, in my opinion, furnish protection against this rapid spread in a barn full of cars, and the obviously sensible thing to do is to limit the number of cars that any fire can reach. This type of car barn, possibly safeguarded by automatic sprinklers to retard the spread of fire as much as possible, ought to enable the insurance companies to make reasonable rates on this class of risk and to make money beside.

As to the cheapness of this type of barn, the first barn constructed in 1894 at Stillwater, N. Y., consisted of two compartments, 32 ft. x 160 ft., and the building, without tracks, cost us $5,500 plus the cost of the front doors. These doors were sliding doors, covered with tin, after the plan of approved fire doors, one to each track, so that any two tracks could be open at once. The placing of swing doors inside the car house always reduces the car space, while swinging them outside is almost always disastrous in times of high wind, particularly if the doors are carelessly left unhooked.

In conclusion, I would say that substituting for the 8 x 14-in. yellow pine sticks, timbers of sufficient size to carry a 9-ft. or 10-ft. bent, or using 15-in. I-beams in their place with flat roof, will save considerable expense. Should it be deemed necessary, the 15-in. beams can be easily covered by concrete and woven wire, or some other fireproof covering.

The ordinary type of light iron roof truss construction has always seemed to the writer the worst possible design, in spite of the fact that he has been engaged in bridge and roof designing for many years. The first lick of the flames on the slight steel members is sure to bring the roof down bodily, to say nothing of the most flagrant waste of space, to which Mr. Carver calls attention.

The writer notes with particular interest the careful demonstration of the fact that barns of this type are much less expensive per cubic foot of contents than the usual type of car barn with truss roof.

J. A. Powers.

THE PAINTING OF CAR HOUSES.

Bound Brook, N. J., Feb. 10, 1905.

Editors Street Railway Journal:

I have read Mr. Carver's description of the Plank Road storage house of the Public Service Corporation in your issue of Feb. 4 with a great deal of interest, for, to my mind, one of the most important subjects to railway managers to-day is the proper and safe housing of surplus cars, both as to the risk of fire and proper regard to the protection of the car bodies, etc.

After the installation of the automatic sprinkler system, I am of the impression that the building Mr. Carver describes comes as near perfection, for combatting the danger of fire, as the ingenuity of man can devise. However, from the standpoint of a painter, it occurs to me that a reference to the proper protection of those heavy timbers used in the construction of the building, and also the possible effect the damp contained in the side walls will have upon the varnish on the cars, will not be out of place.

Mr. Carver does not mention the kind of paint he used on the beams and other woodwork. If he employed an oil paint I fear that the application of oil will tend to make the wood inflammable and liable to catch fire more readily and "char" deeper than it would if treated in other ways. Of course, it is necessary to preserve the wood from natural decay, and to those who in the future contemplate building on Mr. Carver's plan, I would suggest that instead of any oil paint it would be better to treat the wood in the following manner: First apply a heavy coat of a mixture of alum, copper sulphate and a little quicklime, applied with a powerful spray pump. The best time to do this is on a day when it is raining, as damp atmosphere allows the liquid to penetrate into the wood more deeply than if the wood is perfectly dry. After a few days apply another coat of the same liquid, with the addition of more lime, common yellow ochre and Prince's metallic, ground through a mill and strained into the spray pump and applied as before. Repeat this until you have a good heavy coat all over the surface. Add a little salt after the first coat to make it hold on to the wood more firmly. This I have used myself, and it will be found that wood so treated will withstand the attack of fire for a long time, and will char very slowly.

As to the varnish on car bodies, some years ago I had to store a number of winter cars in a brick building. The tracks were so arranged that the car bodies were distant about 3 ft.

from the side walls. It was found that the varnish on the cars stored nearest the walls used to lose its gloss, turn white and generally perish, while the other side of the cars was not in the least affected. I presume the trouble was the dampness contained in the brick work, which the hot summer weather brought out, to the detriment of the varnish as above described. Probably a good coat of Portland cement applied to the walls near the cars would overcome this trouble.

JOHN C. WEAVER.

THE CONGESTION POINT IN RAILWAY OPERATION

Towanda, Pa., Feb. 6, 1905.

EDITORS STREET RAILWAY JOURNAL:

I was much interested in your article of Oct. 1, 1904, on "The Congestion Point in Car Headway," and have been hoping you would return to the subject, or that some of your readers would take it up. You mention a headway of "about twenty-five seconds" as having proved to be just about short of "congestion point" on Olive Street, St. Louis; while in your issue of Sept. 24, 22.5 seconds (forty cars in fifteen minutes) were stated as not having decreased the carrying capacity per hour. Even these statements show a variation of about 10 per cent, thus bearing out your remark that the question is not one generally well understood. Starting with any given time schedule, it will be found that increasingly better results are obtained, theoretically, by increasing the number of cars per unit of track, while decreasing the time schedule in about an even inverse ratio, until "congestion point" is reached. But "congestion point" is a variable dependent on the time schedule, as well, of course, as upon rates of acceleration and retardation and number of stops per mile. But just what time schedules can be safely maintained in practice with different numbers of cars per mile of track would be very interesting information. That the facts in connection with headway and schedule speed must be obtained from practice, and not from calculation, is clearly shown by the brake tests made by Mr. Taylor, and described in the STREET RAILWAY JOURNAL of Dec. 24, 1904, in which there were almost seven "slow-downs" to each full stop made.

R. E. DUNSTON.

PIETERMARITZBURG AND DURBAN

THE PIETERMARITZBURG MUNICIPAL TRAMWAYS

Jan. 6, 1905.

EDITORS STREET RAILWAY JOURNAL:

I am writing to correct a slight error which I have noticed in the Dec. 4 number of the STREET RAILWAY JOURNAL. On page 1004, in an article headed "A Glimpse of the Durban, Natal, Tramways," you state, "as exemplified in the modern overhead trolley system operated by the Municipality of Durban, the flourishing *capital* of Natal." This city, namely, Pietermaritzburg, or Maritzburg as it is more often called, enjoys the distinction of being the capital of Natal. Durban is the only seaport of Natal. Instead of the word "capital," the word "seaport" should be substituted.

P. FINLAYSON, Tramway Manager.

At the February meeting of the Electric Club of Cleveland, E. P. Roberts, of the Roberts & Abbott Company, presented a paper on the new interurban terminal station at Indianapolis. He gave a lot of interesting data on the location and construction of the terminal building, the methods of handling passengers, etc., and illustrated his points with views and prints taken from the description of the station which appeared in the STREET RAILWAY JOURNAL some time ago. The paper was of great interest to Clevelanders, as the subject of a station for Cleveland is being discussed at the present time.

OPERATING CONDITIONS IN NEW ENGLAND

At a meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, on Feb. 8, President P. F. Sullivan, of the Boston & Northern and Old Colony Street Railway companies, delivered an interesting address on the status of the street railways in New England.

In a comparison of conditions in the United States and Europe, Mr. Sullivan said that the inquiry was often made why certain fares and other features of European practice were not introduced in this country. Conditions, he said, were so radically different as to make a comparison of many features almost impossible. The cities in Europe were older and the population still congested to a very marked degree. The problems which the street railways had to work out in these cities were simple—a congested population, small municipal area and a low scale of wages. The solution was equally simple, involving a small number of miles of track, low rate of capital invested per capita and a graduated scale of fares sometimes referred to as the "zone" system.

There is no city in Europe, according to Mr. Sullivan, that has a better constructed, maintained and operated street railway than has the city of Glasgow. Those who engineered and managed it showed care and ability; they met the problems and solved them well. The only feature about the system which he would criticise is the type of car used; but inasmuch as the people of that community are satisfied with their cars, any outside criticism fails. They have only one type of car, a double-deck, four-wheel, two-motor car, seating varying from fifty-eight to sixty-two persons; in some the upper deck is open and some enclosed. Mr. Sullivan then made the following comparison:

	Glasgow.	Boston Elevated.
Population	1,000,000	900,000
Miles of track	135	400
Population per mile of track	7,500	2,250
Investment	$10,500,000	$54,000,000
Investment per capita	$10.50	$60.00

The Boston Elevated Company and its leased lines have substantially the same amount of capital invested in cars and their equipment as the total investment in Glasgow for street railway purposes. The Glasgow railways paid in taxes last year $175,000; the Boston Elevated in 1903 in taxes of all kinds, including excise tax, $917,000; and owing to difference in condition of operation and laws with reference to ability, the Glasgow company paid out $83,000 for accidents last year; the Boston Elevated in 1903, $505,000.

The management of the Boston Elevated Company has a more difficult problem, Mr. Sullivan thought, than that of Glasgow.

The fares in Glasgow vary from ½ cent to 10 cents; the fare in the Boston system is 5 cents. In the Glasgow system the longest ride is nearly 10 miles, and only a small proportion of its population avail themselves of it or can afford to do so. In the Boston system a large proportion of its passengers ride twice daily from 5 miles to 8 miles for 5 cents.

The total length of railway route in England, including street, overhead and underground, is, in round numbers, 1900 miles, and of track, 2900 miles, for a population of nearly 33,000,000, or 1 mile of track for each 11,400 of its population. In Massachusetts the track length is over 2700 miles, the population nearly 2,000,000, or a mile of track for less than each 1100 of its population.

Referring more particularly to operating conditions, he showed that if, for instance, the Boston & Northern and Old Colony Street Railways had been able to secure their fuel at the price paid in Glasgow ($1.38 per ton), they could have saved on this item alone $395,000. If they required only the same amount of power per mile, they would have saved $366,-

000. If they had winter conditions such as exist in the foreign city, they could have saved $175,000 for the year, or a total of $936,000, or equivalent to nearly 6 per cent upon the capital stock of both companies. Under these conditions it was easy for street railway authorities here to answer why it was not possible to carry people as cheaply here as in Glasgow.

Comparing conditions in New England with those in other sections of the country, Mr. Sullivan said that while differences were not so marked as those in Europe, there were still many disadvantages under which the companies in this section had to labor. Lower wages, cheaper fuel and broader streets, he said, were very important factors. He referred to the low receipts per car-mile and per mile of track on the roads in New England, and believed that the companies should increase their fares.

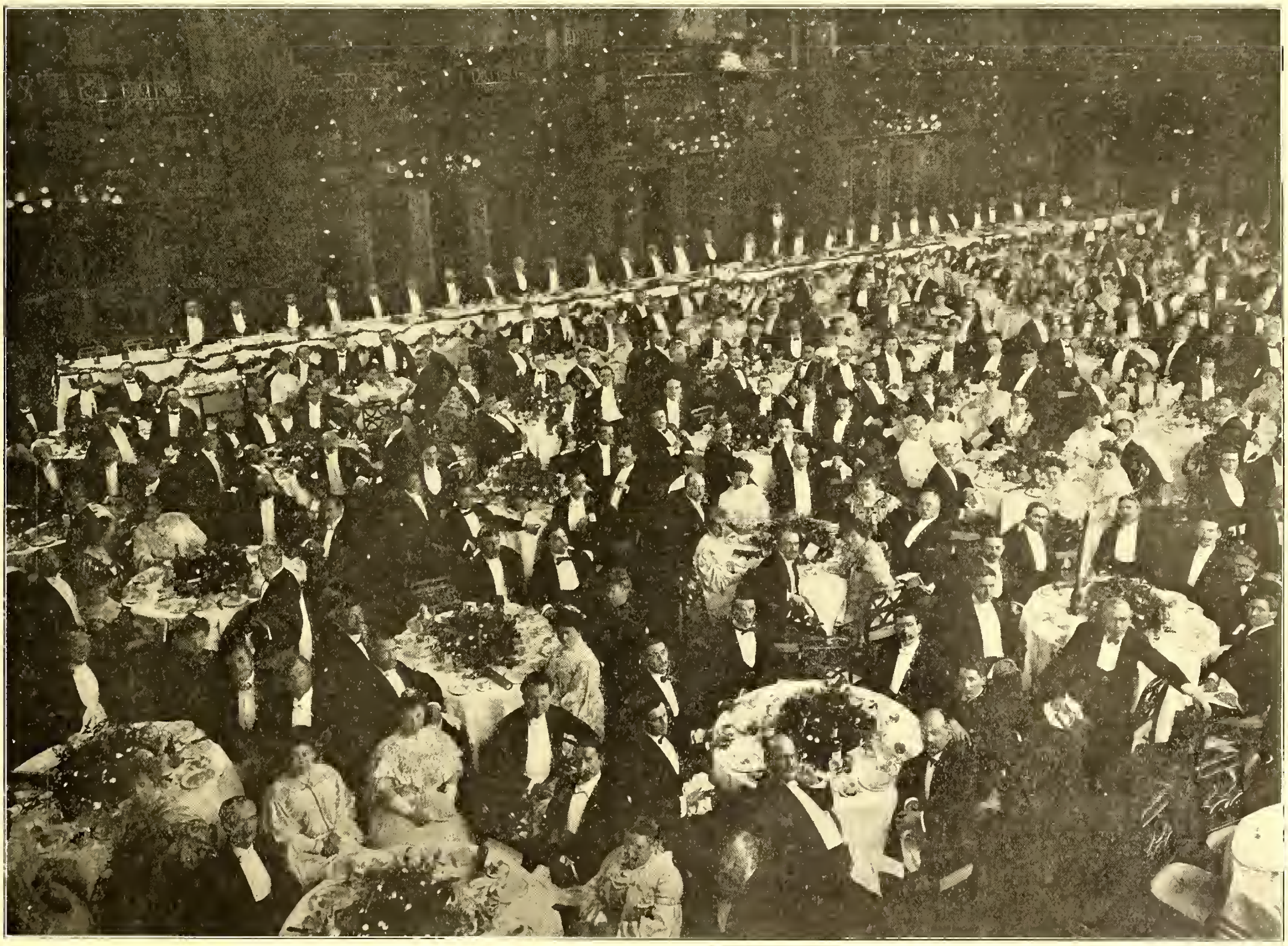
TRACTION DINNER OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The annual dinner of the American Institute of Electrical Engineers was held at the Waldorf-Astoria Feb. 8, and was this year devoted to signalizing the triumphs of electric traction, so that the speakers and speeches had all a specific relation to that subject. The large ball room in the hotel was attractively decorated and the attendance at the dinner was about 400. Preceding the speeches and following the dinner, there was a biographical exposition of electrical manufacturing, of the subway in operation and of the new New York Central locomotive competing with a steam locomotive. A photograph was also taken of the assemblage by means of the Cooper Hewitt mercury vapor light, and a reproduction of this view is presented on this page. The speakers were J. W. Lieb, president; F. J. Sprague, Leo Daft, H. H. Vreeland, L. B. Stillwell and Gen. A. W. Greely; the toastmaster was T. C. Martin. Among the representatives of electric railway companies present were D. F. Carver, J. S. Doyle, Dudley Farrand, W. E. Harrington, Hugh Hazelton, Frank R. Hedley, Edwin B. Katte, J. D. Keiley, I. A. McCormack, W. A. Pearson, C. E. Roehl, Oren Root, Jr., W. G. Ross, A. H. Smith, D. S. Smith, Albert H. Stanley, M. G. Starrett, Col. C. A. Sterling, H. G. Stott, R. C. Taylor, Calvert Townley, W. S. Twining, J. Van Vleck, James T. Whittlesey, Wm. J. Wilgus and E. W. Winter.

ANOTHER LOW FARE TEST IN CLEVELAND

The Cleveland Electric Railway Company on Saturday, Feb. 4, abandoned the 3-cent fare zone scheme which had been on trial on portions of its system for two weeks, and which was the subject of an article that appeared in the Street Railway Journal of Feb. 4. There was substituted for the 3-cent plan on Monday, Feb. 6, a 4-cent cash fare scheme. Under this plan all the lines are operated as before the 3-cent trial, the regular ticket (eleven for 50 cents) or a 5-cent cash fare being accepted if the passenger wants a transfer. Where a transfer is not desired a 4-cent fare is charged. For convenience, tickets are sold at the rate of five for 20 cents. Like the 3-cent fare tickets, the new tickets read "Good for 4 cents toward fare on the Cleveland Electric Railway." One of the 4-cent tickets and a cent entitle a passenger to a transfer under the restrictions heretofore in force.

The company has not yet given out the figures showing the



GROUP VIEW, TAKEN AT THE TRACTION DINNER AT THE WALDORF-ASTORIA, OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS results of the 3-cent fare zone scheme, but it is evident to everyone that it was a flat failure. Practically the only people who were benefited by the scheme were those who lived within the zone limits and who worked in the downtown section of the city. A man who worked even a short distance from the center of the city had to pay as heretofore because he required a transfer, and if he boarded a 3-cent fare car for the ride to the center of the city it cost him 6 cents and perhaps 8 cents to reach his destination. Only in a small degree did the zone cars relieve the rush-hour crowds on the through cars, and the presence of so many additional cars made a congestion that delayed cars all over the system. Altogether it was a poor scheme, and must have been a revelation to Mayor Tom L. Johnson.

The new 4-cent scheme appears to be more satisfactory to all concerned. Comparatively few require transfers, and the majority of those that do, appear to be willing to pay the extra cent for a transfer. From the standpoint of the company it is probably a much better scheme than the "six tickets for a quarter and universal transfers" scheme, which was tried some months ago and proved disastrous to the company because of the flagrant abuses of the transfer privilege. Under the new scheme the practice has been checked of obtaining a transfer with the avowed intention of giving it away, while many people who have but a short distance to go on the second car, now walk and save the cent that the transfer would cost. Heretofore many people who could reach home by taking any of several routes and transferring would take the first car that came along. Now they wait for the car that takes them directly home. This results in less transferring and delays at transfer points. Conductors are obliged to pay 1 cent each for transfers, which makes them more careful about punching and giving out the slips. This also makes it impossible to secure a transfer on a transfer, cutting out many long hauls upon which the company obtained nothing.

It is by far the best scheme that has yet been tried, but it is safe to predict that it will not be permanently adopted, for there remains the point that it is still possible to get a longer ride for a smaller amount of money than a great many people will have to pay for a shorter ride. For instance, under the present arrangement a person can go from South Brooklyn to East Cleveland, about 15 miles, for 4 cents, yet the man who boards a car at a downtown hotel and wants a transfer to a depot car has to pay 5 cents. The same is true of the working man who lives a mile from the center of the city in one direction, and works half a mile from the center in another direction.

BILL INTRODUCED IN PENNSYLVANIA LEGISLATURE TO PERMIT ELECTRIC RAILWAYS TO CARRY FREIGHT

If the Creasy bill, permitting the electric railways of Pennsylvania to carry freight, survives the opposition of the steam railroad lobby and becomes a law, it is expected greatly to stimulate the construction of electric railway lines through the more sparsely settled sections of the State, which cannot at present support, for profitable operation, lines depending entirely on passenger receipts. One of the counties desiring the passage of this bill is Fulton, as yet without a railway.

Two trolley cars on the Newark line of the Public Service Corporation met in a head-on collision in Franklin Avenue, just inside the limits of Paterson, Feb. 4, and a score of persons miraculously escaped serious injury. Both cars were running the switch, and each motorman asserts that the light at either end of the block signal indicated a clear way.

MEETING OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION

The Indiana Electric Railway Association held its regular monthly meeting for February at Anderson, Ind., Feb. 9. By the courtesy of the Indiana Union Traction Company, a special car was provided for those members going by way of Indianapolis. This car left Indianapolis at 9 a. m. and landed its guests at Anderson in time to open the convention at 10:40 a. m. President Charles L. Henry presided.

The subject selected for the meeting was "Interurban Passenger Traffic," which was opened by the reading of the paper of that title by L. J. Shlesinger, superintendent of the Muncie, Hartford & Fort Wayne Railway Company, an abstract of which paper is printed elsewhere in this issue. This paper is a minute analysis of the passenger earnings of Mr. Shlesinger's road from different points along the road and from different classes of patrons. It is of much interest and value to all who may have occasion to estimate the probable earnings of projected interurban railways. Mr. Shlesinger, when asked how his figures on actual earnings compared with the engineers' preliminary estimates, said that the actual figures were a little better than the engineers' estimates.

J. R. Cravath, of the Street Railway Journal, said that Mr. Shlesinger's figures on track-mile earnings were very close to the average of the thirty-two purely interurban Ohio roads reporting to the Auditor of State, Mr. Shlesinger's figures, however, being a little better than the Ohio average.

J. W. Chipman, general manager of the Indianapolis & Eastern Railway, asked what the probable effect would be were the rate of fare reduced on the road under discussion; whether it would stimulate enough travel to increase the gross revenue, or whether it would simply reduce the revenue in proportion as the rate of fare was reduced.

Mr. Shlesinger though such a move would reduce the gross revenue. The rate of fare had been given much consideration when the road started, as it was much easier to lower than to raise rates of fare when once established.

Mr. Chipman then brought up the question of an interchangeable coupon ticket, similar to that used by Ohio roads, and favored the adoption of some such plan by Indiana roads.

J. H. Merrill, of Lima, Ohio, ex-secretary of the Ohio Interurban Railway Association, explained that the Ohio interchangeable ticket was not as some Indiana men evidently supposed, a mileage ticket, but simply a coupon ticket, the coupons of which call for so many cents worth of transportation on whatever line they may be presented. This did not affect the rates of fare of any road, except that the coupon ticket was sold for less than the face value of the transportation, so as to make it an object to purchase the interchangeable ticket. The sales of these tickets were increasing each month. They undoubtedly brought some traffic to the roads, especially from traveling men. He thought the ticket should not be limited to individuals. If it could be limited only to members of the same family his road could abolish the family ticket it now sells at 25 per cent less than regular rates. It would pay his company to do this.

C. A. Baldwin, superintendent of transportation of the Indiana Union Traction Company, favored the adoption soon of an interchangeable coupon book. Answering Mr. Chipman's questions as to the effect of raising the rates of fare, he said that his experience had been that it did not decrease the revenue. His company had done it in some places.

C. D. Emmons, general superintendent of the Fort Wayne & Wabash Valley Traction Company, favored an interchangeable coupon book something like the Ohio book.

Mr. Merrill, of Ohio, explained that some Ohio roads accepted coupons from the interline books in payment for baggage.

This brought up the question of whether to check baggage free or charge for it.

H. A. Nicholl, general manager of the Cleveland & Southwestern Traction Company, who happened to be present, was asked about the free checking of baggage, which is the rule on his road. He said it was practically forced upon them by steam road competition, but that he believed in it strongly.

F. H. Norviel, traffic manager of the Indianapolis & Northwestern, who is an earnest advocate of the free checking of baggage, here read an extract from the STREET RAILWAY JOURNAL of Feb. 4, 1905, page 205, citing the experience of the Lake Shore Electric Railway Company as regards the large number of traveling men carrying trunks on those roads which might otherwise patronize the steam roads.

On motion of A. W. Brady, president of the Indiana Union Traction Company, it was voted to appoint a committee of five to arrange for interchangeable coupon tickets and discuss interline baggage arrangements. This committee, as appointed by President Henry, will consist of C. C. Folsom, of the Fort Wayne & Wabash Valley Traction Company; C. A. Baldwin, of the Indiana Union Traction Company; W. R. McKown, of the Indianapolis & Eastern Railway Company; F. D. Norviel, of the Indianapolis & Northwestern Traction Company; J. McM. Smith, of the Indiana Railway Company, South Bend, and one member from Southern Indiana, to be appointed later.

Upon the suggestion of Mr. Chipman, Secretary White was instructed to call a meeting of representatives of all roads using the Indianapolis terminal depot to arrange for the maintenance of a joint ticket office and information bureau at the Indianapolis depot.

A communication was read from Paul Richey, formerly of the Indiana Union Traction Company, who proposes to publish an attractive monthly time-table and guide book of Indiana interurban roads, asking that his publication be made the official guide for roads represented in the Indiana Electric Railway Association. The proposed publication was authorized by the association and a committee appointed to arrange details with Mr. Richey. The idea is that the publisher shall make the guide self-supporting by the advertising that it contains and that the roads represented in it agree to give it a certain circulation each month. The committee appointed on this consisted of L. J. Shlesinger, J. A. Berry and C. A. Baldwin.

As this finished the regular business of the meeting, F. W. Norviel, of the Indianapolis & Northwestern, was asked to tell how his company had increased Sunday traffic during the summer. Mr. Norviel explained that his road was peculiarly situated in that it had no parks or special attractions of that kind to bring out pleasure riding in summer on Sundays. The steam roads, moreover, had been giving low excursion rates on Sundays to Indianapolis and Chicago, so that for his road Sunday was the dullest day of the week instead of the best day, as on many other interurban roads. His company had therefore adopted the plan of making a special Sunday round-trip rate of $1 to any point on the 90 miles of road the company owns, where the rate is not regularly less than $1. The gross earnings were increased 100 per cent on Sunday by this change.

Mr. Chipman asked what effect the low Sunday rate had on Saturday and Monday traffic. Mr. Norviel thought it had none.

President Henry favored making "week-end" reductions in rates to cover Saturday, Sunday and Monday. This would appeal to more people and avoid congestion on Sundays. The purely Sunday excursion was not altogether a desirable thing.

Adjournment was then made until the second Thursday in March, place and programme to be left to the executive committee.

President A. W. Brady, of the Indiana Union Traction Company, played the part of host to the convention and entertained the members at an elegant luncheon at the Hotel Doxey.

After lunch, the special car was again ready to take the party to the company's large power station at North Anderson. The special test car of the Electric Railway Test Commission was also a matter of interest during this visit.

The return was made to Indianapolis via Tipton and the new "Northern" division of the system, so that the company's latest construction work, recently described in these columns, could be inspected. The special car used by the party was the one exhibited at the World's Fair. Most of the distance over the new track was covered at a mile-a-minute clip, and the easy riding qualities of the car demonstrated that the interurban sleeping car is not by any means the impossibility that some people think it is.

A. S. Richey, chief engineer, and C. A. Baldwin, superintendent of transportation, accompanied the party, and would have been justified in feeling considerable pride in the rapid and comfortable transportation they were able to offer. The hospitality of the Indiana Union Traction Company and its officers was much appreciated by all who enjoyed it.

INTERURBAN PASSENGER TRAFFIC*

BY L. J. SHLESINGER

The State of Indiana has been one of the foremost in the development of the modern interurban road. Encouragement has been given investors by the attitude of the legislative authorities of the State and considerable outside capital has been attracted. We have to-day within the limits of the State twenty-three different companies operating 818 miles of interurban track, all of which has been constructed within the past seven years, with the exception of the 23 miles previously mentioned. This is truly a wonderful growth. For the purpose of obtaining a fair notion of the total results accomplished by Indiana within these past few years, let us imagine that the 818 miles of interurbans were placed in one continuous line. We would have a railroad track extending from the city of Indianapolis to the city of New York. If a passenger were to undertake this journey, making direct connections upon leaving the lines of each company and taking advantage of the limited service in vogue on a number of the roads, the trip would occupy a period of thirty-eight hours and thirty minutes. This represents an average speed of 21.25 m.p.h., and varies from 8.5 m.p.h. to 27.5 m.p.h. on the various roads. Without the limited service mentioned, the time required to make the journey would be forty-two hours and thirty minutes. Our traveler, unless supplied with free transportation, would find that $12.75 would be required to pay his fare for the entire distance, an average of 1.56 cents per mile. Some portions of his route would be traveled for 1.05 cents per mile, while other distances would require an expenditure of 2.23 cents per mile.

In preliminary work on interurban enterprises one of the engineer's chief sources of perplexity is to establish a basis upon which to estimate gross receipts. Each proposition necessarily presents local conditions which must be carefully studied before comparison is made with apparently similar conditions in other localities.

Whether prospective earnings are calculated upon the basis of car mileage, track mileage, population or any other method, it is only by a study of results actually obtained that we may arrive at any sort of rule to apply in an effort to eliminate as much as possible the element of "guess."

The Muncie, Hartford & Fort Wayne Railway represents a type peculiarly and distinctively interurban. The company has its own track extending from court house to court house of the terminal cities. Outside of towns, the road is located entirely upon private right of way, three-fourths of the entire mileage

* Abstract of a paper read before the Indiana Electric Railway Association, Anderson, Ind., Feb. 9, 1905.

lying adjacent to the right of way of the Lake Erie & Western Railroad. No city cars are operated, nor are the tracks of any other company used. In the terminal city of Muncie but four minutes' time is required for the run from the court house to the corporation limits, so that practically no city service is given. The towns, mileage, rates of fare and population served are shown by the following table:

City or Town	Miles	Local Fare	Population	Additional Rural Population of Township 1 Mile from Track
Muncie	0.	$.0	32,000	1,000
Royerton	5.2	.10	300	400
Shideler	2.9	.05	300	
Eaton	2.5	.05	2,000	400
Hartford City	7.9	.15	8,000	600
Montpelier	9.3	.15	6,000	800
Keystone	3.0	.05	400	800
Poneto	4.5	.10	500	200
Bluffton	6.5	.10	7,000	800
Totals	41.8	$0.75	56,500	5,000

The total population served, 61,500, is approximately one-third the number of people in the city of Indianapolis. The population per mile of track averages 1470; excluding the principal terminal, Muncie, the average per mile is 705. The average rate of fare charged approximates 1.8 cents per mile. No local or round-trip tickets are issued, but 5-cent coupon and commutation books are sold at from 20 per cent to 25 per cent reduction. Reduced rate tickets to the company's park at Eaton are on sale during the summer months. The company has not yet developed the freight business, although packages are handled on all cars; consequently, all the succeeding figures given refer to passenger business purely. The use of the Ohmer fare registers enables complete traffic statistics to be maintained at a minimum of clerical expense.

The following table shows the number of passengers carried during the year 1904, classified according to fare denominations:

5 cent fares	276,202	50 cent fares	33,634
10 " "	128,559	55 " "	4,592
15 " "	199,701	60 " "	230
20 " "	95,091	65 " "	1,013
25 " "	46,615	70 " "	106
30 " "	12,720	75 " "	9,740
35 " "	80,341	Tickets	117,995
40 " "	14,453	Passes	7,908
45 " "	664		
		Total	1,029,564

It will be noted from this table that over one-fourth the total number of passengers represent 5-cent cash fares. The 15-cent fares are the most profitable, followed closely by the 35-cent fares, while the least remunerative are the 70-cent fares. The average cash fare per passenger is 17 cents, while the average value of tickets used is 15.5 cents. At the rates of fare charged, this indicates that the average passenger rides a distance of nearly 10 miles. The average number of passengers carried per day is 2813, indicating that 4.6 per cent of the total population make a one-way trip each day, or every available person in the territory served rides seventeen times per year. Introducing the element of car mileage, it is found that there are 1.8 passengers registered for every car-mile of service. The receipts per car-mile figure 32.05 cents, of which 27.32 cents represents cash fares, 3.23 cents represents ticket sales, .69 cent represents packages, .24 cent represents newspapers carried, .16 cent represents chartered cars, and the balance comprises miscellaneous minor items. On the basis of receipts per mile of track per annum the figures for 1904 show this item to be $4,335.

The table showing the number of passengers representing each denomination of fare indicates general facts in reference to passenger traffic. The following method was adopted for determining more specifically what might be termed the "location" of business: During the last week of January all conductors were supplied with blank forms on which they were required to keep a record of the number of passengers boarding and leaving trains at and between towns. At first thought this would seem to be a gigantic task with which to burden a trainman in addition to his other duties, but it must be remembered that no transfers are in use and that the type of register employed requires duplex tickets to be issued for an average of less than two fares for every 1000 collected. Consequently, the results obtained may be considered as fairly accurate, inasmuch as a considerable personal error would have no appreciable bearing on the total amounts. A tabulation of the statistics thus collected shows the following results, which are the total figures for seven consecutive days:

	Passengers On	Passengers Off	Total On and Off	Percentage	Mileage	No. of Rural Passengers On and Off per Mile per Day
Muncie	2,826	2,812	5,638	16.1	.7	
Intermediate distance.	354	364	718	2.1	4.5	23
Royerton	392	410	802	2.3	.0	
Intermediate distance.	204	225	429	1.2	2.9	21
Shideler	483	438	921	2.6	.0	
Intermediate distance.	146	168	314	.9	1.9	24
Eaton	1,399	1,313	2,712	7.8	.9	
Intermediate distance.	634	682	1,316	3.8	6.6	28
Hartford	3,905	3,857	7,762	22.2	2.0	
Intermediate distance.	681	752	1,433	4.1	7.7	27
Montpelier	2,274	2,285	4,559	13.0	.8	
Intermediate distance.	156	187	343	1.0	2.6	19
Keystone	818	806	1,624	4.6	.3	
Intermediate distance.	306	358	664	1.9	4.1	23
Poneto	731	713	1,444	4.1	.5	
Intermediate distance.	383	428	811	2.3	5.5	21
Bluffton	1,800	1,694	3,494	10.0	.8	
Totals	17,492	17,492	34,984	100.0	41.8	

By combining the number of passengers on and off, each town or rural district receives credit for every incoming and outgoing passenger; comparative results are thus obtainable, using as a base the figure representing the total number of passengers on and off. The column of percentages given in the table indicates the relative amount of traffic furnished by each town and by the rural districts lying between adjacent towns. The proportion of business furnished by the towns is shown to be 82.7 per cent of the total, in comparison with 17.3 per cent supplied by the rural districts, a ratio of nearly 5 to 1. Incidentally, it might be mentioned that similar statistics were gathered for one week during the month of August, 1903, at which time only that portion of the road between Muncie and Montpelier was in operation; the results showed 88.3 per cent for the towns and 11.7 per cent for the rural districts, a ratio of over 7 to 1. In the preceding table a column of figures is given showing the mileage in towns and in the intervening country. By using these figures, the results in the last column of the table are obtained, the purpose being to show the relative traffic value per mile of track of all the rural territory traversed. The general results of the table indicate that the greatest volume of town and rural traffic is supplied by Hartford City and the adjacent territory. On account of geographical and local conditions, this result is a natural one to expect.

Proceeding further in an effort to determine the relation between gross receipts and population, the following earnings per capita per annum are obtained, the method used being to credit each community with its proportion of the total receipts to which it is entitled, according to the percentage values given in the preceding table. The results are as follows:

Muncie	$0.91	per capita per annum
Royerton	13.89	" "
Shideler	15.70	" "
Eaton	7.07	" "
Hartford City	5.03	" "
Montpelier	3.93	" "
Keystone	20.84	" "
Poneto	14.86	" "
Bluffton	2.59	" "
Rural population	6.27	" "

The average receipts per capita per annum show a figure of nearly $2.95. Omitting the population of the principal terminal city, which method is sometimes used in calculating per capita earnings where the terminal is a large city, though hardly applicable in the present instance, the per capita value increases to 6.14.

The question of providing the requisite number of stopping stations for any road is one which should be carefully considered as having more or less bearing upon passenger traffic. The tendency has been to establish stations at rather too frequent intervals, with the result possibly of stimulating rural traffic to the detriment of through business, operating schedule, car maintenance, etc. Each problem must be considered according to its own conditions, bearing in mind the endeavor to provide the greatest good for the greatest number. On the road under consideration in this article, the established rural stopping stations vary from ½ mile to 1½ miles apart. There are forty-seven stations provided in the rural districts and twenty-three within the corporate limits of the towns. Of these seventy, fifteen may be classed as regular or compulsory (i. e., on account of occurring at railroad crossings or at the principal stations in the towns), and the remaining fifty-five may be considered as flag stations. While the passenger statistics previously referred to were being collected by the conductors, a record of the number of train stops was taken by the motormen. The result for the week showed an average of twenty-eight stops made per single trip, twelve of these being within the corporate limits of the towns and sixteen in the rural districts. Of the twenty-eight stops, fifteen were compulsory and the remaining thirteen were at flag stations. That is to say, with fifty-five flag stations along the line, an average of thirteen are used per single trip.

In conclusion, it should be stated that the Muncie, Hartford & Fort Wayne Railway was first opened for traffic between Muncie and Hartford City in February, 1903. The mileage between Hartford City and Montpelier was added the following May. The division between Montpelier and Bluffton was opened in December of the same year with bi-hourly trains, continuing with this inadequate service until July, 1904, at which time the full hourly schedule was inaugurated. Consequently, although general traffic statistics should preferably be based upon second-year results, it will be noted that in the present instance all figures applying to the year 1904 are hardly indicative of the fully developed results which may be expected for the coming year.

ONE WAY TO PLOW A PARK

At the meeting of the Indiana Electric Railway Association at Anderson, Ind., recently, some of the members were heard asking J. W. Chipman, general manager of the Indianapolis & Eastern Railway, whether he intended to go into the gold mining business again this season. Further inquiry revealed a novel scheme worked by the Indianapolis & Eastern Railway Company last season. The company buried $500 in gold coin in its park. The company wanted the ground thoroughly plowed up and pulverized, and it also wanted to attract some traffic to the park. The plan worked like a charm, and all the company's patrons who desired were given the privilege of digging for this gold coin buried in the park. Nothing but small hand implements were allowed. It is hardly necessary to say that by the time all of the coin was found (as it was) the entire surface of the park was loosened up and pulverized to an extent never equaled by any other scheme of ground preparation in vogue among landscape gardeners. Like many gold mines, the profits did not all go to the miners by any means.

MEETING OF EXECUTIVE COMMITTEE OF THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION

A meeting of the executive committee of the American Railway Mechanical and Electrical Association was held at the Holland House, Feb. 3, the following members of the committee being present: President C. F. Baker, of Boston; First Vice-President H. H. Adams, of Baltimore; Second Vice-President John Millar, of Buffalo; Secretary S. W. Mower, of Detroit; D. F. Carver, of Jersey City, and J. S. Doyle, of New York.

At the morning session the committee thoroughly discussed the relation of the Mechanical and Electrical Association to the reorganization of the American Street Railway Association, and on motion made by Mr. Adams, President Baker was authorized to represent this association on the executive committee of the American Street Railway Association. The meeting adjourned at 12 o'clock noon and attended a joint meeting of the executive committee of the American Street Railway Association, the Accountants' Association, the Manufacturers' Association and the Claim Agents' Association, to consider with them the question of reorganization. A report of the discussion and action taken at this joint session of the executive committees has already appeared in the columns of this paper.

At the afternoon sessions of the executive committee of the Mechanical and Electrical Association the following papers were assigned for the coming convention:

"Power Transmission," by C. H. Hile, superintendent of wires, Boston Elevated Railway.

"Maintenance and Inspection of Electrical Equipment," by William Pestell, of J. G. White & Company, New York City.

"Way Department Matters," by F. G. Simmons, Milwaukee Electric Railway & Light Company.

"Power Stations," by Fred Bushnell, chief engineer, the Rhode Island Company, Providence.

The following-named gentlemen were appointed chairmen of standing committees on the subjects indicated for a term of three years; these to choose two associates, one to serve for two years, the other for one year, with full power to act in regard to papers, etc. By this arrangement the work will be continuous, one member of the committee being replaced each year or continued, but in either event, there will be two old members of the committee remaining:

"Controlling Apparatus," J. S. Doyle, Interborough Rapid Transit Company, New York.

"Brakes," D. F. Carver.

"Wheels," John Millar, International Railway Company, Buffalo.

"Shops," W. D. Wright, Rhode Island Company, Providence.

"Way Matters," F. G. Simmons, Milwaukee Electric Railway & Light Company.

The Question Box will again be handled by the secretary.

The resignation of C. C. Lewis, formerly of Schenectady, was read and accepted, and President Baker was authorized to fill the vacancy on the executive committee. Motion was made and carried that members desiring extra copies of the Second Annual Report, 1904, be charged $3 a copy therefor, and that new members joining the association and wishing to obtain back numbers will be charged $1 per copy.

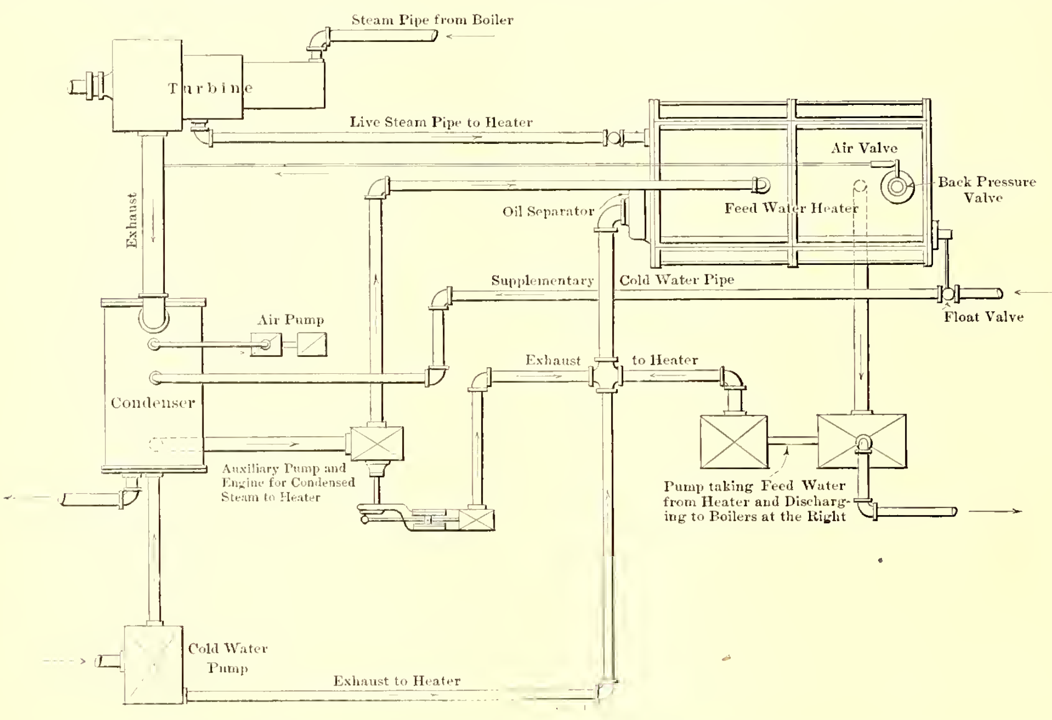
The meeting adjourned until 3 o'clock the following afternoon, at which time the members accepted the invitation of Mr. Doyle to take a trip through the subway of the Interborough Rapid Transit Company with him.

The Springfield, Troy & Piqua Railway Company has opened a park and baseball grounds west of Springfield, and has placed contracts for the erection of a grand stand to seat 2500 people. Regular league games will be played there next summer.

A SYSTEM FOR HEATING AND REGULATING BOILER FEED-WATER

Among the new problems and opportunities presented by the recent commercial development of the steam turbine is the application of the auxiliary equipment in plants operated by turbines. The Harrison Safety Boiler Works, of Philadelphia, Pa., manufacturers of the well-known Cochrane feed-water heaters, have paid special attention to the adaptation of these heaters to such plants (the actual and contemplated installations of Cochrane heaters in connection with steam turbines already exceeding 25,000 hp) and have developed some features which should prove of considerable interest to engineers.

The accompanying illustration shows a method patented by the Harrison Safety Boiler Works for heating and regulating the boiler feed-water, and is particularly adapted to plants where steam turbines are operated in connection with surface condensers, although this method is also applicable to



PLAN OF PIPING FROM STEAM TURBINE AND ITS AUXILIARIES TO FEED-WATER HEATER

plants where surface condensers are used in connection with reciprocating engines.

Steam from the boiler enters the turbine through the upper pipe, the exhaust passing to the condenser. The pump below the condenser takes cold water through a suction pipe coming from the left and forces it into the condenser to liquefy the exhaust steam therein, the circulating water being discharged finally through the bend at the lower end of the condenser. The condensation of the steam is drawn from the condenser through its lowest horizontal connecting pipe by an auxiliary engine and pump and is delivered to the open feed-water heater. Another connection to the open heater consists of the joined exhaust piping from the various pumps and small engines, the combined exhausts first passing through the oil separator of the heater. The feed-water from the heater is taken through the vertical pipe connected with the pump below and is discharged to the boilers by way of the bend underneath the pump. As shown in the diagram, the exhaust from this last pump combines with the exhaust from the other auxiliaries before entering the oil separator. The middle horizontal pipe connected to the condenser carries a supplementary cold-water feed supply to make up any difference between the quantity of the condensed steam and the amount of water required by the boilers. This supplementary water supply is controlled by the valve at the extreme right of this pipe, according to the water level in the heater. This valve is automatically opened or closed by the float and connecting mechanism. In cases where the condenser air pump is steam driven, its exhaust is also connected to the combined exhaust piping of the various auxiliaries before entering the oil separator. The heater exhaust is provided with a back-pressure valve. The pipe above it is joined to the piping between the turbine and condenser. It is provided with an air valve at its right end for passing to the condenser the air which is liberated from the water by heating it in the heater. By this means the air in the heater is disposed of without permitting the escape of steam.

Should there be more exhaust from the auxiliaries than can be condensed in the heater, the pressure increases until it is high enough to open the back-pressure valve of the heater and allows the surplus to escape to the atmosphere. It often occurs, however, that the steam from the auxiliaries is insufficient to heat the feed-water to the temperature of the steam itself. In order to cover such cases a pipe is carried to the heater from such a point of expansion in the turbine as will insure the least loss of effectiveness with the greatest potentiality, for the purpose of making up any possible deficiency in the auxiliary exhaust. In this pipe is placed an automatic throttling valve, so adjusted that the pressure of the steam when it enters the heater shall be below the pressure at which the back-pressure valve is set. Thus the supply of supplemental steam from the turbine depends upon the pressure in the heater, and is regulated by the needs of the heater itself.

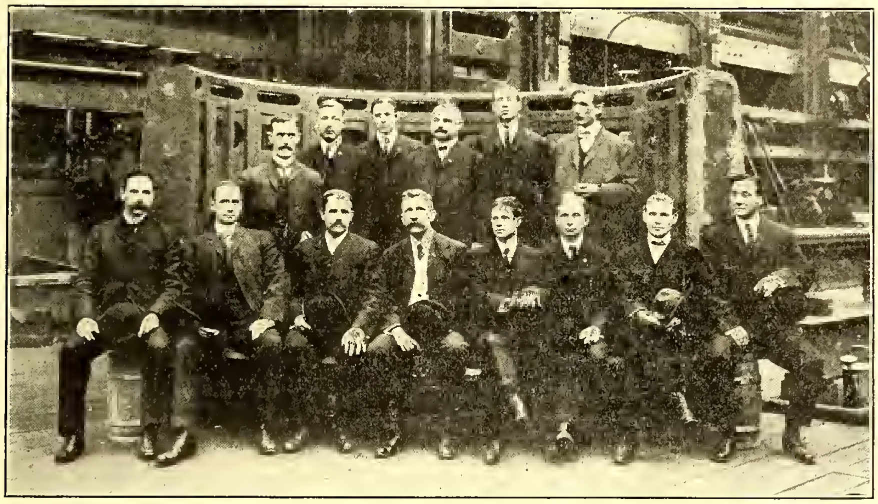
The operation of this novel arrangement has important advantages. In addition to all of the condensation of the main exhaust being utilized in the heater, the supplementary cold water is automatically regulated and supplied, and is partially heated in the condenser by the utilization of the latent heat in the main exhaust. All of the exhaust from the auxiliaries is utilized up to the point where they provide more exhaust than is required in the heater, and should the supply fall below the maximum quantity required it is automatically supplemented by steam in the manner already described. The boilers are furnished with water at a uniformly high temperature, there being no sudden fall in the temperature due to variations in the quantity of steam available for heating the water or in the quantity of the supplemental cold water required. The methods by which these desirable results are obtained are simple, positive and entirely automatic.

It will be seen that in a plant in which this method of heating and regulating the boiler-feed supply is used, the auxiliaries are of the independent, steam-driven, non-condensing type. The manner in which the exhaust from these auxiliaries is utilized, however, makes them far more economical than the turbines or main engine run condensing, even though the latter may show an efficiency of 15 per cent or better. If the auxiliaries were run condensing they could not exceed and probably would not equal this efficiency of 15 per cent, but when operated in the manner described above, their efficiency is practically

100 per cent, for all of the heat in the steam which is not converted into work or accounted for by losses from radiation, etc. (and these quantities would be identical whether the auxiliaries were run condensing or non-condensing), is utilized in heating the feed-water and turned back into the boilers. This efficiency of 100 per cent compares with the absolute loss of 85 per cent which must occur if the auxiliaries are run condensing and the heat in the exhaust dissipated and wasted in the condensing water.

MEETING OF ELECTRICAL CONTRACTORS

On Feb. 6 and 7 the board of directors of the National Electrical Contractors' Association, comprising twenty-six delegates from electrical contractors' associations from the various States, met at the Hotel Schenley, Pittsburg, Pa. Plans for the annual convention to be held this year and the business outlook for 1905 were discussed. Owing to the large amount of business transacted, little opportunity was afforded the visitors to visit the many industries for which Pittsburg is noted, but a party of twelve, accompanied by E. McCleary, of the McCleary Electric Company, Detroit, Mich., and president of the National Electrical Contractors' Association, spent a day in the works of the Westinghouse Electric & Manufacturing Company at the end of the convention. They found the trip interesting and enjoyable, and only regretted that lack of time prevented a more thorough investigation of the works of the Westinghouse interests. A group of the delegates as they appeared in the works of the Westinghouse Company is shown in connection with this item, Mr. McCleary appearing as the central figure in a sitting posture.

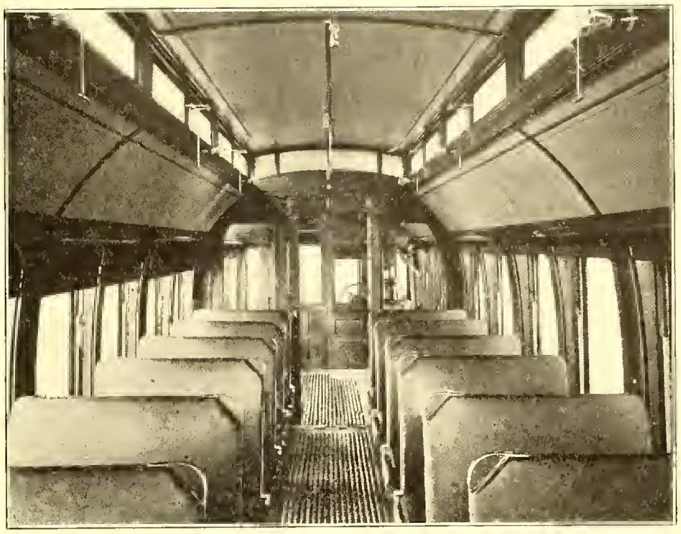


VIEW OF A GROUP OF MEMBERS OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION, IN THE WORKS OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

The interline tickets adopted by the Ohio Interurban Railway Association have been placed in use by practically every road identified with the association, and a number of roads in Indiana have agreed to accept these tickets when they are issued by Ohio electric railway companies.

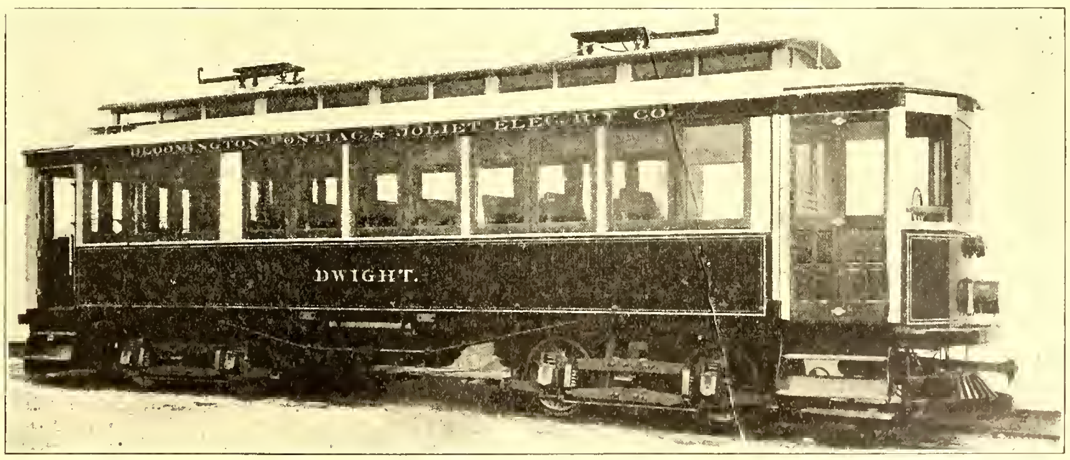
FIRST CAR FOR BLOOMINGTON, PONTIAC & JOLIET SINGLE-PHASE SYSTEM

The American Car Company has delivered to the Bloomington, Pontiac & Joliet Electric Railway a large high-speed passenger and smoking car of the semi-convertible type, built under the Brill patents and ordered through the Arnold Electric Power Station Company, of Chicago. The road has recently been completed and connects many towns between the above-named cities. This is the first car in Illinois to be operated with the single-phase system. It is equipped with a transformer, which steps down a trolley potential of 3300 volts. The new system has been so thoroughly described in recent numbers of the Street Railway Journal that it is not necessary to enlarge upon it.



SEATING ARRANGEMENT OF BLOOMINGTON, PONTIAC & JOLIET INTERURBAN CAR

The company has constructed and equipped its lines after the latest methods, and in choosing its car adopted this type of semi-convertible as being best adapted to the requirements of thoroughly modern high-speed service. For the same reasons the Brill No. 27-E-1½ trucks were selected, which are capable of the highest speeds, and may be run around curves of short radii in very fast time because of the cushioned side swing. The trucks have solid forged side frames and are well adapted



AN EXTERIOR VIEW OF THE FIRST CAR IN ILLINOIS OPERATED BY THE SINGLE-PHASE SYSTEM, SHOWING ALSO THE MOUNTING OF THE TROLLEY BASE ON INSULATORS to service under a heavy passenger car of this type.

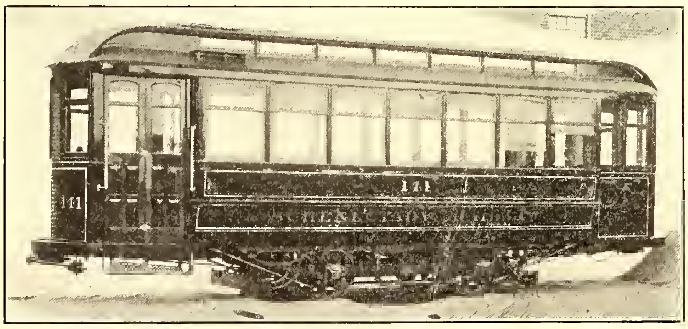
The car is divided into two compartments, one the regular passenger compartment and the other for smokers. The semi-convertible window system allows the windows to be held at any desired height or raised entirely into the roof pockets. The interior finish is cherry, with green ceilings decorated in gold. Transverse seats upholstered in green leather and with reversible high backs are used in the regular compartment, while longitudinal seats are in the smoking compartment. Removable storm sashes are included in the equipment. Among the furnishings are Brownell accelerator doors, Brill angle-iron bumpers, "Dedenda" gongs and radial draw-bars, and American Car Company pilots.

The car is 31 ft. 8 ins. over the end panels, and 41 ft. 8 ins. over the crown pieces, including the vestibule sheathing; from the panel over the crown, 5 ft.; width over the sills, 8 ft. 7½ ins.; distance between centers of posts, 2 ft. 8 ins.; side sill size, 4 ins. x 7¾ ins.; end sill size, 4¾ ins. x 6¾ ins.; sill plates, ⅜ in. x 12 ins.; thickness of the corner posts, 3¾ ins., and of the side posts, 3¼ ins. The length of the seats is 38 ins.; width of the aisles, 23½ ins.; height of the steps, 15¼ ins., and of the risers, 13 ins. The No. 27-E-1½ trucks have a wheel base of 6 ins. and 34-in. wheels.

NEW EQUIPMENT FOR THE SCHENECTADY RAILWAY

A shipment of six cars like the one shown in the illustration was lately delivered to the Schenectady Railway Company by the J. G. Brill Company. The wonderful growth of Schenectady, which has tripled its population since 1890, necessitates frequent additions to the equipment of the railway company, which now operates about 175 cars with 115 miles of trackage, and also owns the large pleasure resorts, Brandywine Park and Forest Park, on Ballston Lake.

The new cars are for use in Schenectady, and are mounted on No. 21-E trucks, which the builder claims carry the car



ONE OF THE NEW SINGLE-TRUCK, DOUBLE-VESTIBULE CARS FOR THE SCHENECTADY RAILWAY COMPANY

body lower than any others. The roofs are of steam car form and add to the strength, longitudinally, of the upper structure, as well as to the general appearance of the cars. The interiors are handsomely finished in mahogany, with ceilings of decorated birch. Longitudinal spring cane seats in two parts are used. Instead of the usual dropped sash arrangement of windows, the windows have a pair of sashes, the upper one stationary and the lower one raised partly into a pocket behind the letter board. This arrangement gives additional width by getting rid of wall pockets, and saves much glass, as the sashes when dropped into pockets are usually allowed to fall with considerable force. Folding doors give entrance to the vestibules on one side only, the other side being solidly paneled.

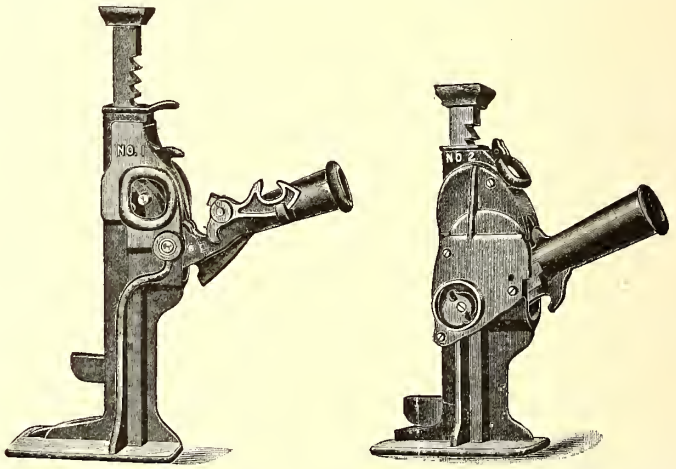
The general dimensions are as follows: Length over the end panels, 20 ft., and over the crown pieces and vestibules, 29 ft. 6 ins.; width over the sills and plates, 6 ft. 4 ins., and over the posts at the belt, 7 ft. 4 ins.; over the water table, 7 ft. 7 ins.; sweep of the posts, 6½ ins.; side sill size, 5 ins. x 8 ins.; end sill size, 4½ ins. x 8 ins.; sill plates, ⅝ in. x 7 ins.; thickness of the corner post, 3¾ ins., and side post, 2 ins.; bottom of the sill to the top of the trolley boards, 9 ft. 2 ins.; floor to ceiling, 8 ft. 1⅛ ins.; length over the bumpers, 30 ft. 6 ins.; panel over crown piece and vestibule, 4 ft. 9 ins. The Brill specialties used are angle-iron bumpers, radial draw-bars and "Dedenda" alarm gongs.

TRIP AND AUTOMATIC LOWERING JACKS

The jacks shown in the accompanying cuts are made by the Buckeye Jack Manufacturing Company, of Louisville, Ohio, and represent two types widely used for railway work.

The No. 1 track or trip jack has a lifting capacity of 10 tons. The leverage is compound, double-acting, lifting the load half a notch on both upward and downward strokes. The load can be dropped instantly from any operation at the will of the operator. This is a standard track jack, strictly conforming in its construction to the requirements of the Roadmasters' Association. It is recommended for track work only.

The automatic lowering jack No. 2 is also of 10 tons capacity, and is a very popular style because of its suitability for all lift-



NO. 1 TRACK JACK NO. 2 AUTOMATIC LOWERING JACK

ing purposes. It can be used as a track jack as well as for a car jack in cases of derailment. The load is moved up or down half a notch at each stroke on both upward and downward movements of the lever. The direction is easily controlled by the eccentric at the side of the frame, the jack operating at any angle. It has no trip, consequently its load cannot be dropped through carelessness. The adaptability of this jack has made it especially popular on electric railways.

In general, the jacks constructed by this company are made of high-grade carbon steel for the drop forgings and malleable iron castings. Owing to the simplicity of construction and interchangeability of all parts, replacements can be quickly made without the help of a skilled mechanic. These features have been chiefly instrumental in bringing this line of jacks into extensive use.

The Pennsylvania & Mahoning Valley Railway Company has announced a new schedule for all the lines in its city and interurban system radiating from Youngstown, and the schedule has been indorsed for trial by the City Council. It provides for ten, fifteen and twenty-minute headway on the various local lines and half-hourly headway on the interurban lines. Cars on the hour in both directions out of Youngstown will be limited cars, and will stop only at a few of the most important streets in Youngstown. This settles a long-standing dispute over the handling of local passengers by limited cars.

NEW RAILROAD CURVE PROJECTOR AND SCALE

The drafting instrument shown in Fig. 1 has recently been designed by Queen & Company, of Philadelphia, for drawing track work where curves of varying radii are required. This railroad curve projector and scale combines, in one, all the different curves required in the plotting and investigation of the alignment of a railway. The application and facilities offered by the use of this instrument will be apparent to the railway engineer, as explained in connection with Figs. 2 and 3.

Fig. 2 shows the curve projector as applied to plotting and fitting simple curves to the conditions shown on a contour map. Using proper care, the line may be put on the plan by aid of the curve projector, straight edge, triangle pencil and scale, or only the curve projector, pencil and scale; to get the notes for the field it would be necessary to check up the line as to central angles and pluses.

Fig. 3 illustrates the application of the curve projector to the plotting of compound curves. It facilitates the work by allowing the engineer the use of 1640 different combinations with the forty-one curves on the two sheets; he can also hold the combinations he is trying in a fixed position on the paper without marking the plan, thus saving the erasing which would result from the use of compass and curves.

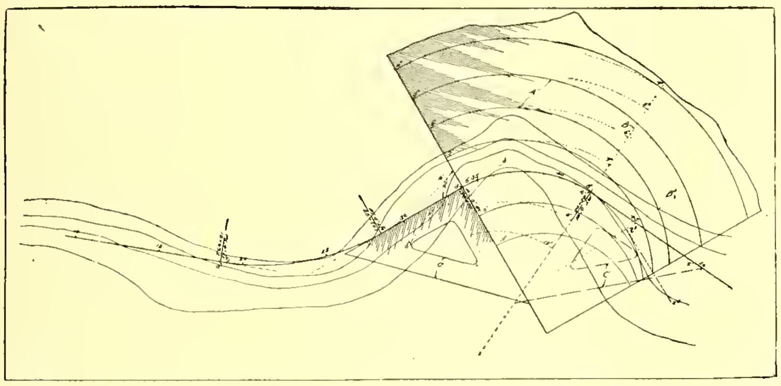


FIG. 2.—CURVE PROJECTION AS APPLIED TO PLOTTING AND FITTING SIMPLE CURVES TO CONDITIONS SHOWN ON A CONTOUR MAP

The curves are all carefully scaled. At each ½ in. along the curves an aperture is made large enough to allow the passing of a pin or pencil through the sheet, allowing the points to be transferred to the plan. A clamp is provided to hold the sheets together while any combination of curves is being made.

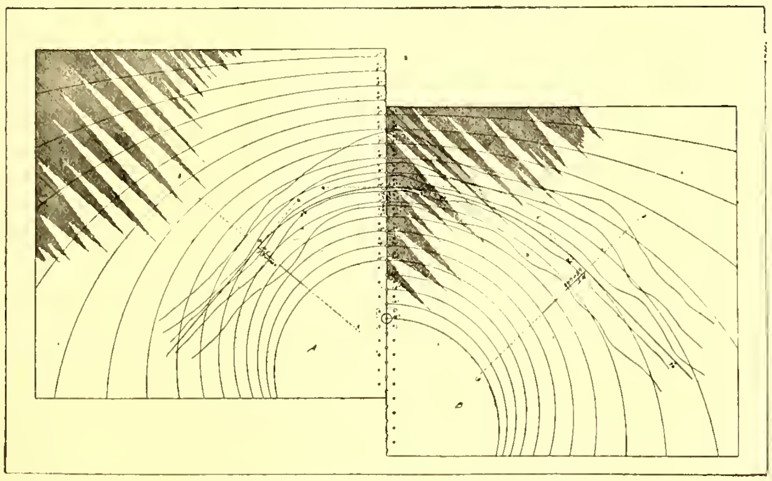


FIG. 3.—APPLICATION OF THE CURVE PROJECTION TO THE PLOTTING OF COMPOUND CURVES

The following figures will give some idea of the wide range of this instrument. There are forty-one different curves on each sheet, varying by fifteen minutes, and running from 0° 30′ to 10° 30′, for a scale of 1 in. equals 200 ft., or varying by thirty minutes, and running from 1° 00′ to 21° 00′, for a scale of 1 in. equals 100 ft.

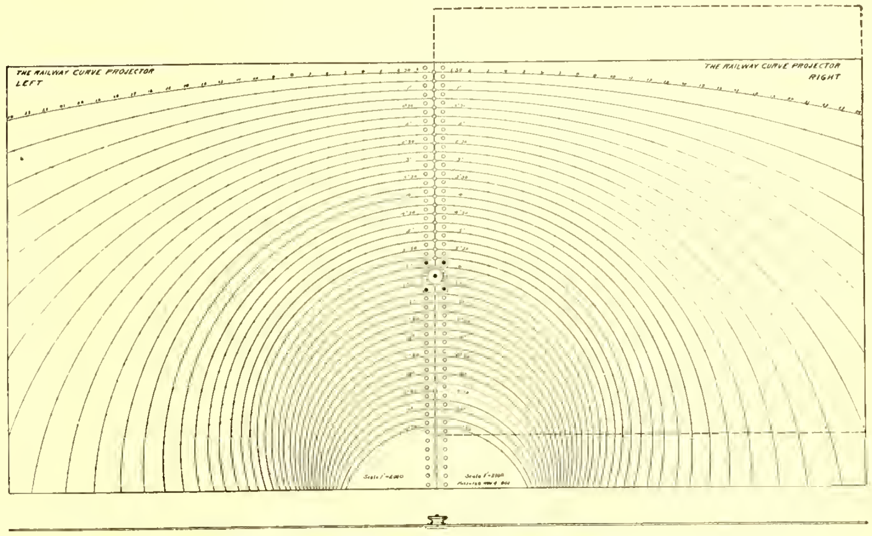


FIG. 1.—DRAFTING INSTRUMENT FOR DRAWING TRACK WORK OF VARYING RADII

DR. LOUIS DUNCAN LECTURES AT THE BROOKLYN POLYTECHNIC

The Brooklyn (N. Y.) Polytechnic Institute recently made arrangements with a number of specialists in different branches of electrical engineering to give a series of practical lectures in connection with their work. All of these lectures are given in the evening and are designed especially to fill the wants of operating men who are anxious to obtain a broader knowledge of their respective fields.

A course of eight two-hour lectures was also arranged on the subject of electric traction, to be given by Prof. Louis Duncan, the well-known railway expert. Mr. Duncan's first lecture, which was given on Feb. 15, was devoted to a general consideration of load factors and cost factors, including the presentation of a number of interesting load curves obtained in both city and interurban electric railway operation. The main point emphasized by the lecturer was that the percentage of load factor could not be taken as conclusive, but that it would first be necessary to study the character of the load factor, since two load factors of the same percentage might be due to entirely different causes. Dr. Duncan then showed how much copper would be required on a line with a given drop for different kinds of load factors.

The second lecture by Prof. Duncan will be given on March 2, and will be devoted to car and train resistance, track construction, interurban roads and city railways.

The Hocking Valley Railway (steam) is trying to overcome the competition of the electric lines between Marion, Columbus and Lancaster, Ohio, by selling a new form ticket good for two trips by one person in either direction, or for two persons in one direction, at about the same rate as for a single-trip ticket heretofore. It has also placed a thirty-ride ticket on sale which is transferable.

FINANCIAL INTELLIGENCE

WALL STREET, February 15, 1905.

The Money Market

The principal feature of the money market this week was the sharp advance in the price of sterling exchange at Paris to 25 francs, 21 centimes, and a decline of 15 points in the local rate for sterling to 4.8790. This, following upon the reduction in its discount by the Imperial Bank of Germany, and the expectations of a reduction in the Bank of England rate later in the week, were regarded as a forerunner of further ease in the European money markets. At the present rates of exchange gold exports to Paris are unprofitable, and unless the market develops decided strength it is unlikely that further shipments of the precious metal will be made by the end-of-the-week steamers. Gold, however, continues to be sent to Cuba in payment for Cuban bonds, but present indications are that the final consignment on this account will be made this week. Otherwise, the market was not materially changed. The tone was called firmer, but rates for all maturities were practically the same as those ruling at the close of a week ago. The demand for accommodations was not large, but at the same time there was no pressure of funds upon the market, the banks generally being disposed to strengthen their reserves by holding off in expectation of better returns. Call money was fairly active throughout the week at rates ranging from 1¾ to 2¼ per cent. In the time loan branch business was extremely quiet. On high-grade collateral five and six months' contracts were easily obtainable at 3¼ per cent, but where ordinary mixed securities were offered the borrower was obliged to pay 3½ per cent. There was no inquiry for the short periods, and rates were nominal at 2½ to 2¾ for sixty days, and 3 to 3¼ for three and four months. Prime mercantile paper continued in good demand, but the volume of business was somewhat restricted by the light offerings of choice names. Rates were unaltered at 3¾ to 4 per cent for the best double-named endorsements, and 4 to 4¼ for choice single names. The bank statement published last Saturday was unfavorable. There was a decrease in cash of $7,307,000, making the total loss sustained by the banks for the first half of February of $12,656,700. Loans increased $14,019,300 and deposits increased $5,992,000. The surplus reserve decreased $8,805,000 to $11,036,925, as against $20,379,225 in the corresponding week in 1904, and $15,529,675 in the same week of 1903. Open markets discount rates in Europe were firmer. At London the rate advanced 3-16 to 2⅝ per cent; at Paris the rate was 1 15-16, as against 15-16 a week ago, while at Berlin the rate stood at 1½ per cent.

The Stock Market

There was a noticeable falling off in the volume of business on the Stock Exchange this week, and although prices displayed considerable irregularity at times, the undertone was decidedly strong. During the early part of the week prices generally continued the upward movement, despite the passage by the House of the railroad rate bill, but subsequently reactions occurred throughout the list on selling by traders who were not disposed to carry too many stocks over the double holiday. On Saturday the selling from this source was renewed, and was helped by the unfavorable bank statement. On Tuesday the market opened strong, but became dull and heavy after the first hour. During the last hour the market started up violently under the lead of Union Pacific, which made a new high record. A factor of strength in all the railroad issues was the belief that the breach between the President and the Senate over the arbitration treaties would effectually prevent the President's desired railroad legislation. Other important factors were the improvements in the European markets, suggesting an early termination of the war between Japan and Russia, and the prospects of an early decision by the United States Supreme Court in the Northern Securities matter. The bond market was rather less active than a week ago, but prices generally ruled strong. The features were the Union Pacific convertible 4s, which made a new high record, and the Japanese war loan bonds.

The traction stocks were generally strong under the lead of Manhattan Railway, which responded to a heavy demand, and closed with a net gain of 2¼ points to 173¾. Metropolitan Street Railway was also strong, showing a gain of 1¼ to 122⅛. Metropolitan Securities and Brooklyn Rapid Transit were fairly active, but without material change in prices.

Philadelphia

Considerable activity developed in the local traction issues this week, and prices generally displayed decided strength. The feature of the trading was the unusually heavy trading in United Gas & Improvement, which was accompanied by a sharp advance in price on reports of valuable rights to be given to the stockholders. There were also rumors of a "deal" of some kind which included Philadelphia Rapid Transit. These rumors were subsequently denied by President Dolan of the first-named company. From 109½, at the opening, United Gas & Improvement declined to 108½, but subsequently the price rose sharply to 115. At the close there was more or less profit-taking, on account of the double holiday, which, together with the official denial of pending deals, caused a reaction of 1⅜ points from the highest. About 30,000 shares were dealt in. Philadelphia Rapid Transit was extremely active and buoyant. From 26⅝, the price ran off to 26, but later, on heavy buying, said to be for New York interests, there was a rise of 3½ points to 29½. At the close there was a reaction of ⅝. Upward of 72,000 shares changed hands. American Railways was also strong, with sales at 51. Philadelphia Company rose from 42 to 43 and closed at 42½, while the preferred declined from 47½ at the opening to 45, and subsequently to 46¾. Philadelphia Traction was exceptionally quiet, the trading for the most part being confined to odd lots at prices ranging from 100½ to 101. Other transactions included odd lots of Consolidated Traction of New Jersey at 82¼ to 82, United Companies of New Jersey at 273½, Union Traction at 58¾ to 59. United Railways of San Francisco at 31⅜ to 31, and of the preferred stock at 79½ and Railways General at 3⅞.

Chicago

Trading in the street railway shares were unusually quiet this week, the market for them reflecting the extreme dullness prevailing in other quarters of the market. Dealings included a very small number of issues, but prices were not materially changed from those prevailing at the close of a week ago. North Chicago held firm at 98, and small lots of Chicago Union Traction brought 13. Of the Elevated Railway shares, Chicago & Oak Park and South Side Elevated were strong, over 1000 shares of the first-named changing hand at 6½ to 6⅞, while several hundred shares of the latter brought 95 to 95⅛. Northwestern brought 62 for small amounts. Metropolitan issues were quiet and steady, pending the meeting of the directors, the latter part of the week, to take action on the preferred stock dividend. It is said that the company could make a distribution of 5 per cent, and still have a surplus of $230,000, the same amount it had on hand a year ago.

Other Traction Securities

The overshadowing feature of the Baltimore market was the extraordinary activity and strength in United Railway incomes. The demand for this issue was extremely heavy during the early part of the week, causing an advance from 55⅛ to 58. At the close profit-taking carried the price off 1½ points. Upward of $400,000 changed hands. There was no news to explain the advance. The 4 per cent bonds were extremely quiet and firm at 95¼ to 95½, while several hundred shares of the stock brought 13½ to 14¼, the closing transaction taking place at 14. Norfolk Railway & Light 5 per cents brought 94 to 94¼ for about $10,000. The Boston market was dull and irregular. Boston Elevated advanced a point, about 1000 shares selling at from 155½ to 156½. West End common and preferred sold at 95½ to 96 and 115 to 115½, respectively. The Railroad Commissioners have authorized the West End Street Railway Company to issue $200,000, 4 per cent, thirty-year bonds, and the Worcester & Holden Street Railway Company to issue $25,000 5 per cent, twenty-year bonds. Massachusetts Electrics were conspicuously weak, the common declining from 15⅛ to 13½, and the preferred from 59½ to 55½. Trading in Interborough Rapid Transit stock on the New York curb has been considerably less animated, but price movements have been more or less erratic. From 217 at the opening there was an advance to 222, but toward the close the price reacted to 215, or 10 points below the high price attained in the previous week. There was no news to explain the decline. New Orleans Railway common sold at 3⅝, and the preferred at 13¾. The new stock "when issued" was dealt in for the first time at from 15 to 16. Washington Railway & Electric 4s held strong, $21,000 selling at 87.

Traction bonds featured in the trading at Cincinnati last week. The 4s of the Indianapolis Street Railway sold to the extent of

$175,000, repeating the performance of the previous week. Cincinnati, Dayton & Toledo 5s sold at 86½ to 87½ for $45,000 worth. Columbus Railway 4s sold at 92½ for $35,000 worth. Cincinnati, Newport & Covington second 5s at 109 for $17,000 worth. The common stock of this company sold at 31¼ and the preferred at 9½. Detroit United sold at 77 and Cincinnati Street Railway at 141½.

Cleveland Electric moved up to 85 at Cleveland. Northern Texas Traction advanced to 48 on small lots, and little is to be had at near this figure. Northern Ohio Traction & Light sold at 18⅞ to 19¼. Northern Texas Traction 5s to the amount of $116,000 worth at 93½ to 95. Aurora, Elgin & Chicago 5s, to the amount of $26,000, sold at 81½ to 83. Western Ohio 5s sold at 73 to 74, and Cincinnati, Dayton & Toledo 5s at 86⅜.

Security Quotations

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

	Feb. 8	Feb. 15
American Railways	50½	50
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	155	*155
Brooklyn Rapid Transit	62⅛	62¼
Buffalo Con. 5s	109	109½
Buffalo Deb. 6s	104	104½
Chicago City	198	198
Chicago Union Traction (common)	12¾	11¾
Chicago Union Traction (preferred)	51	50
Cleveland Electric	81	83
Consolidated Traction of New Jersey	80	—
Consolidated Traction of New Jersey 5s	109	110
Detroit United	77½	78½
Interborough Rapid Transit	217½	217
Lake Street Elevated	—	—
Manhattan Railway	171¼	173⅝
Massachusetts Electric Cos. (common)	15	13½
Massachusetts Electric Cos. (preferred)	59½	55
Metropolitan Elevated, Chicago (common)	21⅛	20½
Metropolitan Elevated, Chicago (preferred)	60	60
Metropolitan Street	120½	122¼
Metropolitan Securities	81⅞	81¾
New Orleans Railways (common)	3¼	3
New Orleans Railways (preferred)	13	12⅛
New Orleans Railways, 4½s	79	a81
North American	103¼	103¼
Northern Ohio Traction & Light	—	—
North Jersey Street Railway	22	22½
Philadelphia Company (common)	41¾	41¾
Philadelphia Rapid Transit	25¾	28½
Philadelphia Traction	100	100½
South Side Elevated (Chicago)	94½	94½
Third Avenue	130	132
Twin City, Minneapolis (common)	105⅝	105½
Union Traction (Philadelphia)	58¾	58¾
West End (common)	95¼	96
West End (preferred)	115	115

* Ex-div. a Asked.

Iron and Steel

The "Iron Age" says it is estimated that in the past ten days leading Southern producers have sold 100,000 tons of pig iron, of which 40,000 tons was taken by a large firm of merchants. The extraordinary statistical position has aroused much interest, and buyers are inclined to cautiously feel the market for deliveries well into the third quarter. The position of the United States Steel Corporation is shown by the fact that a few days since a lot of 65,000 tons of pig iron was bought for immediate shipment to the Lorain steel plant. This comes on the heels of recent buying, which was supposed to have taken care of the February needs. It is important that the Illinois Steel Company is withdrawing as a seller. Some good additional orders have come in for steel rails; the Illinois Steel Company now has 425,000 tons on its books. Tin plate mills are running to their full capacity, and yet they are getting behind in deliveries. Premiums are appearing and the trade expects an advance.

The four-cent plan of operation of the Cleveland Electric Railway Company, referred to elsewhere in this issue, has been abandoned by the company as unprofitable, and it is not likely that any further low-fare tests will be made. At the time of going to press President Andrews, of the company, had not made public the result of the trials. He will, however, make a report in full within a few days.

THE APPLEYARD SITUATION

It is rumored that application will soon be made to the court to raise the receivership of the Dayton, Springfield & Urbana, Columbus, London & Springfield, Urbana, Bellefontaine & Nothern Electric Railways, and the other properties of the Appleyard syndicate now in the hands of receivers, and that the systems will be reorganized and placed in charge of Guy Morrison Walker. A plan whereby the roads may be consolidated is also said to have been agreed upon. Mr. Walker is regarded as an expert in matters interurban. He formerly was connected with the Everett-Moore syndicate, and is well known throughout Ohio, Indiana and Michigan and in New York.

At a meeting of stockholders of the Appleyard properties held in Springfield a few days ago, officers were elected as follows:

Dayton, Springfield & Urbana—Directors, A. E. Appleyard, Boston; W. R. Pomerene, Columbus; Adam Newsalt, S. H. Carr, Dayton; J. S. Harshman, C. A. Alderman, Springfield; C. C. Williams, Columbus; president, A. E. Appleyard; vice-president, S. H. Carr; secretary, W. R. Pomerene.

Columbus, London & Springfield—Directors, A. E. Appleyard, W. R. Pomerene, Adam Newsalt, H. L. Dowd, Columbus; C. C. Williams, J. S. Harshman and C. A. Alderman.

Urbana, Bellefontaine & Northern—Directors, A. E. Appleyard, W. R. Pomerene, Theodore Stebbins, W. T. Haviland, A. J. Miller, W. R. Nevin, Bellefontaine; C. A. Alderman.

The officers of the last two companies were not elected.

The Ohio River & Western Railway, another Appleyard property, has been thrown into the hands of a receiver. This is the steam road which Mr. Appleyard bought and proposed to electrify, making it a part of a system crossing Ohio. The Farmer's Loan & Trust Company, of New York, made application for the receiver. It claimed it held $600,000 worth of Appleyard bonds, on which no interest had been paid for eighteen months. J. K. Geddes, of Zanesville, general manager of the road, has been appointed receiver.

INTERBOROUGH REPORT FOR QUARTER AND SIX MONTHS

The Interborough Rapid Transit Company, operating the elevated and the subway lines in New York, has made public a report of operations for the quarter and for the six months ended Dec. 31, 1904. The passengers carried in the last quarter were 16,245,582 in excess of the number for the corresponding quarter in 1903, and gross earnings for the quarter increased $815,145. Surplus for the quarter, after all charges and the guaranteed dividend on Manhattan, decreased $310,766, but amounted to $439,569, indicating a surplus for the year of about $1,800,000, or just about enough to pay 5 per cent on the capital stock of the Interborough Company. The statements follow:

Quarter ended Dec. 31:	1904	1903
Gross receipts	$4,472,855	$3,657,700
Operating expenses	1,888,087	1,396,395
Net earnings	$2,584,768	$2,261,314
Other income	96,015	85,599
Total income	$2,680,783	$2,346,913
Charges	999,213	768,579
Balance	$1,681,570	$1,578,334
Manhattan guaranteed dividend	828,000	828,000
Balance	$853,570	$750,334
Extra dividend Manhattan	414,000	......
Surplus	$439,570	$750,334
Passengers carried	90,105,066	73,859,484
Six months ended Dec. 31—	1904	1903
Gross receipts	$7,705,804	$6,596,463
Operating expenses	3,257,181	2,704,016
Net earnings	$4,448,623	$3,892,447
Other income	175,013	165,886
Total income	$4,623,636	$4,058,333
Charges	1,702,756	1,437,054
Balance	$2,920,880	$2,621,279
Manhattan guaranteed dividend	1,932,000	1,932,000
Surplus	$988,880	$689,279
Passengers carried	155,557,130	133,302,788

BROOKLYN RAPID TRANSIT REPORT FOR YEAR ENDED DEC. 31, 1904

The results of the operations of the Brooklyn Rapid Transit system for the year ending Dec. 31, 1904, were presented by the company in reply to the New York Stock Exchange for the listing of its first refunding bonds. These figures compare with those presented on a similar occasion a year ago, for the operations during 1903, as follows:

	1904	1903
Gross earnings	$15,459,660	$14,025,825
Operating expenses	9,261,916	8,392,607
Net earnings	$6,197,744	$5,633,218
Other income	237,141	207,522
Total net earnings	$6,434,885	$5,840,740
Taxes and charges	4,961,614	4,702,514
Balance	$1,473,271	$1,138,226
Additional improvements	844,909	338,611
Balance surplus	$628,362	$799,615
Surplus, Dec. 31, 1903	2,657,726	
Total surplus	$3,286,088	
Discount on bonds sold, old accounts, adjustments	1,158,852	
Surplus	$2,127,236	

The following is a consolidated general balance sheet as of Nov. 30, 1904, of Brooklyn Rapid Transit Company and constituent companies:

ASSETS

Cost of road and equipment		$101,046,143
Advances account of construction for leased companies		6,711,126
Construction expenditures, constituent companies		1,331,712
Guaranty fund—securities and cash		4,005,755
Treasury bonds		6,905,000
B. R. T. first ref. gold mortgage, 4 per cent	$6,795,000	
Other issues	110,000	
Treasury stock		146,228
Current assets		1,792,895
Cash on hand	$481,442	
Due from companies and individuals	368,232	
Construction material and general supplies on hand	784,798	
Prepaid accounts	158,421	
Bond discount		346,800
Total		$122,285,660

LIABILITIES

Capital stock		$45,959,605
Bonded debt and real estate mortgage:		
B. R. T. Company		23,795,000
Bonded debt of constituent companies		45,866,140
Brooklyn Heights Railroad Company	$250,000	
Brooklyn, Queens County & Suburban Railroad Company	6,624,000	
The Nassau Electric Railroad Company	15,000,000	
Sea Beach Railway Company	650,000	
Brooklyn Union Elevated Railroad Company	23,000,000	
Real estate mortgages	342,140	
Current liabilities		4,516,175
Loans and bills payable	$1,250,000	
Audited vouchers	626,168	
Due companies and individuals	89,185	
Taxes accrued and not due	1,293,193	
Interest and rentals accrued and not due	1,205,443	
Interest accrued on real estate mortgages and not due	755	
Insurance reserve fund	51,428	
Long Island Traction trust fund		9,439
Accounts to be adjusted		17,922
Surplus		2,121,337
Total		$122,285,660

THE TUNNEL FROM NEW YORK TO LONG ISLAND CITY

From information now to hand the Belmont interests have been quietly at work perfecting the plans for building the subway from Forty-Second Street, Manhattan, to Long Island City, of which mention was first made in the STREET RAILWAY JOURNAL several months ago. It seems that the consents have all been obtained of property owners on Forty-Second Street, and that a terminal has been acquired in Long Island City for the road. This terminal is to be on the block between Fourth and Fifth Streets, upon which formerly stood the plant of the Smith Varnish Works. It is here that the work has been begun of sinking shafts for the tunnel under the river. The plan for the new road as generally admitted to be authentic is for a line from the Grand Central Station, in New York, at a connection with the subway in that city by way of Forty-Second Street and thence under the East River to Long Island City, where connections could be made with the New York & Queens County Railway Company, operating to Jamaica, Flushing and other places in Queens County. As Mr. Belmont's connection with the Queens County Company is generally admitted, and as he is president of the Interborough Rapid Transit Company, operating the subway lines in New York, it is evident that the connection between the two systems that the new line would supply would tend greatly to develop the territory through which the New York & Queens County Company operates. The tunnel is to be built under the grant made to Mr. Steinway, of Long Island City, long ago.

BILLS BEFORE THE CONNECTICUT LEGISLATURE

Of matters before the Connecticut Legislature there are several concerning the incorporation of new companies that are of interest. The bill that, perhaps, is causing the most discussion is the one looking toward the revival of the project of building an electric railway from New Haven to Hartford by way of Middletown, thus paralleling the New York, New Haven & Hartford Railroad. This project was first before the Legislature several years ago. The plan was for one set of interests to incorporate two companies to build the road, one company to carry out the work between New Haven and Middletown, and the other between Midletown and Hartford. Now it seems that only one company is proposed. It will be known as the Hartford, Middletown & New Haven Railroad Company. Cornelius J. Danaher, of Meriden, presented the application to the Legislature. Inasmuch as the New York, New Haven & Hartford Railroad has fortified itself so well in the territory through which the proposed road is to build, by the purchase of existing systems, there is considerable speculation as to the significance of the new application.

Another application receiving considerable attention is from the Norwalk, Bridgeport & Bethel Traction Company for an extension of time in which to organize and build its lines. This company was chartered in 1901, and was given permission to build an electric railway from Norwalk to Bethel, thence to Easton and to the outskirts of Bridgeport, there to connect with the lines of the Connecticut Railway & Lighting Company.

The Lebanon Street Railway Company, a petition for the incorporation of which is now before the committee on railroads, proposes to build from the Chestnut Hill station, on the Air Line division of the New York, New Haven & Hartford Railroad Company, through Lebanon, Liberty Hill, Franklin, Bozrah, Fitchville and Yantic, to connect with the line of the Norwich Street Railway in Norwich. The incorporators are: N. C. Barker, W. L. L. Spencer, Frank P. Fowler, George H. Hewitt, Isaac J. Gillette, L. P. Smith, L. E. Livermore, S. W. Thropp, Dr. E. L. Danielson, J. H. King, George E. Manning. The charter also provides for the right to sell and distribute electricity for lighting and power purposes.

Improvements of an important character to the Hartford Street Railway are provided for in a bill from that company which seeks an increase of stock from $2,000,000 to $5,000,000, and asks an extension of time to July 1, 1907, in which to build from Broad Street, Hartford, to Wethersfield. The increase in stock is to be used for general improvements to the system. Cited as among these improvements are considerable track work, the building of a power house, and the erection of repair shops and car houses. Another bill of concern to this company is from the Hartford & Glastonburg Railway Company, of which the Hartford Company is the owner, for permission to increase its capital stock from $200,000 to $1,000,000. The plan is to unite under the charter of this company all the lines owned by the Hartford Street Railway Company on the east side of the Connecticut River.

RAILROAD COMMISSIONERS' RECOMMENDATIONS FOR BROOKLYN

The recommendations of the Railroad Commissioners of New York for reforms looking to the improvement of transit facilities in Brooklyn urge that several tunnels be built between New York and Brooklyn and that the Brooklyn and the Williamsburg Bridges be connected by an elevated structure to relieve congestion of traffic at the terminals of these structures. The Poulson plan for relieving congestion at the terminal of the Brooklyn Bridge in New York, which has been given considerable attention by municipal bodies, and in a short test proved to be a failure, is not approved by the Commissioners. The recommendations to the Brooklyn Rapid Transit Company are general in their character, and in many instances are merely for expediting work already under way. The lengthening of platform on the elevated structure, one of the recommendations of the board, is practically completed on the Fifth Avenue line, and will be extended to the other lines at once. Perhaps the most important recommendation is that for the third-tracking of the elevated structure so that express service may be operated. This work would require the removal of a number of "island" stations, but would provide outlying districts with a means of ready transit that would tend to develop the territory rapidly.

MONTEREY ELECTRIC TRACTION DEAL

William Mackenzie, president of the Toronto Railway Company and other electric traction systems in Canada, who is also primarily interested in the Sao Paulo Tramway, Light & Power Company, of Sao Paulo, Brazil, and other South American electric traction enterprises, has concluded arrangements for the purchase of the existing horse car lines, and what is known as the Mackin & Dillon concession, in and around Monterey, the Pittsburg of, and one of the principal cities in, Mexico. About 30 miles of track will be converted into electric lines, in the first instance, at an estimated cost of about $1,250,000. The construction work will begin in about two months, under charge of Mr. Keating, of Toronto, who has just returned from Mexico, after making an exhaustive examination of the situation. It is the intention, ultimately, of the new interests to build and operate upwards of 50 miles of electric tramways in the Mexican city and suburbs.

The Ferrocarriles de Monterey y Topo Chico—a horse road, formerly controlled by the Hayden family, the president of the company being ex-Congressman G. W. Hayden, of the financial house of G. W. Hayden & Company, of 50 Broadway, New York City—is included in the deal. This system is about 15 miles in length. It runs from Monterey to Topo Chico. Included in the purchase of the Hayden line is a long lease of the park, baths and pavilions at Topo Chico. A hotel of large size will be built by the new interest, the bath-house accommodations will be enlarged, new pavilions are to be constructed, and other up-to-date improvements will be brought about.

The Ferrocarriles Urbano de Monterey "Empresa Mexicana," S. A., has also been bought. This system's operations are at present confined to Monterey proper. Francisco Belden, the president of one of the big British-Mexican financial institutions, was the prime factor in the "Empresa." It is a mule line, about 24 miles long.

The concession held by the American contracting firm of Mackin & Dillon, which, as previously stated, has now become the property of the Mackenzie interest, permits of the construction of about 15 miles of lines in Monterey and to one of its principal suburbs. The purchase price, on a cash basis, for the Hayden & Empresa systems, and the Mackin & Dillon concern, is in the neighborhood of $450,000 gold.

There have been various unsuccessful projects within the last three years to buy up the Monterey horse lines and convert them into electric traction. Late in 1902, the late Baltimore financial house of Sperry, Jones & Company secured options on the systems but were unable to finance the scheme. The same fate attended the efforts of a Philadelphia syndicate, which some months ago endeavored to float the undertaking in New York. Edward F. Walker, of Philadelphia, was one of the principals in the scheme.

At time of writing, it is not known definitely whether Mr. Mackenzie intends to build and operate the new system alone, or whether he is acting on behalf of the powerful Canadian capitalists who control the Sao Paulo Tramway Light & Power Company, the Havana Electric Railway Company, the West India Electric Company, Limited, of Kingston, Jamaica; the Trinidad Electric Company, Limited, of Port au Spain, Trinidad, British West Indies; the Mexican Light & Power Company, and the Rio Janeiro Tramway Light & Power Company. At any rate, Mr. Mackenzie, who left last week for Europe, to be gone for about six weeks, is one of the most influential capitalists in the Dominion, so that from a monetary standpoint, there seems no reason why Monterey should not have, for the third time of asking, an extensive up-to-date electric traction system. The purchases of equipment, etc., will in all probability be made through F. S. Pearson's office, 29 Broadway, New York City.

CLEVELAND LOW-FARE INJUNCTION MADE PERMANENT

The Cleveland Electric Railway Company has scored a decided victory over the Forest City Street Railway, the so-called 3-cent fare company, for Judge F. J. Wing, in the United States Circuit Court, has made permanent the injunction prohibiting the Forest City Company or the city from taking possession of the Woodland Avenue and the Kinsman Street routes for 3-cent fare lines. The Forest City Company was granted a franchise over these routes to start Sept. 20, 1904, the date Mayor Johnson and the city administration claim the franchise of the Cleveland Electric Railway Company expired. A temporary restraining order was secured by the latter, which has now been made permanent. The court established the allegation that the franchise in contention does not expire until Feb. 10, 1908. The case will probably be appealed to the Supreme Court of the United States.

REORGANIZATION OF THE NEW ORLEANS COMPANY

Details are announced of the plan of reorganization of the New Orleans Railways Company, prepared by the reorganization committee in the interest of the security holders of the company. A new company will be created under the laws of Louisiana, or such other State as the committee may deem desirable, or an existing charter or company will be used for the purpose of reorganization. This new company will authorize an issue of $30,000,000 thirty-year 4½ per cent gold bonds, $10,000,000 non-cumulative 5 per cent preferred stock, and $20,000,000 common stock, making the total capital liabilities $60,000,000.

Of the total of $30,000,000 bonds, $12,821,500 is to be reserved to retire underlying bonds of constituent companies, $13,356,750 is to be issued to depositing bondholders at the rate of 75 per cent of bonds deposited, and $3,818,750 is to be reserved for betterments, improvements and the general business purpose of the company. These bonds, as previously stated, are to bear interest at the rate of 4½ per cent, payable semi-annually. They are to be of the denomination of $1,000 each, and are to be redeemable at the option of the company on any interest-payment date, upon sixty days' notice, at 105 and interest.

The preferred stock of $10,000,000 is to be entitled in preference and priority over the common stock to non-cumulative dividends up to but not exceeding 5 per cent per annum, said preferred stock to be entitled to no other or further share of the profits. No dividends shall be declared or paid on the common stock of the company in any year until the full 5 per cent (5%) dividend is declared on the preferred stock for such year. This preferred stock is to be applied as follows: To depositing bondholders to the amount of 25 per cent (25%) of the deposited bonds, $4,452,250; for subscription by depositing preferred stockholders, $1,758,480; for subscription by depositing common stockholders, $2,758,890; at disposition of reorganization committee for purposes of the reorganization, $1,030,380; total, $10,000,000.

Of the $20,000,000 of common stock, $8,792,400 is to go to depositing preferred stockholders to the amount of 100 per cent of deposited preferred stock; $9,656,115 is to go to common stockholders to the amount of 35 per cent of the deposited common stock, and $1,551,485 is to be at the disposition of the reorganization committee for purposes of reorganization.

Depositing bondholders shall be entitled to receive for each $1,000 par value of bonds, with coupons due Jan. 1, 1905, and subsequent annexed, deposited by him: Cash to amount of interest due Jan. 1, 1905, on deposited bonds, $22.50; new bonds to the par value of $750.00; new preferred stock to the par value of $250.00. Depositing preferred stockholders shall be entitled to subscribe for and to receive in respect of each share of preferred stock (par value, $100) deposited by him and upon payment of $20: One-fifth of a share of new preferred stock of a par value of $100 per share; one share of new common stock. Depositing common stockholders shall be entitled to subscribe for and to receive in respect of each share of common stock (par value, $100) deposited by him and upon payment of ten dollars ($10): One-tenth of a share of new preferred stock at a par value of $100 per share; thirty-five one-hundredths of a share of new common stock of a par value of $100 per share. Securities are to be deposited on or before Feb. 28, 1905, with the New York Security & Trust Company, depository, New York City.

CAR HOUSE FIRE IN NEW YORK

The car house of the New York City Railway Company on the block between Eighth and Ninth Avenues, Fifty-Third and Fifty-Fourth Streets, New York, was gutted by fire early Thursday evening, Feb 9, entailing a loss to the building and its contents estimated at about $175,000. In the car house at the time of the fire were stored some 75 cars of Columbus, Sixth and Ninth Avenue lines. Of this number 40 are said to have been burned. The flames were first discovered by employees of the company issuing from one of the cars. An alarm of fire was turned in, and an effort was made by the employees of the company to check the progress of the flames. The department was slow in responding, for it had stormed all day and the streets were well-nigh impassable. Second and third alarms brought forty pieces of apparatus to the scene of the conflagration.

DISCUSSION ON TWO-MOTOR AND FOUR-MOTOR EQUIPMENTS

A paper on the above subject is scheduled for the next meeting of the American Institute of Electrical Engineers, to be held in the chapter room, Carnegie Hall, New York City, on Feb. 24. It will be presented by N. McD. Crawford, general manager of the Hartford Street Railroad Company, of Hartford, Conn.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEB. 7, 1905

781,639. Railway Signal; Frank L. Dodgson, Rochester, New York. App. filed March 27, 1903. Relates to that class of signal comprising a counting device at each block for counting-in and counting-out cars in a block.

781,651. Stringer Support for Electric Third Rails; Frank E. Kinsman, Plainfield, N. J. App. filed July 28, 1903. Comprises a stringer of wood provided with a conductor attached thereto and with sockets to receive the heads of insulator pins which support the stringer.

781,721. Guard for Trolley Wheels; Merwin M. Hart, Chicago, Ill. App. filed April 15, 1904. Idler wheels mounted on each side of the trolley wheel have inwardly directed lugs which retain the wire on the wheel.

781,740. Fender for Cars; Jesse T. Rice, Grand Rapids, Mich. App. filed Dec. 26, 1903. The body of the fender consists of a yieldable surface connected at one end thereof and the other end connected to a roller, a tension device for the roller and means for controlling the reaction of the tension device.

781,785. Circuit Controller; Louis Pfingst, Boston, Mass. App. filed April 4, 1904. The circuit controller handle is mounted upon an ordinary brake handle and can be actuated with the latter.

781,835. Switch Operating Mechanism; Joseph P. Lowe, South Seattle, Wash. App. filed May 4, 1904. Details of construction.

781,902. Street Car Fender; James J. O'Dell, Erie, Pa. App. filed Sept. 17, 1904. Relates to a fender which may be readily attached to the ends of a car and which may be folded up in front of the car so as to occupy small space.

781,931. Means for Protection Against Short Circuits; Charles E. Barry, Schenectady, N. Y. App. filed July 15, 1904. In case a short circuit occurs between the collector shoe and the car truck, a circuit breaker is caused to automatically cut out that section of the feeder supplying the shoe.

781,953. Brake; Sheshbazzar Kennedy, Riverview, Pa. App. filed Aug. 3, 1904. Relates to the manner of mounting and applying a combined wheel and track brake.

781,962. Trolley; Edward H. Miller, Pittsburg, Pa. App. filed Sept. 30, 1904. Spirally grooved cylinders each side of the trolley wheel, the grooves serving to conduct the wire toward the wheel in case it leaves the same.

781,984. Magnetizable Conductor Conduit System; William J. Alexander, Philadelphia, Pa. App. filed July 1, 1904. A magnetizable conductor in a closed conduit, the conductor being divided into convenient lengths for removal should any one length become damaged, and devices for taking up slack in the conductor, and for securing the ends of the cable divisions.

781,991. Car Fender; Louis A. Bechtel, Jr., Benwood, W. Va. App. filed Sept. 23, 1904. Relates to a novel manner of mounting the fender.

781,993. Circuit Closer; Walter J. Bell, Los Angeles, Cal. App. filed Oct. 9, 1903. A magnet carried by the car lifts a body of iron filings into bridging contact with two terminals in order to close the circuit between the car and a signal to be actuated.

782,007. Third Rail; Leonard T. Crabtree, Cranton, Wis. App. filed April 14, 1904. Details.

782,195. Trolley Pole Controller; Clarence V. Greenamyer, Los Angeles, Cal. App. filed Feb. 4, 1903. Pneumatic pressure maintains the wheel in proper contact with the wire and the pole is withdrawn in case the wheel leaves the wire.

PERSONAL MENTION

MR. EDWIN T. AISTHORPE has been elected superintendent of the Cairo Electric & Traction Company, of Cairo, Ill., to succeed Mr. Edwin W. Halliday, resigned.

MR. N. C. DRAPER has accepted the position of manager of the street railway and lighting department of the Cleveland office of the Westinghouse Electric & Manufacturing Company. Mr. Draper has previously been connected with operating companies, among them the Peoria & Pekin Terminal Railway, the Central Railway, of Peoria, the Joliet Street Railway, the Chicago City Railway, and the Independent Light & Power Company of Quincy, Ill.

MR. A. S. RICHEY, electrical engineer of the Indiana Union Traction Company, has recently had his duties extended to include charge of track as well as electric transmission and distribution, his title now being chief engineer. Mr. Richey has planned and carried out the electrical transmission and distribution system for all the Indiana Union Traction Company's work the past four years and has made a practical study of the actual daily performance of the systems that has been of benefit to his company and the electric railway business at large.

MR. H. S. REYNOLDS, who for the last four years has managed the Columbus Railway Company, of Columbus, Ga., which owns the street railway, electric light and gas properties in that city, has resigned from the company to accept a position in the operating department of J. G. White & Company, of New York. Before going to Columbus, Mr. Reynolds was connected with the Brockton Street Railway Company, of Brockton, Mass., in charge of construction. He is a graduate of the Massachusetts Institute of Technology, class of 1894, and since graduation has devoted his entire time to the construction and operation of street railway, electric light and gas plants.

THE WILKESBARRE & HAZLETON RAILWAY COMPANY and the Lehigh Traction Company, of Hazleton, Pa., announce changes in the officers of the companies. Effective Feb. 1, Mr. C. J. Kirschner was elected comptroller of the Wilkesbarre & Hazleton Railway Company; Mr. C. B. Houck, general superintendent and purchasing agent, with offices at Hazleton; Mr. A. F. Harger, superintendent of transportation, with offices at Hazleton. The office of traffic manager was abolished. Effective Feb. 1, Mr. C. J. Kirschner was elected secretary of the Lehigh Traction Company; Mr. C. B. Houck, general superintendent, with offices at Hazleton; Mr. A. F. Harger, superintendent of transportation.

MR. L. S. WELLS, whose appointment as electrical superintendent of the Long Island Railroad Company was announced in the last issue of this paper, has had charge, for the past twelve or thirteen years, of all of the electrical work of that company, including the various isolated electric railway, lighting and power plants. During this time his title has been that of superintendent of telegraph, although the actual telegraph service formed only a small part of the department under his charge. Mr. Wells has had an experience in electrical work, both constructive and operative, extending over some seventeen years. His first work was in the telegraph field as operator, and in the electrical testing department. Since the year 1890 his duties have covered the installation and operation of electric generating plants, and he has grown up with this class of machinery. In 1892, as stated, he became superintendent of telegraph of the Long Island Railroad, and as the various trolley lines now owned by the Long Island Railroad were acquired or constructed by that company they became part of this department. In this way Mr. Wells has had immediate supervision and has been electrical superintendent of the Huntington Railroad, the Northport Traction Company, the Nassau County Railway Company, the Ocean Electric Railway Company, and the trolley lines operated over the Long Island Railroad Company's tracks. The extensive electrification of the Long Island Railroad, which has been described in recent issues of this paper, made necessary additions to the duties of departmental heads, and the creation of the office of electrical superintendent. In the new organization of this work the maintenance of the contact rail and track bonding is assigned to the maintenance of way department, the maintenance of rolling stock, including motor equipments, comes under the mechanical department, while the preparation of plans, specifications, etc., for extensions and new equipment, and the making of all electrical tests is placed under the electrical superintendent. In addition to his other duties, Mr. Wells also has charge of the maintenance and operation of power houses, sub-station equipments, transmssion lines, electric lighting, telegraph and telephone lines, etc.

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1903, *to date,* 66,750 *copies—an average of* 8344 *copies per week.*

The Ideal Shop

The publication of the official proceedings of the American Railway Mechanical and Electrical Association, with its accompanying diagram of a proposed shop plan drawn on the blackboard during the convention by W. O. Mundy, makes it appropriate to call attention to some of the merits of that plan. The plan provides for a repair shop having a long row of repair tracks placed at an angle to the wall of the building. The plan has a great many points to recommend it. In the first place, it does away with the objectionable transfer table, as the repair tracks leave by an easy curve to a main track running the length of the building on one side. This track may be either outside or inside the building, but preferably inside, as this would make it necessary to have only one or two entrance doors. With the transfer table there must be an entrance door for every track, unless the transfer table is enclosed, which makes a very expensive arrangement as well as an unsafe one from an insurance standpoint. The arrangement of tracks diagonally with each one connecting to the main supply track also makes it possible to switch trailers and disabled motor cars on to repair shop tracks without having recourse to the awkwardness of maintaining a gang of car pushers or special winding drum apparatus for pulling in dead cars.

Excursion Rates and Regular Traffic

An important point was briefly touched upon at the Anderson meeting of the Indiana Electric Railway Association, namely, the effect that low excursion rates on certain days may have on the regular traffic of an interurban road. This is a matter about which it is difficult to theorize, and we should have at hand some exact figures covering a large amount of experience before drawing any conclusions. But it is well to remember in planning excursion rates on interurban roads that they may have an effect on the regular traffic. It is obviously false economy to put on a low rate excursion on Wednesday which will rob the regular business of Tuesday and Thursday which is carried at the full rate. With the low rates which are common on interurban roads great reductions in fare for excursions are not usually advisable. The interurban road is usually in a position where it gets the traffic anyway on special holidays and the like, provided there are special attractions. Reducing the fare, of course, means that more people must be handled and a greater operating expense incurred for given gross receipts. Unless the net receipts are to benefit by an excursion rate, it had better not be made. Excursion rates given on days when the traffic is bound to be extra heavy anyway may be a decided detriment by so overloading the traffic carrying capacity of the road as to cause general discomfort and dissatisfaction, with no corresponding gain in net receipts. The object of the excursion rate should be to encourage traffic which would not otherwise come to the road. There are a great many people in the world who like "bargain counters," and a reduction in fare, even if it be small, will attract them. The necessity for low excursion rates will depend very much on local conditions. If a road has a pleasure resort which will attract Sunday and holiday traffic, and at which special attractions can be occasionally given, this will be an inducement to travel which will largely take the place of low rates. If the lines of a company are absolutely without such attractions, it may be desirable to offer excursion rates at times when traffic would otherwise be very light. The plan adopted by the Indianapolis & Northwestern, as mentioned at the Indiana convention, just referred to, is to give a low rate on Sundays in summer, for the reason that there is no feature on the companies' lines which attracts extra travel on Sundays, so that Sunday in summer instead of being the best day would be the poorest day of the week were it not that the low rate was in force on that day. The necessity for this is partly, no doubt, due to the policy of the steam roads in that territory of running very low rate excursions to Chicago and Indianapolis. Judging from the action taken by some of the large steam railroads last year, the very low rate Sunday excursion on steam roads is falling somewhat into disrepute, and considering the nature of some of these excursions, it is well that they should, as they are not conducive either to the morals of the towns through which the railroad passes or the good will of the better element in those communities. It is well for interurban railways to avoid this kind of thing and recognize that its regular and respectable patrons are to be catered to rather than the rowdy element.

Cold Weather Delays

The cold weather of the past two weeks in the Eastern States, as well as in the Middle West, has entirely demonstrated the fact that electric traction, as far as the heavier suburban and interurban lines are concerned, has turned the tables on steam traction as regards reliability of service and freedom from delays in extreme cold weather. There was a time when even the friends of electric traction were obliged to admit that for regularity of service in all kinds of weather, steam railroads had the advantage. We have come to look upon steam trunk lines as about as nearly infallible as human ingenuity and years of experience can make them. The experiences of this winter, which have exploded those ideas, cannot fail to come as a great shock to most of us. Among the steam railroads centering in New York and Chicago it has been no uncommon sight to see through trains standing in terminals for some time after their regular leaving time, simply for lack of a locomotive to take them out. This lack of motive power has not been confined to the more unimportant trains, as we have personal knowledge of cases where the best and most advertised trains of a road have been held up in this way. Even after these trains have secured a locomotive to haul them, no pretense has been made of maintaining regular speed. In fact, the condition of the motive power of most of the steam roads during the recent weeks of the present winter has been either laughable or pitiable—we do not know which. It is true in every clime that extremes in weather find the people of that locality unprepared to meet them with comfort, for the simple reason that these extremes of heat and cold are comparatively rare. As steam railroad men are but human, it is perhaps too much to expect that they be prepared to cope with the coldest weather which occasionally strikes them.

As regards the comparative ability of steam and electric traction to maintain service in extremely cold weather, there are some inherent advantages in favor of the electric motor. As the steam plant of the steam road must be carried on each locomotive, the chances for freezing of pipes, leakage of flues from overwork, etc., are increased with every degree of cold. The steam plant of the electric road is comfortably housed in a warm power plant, with sufficient reserve capacity so that a break-down of some piece of machinery is not as serious as on a locomotive. Further than this, the colder the weather the less danger of overheating the motors under a car, and this tends to counteract the additional work that is likely to be put on the motors in plowing through snow banks. The snow-fighting equipment of the modern electric road, whether city or interurban, is so complete as to make snow fighting as easy if not easier than on steam railroads. We do not claim that electric roads of the country have been able to give perfect service during the recent extreme cold and blizzards, but they have not shown any such deplorable lack of motive power as the steam railroads.

Another Chance for Electricity

At a recent hearing before the Massachusetts Railroad Commission in reference to the delays in train service which have occurred during various heavy snow storms in the yard of the South Terminal Station at Boston, several expedients for betterment were discussed without arriving at satisfactory conclusions. It was pointed out that during 360 days of the year the trains at the South Station are handled practically on time, and the steam railway men present urged that the criticisms of the traveling public are hardly just in view of the small percentage of time in which the service is demoralized. For two years experiments have been made with apparatus designed to melt the ice and snow by applying steam to the switches and frogs of the complex interlocking system installed at the South Station, but little success has thus far been attained. It was further argued that the arrangement of tracks is the best that can be made under the circumstances, and that if a roof was built over the entire yard it would cause more serious delays than are now suffered from the snow, on account of the dense mass of smoke and steam which would fill the train shed under conditions of low temperature and heavy atmosphere.

Strangely enough, no one brought out the fact that the electrical equipment of the suburban lines entering the South Station would completely solve the problem, if used in connection with an extended roof built to cover the exposed interlocking which now suffers so severely from the storms. The smokeless and steamless atmosphere of an electrified terminal service is still unrecognized in many quarters, and there certainly appear to be few situations in the transportation world which offer better fields for electrical operation than the suburban lines radiating from the Hub. The South Station at Boston has enjoyed an enviable reputation as a well-nigh perfect piece of terminal work since its opening day a few years ago, and the stalling of its interlocking seems to be the only weak point of consequence that has developed in reference to the handling of something like 800 trains a day. We have no doubt that with electrical suburban service and suitable protection of the interlocking, the present difficulties would disappear, as far as they are dependent upon the causes enumerated.

The Size of Car Windows

For a long time it was the accepted practice in steam railroad coaches to place windows so as to bring a window exactly opposite each seat. In the past few years it has become a kind of fad among some steam railroads to build coaches and chair cars with wider windows, thus following a style of construction which has been adopted on some of the recent Pullman coaches, which have one wide window for each section instead of two narrower ones, as formerly. Electric railway companies have attempted to follow the wide window idea to some extent on both city and interurban cars, and the results have not always been satisfactory either to the public or the operating companies. Most street railway companies which have adopted cross-seated cars have adhered to the old standard plan of a window opposite each seat. We have in mind some companies which are among the most particular regarding details in car construction, which are very careful in planning new cars, to see that the windows and seats come exactly opposite, so that there will be no obstruction of any passenger's view. A few companies have disregarded this rule and have adopted windows considerably wider than the distance between seat centers. Where such wide windows have been adopted, it has been thought advisable to have some distance between windows to admit of proper stiffness in the car framing. The way that this is practically worked out is that some seats have nothing but window space opposite them, while others come opposite a mirror or a panel, which fills the blank space between windows. If the car is used as a semi-convertible car, as most such cars are, this gives the passenger who is unfortunate enough to get a seat that is not opposite a window but very little view and correspondingly little breeze in hot weather. Of course, the passengers sitting opposite windows have a much better position than if they were in a car with a window for each seat. A wide window is difficult to raise and lower, and in case of sudden storms coming up may prove itself a nuisance. Moreover, the breaking of a glass in a wide window causes more expense and inconvenience than the breaking of a glass in a smaller window, and on account of the size of the pane, unless the windows are of very heavy glass, large windows are more likely to be broken than small ones. The chief argument in favor of the wide windows is the supposed greater elegance in the exterior appearance of the car. We are inclined to think, however, as time goes on and as styles change, that cars of this kind will seem worse out of date than those employing a more conservative type of construction.

Electric Railway Rates

There has been considerable discussion of late regarding rates of fare on interurban and other lines, and there has been a growing feeling that in the enthusiasm of competition with steam lines, rates had been cut rather too freely. Here, as in many other respects, the interurban line finds itself in a somewhat anomalous position. At its termini it finds street railway lines charging a uniform 5-cent fare for long distances into the suburbs, and practically compelling a similar policy on other lines in the same general district. On the other hand, in the strictly interurban part of a route, there is no such precedent, and the regulating factor is competition with steam roads. Hence, fares on the average higher than city fares can reasonably be charged. If interurban lines go into long hauls they are essentially on an ordinary railroad basis, and may even dip into interstate business, which still again complicates the situation. It is particularly hard to adjust local rates when a road runs from town to town, at the same time having urban termini, in which a uniform fare prevails. Many a manager has cudgeled his brains for a way out of his difficulties, and many Western lines have gone extensively into the mileage-book scheme, sometimes at rates decidedly too low. The fact is that with the extension of electric lines a point has been reached at which the ordinary basis of computing fares fails to be satisfactory.

The ordinary foreign plan of zones does not strongly appeal to the American mind unused to minute economies, although for many years variable fares were charged in suburban runs. a plan now honored only in Mark Twain's immortal rhymes. It certainly would be unwise to go back to the days of the "pink trip slip," and yet it had its merits. As the problem now works out in many cities, there is a species of irregular suburban area within which a uniform 5-cent fare is charged and a wide zone beyond in which another nickel is required. The urban area is generally generous enough in dimensions to make the running time to its edge materially longer than the time on the suburban steam trains. As a result, the electric railway traffic falls off with startling rapidity beyond the urban area, and we could mention roads that, in spite of apparently favorable territory, have been brought to the verge of disaster through these conditions. Steam roads have little chance in the urban area, but in the first suburban zone, so to speak, they cut considerable figure; in the second zone, requiring still another nickel, they again gain, and so on. The thing to be desired in many instances is a system of rates so arranged that a simple commutation scheme can be carried out without making too sharp a transition at the urban district. Of course, the steam railways have worked out the commutation arrangements very completely, but have generally given over the urban area to the electrics. It is not altogether simple for the electric roads to draw nice distinctions between commuters and non-commuters, and some easy plan of working would be most desirable. Merely as a suggestion in the direction of simplicity, how would the following plan work out? Suppose one were to establish a mileage rate that would serve equally for the collection of fares within and without the urban zone—that is. with the mile rate a submultiple of a nickel, say, $1\frac{1}{4}$ cents or $1\frac{2}{3}$ cents.. Then for the urban zone, wherever established, an exact nickel's worth of mileage could be torn off, with whatever might be required in addition for exterior stations. If this mileage were sold in 100-mile books or strips, quite unrestricted, they would probably be very freely used, and would give the advantage of furnishing a universal commutation ticket. It would seem likely that such a device would be of material use in building up the outer suburban traffic of interurban lines, and would also serve for the longer runs. It amounts to a flat mileage rate on the interurban part of the line, combined with a graded commutation rate near the termini, regulated by the size of the urban area. We merely cast out the idea for what it is worth, not even knowing that it may not have been suggested. At all events, it is worth thinking about.

Snow Sweepers and Plows During Summer

The series of articles which has appeared in recent issues of this paper on snow-fighting appliances has called attention to the disposition of this apparatus during the summer. Practice differs on this point. Certain roads, after removing the motors, store their plows and sweepers during the summer. Other roads dismount the brooms, nose pieces or wings and utilize the cars for freight cars or "locomotives," while still another class uses the sweepers through the summer for cleaning the track. In many respects the average sweeper or plow is well fitted for freight haulage. The hard service to which this rolling stock is subjected in winter makes a very strong construction necessary, and with some additional ballast, if required for traction, the dismantled sweeper or plow makes a very efficient traction machine. The practice of using the sweeper in summer, however, to clean the track is growing, especially with those roads using a grooved rail, and in certain cases it has even been satisfactorily employed on girder rails laid in macadam. In such cases it is desirable to precede the sweeper with a sprinkler. An interesting instance of this practice is reported from Lima, Peru, where the passage of the electric cars raised so much alkali dust as to be disagreeable to the passengers and destructive to the equipment. Here the combined use of a sprinkler and sweeper eliminated the trouble.

THE NEW INTERURBAN LINE OF THE LANSING & SUBURBAN TRACTION COMPANY

BY I. L. DIXON

The attention of the street railway world was for several years directed with great interest toward the construction of an electric railway line between Lansing and St. Louis, Mich., for the promulgation of experiments upon the Arnold electro-pneumatic system of railway operation. An opportunity of great promise was, it was thought, offered for a practical test of the high-voltage single-phase alternating-current system of electric traction, in that this line was laid out through a country which did not seem to offer sufficient return to warrant the installation of a trolley line of the usual type of construction, involving direct-current power apparatus and transmission equipment. It was accordingly decided to make a trial of the Arnold system, which promised to make the road commercially practical by the elimination of the expense of rotary transformer sub-stations and the heavy feeders necessary in the direct-current system.

The line was completed in 1901, and, pending the experiments upon the completed Arnold single-phase motor, the road was opened for service and operated with steam locomotives. While the experiments were progressing nicely upon the proposed new alternating - current system, however, an end was put to this interesting new development by a disastrous fire in the car house and shop late in 1903, which, as noted in the Jan. 2, 1904, issue of this journal, destroyed all of the cars and experimental equipment which were to be used in connection with the new system. The fire proved a serious setback to the experimental work, and the company became involved in financial difficulties. As a result of this, and the increased desirability of instituting electrical operation, the company was reorganized in the early part of 1904, and the decision at once made to equip the road for operation upon the direct-current system, after the manner of usual practice in this work.

In April of last year, the company developing the interurban line which was then known as the Lansing, St. Johns & St. Louis Railway Company, effected a consolidation with the Lansing City Electric Railway Company, under the new name of the Lansing Suburban Traction Company, and provided for a complete reorganization of both companies for a new and more effective condition of united operation. Thomas M. Keeley, who had long been identified with early electric traction work in Chicago and other points in the West, and had been actively in charge of the experimental work upon the single-phase system, was selected as superintendent. Active steps were then taken to re-equip the interurban line for direct-current operation, and by making an arrangement for the purchase of direct-current power from the water power company supplying the city lines, the interurban division was opened for service about July 1, 1904. Subsequently, the Lansing city lines were greatly improved and in some instances practically rebuilt, the desire being to bring up the permanent way equipment of the new company to a very high standard.

The total length of lines now operated by the new company amounts to 34 miles; this embraces the interurban line to St. Johns, 22 miles long; one from the city of Lansing to the Michigan Agricultural College, to the east, 3½ miles long, and another extending to Waverly Park, 3 miles to the west, which, with the lines in the city and extending to North Lansing, made a total of 34 miles. The line to Waverly Park is a new addition, having been completed early in the summer of 1904 to a point within ¼ mile from the park entrance, where the line of the Grand Trunk Railway is to be crossed, although plans and preparations are now being made for a depressed crossing at this point, which will enable cars to run into the park without the ever-present danger of a grade crossing with the steam railroad. The company has recently completed plans for the extension of the Agricultural College line further east, to a resort known as Pine Lake, which will unquestionably prove another very profitable venture; construction upon this extension was begun Feb. 1, and the new line will be in operation by June 1.

THE INTERURBAN LINE

An excellent roadbed was built originally for the interurban line to St. Johns, a private right of way, 50 ft. wide, having been secured over the most direct route possible between the two cities. An especially favorable tract of country was encountered, so that few difficulties of railroad building were met. High land is traversed in general, and in only a few stretches is low land encountered; in one of these, a sink hole developed, but it was easily filled up, and soon settled to a firm bearing. Practically no hills are encountered, the steepest grade upon the system being the incline approach to an overhead crossing of the Pere Marquette Railroad, in North Lansing, which is a 4.3 per cent gradient. The section of the system to the south of St. Johns embraces an unbroken tangent 10½ miles in length, which will greatly facilitate fast running.

The line to St. Johns is 22 miles in length from the center of the city of Lansing north to the end of the line in St. Johns. It leaves Lansing over the Michigan Agricultural College branch of the city lines, turning to the north to enter upon its own tracks a short distance east of the center of the city. In North Lansing the Pere Marquette Railroad is crossed by an overhead bridge, the approach to which is a timber trestle, built on a gradient of 4.3 per cent. The span across the railroad tracks is carried by a steel truss bridge, as shown in a view on page 347. At the north end of the bridge is located the car house and storage track yard where the various freight cars and the steam locomotive are kept. At a distance of 8½ miles north of Lansing, the line passes through the small town of DeWitt, shortly beyond which it enters the 10½-mile continuous tangent

THE NORTHERN TERMINAL OF THE INTERURBAN DIVISION OF THE LANSING & SUBURBAN TRACTION COMPANY AT ST. JOHNS of the line, which extends nearly to St. Johns. Few bridges are required, as the country traversed is a fine high and dry section of excellent farming land.

The track has been laid to standard gage with 67-lb. T-rails of standard A. S. C. E. section, although over the railroad crossing trestle and bridge a 75-lb. T-rail is used for additional stability. The ties are of cedar and oak, set to 24-in. centers, and the ballasting has been carefully done with gravel, taken from a conveniently located gravel pit near DeWitt. Split switches and standard spring frogs are used in accordance with the best steam railroad practice, and the work of track repairs will be carried on in sections, which will be patrolled and cared for by individual crews. Three tool houses have been built for housing the section hand cars and track tools, and the work of maintenance will be carried out by three crews.

The trolley and transmission lines are carried upon side poles, set with centers 8 ft. from the center line of track. The poles used are of the best cedar, 35 ft. long with 7-in. tops, and were carefully selected for soundness. They are spaced 100 ft. apart, and are set with heel pieces and breasters for extra stability; in addition, upon curves they are heavily guyed to anchored poles.

The brackets are of special wooden construction, having been originally installed with a view toward providing extra insulation for the high-voltage line current to be used; but they were easily adapted to the requirements of standard direct-current construction. The original glass trolley wire hangers are being replaced by standard hangers of the Ohio Brass Company, with the well-known dirigo insulation; these are supported from the 5-16-in. seven-strand steel cables formerly used for sake of flexibility. The trolley wire, which is a 135,000-circ. mil wire of the General Electric standard grooved section, is supported beneath the hangers upon 15-in. Eureka clinch ears.

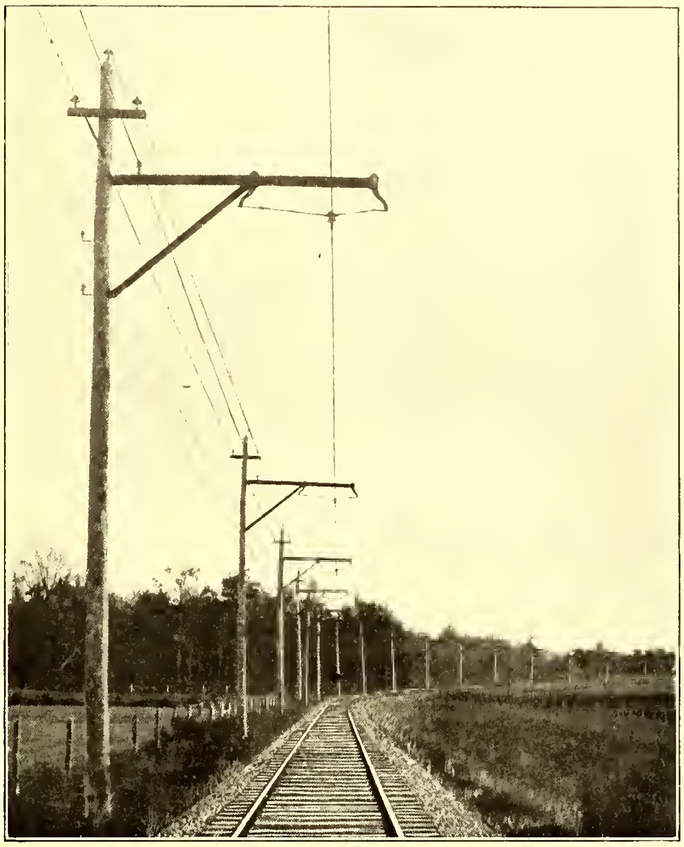
The transmission line by which the power is delivered in the form of 5500-volt three-phase alternating current from the power station in Lansing to the two sub-stations out upon the line, is also carried upon the side-pole line. The high-tension wires are carried upon Lock insulators, the wires being

VIEW UPON THE INTERURBAN LINE NEAR DEWITT, SHOWING FILL AND TRESTLE

mounted in the usual triangular arrangement and spaced 28 ins. apart. The principal features of the line are shown in an accompanying view of the line construction. The 0000 bare feeder is carried upon the arms adjacent to the pole, while the telephone line is mounted on bracket insulators upon the opposite sides of the poles.

POWER EQUIPMENT

Current is supplied to the interurban lines, as well as to the city lines of the company, from two power houses which are operated by a private corporation doing a commercial power



TYPICAL LINE VIEW UPON THE INTERURBAN DIVISION, SHOWING SIDE BRACKET CONSTRUCTION

business in the city of Lansing. One of these is located in the central portion of the city, and is steam driven, while the other is a water-power plant with steam auxiliary, located at a dam upon the Grand River, where it passes through the southern portion of the city. This double source of power, which is supplemented by a storage battery plant, proves a very reliable supply.

In the city plant of the power company, the railway company has a 225-kw, 575-volt Westinghouse generator, which is belt-driven by a Corliss engine of the power company. This generator delivers directly to all of the city lines and to the Lansing end of the suburban line, there being no high-tension current handled in this plant on account of its location so near to the center of the business section. In this plant is also located the storage battery plant, which is arranged to float on the trolley system, and thus maintain a more steady average load upon the generating equipment. The battery consists of a set of 265 cells, giving thus a maximum discharge voltage of 650 volts. The battery was furnished by the Gould Storage Battery Company.

In the water-power plant at the river, the street railway company has a 300-kw General Electric rotary-converter set, which is belted to a line shaft, the latter being driven by the water wheels, or the steam auxiliary in case of low water in the river. This machine is operated as a double-current generator, the direct-current side being used to supply power to the railway system through the switchboard at the city plant, while the alternating-current side operates the transmission line. The direct-current source is handled and controlled at the switchboard of the city plant in the same manner as an additional dynamo would be if one were located there. The alternating-current side of the generator delivers three-phase alternating current at a potential of 360 volts to step-up transformers located at that plant also. These transformers, which are of the air-cooled type, supplied by the General Electric Company, have a total capacity of 300 kw, and supply the transmission lines at a voltage of 5500 volts.

The switchboard in the city power plant is therefore the controlling point for the 550-volt local direct-current system, by which the city lines are operated directly. This board contains the usual equipment of generator panels and a feeder panel for each section of the city lines. The feeder panels are equipped with I. T. E. circuit breakers, Weston ammeters and single-pole double-throw knife switches. The double-throw knife switches are used for transferring the load either to the city plant generator or to the water-power plant machine, this being a convenient means of dividing the city load between the machines in any desired proportion, or, in emergency, of throwing all of it upon either one.

THE SUB-STATION AND DEPOT AT DEWITT, UPON THE INTERURBAN LINE

The interurban line is divided into three approximately equal feeder sections, inasmuch as sub-station No. 1, which is located at DeWitt, is 8½ miles north of Lansing, and sub-station No. 2, at County Farm Crossing, is 9⅓ miles north of DeWitt. This arrangement was selected so that each sub-station should not be required to feed further than about 4 miles on either side of it, while the city power plant takes care of approximately 4 miles north from the center of the city; practically the longest single feeding distance is from sub-station No. 2, at County Farm Crossing, northward into St. Johns, a distance of 4 1-6 miles, all other sections being fed from both sides. Each sub-station is equipped with a 150-kw General Electric rotary converter, which takes current from the three-phase transmission system through step-down transformers and delivers it at 600 volts to the trolley system. The step-down transformers, which reduce the 5500-volt transmission current to 360 volts for use in the rotaries, are of the air-cooled type of the General Electric Company, and of 150-kw total capacity. Current is fed out upon the line in both directions from each sub-station by a 0000 bare copper feeder, which extends nearly to the extreme end of the section fed by it, feeding-in taps being made at frequent intervals.

ROLLING STOCK

Four new cars were purchased from the John Stephenson Company, of Elizabeth, N. J., for use upon the interurban line. They are of the semi-convertible type of car, and are 42 ft. long, equipped single ended, as turning "Y's" are provided at either end of the run for turning the cars around. Their interiors are attractively finished in oak, and are arranged with a smoking compartment, seating twelve, at the front end, and the main passenger section of the car, seating thirty, at the rear. The seats are of the Hale & Kilburn walk-over type, finished in rattan. The cars are heated by hot-water heaters, supplied by the Peter Smith Heater Company, which are located in the front vestibule compartments. Each car has also a toilet compartment, which is located next to the dividing partition between the smoking and main passenger sections.

The mechanical and electrical equipments of the cars are of the best and most modern. The cars are mounted upon type 36 Peckham M. C. B. trucks, and the system of air braking used is the Christensen straight-air type, supplied by the National Electric Company. Thirty-three-inch cast-iron wheels are used, having 3-in. treads and ¾-in. flanges. Each car is equipped with four General Electric type 67 motors and type B-28 controllers. The auxiliary equipment consists of Milloy roller-bearing trolley bases, Knutson trolley retrievers, Ham sand boxes and Imperial arc headlights, manufactured by the Crouse-Hinds Electric Company.

A number of flat and box cars which were used in the construction of the road have been retained for the handling of freight upon the interurban lines. These cars are of standard construction as used upon steam railroads, and are adaptable to the heaviest classes of freight handling. Owing to conformity of gage, interchange of cars in freight shipments is thus made possible with any of the steam roads intersected in Lansing.

CITY SYSTEM

Several new cars have also been added to the former rolling-stock equipment of the city operating company for use upon the city lines. These embrace several Jewett open cars, one of which is illustrated in an accompanying illustration. Single-truck cars are in general use upon the city lines, although double-truck cars are operated over the 3½-mile line to the Michigan Agricultural College. The standard city car of the company is the single-truck car, 22 ft. to 26 ft. long, while upon the Agricultural College line, 42-ft. double-truck cars are used. The greater part of the older cars formerly used in the city

ONE OF THE STANDARD DOUBLE-TRUCK CARS IN USE UPON THE INTERURBAN DIVISION, TURNING INTO THE CITY TRACKS TO ENTER LANSING have been largely rebuilt and re-equipped to bring them up to the latest standards. The closed cars have been equipped with vestibules, in accordance with the Michigan laws, and a very pleasing appearance is the result.

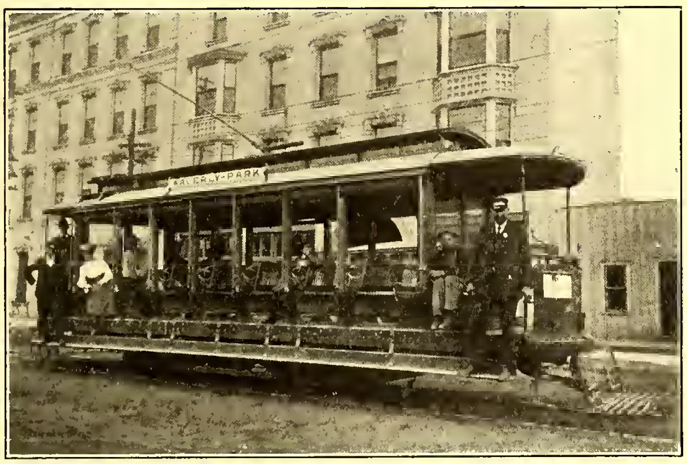
The above new work has been carried out in the repair shops upon South Washington Street, where also the running repair work for both city and interurban lines will be carried on. The former shop equipment has been greatly enlarged and re-equipped to provide for the new work. New tools have been added, and it is proposed to carry on the entire work of electrical repairs there, in a department devoted to it.

Extensive improvements have also been made to the track work of the city lines. In many places the track has been relaid and ballasted to provide a firm and easy-riding line. The city tracks are in most cases laid with 7-in. 80-lb. Cambria girder rails, to conform with pavement requirements upon the principal streets. Upon unpaved streets, such as upon the Waverly Park line, a 60-lb. T-rail is used, ballasted flush with the top of the rail. An accompanying illustration shows representative line and track construction upon Washington Avenue, the principal street of Lansing; also the inspection automobile used by General Manager Elliott and Superintendent Keeley is shown.

A similar high grade of city construction was installed for the terminal of the interurban line upon the streets of St. Johns. An illustration shows the track and overhead line work upon Main Street in that city. The track is here also laid with 7-in. 80-lb. Cambria girder, and the line work is supported by span-wire construction, for which neat iron poles are used. At the north end of the line a Y turning track and side track is installed for turning cars, and also for accommodation of freight and baggage cars.

TRAFFIC

The interurban line to St. Johns travserses a well settled farming district, which, although it cannot be said to be densely populated, is capable of originating a large amount of passenger and freight traffic. It is an excellent farming country, and is peopled by a splendid class of prosperous farmers. Owing to the fact that heretofore there was no railroad communication to the district in the vicinity of DeWitt, there has, of course, been little development there; but since the opening of this new line the growth which has taken place is remarkable. A very



ONE OF THE STANDARD OPEN CARS USED IN THE CITY SERVICE ON THE WAVERLY PARK LINE

encouraging local business traffic has originated and, in addition, a large amount of freight traffic has been worked up.

A regular freight service has been instituted in addition to the half-hourly passenger service, and last fall an important development was made by the company in the handling of farm products in large quantities; many carloads of sugar beets were delivered by the company from local shipping points along the line to the large beet-sugar factory in Lansing, and also large amounts of apples, grain and other farm products were handled by the freight department. Through mail between Lansing and St. Johns is handled in pouches, and also local mail to and from DeWitt in both directions. An interesting feature of the development of the mail service is to be noted in the arrangement that has been made with the company to deliver local

THE OVERHEAD CROSSING OF A STEAM RAILROAD, UPON THE INTERURBAN LINE AS IT ENTERS LANSING

pouches of mail to the various rural free-delivery carriers, who meet the car carrying mail, at specified road crossings, up the line.

While there would appear to be little opportunity for the development of park attractions upon the interurban line for increase of traffic, yet two resorts have proven available which will prove of value in creating traffic. Merle Beach, which is one of them, is a pleasant resort upon a lake located about a mile to the west of the line, some distance north of DeWitt. Regular stops are made at the road crossing nearest to this

THE HOTEL IN THE PARK OWNED BY THE COMPANY AND REACHED BY ONE OF ITS LINES

point, and a 'bus from the hotel at this resort meets all passing cars for passengers; in this way a considerable amount of traffic has grown up, owing to various attractions of this resort. Also a winter attraction has been developed at Alvard Lake, which is a small lake passed by the line still further north of DeWitt. The railway company has established an open skating rink upon this lake, which will be continued throughout the winter if weather permits. The lake is lighted by lamps supplied from the railway feeders, and a casino has been installed for the accommodation of patrons. An excellent business has resulted from this venture.

The larger park above mentioned, known as Waverly Park, is the development of a park property which was purchased by the new company and opened to the public, with many improvements, on Aug. 1 last, the opening day being welcomed by the city in the form of a holiday. This is a very prettily located park site of 73 acres, 20 acres of which have been improved for actual park purposes. The land is located upon the Grand River, southwest of the city, so that the advantages of boating and bathing are available. The park has a large hotel, open-air theater, dancing hall and fine new baseball park and grand stand; representative illustrations presented herewith show some of the park attractions. The buildings and grounds are electrically lighted by a private isolated plant upon the grounds.

THE BASEBALL GROUNDS OF THE COMPANY AT WAVERLY PARK, WHICH ARE EFFECTIVE IN CREATING A LARGE AMOUNT OF TRAFFIC

A VIEW OF THE WATER FRONT AT WAVERLY PARK ON A TYPICAL SUMMER DAY

The attractions at Waverly Park are in general operated by outside effort, through arrangement with the railway company. Excellent attractions are provided, and it is arranged to provide the very best of accommodations, the result of which has been very gratifying in the amount of traffic created in this way. During the winter, dances and parties have been made a special feature of the park by the company, and also a gun club has been organized with a large membership, which will have its headquarters at the park. Better access will soon be provided for entrance of cars to the park, as a subway will be built next spring under the line of the Grand Trunk Railroad, next to the park grounds, so that cars may then approach directly to the grounds; it is expected that this subway will be completed by May 1.

The line to the Michigan Agricultural College, to the eastward, is also a valuable source of revenue. This line traverses the most important part of the east end of the city, besides being upon a direct line to three of the important railway depots of the city, and also to the Industrial School for Boys, a State institution. The Agricultural College, 3½ miles east, is an important source for traffic, as it is visited by large numbers of excursionists, particularly in the summer; also the vicinity of the college has grown to be a very densely populated section, and the easy communication thus afforded with the city of Lansing in the way of a frequent service will be productive of further growth.

The proposed extension of the line from the Agricultural College, 7 miles further to the east, will open up another important district and reach a very popular summer resort known at Haslett's Park, or Pine Lake. This lake is one of the principal resorts in that section of the State, but is inaccessible at present except by a steam railroad which gives very poor passenger service. This lake occupies a space of 360 acres, and is surrounded by numerous summer cottages, hotels and club houses; also the Spiritualists' organization have made that resort the meeting place for their annual conventions, which brings large crowds to the lake in the summer. In addition, the lake abounds with excellent fishing, which furnishes unlimited sport for the angler. Active work has already begun upon the Pine Lake extension, the contract for construction having been let to the L. E. Meyers Company, Chicago, Ill., and it is expected that it will be opened for traffic by June 1. The extension will be built upon private right of way from the college to the lake, and conform in general to the construction used upon the interurban line to St. Johns.

OVERHEAD LINE AND TRACK CONSTRUCTION VIEW IN THE CITY OF LANSING

The various park enterprises which have been developed by the company, as well as also the greatly increased service and progressive methods which have been inaugurated, have been productive of wonderful results. The population has responded very favorably to the increased and well maintained schedules upon the city lines, and the park attractions, the first of any account that the city has ever had, have been greatly welcomed. The results cannot be better shown than by stating that, in the first seven months of operation by the new management, the growth in business upon the city lines amounted to 142 per cent.

The president of the Lansing & Suburban Traction Company is Barney Mills, of Port Huron; George G. Moore is vice-president; Myron W. Mills, treasurer; J. R. Elliott is secretary, general manager and purchasing agent, and Thomas M. Keeley, superintendent and electrical engineer.

THE CLEVELAND LOW FARE EXPERIMENT

Considerable space has been devoted in the last few issues of this paper to accounts of the progress of the Cleveland low fare experiment. The results of a month of fair trial under two plans indicate that both methods were failures and that the frequent claims that low fares will attract considerable additional traffic have no foundation. The history of this important trial is summed up in a letter addressed to the City Council of Cleveland on Feb. 15 by President Horace E. Andrews, of the Cleveland Electric Railway Company, and the lessons taught are so valuable that his letter is given in its entirety below:

MR. ANDREWS' LETTER

To the City Council of the City of Cleveland:

Gentlemen—Pursuant to the permission granted this company, several experiments have been conducted to determine the revenues obtainable in Cleveland under lower rates of fare for street car service, and in accordance with statements made through the press by representatives of the Cleveland Electric Railway Company, we beg to submit the results of the tests so far tried.

The statements are in as condensed form as possible, but the details which go to make up the figures presented are on file in the office of the company, and will at any time be placed at the disposal of any committee representing the city government or any accountants who may be named for the purpose of investigating the correctness of the information which follows:

The company has endeavored to get at the facts, with no intention of attempting to prove or disprove contentions that have been made as to the actual results produced by lower fare. It does not intend, and cannot afford, to be otherwise than absolutely frank with the public, nor can it afford to deceive itself. The relation between the public and a public service corporation is a mutual one. A street railway company cannot be injured or its success impaired or hampered without injury to the public. The company has endeavored, and is endeavoring, to give the highest degree of service to its patrons, and is at present seriously handicapped by the lack of adequate terminal capacity in the center of the city, and because it has been denied the privilege of building crosstown lines and many additional miles of track through already-developed territory in Cleveland.

The results of the tests which have been made lead to the conclusion that fare as low as 3 cents is only financially possible within a zone considerably inside of the city limits. We realize that the so-called 3-cent-zone test was not satisfactory to the public nor to the company, and was not a conclusive test of 3-cent fare. The results obtained were sufficient, however, to indicate that if 3-cent fares were made applicable to the entire city the reduction in the earnings of the company would be so large as to be disastrous.

The gross earnings of the company for the seventeen week days preceding the 3-cent-zone test were as follows:

Jan. 3—Tuesday	$13,313.24	Jan. 13—Friday	$12,598.70
4—Wednesday	13,081.72	14—Saturday	15,014.24
5—Thursday	13,228.10	16—Monday	13,195.32
6—Friday	12,397.19	17—Tuesday	13,424.71
7—Saturday	14,391.49	18—Wednesday	13,256.77
9—Monday	12,882.68	19—Thursday	13,342.05
10—Tuesday	12,798.01	20—Friday	12,679.01
11—Wednesday	12,387.16	21—Saturday	14,914.42
12—Thursday	13,191.17		

The gross earnings of the company for the twelve days of the 3-cent-zone test were as follows:

Jan. 23—Monday	$12,477.64	Jan. 30—Monday	$12,590.45
24—Tuesday	12,268.74	31—Tuesday	12,318.79
25—Wednesday	11,434.22	Feb. 1—Wednesday	12,215.39
26—Thursday	12,279.74	2—Thursday	12,477.74
27—Friday	11,757.96	3—Friday	11,628.77
28—Saturday	14,654.44	4—Saturday	14,460.09

It will be remembered that the reduced rate of fare was in effect for only thirteen hours of each day, during which time the loss over the earnings of the seventeen week days preceding was 5.74 per cent, or $764.47 per day. This decrease was shown when the 3-cent fares collected were 18½ per cent only of the fares collected on the entire system. If the low rates of fare had been in effect for the whole twenty-four hours of each day, the percentage of loss would have been greater.

The only lines of cars which were operated wholly on a 3-cent basis, with transfer upon a 5-cent cash fare or an eleven-for-fifty ticket, were the Willson Avenue line and the Fairfield line on the South Side, both of which lines show an abnormally large percentage of transfers under ordinary conditions, the percentages being, on the Willson Avenue line, 81, and on the Fairfield line, 42.

The percentage of transfers issued on all the lines operated by the company is normally 30, and was, during the 4-cent test, when the fare for a ride with a transfer was greater than for a single ride, 23.

The results obtained on the Willson Avenue line show a loss in revenue of 13.4 per cent. If the same rate of fare had been in effect during the entire day, instead of during thirteen hours only, the loss would have been 15.5 per cent.

The results on the Fairfield line show a loss in earnings of 16.26 per cent, indicating a loss, if the same rate of fare were in effect during the entire day instead of thirteen hours, of 20.78 per cent.

As stated above, these two lines issue and collect an abnormal number of transfers, thus making the average fare collected considerably higher than it would be on the lines of the company as a whole under the rates of fare charged during the test; i. e., 3 cents for a single ride and 5 cents or an eleven-for-fifty ticket for a ride with a transfer.

If the results obtained on the Willson Avenue line were applied to the whole system of lines operated by the company for twenty-four hours daily, and if operated upon the same rates of fare of 3 cents for a single ride, and 5 cents or an eleven-for-fifty ticket for a ride with a transfer, and assuming that 80 per cent of the passengers pay 3-cent fare and 20 per cent pay 4.7 cents for fare and transfer, the percentage of decrease would be 29.05, or a loss of $3,600 per day in gross earnings as compared with the earnings under the present legal rates of fare. This result would be altered if lower fares stimulated traffic. The actual stimulation, however, during the 3-cent-zone test was only 1 per cent, and during the 4-cent test 1.38 per cent.

The 4-cent test was begun on Monday, Feb. 6, and was discontinued on the following Monday at midnight.

The gross earnings of the company for twenty days in January, at the regular rates of fare, were as follows:

Jan. 3—Tuesday	$13,313.24	Jan. 13—Friday	$12,598.70
4—Wednesday	13,081.72	14—Saturday	15,014.24
5—Thursday	13,228.16	15—Sunday	8,710.83
6—Friday	12,397.19	16—Monday	13,195.32
7—Saturday	14,391.49	17—Tuesday	13,424.71
8—Sunday	8,516.13	18—Wednesday	13,256.77
9—Monday	12,882.68	19—Thursday	13,342.05
10—Tuesday	12,798 01	20—Friday	12,679.01
11—Wednesday	12,587.16	21—Saturday	14,914.42
12—Thursday	13,191.17	22—Sunday	9,358.99

The gross earnings of the company for the eight days of the 4-cent test were as follows:

Feb. 6—Monday	$11,398.90	Feb. 10—Friday	$11,459.18
7—Tuesday	11,618.29	11—Saturday	13,510.57
8—Wednesday	11,750.17	12—Sunday	7,519.98
9—Thursday	11,725.72	13—Monday	11,380.75

The decrease in earnings during the 4-cent test, as compared with the earnings of the twenty days in January given above, was 10.87 per cent, or $1,375.74 per day, or, at 365 days per year, $502,145.10.

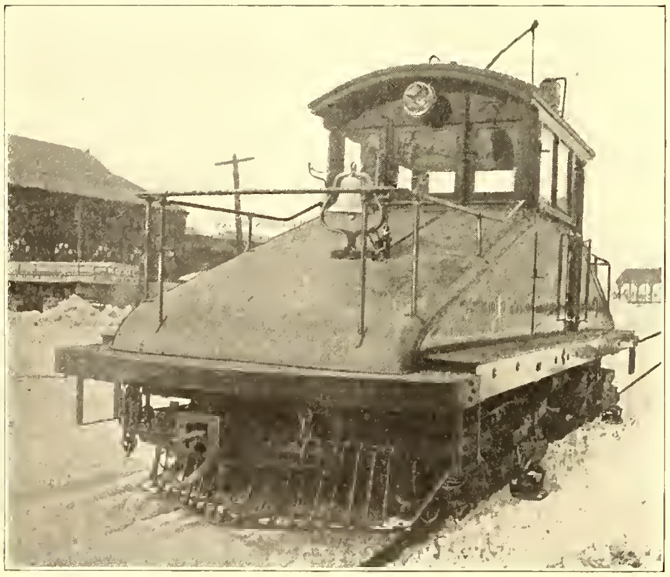
The tests conducted have cost the company in the neighborhood of $25,000 in decreased receipts and increased operating expenses, but it believes that the information gained justifies the cost, and it will be glad, if desired, to make further experiments in lower fares, which, in the light of the experience already obtained, will produce a reasonable revenue, and will file with the Council the information gained. Respectfully submitted,

The Cleveland Electric Railway Co.,
By Horace E. Andrews, President.

A NEW SHIFTING LOCOMOTIVE FOR THE BROOKLYN RAPID TRANSIT COMPANY

One of the most important features of the work in a large car repair shop is the moving of cars into the shop and out, when completed, and the shifting to various departments or locations, as is required for facilitating the work; this, if easily accomplished, is often of great assistance in the work. Even in the case of electric railway cars, it is not always possible to move them by their own power, owing to repairs under way upon their motor equipments, while the practice of moving them about by means of a steam locomotive or of retaining a standard motor car out of service for this purpose is undesirable in many ways, involving, in the former case, serious fire risks and the troublesome boiler maintenance problem, and, in the latter, the tieing-up of a comparatively large investment where it is not warranted. Special motor cars have been, in various instances, designed for this work, but none has met the requirements as well as does the interesting electric locomotive illustrated below.

The Brooklyn Rapid Transit Company, since the opening of its large elevated division repair shops at Thirty-Ninth Street and Third Avenue, Brooklyn, and the inauguration of the work of reconstruction of its elevated rolling stock, has met the above problem in an aggravated form. This large shop, as was referred to in the article descriptive of the reconstruction work in the Aug. 13, 1904, issue of this journal, has eight longitudinal tracks, which will accommodate upward of 100 cars, about seventy being kept there under repairs all the time; from this and the fact that eight to ten completed cars are turned out per week, an idea may be gained of the magnitude of the work carried out at this shop and of the amount of shifting of cars which naturally arises. This problem proved to be of such importance in the furtherance of the shop work that an interesting departure was made in the building of an electric locomotive especially designed for the shifting of cars, as is here illustrated and described. It has been in service now upward of two months and its operation has proved more than satisfactory in all respects.



END VIEW OF THE ELECTRIC LOCOMOTIVE, SHOWING WIDE RUNNING-BOARD AND AMPLE PROVISION OF RAILINGS AND GRAB-HANDLES FOR SWITCHMEN

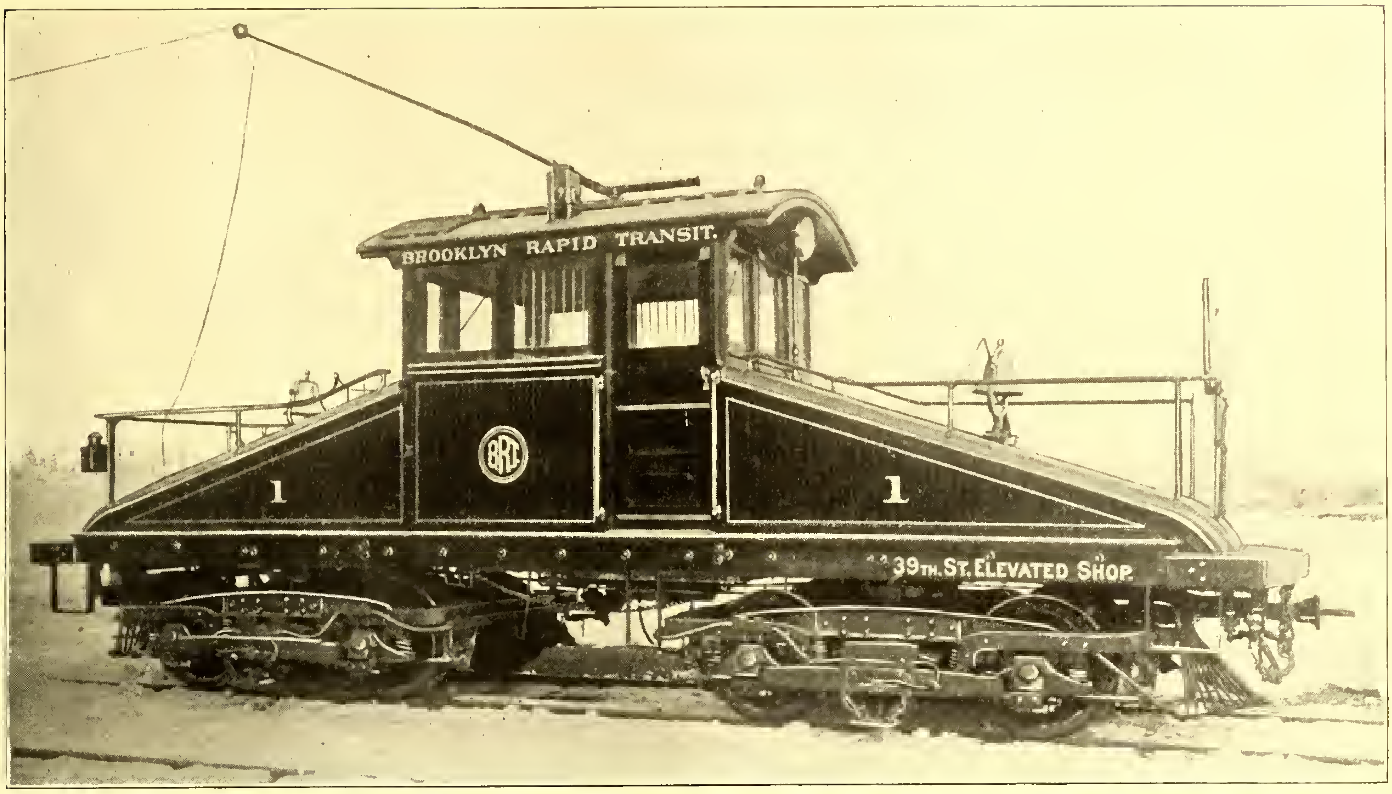
The locomotive is illustrated in the accompanying photographs and drawings of its details of construction. In general outline it resembles some of the earlier models of electric locomotives that have been built in certain cases for special classes of work. The sloping ends of body were chosen to enable the operating motorman to have a clear view direct to the drawbar at either end for facilitating movements in coupling to cars; this is in fact one of the prime requisites of this special type of car for switching. Another important feature of its construction is to be noted in the generous width of running board provided upon either side for accommodation of the switchmen and assistants. The general appearance of the body impresses one with the idea of strength, compactness and adaptability to service requirements; also, while no efforts were made to beautify the car, a very pleasing outline and attractive appearance are nevertheless the result of the design.

The body of the locomotive was built along as compact lines as possible, in order to provide easy handling qualities. As may be noted from the drawings, the length of the under frame is 30 ft. 4½ ins. over buffer beams, giving thus the total wheel base of 20 ft. 7 ins. The cab has an interior length of 7 ft. 4 ins., but only 6 ft. of width, while the under frame has a total width of 8 ft. 7 ins., in accordance with the elevated car body standard width upon the system. The latter feature of the design was for the purpose of providing a wide and convenient running board along either side, which is so necessary for the switchmen and the assistant handling the trolley rope. Thus while the cab is compact, still ample room is provided for the motorman and assistants as may be necessary.

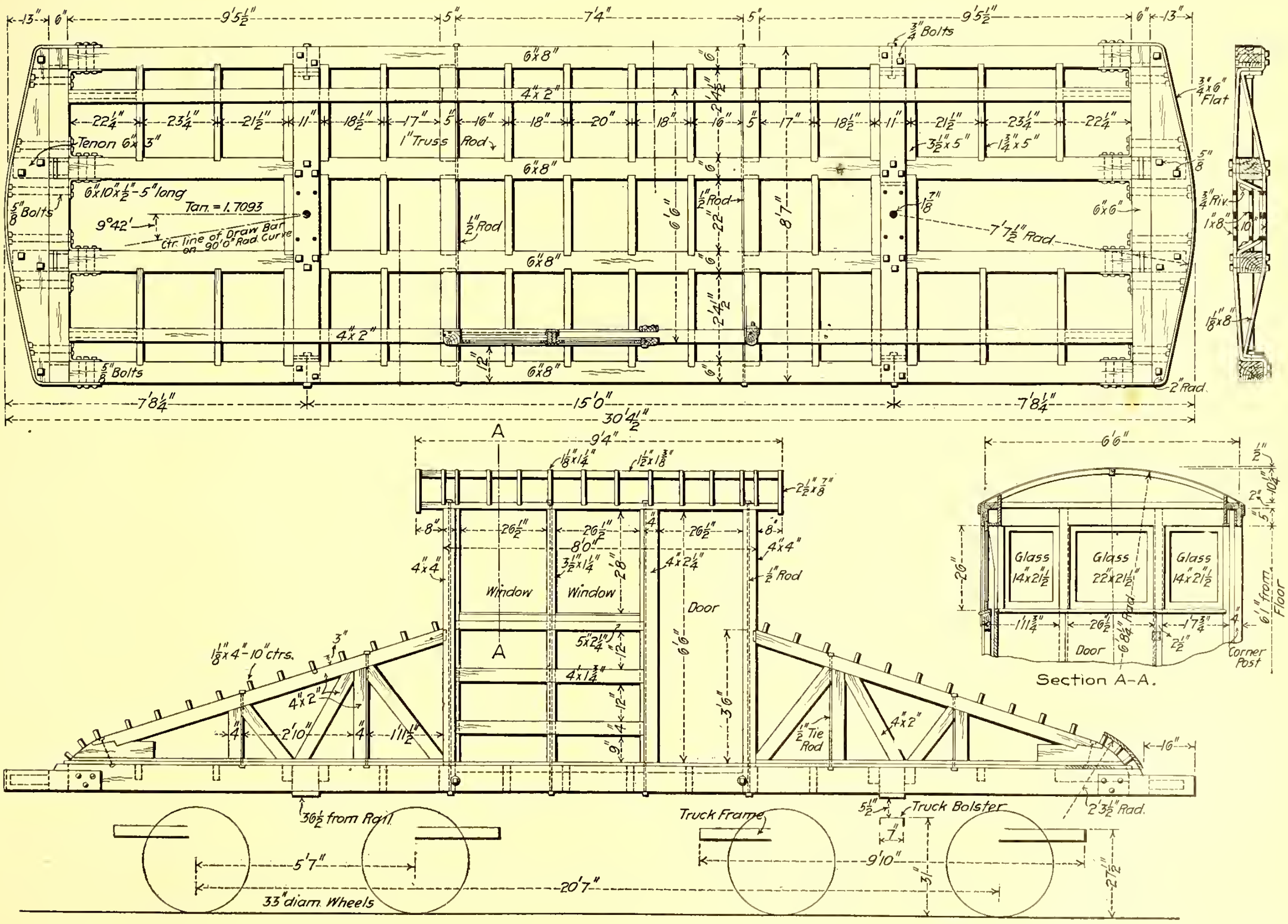
The under framing of the locomotive body is, as may be noted from the detail drawing, of very strong construction, in order to withstand the shocks of heavy switching service and hauling work. The side and center sills are of 6-in. x 8-in. timbers, with very rigid end attachments to the buffer beams. The other under frame details and details of bolster construction are also shown in the drawing. The draft gear and connections to the bolsters are in accordance with the new standards of construction of the company, the draw-heads used being of the Van Dorn automatic type. The frame work for the body and upper works are also illustrated in the drawing.

One of the most interesting features of the construction of the locomotive lies in the fact that all details of its equipment were taken from discarded motor and car equipments, or from unused or waste stock at the shops. The trucks are of a type now no longer in use upon the elevated lines, and the motors, of which there are four, one of 90 hp capacity upon each axle, are from a group that were discarded two years ago, although these happened to be in good condition and available for the purpose. Likewise the pilots, or "cow-catchers," as also the bells, are relics of the recently discarded steam locomotives, while the air compressor and governor for the air-brake system are of an odd size, having been taken from an old shuttle car that was used in the elevated service about four years ago, and thus not interchangeable with standard equipment. This is an interesting feature of the construction of the locomotive and one of great importance, as by this means the resulting cost was reduced to only that of the carpenter work and assembling, fitting, painting, etc., amounting to only one-fifth of its estimated completed value.

An interior view of the cab shows the general arrangement of control apparatus and auxiliaries. The motors are controlled in pairs, each by their original series-parallel controllers; the two controllers are connected mechanically, as shown, by an ingenious operating mechanism, which keeps both control and reverse staffs absolutely in step under all conditions. The control and reverse handles are also reversible, so that the motorman may operate from either side of the cab, and for this purpose the air-brake valve is duplicated upon both sides of the cab also. The circuit breaker is located in the cab, as shown, being provided with a rope leading from its handle around to one side, so that, in emergency, a quick stop may be made by opening the breaker. The large switches shown in the middle of the cab roof are the double-throw switches, by which the motor and auxiliary circuits are thrown either onto



GENERAL VIEW OF THE ELECTRIC LOCOMOTIVE RECENTLY BUILT BY THE BROOKLYN RAPID TRANSIT COMPANY FOR SHIFTING PURPOSES AT ITS LARGE ELEVATED DIVISION OVERHAULING SHOPS AT THIRTY-NINTH STREET



DETAILS OF BODY AND UNDERFRAMING OF THE NEW ELECTRIC LOCOMOTIVE FOR THE BROOKLYN RAPID TRANSIT COMPANY the trolley pole circuit or to the third-rail shoes, for operation thus either in the shop yard or upon the elevated structure.

The spaces underneath the sloping front decks at either end provide valuable storage facilities for the auxiliary apparatus. Under one end is located the air compressor, pump governor, main reservoirs and piping for the air-brake system, all of which apparatus is of the Christensen automatic type. Underneath at the other end are located the resistance units required in the motor control circuits. This disposal of the auxiliary apparatus gives the maximum amount of room below the under frame. The spaces beneath the sloping decks also serve to carry the ballast that was found necessary to bring the total weight of the locomotive up to 25 tons for adhesive purposes in hauling; the ballast consists of a pile of old rails at each end near the lowest point of the deck.

The auxiliary equipment consists of the standard New York

INTERIOR VIEW IN CAB OF THE BROOKLYN ELECTRIC LOCOMOTIVE, SHOWING CONTROL APPARATUS

automatic air-brake system, the air for which is supplied by a special size Christensen air compressor and governor, which were, as above noted, taken from an abandoned shuttle car. In connection with the air system, there is an air whistle, operated by foot valves in the floor of the cab, and also one of the bells is operated by compressed air. The coupler equipment is the standard Van Dorn automatic type as used upon the elevated division. The car is well equipped with grab handles and steps for the convenience of the switchmen, and is provided with a complete set of signal flags, tail lights, lanterns and also roof markers for traveling upon all lines by day or night.

Especial interest is attached to this accomplishment of the mechanical department of the Brooklyn Rapid Transit Company, as this is the first electric locomotive that has been built in its entirety by a railway operating company. Furthermore, additional interest is involved in its entire adaptability to heavy service, as while intended specifically for use upon the elevated divisions, it is largely used for handling standard steam road freight equipment. Not only the many desirable features of its design, but also its success in operation, reflect great credit upon the officials responsible for the design.

SHOP METHODS AT THE REPAIR SHOPS OF THE DETROIT UNITED RAILWAY COMPANY

This article will supplement those presented in the two preceding issues of this journal relative to the new repair shop plant of the Detroit United Railway Company, Detroit, Mich. This shop installation has embodied in its layout of buildings and grounds an excellent arrangement for facilitating all classes of work, and one that brings its various departments into a most harmonious relation. As its mechanical facilities and its working equipment are the result of a careful study of all details of the work, a reference to the shop methods pursued there may be of interest.

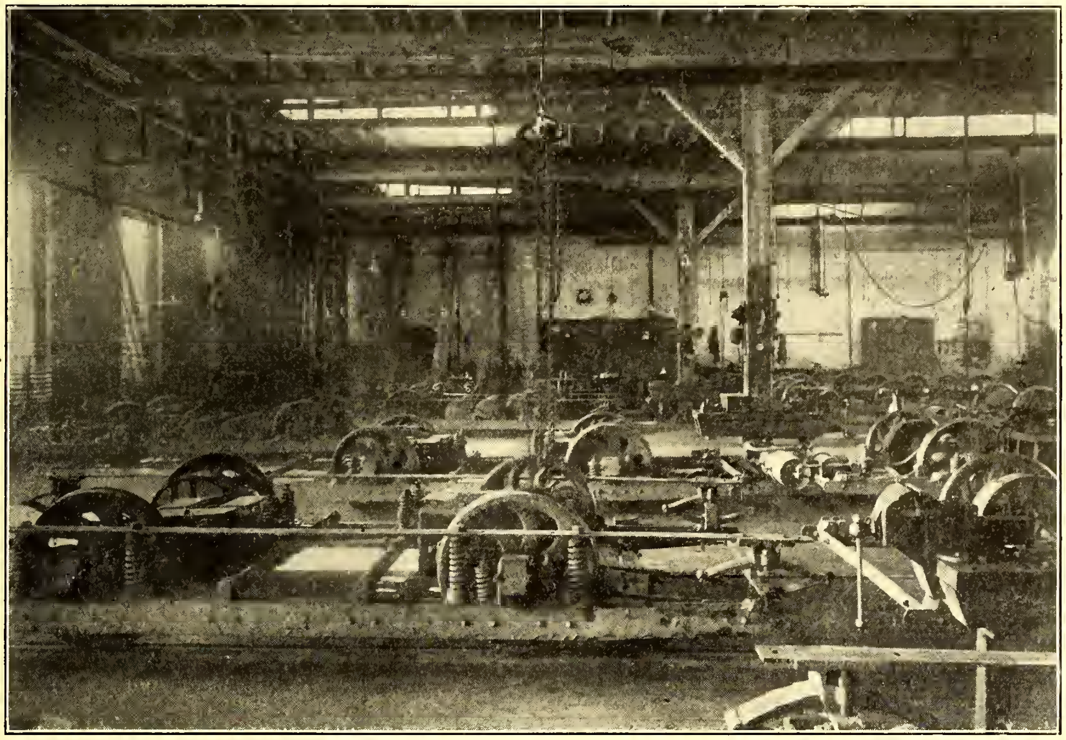
As has been noted in the preceding articles upon the Detroit shops, the shop installation is intended to take care of all the heavy overhaulings and general, as well as detail, repairs to all cars operated upon the various lines of the company; this will include both emergency and special repair work of all kinds, and to all portions of car equipments, and, in addition, the periodical thorough overhaulings and renewals of car equipments which are made every eighteen months to two years upon all cars. On account of the large number of cars operated—over 1200 in all—it is evident that this is a problem of considerable magnitude and one that requires very particular treatment. In fact, on account of the difficult nature of the electrical maintenance work, in its special relation to the conditions ordinarily met in street railway operation, there is, in all probability, no more difficult maintenance problem to be found upon any of our steam railroads, and its successful and efficient handling under the severe conditions of city, as well as interurban service, is only the result of great care and study of the requirements of the work.

METHOD OF HANDLING CARS

One of the first of the many provisions that have been made for all details of the work may be noted from inspection of the drawing in the preceding article upon these shops, in that a storage yard is provided to take care of cars as they come to the shop for work upon them or which are ready to leave. As indicated in the shop layout plan, on pages 260 and 261 of the Feb. 11 issue, this storage yard, which is located at the Monroe and St. Aubin Avenue corner of the grounds, contains fifteen storage tracks, all of which are served by the shop transfer table. An entrance track in this section of the yard also leads out to the adjacent street car tracks, as indicated, whereby easy access is made for cars to and from any portion of the company's system; an additional point of entrance is possible through the end track which connects with a cross track leading down St. Aubin Avenue to the eastbound track of the adjacent loop line on the street below. The total storage capacity of this yard is forty-five city cars, allowing three cars to a track, or thirty interurban cars.

When a car is to be taken into the shops for general overhauling it is first delivered by means of the transfer table to the stripping room at the west end of the buildings upon the Monroe Avenue side, which department is, in general, the starting point for all work of repairing. The stripping room is essentially an inspection department, where all features of the equipment of a car are examined for work needed. In the process of examination, all seats, window sash, doors and other removable fixtures of all kinds are taken out of the car, not only for facilitating the work, at the beginning, of examination as to repairs needed, but also on account of the fact that this enables the parts to be more readily delivered to the other departments in which repairs will be made upon them. Storage space is provided in the stripping room in the form of shelves upon the east wall, in which the parts removed are placed until time for delivery to the repair departments or to the paint shop.

This method of starting the work combines the advantages resulting from concentrating the work of taking out the removable equipment of the cars prior to the work of repairs to a single gang of experienced strippers, with those resulting from the possibility of the shop foreman to thus carefully inspect the equipment, as it is removed, and determine the character and extent of repair work needed upon each part. This combined stripping and inspection process is the regular procedure in car and locomotive repair work upon steam railroads, being there also found to offer many advantages in that better facilities are provided in this way for examining the equipment than can in any other way be obtained. The location of the stripping room in a convenient and well lighted room makes both stripping and inspection process much more convenient than if this work were done upon one of the tracks in the erecting shop, where equal lighting facilities could not possibly be obtained. In addition, the dust and dirt that naturally rises from the stripping process is in this way kept confined entirely to one room, and thus is not liable to spread to other departments, as, for instance, the paint shop, where it would interfere with the work and be liable to do considerable damage.



VIEW IN THE TRUCK DEPARTMENT OF THE NEW REPAIR SHOP PLANT OF THE DETROIT UNITED RAILWAY COMPANY

The next step in the work of the mechanical repairs is that of removing the car body from the truck and delivering it to the erecting shop for repairs, and the truck and its equipment to the truck shop. On account of the fact that in many classes of equipment used in this city the trucks are entirely interchangeable, it is possible to transfer a body which is to undergo repairs onto another truck which has previously been gone over and repaired, and thus permit the body to be moved about the shop upon a completed truck equipment. Another method of procedure is to deliver the car body to the erecting shop upon a dummy truck and the truck proper to the truck shop for repairs independent of the work upon the car body.

THE TRUCK SHOP

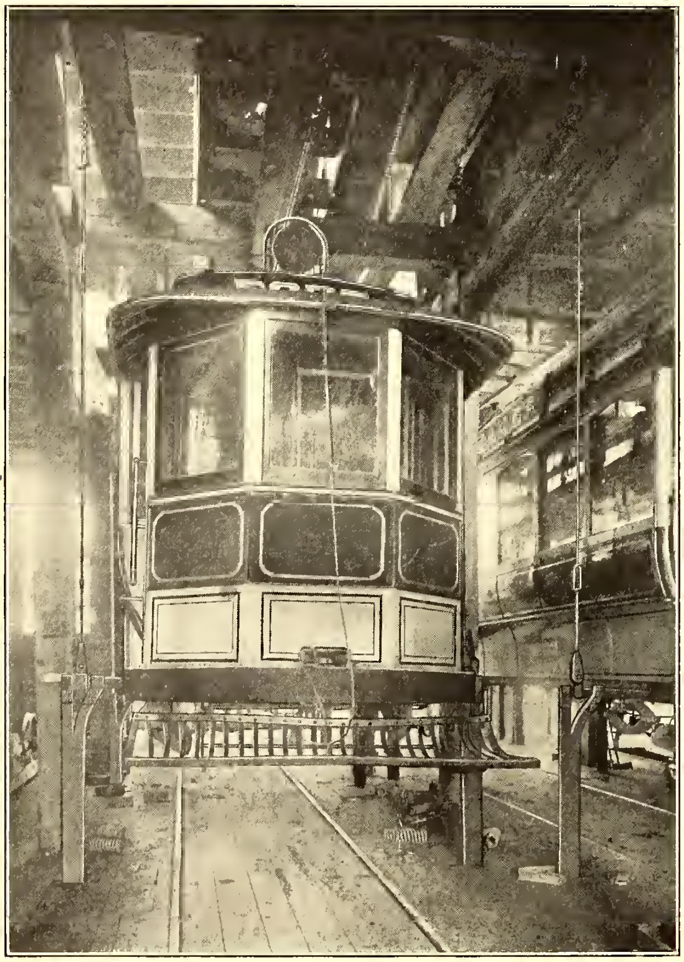
A representative illustration is presented above of the interior of the truck shop, showing the general character of the work carried on in that department. This shop occupies a section of the building upon the Monroe Avenue side 180 ft. x 70 ft. in size, and has fifteen tracks for the accommodation of the work. It is especially well adapted for work of this nature, as it is well lighted and is conveniently arranged. In this shop the trucks are carefully gone over and all wearing parts inspected for wear and renewed if necessary; the motors are here removed for repair work, or their field coils and armatures replaced from stock in the electrical department as is found to be necessary. The same procedure is carried out in the handling of wheels, which are removed at this time if necessary for replacing or for repairs of any description.

For handling the truck work to the best advantage, crane runways, with traveling pneumatic or chain hoists, are located over each of the parallel tracks in this shop, by means of which the repair work is greatly facilitated. Armatures are lifted out or in with ease in this way, and also assembling work is likewise greatly facilitated. As may be noted from the view in this shop, in many cases the track has both a chain hoist and a pneumatic hoist over it; both the chain and the pneumatic hoists used are of 1-ton capacity. The runways are plain 8-in. I-beams, carried upon roof beam supports 5 ft. to 6 ft. apart. Over one end of the fourth track from the west end of the shop is located a stationary 10-ton pneumatic hoist, which is used for lifting trucks with motors in place for certain classes of work.

Six of the tracks toward the east end of the truck shop are equipped with pits for facilitating inspections and light or emergency repairs to the trucks or motor equipments which do not require disassembling the equipment. There is not as much call for pit work in a shop of the scope of these, yet the pits as here used are a great convenience. One of the pits is equipped with wheel - grinding apparatus for the truing of "flatted" wheels without removing them from beneath the car. The grinding machines, which are located in adjacent pits, consist each of adjustable emery wheel stands, one beneath a removable section of the pit track on either side. The emery wheel spindles are driven through belting from a Westinghouse type 12a railway motor at the rear end of the pit, the belt connection allowing the necessary vertical adjustment up beneath the car wheels. The car wheels are, in grinding, rotated in the opposite direction from the emery wheels by the car motors themselves. This apparatus was designed by the officials of the railway company and has proven very satisfactory in operation.

Another interesting feature of the truck shop equipment is to be noted in the car-hoisting apparatus which are illustrated in an accompanying photograph. There are two car hoists, located on adjacent tracks, which consist essentially of electrically-driven elevators located above the roof beams, by which the car bodies may be lifted off of their trucks for repair work. As mentioned before, the use of interchangeable trucks under certain standard classes of car equipments is one of the desirable practices in this city, and by it truck work is in all cases greatly facilitated. In the case of a car coming to the shop for truck or motor equipment repairs, while the body is in too good a condition to warrant the expense of overhauling, it is only necessary to replace this truck by another one which has been previously gone over and is in good condition, whereupon the car is enabled to immediately go back into service; this is in many cases a great saving in time of keeping equipments out of service, and is, it is thought, a means by which the amount of spare equipment necessary for the satisfactory operation of the road has been greatly reduced from that which would otherwise be necessary.

The car hoist consists of an elevator mechanism located in a protecting housing above the roof beams, and arranged with four car lifting slings or hooks. The mechanism does not differ materially from that of usual elevator construction, a drum being used for the two lifting chains at either end of the car. It is driven by a direct-connected railway type motor, which is controlled from the floor by a car controller conveniently located for the operator. An interesting sling construction is used for the actual lifting connection, as shown in the view. These consist of 6-in. x 1-in. bars, which are arranged to play up and down through an opening in the floor between guiding rollers; at the top are riveted projecting struts which are hooked beneath the car body sills for hoisting. This construction, while very simple, is amply strong for the maximum requirements.



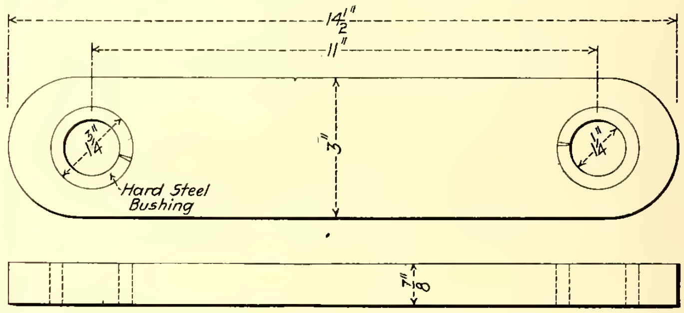
THE CAR HOIST IN THE TRUCK SHOP FOR LIFTING CAR BODIES OFF OF TRUCKS

An interesting practice is carried out in the truck repair work in the construction of swing links for the trucks of double-truck cars. It was formerly found that the wear upon the swing links, between the frames and bolsters of the trucks, was sufficient to seriously lower the car body in relation to the truck after the wear of only a year or so; this lowering of the body required in practically all cases the links to be replaced by new ones, at a considerable expense, in order to properly adjust the height of the car body. The practice is now to equip all swing links with steel bushings in the bolt holes, which bushings may be removed when seriously worn and replaced by new ones. The accompanying drawing shows in detail the construction of one of the swing links for a standard type of truck used upon one of the interurban lines. The bushings are, as may be noted, made of ⅞-in. x ¼-in. steel bars, which are shaped in the blacksmith shop into rings of size sufficient to form a press fit in the holes in the links, and give an interior diameter of hole of 1¼ ins. It is evident that when worn these bushings may easily be driven out and replaced by new ones. A hard grade of steel is used for the bushings, while, as a result of this, a much more tough grade of soft steel may be used for the links proper. This practice has been found very economical and satisfactory. The links of this construction have all been made in the blacksmith shop, and all repairs are made upon them there also.

A feature of the equipment of the truck shop is to be noted in the air compressor, as shown in the general interior view, which is used for supplying the high-pressure compressed air to the storage air-brake system. The compressor, which was supplied by the National Electric Company, is of the two-stage belt-driven type, having a capacity of 125 cu. ft. of free air per minute. It is driven by a Walker type-75 railway motor, belted to the countershaft upon the side wall, as shown; the drive to the compressor is through belts running to each of the two fly-wheels. Two large storage tanks are installed in the corner of the room for maintaining a supply of air for the charging of storage tanks upon cars passing on the adjacent street railway track, and also supplying compressed air for use in the shops. For the latter service the pressure is reduced from 300 lbs. maintained in the storage tanks, by means of reducing valves, to a pressure of 80 lbs. for distribution in the shops; the shop supply is piped to various departments, where it is used in hoists, for cleaning, the driving of air hammers and drills, etc.

THE ERECTING SHOP

Coincident with the delivery of the truck of a car from the stripping room to the truck shop, the car body is removed either



METHOD OF USING REPLACABLE HARDENED BUSHINGS IN BOLT HOLES OF SWING LINKS FOR INTERURBAN TRUCKS

upon its own truck or upon a dummy truck to the erecting shop, where any necessary repairs are made either to the frame or to the exterior or interior finish. It occasionally happens that new sill or frame work is necessary, while in many cases repairs to the floors, windows, platforms and other features of the equipment are required, which are here done to the best advantage. It may be stated that frame work repairs are found very light upon the smaller city cars, although such work has developed upon the heavier interurban cars to a small extent.

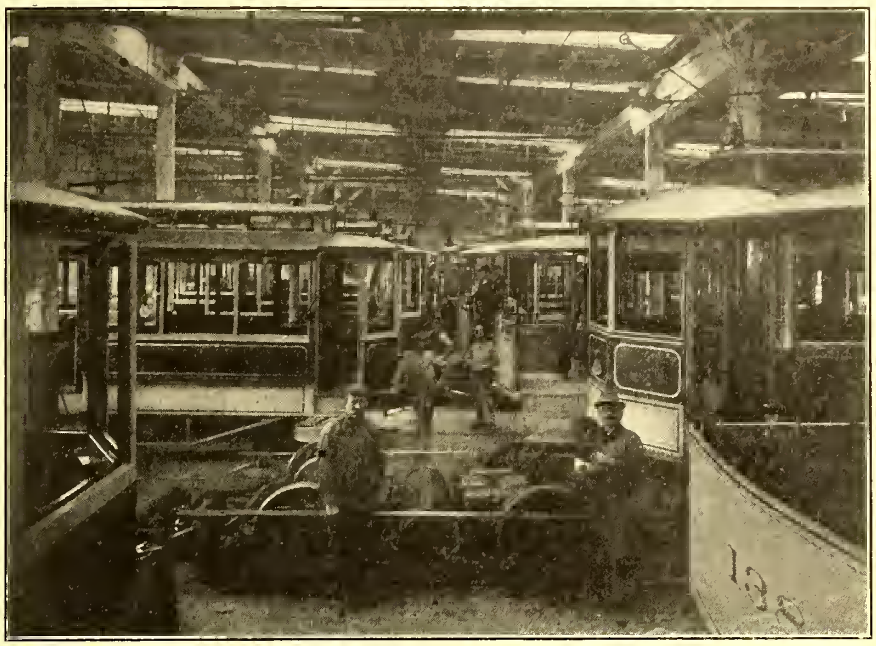
This shop is 94 ft. x 82 ft. in size and is amply large for the work. It is well lighted by both side window and skylighting. The floor is finished flush with the level of tops of rails, with one exception; in this shop the work of installation of the new style of fender is being carried out, as will be referred to later on; for this work one of the tracks is provided with a pit which permits easier access to the lower side of the front platform, for mounting the necessary supports and brackets for the fenders, and also the arrangement of the tripping mechanism. Cars are usually also brought back to this shop after the painting process for the final resassembling of window sash, doors, etc., back into the cars when dry.

The erecting shop will be made an important factor in the shop work of this company, and it will no doubt exert an important influence upon future practice in this country. Where a company expects to undertake heavy repairs to cars, or even the work of heavy repairs, involving changes of frame work, etc., the provision of an erecting or assembling department, carefully devoted to the requirements of car building, is of great importance. The Detroit United Railway Company has done considerable car building, including both local city cars and interurban cars; nine of the double-truck cars used upon the Wyandotte division were built in the repair shops, as well as also 124 of the standard single-truck closed cars, of the type illustrated on pages 357 and 358, and the parlor car of the company, known as the "Yolande."

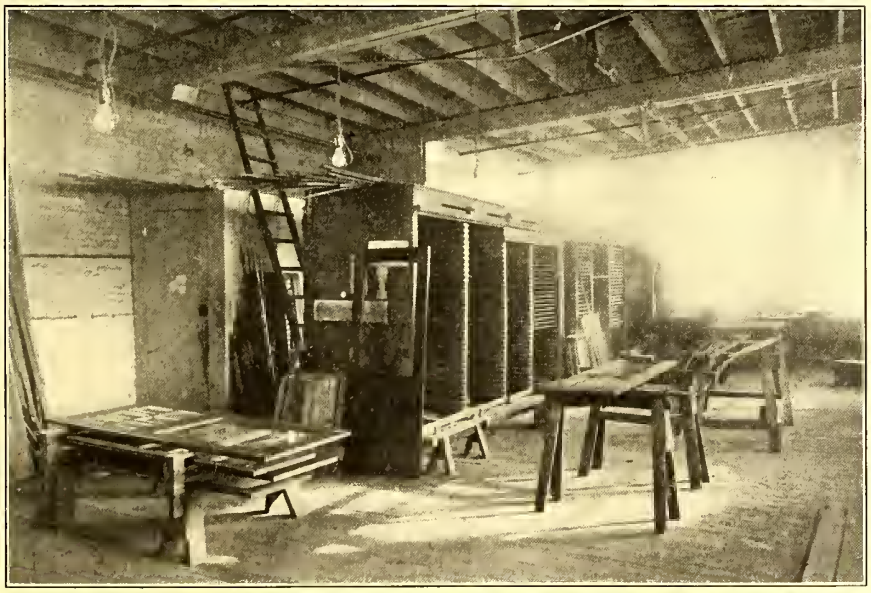
THE PAINT SHOP

After leaving the erecting shop, or if no heavy work is found necessary after stripping, the car is taken to the wash room, where it is thoroughly cleansed from dirt and grease preparatory to the painting process. The wash room is a single-track department opposite the stripping room, and provided with a concrete floor sloped so as to give adequate drainage, which permits the free use of the hose in washing. It is the practice to go over the cars very thoroughly with the hose, and subsequent sponging and brushing, to bring them to as clean a state as possible. The room is well ventilated for quick drying, and also extra radiators are installed in this room to give the heat necessary for drying the work quickly after washing in the winter or in damp weather, this being an important feature for quick and effective wash-room work.

The next step for the cars is to the paint shop adjacent, where the touching-up and final varnishing is given the bodies preparatory to the completion of the work. Cars are generally scraped preparatory to painting, and filled wherever necessary; after this they are rubbed down carefully and then given a final painting. The standard color used in Detroit for the city cars, as may be noted from the accompanying views, is a yellow with dark trimmings, which gives the cars a very bright and attractive appearance; the standard color for the interurban cars is a dark red or wine color. The work of varnishing of car interiors is greatly facilitated by the removal of the sash, doors, seats, etc. A separate department is provided on the second floor of the wash room for the work of varnishing window sash, doors and other parts of cars, as well as also the sign painting. Excellent facilities are here provided for this work, one of the principal advantages being that of excellent lighting. The window sash and doors are brought here after washing by means of an elevator at the rear of the wash room. An important special provision is made for the handling of varnished work, in the form of drying racks, by which the doors and sash are mounted for drying after varnishing. The drying racks are shown in an accompanying engraving; those used for doors are to be seen in the left foreground. The first door is mounted upon a pair of horses, by means of four three-cornered wedges, in such a way that only the corner of one edge of the door rests on each supporting wedge, and thus no flat support is brought against a varnished surface. Above this is laid a bridge in such a way as to support the next door above it without contact with the door underneath; the next door rests upon similar wedges upon this bridge, and in this way doors may be piled to any height desired.



GENERAL VIEW IN THE PAINT SHOP OF THE DETROIT SHOP PLANT



VIEW IN THE VARNISHING DEPARTMENT, SHOWING METHODS OF SUPPORTING DOORS AND WINDOW SASH IN DRYING

The sash drying storage consists of a series of cabinets with similarly arranged means of supporting each individual sash separately. The partitions are provided with three-cornered cleats, as shown, which are mounted in such a way as to support the newly varnished sash between them by their edges only; this is possible without bringing more than the corner of each edge of the sash in contact with the supporting strip, and thus prevents marring of the freshly varnished surface. These cabinets have curtains which may be drawn down over the fronts to keep out any possible dust that may find its way into this department, thus insuring the drying to the best possible advantage. This cabinet has adjustable partitions, which may thus be moved along to accommodate different widths of sash.

An important feature of the paint shop equipment is the painters' supply room, a paint storage department, which is maintained for most economically handling the oil, color, varnish, brushes and other supplies for the painting of cars. This store room, of which an interior view is presented herewith, occupies a space, 12 ft. x 52 ft. in area, between the erecting and woodworking shops. All construction in this room is fireproof, the floor being of concrete and the ceiling of brick, arched between I-beams. The best of facilities are provided for properly handling the supplies. The dry colors are kept in bins underneath the counter in the middle of the room, while

THE FIREPROOF PAINT STOCK AND SUPPLY ROOM FOR USE OF THE PAINT SHOP DEPARTMENT

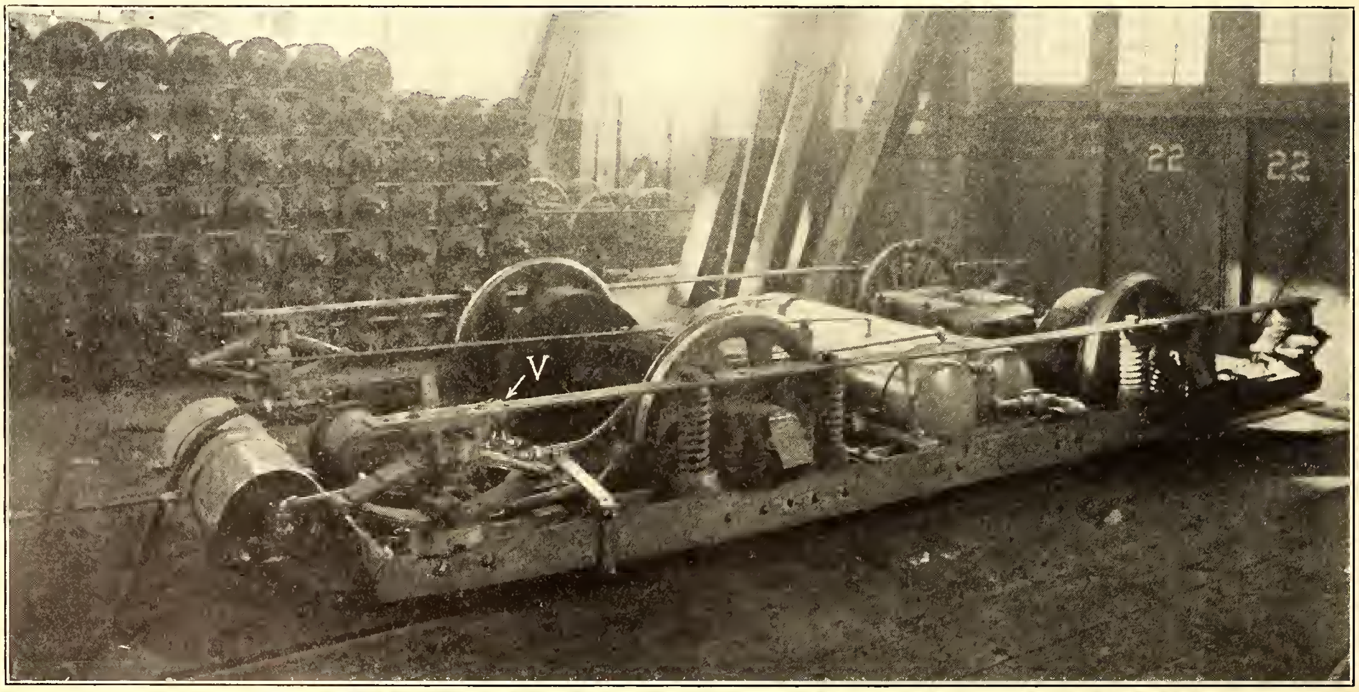
shelving is provided for can paints, sandpaper, etc. Barrels of oil are set upon pedestals over large tray-like pits in the floor so that accidental leakage may not easily cover the entire floor and thus offer serious fire risk. This store room is equipped with a color grinder for facilitating the preparation of paints.

STORAGE AIR BRAKES

Detroit is looked to as practically the birthplace of the storage air-brake system. Its first application was upon the cars of the Detroit & Pontiac Railway, a 26-mile interurban line between the two above cities, which is now a part of the Detroit United Railway. This system was equipped in 1898 by the Magann Air Brake Company, two high-pressure storage reservoirs being applied to each car, which carried 300 lbs. pressure. The car-braking system was a straight-air equipment of usual construction, taking its service air supply from an auxiliary reservoir, into which air is fed at 40 lbs. by a reducing valve from the storage tanks. The high-pressure supply was furnished by a compressor in the power station at Birmingham, the cars being charged at least once per trip.

The results from the storage-air system, as here tried, were very satisfactory and led to further applications to cars of both the city and interurban systems. During 1900 and 1901 the company made an extensive series of tests of the workings of the system, under varied conditions of service, weather, etc.; with various minor changes and improvements, it proved very reliable, and as a result it was adopted as the standard system of air braking for the lines of the company. Later on, when the decision was made by the company to apply air brakes to its entire rolling stock equipment, the storage-air system was accordingly adopted, and has now been applied to all of its double-truck cars and to many of the single-truck equipments. The remainder of the single-truck cars are now being rapidly equipped, from three to five trucks being completed per day.

An accompanying photograph illustrates a typical application of the storage-air equipment to the truck of a single-truck car, this one having been photographed when just completed and ready to be placed in service. As may be noted, the two high-pressure storage tanks are carried in the middle of the truck upon cross frame members between the motors. The tanks are connected together by the charging hose line which projects upon either side, ending in hose couplings next to the outside, for charging at car houses. The auxiliary or service reservoir is hung beyond the end of the frame at the leading or forward end of the car, the air supply to this reservoir being piped from the high-pressure tanks through a reducing valve,



VIEW OF ONE OF THE STANDARD TRUCKS USED UNDER THE SINGLE-TRUCK CARS AT DETROIT, SHOWING APPLICATION OF THE STORAGE AIR-BRAKE APPARATUS

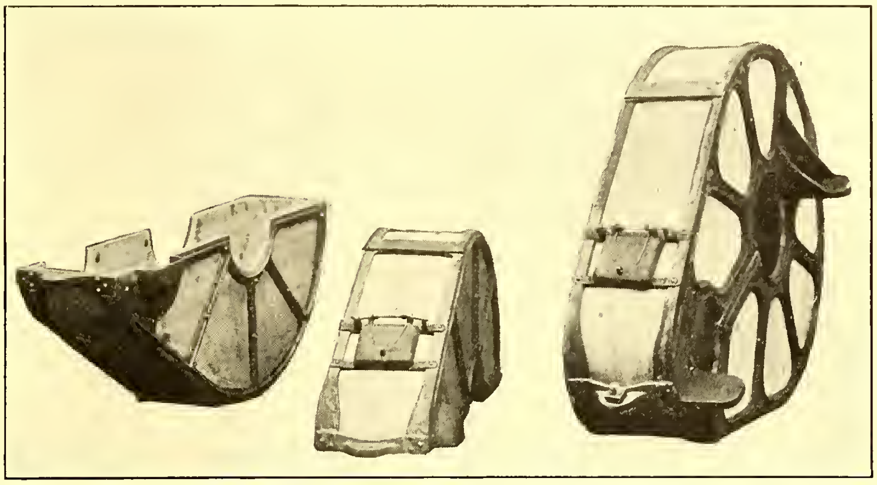
as shown at *V*. The connections to the motorman's valve in the front cab of the car are made through flexible hose couplings, as are shown projecting over the service tank at the front in the illustration. A connection is made from the storage tanks to the high-pressure gage in the cab through the ¼-in. pipe, which is pivoted back toward the middle of the truck so that the tilting of the car does not bring undue stresses upon the connections.

The operation of the brake system is, as is usual in the storage-air system, upon the "straight-air" principle, the service air being admitted directly to the brake cylinder or released, as desired, by a "straight-air" motorman's valve in the cab. The brake cylinder used is of the duplex type, as was thought to be necessary on account of the limited space afforded by the arrangement of leverage adopted; this permitted its application with ease to the very small amount of room found available. The cylinder is set crosswise of the car and operates the brake beams through a differential or toggle system of levers, by which the proper amount of brake-beam travel is obtained.

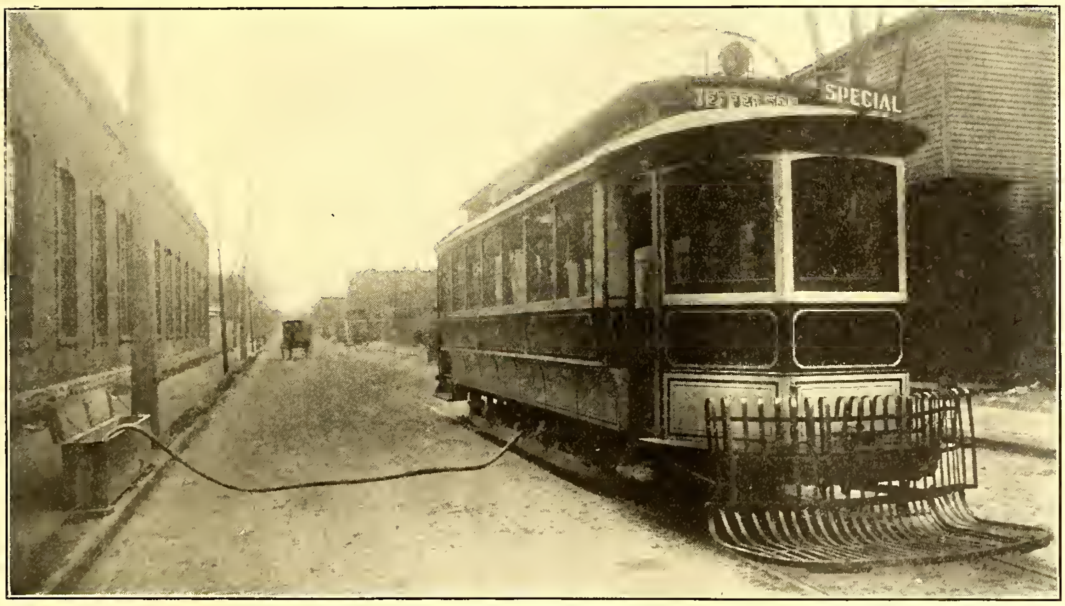
The application of this apparatus necessitated various changes in details of the truck, one of the most important of which was the lengthening of its wheel base by approximately 6 ins.; this was necessary to admit of the two storage tanks between the motors, the former arrangement of motors not furnishing sufficient space. The other changes involved very little additional work; the securing of both the storage tanks and the service tank to the frames was easily accomplished by special shaped bars for clamping directly to the available supporting parts. The arrangement of the brake cylinder is rather novel for the small amount of space required, while the arrangement of the entire equipment, in general, is commendable for its simplicity. All of the apparatus used in the equipping of the cars, which is of the well-known Christensen type, was furnished by the National Electric Company, and is being installed upon the cars by the railway company.

Another illustration shows the method of charging the car tanks when in service. As the cars stop in passing their car house, which in most cases is the charging station of the line, the charging hose is carried out from the protecting box at the side of the street and hooked on to the charging coupling upon the nearer side of the truck and the high-pressure supply turned on by means of a cock in the street box. The time taken for charging the storage tanks to the pressure carried, namely, 300 lbs., is very short, varying from thirty to forty seconds, according to the pressure remaining in the storage tanks. The station shown in the view is the charging station at the Monroe Avenue shops, the high-pressure supply being obtained from the air-compressor outfit, above referred to in the truck department. Other charging stations are provided for nearly every line, being installed usually at the car houses.

An interesting development in connection with the use of the storage-air system is to be noted in the recent completion at the shops of a portable compressing equipment. This outfit consists of a standard high-pressure Christensen compressor, direct-driven by a Walker 75 railway motor, together with the necessary storage and cooling tanks; these have been installed upon a specially built box car so that it may travel from point to point upon the lines of the company, as may be desired. The car is a double-truck closed-body car, resembling the style of baggage car used in Detroit, and is equipped with motors so that it may travel under its own power, being geared to a fairly high speed for rapid traveling. One of the prime purposes of this car is to provide a charging station for emergency cases and for use at points where it is deemed inadvisable to maintain a compressing equipment; this will occur at certain points in Detroit, particularly upon short lines where only a very few cars are operated. In this way the compressor car will be run to the car house in question once or twice a day to fill up the stationary charging tanks there, and thus in this manner cover several different car houses; the resulting saving in air-compressor equipments at these less important charging stations will be evident.



DETAIL VIEW OF THE NEW TYPE OF REINFORCED WOODEN GEAR CASE NOW IN USE AT DETROIT

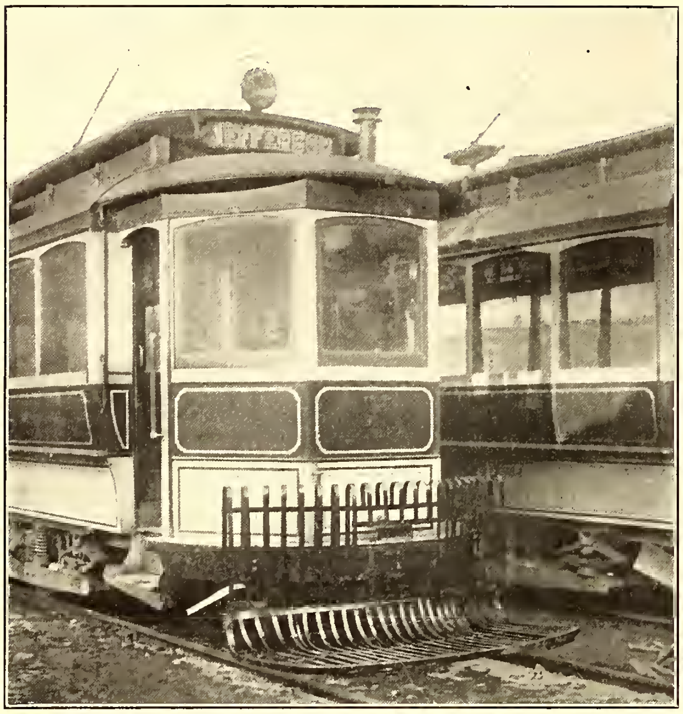


ONE OF THE SINGLE-TRUCK CARS, EQUIPPED WITH STORAGE AIR BRAKES, TAKING SUPPLY OF HIGH-PRESSURE AIR

WOODEN GEAR CASES

One of the important departures in mechanical practice which were adopted by this company has been the use of wooden gear cases to supplant those of all-metal construction. This was tried some years ago in an attempt to not only cheapen the cost of gear case renewals, but also to provide immunity from the damage to motors which occurs when the all-metal gear cases are broken accidentally. Several forms of the wooden gear case have been tried experimentally at Detroit, with the result that the form of case with a light metal reinforcing frame work was eventually adopted and is now being applied for all renewals. The experience with the plain all-wood case was not entirely satisfactory, principally for the reason of its inherent lack of strength; the reinforced case offers the advantage of freedom from warping and has sufficient strength of its own to withstand very considerably more severe usage.

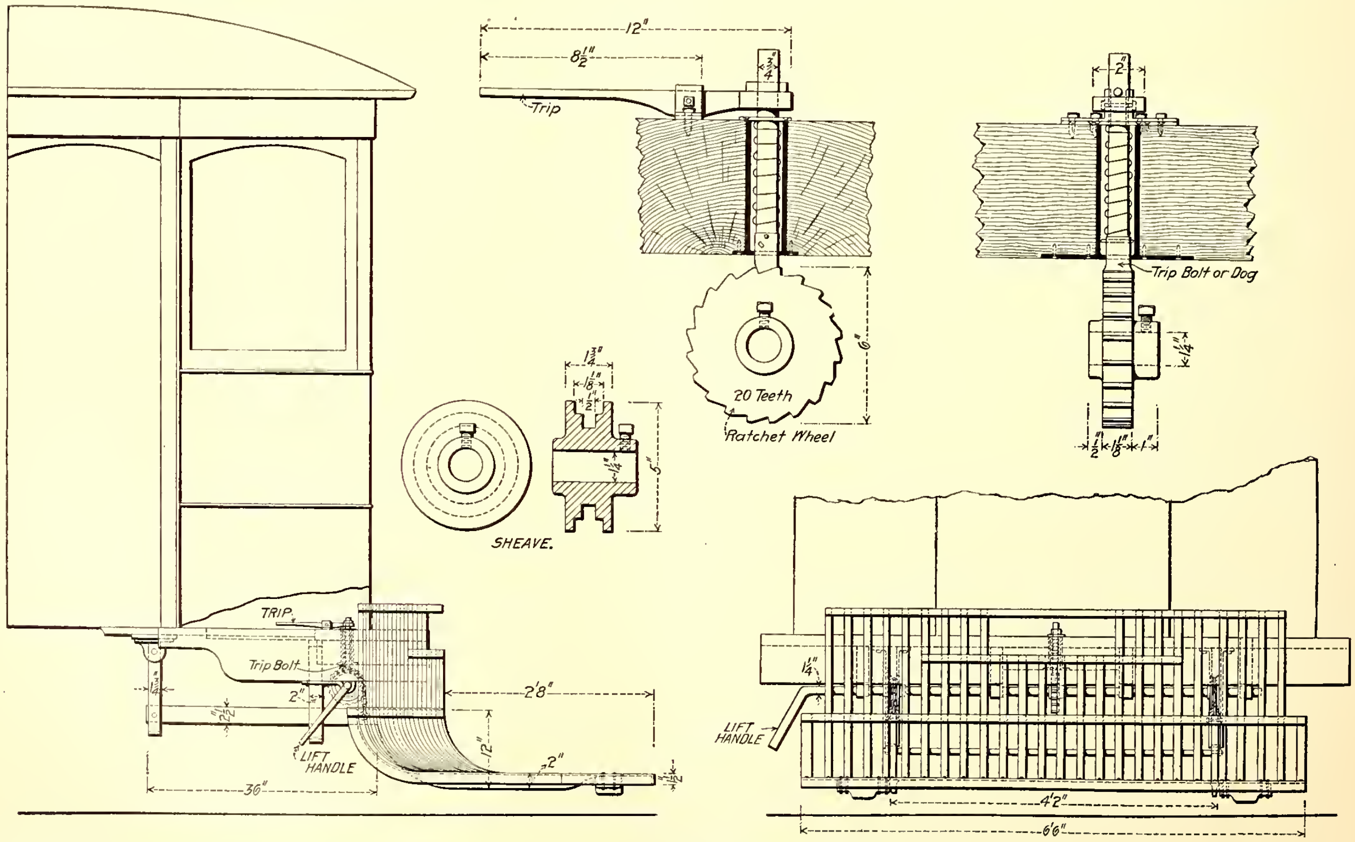
The accompanying illustration presents an excellent idea of



THE PRESENT FORM OF DROP-FENDER AS APPLIED TO ONE OF THE STANDARD CITY CARS OF THE DETROIT UNITED RAILWAY COMPANY

whitewood, which is riveted firmly to the frame work. The edge pieces are of ¼-in. elm, which are steamed to a shape corresponding to the contour of the frame and slipped in place first; the side pieces, which are of whitewood ⅜ in. thick, are afterward set in place and securely riveted, which results in holding the edge pieces in place without further fastening. The spring oiling door is easily applied by means of the malleable casting, which, in addition to forming the door, provides also additional cross bracing between the side frames, as shown.

The advantages found in the use of the wooden gear case at Detroit embrace not only those of less cost, but also those of much less weight and less space occupied, while, in addition, the danger of bending of an armature shaft by broken pieces getting between the gears, as when an all-metal case is broken, is hereby practically avoided. The nature of the wood sides is such as to hold the parts together to a limited extent, even if the case meets an obstruction upon the street and is badly broken. The weight is, of course, less than a quarter of that of the metal case, while the cost is said to be less than a third; the wooden cases are found to cost less than $5 each, ready to apply to the car. They are not painted, but are put in service just as they are finished in the machine shop, and are found to work very satisfactorily in that condition; the impregnation of the wood sides with the grease from the gears is found to amply protect the wood from the effects of moisture. One feature that contributes very largely to the low cost of manufacture of the case is the small amount of machining or finishing that is necessary in preparing the side frames for assembling; practically all that is necessary is to grind the lugs and supporting faces smooth and then drill the holes for the rivets. The preparation of the wooden parts involves as much cost, if not greater, than that of the metal reinforcing frames.



DETAILS OF THE QUICK-ACTING DROP-FENDER AS APPLIED TO A STANDARD CITY CAR, SHOWING FOOT TRIP AND DETAILS OF RATCHET MECHANISM

the construction of this type of gear case. It consists of four side frames of light malleable iron construction, the two half sides being tied together and thoroughly braced by the cross metal strips, which are riveted at frequent intervals to projecting lugs, as shown. The wooden filling is of thin elm and

DROP FENDERS

Another interesting departure is to be noted in the new style of drop fender which is being built and applied by the company to its cars of all classes, both single and double truck. This fender is considerably different from any other style of drop fender, and involves interesting and important features. The prime requisite sought in the design of this fender was that, while it should be normally carried in a position elevated from the track, it could, when needed, be dropped instantly to such a position in close proximity to the rails that a person cannot fall and be rolled beneath it and the car.

The details of the fender and its application to one of the cars are clearly shown in the accompanying photograph and drawings. The lower portion of the fender consists of a scoop-shaped frame 6 ft. 6 ins. wide, with a forward projection of 2 ft. 8 ins. This portion is built up of twenty-four steel straps 1½ ins. wide, which are riveted to shaped side pieces for supporting and stiffening, as shown. The bar forming the front edge is a 1½-in. angle, which is shaped as indicated. The actual support of the fender is through the lifting and tripping chain, which acts upon a 1¼-in. square bar forming the supporting frame work; this bar is pivoted to a trunnion underneath the platform and 1 ft. back from the front of the car. The upper portion serves merely as a spring cushion to prevent a person falling into the fender from striking heavily against the buffer beam of the car.

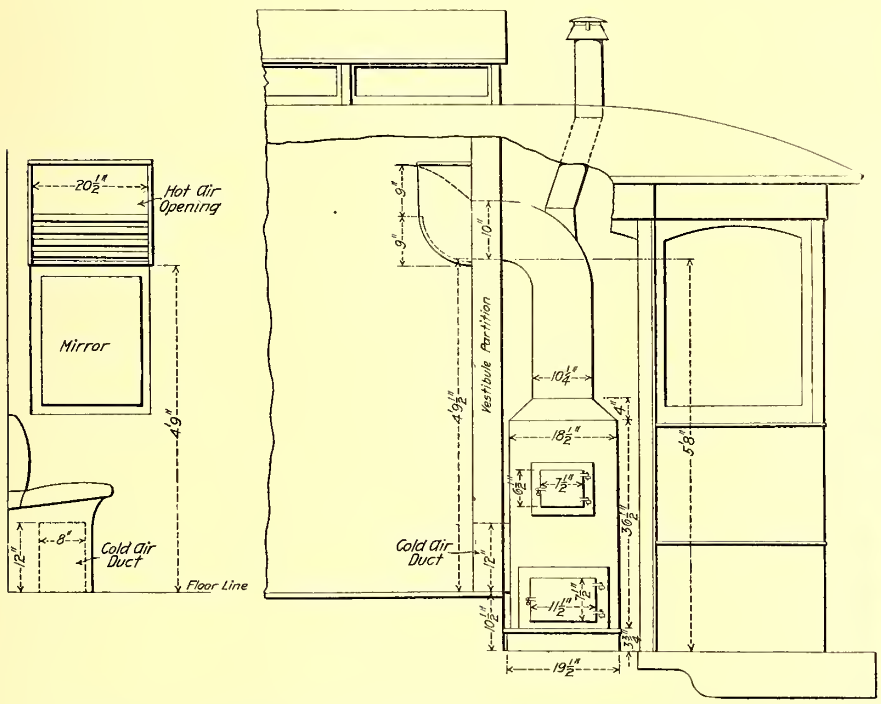
The details of the tripping and lifting mechanism are shown enlarged in the drawing. The lower portion of the fender is normally held in a lifted position by means of the trip bolt or dog acting upon the ratchet wheel at the middle of the lifting shaft. When it is desired to drop the fender it is only necessary for the motorman to step on the trip lever, which allows the fender to drop by its own weight, and this it does so quickly as to be practically instantaneous. When it is desired to return the fender to its lifted position the motorman works the lift handle up one-quarter of a turn in order to wind the lifting chains upon the sheaves, which returns the fender to its normal elevated running position. The ratchet wheel normally holds the lifting shaft from unwinding, although the trip dog is shaped so as to release its load with the least possible effort when desired.

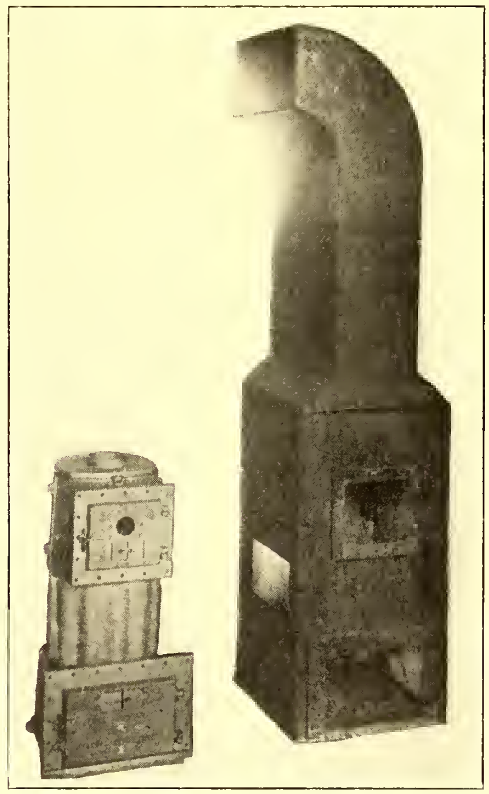
Much care and thought has been devoted to this fender construction, with the result that a very satisfactory type has now been secured. A recent departure, which is not indicated in the drawing, has been made which provides additional security for those unfortunate enough to be caught by the fender. This is to be noted in the provision of a spring frame work which is found to very materially soften the fall of a person if thus caught. This spring frame work is separated from the lower portion of the fender, and may be lifted on or off of the end buffer of the car, as may be desired, four supporting clips being provided for the purpose.

All of the work of construction of the fenders is being carried out by the company at the shops. The various parts are made up in quantities, the frames being forged to standard templates and the detail parts made to standard for interchangeability. The assembling of the various sections of the fender frames is carried out in the smith shop, special jigs having been fitted up for facilitating the riveting of the strips to the frames, as well as for the punching of rivet holes in the metal bands, and reflects much credit upon the manufacturing facilities that are provided in the new shop.

CAR HEATING

An interesting stove arrangement for the heating of cars is made use of in Detroit, as indicated in the accompanying drawings. As all cars are operated single ended in this city, it has been found very convenient to install the stoves in the motorman's vestibules and deliver the heated air through register openings into the car proper. This arrangement is illustrated in the drawing, while the photograph shows the style of stove used and the casing which serves as the hot-air flue.





DETAILS OF THE HOT-AIR SYSTEM OF CAR HEATING AS APPLIED TO THE DETROIT CARS, AND DETAIL VIEW OF THE SPECIAL STOVE AND FLUE

The style of stove used is a special design of the "Jewell" anthracite coal burner, which was furnished by the Detroit Stove Works to meet the requirements of this service. Both the fire door and ash door plates are finished flat and provided with bolt holes for bolting to the openings in the hot-air flue, as shown. The lower left-hand opening in the case connects through the vestibule partition to the space under the car seats, so that the cold air intake is from the lower portion of the car body; the outlet, or hot-air delivery, is at the upper curved end, which projects through into the upper portion of the car. The diagrams and further details of this arrangement are clearly shown in the drawing. It may be added that the window sash, opening toward the heater casing, is filled with a mirror instead of the ordinary glass in this case.

This arrangement is found to afford many advantages, one of the most important of which is the saving of available passenger space by locating the stove in practically waste room in the vestibule; this is made possible by the fact that cars are operated single-ended in this city, so that it is not necessary to keep the front vestibule free for use of passengers. Furthermore, it keeps the dirt and dust, which are unavoidable in caring for the fire, entirely out of the car and where it is easily attended by the motorman. The results in actual heating of the car has in all cases proven very satisfactory, a very even temperature being maintained in the car and with the least possible trouble.

The foremen in charge of the above departments are as follows: Truck shop, Wm. Melchoir; air-brake work, F. Curtain; paint shop, Wm. F. Lampson, and chief inspector, H. Savage. As stated in the preceding article, all the mechanical work comes under the supervision of Sylvester Potter, master mechanic, who reports to F. W. Brooks, assistant general manager of the company. Mr. Potter is a man of wide experience in shop work, having been engaged in such work for many years. Credit is hereby acknowledged to Mr. Potter for the interesting information contained in the articles descriptive of the shop plant and its management.

THE CENTRAL PASSENGER ASSOCIATION MEETING

It is understood that at a meeting of the Central Passenger Association held at Chicago last week, objection was made to the manner in which some of the steam roads in the district, notably the Clover Leaf and the Wheeling & Lake Erie Railway, are ignoring the policy of the association and making alliance and interlining business with electric roads. However, no formal action was taken in the matter.

Alliances between the steam and the electric roads are becoming quite common. In fact, this kind of alliance has been entered into by some of the strongest steam roads in the country, and in a number of cases contracts with traction companies have been made which extend over a period of years. The railroads are not in a position to abrogate these contracts even if they wanted to. If the association had insisted upon obedience to its rules covering this point, the railroads having such agreements would have been compelled to withdraw. Another feature enters into the situation. It is the fact that a number of the leading steam roads, particularly in the East, have adopted the policy of buying up competing traction lines, making them the short-haul carriers in their own systems. These companies could not very well refuse to have dealings with the electric lines.

A short time ago the Canton-Akron Railway Company decided to abandon the plan of operating its city system on a ten-minute headway, as it was found that the patronage did not warrant such frequent service. A fifteen-minute headway was therefore instituted. The change met with such strenuous opposition, however, that the company has announced in an open letter that it will make a thirty days' trial of a new schedule giving fifteen-minute headway on all city lines. In this communication it was stated that the fifteen-minute headway represented a saving of four cars a day, or $1,800 per month, over the old ten-minute headway. It is claimed that for the twelve-minute headway as many cars will be required as for the ten-minute headway, but the company expresses a willingness to give this schedule a trial, so that it can be demonstrated by actual figures whether the same can be maintained at a reasonable profit. It is announced that if the results show that the service cannot be maintained at a profit, the company will take action to protect its interests.

SUMMER RESORTS

BY R. T. GUNN,
General Manager of the Lexington Railway Company and former General Superintendent Norfolk Railway & Light Company

This article will deal primarily with the seaside resort, but as the pleasure parks of the inland cities doubtless experience the same difficulties and encounter the same problems, in construction and operation of both parks and railways tributary to same, it may not be uninteresting to persons operating either class of resorts to hear of the other fellow's experience.

The resort of a few years ago is a thing of the past. Nothing in this country has shown its advance any plainer than the resort of to-day, and it marks the tendency and progress of our progressive country.

The first parks opened by the street railways were experiments, and, as a rule, were furnished poor talent, not only in the amusements, but also in designing. No one is to be blamed for this condition—the possibilities of the resort had not been demonstrated, there was not enough in sight for good talent for the amusements, and it was all guess work from the railway's standpoint. Now we have the light of a few years experience to guide us, and mistakes (a great many costly ones) are to be remembered and a repetition of them avoided. Perhaps the most costly mistake made by the parks of early days was the character of attraction offered and the class of people catered to. The average park then was patronized by the rough and tough element—unprotected ladies and children dared not go. Perhaps the Chicago World's Fair was responsible for part of this. It had the name that "everything goes on the Midway," and how many of us can remember the "leaders" on the billboard as that time, reading "Direct from Coney Island," and the smaller places naturally imitate the larger ones.

Speaking of Coney Island calls to mind an article in the last August "Century Magazine," by Albert Bigelow Paine, on "The New Coney Island." It is the greatest advertisement the resort ever had—by a leading author, in a leading magazine—and it is certainly interesting reading, giving an accurate account of the "Old Coney" and bearing out the statement made in this article of its character and describing vividly the new; giving in detail the transition from the old, with its hard reputation, to the new, where any person can go with perfect propriety and safety to a "clean and beautiful garden of delight," as he very aptly puts it.

Speaking from experience, the Ocean View, Va., resort, about which this article is supposed to be written, has had, comparatively speaking, a history similar to that of Coney Island. Ocean View is situated on Chesapeake Bay, looking out on the Atlantic Ocean, between Cape Charles and Cape Henry, 10 miles from Norfolk proper. The Ocean View division of the Norfolk Railway & Light Company runs from Norfolk (where it connects with the city division, issuing to and accepting transfers from same) to Ocean View, the line being double-tracked with a loop on each end for handling trailers. Three miles of single track is operated between Ocean View and Willoughby Pier, where a ferry is maintained to and from Old Point Comfort, 4 miles across Hampton Roads.

The geographical situation of Ocean View is such as to make it logically the future summer home for Farther Norfolk, as well as for residents of Old Point Comfort, Hampton and Newport News.

Ocean View, like any other resort situated near seaport cities, has a varied class of people to cater to. Sailing and steam vessels are constantly coming to Norfolk harbor for coaling and cargo from all over the world, the great Lambert's Point coal piers being only 4 miles from the heart of Norfolk, not mentioning the coaling piers of the Chesapeake & Ohio Railway at Newport News. The crew from a vessel which has been out of sight of land from three to five months is pretty apt to become boisterous when first visiting a resort, but a good and sufficient police force will work wonders in handling even the roughest element.

We will pass over the early days of Ocean View, except for comparison and to show how apparently insurmountable difficulties may be obliterated. The gambling devices, fakirs, Sunday drunks, entertainments which bordered on the limit are all things of the past and gone. In their stead is a place (with three times the attendance) clean, morally and physically, with its healthful and harmless attractions. Where the weeds once grew rank is a beautiful lawn. Nothing perhaps has done so much to improve and elevate the place as the landscape gardener. His flowers and foliage beds tastefully arranged, the grass kept trimmed to the proper length, cause the visitor as he alights from the car and enters the grounds to utter an exclamation of pure joy and pleasure. The sincerest compliments have not all been letters sent or speeches made to our general manager, but the smile of the child or mother is well worth our efforts to please. And while mentioning efforts to please, at one time it appeared that no efforts made to please were appreciated, but old "Public Opinion," ever ready to condemn but slow to praise, finally came around, and now it is the proper thing to admit that Ocean View is what it is and to bestow unstinted and sincere praise. And during the condemnation and praise alike our management has lost no opportunity to do everything possible to please. This probably has done more than anything else to make the place a success.

SUNDAY BARS

A few years ago it was decreed that the State of Virginia must not allow intoxicating liquors to be sold on Sunday. A law was passed by the Legislature, becoming effective last summer, 1903. There was naturally a great deal of speculation as to the effect of such a law on summer resorts. The wise ones predicted that it would ruin the Sunday excursion business. And right here was where our general manager displayed his good judgment by issuing orders that the law must be obeyed to the letter; that the management would not stand for any attempt at evasion of the law on the part of the concessionaires. It made no difference what the other resorts did, we were to close for good and all, and we did. Now, contrary to all prediction, we began to haul more people every Sunday from that date, and continued to do so for the remainder of the season.

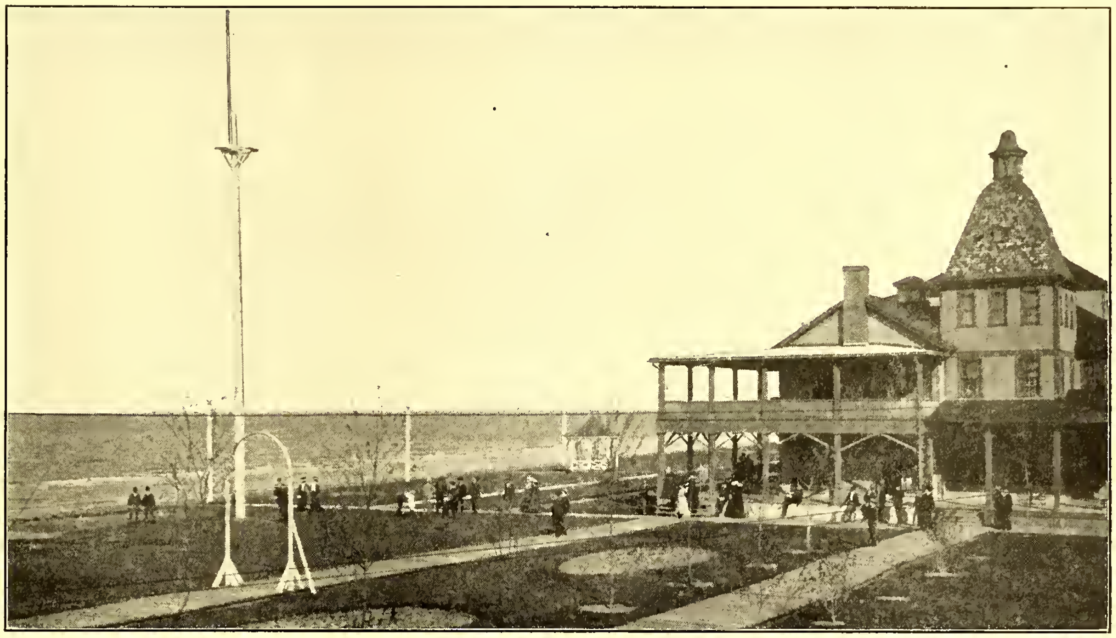
SUNDAY NIGHT CONCERTS

When the summer of 1904 came we inaugurated a series of night free band concerts in addition to the usual Sunday afternoon concert. As soon as this was properly advertised, a great deal of the Norfolk public would wait until the excursion crowd, which was on the grounds during the afternoon, left, and then they would come at night en masse. It made great street car riding until 11 p. m.

Referring again to the character of the crowd patronizing Ocean View, the women and children are most in evidence. This is especially noticeable at the Sunday night concerts. It is worth while to watch the crowds at this time, the children stretched at full length on the lawn around the band stand, the elderly persons assuming more dignified attitudes by occupying the seats, of which there are an abundance, and over all, absolute order and quietude, which goes with perfect peace, comfort and content. Parents know it is absolutely safe for children to come alone if they choose, and stay as late as they please, that perfect order is maintained and that disturbances will not occur.

POLICE FORCE

A good strong police force is the ounce of precaution which saves a pound of trouble, and we endeavor to see that difficulties are prevented, rather than to have arrests afterward and the attending notoriety. The force is composed of a chief and a squad of men under him. While they wear Ocean View police badges, they are sworn officers of the law under the jurisdiction of the Norfolk County Court. These men wear metropolitan uniforms, including helmets. The presence alone of a "blue coat" is a sort of quietus on the would-be rowdy, and while the strict discipline may drive away a certain element, we feel that we are better off without them. If a person persists in getting noisy he is hustled off the grounds at once, and if he then isn't satisfied, he is sent to jail and prosecuted in the courts. The force receives its instruction from the chief, who, of course, is coached by the management as to what his duties are.



OCEAN VIEW HOTEL AND GROUNDS

WHITE PAINT

Is quite a factor in making the place attractive. The color scheme is straw and white, nature furnishing the green. Even the fences surrounding the property are white. The buildings, including the hotel and theater, are painted straw and trimmed in white. A liberal use of paint has added to the beauty of the resort and causes very favorable comment. While this costs considerably, it seems to us to be filling a long felt want. Improvements are being made from year to year which cannot fail to appeal to the taste of the visiting public. Along the line of improvements probably the greatest one for next year will be in

THE LIGHTING SCHEME

The factor that electric light is in a summer resort cannot be overestimated. The old resort with its few "red" incandescents, called "lightning bugs" by the public, is forgotten by the visitor who now sees the grounds with over fifty arc lamps of fully 2000 cp each, along with hundreds upon hundreds of incandescent lights burning right up to candle-power. The incandescent service is three-phase alternating current, furnished from the main power house in Norfolk over a 10-mile 10,000-volt transmission line, 200 kw capacity being furnished at the grounds. The difference in ratio of transformation between the step-up and step-down transformers compensates for line loss and allows us to use the same voltage lamps as in service in Norfolk.

The arc lights are furnished from a machine located near the resort. This was deemed advisable on account of the fact that a pumping station had to be maintained there, and it cost little beside the fuel to operate this generator, as the boiler capacity was sufficient and no additional labor was necessary. The benefit to be derived from this arrangement was that in case of accident to the main power house or transmission line, the grounds would not be left entirely in darkness, and total darkness in a resort with several thousand persons might be a very serious matter. As the two plants are 10 miles apart, and the usual summer storm is local, lightning is not apt to cause trouble in both plants at once. The emergency, however, has not yet arisen, as the incandescent service was only off for a total of five minutes during the entire season of 1904. A very elaborate scheme for improvement in the lighting is now being figured on and will be installed for the next season, as the resort justifies the expenditure for a great deal of light.

THE OCEAN VIEW HOTEL

For those visitors who wish to remain several days or weeks at the seaside, the hotel furnishes accommodations. Its location is good, facing the ocean, having an unobstructed view. It is under the direct management of Charles Consolvo, who also manages the Monticello Hotel in Norfolk, one of the finest hotels in the South. Almost adjoining the hotel are the bath houses, the bathing along the beach here being the best and safest in the South Atlantic Coast. The fact that no accidents occur here speaks well for the beach and also for the management.

STREET SCENE—CARS LOADING FOR OCEAN VIEW

A SCENE ON THE BEACH AT OCEAN VIEW

CHARACTERISTIC ILLUSTRATIONS PUBLISHED IN "STREET RAILWAY CHAT"

THE CASINO

Possibly the greatest attraction Ocean View has is its theater. For a clean, bright, well arranged and comfortable (even in the warmest weather) playhouse, it cannot be surpassed. It is painted white throughout and brilliantly lighted, and has an ample stage, well equipped. The Casino will seat 1200 people. The ventilation of this building is well-nigh perfect, the sides and rear being practically thrown open in warm weather and provided with close-fitting shutters for stormy weather. The policy of the Casino is to give good, clean vaudeville or light opera, and nothing that borders on the vulgar is permitted. The popularity of this house has been phenomenal. Although a show is given every week night and two matinees a week, the house has sold out every clear night, and that with a 25-cent admission.

Perhaps the wisest move made by our general manager was when he leased the Ocean View concessions—for everything is leased—the policy being outlined by him, but the property being directly operated by the lessees, Jake and Otto Wells, the leading theatrical managers in the South. Jake Wells, in addition to having some twelve summer parks and possibly that many winter theaters in his own circuit, has recently come into the management of the "Leath" circuit of theaters, composed of eight of the largest theaters in our largest Southern cities. Otto Wells is the local manager for the Casino and the city theaters in Norfolk. The wisdom of turning over to them all the concessions has been demonstrated by the fact that they can give much stronger shows, getting their return from the increased patronage of attractions other than the theater, than they could possibly do depending on the Casino alone to reimburse them. This naturally increases the travel on the road, and the policy of this company has been to make the resort self-supporting, paying its own maintenance and bond interest, leaving the increased business on the road as "velvet."

"TRAIN SERVICE"

The old method of handling the public to and from this resort was to run trains with one motor car and four or five trailers, trains running one to two hours apart. These passengers were unloaded at the Henry Street station, which is about a mile from the center of Norfolk, and then transferred to the city lines. The present method, since the double track has been installed, is to run motor cars as frequently as the business demands, and when trailers are used only one is carried behind each car. During the entire summer of 1904 a fifteen-minute headway was maintained, and in the evening a 7½-minute headway. On heavy Sundays and exceptionally heavy week days, cars have been run as frequently as five minutes apart. On the Fourth of July there were 157 trains each way between Norfolk and the resort, not mentioning the hour service maintained between Ocean View and Old Point and the half-hour service between Ocean View and Willoughby Pier. The improvements in this car service, making it possible for persons to get a car either way whenever they want it, has done more than any one thing to upbuild the resort. This naturally requires a great deal of attention on the part of the management, and especially as the travel here is spasmodic to some extent, a great many excursions being run into Norfolk from all over the South by the steam roads, making travel extremely heavy on these excursion days. As many as 3500 people have been brought into Norfolk by one railway in one day. The Norfolk & Western Railway Company states that they handled 100,000 excursionists during last summer alone, and the bulk of these people during their stay in Norfolk visit Ocean View. This, coupled with the good opinion of the resort held by the Norfolk people and the attractions above enumerated, has made this resort experience its most successful year during the season just past, and at a time when most places were suffering on account of unseasonable weather and an off year on account of Presidential election. With anything like normal conditions, the coming season will break all records.

ADVERTISING

Perhaps the greatest factor in making a summer resort a success is persistent and systematic advertising. For Ocean View a considerable amount of space is arranged for in each and all the local newspapers, about the same amount of money being spent with each, for a street railway company cannot afford to "play favorites." This space is used every day during the entire season, and complimentary reading notices naturally follow for good newspaper patrons.

Before the season opens, the tributary territory is pretty well covered with three-sheet posters, calling attention to the fact that Ocean View is a "popular resort" on the seashore, where numerous attractions are located, and where the finest bathing on the coast can be had. These are followed up with numerous other methods of advertising. For instance, last season we distributed 10,000 good hand fans with pictures of attractions at Ocean View on one side and printed matter on the other, setting forth the advantages of the resort. The fans were distributed from several points in Norfolk on the first warm days of summer, and a large proportion were sent to excursion agents on the steam roads. During the hot weather these fans in thousands of homes were constantly presenting the advantages of Ocean View to the "suffering" people. Thanks to the good quality of the fans, this gentle reminder lasted about all of the season.

But the best method by far for presenting the claims of the resort was through the medium of "Street Railway Chat," our own publication, issued twice a week, containing pertinent suggestions and the programme for the next few days' entertainment, calling special attention to features and extra attractions—constantly exploiting the fact that it was foolish to stay at home or go anywhere else while Ocean View was open. The present policy as enumerated above is rapidly making this resort one of the leading ones on the Atlantic Coast.

CORRESPONDENCE

SNOW FIGHTING IN BUFFALO AND VICINITY

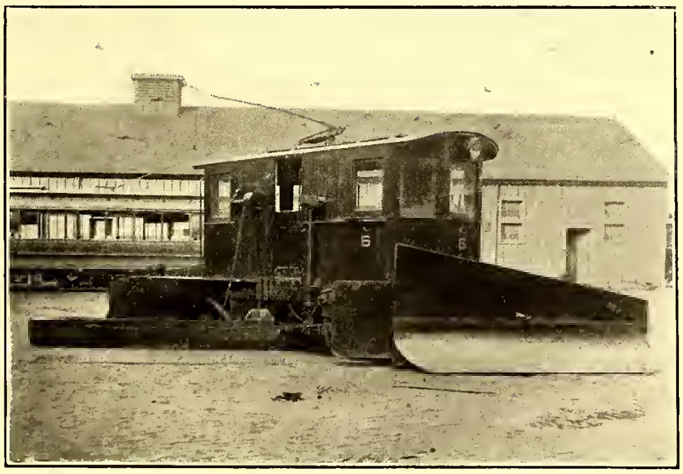
INTERNATIONAL RAILWAY COMPANY
Buffalo, Feb. 15, 1905.

Editors Street Railway Journal:

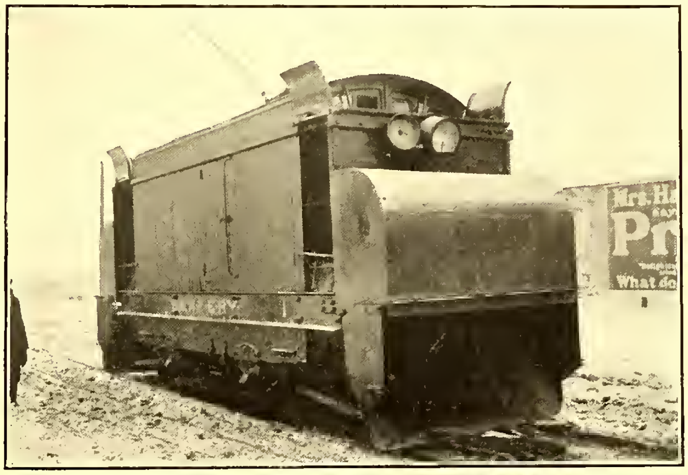
In reply to your request for information relative to our methods of handling the snow problem, the following may be of interest:

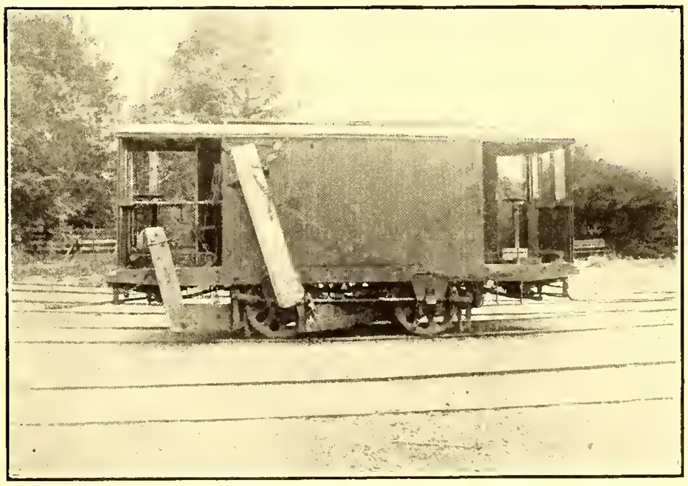
Our system is divided into three divisions, as follows: Buffalo Division, with 260 miles of track, all of which is city mileage, except one 14-mile suburban line; the Lockport Division, consisting of 45 miles of track, practically all of which is interurban, and the Niagara Falls Division, consisting of 45 miles of track, all of which is also interurban mileage.

Our snow-fighting equipment consists of fifty-two sweepers and plows, made up of several different types. The International Railway Company is strongly committed to small single-truck plows, as it is believed more effective work in fighting snow can be done with these small units, provided there are enough of them, than can be done with a smaller number of larger and heavier plows. For our city mileage, and even on our interurban lines, we rely chiefly upon the small single-truck plow for keeping our lines open. These are sent into service at the first sign of a serious snow storm, and are kept going until the snow is thoroughly packed and the danger of tie-up is past. We have two types of single-truck plows, known locally as the "Red" plow and the "Green" plow. The first type has a short but heavy body mounted on a single-truck equipped with two GE 57 motors. It has a heavy nose or shear, as shown in the illustration, and it also has a movable wing at the side for clearing a space 6 ft. or 8 ft. outside the track. Both the nose and the wing are operated by chains wound on drums by hand power.


THE "RED" PLOW

The "Green" plow is a type which we believe is peculiar to Buffalo, and which we have found to be exceedingly effective. It consists of a short body mounted on a single truck with two GE 1000 motors; it has no nose or shear, but its work is done by means of a mold board hanging underneath the body at an angle of approximately 45 degs. with the line of the track. The mold board is made of 14-in. heavy planking, reinforced with steel sheathing. The board runs in vertical grooves, and is raised and lowered by a chain and hand power from the vestibule. There are two of these boards under each plow, one for each direction of travel. This type of plow also has movable wings for pushing back the snow from the side of the track. Of course, this machine is effective only before the snow is piled up seriously, and it is of little use for bucking drifts. However, if it is brought into service early in the fight it will keep its lines open under extremely difficult conditions. We find it particularly useful in keeping switches, crossings and cross-overs free from snow and ice, as the mold board can be kept close to the track when running over special work.


SINGLE-TRUCK ROTARY


THE "GREEN" PLOW

We also have a number of single-truck rotary plows which are used on the city lines as well as on the suburban and interurban lines whenever a particularly long and severe storm shows signs of getting the best of our single-truck plows. We also have two heavy double-truck nose plows, which have been dubbed locally "Nancy Hanks." These find their particular application in bucking drifts.

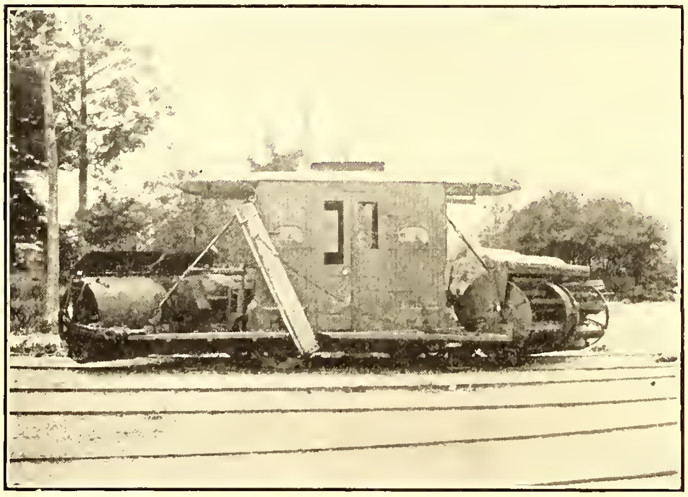
The distribution of the snow-fighting equipment over the three divisions is as follows:

The Buffalo Division has twenty-two of the single-truck plows known as the "Red" type and eleven of the "Green" type. There are also on this division two single-truck sweepers, four single-truck rotaries and three single-truck plows of the Taunton type.

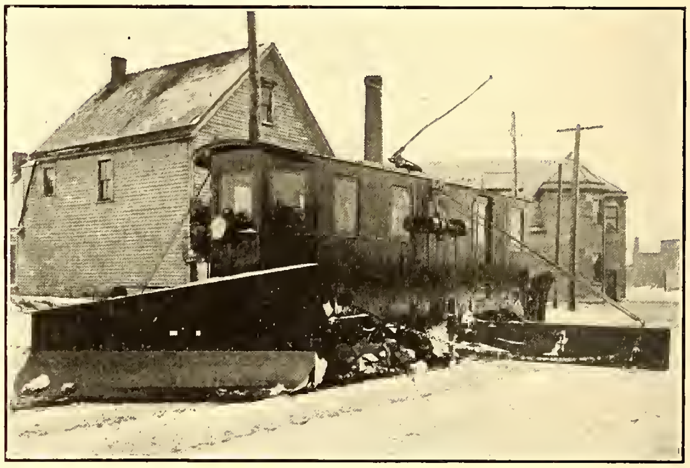
The Niagara Falls Division has two of the "Red" plows, one "Green" plow, two rotaries and two of the "Nancy Hanks" type, the latter being equipped with four motors to each plow.

The Lockport Division has one "Red" plow, one "Green" plow and one rotary.

On the Buffalo division of the International Railway system the entire problem of fighting and removing snow is in direct charge of the transportation department, and the superintendent of transportation is alone responsible to the general manager for the maintaining of service during snow storms. Contrary to the more usual practice, this supervision is even extended to the matter of keeping crossings, switches, curves and special work free from ice and snow. This latter detail was formerly under the track department, but this winter the experiment has been tried of doing away with extra men from the track department at special work, and the responsibility for keeping special work open has been placed with the snow-plow crews. This experiment has proven very satisfactory, and we have done away entirely with extra men for taking care of crossings, curves and special work. The mold boards on the "Green" plows, as before mentioned, remove most of the snow from these places. The plows carry a barrel of sand and a barrel of salt, and if the plow crews see that a switch or crossing needs cleaning out they do what work is necessary and throw a little salt into the special work to keep it from freezing up. This does away entirely with the necessity for keeping men at switches. Of course, it takes up a little of the time of the plow crews, but not enough to make a serious objection to this practice.



SINGLE-TRUCK SWEEPER



THE "NANCY HANKS"

All passenger cars are equipped with track scrapers, and these are relied upon to take care of light snows. At the first sign of snow, the plow crews report at their respective car houses, but we usually wait until an inch or so of snow has fallen before starting out the plows. If, however, a storm gives evidence of more than an inch of snow, orders are immediately issued to the plow crews, through the division superintendents. The "Green" plows are usually ordered out first, and we put out one plow to each line—that is, a plow to each 5 miles to 15 miles of track. If the storm keeps up and indications are that it will continue, the plows are added as required. On the suburban lines the plows are put out in greater number, in order to make sure of keeping the lines open.

For snow duty we take men from the regular lists, and usually try to pick out the older and more reliable men. The men are assigned to plow work in the fall and are instructed to report at their car houses at the first indication of snow. If the storm starts in the night the men are called from their homes, and if the storm starts in the daytime they are called in from their regular work. The instructions read that in case of snow all men laying off must report to their stations immediately. Each plow is placed in complete charge of a designated man, who is responsible for getting it into service and covering the allotted territory.

Trainmen on plows between the hours of 5 a. m. and 10 p. m. are paid at a flat rate of 30 cents an hour; from 10 p. m. to 5 a. m. they receive 40 cents per hour. The regular pay of trainmen on passenger cars is 20 cents, 21 cents and 22 cents an hour. Usually three or four men are placed on each plow.

When necessary to operate the plows continuously for several hours, the plow crews are fed at the expense of the company, the division superintendents having instructions to take the men to the most convenient restaurant and give them a good meal. The men as a general rule do not object to the plow service, and by picking the older men we get employees who will stand right by us until the fight is won, and the plow crews take as much interest in keeping the lines open as do the officials of the company.

We have about twenty-five sand cars on the system, and when the conditions give rise to slippery rails the sand cars are sent out over all lines. We make it a practice to sand only the inside rail of each track, as this prevents wasting the sand, and it is found that one sanded rail is as effective as when sand is poured on both rails.

In the city of Buffalo the city authorities remove all snow from the principal streets after our plows have piled it at the side of the tracks, the railway company paying an agreed proportion of the cost.

We have about 40 miles of snow fences along our suburban and interurban lines, and have adopted the New York Central type of fence.

C. A. Coons,
Superintendent of Transportation.

The street railway companies of Chicago have notified Corporation Counsel Tolman that they will comply with the ordinance recently passed by the City Council which requires that the temperature of cars be kept at 50 degs. F. Thermometers are to be installed in the cars and a supply of cards is to be kept at hand upon which patrons may send to the city complaints concerning the temperature of the cars.

THE QUESTION BOX

This Question Box is open for a free discussion and exchange of ideas and suggestion on all topics relating to electric railway construction and operation. Replies are requested from readers of this paper who can shed light or offer suggestions on any topic concerning which inquiries are made. Oftentimes the answers themselves as printed will suggest replies, and these additional answers are invited and will be printed in succeeding issues. There is but one restriction. Statements of an advertising nature cannot be published; otherwise these columns are open to the readers of this paper, whether they be representatives of operating companies, independent engineers or supply men.

A—GENERAL.

A 1.—What various methods do you employ for advertising your road and its attractions?

We have at one time or another used to some extent, at least, nearly all forms of legitimate advertising, but I believe the best results have been obtained from a descriptive pictorial folder containing a map, time card, and general information relative to the road, with a description of the parks and features of interest along the line. We make it a point to keep all alien advertising out of our printing. Although this means a loss of a small revenue I believe the results secured are more satisfactory without alien advertising. It is a hard matter to say from just what sort of advertising one obtains best returns. Last season we posted in Columbus, Ohio, along 200 eight sheet stands (this means a billboard 9 ft. high by 7 ft. wide) 1500 full sheets of attractive paper, a regular circus billing, posted on all the main streets of that city, notifying the public that we operated every hour between Columbus, Newark and Zanesville, high-speed 65-ft. cradle riding cars, containing baggage, smoking and toilet compartments. Our trains are crowded to more than capacity during the summer season, while our regular winter traffic is very satisfactory. We do not, however, offer reduced rates as an incentive.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Trac. Co.

We publish time tables and advertise in newspapers. In August, 1904, we published a 50-page pamphlet, 4 in. x 8 in., containing descriptions and illustrations of our various properties, and time tables of all the lines. It also contains a two-page map in colors, showing our lines and connections. The book contains about 24 pages of alien advertising, which helped defray the cost of publishing.

THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

We use the newspapers extensively.

W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

We get up an attractive description booklet of our road, illustrated with cuts showing the roadbed, and attractive points along the line. We advertise the road as covering a very fine scenic route. We also advertise the attractions at our summer park in the local and county newspapers.

H. C. PAGE, Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

The Boston & Northern and Old Colony Street Railways which operate over 800 miles of suburban and interurban roads in Eastern Massachusetts, have one of the greatest opportunities for creating pleasure riding of any company in the country, by reason of the fact that they not only reach practically all the historical cities and towns, the seashore resorts, lake regions and river valleys through this historical section, but their lines also run through a section of diversified scenery, all of which is calculated to attract travel. The companies have just established a passenger and advertising department, the first of its kind in this section of the country. Various plans for advertising their lines and attractions are under consideration, but have not been fully matured. However, the department is compiling six folders for editions of from fifty to seventy-five thousand each. One folder is devoted exclusively to seashore resorts, parks, summer resorts and picnic grounds that are especially adapted for public school picnics, as well as for other societies and organizations. As to the other five folders the two systems are divided into five divisions, and each folder gives the mileage, rates of fare, running time, general time-tables and a brief description of the routes in one division. These folders will be distributed from all the various important places along the two systems, from folder cases and racks, similar to those used by steam railroads. At the present time it is impossible, as this office is in its infancy, to give any estimate of what the companies will spend annually for advertising, neither is this office in a position to state how much money can be spent profitably by an electric railway company for advertising. The amount that could be spent profitably depends entirely upon what the different lines offer as an inducement to create pleasure riding. The lines in order to pay for expenses incurred by advertising, should have attractions for tourists; otherwise it would be useless to try and induce travel. It is hoped that some suggestions that will be of value to us in this direction will be obtained from your columns.

ROBERT H. DERRAH, Pass. and Adv. Agt.,
Old Colony St. Ry. and Boston & Northern St. Ry.

A 2.—How much money do you spend annually for advertising?

In the neighborhood of $1,000.00.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Trac. Co.

About $1,000.

W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

About $2,000.

H. C. PAGE, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

A 3.—How much money can be spent profitably by an electric railway company for advertising?

It depends on where the road is located, the number of miles operated, competition, what lines you connect and interline with, etc. If you go after foreign business and your line is so situated for such traffic I would say set aside about 1 per cent of the net annual earnings for advertising your road.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Trac. Co.

A 4.—What are some of the ways by which an electric railway company can kindle and foster a more kindly feeling and a fairer treatment on the part of the public press of its community?

On the first of January of each year enter into an advertising contract with each paper within your jurisdiction, under which you agree to give transportation of a stated value at stated rates in exchange for advertising space in the paper of an equivalent value and stated rates. News items of general reading interest not to be classified as advertising matter. Contract considerations should be proportionate to size of circulation and influence. In that connection request the newspaper men not to write up your accidents and disturbances until they have both sides of the story. Also request them not to call attention to jury verdicts against you in any larger head lines than are used in announcing verdicts given in your favor.

A. H. ROGERS, Pres.,
Southwest Missouri Elec. Ry. Co., Webb City, Mo.

Try and keep in close touch with all the papers. Have found it profitable to give once a year, the representatives of the local press an outing, consisting of a trolley ride and banquet.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

It has been claimed by a number of railroad men that the best policy to pursue with newspapers is to pay for what you get and vice versa. With the steam roads this policy is perhaps best pursued, their advertising being so much more extensive. With electric roads, however, I believe that passes placed judiciously among the newspapers will not only create a kindly feeling, but will bring better returns than twice the amount of money that the transportation will cost, expended in advertising. I think that the policy of friendly, dignified association between the newspaper men and the operator of the electric roads, and understanding that at all times and in all cases a true statement of any so-called news features, in connection with the company, can be obtained at the company's office, will in nine cases out of ten keep out scare-head lines and a garbled story.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Trac. Co.

Strict attention to business.

W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

The question of how an electric railway can kindle and foster a more kindly feeling and a fairer treatment on the part of the public press, is fully answered in an article in the STREET RAILWAY JOURNAL for Dec. 24, 1904, page 1096, entitled "Newspapers and the Interurban Road." I have for fifteen years been brought into close contact with the newspaper men of New England, and I am more satisfied to-day than ever, that any confidence placed in them is not misused. I believe that if any subject of importance comes up concerning the street railway, in which the public are directly interested, that the newspapers should feel there is one office or department where they can always rely upon getting accurate information. If this policy were pursued by the street railway officials, it would be found that newspaper articles would be more reliable than in some cases to-day, where the newspaper representative is obliged to get information from outside sources. Personal acquaintance with newspaper representatives is a valuable asset to a passenger agent, and it takes years to cultivate it. The newspaper man must be made to feel that he is a personal friend of the management and he will accept their statements with confidence. To do this, he must be cultivated and always treated fairly.

ROBERT H. DERRAH, Pass. and Adv. Agt.,
Old Colony St. Ry. and Boston & Northern St. Ry.

Give them small orders for printing from time to time and send an annual pass to the business manager.

H. A. TIEMANN, New York City.

Treat the representatives of the press in a candid, honorable, liberal and courteous business spirit. With regard to the local newspapers, the policy of the writer has always been to bring the relations between them and his companies to that of strict business so far as business relations were concerned, and to treat them with candor, courtesy and strict impartiality so far as news was concerned. Primarily, the writer has tried, and in nearly every case has succeeded, in abolishing all passes and free transportation to everyone not in the employ of the company and not legally or contractually entitled to them, and no exception to this rule has ever been made in favor of newspapers or their representatives. This has always cleared the way, possibly with a little temporary thunder and lightning, for an adjustment of business relations on a strictly business basis, the representatives and owners of the papers paying for their transportation at regular rates, and the railway paying for its newspaper advertising also at regular rates. Any proposition that "free transportation equals free publication" will sooner or later produce dissatisfaction and friction. The railway company will expect too much from the papers, and the papers will want the free transportation favors extended to the sisters and cousins and aunts. Let the company pay for its advertising, and the representatives of the press for their street railway transportation.

H. S. COOPER, Gen. Mgr., Galveston City Ry. Co.

A 5.—What are some of the ways by which an electric railway company can kindle and foster a more kindly feeling toward it on the part of the public?

A public serving corporation cannot afford to hold a public off at arm's length. We try to cater to the needs of the people in the different towns and cities, and keep the public as good-natured as possible. We find that the public, as a rule, appreciates being catered to, and it pays to create a local pride in the road.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

In my opinion a too "kindly feeling" is not conducive of good results in the end, as it will mean too much individual personal expectancy sooner or later. But a "square-business-deal feeling" to all alike is the best in the end. Give the people of the community to understand by fair, firm business-like treatment that you have rights, and intend to maintain them at all times; that you will always respect their rights; but that you know what their rights are in connection with your company as a common carrier, tax payer, and promoter of the city's and country's interests, and that you will also look to it that they do not abuse their rights. Have them bear in mind at all times that while you are a caterer to their patronage, you give value received, and you meet their wants. Good service, equipment, roadbed, gentlemanly employees, the guarding of property and precautions against accidents are the things that bring not only patronage and results, but business esteem and confidence as well.

J. R. HARRIGAN, Gen. Mgr.
Columbus, Buckeye Lake & Newark Tract. Co.

Good service and civility.

W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

There are several ways by which an electric railway company can kindle and foster a more kindly feeling toward it by the public. First, by familiarizing people with all the advantages which the lines of the companies afford for pleasure riding. Our companies will do this not only by means of booklets, magazines and newspaper advertising, but our general passenger office is established in the heart of Boston and we have there a display of hundreds of photographs showing practically all the historic houses, parks, and resorts along our lines. It is both free and instructive to the public. Second, by having within easy reach time-tables and other literature which gives the mileage, rates of fare, running time and time-tables. Third, by having competent motormen who so guard the front end of the car that the safety of the passengers is assured, and courteous conductors who will not only watch for the safety of the passengers, but who can enlighten them regarding the historical places, points of interest and picturesque scenery along the lines. A class of motormen and conductors similar to those indicated, will do more to create a friendly feeling between the public and the corporation than can be done in any other way. I also believe that the method of going before clubs, churches, and other societies, giving illustrated talks on the development of street railways and the beauty spots and historical places, has a good effect in creating a desire on the part of the public to travel by electric lines.

ROBERT H. DERRAH, Pass. and Adv. Agt.,
Old Colony St. Ry., and Boston & Northern St. Ry.

Good treatment by employees and reliable service.

H. A. TIEMANN, New York City.

A 8.—A company wishes to carry its own fire insurance, by setting aside a certain percentage of its gross receipts each year to cover fire losses. What would be a safe percentage to allow?

Our present premiums are under 2 per cent of the receipts.

THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

I am not in position to state what this percentage should be. Our rate of insurance runs from 1.25 to 1.40. We get this rate by putting our buildings in exact accordance with recommendations made by the Board of Fire Underwriters, and we feel that this is the cheapest manner of handling our insurance.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Trac. Co.

A 9.—Under what conditions can an electric railway company venture to carry its own fire insurance on its various properties?

Our group of companies might perhaps carry their own insurance owing to many scattered risks, but we have not done so, and I do not think the ordinary company could.

THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

It is my judgment that a street railway company cannot carry its own insurance judiciously unless the rates in the locality are exorbitant.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Trac. Co.

In my opinion, a company having a number of car houses and power stations located at different places on its system, can very wisely assume its own fire insurance, in view of the exorbitant rates demanded on street railway property. Take the case of a company having four car houses and three power stations, located at as many different points. The seven plants have a total valuation of about $2,500,000 and are covered by a blanket fire insurance policy, which also includes rolling stock, the premium being at a flat rate of about 1 per cent per annum. The premium will be $25,000 per year. I would suggest as a better method of handling this matter, the following: Let the company place $250,000 of its own bonds in escrow with a trust company as a fire insurance fund, and charge the 5 per cent interest on these bonds or $12,500 per annum to fire protection. Under the blanket insurance policy first mentioned, the $25,000 premium per year is absolutely gone, unless the company happens to have a serious fire. Under the bond method, the $12,500 interest accumulates as a fire insurance sinking fund. The chances of a conflagration wiping out more than one of the car houses or power stations and involving a loss greater than $250,000, are so remote that the company is justified in taking the risk. As a matter of fact, in the case cited, a conflagration so widespread as to destroy any two of the company's plants, would leave conditions in which an electric railway would no longer be required.

EDGAR S. FASSETT, Supt.,
United Traction Company, Albany, N. Y.

A 10.—What percentage of your gross receipts are you paying out through the claim department?

About 4½ per cent.

E. G. CONNETTE, Vice-Pres. and Gen. Mgr.,
Syracuse Rapid Transit Ry. Co.

During the past six years our legal and claim department absorbed the following percentages of our gross receipts:

Year ending August 31, 1899, 2½ per cent.
Year ending August 31, 1900, 6½ per cent.
Year ending August 31, 1901, 6½ per cent.
Year ending August 31, 1902, 4 per cent.
Year ending August 31, 1903, 4 per cent.
Year ending August 31, 1904, 5½ per cent.

A. H. ROGERS, Pres., Southwest Missouri Elec. Ry. Co.

One and one-tenth per cent.

H. C. Page, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

About 2 per cent. J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

For the past year we paid out in damages $45,000; in other legal expenses connected with the claim department, $11,000; or a total of $56,000 as the cost of the claim department. Our gross receipts were, approximately, $1,700,000. Percentage of cost of claim department to gross receipts, about 3⅓ per cent.

United Traction Company, Albany, N. Y.

Two per cent. to 3 per cent.

H. A. Tiemann, New York City.

A 11.—A company wishes to set aside a certain fund each year to cover all accident claims. Should this fund be based on a definite sum per car-mile, or on a percentage of the total gross receipts? What would be a proper allowance?

The setting aside of 6 per cent of the gross receipts of an interurban road should be a proper reservation.

A. H. Rogers, Pres., Southwest Missouri Elec. Ry., Webb City, Mo.

Gross receipts. Proper allowance is a question.

W. T. Nary, Supt., Hoosac Valley St. Ry. Co., North Adams, Mass.

A company should set aside a certain fund each year to cover accident claims. It should be based on a percentage of the gross receipts. E. G. Connette, Vice-Pres. and Gen. Mgr., Syracuse Rapid Transit Ry. Co.

Set aside a certain percentage of the gross receipts. The rate will vary on different roads. A road operating wholly interurban lines would be a different proposition from a city road.

H. C. Page, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

My judgment is that this should be on the gross receipts. We are at present laying aside 4 per cent to take care of accidents.

J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

A 12.—What is a proper basis on which to compute accident liability insurance?

Three per cent on the gross receipts ought to cover an interurban road, provided it is properly managed.

J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

A 13.—In the electric railway business, is an accident liability insurance company—mutual or otherwise—feasible? Why?

I doubt the feasibility or practicability of accident liability insurance, either mutual or otherwise, because the conditions of operation are so different, making the liability and expense much greater in one locality as compared with another.

E. G. Connette, Vice-Pres. and Gen. Mgr., Syracuse Rapid Transit Ry. Co.

Accident liability insurance (public) is not feasible. Each company must attend to its own affairs of this kind. They cannot be delegated to strangers, even through specialists.

A. H. Rogers, Pres., Southwest Missouri Elec. Ry., Webb City, Mo.

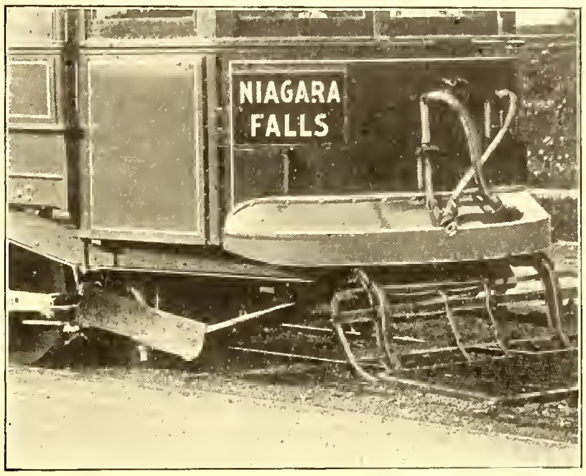
Do not think it is feasible to have a mutual accident liability company, as it would be impossible to get a group of roads with the same conditions. If each road could have a standard equipment of the same style, running at the same speed, and have rules and regulations the same as insurance companies do, this would be practical. H. C. Page, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

I have never believed that it was, but there is a mutual company being organized in Cleveland at present, and with the exception that the power that is invested in the board of trustees is more than I think it should be, I think it a good idea.

J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

A 13 C.—What can be done to prevent newsboys and others from riding on the bumper?

The International Railway Company, of Buffalo, had considerable trouble from this source and the number of accidents caused by boys stealing rides on the bumper became a serious matter. To prevent persons from securing a foothold on the bumpers, all the cars of this company are now fitted with a piece of No. 14 sheet steel fastened to buffer and dasher at an angle of 45 degs., with ¼-in. stoll bolts about 3½ ins. apart, as shown in the engravings. This incline effectually prevents anyone from standing or sitting on the buffer. A hardwood block, 2 ins. long, is placed



BUFFER ARRANGED WITH INCLINED TOP

underneath this incline at the center line of the car in front, to strengthen it at this point. No other filling is used.

Editors.

A 14.—Do you carry United States mail over your road? If so, please describe how you do it.

Yes; in front vestibule.

Theodore Stebbins, Gen. Mgr. for Receivers, The Appleyard Lines in Ohio, Columbus, Ohio.

United States mail in pouches is carried by our company over our road between Columbus and Newark and intermediate points. Our contract requires that we carry the mail pouch twice a day from Columbus to all stations along our road, the pouches being delivered to our car and taken from it by the government's agent. The pouch is carried in the motorman's cab of regular cars.

J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

A 16.—What would be a proper basis on which to formulate contract with the Government for carrying United States mail on electric railways?

Ten cents a mail bag for any distance.

W. T. Nary, Supt., Hoosac Valley St. Ry. Co., North Adams, Mass.

We get 3 cents a mile for carrying the mail.

J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

E.—MASTER MECHANIC'S DEPARTMENT

E 50.—Are you in favor of split or solid gears? Please give your experience with either. What are the relative advantages and disadvantages of each?

The first gears used were made of cast iron, but it was demonstrated in a short time that cast-iron gears would not stand the wear and knocks they had to bear on a motor car. Open hearth cast steel was then tried and is now commonly used for gear rims. The split gear of to-day causes troubles which are numerous and of a varied effect. Gears become loose on axle, due to poor fit, causing knock or jar on starting car. Nuts run off and bolts break and get caught between gear and pinion. The keyseat in axle required by split gear is quite deep, and it has been the practice on most roads to have seat cut to edge of gear hub and without taper at ends of seat, thus reducing the strength of the axle. The effect of loose gear on an axle is a wearing away of the key, spreading of the keyseat in axle and gear, and wearing away of axle seat—thus ruining the gear, key and axle in many instances. If axle seat is not worn enough to interfere with clamping effect of gear, a compromise key can be made and save the axle. If seat is worn too much for a fit, then axle must be used for an idle wheel or as is sometimes done, turned down and used on smaller equipment where it is possible,—otherwise it must be scraped. Before putting a split gear on axle, the gear seat on axle should be calipered and bore of gear gaged to see that the gear seat is not worn away too much, and that gear is bored sufficiently under diameter of axle seat as to allow a good clamping fit. It is the practice on some roads where the gear seats on their axles are worn, to use a thin metal shim on axle opposite the key seat, but this is a poor practice and one that should be abandoned. The damage done due to the loose gear, would, in most cases, pay for the cost of a new axle to replace the one with the worn gear-seat. To overcome some of the drawbacks of the split gear, several roads have adopted the solid gear and claim to be very well satisfied with it. While the solid gear eliminates a number of bad features of the split gear, it has some drawbacks that must be considered. Unless the gear is made with a solid web with holes for bars to pass through for pushing off track wheels, these gears are liable to break the same as the split gear. The solid gear has the disadvantage that, when gears wear out, the axle must be taken from under car and wheel next to gear pressed off, a new gear pressed on, and then it becomes a matter of controversy whether it would be safe to press the same wheel back on that was pressed off to remove the gear. The condition then presents itself where the track wheels are worn out and must be pressed off, and where the solid gear we will say has been about three-fourths worn out. Would it be policy to press new wheels on axle with a gear in this condition? The first cost of a gear is of such amount that the master mechanic does not want it scrapped until it is worn out. The chance of gear and track wheels being worn out at the same time is about one in a hundred. While the first cost of a solid gear is less than of a split gear, the increased mileage from split gear will overcome the difference of first cost. We read accounts of steel-tired and rolled-steel wheels making mileage as high as 190,000 car miles which is about three times the average life of a gear, and if solid gears are used under equipment of this type, the expense and trouble of renewing gears would discourage the management from using them. While the solid gear does away with trouble of loose gears, broken bolts and nuts getting jammed in gearing, yet the disadvantage due to renewing same when worn out is a great draw-back to their adoption. The ideal gear would be one whose hub is pressed on axle under high pressure and not requiring key-seat in the axle, and having the rim of gear so constructed that it could be detached from hub and replaced by a new rim without having to press off the truck wheels, the rim being fastened to hub in such a manner as to be absolutely sure of not coming loose on hub, and no possibility of parts used in fastening rim to hub getting detached and jamming between gear and pinion. Gears have been pressed on axles under 30 tons pressure without using key in axle and have worked satisfactorily. There is a detachable rim gear which has been recently developed and is being tried out by quite a number of roads, which gives promise of coming near to the ideal. The hub of this gear is pressed on the axle and rims bolted on with four 1⅛-in. wedge bolts. The outer edge of hub section is turned V-shaped, and a V-slot cut in under edge of rim fitting over V of hub; the rim is made of T section, open-hearth cast steel. The four wedge bolts clamps the V of hub into V slot of rim forming a very powerful clutch. The heavy shank of wedge bolts act as the key for rim on the hub, and is a positive preventive of rim turning about hub. The only tensional strain on these bolts is the strain that is applied in tightening up on nuts, and whatever strain that comes on the bolts afterwards is a cross-strain, tending to shear off the heavy shank of the wedge bolt. Here we have a gear which is the most unlikely to come loose on axle, whose rim is removable without disturbing track wheels, and the bolts used in fastening rim to hub of sufficient size as not to break under the severest strain. While this gear hardly comes up to the ideal on account of the fact that bolts are used in fastening the rim to hub, it has features that are commendable and will no doubt be adopted by many of the different trolley companies of the country. A MASTER MECHANIC ON AN EASTERN ROAD.

E 51.—If split gears are used, what do you do to prevent bolts and nuts from becoming loose?

The running off of nuts and breaking of bolts which get jammed between gear and pinions, is the worst source of trouble to be found with the split gear. Owing to the severe and constant jar and strain coming on bolt and nuts, it becomes a difficult problem to secure them. On different roads different methods are used for locking nuts. Some prefer stud bolts with lock nuts with cotters; others steel bolt and split lock washer with standard nuts and cotter; others stud bolts, split lock washers and crown nuts with cotter, etc. But with all the systems of securing the nuts, trouble continues from their getting loose and dropping off into gear case. The trouble from broken bolts is due to the use of too small a bolt. The majority of bolts used in gears of the motors for city service are ¾-in. steel bolts. The car house man is drilled to pull up all he can when tightning bolts, and with a long socket on a ¾-in. bolt he can always get a little more—the consequence is he snaps the bolt. If he does not pull until nut comes hard up, then he does not know whether the bolt is pulled up sufficiently, or whether it is strained. If it is not pulled up sufficiently the gear will work loose; if he has pulled too far the bolt will be liable to break under a severe strain. With 1-in. steel bolts the trouble from broken bolts is practically eliminated. ANONYMOUS.

E 76.—Many of the steam roads dry-wipe their cars without the use of any water. Do you think this method is applicable to electric cars?

An oxygenized coat of varnish that will resist the effects of the elements a reasonable length of time must necessarily be of a semi-elastic nature, and, therefore, its superficial gloss cannot be expected to stand the effects of attrition as though it were a vitreous glaze; yet the methods sometimes employed in car cleaning leads one to suppose that the two surfaces were regarded as being identical. The employment of some of these methods of car cleaning is more or less open to criticism, and one in particular, is the so-called "dry-wipe" practice. The dust that is attracted and adheres to car surfaces is composed of a very fine grit, and in the process of dry wiping a car the waste that is usually used for this purpose being filled with an ever increasing amount of grit has the effect on varnish that is equivalent to that of a slight rub with flour pumice. By following this practice the grit in the waste is not removed at short intervals as it is from a sponge where water is used, and therefore, the waste becomes more and more injurious to the varnish as the work of cleaning proceeds. This, of course, means that every time a car is cleaned by dry-wiping a small percentage of varnish is thereby removed, and the duration of time that this thin film will exist under these conditions can only be estimated by the number of times that the varnish is subjected to this treatment.

The above view of the matter of dry-wiping a car is taken in its most favorable light when the fine grit from dust was alluded to, but if there be any doubt existing about the injurious friction of dry-wiping a car, let one imagine the results of dry-wiping car panels covered with the cement-like lumps of dried mud which condition is no uncommon sight, and the matter should be settled.

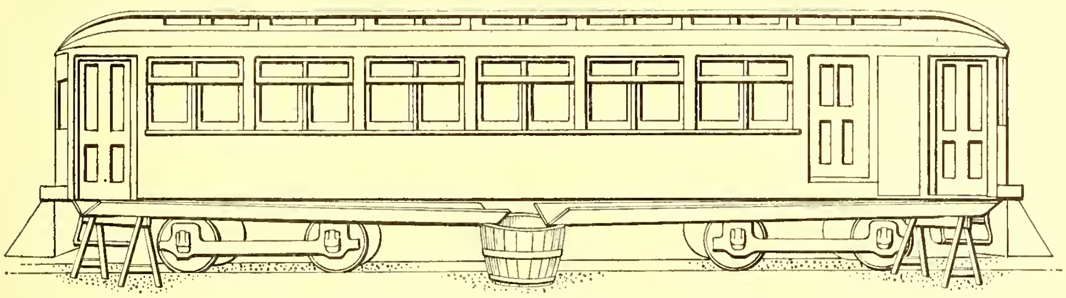
H. ARNOLD FRENCH, Master Painter,
The Rhode Island Company, Providence, R. I.

E 79.—Should the matter of cleaning and washing cars come under the transportation department or the master mechanic's department? What are the advantages or disadvantages of either system?

The washing of cars properly comes under the master mechanic's department and under the immediate supervision of the foreman car painter, for the reason that he can tell at once what condition the car is in, and what materials or methods should be used in cleaning it. Also, he is in position to know whether the car has been painted previously under conditions that would make a special way of washing necessary. For instance, the car may have been repaired and a section of a side or end repaired hurriedly in order to get the car back into service, and it may not have received the usual method of painting. In this case the particular section should be washed without the use of the stronger cleaning materials, which might, perhaps, be used on cars that had received the regulation painting process. As a matter of fact, a thoroughly competent foreman painter is the only man on the road who knows how the car should be washed. Again, if the washing is done under the supervision of the foreman painter, he is at all times familiar with the condition of his work and may observe the result of using different processes and various kinds of materials. In short, he should have opportunities for watching the condition of his work from the time the car leaves the paint shop until it returns. E. W. SELKIRK, Chicago, Ill.

E 80.—Please describe a good arrangement of stand and room for washing cars.

A cement stand for washing cars is best if arrangement of shops permits cars to be transferred readily from one portion of the shop to another. If cars cannot be brought to a central point for washing, or if there is no cement or other sloping floor to give drainage, cars can be washed where they stand. However, if it is the practice to wash cars in different parts of the shop, some precaution must be taken to avoid water soaking the floor and pits. A good scheme is to have wooden troughs, each one about half the length of the car and wide enough at top to catch the drips. These troughs can be placed just under the side-sills in the manner shown, with the outer ends supported on saw horses and the inner ends resting on a half barrel, to catch the water. It is surprising how much undesirable muss can be avoided by using these troughs when washing cars.

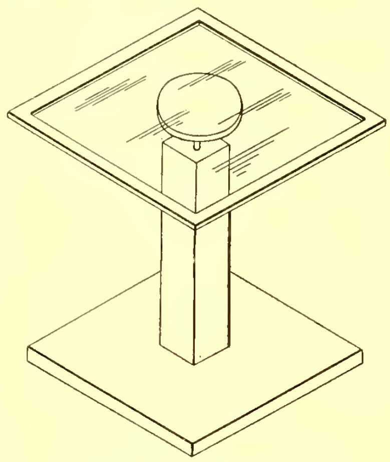


TROUGHS USED WHEN WASHING CARS

E. W. Selkirk, Chicago, Ill.

E 83.—Do you know of an improved form of table or rest for expediting the work of varnishing window sash? If so, please give description with photograph or drawing. (A rough sketch of the device will do.)

A good sash varnishing table can be made as shown in the illustration. The wooden disc on which the glass rests revolves on a spindle placed in a hole in the upright standard. With this revolving stand, a man can varnish all around a window sash on both sides without changing his position, and without danger of marring the freshly varnished surfaces. The support can be placed on a table, or the upright piece can be made long enough so that the base can rest on the floor.



STAND FOR HOLDING SASH

E. W. Selkirk, Chicago, Ill.

E 85.—What are good ways of heating the paint room?

In a room for car painting it is only necessary to maintain a normal temperature, say 70 to 75 degs. F. Higher temperatures are not in any respect necessary or desirable.

E. W. Selkirk, Chicago, Ill.

E 86.—What can be done to prevent dust in the paint room?

For cleanliness, the ceiling or roof timbers in a paint shop, and also the side walls should be sprayed with good white cold water paint that will not flake nor peel off. In order that cobwebs and dust accumulations can be noticed easily and removed at other than varnishing times, a 5-ft. dado should be placed all around the side walls and painted with a good dull gray paint. Keep the paint room floor clean by frequent sweeping after slightly sprinkling. The floor should never be flooded with water.

E. W. Selkirk, Chicago, Ill.

E 89.—What are the relative advantages and disadvantages as regards cost, durability, etc., of the two general systems of painting cars, i. e., that known as the "knifing" process, using a foundation coat of pure lead and linseed oil, rubbed in with a putty-knife; and that known as the "rough-stuff" method?

It is possible to outline plainly various methods of car painting, any one of which has particular merits for certain conditions, but no matter how good the system or how plain and explicit the method or formula may be laid down, the results depend entirely upon the application, and the application must be under the direction of a practical car painter. The best method for a system of car painting ever devised will prove a failure if the application is faulty. Any system or method will have to be altered or modified to meet the particular conditions and requirements of each individual case. The condition of the preparatory work that is done before the car painting begins has a great influence on the methods to be followed in the painting and varnishing operations. If the time limit is an item, the experienced foreman painter must know, and will know, where, in the particular system he is using, the time can best be saved without injuring durability. Practical experience and no rigid set of rules will apply in car painting. The question suggests comparisons between different ways of arriving at a surface. The use of linseed oil in proper proportions with other liquids and materials, in priming and white lead for pasting or knifing, in other than "ready-to-use" surfaces, is customary. The writer is of the opinion that neither pure linseed oil nor pure white lead need have any place in the proper painting of a steam, elevated or street car. The belief that the more linseed oil used in priming, according to the time available for the work, the better, is an error, and pure white lead can be dispensed with entirely in any car paint, with excellent results. The truth of this statement can be determined by a simple experiment. Coat two pieces of white-wood siding on the face only, one with pure white lead and oil priming, and the other with priming made of slop varnish of known good quality, thinned with turpentine to oil consistency and mixed with any dry paint material such as ochre or brown mineral. It will be evident that the lead and oil priming will take much the longer to dry. Then coat both pieces of the wood with any flat color, varnish, and, when dry, hang the pieces out-doors where they will be exposed to the weather, and note the result. This experiment will prove conclusively that the theory of the use of linseed oil in car priming is wrong. In hurried work it never has time to dry properly, and plastered over with several coats of surfacer, body color and varnish coats, it has every chance to decompose by its own heat. Badly checked and cracked cars primed with pure linseed oil and pure white lead priming, after being in commission several years, on examination other than by burning or removing the outer coats with patent paint and varnish removers, will often reveal the fact that the priming is still soft and warm. If further proof of how the oil acts under the surfacer and varnish coats is required, saturate a small piece of cotton waste with pure linseed oil and hold tightly in the hand for a few minutes. The experimenter will need a pail of water handy to prevent seriously burning his hand.

E. W. Selkirk, Chicago, Ill.

E 90.—What can be done to reduce the cost of painting and varnishing cars without sacrificing durability?

Secure the services of a first-class foreman car painter. He should be a man who has learned the trade of car painting and can do any part of the work personally from wood to finish; he should have worked on new work, both in contract and companies' shops by day work and piece work; he should be a man who is willing to try out, and, if found available, to adopt and put in practice up-to-date methods of doing work; and he should have the ability to induce others to do work as he knows it should be done.

E. W. Selkirk, Chicago, Ill.

E 92.—Do you favor the use of rubbing varnish on the exterior of cars? Why?

The use of rubbing varnish is advisable when necessary to hasten the work, whether it is the intention to rub down or not. It is better to use rubbing varnish than to attenuate the finishing varnish in any way, either by the addition of japan or by thinning with turpentine to hasten the drying. If time is not an item in the question, two coats of finishing varnish are preferable.

E. W. Selkirk, Chicago, Ill.

E 93.—Have you ever tried mixing varnish in body colors in order to make the body coats more elastic? What were the results secured?

Every car painter knows that the addition of some varnish to body color is advisable, as its addition assures him that there will be sufficient binder to allow the body color to be properly cleaned after striping, ornamenting, etc. Also the body color will hold out the varnish coats better. E. W. Selkirk, Chicago, Ill.

E 100.—The suggestion is made that the regular daily inspection of cars should be made at the terminals of the lines, between regular trips. Is this feasible, and what are the advantages to be gained?

Not possible in many cases, but where it can be done there is much to be said in its favor. Trip inspection admits of regular and frequent daylight inspection and gives good opportunity for competent and trained men to take the "stitch in time that saves nine." Thus, the equipment can be kept in first-class shape, efficient, neat, and attractive to the passengers at low cost. Also, when necessary to take a car off the road and put another one in its place, the substitution can be made without inconvenience to the traveling public. Better results can be secured by having an extra car on each division for a layover car at each terminal at the outer ends, and having the crews change cars there.

D. F. CARVER.

E 146.—Do you know of any cheap and convenient form of small gas or electric furnace for heating soldering irons, etc.? If so, please give description, with photograph or drawings. (Rough sketches will do.)

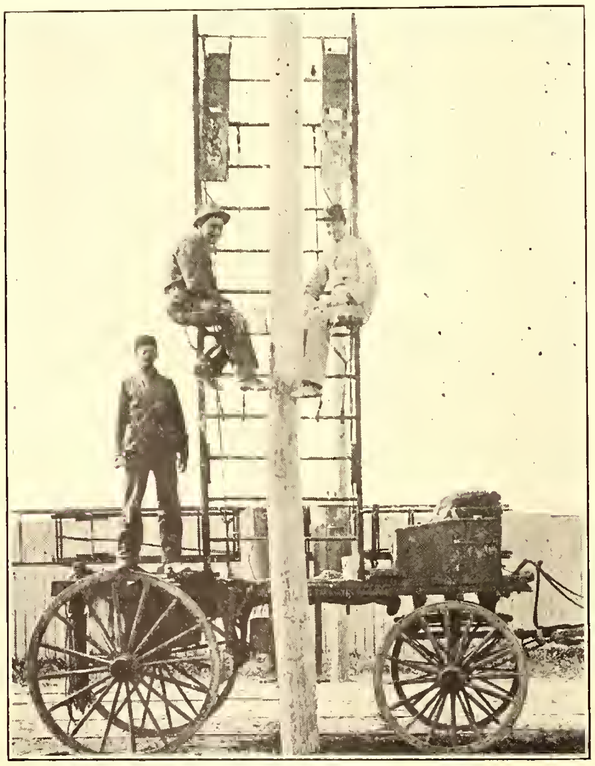
There is on the market an efficient and economical gas heater for soldering irons. Any of the first-class dealers in gas stoves and appliances can furnish them. When the irons are in the furnace the weight of one of them will keep the flame on. When the furnace is empty the flame is automatically cut down as low as possible, and kept burning. Sometimes the insurance companies make it advantageous to use these in place of gasoline torches.

D. F. CARVER.

H.—LINE DEPARTMENT

H 8.—What is the best way to paint trolley poles? Give sketch or photograph and description of apparatus used; also detailed cost of doing the work.

We use a ladder wagon for painting poles. The apparatus consists of a light platform mounted on wheels, and designed to be drawn by a horse. To one side of this platform is fastened a ladder, the ladder being attached to the platform by brackets and renewable pins at the lower end. The ladder is in two sections; the lower half being fixed to the platform as stated, while the other section, known as the "fly," may be raised or lowered according to



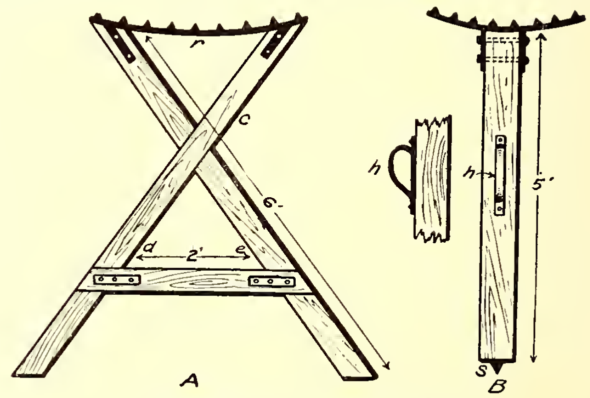
LADDER WAGON

the height of the pole to be painted. This extension section is arranged after the fashion of a painter's ordinary extension ladder. The ladder is re-enforced with a support or rib running the length of the ladder between the two outside pieces. This serves to strengthen the rounds and gives greater stability. The fixed section of the ladder is braced with two rods which run from the upper ends of the sides of the ladder diagonally to the opposite side of the platform, where they are held between brackets with renewable pins. Several holes are provided near the lower ends of these bars or braces so that the ladder may be adjusted to different angles. The painters work from small seats or platforms, which are hung at one end from the rounds of the ladder by hooks, and are supported at their outer ends by Y-shaped braces, the upper ends of the Y being hinged to the outer ends of the seats, and the lower end being formed like a fork to allow it to rest on a lower round of the ladder. It will be understood that with this arrangement the lower ends of the Y braces can be lifted from the rounds, thus permitting the seats to fall flat against the ladder when passing poles or trees, or when the ladder is being drawn through the street. There are also two movable supports arranged on the wagon platform which can be drawn out so that the course between the ground and the lower platform can be painted when the fly is raised for painting high poles. A tank having a 40-gallon capacity is attached to the rear of the apparatus for carrying paint, and the driver's box at the front is utilized for carrying tools and brushes. This box also serves as a wardrobe for the mens' clothes. With the use of this apparatus the cost of painting poles has been reduced nearly one-half as compared with the use of such implements as the common ladders, the lineman's spurs, the boatswain's chair, etc. Also the obstructing of highways with paint pots, etc., is entirely unnecessary, as the paint pails and tools are always confined to the apparatus. The apparatus has been used by this company for seven years. It was designed by the writer, who holds letters patent covering the chief features.

H. ARNOLD FRENCH, Master Painter,
The Rhode Island Company, Providence, R. I.

H 9.—What is the best way to raise and set trolley poles? Give sketch or photographs and description of method; also detailed cost of doing the work.

P. A. Price, writing in the "American Telephone Journal," gives the following description of modern methods of setting telephone poles; the remarks contain suggestions for electric railway work:—In raising poles a skilled lineman should be in charge of the gang. Three skilled men can do the work of six green hands, for there is a knack in handling the heavy, awkward dead weight of a large



SUPPORTS FOR RAISING POLES

pole that only comes of practice. Solid pike-poles of assorted lengths are essential, and they should be tipped with metal points. A man should be stationed at the butt of the pole with a cant hook to keep the pole from turning as the men raise it. A "dead man" is indispensable, and any blacksmith can readily make the metal parts. In the illustration two styles of "dead men" are shown. "A" is somewhat heavy, and to a green hand is awkward, but it is a very safe affair. "B" is easily handled in rough ground, but requires that the pikers understand their business, as it has no side supports of its own. These are usually about 5 ft. in height. The pole can be lifted by the men so its top rests on the "dead man," and it can be shifted up the body of the pole as the men raise on it. When the top of the pole is raised high enough to admit of pikes being used, have a man on either side of the pole with short pikes to hold the pole to its direction. This "side-piking" is essential when the "B" type of "dead man" is used. Do not allow the men to hold the pikes against their bodies under their tool belts. No matter how carefully the work be done, the pole may get away from the men, and woe to the man who has his pike under his belt. On the shoulder or free in the hands is the place for a pike, so it can be dropped in case the men should lose control of the pole. When high poles are to be set it will facilitate matters if the hole be trenched; that is, dug away on the side the pole is raised from. This provides a natural path for the butt to the bottom of the hole. Above all, have a cool-headed person to direct operators.

EDITORS.

ELECTRIC RAILWAY OPERATION IN A GREAT CITY*

BY H. H. VREELAND

You are dealing with the most interesting problem that now engages the practical ingenuity of men. The azure of speculation seems nowhere so illimitable as in the region which your science seeks to explore. What the knowledge-seeker in politics or medicine or mechanics or other departments of human activity may yet accomplish for the betterment of life is bounded by a horizon that seems short indeed, in comparison with that which measures the broad area within which a new force can operate. What limit is there to the practical advantages that can be extended to mankind if the energy which is capable of sending an impulse around the earth within the space of a few seconds can be caged and stored and trained? When I consider what you have enabled it to do for human comfort and convenience in the single industry that I represent, the attempt to measure your possible achievement seems as futile as a guess at human destiny.

It is not my duty to tell you what electrical energy is, or how you can catch it and put it in harness; but I can tell you something of one of the existing conditions to which it must be applied. And you have poorly learned the very first lesson of life until you have convinced yourselves that the business of adaptation pays better than the business of revolution. Your invention, however interesting and wonderful, and whatever may come of it in the end, is going to be of small use to you if its employment calls for the upsetting and overturning of established conditions with all the waste that that implies. It is for this reason that the first study of an electrical engineer who finds himself in the possession of an idea as to a profitable use that may be made of electrical power, must be the existing conditions of the business to which he believes his idea applicable.

Although it is true that all great industries are organized in this country to-day upon substantially the same lines, and while the peculiarities of each are apparently slight, it is in the comprehension of such differences as do exist that a specialist must excel. The distance between the claim agent and the electrical engineer seems remote, until it appears that the engineer's device, by its too great intricacy or delicacy of construction in the hands of a low-salaried motorman, has involved the company into disastrous accidents. The distance between the electrical engineer and the auditor seems remote until when the engineer's device has been tested and compared, and its economic results have been written down in the auditor's cold figures and submitted to the general manager, the engineer is informed that it costs too much for installment, and saves too little in operation. It must not be supposed, therefore, that the utility of an idea or of the machine that embodies it has been fully passed upon, even when the operating manager and the master mechanic are satisfied.

It is fortunate for you that in these days of combination the president of a great corporation is no longer its owner with his thoughts fixed solely upon the immediate recovery of his investment. Combinations, call them trusts, if you prefer, by the very fact that they represent so great an investment that no one man, indeed, no small group of men, is ever in secure and absolute control, afford the best assurance that any business method has ever provided in the history of trade of the largest opportunity for men of force and brains. The ownership of a property capitalized for twenty-five or fifty millions, bonded for fifty or one hundred millions, is distributed all over the country and lodged in the hands of thousands, and often tens of thousands of investors. However identified it may be in the public mind with the genius of a single individual who may have created or brought it together, the fact invariably is that his personal financial interest in the concern bears only a trifling proportion to the total investment, and well he knows that his control is no control at all, but merely that measure of authority which he can justify by an annual dividend. He knows, moreover, that its continuance depends not so much upon what he can accomplish to-day as upon the steady, constant and permanent value that he can give to his corporation's securities. He and his associates, for of himself he amounts to little, perfectly realize that they must keep their eyes constantly trained on the future and their minds are always receptive, therefore, to a man with an idea.

You are all familar with the claim that the consolidation of great properties is against the interests of the individual, of labor as a class, of inventors as a class, of youth and ambition however employed, unless it is backed with money. It is constantly alleged with most elaborate sophistries that the ultimate result of consolidations is a reduction of working forces, and that the effect of elaborate organization is to thwart ability and stifle hope. I suppose that, in a modified way, the experience of my corporation is that of every other. If it is, this is the fact—computing on a mileage basis, since the street railroads of New York City were consolidated into the Metropolitan System, and since the electrical engineer drove the electrical force against the wheels of our cars, we employ three times the number of men that formerly were employed upon the same mileage. We have one president, it is true, instead of twenty odd, and we have reduced the number of secretaries, managers, treasurers and superintendents and the like, but as to the working force, from which the loudest protest is heard against combination, it is three times as great and its wages per individual have increased fifteen per cent.

Not only so, but in our organization we are absolutely dependent upon ability. What should an electrical engineer, who is a director's son but a man of no particular capacity, weigh with me against an electrical engineer through whose device I can start my cars more easily, stop them more swiftly, govern them more accurately, when my relation to my company depends solely upon the value of securities owned by ten thousand individuals scattered throughout the land? Influence may secure to youth an opportunity, it may set his foot in the right direction, but there never was a time when the length and the swiftness of his stride depended so entirely upon the man himself as they do to-day.

But combination has had this result and you must never omit it from your calculations. There is no one of the departments into which a great industry is now classified that is not going to be affected in its operation by each and every idea as to management that is attempted to be put into execution. The general manager, the secretary, the treasurer, the attorney, the chief engineers, the purchasing officer, expert, and separate as each may be as to his particular functions, work so completely through the executive head of the industry that at that central point the effect of the slightest change at any spot in the whole working plane of operation is registered for the information of them all with the accuracy of the sensitive plate in the photographer's camera as it records the moving picture. Just when the change occurred and what its effect has been upon the entire prospect are witnessed for the judgment of all.

Important, therefore, as an electrical engineer or other expert is in the system of a street railway, his value depends upon his realization of the unity of the system and the effect which his idea, incorporated into an apparatus, is bound to have upon each department of a complicated organization. Of course he must bear in mind at all times that his machine must go into the hands of a class of men who, however expert they may become in its manipulation, must be recruited in large numbers from those whose physical strength is their chief

* Abstract of an address delivered before the New York Electrical Society, Feb. 15, 1905.

capacity, there to be subject to continual use under the most disadvantageous conditions that can possibly arise. It must be stowed away where it is out of sight and reach, under the car body and close to the roadway. It must stand not only use, but the hardest sort of abuse not only from the incompetency of a great army composed of unskilled labor, in which there will always exist a large percentage of gross dullness, and into which there must always be drawn another large percentage of inexperience, but from adverse weather conditions and from adverse conditions of traffic, and that the machine operating under these circumstances, however it may break down, must never be permitted to stand in the way of the car that is coming on.

These conditions, of course, are fairly obvious, but it is beyond belief how often some one or more of them has been overlooked by the electrical engineer. He learns his business generally in some great establishment largely devoted to experiment where the gross earnings of an ordinary street railroad are written off the books in a single month of fruitless investigation, where he is provided not only amply, but even superfluously, with the tools of his trade, and it is difficult for him to understand when he comes to street railroad work that, in the running of a car there is no time for repairs, and that no device, however generally useful, can be employed on a street car which, if it falls out of gear, requires the car to be stabled before it can be repaired. He easily forgets that the motorman, however well instructed, is not a machinist; that he must keep his car going without the facility of a machine shop, and that often the most important repairs must be made at dead of night in a dark and narrow pit, with cheap labor and under whatever circumstances the fates may provide.

Later in the evening I have provided for an exhibition, both for your information and your criticism, of the provision we have made for the instruction of our men. You are well informed, no doubt, of the remarkable improvement that has come about in the course of twenty-five years in the handling and instruction of every class of railroad employee. When I first threw gravel from a flat car, I was just as likely as any other man to be employed the next day in running an engine, for the business of railroading in those days required no other equipment than strength and adaptability. The same hand that built the fire held the throttle, and if a man applying for work claimed to be experienced, it meant that he was a brakeman, a fireman, an engineer and a conductor, all in one, and his word was generally taken for it all. To-day the employees of a great railroad are highly classified and I am proud to say that among street railroads, at least, my corporation has lead the way in all that pertains to the care, instruction and development of its men. Nobody gets a job in our business nowadays simply because he has provided himself with influence. The action and reaction of corporate employer upon corporate employee has taught both of them many useful lessons. It is no longer possible for a large employer of labor to pay or promote his men entirely as he pleases. The rule of seniority will be invoked, and in response to its operation it is necessary for him to exact of them the attainment of a certain standard of efficiency, and their retirement from the service when their capacities fall below the necessary point of skill. They will not endure the competition of the superannuated, and the employer will not endure the service of the incompetent. Consequently, for the betterment of all, the men must adjust themselves to periods of service, to promotions only after careful examination, and that the consequences of these rigid general rules may not fall too heavily upon age and infirmity, we have provided in our organization a pension system that secures to old age and long and faithful service a safe lodge against the winter of its disability.

At the base of this organization is the school of instruction. As its methods are disclosed to you by practical examples you will see the extent to which our experience justifies us in going in the attempt to turn that class of ability which is sufficient for a motorman and a conductor into the ability of an artisan and mechanic. We aim to do as well for him in this respect as his work on the car requires, and the point that you must bear in mind is that you must adapt your devices, appliances and machines to that class of ability and that degree of training. Nothing the use of which requires of him greater ability or higher training can be useful in a street car. The motor that he runs must not be complicated to an extent beyond which his mind and his hand can go in its management. The repairs that it requires must be limited to his capacity and to the few minutes of time that he can be allowed for making them. The machine not only must be accessible to you for the renewal of its parts, but accessible to him, and this fact should be present in your minds at all stages of your work,—that any single element the use and control of which are beyond the ability of this class of labor with the amount of preliminary training that practical conditions enable us to give and the men to take, is an element that detracts from its value.

It is the characteristic weakness of an expert to exaggerate the importance of his line of work to the industry with which he is connected. No established industry can afford to spend more than a certain fixed proportion of its earnings upon improvements and betterments. It must pay its fixed charges, maintain its dividends and store up something in its surplus, and whatever it spends for betterments, whether by the use of what remains after all this has been done or by an issue of new securities, must be done with an eye carefully fixed upon its earning capacity. The expert, whether an electrical engineer or other specialist, is rarely willing to concede this condition of things, and the more absorbed he is in his own line of investigation the more unwilling he becomes to admit that anything else counts. When, therefore, he ascertains that of the all too insufficient sum that can be applied to improved methods, some must go in one direction and some in another, and that the amount that is left for him to work on is but a fraction of the insufficient whole, his dismay not infrequently takes the form of a fit. He has been trained, moreover, in institutions where experiment is a part of the business, and when he goes into the service of an established industry, or undertakes work for the advantage of such an industry, he is slow to adjust himself to the fact that it has no funds for experiment. No small part of the discouragement which awaits the specialist as soon as he leaves that occupation in which his specialty is the sole aim and business, to employ his talents and training for the benefit of an industry in which his specialty is merely a feature, arises out of this circumstance, and he must quickly learn the great art of making bricks without straw. He will find his consolation in the fact that that is the only way good bricks are ever made; that the man who can only produce when the conditions of production are perfect rarely produces anything worth while; and that the valuable things of life almost invariably come by easy and natural stages from one good and successful thing to another that is better and more successful, from one valuable improvement to another that is better still, and that the perfect has never been reached, but is always further on. His opportunity is limited, therefore, not by what has been accomplished, but only by the inevitably insufficient means with which he must work. He has accomplished his greatest triumph when he has adjusted himself to this fact.

So swift has been the advancement in your science that there always exists the great practical danger of your getting too far ahead, commercially speaking, of the operator. If I were to go to a manufacturer of a locomotive and say that I wanted ten of his machines and wanted them to attain a certain standard and be able to perform a certain work, and when I had them a couple of months in operation, and, having ascertained that they were not perfectly adapted to my other stock, upon complaint to the manufacturer were to be told, "That locomotive is two months old; what you want is our new locomotive; you must throw all those two-month's old locomotives away and buy our new and perfect machine," I should feel that I was being pretty badly imposed upon. This, however, is a common experience in dealing with electrical engineers and manufacturers of electrical apparatus.

It is no unusual experience for us to buy and install a very expensive electrical device, to discover that it does not work in perfect synchronism with other parts of the machine, or with other machinery necessary to be operated with it and to have it said to us, "Nothing ails this new motor; it is a good motor. What you want is a new governor; since we made that motor we have made some other new thing to go along with it; you must get that." And then before this other new thing has been in operation a week, still another and still a better thing has been devised or is claimed to be devised. There is great danger of your getting too far ahead of us. This may be all very well for the development of the science, but in a practical sense it is not well for you or for us. If you are going to make money at your profession, you must help us make money in our business. You must not forever be postponing the day when income begins to pay for investment. You must not be forever requiring one great investment on top of another until we have paid half a dozen times over for substantially the same service. You must keep the practical phase of every subject closely harmonious with experimental conditions.

The word "mysterious" is in frequent use whenever electricity is talked of; but when we consider how little we know about any great causation, it does not appear that we are much more deficient in our knowledge of the electric than of any other force. Perhaps, indeed, the use of such adjectives as "mysterious" refers to the state of mind which the amazing power of electricity produces coupled with the fact that only its effects are subject to visual examination. It is this circumstance probably that has so long delayed to science the knowledge of its characteristics. The way to exact knowledge was thereby rendered more difficult. But so well have you succeeded in overcoming these embarrassments that it is hardly an exaggeration to say that the habits, peculiarities, preferences and methods of the electric force are as well known to you to-day as those of any other. If this is so, the facility with which the practical application to commerce of its possibilities will now be ascertained is limited by nothing impossible to human apprehension that relates to the force itself. In other words, the difficulties you are now to encounter, in the present advanced stage of your science, in the practical use of the electric force, are similar in character to those that hinder your ingenuity in the effort to utilize each of the other forms in which power is manifested. I congratulate you upon the existence for the genius and ambition of the electrical engineer of so magnificent a field of possible achievement. Only its infinitude can give you dismay, and that has not long perplexed nor greatly thwarted the hand and mind of intelligent men.

I envy you these noble possibilities. I envy the inspiration with which they must exalt your courage and ambition. The release of mankind from war lords and superstititions and its engagement so general as to be fairly called universal in the grand business of making life comfortable, assures to you an appreciation in your work vastly greater than the student of applied science has ever enjoyed in the history of the world. You are doing things in the nick of time,—when opportunity and appreciation are both at their best.

To analyze the general organization of a large property involves a great amount of detail and statistics, and more time and patience than either you or I have to devote to such a task. As each one of the many departments has its own details of a more or less technical nature, it would require a special paper to be written on each department to give the specific value of each department and its relation to the general organization.

The points to which I have referred as bearing on the electrical engineer and his branch of the business, are just as applicable to the other departments of the general organization, whether it be executive, legal, financial, accounting or transportation.

The systematic working of the various department and preserving the proper relation to the executive department is in recognizing the necessity of strictly adhering to established policy for conducting the business. Satisfactory results can no more be obtained from the railroad organization with each or any of the departments conducting its business on the views that best suit the head of the department any more than a battle could be successfully waged with each captain fighting on his own "hook" without reference to the plans of the commanding general. Of course, there are times when emergencies demand quick action on the part of departmental heads, but there is no reason whatever when the emergency has passed why affairs should not at once be brought in line with managerial policy and method.

With well conducted policy and maintaining of standard methods, and with an authority equal to the responsibilities placed upon departmental chiefs, successful operation must follow. There are many avenues for expenditures and but one principal source of revenue. Efficiently organized, well conducted departments, each doing their share in furnishing thoroughly satisfactory and up-to-date service to meet the requirements of the traveling public, is the true measure of departmental success. Equipped with the best facilities that can be purchased, and safe and efficient mechanical and electrical appliances, all is then dependent upon the character of individual service rendered by each and every employee of a railroad company. No matter what the technical ability, experience and education is of a department head, unless he understands human nature and is capable of discrimination and good judgment in the selection and handling of employees he cannot successfully bear his share of the burden imposed.

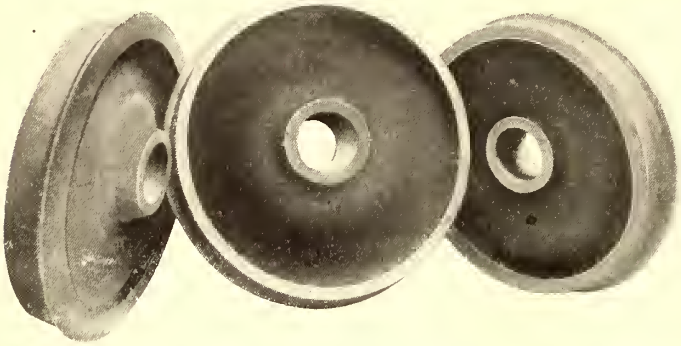
If I can do you any service, it will be by leaving with you the idea with which I began. The world does not want to be pushed or jarred or thrown out of gear; it wants to be facilitated in the daily routine to which it has grown accustomed. It resents a shock; it is pleased with an accommodation. It pays for what it wants. It leaves the giver of what it does not want, though his benefaction be never so great, to the unsatisfying reward of private reflection.

IMPROVED SCHEDULE ON THE DETROIT, MONROE & TOLEDO SHORT LINE

The Detroit, Monroe & Toledo Short Line has announced a new schedule by which the time between Detroit to Toledo is reduced from three hours to two and a half hours. Later the company expects to put on limited cars, making the run in two hours. The Lake Shore Electric Railway, which connects with the Detroit, Monroe & Toledo Short Line at Toledo, has arranged to have its limited cars meet the Detroit cars on the loop in Toledo on the even hour. Through passengers and baggage are transferred without being taken to the Toledo station, as the limited cars are not due to arrive there until a quarter after the hour. This saves a layover of forty-five minutes in Toledo and makes the run of 178 miles from Cleveland to Detroit six and a half hours, instead of about eight hours, as heretofore. The new schedule is drawing a great deal of through trade, as the time is nearly as good as the steam road. The Detroit, Monroe & Toledo Company is planning to double-track the portion of its line from Monroe to Detroit.

THE SOLID FORGED AND ROLLED STEEL WHEEL FOR STREET RAILWAY SERVICE

Probably no one feature of the question of electric railway operation is of more interest and importance to operating men than that of the type of wheels to be used for the best results. With the rapidly increasing stress of service in all features of railway work, in the form of heavier rolling stock, faster schedules, etc., the demand has come for similar increases in strength in the wheels to properly carry the loads. It has long been evident that something stronger than the chilled cast-iron wheel should be used under electric cars, especially those oper-



THE NEW SOLID FORGED AND ROLLED STEEL WHEEL FOR STREET RAILWAY SERVICE

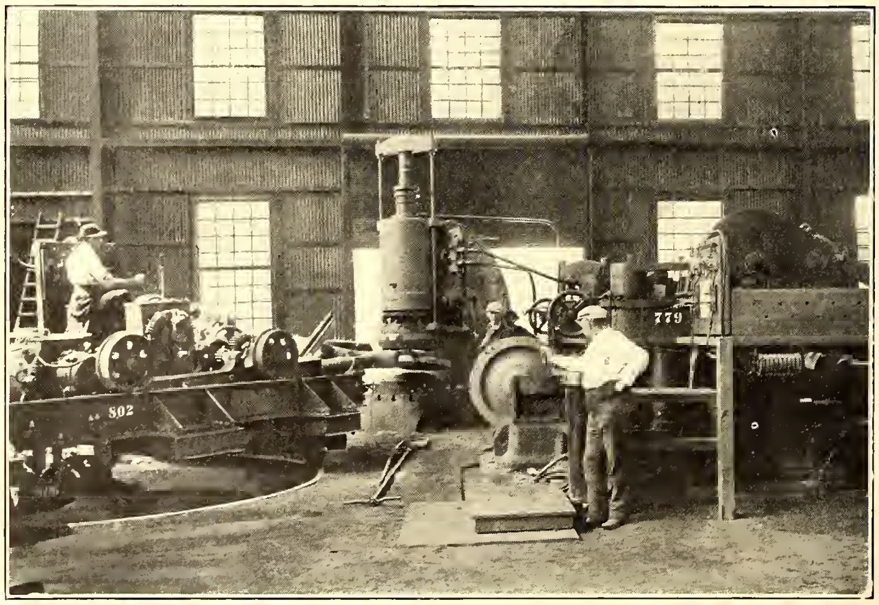
ated under high-speed conditions and upon tracks that are none too smooth or straight. The conditions under which electric car wheels are operated have too often been wrongly compared with those met by wheels under passenger cars in steam road service, which is manifestly incorrect; in the latter service, wheels are called upon to carry heavy weights in the car body carried through the truck springs, but in motor cars the wheels have to carry not only the heavy car body weights but also the uncushioned loads of the heavy motors themselves.

For satisfactory operation, wheels should, to meet the severe requirements of present conditions of electric railway operation, be absolutely unbreakable in any part and free from defects incident to manufacture; they should also have wearing surfaces of great density and solidity, and also be of the proper hardness to resist rapid wear. The various types of built-up wheels, having tires secured to separate centers made of cast iron, wrought iron or cast steel, have been very largely used in both steam and electric road service, and are giving very satisfactory results, filling in every respect the most rigorous specifications. Yet the development of street railways, the demand for a wheel of similar strength, but of a cost not so greatly exceeding that of the chilled cast-iron wheel, has arisen; the cost of the steel-tired wheel, while not absolutely prohibitive where safety requires its use, is still such as to cause a reluctance in applying it more generally to this so-called "light service."

Much interest has been centered in the recent perfection of the solid forged and rolled-steel wheel, which seems to embody every requisite demanded by the new condition. The following illustrations present interesting details of the manufacture of the new solid forged steel wheel which the Standard Steel Works, Philadelphia, Pa., have recently placed upon the market. This company has long been well known as one of the successful builders of steel-tired wheels, its wheel of that type having been used in all classes of railroad service with the most satisfactory results. In the aim, however, to still further extend the use of higher quality wheels, it has made experiments along the line of the solid formed wheel, and has succeeded in producing one the cost of which will compare so favorably with that of the chilled-iron wheel as to make its more general use practically a certainty.

In the manufacture of this new type of wheel, the whole wheel is treated with as much care and forged as thoroughly as a tire bloom, and is subsequently rolled to the required form and size, which so increases the strength of the hub and web that a much lighter design is permissible, reducing largely the weight in comparison with steel-tired wheels. The steel used in the manufacture of these wheels is made from the acid open hearth, of composition similar to that used for steel tires of medium grade of hardness—that is, from .60 to .65 carbon. The method of manufacture has, however, appeared to increase the density of structure of the steel so as to give better wearing qualities than would the steel tires of the same chemical composition. In the process of manufacture great precautions are taken in the selection of the billets, which will enable wheels of a maximum soundness to be produced. The billets from which the wheels are rolled are cut from long vertically-poured ingots, the bottom sections only being used; the top of the ingot which contains the piping and segregation is discarded, nothing being used except billets cut from the solid part, so as to insure perfectly solid and homogeneous construction. This is one of the strong features of this steel wheel, in that it obviates the possibility of defects and hidden weaknesses which exist in wheels made in any other way.

The billets are first forged under a 5000-ton hydraulic press into wheel blanks of suitable size for the final rolling. They are then rolled to shape in a specially designed rolling mill, by which they are subjected to great pressure simultaneously with



MACHINERY USED IN THE MANUFACTURE OF THE SOLID FORGED AND ROLLED STEEL WHEELS, INCLUDING ROLLING MACHINE, SHAPING PRESS AND MANIPULATOR

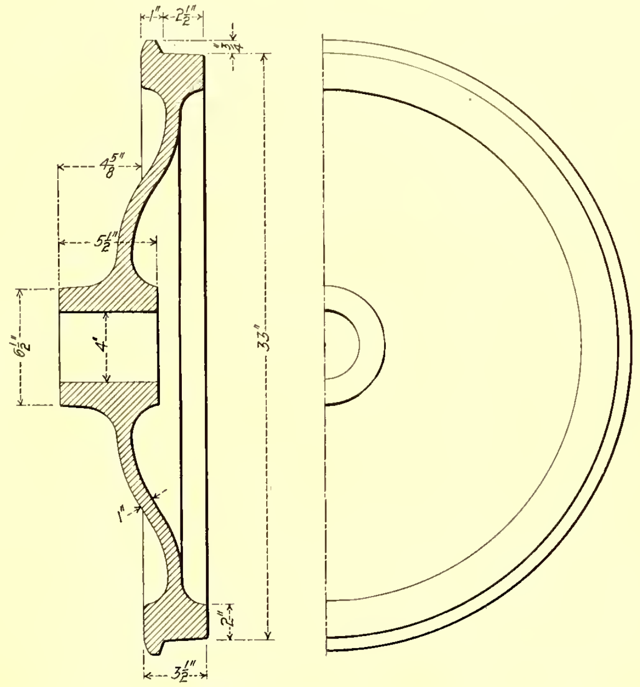
the rolling, so as to produce the finest possible structure in the steel; this rolling machine is shown to the right in the shop view presented herewith. Next the curve in the web of the wheel is shaped in the 500-ton hydraulic press shown at the left of the accompanying shop view. The electric manipulating machine, by which the hot ingots are handled, is also shown to the left of the press in the same view; a heated wheel blank is shown just being lifted by it off of the shaping die. After carefully cooling, the wheels are finished by boring and machining, the latter process consisting of facing the hubs and rims and truing the treads to exact diameter.

Many chemical and physical examinations have been made of the wheel as manufactured in this manner, in order to determine the degree of homogeneity of the steel in all parts; the results have been very gratifying, indicating that the work done on the billets by the 5000-ton press, and subsequently in the rolling mill, produces material of remarkable density and solidity. The accompanying table is of interest in indicating the results of both chemical analyses and physical tests upon specimens taken from various parts of a representative sample wheel.

In another view are shown radial sections from the solid rolled wheel, upon which the above noted tests were made, which have been subjected to bending and distortion tests. These tests were made cold, the sections receiving no treatment of any kind after being cut from the wheel; the wheel itself, of course, in no case received any heat treatment after the rolling process. The results indicated are excellent proof of the character of the material put in the wheels and the efficiency of this process of forging and rolling in improving the structure of the steel. It seems to result in providing exactly the character of wheel material that wheels should have to best withstand the very severe service met under modern operating conditions.

The result is a wheel embodying lightness, strength and durability—three very important requisites. It is believed that these wheels are especially adapted for all classes of electric railway service, not only interurban but also for city lines, particularly under the heavier double-truck cars. It is being tried by many companies and is proving satisfactory in all cases. The accompanying illustration shows the details of the solid rolled wheel which has been manufactured by the Standard Steel Works for the Hartford Street Railway Company, Hartford, Conn., as was referred to in detail upon pages 107-8 of the Jan. 21 issue of this journal; a number of these new solid rolled wheels have been placed in service at Hartford, under both city and interurban operating conditions, and the results will be watched with much interest.

Inasmuch as the solid forged type of steel wheel should outlast four or five chilled-iron wheels in actual service, its economy over the use of the iron wheel will be evident; also an additional economy should be taken note of in the form of the greater security of the steel wheel over that of the chilled-iron wheel while in service, which feature is one of inestimable value. Furthermore, this type of wheel, which, as used at Hartford, weighs about 425 lbs., while considerably more expensive than the chilled-iron wheel, costs very much less than the complete steel-tired wheel. The steel wheel involves, by virtue of its construction, the certainty of maximum soundness and ability to withstand all classes of service with absolutely definite results. Its use offers many inducements to electric railway operating men, particularly in view of the present heavy equipment and fast running in suburban service, which demands a better quality of wheel than those of the chilled cast-iron type.



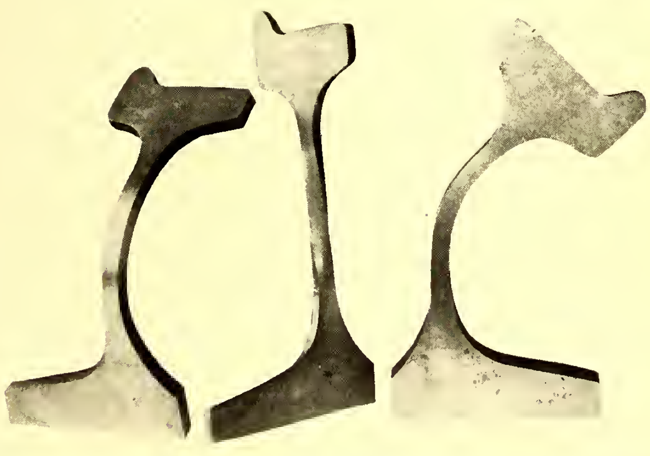
DETAILS OF THE SOLID FORGED AND ROLLED STEEL WHEEL AS USED BY THE HARTFORD STREET RAILWAY COMPANY

Chemical Analyses.

Specimen Tested.	Carbon.	Silicon.	Phosphorus.	Manganese.	Sulphur.
From Flange of Wheel.	.610	.268	.043	.87	.050
" Tread "	.614	.268	.042	.90	.048
" Face "	.620	.267	.041	.86	.052
" Rim "	.614	.270	.042	.91	.052
" Plate "	.602	.265	.043	.89	.051
" Hub "	.608	.265	.042	.86	.048

Physical Tests.

Specimen Tested.	Size of Specimen.	Elastic Limit.	Ultimate Strength.	Elongation.	Reduction of Area.
From Flange of Wheel.	2″ x .619″	50300	126600	12.0%	19.0%
" Tread "	2″ x .619″	50600	124600	10.0%	12.0%
" Face "	2″ x .619″	52600	121000	10.0%	13.0%
" Rim "	2″ x .619″	52000	121300	12.0%	16.3%

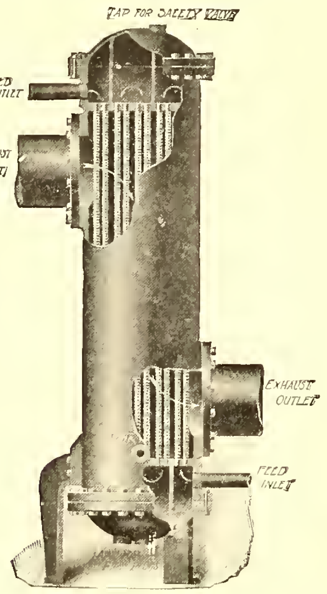

THIN RADIAL SECTIONS OF THE SOLID-STEEL WHEELS, SHOWING HOMOGENEITY AND REMARKABLE STRENGTH UNDER PHYSICAL TEST

At a recent meeting of the stockholders of the Guatemala Street Railway Company it was decided to change the system of traction from mules to electricity. Water-power up to 600 hp will be developed and transmitted some 8 miles. The company is now operating 10 miles of track. An additional 5 miles will be added. L. E. Allen, of San Jose, Costa Rica, has been appointed engineer of the company, and will have charge of the work.

The Lake Shore (steam) has completed a spur between Elyria and Lorain, and is going after the local business heretofore held by the electric lines, by operating passenger trains between the towns morning and evening at a 5-cent fare.

A NEW FORM OF EVEN-FLOW FEED-WATER HEATER

The Taunton Locomotive Manufacturing Company, of Taunton, Mass., has recently brought out its "K" schedule Wainwright even-flow water-tube heater. This later type preserves all of the valuable features possessed by the company's well-known "B" schedule heater, and, in addition, contains new and equally valuable features of its own. No reduction has been made in the amount of heating surface per horse-power in the "K" schedule, but 1-in. tubes are used instead of 1½-in. tubes.



PART SECTIONAL VIEW OF EVEN-FLOW FEED-WATER HEATER

The tubes are divided into groups and the water sent back and forth several times through the heater, but in dividing the tubes an odd number of divisions has been made, making it possible to put the feed inlet at the bottom of the heater and the outlet at the top. This arrangement has also made it possible to arrange the exhaust openings so that the cold entering water meets the partially cold outgoing steam, while the heated water just as it leaves the heater receives the full benefit of the entering exhaust. Not only are the tubes separated into groups and the water caused to flow back and forth seven times through the heater, but when conditions justify this arrangement partitions are put in the steam chamber and the steam made to travel back and forth through the shell, securing in this way a double counter-current and multi-flow effect.

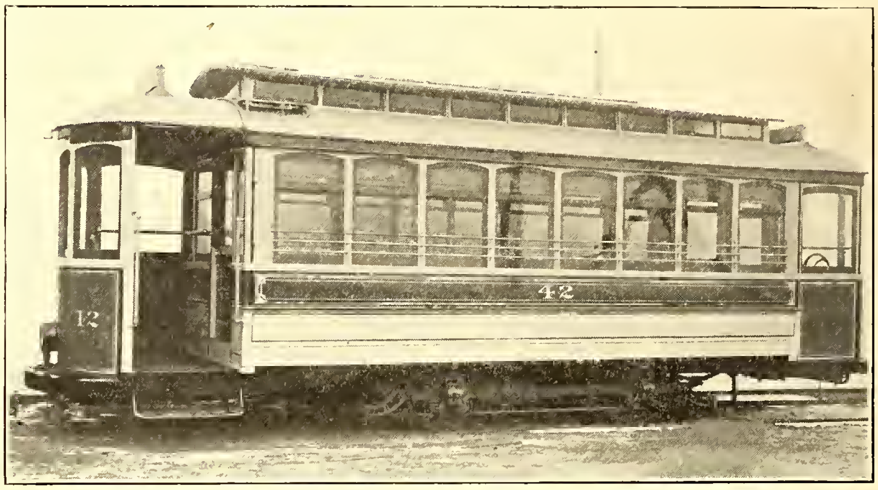
The change in size of tubes from 1½ ins. in the "B" schedule to 1 in. in the "K" schedule has increased the efficiency of the heater by breaking the water up into smaller columns, and has increased the value of the heater for use with bad water by increasing the scouring and cleaning effect in the tubes.

Although the velocity of flow is much larger than in ordinary heaters, it does not even approach a velocity which produces friction enough to offer any objectionable feature. This point has received very careful consideration, and has resulted in securing a velocity high enough to produce enormous heat transmission and at the same time have no more friction than is encountered in the feed-pipe itself. The use of smaller tubes allows more heating surface in a shell of small diameter. The heaters therefore, though apparently small in size per horse-power, are large in power and heating capacity. They are made in both the vertical and horizontal types.

The Columbus, Delaware & Marion Railway is planning to place limited cars between Columbus and Marion, making practically the same time as the parallel steam trains.

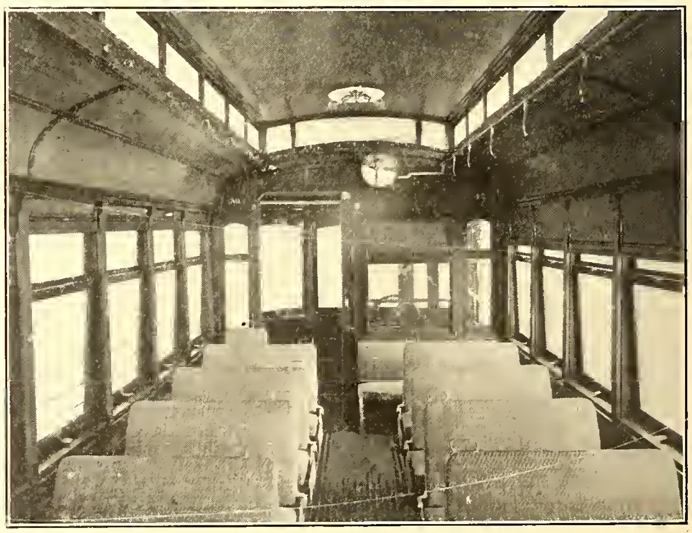
NEW CARS FOR DECATUR

Two closed cars like the one illustrated have lately been delivered to the Decatur Railway & Light Company by the American Car Company. As the cars are to be run in one direction, entrances are provided at only one side of the vestibules, and semi-accelerator doors of the Brownell type are used. The cars are transversely seated with a capacity of thirty-two. At the forward right-hand corner and the rear left-hand corner the transverse seats are arranged to hold three passengers, while in the opposite corners the seats are for one passenger. Thus the seating arrangement does not interfere in the slightest with the semi-accelerator doors, and, as will be seen from the illustration, these doors, situated right at the step where the way in and out is clear, greatly facilitate the movement of passengers. The platform passengers are also as comfortable as men can stand together without being continually disturbed by passengers getting on and off.



DOUBLE-VESTIBULE SINGLE-TRUCK CAR FOR THE DECATUR RAILWAY & LIGHT COMPANY

The lower sashes are arranged to drop into pockets in the side walls, the openings being closed with hinged covers and the upper sashes are stationary. Three-bar bronze rails extend from corner post to corner post. The grab handles attached to the seats are found to be a decided improvement over the old method of strap hanging. The interiors of the cars are finished in cherry, with bronze trimmings, and the ceilings are green, with gold decorations. The furnishings include Brill sand boxes, "Dedenda" gongs, angle-iron bumpers, steps and tilting seats.



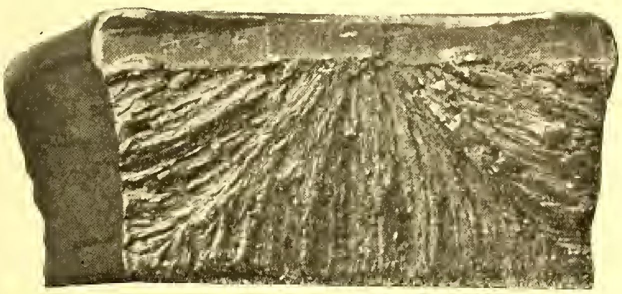
SEATING ARRANGEMENT OF DECATUR CARS, WITH SEMI-ACCELERATOR DOOR

The general dimensions are: Length over the end panels, 20 ft. 8 ins., and over the outside vestibule sheathing, 30 ft. 1 in.; from the panel over the vestibule sheathing, 4 ft. 8½ ins.; width over the sills, including the panels, 8 ft. 1 in.; width over the posts at the belt, 8 ft. 3½ ins.; sweep of the posts, 1¾ ins.; distance between the centers of the posts, 2 ft. 5 ins.; side sill size, 4 ins. x 7 ins.; end sill size, 4 ins. x 7 ins.; sill plates, ½ in. x 7 ins.; thickness of corner posts, 3¾ ins.; thickness of the side posts, 2¾ ins.; length of the seats, 35 ins.; width of aisle, 20 ins.; height of the steps, 15⅞ ins.; height of risers, 14 ins.

A NOVEL ANTI-FRICTION METAL

An interesting feature in the line of anti-friction metals, and something which is said to be entirely new, is shown in the accompanying illustration. The particular point of interest lies in the peculiarity of crystallization, and forms the chief basis of the claims of superiority which are made by its producers. The cut represents a piece of metal which has been nicked on one side and after being placed in a vise has been broken off by a sharp blow from a heavy hammer. This operation reveals a fibrous, stringy mass; the crystals, it will be seen, extend perpendicular to the chilling surfaces. The alloy is of tin and aluminum base, and a remarkable characteristic is that these fibres always radiate from the chilling surfaces, regardless of the number of times reheated, thereby presenting the ends and not the sides of the fibre to the sliding friction surface.

It is well known that in the case of wood and of wrought iron, the surface exposing the ends of the fibre will stand a greater amount of crushing weight and wear than the sides of



PIECE OF ANTI-FRICTION METAL, BROKEN BY HAMMER

the material. The metallurgist who produced this combination worked for this principle in an alloy.

To prove the soundness of the theory of resistance to wear the composition was given many severe tests which were, in all instances, gratifying. Its great toughness and malleability combined permits it to withstand the most severe shocks without becoming brittle or "crystallized." A close examination of the fractured metal shows it to be of so fine and smooth a texture, with no granular matter intervening, that it may be said to be a true chemical compound.

Users of anti-friction metals always experience difficulty in remelting and using them over, owing to the grosser metals—those which melt at the lowest point—volatilizing and escaping, which leaves the composition harder with each pouring. The producers of this metal say they have entirely overcome this, and that by a perfect combination of metals they have secured an alloy which, it might be said, has produced not a new composition, but an entirely new metal in itself that will admit of remelting an indefinite number of times without becoming hard or harsh or losing any of its original properties. The characteristics of this metal should make it particularly desirable for use in linings of driving box and engine truck brasses, eccentric straps, cross-head gibs, steam and gas engine bearings, ships' bearings and other high-speed machinery.

The Buda Foundry & Manufacturing Company, of Chicago, will place this metal on the market, together with some new bronzes and a copper-steel composition. This departure on the part of the Buda Foundry & Manufacturing Company, whose former output has been largely confined to track supplies, will in the future be made an important branch of its increasing business, though it will not in any way interfere with its railroad specialties. The company was attracted to these metals by the exceptional merits which they possess, and after thorough tests became convinced that it had something which would be an agreeable surprise to users of anti-friction alloys.

ADJUSTABLE WEDGE GATE-VALVE AND CUSHIONED NON-RETURN VALVES

In designing a steam plant too much care cannot be given to the arrangement and quality of the steam piping. This branch of power station work has become in fact a specialty in itself, which development has naturally resulted in bringing about many improvements. As the Best Manufacturing Company is

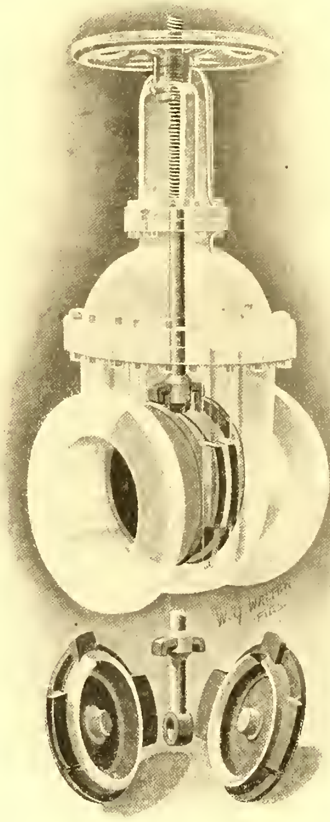
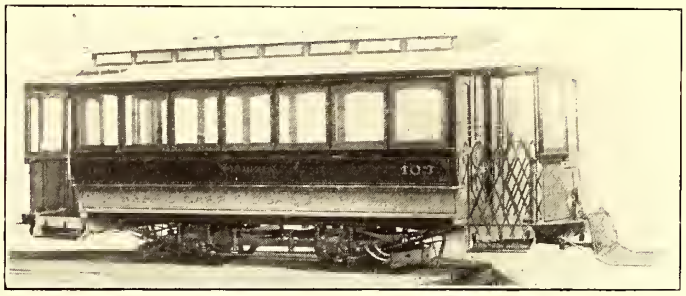


FIG. 1.—ADJUSTABLE WEDGE GATE VALVE

a firm which has accomplished a great deal in this line, having furnished its products to a number of the most important installations in the world, a description of some of its steam plant apparatus should offer interesting points for consideration.

The accompanying transparent view, Fig. 1, of the adjustable wedge gate valve shows the wedge in the same form as the solid taper wedge, except that it is in two parts, there being a ball joint on the inner surfaces the entire circumference of the wedges. This arrangement permits a positive and absolutely adjustable seating, which also insures the taking up of the wear. The renewable feature makes the valve very durable. Rails or guides are cast in the body on either side, and wings are cast on either side of the wedges, which fit inside of the guards or rails in the body, to forbid any possibility of the valve becoming disarranged. Wings are also cast on the top edge of the wedges and a collar with guides cast on the spindle as a factor of safety. Adjustable wedge gate valves of this type are so constructed that they have no more parts than a solid taper wedge gate. The wedges have bronze facings. Even the bronze seats are screwed up in such a manner as to leave no pockets in the rear for the water and steam to attack the threads. The correct mechanical construction of these valves makes them especially fitted for all classes of service.

Fig. 2 shows the Anderson cushioned non-return valve, which fills a vital point in the general piping system of steam power plants. When valves of this type are placed between the boilers and header they equalize the pressure between the different units of a battery of boilers because they remain closed as long



AN INTERESTING CAR FOR A SOUTH AMERICAN RAILWAY

as the boiler pressure is lower than that of the header. When the boiler and header pressures are equal, the valves open and remain in that position without chattering or hammering, on account of the dash-pot arrangement for cushioning these valves. They will cut off a boiler automatically in case of an accident to the latter, such as the bursting of a tube, and they will also act as a safety stop to prevent the turning on of steam into a cold boiler. Fig. 3 shows the Anderson cushioned combination non-return valve, which has the same vital points as the one shown in Fig. 2, except with the additional feature that the valve can be opened and held in that position if desired simply by operating the auxiliary hand wheel.

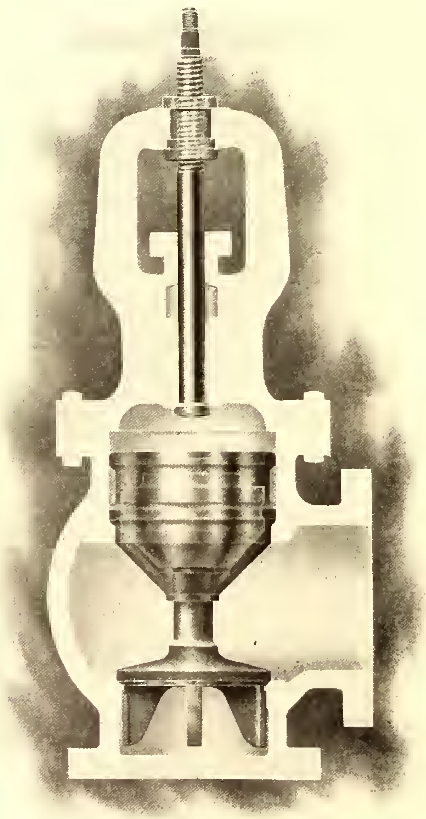


FIG. 2.—CUSHIONED NON-RETURN VALVE

AMERICAN CARS FOR LA PAZ, BOLIVIA

The J. G. Brill Company has recently shipped to the Ferrocarril Guaqui a La Paz, Bolivia, a number of single-truck closed cars. These cars are for use at La Paz, a city in the central western part of Bolivia, having 80,000 inhabitants, and situated in a deep valley, and yet 12,000 ft. above sea level. It is worthy of note that the cars are transferred seven times before reaching their destination, their route being from Philadelphia to New York, from New York to Colon, from Colon to Panama, from Panama to Mollendo, from Mollendo to Puno, at Puno put on board steamer on Lake Titicaca, which is the largest lake in South America—155 miles long—and whose surface is 12,200 ft. above sea level, making it the highest lake in the world upon which there is steam navigation, and at Chililaya the cars are again put aboard steam cars, and from there go direct to La Paz. The cars are shipped in sections, but so simple is their construction that they can easily be put together at Bolivia without the builder's assistance.

No. 21-E trucks are used, the company already having in use trucks of this type which are giving excellent satisfaction. The seats are of spring cane, and are longitudinally placed. Wall pockets are provided, into which the sashes may be dropped. The cars are 20 ft. long over the end panels, and over the crown pieces, 28 ft.; panel over the crown piece, 4 ft.; width over the sills, 6 ft. 2 ins., and over the posts at the belt, 7 ft. 6 ins.; sweep of the posts, 8 ins.; side sill size, 3¾ ins. x 5¾ ins.; end sill size, 4½ ins. x 5½ ins.; thickness of the corner post, 3¾ ins.; thickness of side post, 1¾ ins. The 21-E trucks have 4-in. axles and 33-in. wheels. The cars are finished in cherry, with bronze trimmings, and the ceilings are alternately poplar and linwood, stained. Among the builder's specialties with which the cars are equipped are angle-iron bumpers, radial draw-bars, "Dedenda" gongs and folding gates.

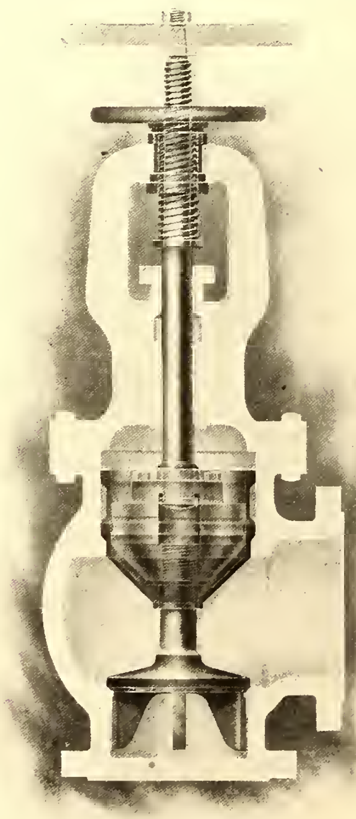


FIG. 3.—CUSHIONED NON-RETURN VALVE WITH AUXILIARY HAND WHEEL

FINANCIAL INTELLIGENCE

Wall Street, February 21, 1905.

The Money Market

There were no important changes in the local money market this week. The tone was somewhat harder, but there was an ample supply of funds for all maturities at near the recently quoted rates. The inquiry for funds was confined largely to the call loan department, which was fairly active throughout at rates ranging from 1¾ to 2½ per cent, borrowers generally being disposed to take advantage of the continued ease in this department rather than to pay the higher rates asked by the banks and individual lenders for time accommodations. Consequently, the volume of business in time contracts was extremely light. The demand was principally for small amounts, but at the same time there was no disposition on the part of lenders to press their funds upon the market. The belief prevails in local banking circles that better returns will obtain for money in the near future, this belief being evidently based upon the fact that within the next fortnight the receipts of currency from the interior will show a material falling off as a result of the opening up of the spring trade. That preparations are already making at the interior to take care of this demand is shown by the fact that in the week ending February 17 the receipts of currency by the local institutions decreased $1,750,000, as compared with the preceding week, while the shipments by the same institutions were about $500,000 larger. The weakness in sterling exchange noted at the close of last week has continued during the present week, prime demand bills declining 65 points in the local market, while the price of sterling at Paris has advanced fractionally. This eliminates, at least for the present, all possibility of a resumption of gold exports to Paris. The shipments of gold to Cuba are also likely to cease, the payment of the final instalment on account of the Cuban bonds having been practically completed. The bank statement was better than was generally expected. The loss in cash of $4,436,000 was indicated by the reported movement of currency. Loans decreased $6,094,000, due partly to liquidation, and deposits decreased $10,416,400. The surplus reserve decreased $1,832,500 to $9,204,425, and compares with $27,506,600 in the corresponding week last year, $9,041,675 in 1903, $12,456,650 in 1902, $14,546,675 in 1901 and $12,678,550 in 1900. At the close indications pointed to a firmer market in the near future. Besides the usual spring outflow of currency, the national banks will be required to pay into the national treasury about $15,000,000 by March 15, most of which will probably be paid by the New York banks. Various railroad and municipal bond issues now pending will also have to be provided for. There was no material change in the discount rates at the leading European centers, except at Berlin, where the open market rate advanced from 1½ per cent a week ago to 2⅛ per cent.

The Stock Market

Greater activity and breadth developed in the local securities market this week, and although prices showed more or less irregularity, the general tone was decidedly strong. The opening was substantially higher, but toward the close of last week the market became unsettled. The news from Washington was to the effect that the prospects were more favorable to the proposed railroad rate legislation, which, together with the developments at St. Petersburg, caused considerable selling both for local and foreign account, and which carried prices down sharply. On Saturday, however, the upward movement was renewed, and prices for many issues more than recovered the earlier losses. There was no unfavorable news developments over Sunday, and at the beginning of the present week prices were lifted to a much higher level. It was evident that stronger interests had taken hold of the market, and despite of a hardening in local money market, prices moved up with comparative ease. Interest centered largely in Union Pacific and Northern Securities on the "curb," both of which established new high records. Other stocks to make new high records were Ontario & Western, which rose several points on reports that the New York & New Haven's holdings in the company were to be acquired by the New York Central. Southern Pacific was also conspicuously strong. Other noteworthy strong features were Reading and the other coal stocks; the Southern iron and steel issues, which advanced sharply on rumor of a consolidation of the various companies; National Lead, American Smelter and a number of the prominent stocks. The bond market was active and strong, the overshadowing feature being the Union Pacific convertibles, which made a new high record, and the Japanese 6s, and United States Steel Corporation sinking fund 5s.

The local traction issues were practically neglected, but prices held fairly steady.

Philadelphia

Increased activity developed in the local traction issues this week, and, although prices displayed more or less irregularity, the general tendency or values was toward a higher level. Interest shifted to the stocks of the Philadelphia Company, both of which made new high records for the present movement on unusually heavy transactions. The common opened around 42¾ and rose to 44¾, while the preferred stock moved from 46¾ to 48⅛. The advance in both issues was attributed to buying for the account of a local pool. In the final dealings there were fractional reactions. About 30,000 shares of the common and about 4000 shares of the preferred were dealt in. Persistent rumors of a "deal" of some sort were largely responsible for the activity and strength displayed by Philadelphia Rapid Transit. In the early dealings realizing developed which carried the price from 28⅞ to 27½, but toward the close there was a sharp advance to 29⅛ on extremely heavy buying. Total transactions in the stock aggregated about 29,000 shares. United Gas & Improvement was considerably less active than a week ago, and the price displayed a drooping tendency throughout. On sales of about 12,000 shares, there was a gradual decline from 114⅞ to 113⅛, a net loss for the week of about ½ point. In the other issues the dealings were comparatively small, and prices showed no material change from those ruling at the close of a week ago. Philadelphia Traction moved between 100½ and 101, while Union Traction sold in small amounts at 59 to 58⅞. Consolidated Traction of New Jersey brought 82, and United of New Jersey brought 27½ for 99 shares. Other sales included American Railways at 51 to 51¼, and Railways General at from 4⅛ to 4⅞ and back to 4½

Chicago

Little interest was manifest in the local traction stocks this week. Trading in them was extremely quiet, but prices generally held firm. Chicago Union Traction opened at 12⅜ and declined to 11⅞, but later, on very light purchases, there was a full recovery to the opening figure. North Chicago fluctuated between 97 and 99, closing at the latter figure, while small amounts of West Chicago brought 68. The elevated railroad stocks were also quiet. Metropolitan sold at 21 to 21½, and $10,000 of the extension 4 per cent bonds brought 90¼. Chicago & Oak Park common changed hands at 6⅞. South Side brought 94 and 95.

Other Traction Securities

There was a very active market for street railway securities at Baltimore. Trading included a much larger number of issues, and prices generally were inclined to a higher level. Interest centered largely in the United Railway issues, especially the income bonds, which advanced nearly 3 per cent to 59⅝, and closed at the highest. About $1,000,000 of them were traded in. The buying was said to be for account of a local pool. The first 4s were also strong, upward of $50,000 of them selling at prices ranging from 95¼ to 96¼. The stock advanced to 14½ on rather light purchases. Other transactions included Macon Street Railway 5s at 99 to 99½, City Passenger Railway 5s at 117½, Washington City & Suburban 5s at 106½ to 107, Norfolk Railway & Light 5s at 94¼, and Toledo Traction 5s at 102. The feature of the Boston market was the sharp advance in Boston & Worcester common and preferred on unusually heavy dealings. From 22½ the common advanced to 27, a gain of 5 points, while the preferred moved up from 71 to 77. Massachusetts Electric common was unchanged at 13½, but the preferred scored a substantial advance to 57½, and closed at 57. West End stocks were both stronger, the common selling at from 96 to 96¾, and the preferred at 115. In the New York curb market Interborough Rapid Transit has continued the downward movement. The opening was unchanged at 215, but shortly afterwards the price dropped to 207. In the subsequent dealings there was an advance to 216, but at the close there was another drive against the stock, which carried the price off to 204¼, where it closed, a net loss for the week of 10¾ points. Other transactions included 3000 New Orleans Railway common at 3 to 3⅜, 500 preferred at 12¾, United Railway of St. Louis preferred at 76, and $20,000 Washington Railway & Electric at 87⅞ to 88.

Security Quotations

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

	Feb. 15	Feb. 21
American Railways	50	50½
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	*155	156
Brooklyn Rapid Transit	62¼	62⅜
Buffalo Con. 5s	109½	109½
Buffalo Deb. 6s	104½	104½
Chicago City	198	198
Chicago Union Traction (common)	11¾	11½
Chicago Union Traction (preferred)	50	49
Cleveland Electric	83	83
Consolidated Traction of New Jersey	—	81½
Consolidated Traction of New Jersey 5s	110	110¼
Detroit United	78½	78½
Interborough Rapid Transit	217	209
Lake Street Elevated	—	—
Manhattan Railway	173⅝	172⅜
Massachusetts Electric Cos. (common)	13½	13½
Massachusetts Electric Cos. (preferred)	55	57
Metropolitan Elevated, Chicago (common)	20½	20
Metropolitan Elevated, Chicago (preferred)	60	63⅜
Metropolitan Street	122⅛	120⅜
Metropolitan Securities	81¾	80⅞
New Orleans Railways (common)	3	3⅜
New Orleans Railways (preferred)	12⅛	12½
New Orleans Railways, 4½s	a81	80½
North American	103¼	101
Northern Ohio Traction & Light	—	—
New Jersey Street Railway	22½	22½
Philadelphia Company (common)	41¾	45⅛
Philadelphia Rapid Transit	28½	30
Philadelphia Traction	100½	101
South Side Elevated (Chicago)	94½	94
Third Avenue	132	131
Twin City, Minneapolis (common)	105½	105½
Union Traction (Philadelphia)	58¾	58¾
West End (common)	96	98
West End (preferred)	115	a116

* Ex-div. a Asked.

Iron and Steel

The "Iron Age" says there has been a very heavy movement of pig iron in the Eastern markets. Steel makers in the Philadelphia district have bought fully 75,000 tons of basic pig at $16 at furnace, deliveries in some cases to run well to the end of the year. Schuylkill Valley furnaces have also sold fully 25,000 tons of foundry iron in lots running up to 3000 tons. In the New York market a leading pump interest has purchased about 5000 tons, and other melters have bought. A large electrical company has taken some round blocks of foundry iron, Buffalo doing the bulk of the business. That producing center has also sold to a group of malleable foundries fully 25,000 tons of malleable Bessemer. In the Pittsburg district a large manufacturing concern has purchased 21,000 tons of foundry and forge iron, 8000 tons thereof from Southern makers on the basis of $13.50, at Birmingham, and 13,000 tons at about $15.75, at the Valley furnace. At other distributing centers the market is very firm. An interesting inquiry is for 21,000 tons of pig iron for the castings of another Hudson River tunnel. It is understood that the United States Steel Corporation is again testing the market for additional supplies, the tonnage needed being estimated at about 40,000 tons. Some large additional sales of steel rails have taken place. The Rock Island has contracted for 49,000 tons. Great Northern and Northern Pacific together 50,000 tons, and two Wisconsin lines 30,000 tons. Railroad Equipment Company has been booking quite heavily lately, and a good deal of additional business is in sight.

A DISCUSSION ON TECHNICAL JOURNALISM

At a meeting of the American Trade Press Association at the Hardware Club, New York City, on Feb. 17, Arthur Warren, manager of publicity for the Allis-Chalmers Company, delivered an interesting address entitled "A Plain Talk on Trade Journals." Mr. Warren is not only well versed in the subject discussed, but has established a high record himself as a successful newspaper editor, correspondent and contributor. He not only considered the technical and trade journal from many standpoints, but outlined the duties of a manager of publicity for a large company and the general principles of advertising. He did not hesitate to say that there were too many trade papers in the field, and too many special issues. It is constant, systematic advertising, not spasmodic, that brings results.

Mr. Warren pointed out the essential differences between advertising a soap or a breakfast food and that of pushing the sales, by advertising, of reciprocating engines, steam turbines, dynamos, motors, transformers, converters, controllers. The advertiser of the corset and the pill appeals to the world in the bulk, and to an unsophisticated audience. The industrial advertiser did not enjoy this advantage, but addressed his claims to an audience that is trained and experienced, and technically educated along the lines of the apparatus brought forward; and quite as likely to know as much about the wares advocated as the man advocating them. These facts made a remarkable differentiation, and constituted part of the problem of trade journal advertising. The technical press was none the less an educator, and Mr. Warren remarked that the editors of the technical and trade papers in America "yield as a body not an inch nor an ell in ability and influence and character to any body of professional men in any part of the world. They make your papers powerful and respected. Publishers, as well as other leaders of enterprise, civil, religious, military, are known by their lieutenants, by the company they keep. If it were not for your editors your advertisers would be fewer. The theory is that advertisers advertise in papers that men wish to read." As to elemental principles in the treatment of advertising, Mr. Warren contended that there should be absolutely no cutting of rates; that advertising business should not be handled through agencies, and that every advertiser should buy and handle his own advertising space, design his own advertisements and realize that a publicity department was as much a necessity as a drafting room or a foundry.

This brought Mr. Warren to the question of circulation. He said that circulation had been regarded as "one of the dim gods that men cherish in silence, but the time had come when the veil of the temple must be rent." He then described in detail the canvass that he had recently made of papers in which his concern advertised, requesting definite and specific information as to the figures of circulation. On the whole, the results were gratifying, although there had been instances of undue reticence. He was glad to note the fact that in the month of January three New York publishers of trade and technical journals—members of the association—were to be found publishing in seven of their journals statements of circulation. He thought that these figures might be carried one point further, namely, in making a distinction between copies printed and copies paid for. Their example at any rate was one which no publisher of good standing could afford to ignore, and the next step was one which he believed all members of that representative body could afford to make.

Mr. Warren brought a most admirable, interesting and suggestive address to a close by discussing the reading matter contained in technical papers, approving the development of the news features and pointing out ways in which even the ordinary descriptive article of a new appliance could be made instructive. It was impossible that the engineers of any great concern could write all the articles demanded of them, as they would then do little else, and he suggested, as an alternative, that the editors themselves or members of the editorial staff should be allowed to circulate more freely through the shops and factories, making observations at first hand and acquainting themselves for the benefit of their readers with what was going on. Some papers were conservative in this and other respects, but he did not believe that the technical press had yet developed the field of information. "There should be, and there can be a closer touch between the papers and the manufacturers. And that closer touch can be obtained without the loss of any independence on the part of the press. The papers that are not independent, the papers that are partisan and that curry favor, are the papers we don't want. The manufacturing concerns are sources of news. You want technical news, and perhaps other kinds of news. But very often, especially in regard to large undertakings, you do not get the information until it has lost its news value. There are reasons for that. Perhaps they will never be entirely overcome, because the manufacturer has not only to guard his own interests, but he has to guard the interest of his customer. When large investments are at stake the persons who are paying the money have the privilege of keeping their own counsel. You, as business men, can understand that clearly enough. And again, when the manufacturer is producing a new invention, he prefers silence until he has protected himself by patents, completed his tests and perhaps made a successful installation or two."

The street railway system of Para, Brazil, has been purchased by an English syndicate, and C. H. C. Moller, of the firm of Moller & Company., New Broad Street House, London E. C., who has been in Para as agent for the syndicate, left Jan. 30 for London with the documents perfecting the deal. According to the correspondent of the STREET RAILWAY JOURNAL in Para, it is too early yet to give the names of the contractors who will install a modern system of electric traction.

SUBWAY TERMINAL IN CINCINNATI

It has been announced that the company which for more than a year has been planning a subway in Cincinnati, presumably for telephone and lighting work, is in reality working on an extensive subway system and terminal station for the steam roads entering that city. The new company is known as the Union Terminal Railroad Company, and the plans under way call for an outlay of about $10,000,000. It is the intention to build a subway from Broadway to a point east of Millcreek with a magnificent passenger station fronting on Court Street, and extending from Vine Street to Race Street, within a block of Fountain Square, the Court House and the City Hall. It is stated that all the roads entering Cincinnati have agreed to aid the proposition, and the announcement of the plans has just been precipitated by the election of W. H. Newman as president of the Big Four Railroad. This company is one of the important figures in the enterprise, and Mr. Newman has already given his assent to co-operate with the other roads.

For construction purposes the Passenger Terminal Construction Company will be formed. The president and general manager of this company will be George R. Scrugham, who is known in electric railway work as the promotor, builder, and, until recently, the president, of the Interurban Railway & Terminal Company, which operates one of the largest and most successful interurban systems in Ohio.

Mr. Scrugham informs the STREET RAILWAY JOURNAL that a large force of engineers is now at work on the proposition, and that it will be several months before the plans are completed. While this is a steam railway proposition, the question of using electricity in the subway is being seriously considered. This point will not, however, be decided for some time, and it is understood will depend to a large extent upon the success of electricity in the New York terminals of the New York Central.

WEST SHORE TO BE ELECTRIFIED BETWEEN FRANKFORT AND ILION

The Utica & Mohawk Valley Railway Company is planning to run its large interurban cars on the West Shore tracks between Frankfort and Ilion, because the trustees in these villages will not permit the company to build a double-track line through the main streets in order to make the complete distance from Rome to Little Falls, a distance of 37 miles, double instead of single track. The company has been trying for two years to get the franchise in Ilion. Two weeks ago a public meeting was held in the Ilion Opera House and the sentiment was against the movement; in fact, so strong was public opinion that at a subsequent meeting the trustees decided to vote down the proposition. The company is determined to have double tracks the entire length of its interurban line, and as it is merged with the New York Central interests, which control the West Shore, it has been decided to use the West Shore tracks between these two places, a distance of about five miles. The company will still continue to give local service in Ilion and Mohawk, but when the residents of either of these places want to reach other places in the interurban route, they will have to transfer.

The terminal of the company's double tracks in Frankfort is not far from the West Shore Railroad, and in order to reach the tracks of the latter company, a line will have to be built to connect the two. Permission will have to be obtained from the canal board to build an iron bridge across the Erie Canal, which lies between the two connections. The overhead trolley system will be used on the West Shore. When this work is completed, the running time between Utica and Little Falls will be one hour, instead of an hour and a half. The time to Rome from Utica will also be lessened.

General Manager Allen, of the Mohawk Valley Company, says that the electric schedule will be so arranged that the regular trains and the electric cars will not conflict..

CHICAGO CITY RAILWAY STOCKHOLDERS' MEETING—DIRECTORS ELECT OFFICERS

The stockholders' meeting of the Chicago City Railway Company, which was held Feb. 16, 1905, was of much interest because of the recent purchase of that company by the new syndicate which proposes to consolidate all the street railways in Chicago. Resolutions were passed thanking the retiring president, D. G. Hamilton for his six years' service in the interest of the stockholders of the company. A new board of directors was elected representing the new owners. These directors, with their financial connection are as follows:

John A. Spoor, president of the Union Stock Yards & Transit Company and of the Chicago Junction Railway Company, and a director of the First National Bank; P. A. Valentine, of Armour & Company, director of the Chicago Junction Railway Company, the Union Stock Yards & Transit Company, the National City Bank, of New York, and the Continental National Bank, of Chicago; Robert M. Fair, of Marshall Field & Company; A. J. Earling, president of the Chicago, Milwaukee & St. Paul Railway, and a director of the Continental National Bank and Central Trust Company, of Chicago; Lawrence A. Young, vice-president of the Chicago City Railway Company; Edward Morris, of Nelson Morris & Company, packers; M. B. Starring, the president general manager of the Chicago Railway Company. It was announced after the meeting that at the directors' meeting Thomas E. Mitten, general manager of the International Traction Company, of Buffalo, would be elected first vice-president to take the active management of the road, a step of importance in the coming reconstruction of the system.

The stockholders further passed resolutions that immediate steps be taken without regard to future contingencies to re-establish the company in the confidence of the public, and that in order to attain this end, the directors of the company be instructed to begin at once a systematic and thorough investigation of the property and the affairs of the company, for the purpose of learning what steps must be taken to enable the company to provide ample and satisfactory accommodations for the public. The directors are further advised to put into effect such measures as will put the physical properties of the company into proper condition, without regard to expense, in order to furnish first class service.

If these resolutions are carried out it will mean that the company will not wait for a settlement of the franchise difficulties with the city before undertaking a thorough reconstruction. The following statistics were given as to income and traffic for the year 1904:

INCOME ACCOUNT

Earnings.	Dec. 31, 1904	Dec. 31, 1903
From passengers	$6,609,500	$6,381,245
Other sources	59,478	54,319
Total	$6,668,979	$6,435,565
Operating expenses	4,802,120	4,648,341
Net earnings	$1,866,859	$1,787,224
Depreciation	120,000	100,000
Earnings on stock	$1,746,859	$1,687,224
Dividends	1,620,000	1,620,000
Surplus	126,859	67,224
Capital stock	$18,000,000	$18,000,000

Mileage—	Dec. 31, 1904, miles.	Dec. 31, 1903, miles.
Cable	34.75	34.75
Electric	184.20	183.96
Totals	218.95	218.71

Passengers carried—	Dec. 31, 1904	Dec. 31, 1903
Fare	132,852,717	128,304,445
Transfer	77,732,749	66,883,346
Totals	210,585,466	195,187,791
Car miles run—		
Cable	13,701,643	13,865,473
Horse	86,357	74,210
Electric	20,319,293	18,595,440
Totals	34,107,193	32,535,123

	Dec. 31, 1904	Dec. 31, 1903
Per cent. expense to income	72.01	72.23
Per cent. increase traffic	7.88	16
Per cent. on stock	9.70	9.37
Per cent. transfer passengers to fare passengers	58.5	52.13

On Monday, Feb. 20, the directors organized by electing the following officers: Thomas E. Mitten, first vice-president; Lawrence A. Young, second vice-president; C. N. Duffy, secretary and auditor; T. C. Penington, treasurer; Mason B. Starrring, general manager. No selection of a president was made, the syndicate not having decided who shall have the place.

AN EXTENSIVE RADIAL SYSTEM FOR TORONTO

Toronto railway interests, organized as the Toronto & York Radial Railway, are to build a series of radial lines extending from Toronto to aggregate 96 miles. These lines will extend from Toronto to Oakville, 20 miles; Toronto to Jackson's Point, 50 miles; Toronto to Whitby, 26 miles. The details for building are all being arranged so that construction can be begun as soon as the weather is favorable. W. H. Moore, the manager of the company, who also is assistant to the president of the Toronto Railway Company, informs the Street Railway Journal that every effor will be made by the company to complete this vast system during the present year. The object in building the lines is to further the development of a most promising agricultural and industrial country. Especial attention will be given by the company to the development of freight, and the interests of shippers will be well conserved. Already freight terminal sights have been secured in several places through which the lines will operate. This plan will be followed until in each of the towns along the lines ample facilities are provided for expediting this particular service. In Montreal there will be several regular distributing stations, each of which will be supplemented by an elaborate wagon transfer system.

THE NEW YORK, WESTCHESTER & BOSTON COMPANY'S PLANS

The New York, Westchester & Boston Railway Company, which plans to build from New York City through Westchester County, has just announced that it has reached an understanding with August Belmont, president of the Interborough Rapid Transit Company, whereby a terminal station for the interchange of traffic between the subway and the Westchester lines will be erected at some point between One Hundred and Forty-Ninth Street and One Hundred and Seventieth Street, in New York. This arrangement will make the Westchester Railway practically an extension of the New York subway on the east side of the borough of the Bronx.

According to a statement made to the Street Railway Journal by the company, ground will be broken as soon as the weather will permit, but the work of construction in New York City will be well under way before operations are begun in Westchester County. It is expected that the road will be in operation within two years.

In order to facilitate the interchange of traffic with the Interborough Company, the track and rolling stock of the Westchester Railway are to be electrically equipped similar to the elevated and the subway lines of the Interborough Company. The cars will be built of steel and fire-proof materials. Toilet rooms, lavatories and bundle racks are to be provided. Trains will include passenger, baggage and smoking cars, but the number of coaches to a train is yet to be decided.

The main line of the road as now projected will extend from One Hundred and Thirty-Eighth Street and Third Avenue, New York, to Portchester, a distance of about twenty-two miles. There will be a branch line from Pelham to White Plains, which will be 10.5 miles in length, and a branch to Clasons Point and Throgs Neck, 6 miles, four tracks to the city line and three tracks to the Connecticut State line, making a total of 117 miles. The line will be built over private right of way, fenced in for the entire distance. There will be no grade crossings on streets, highways, private roads or railroads. The rails used will weigh 90 lbs. to the yard. The bridges, culverts and crossings are to be of stone, concrete and steel construction; the stations along the line will be of similar build. Wherever possible, stations will be located between the tracks. An automatic electric block system similar to the one adopted in the Rapid Transit Subway will be used to protect the operation of cars.

As previously noted in the Street Railway Journal, the general supervision of the construction of the road will be under the direction of Samuel Hunt, vice-president of the company, and one of the trustees for the city, of the Cincinnati Southern Railroad, who has had charge of construction work for the Missouri Pacific and other railroads. The engineering staff of the company, as previously noted in these columns, is composed of William A. Pratt, chief engineer; William Barclay Parsons and John Bogart, consulting engineers. Several engineering corps are now in the field perfecting the preliminary surveys that were made last year.

The ordinance giving the company the right to build in New York requires the company to carry passengers between all stations within the city limits for a uniform rate of five cents. The fares outside the city limits will be considerably lower than those charged by the steam railroads for the same distance.

A new board of directors of the company has been elected as follows: William Lanman Bull, of Edward Sweet & Company, New York; Evans B. Dick, of Dick Brothers & Company, New York; Samuel Hunt, president of Detroit Southern Railway Company, Cincinnati, Ohio; Charles E. Lewis, New York City; John R. McAllister, president Franklin National Bank, Philadelphia; William Barclay Parsons, engineer, New York; Robert C. Pruyn, president National Commercial Bank, of Albany, and chairman of the United Traction Company, of Albany; Charles Pryer, New Rochelle; Robert E. Robinson, of Dick & Robinson, New York; Frederick E. Whitridge, New York, director Cincinnati & Northern Railway, Lake Erie & Western Railroad; William H. Buckley, attorney, New York City. Mr. Bull will continue as president of the company; Samuel Hunt, as vice-president, and H. Carroll Winchester, as secretary and treasurer. At the next meeting of the board of directors, which will be held on Thursday, Feb. 23, the representatives of certain traction interests will be elected to the board of directors of the Westchester Company. These will include Andrew Freedman, a director of the Interborough Rapid Transit Company.

THE APPLEYARD SITUATION

Attorney-General Mayer, of New York, last week made public the report of Tracey C. Becker, of Buffalo, who, as special deputy attorney-general, investigated the insolvency of the German Bank of Buffalo.

The bank, according to the report of Mr. Becker, passed into the control of Arthur E. Appleyard, of Boston, on April 30, 1904. Mr. Appleyard then acquired $51,000 of the capital stock of the institution, purchasing it in the name of Richard Emory, an employee, who immediately transferred it to Mr. Appleyard.

Almost immediately after buying the German bank stock Mr. Appleyard is said to have borrowed money in large amounts from the bank. It is alleged that he "kited" checks and drafts on it and through it with various other banks with which he was connected until, when the bank was closed on Dec. 5, 1904, Mr. Appleyard and the various street railways with which he was connected were indepted to the bank in the sum of more than $662,000. The loans, discounts and drafts of Mr. Appleyard and his corporations purported to be secured in part by the bonds of several railway companies.

MORE WORLD'S FAIR MACHINERY SOLD

A sale has been made of one of the big units which was employed to generate current to operate the Intramural Railway at the Louisiana Purchase Exposition. The contract, which was closed through Westinghouse, Church, Kerr & Company, is for one of the seven 900 kw sets. The generator is a Crocker-Wheeler standard railway generator, 550-volt compound wound, running at 100 r. p. m. The engine was built by the Buckeye Engine Company, of Salem, Ohio, and is a cross-compound heavy duty type machine. The equipment is to be installed in the power house of the Consolidated Railway Company, of New Haven, Conn., the electric railway branch of the New York, New Haven & Hartford Railroad.

NEW DISTRICT OFFICERS OF THE NATIONAL ELECTRIC COMPANY

A. W. Wyckoff has been appointed district manager for the National Electric Company to operate in Pittsburg and the surrounding territory. Mr. Wyckoff is well known in that section, as he was previously district manager of the Bullock Electric Manufacturing Company, having been, prior to his taking the Pittsburg office, the general superintendent of the Bullock Works at Cincinnati. Mr. Wyckoff is a graduate of Cornell, and rounded out his engineering education in the Bethlehem Steel Works. He has already started the ball rolling for the National Electric Company by securing the order for the five 300-kw, 120 r. p. m., engine-type generators for the Carnegie Institute. This building when completed will cost $5,000,000, and will be the finest of its kind in the world. Spranley & Reed have just accepted the district managership of the National Electric Company at New Orleans and the surrounding country. They will be remembered as having represented the Bullock interests prior to this time. W. T. Spranley is one of the oldest operators in the electrical market in that section of the country, and Lyman C. Reed, formerly with the Interstate Electric Company and the Safety Electric Company, is known as one of the most enterprising electrical engineers in the South.

The National Electric Company announces that Walter Fairchild has been placed in charge of its office at 135 Broadway, New York. Mr. Fairchild formerly represented the Bullock Electric Company in that city, and prior to that represented the Stanley Electric Company in New York. He is well known in electrical engineering and commercial circles in New York City and throughout the State. Robert S. Hopkins has been appointed city sales agent for this office. Mr. Hopkins obtained his engineering experience with the Bullock Electric Manufacturing Company, for whom he installed many alternating and direct current plants. J. Frank Perry has just been appointed sales engineer of the company. Mr. Perry's field operation has been largely through New England, but he has been connected with large power installations in all parts of the world. He is at the present time in California representing the interests of the National Electric Company.

LARGE REGISTER ORDER

The Detroit United Railway recently gave an order for 750 Sterling No. 8 registers. No. 8 is the Sterling-Meaker Company's printing register for city use, while its No. 9 is adapted to the zone system of interborough roads, any number of records being made with the latter between termini. Considering the fact that the Sterling-Meaker Company did not begin the manufacture of a printing machine until last June, the success achieved is especially noteworthy. The Detroit order is the largest so far, and the Sterling-management state that they have never before met with such ready appreciation of a new machine. The simplicity of the No. 8 is perhaps responsible in part for the welcome accorded to it. One movement of the resetting knob reverses the direction sign, returns the trip figures to zero and prints the totalizer figures in the day slip, together with the identifying number and the direction. Like other recent registers of Sterling make, the No. 8 is attractive in appearance, having the familiar blue and gold dial and the copper case oxidized.

LARGE CAR ORDER IN BROOKLYN

One of the largest contracts for cars ever let has just been placed by the Brooklyn Rapid Transit Company. It is for 200 surface cars of a new semi-convertible type and for 100 elevated cars. In addition to these, there will be 50 surface freight cars, the contracts for which will be let in a few days. Of the 200 surface cars, the J. G. Brill Company, of Philadelphia, will supply 175, while the Jewett Car Company will supply the remaining 25. The contract for the 100 elevated cars was divided among the Cincinnati, Jewett and Laconia Car Companies as follows: Cincinnati, 50; Jewett, 25; Laconia, 25. An article descriptive of the new type of semi-convertible surface car for which orders have been placed, will be published in an early issue of the Street Railway Journal.

THE QUESTION OF VENTILATION OF CARS IN MASSACHUSETTS

The hearing on street car ventilation, continued from Tuesday, Feb. 7, before the legislative Committee on Street Railways, was closed Thursday, Dec. 9. No aditional evidence was put in by the petitioners for improved ventilation, but objection was offered by John P. Fox, who appeared as an independent railway engineer, who has made a special study of street railway conditions in this country and abroad, and by B. W. Warren of the Massachusetts Street Railway Association. Mr. Fox's argument was that the air in the Boston street cars is not foul enough to be injurious, or to warrant additional legislation such as is called for in the bill—that the Railroad Commission be authorized to investigate and to order the railway companies to equip the cars with ventilation devices. Investigations of his own have convinced him of this fact.

B. W. Warren took the ground that there is legislation enough to cover the subject, and the Railroad Commissioners investigated it thoroughly and reported upon it as recently as in 1897, and they have ample authority to take the initiative, should they find conditions changed since their last investigation to warrant them in making recommendations to the railway companies. He questioned the wisdom of creating for the commissioners special power on specific matters, as it tends to minimize their general power, supposed to be broad enough to cover all phases of transportation facilities; he also advanced the argument that it is unwise to give the commission power to "order" railway companies to do certain things, because the commission is not likely to be as comprehensive in its requirements when it "directs" as when it "recommends," and only in two or three instances in the last thirty years are the railroads in Massachusetts known to have refused to carry out the recommendations of the Railroad Commissioners. The commissioners reported to the legislature, and were given power to enforce their recommendations in those particular instances. The authorities in Chelsea, whence come most of the complaints of foul air in the street cars, could go before the Railroad Commissioners to-morrow and be heard, and the commissioners have sufficient authority to investigate again and make recommendations. This closed the hearing on the ventilation bill.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEB. 14, 1905

782,312. Electric Traction Apparatus; Alfred Zehden, Charlottenburg, Germany. App. filed June 21, 1902. The rotary field idea is here carried out for traction purposes by arranging the poles as if they were opened out in a line of indefinite length.

782,405. Trolley; John Martland, Detroit, Mich. App. filed Jan. 2, 1903. The trolley consists of a bail-shaped frame adapted to stand vertically astride of the car, each arm of the frame being upwardly spring-pressed, and a tilting harp provided at the top of the frame having two trolley wheels and springs arranged each side of the harp permitting it to tilt to accommodate inaccuracies in the wire.

782,454. Car or Train Signal; William Lintern, West Park, Ohio. App. filed Aug. 4, 1904. Rear end signals showing whether the current is on or off are operated by contacts upon the controller.

782,455. Car Signal System; William Lintern, West Park, Ohio. App. filed Nov. 28, 1904. The system of circuits involving the idea disclosed in the preceding patent.

782,529. Trolley; Benjamin Williams, Columbus, Ohio. App. filed June 17, 1904. Consists of two trolley poles, one for operation in each direction, and means whereby when one pole is pulled down the other is raised to operative position.

782,598. Apparatus for Lifting Street Railway Cars; Charles Churilla, Allegheny, Pa. App. filed March 30, 1904. Details of a device for replacing a derailed car upon the track.

782,756. Trolley Guard; Edward R. North, Webster Groves, Mo. App. filed May 6, 1904. Details.

782,786. Trolley Pole Controller; Joseph P. Magney, Los Angeles, Cal. App. filed July 11, 1904. Relates to pneumatic control of the trolley pole.

782,796. Trolley Switch; Alexander Palmros, Columbus, Ohio. App. filed June 6, 1901. Details of a side-running trolley switch.

782,805. Car Fender; Raymond Andlauer, Kansas City, Kan. App. filed March 21, 1904. Details.

PERSONAL MENTION

MR. A. P. GODDARD, president and treasurer of the Freeport Railway, Light & Power Company, Freeport, Ill., died on Feb. 12, at the age of 72 years. Mr. Goddard had devoted many years to furthering the interests of the Light & Power Company, and the affairs of the company will be continued along the lines laid down by him.

MR. WILLIAM B. COMSTOCK, a prominent lumberman and banker of Alpena, Mich., died at Detroit a few days ago. Mr. Comstock was prominent in the constructoin and management of several electric railway properties, among them the Toledo, Fremont & Norwalk, now part of the Lake Shore Electric; the Rochester & Eastern Railway, and the Cincinnati, Georgetown & Portsmouth Railway.

MR. FRANK PATTERSON, general manager and vice-president of the Springfield, South Charleston, Washington C. H. & Chillicothe Electric Railway Company, of Springfield, Ohio, has resigned, and Mr. E. B. Gunn has been appointed general manager. Mr. Gunn has been superintendent of construction for the company, and before that was general superintendant of the Dayton, Springfield & Urbana Railway.

MR. H. ROOT PALMER, superintendent of the Norfolk Railway & Light Company's power house in Norfolk, Va., has been promoted to the position of general superintendent of the company's properties, to succeed Mr. Robert T. Gunn, who, as previously noted in the Street Railway Journal, has become general manager of the Lexington Railway Company, of Lexington, Ky. Mr. Charles W. Bradley, superintendent of the Berkley division, will succeed Mr. Palmer as superintendent of the power house. Mr. Bradley's successor has not as yet been named.

MR. FREDERICK COOK, president of the Rochester Railway Company, of Rochester, N. Y., and connected with important commercial and manufacturing interests in that city, died early Friday morning, Feb. 17, aged 72 years. Mr. Cook was born in Wildbad, Wurtemburg, Germany, Dec. 3, 1833. When he was 12 years of age, his father died, leaving a family of eight children. In 1848 he landed in New York a poor emigrant, alone in a strange country, but for a sister and an uncle, each of whom was without means. His first position was as a shoemakers' apprentice. He migrated to Batavia from Buffalo and there began the career that finally saw industry and perseverance crowned with position and wealth. Mr. Cook is survived by a widow and two children.

MR. DICKINSON MACALLISTER, president of the Metropolitan West Side Elevated Railway, of Chicago, at a recent meeting of the board of directors, announced that he would not be a candidate for the presidency of the company at the annual meeting to be held April 4. The directors adopted a resolution expressing regret at Mr. MacAllister's action. Mr. MacAlister in a letter to the directors stated when he identified himself with the company that he intended remaining only until such a time as certain work then in hand was completed. That work being completed, he declined to remain president. Mr. MacAllister formerly was engineer for the Brooklyn Union Elevated and the Manhattan Elevated Railway. He came to Chicago as constructing engineer for the South Side Elevated Railway, but left this company to take charge of the construction of the Metropolitan railway. In 1899 he became president of the Metropolitan.

MR. WILLIAM A. GRAUTEN, of the National Electric Company, of New York, who died recently in Tucson, Ariz., was among the pioneers in electric traction. His first experience in railroading was in steam railway service in the West. This work he left to assist in installing the "Short Series System" in Denver. Mr. Grauten next went to Cleveland with Mr. Short, and was for some time employed at the works of the Brush Company in that city. About 1890 Mr. Grauten went to Rochester, in charge of erecting the line work in that city. He remained there until 1893 or 1894, when he accepted the position of line superintendent of the Hartford Street Railway Company, of Hartford, Conn. Later he became electrician of the Hartford system. In 1898 he resigned from the Hartford Company to enter the employ of the Christensen Engineering Company (now the National Electric Company), with which he was connected until his death. Mr. Grauten was a man who made friends rather than acquaintances. His generosity, good fellowship and unfailing wit endeared him to those with whom he came in contact.

MR. F. W. COEN, the newly elected secretary of the Ohio Interurban Railway Association, is secretary and general passenger agent of the Lake Shore Electric Railway, of Cleveland. He served his apprenticeship in a country bank at Vermillion, Ohio. In 1893 he became cashier of the Sandusky, Milan & Norwalk Railway, one of the earliest interurban lines in Ohio. In 1895 he went to Detroit as assistant secretary of the Detroit Railway, the 3-cent fare company, and a year later went to Cleveland as assistant secretary of the Lorain & Cleveland, now a part of the Lake Shore Electric Railway. During the formation period of the Lake Shore Company, he served as secretary of the Toledo, Fremont & Norwalk Railway, now the Western division of the Lake Shore. He was appointed secretary of the Lake Shore when that company was formed in the fall of 1901. Mr. Coen is particularly well equipped to further the active work of the Ohio Association. He was one of the first electric railway managers to appreciate the advantages of combining with other roads for interline traffic, and soon after the Lake Shore was formed the company commenced to exchange business with connecting steam, as well as electric lines.

MR. THOMAS FITZGERALD, JR., whose resignation as general manager of the Lexington Railway Company, of Lexington, Ky., to become assistant to Second Vice-President Dana Stevens, of the Cincinnati Traction Company, was noted in the STREET RAILWAY JOURNAL recently, is a native of Baltimore. In 1898 he was graduated from Johns Hopkins, where he subsequently pursued a post-graduate course. His first commercial position was with the Baltimore & Ohio Railroad, whose machine shops he entered as an apprentice. He resigned this place to become connected with the operating force of the Third Avenue Railroad Company, of New York, and subsequently entered the service of the Sprague Electric Company. Resigning from the Sprague Company, he accepted the position of superintendent of the Fairmount & Clarksburg Electric Railway & Light Company, of Fairmount, Va., and later became the general manager of the Norfolk, Portsmouth & Newport News Company, which includes in its operations the public service utilities of these places. At Lexington, Mr. Fitzgerald's experience was along lines similar to those at Norfolk, for at Lexington the street railway and lighting systems are under one management. Mr. Fitzgerald will thus take with him to his new position, a wealth of experience in the management of public service corporations.

MR. W. E. HARRINGTON, of Camden, N. J., has announced his resignation as general superintendent of the South Jersey Division of the Public Service Corporation, and the acceptance by him of the office of vice-president and general manager of the New York-Philadelphia Company, which is operating an electric line between New York and Philadelphia by way of Trenton. Mr. Harrington is one of the most progressive managers in this country, and the Camden property, which has been under his management since 1896, has developed rapidly both in extent of service and in physical and financial condition since it has been under his charge. From a system of 31 miles in length it has grown to one of 83 miles, while the annual receipts have increased from $250,000 to $551,000. During this time also he has introduced a number of improvements, including a unique system of discipline, which has been described in these columns, a mutual benefit association for the employees with monthly meetings, and a semi-monthly organization of the heads of departments for a discussion of technical topics and consideration of the best methods of improving the service. Mr. Harrington is a graduate of the University of Pennsylvania, class "87," and besides his experience in Camden was in charge of the Atlantic City Electric Railway, operated and controlled by the Pennsylvania Railroad Company, from 1889 until 1891 was general manager of the Consolidated Railway properties at Wheeling, W. Va., and is also an electrical engineer of considerable note.

MR. THOMAS E. MITTEN, on Feb. 20, was elected first vice-president and managing director of the Chicago City Railway Company, and on March 1 will assume full charge of the property.

THOMAS E. MITTEN

Mr. Mitten, as most of our readers know, has been since 1901 general manager of the extensive electric railway properties controlled by the International Railway Company in Buffalo and vicinity. He took up his work in Buffalo just before the opening of the Pan American Exposition as general superintendent of these properties, and as a result of the success he achieved in handling the many intricate transportation and mechanical problems presented by the Pan American conditions, he was late in 1901 made general manager of the combined systems. Since that date the development of the properties and the financial results accomplished have placed the International Railway System conspicuously in the fore among the important electric railway enterprises of the country.

Mr. Mitten's early training was in the steam railroad field in the West, his first important position placing him in charge of the Denver, Lakewood & Golden Railroad, a combined steam and electric road. In 1895 he was called to Milwaukee, Wis., and was made superintendent of railway department of the Milwaukee Electric Railway & Light Company. Soon after entering upon this work he found it necessary to carry the company through a severe labor disturbance, and in his handling of men and conditions his success was striking, as is evidenced by the fact that when he left Milwaukee to assume his duties at Buffalo, he was tendered a testimonial signed by 1228 employees of the Milwaukee Electric Railway & Light Company, expressing to him their regret at the severance of the relation and their appreciation of him as a man and a manager.

The new position in Chicago to which Mr. Mitten has just been called is likely soon to be one of the most important in the street railway operating and constructing field in the United States, as the indications are that it will involve the reconstruction and consolidation of all the street railway lines in Chicago. As previously announced in these columns, the Chicago City Railway Company has been purchased by a syndicate, the avowed purpose of which is to bring all the street railway lines in Chicago under one management, and as the first official act of the representatives of this syndicate has been to virtually place Mr. Mitten at the head of its practical affairs in Chicago, it is evident that he is the man to whom the syndicate intends to intrust the arduous task of carrying out its plans. He will bring to the work a fresh and hearty vigor, an intimate knowledge of electric transportation affairs, and an executive ability of a rare order.

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8200 *copies are printed. Total circulation for* 1905, *to date,* 74,950 *copies—an average of* 8328 *copies per week.*

The Power Station of the London Underground Electric Railways Company

We devote considerable space in this issue to an extended description of the new power station which has recently been completed in London by the Underground Electric Railways Company, Limited, of that city. It is the largest railway power station in Europe and one of the largest in the world, being exceeded only by the mammoth plants in New York City. The station is interesting, however, for reasons other than mere size. For instance, it is the first large railway power station in Europe or America to be designed for and equipped with turbo-alternators, and the fact that the units are in 5500-kw sizes makes the installation of the generating machinery and steam auxiliaries of especial interest. In other particulars the station will also attract attention, especially in its coal-handling apparatus, its lubrication system and in its switchboard arrangements. Mr. Fortenbaugh draws an interesting comparison between the latter equipment and the switchboard in the Fifty-Ninth Street station of the Interborough Rapid Transit Company, of New York, which was designed along similar lines. He has also presented a very interesting description of the system of distribution and types of cables used, which differ in a number of features from the standards which have heretofore been followed in English installations.

We shall not attempt in this place to do more than to refer briefly to the article in question, as the descriptions of the different portions of the installation are so lucid and so complete that the reader will naturally prefer to obtain his information directly from them. We cannot refrain, however, from calling especial attention to the features outside the power station which will certainly attract comment, notably the third-rail system, in which a rectangular conductor is used, the automatic block-signal system and the design of rolling stock. As will be seen from the portion of the article devoted to the latter subject, the cars are provided with side doors somewhat similar to those used in Boston, but with a different arrangement of seats, and with the doors opened and closed by compressed air. Those for the District Railway—the subway portion of the route—are of wood, while the cars for the tube lines are of steel throughout. We feel confident that our readers will appreciate the action of Mr. Fortenbaugh in thus making public in so complete a way the details of this important installation, which can be compared in extent only to the immense systems of similar character in the metropolis of this country. They will also, we believe, appreciate the international character of this journal and its enterprise in securing and presenting to its readers the first official descriptions of all the important installations in the rapid transit field which have been made public. Thus, the first complete description of the Manhattan Elevated Railway and that of the New York Subway, not to mention other instances, first appeared in the columns of this paper.

Model Electric Car Wiring

Car wiring has long been considered as one of the vulnerable points in rolling-stock equipment. Rubber and braid, as usually applied in the insulation of wires, serve as a very inefficient protection when located in a position where they are subject to abrasion or other mechanical injury, and, if required to cope with the extreme conditions which are sometimes encountered in electric railway work, are liable to fail in emergencies.

While the measures which have been adopted in ordinary car construction have proved satisfactory for that purpose, the engineers of the Interborough Rapid Transit Company have for some time believed that their steel cars require a different treatment. Every precaution has been adopted against fire in any part of the equipment, and even against any slight electrical disturbance which would be of little consequence on a surface line, but which might be followed with panic and disastrous results in a subway. For this reason, most careful study was given to car wiring, with the result that the improvements which have been introduced eclipse anything that has been devised up to this time. The use of all-steel cars on the subway introduced a number of questions of novel character, as nothing was available beneath the car for supporting the wiring but the steel underframing members, so that a radical treatment of the question was required. The scheme finally adopted is described in an article by L. B. Stillwell in this issue, and is of the greatest interest as describing an important and commendable development in methods of wiring for electric cars. In brief, it consists in the adoption of the most improved principles of interior building wiring, inasmuch as each individual wire is not only protected from all possible mechanical injury, but also is so located that if accidentally grounded a dead short-circuit will occur at once, which will cause no other harm than that of blowing a fuse or opening a circuit breaker. Unlike interior conduit wiring for buildings, however, the wires have been given an additional protection against mechanical injury through vibration within the conduits, with the resultant chafing of insulation; the means adopted for securing this end provide also for keeping moisture out of the conduit tubes. Finally, arrangements for supporting the conduits have been carefully designed, and result in maintaining the system absolutely rigid. The methods described by Mr. Stillwell are of the greatest engineering value, and their accomplishment will go far to guide future development in the electrical equipment of motor cars.

Two-Motor vs. Four-Motor Equipments

The above title formed the subject matter of a paper read by N. McD. Crawford before the American Institute of Electrical Engineers. While the tests tabulated in the paper applied perhaps more especially to the local conditions governing street car traffic in Hartford, the general discussion of the paper brought out the relative merits of two and four-motor equipments in a broader light. A fair basis of comparison is, of course, to consider equipments of approximately the same total horse-power per car in each case. It is proper to assume that the manufacturers follow the same general lines in designing large and small motors, and that two 100-hp motors will perform the same service as four 50-hp motors with approximately the same temperature rise. On the basis of the same temperature rise, the two-motor equipment would benefit by the smaller number of motors and cost less for repairs. Given the cost of keeping a two-motor equipment in repair as, say, ½ cent per car-mile, the four-motor equipment, aggregating the same total horse-power, may run this expense up to 6-10 cents or even 7-10 cents per car-mile. The item of repairs, in fact, constitutes the only objection to the four-motor equipment, as the first cost is practically the same as that of a two-motor equipment.

The chief asset of the four-motor equipment is the increased traction which it makes available. For city service, with its frequent stops and demand for high-schedule speeds, this increased traction may permit an increase in the rate of acceleration sufficient to reduce materially the energy consumption of the car. In fact, local conditions may be such that the increased acceleration of the four-motor equipment may permit the use of a greater gear ratio and lower maximum speed for the same schedule performed. It is a well-known fact that the greatest gear ratio possible for a given schedule will call for the lowest energy consumption, and the saving effected in cost of power consumed may readily amount to enough to offset the increased cost of maintaining the four-motor equipment. A 20-ton car consuming 2-kw hours per car-mile with two motors may be operating under conditions where a four-motor equipment could perform the same service for 10 per cent less energy. At 1 cent per kw-hour, this saving of 2-10 cent per car-mile in energy consumed would pay for the extra cost of maintaining four motors and still leave them all the advantages of less weight per axle, smaller wheels, one step instead of a possible two, shorter wheel base and greater clearance over city streets. We regret that operating figures were not more fully entered into, as a carefully conducted series of tests along the lines indicated would be of much more value than the general statements made in the discussion of Mr. Crawford's paper.

It is seldom that figures have been available comparing the performance of two and four-motor equipments of the same aggregate horse-power, and four-motor equipments have often performed a given service with less temperature rise than two-motors previously used, due to the fact that more horse-power per car was installed, and not owing to any ability of smaller motors to dissipate internal losses more readily. In many instances the cost of maintaining four-motor equipments has been given as less than that of maintaining two-motor equipments, but we believe that this statement has seldom been made when both equipments were operating with the same temperature rise, which can only be the case if approximately the same total horse-power per car is installed. There is no reason to doubt the statement that four motors will cost more to maintain than two motors, as the cost of labor in winding an armature is but slightly greater with a 100-hp motor than in the case of a 50-hp, although the supplies, forming the greater item of motor upkeep, will be more nearly proportional to the capacity of the motor.

While the increased traction of the four-motor equipment gives promise of a better maintenance of schedule in all conditions of weather and track, and may permit a considerable reduction in energy consumed at the car, it further provides a means of increasing the carrying capacity upon badly congested city tracks without increasing the number of moving units by the use of trail cars. This phase of the subject is more fully discussed in the following editorial, under the title, "The Use of Trailers for Rush-Hour Service."

The increased traction provided by four-motor equipments has no material effect upon the energy consumption of suburban cars, as the losses in starting form but a small proportion of the total energy consumed in such infrequent stop service. There are, however, two reasons at least which give the four-motor equipment considerable advantage over the two-motor for suburban service. Owing to the infrequency of suburban cars, the complete disabling of a car becomes a serious matter. Four-motor equipments may have one motor disabled without in any way interfering with bringing the car back to the car houses at practically schedule speed. A two-motor equipment, however, is seriously handicapped if operated with a single motor, and if the suburban road contains grades of any extent, or if the tracks are in poor condition, it is probable that such a car would be completely stalled, an incident most strenuously to be avoided in the operation of suburban systems. Furthermore, if a car becomes disabled on a system employing two motors on double-truck cars, the limited tractive effort provided by the succeeding car may be insufficient under certain conditions to bring both cars to the car house without a considerable loss of time.

The high-schedule speed and comforts demanded by patrons of our suburban electric railway systems have made necessary the introduction of very heavy cars, running at speeds approaching in some cases 60 m.p.h. The motive power per car may total 500-hp, making the adoption of four-motor equipments absolutely necessary, as this horse-power capacity could not be introduced in two motors without an impossible diameter of wheel and length of wheel base. The very general adoption of four motors for suburban service seems well justified.

The field of the two-motor equipment seems to be more especially on lines employing trains of several motor cars succeeding each other at short time intervals and operating over tracks free from the congestion of city streets. As the train consists of several units, it becomes possible to cut out a disabled car without fatally reducing the rate of acceleration available. Furthermore, such roads operate trains at very frequent intervals, leaving little time for the accumulation of snow or sleet on the tracks, and hence track conditions may be assumed to be of the best at all times. Large diameter wheels, calling for two or more steps, offer no objections in such service, as platforms are generally used, and the capacity of motor per axle can be kept within the limits of reasonable weight and length of wheel base. For such service the two-motor equipment offers some slight advantage in lower first cost and lower cost of maintenance over a four-motor equipment of equal capacity, unless the service be of such a competitive character as to require extremely high rate of acceleration, calling for a tractive effort in excess of that available with the limited axles per train equipped.

The Use of Trailers for Rush-Hour Traffic

Closely associated with the problem of the two-motor vs. four-motor equipment for city service is the question of the operation of trail cars for rush-hour service. In the early days of electric railroading, long before double-truck cars came into use, the trailer was a regular part of the equipment of most roads. Even the old light motor equipments were made thus to do double duty, often to their misfortune. After a little while came the long car and steadily increasing demands for more power and speed, and it was found that as these requirements increased, the motors had trouble enough without the added burden of trailers. So the fashion gradually changed, the trailers went into retirement and the long car was the mainstay of the equipment. That it did its work well nobody doubts, but as time has gone on and the light motors of ten years ago have been replaced by heavier ones, the use of trailers, particularly as an emergency measure, has sometimes seemed desirable.

In our study of this question, we must first accept the axiom that nothing should be done at rush-hour periods to decrease the running speed. Trail cars will prove only a detriment if the trains run so slowly that the aggregate seat-miles per hour during the rush-hour service is no greater, or only slightly larger, than if single motor cars are used. But with the increased power from four-motor equipments there seems to be no reason why a four-motor car should not haul a light trailer, on city streets with light grades, with no appreciable diminution of the schedule speed.

The question of increased capacity at rush hours is a very broad one, and there is more than one solution which does not involve a reduction in headway. Multiple-unit trains with either a master controller, or two cars with a two-car controller, or long cars for rush-hour service with short cars for intermediate service are at least theoretically possible, but the use of trailers possesses one or two conspicuous advantages for this service over any of those mentioned. They are lighter and less expensive to maintain than an extra motor car of the same capacity would be, and their first cost is considerably less. As regards their safety, when compared with individual motor cars, the testimony is contradictory. Trailers have been used extensively for electric service in only one city in this country, and the experience there as regards accidents has not been very favorable. On the other hand, the records of the German Street Railway Association show that in Germany, where trail cars are in very general use, the proportion of accidents attributable to them is very much smaller than with individual motor cars. There was a general feeling also, at the last meeting of the International Street Railway Verein in Vienna, that the municipal authorities were gradually giving up their antagonism to trail cars. In fact, the crux of the discussion related not so much to accidents but to the possible saving incident to their use. It is noteworthy also that trail cars are successfully used on the Continent even in the older cities, with their accompanying narrow and crooked streets.

If trailers are to be employed, it strikes us that there is no great difficulty in making them entirely safe if they are deliberately planned for use as such. Danger, if danger there be, comes from coupling cars together without provision for the safe entrance and exit of passengers. The point which should be looked out for carefully is the space between the pairs of cars, where there is risk of getting under the wheels of the second car, and the entrances and exits at this point should be carefully guarded. Now this trouble is largely constructional, and in our opinion could be remedied by proper design. A trailer ought to be so planned as to constitute an integral part of the train, and not a mere extra car towed in any way that comes handy. With a mechanical guard between the two cars, such as was formerly used on cable cars, and with Minneapolis gates for all platforms, or with possibly no forward entrance to the trailer, this danger ought to be reduced to a minimum. In other words, the desideratum is a highly specialized trailer designed for that purpose only, and therefore used under the most favorable conditions. Treated in this way, the trailer would greatly add to the capacity of a road whenever necessary and would effect a very considerable saving in the total cost of rolling stock and operating charges as well. It would give a reduction of the operating force during the rush-hour service by one-third or one-half, depending upon whether a conductor is used on the trail car, and a gain in headway owing to a doubling of the capacity of the moving unit without decreasing the clearance between the trains. Against the latter again there is the question of increased stops owing to the greater capacity of the train unit, although in amount this would depend on local conditions according to the number of stops necessarily made by a single motor car.

The advantage of using trail cars is not confined to city service, but applies equally, if not to a greater degree, to suburban systems. Although the time interval between cars is greater on suburban roads, many of these are single track and demand a considerable interval between trains, in order to minimize the meeting of trains, with the consequent delay incident thereto.

We hold no brief for the trail car and admit that the question is one which has not yet been satisfactorily solved. Nevertheless, at least two large cities are conducting experiments to determine the value of this system of operation for city traffic, and any light upon it would be welcome.

THE ELECTRIFICATION OF THE LONDON UNDERGROUND ELECTRIC RAILWAYS COMPANY'S SYSTEM

BY S. B. FORTENBAUGH,
Electrical Engineer, Underground Electric Railways Company, Ltd.

By way of introduction to this article, particularly for those not entirely familiar with the London traffic conditions, it seems advisable to present first a brief history and general description of the various independent railways included in this undertaking, and more particularly with reference to the Metropolitan District Railway. The Underground Electric Railways Company of London, Ltd., was incorporated April 9, 1902, for the purpose of supplying and distributing power to a number of electric railways in London, and is under the control and management of the well-known financier and operator, Charles T. Yerkes. All work in connection with the electrification of the Metropolitan District and other railways controlled by the Underground Electric Railways Company is being executed under the direction and personal supervision of James R. Chapman, general manager and chief engineer.

FIG. 1.—NETWORK OF THE UNDERGROUND ELECTRIC RAILWAYS COMPANY, LIMITED, OF LONDON

The accompanying map, Fig. 1, shows all the various roads, including such parts of the Metropolitan and other railways over which the Metropolitan District trains have running powers, as well as the relative location of the generating station and the twenty-four sub-stations included in the general scheme. The number of independent roads to be supplied with power by this company, mileage, etc., is given in the accompanying table.

The longest continuous run is from Barking to Uxbridge, the length of this run and the average distance between stations being 29.73 miles and 3650 ft., respectively,

The corresponding figures for the "Circle" portion are 13.07 miles and 2556 ft., respectively, over which route the schedule speed will be about 15.5 m.p.h.

All the necessary power for the above roads, exclusive of the Metropolitan portion of the "Circle" and the Harrow and Uxbridge extension, will be supplied from the Chelsea generating station. This station, together with the cable installation, sub-stations, track work, rolling stock, etc., required for the operation of the Metropolitan District Railway, will be completed and electric traction substituted for the present steam service early in 1905. The Baker Street & Waterloo "Tube" Railway will probably be opened for passenger traffic toward the close of 1905, the Great Northern, Piccadilly & Brompton about the middle of the year 1906, and the Charing Cross, Euston & Hampstead toward the latter part of the year 1906.

TABLE SHOWING RAILWAYS TO BE SUPPLIED WITH ELECTRIC POWER BY THE UNDERGROUND ELECTRIC RAILWAYS CO.

Railways.	Miles of double track.	No. of passenger stations.	Average Dist. bet. stations feet.	Average Schedul Speede M. P. H.
Metropolitan District Railway.	*56.07	77	3,125	17.0
Great Northern, Piccadilly & Brompton Railway	10.41	22	2,620	14.0
Charing Cross, Euston & Hampstead Railway	8.02	17	2,640	14.0
Baker Street & Waterloo Railway	4.45	11	2,350	14.0
Edgware & Hampstead Railway	**4.70			

* Includes District mileage and all other lines over which the District Railway has running powers i. e., the upper or Metropolitan portion of the "Circle" (8.35 miles), Metropolitan extension from South Harrow to Uxbridge (6.18 miles), lines jointly owned by the District Railway and all contingent lines now being electrified.

** Light railway and virtually an extension of the Charing Cross, Euston & Hempstead Tube Railway, beyond Golders Green.

METROPOLITAN DISTRICT RAILWAY

About 1.2 miles of the Metropolitan District Railway was first opened for passenger traffic in October, 1868, and from that date until June, 1903, there have been, at irregular intervals, various additions and extensions of "running powers," the total length of double track over which these trains will operate when electrified being about 56 miles. Approximately one-fourth of the above mileage is of shallow tunnel construction, substantially as shown in Fig. 2, with inadequate ventilation, and consequently more or less discomfort to passengers. The electrification will free this line of smoke, sulphur and dirt, and at the same time increase the maximum possible number of trains per hour in each direction from eighteen to forty and the average schedule speed from approximately 12.3 m.p.h. to 17 m.p.h. It is expected that these changes will add greatly to the comfort and convenience of the public, more than double the present traffic and in a comparatively short time bring prosperity to a road, the present condition of which is anything but satisfactory. From 1878 to 1882 a dividend was paid on the ordinary stock at rates varying from ½ per cent to 1¼ per cent per annum, but since that time the ordinary shareholders have received no return.

In 1897 and again in 1900, the District Railway Company obtained parliamentary powers authorizing a change from steam to electric traction, and in 1898, jointly with the Metropolitan Railway, decided to electrically equip and operate experimentally .76 of a mile of double track between the Earls Court and High Street Kensington stations. The equipment and installation of the temporary power house, experimental train, track work, etc., necessitated an expenditure of about £22,000, a very costly experiment to demonstrate that electricity could be successfully introduced as the motive power in lieu of steam, particularly in view of the fact that direct-current installations had been in successful commercial operation for some years, both in Great Britain and in America.

The experimental train consisted of six cars—two end motor cars and four trailers—the weight of each motor car and the unloaded train being 54 tons and 180 English tons, respectively. In all the experiments which were made, the leading motor car only was used, the trailing motor car running idle.

Specifications covering the electrification of the "Inner Circle" (13.07 miles) were issued in August, 1900, by the electrical traction joint committee of the Metropolitan and Metropolitan District Railways, and in January, 1901, the committee recommended the acceptance of the three-phase system of electric traction as proposed by Ganz & Company, of Buda-Pest. The essential features of this proposition were the supply of three-phase, 12,000-volt, a. c. current to a number of sub-stations equipped with static transformers, the employment of three working conductors, two overhead, for distributing current to the trains at 3000 volts pressure, and two groups of three-phase motors per car, with water rheostatic control, these to be arranged for a combination of the "cascade" and parallel system of connections. Mr. Yerkes became interested in the District Railway just about the time of this report favoring the adoption of the Ganz system, and immediately decided to adhere to the almost universal direct-current practice rather than risk

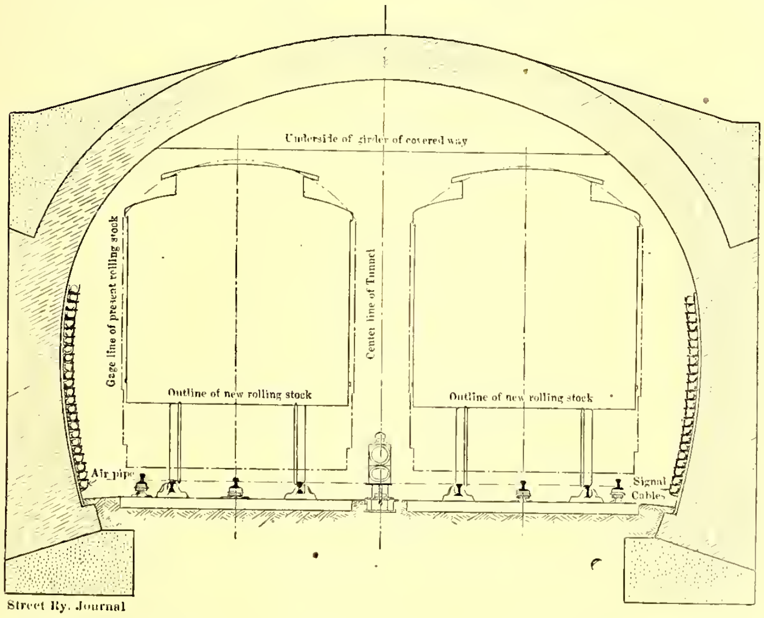


FIG. 2.—CROSS SECTION OF DISTRICT RAILWAY TUNNEL, SHOWING ARRANGEMENT OF CONDUCTOR RAILS AND HIGH-TENSION CABLES ON TUNNEL WALLS
Scale—⅛ in. = 1 ft.

the comparatively untried system for such an extensive and exacting service. It was essential that the Metropolitan and Metropolitan District Railways—two separate and distinct organizations operating over each other's tracks and physically united by the continuous track forming the "Inner Circle"—should use the same system of electric traction over at least a portion of the total mileage controlled by them. It was therefore necessary to appeal to arbitration, under the auspices of the Board of Trade, for the choice of system to be adopted, as each company was committed to its respective system and there

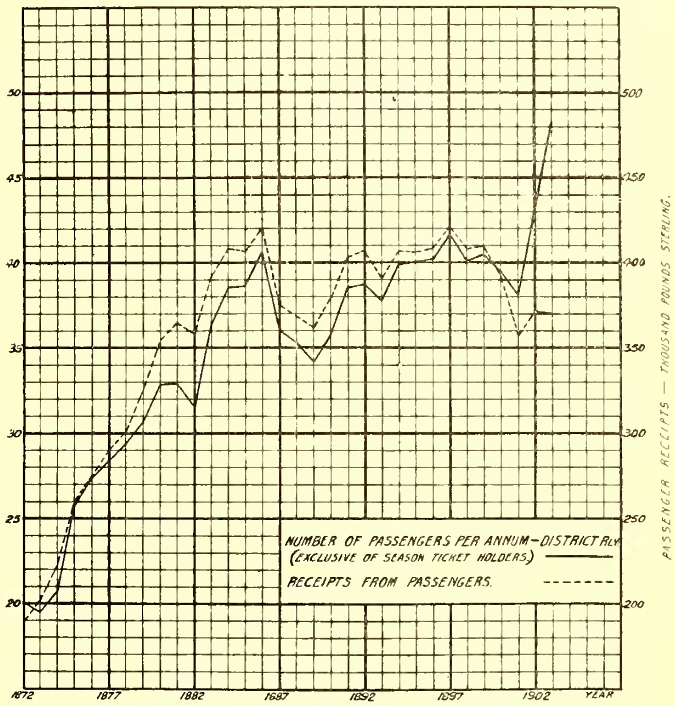


FIG. 3.—PASSENGERS AND RECEIPTS, DISTRICT RAILWAY

seemed no possibility of a compromise. The arbitration proceedings began Oct. 7, 1901, and toward the end of the following month a decision was finally given in favor of the direct-current system, as proposed by the District Railway, and which is now being installed in harmony by both companies.

Fig. 3 shows graphically the total number of passengers carried per annum, exclusive of season ticket holders, and the receipts therefrom. With the advent of the new management came timely and repeated reduction in fares, resulting in the rapid and unprecedented increase in the number of passengers carried during the last two years.

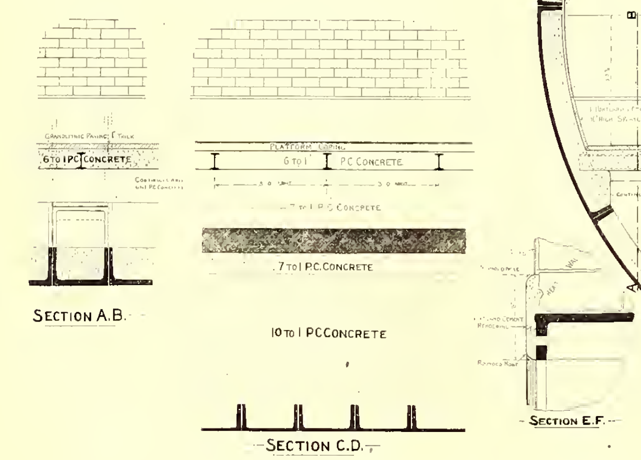
TUBE RAILWAYS

The accompanying map shows the relative direction and extent of the deep level "tube" roads now being constructed by this company underneath the streets of London, and Fig. 4 a type section. All these lines are being built with cast-iron linings at an average depth of about 70 ft. below the surface, the variation in depth depending upon local conditions and ranging from 30 ft. to 185 ft. A grand total of approximately 170 lifts will be required for these roads, these to be electrically operated by direct current at 550 volts to 600 volts pressure, and each capable of carrying a load of 10,000 lbs. continuously in either direction at a speed of 200 ft. per minute. Practically all the lift shafts will be 23 ft. in diameter, with two lifts per shaft, the openings to and from the lift cages being on opposite sides of the shafts so as to facilitate the rapid loading and unloading of passengers. Electrically-operated blower sets will be installed at practically every passenger station for ventilating purposes, each set being capable of removing 20,000 cu. ft. of air per minute. It is estimated that the number of passengers carried on these tube roads will reach 150,000,000 per annum.

CHELSEA GENERATING STATION

The site comprises 3.67 acres of land, with a frontage of 1100 ft. and 824 ft. on the Thames River and Lots Road sides, respectively, the outline of the property and general arrangement of buildings being shown in Fig. 5. The main building is entirely of fireproof construction, without ornamental features, and consists of a self-supporting steel frame, weighing about 6000 tons, enclosed with brick and terra-cotta. It is 453.5 ft. long, 175 ft. wide, 140 ft. in height from the ground floor to the peak of the boiler room roof, and is divided longitudinally by a brick wall. The inside dimensions of the engine and boiler room are 72.5 ft. and 96.5 ft., respectively. Figs. 6, 7, 8 and 9 show the general appearance of the building during the various stages of construction, and Figs. 10 and 11 the east and Thames River elevations, respectively.

There are four chimneys built of Custodis brick, each 19 ft. internal diameter and 275 ft. high. Concrete, expanded metal and asphalt are used in the construction of the roof and all



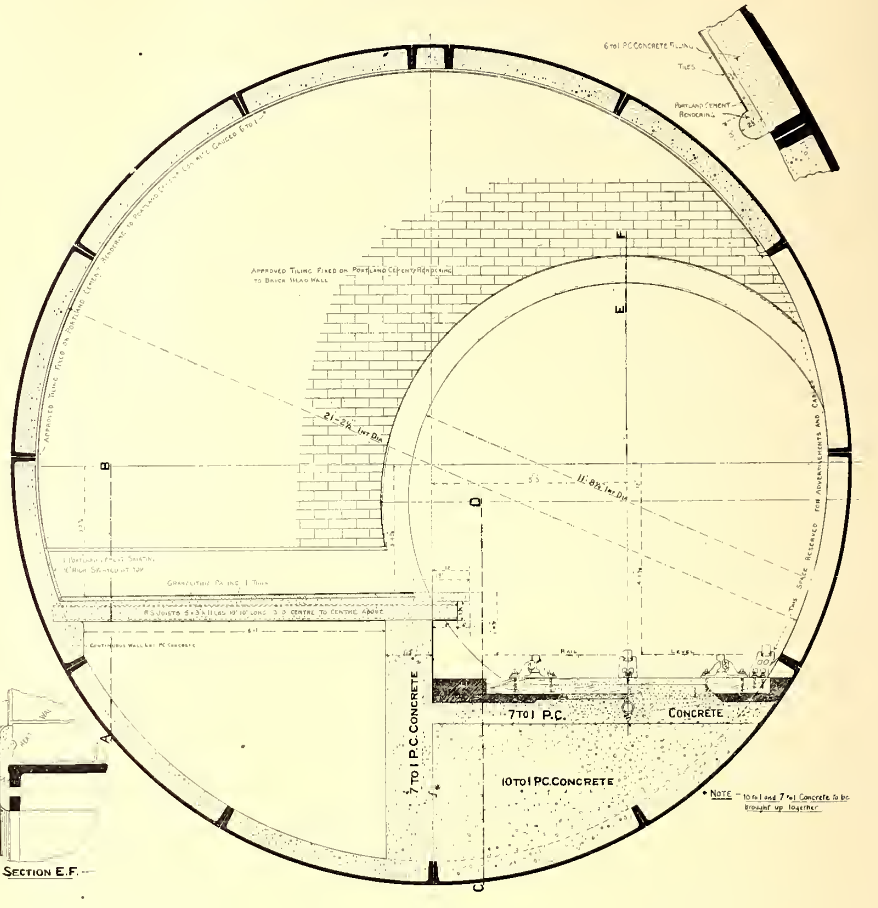


FIG. 4.—TYPICAL CROSS SECTION OF TUNNEL, SHOWING PLATFORM, TILING, CONCRETING, ETC.

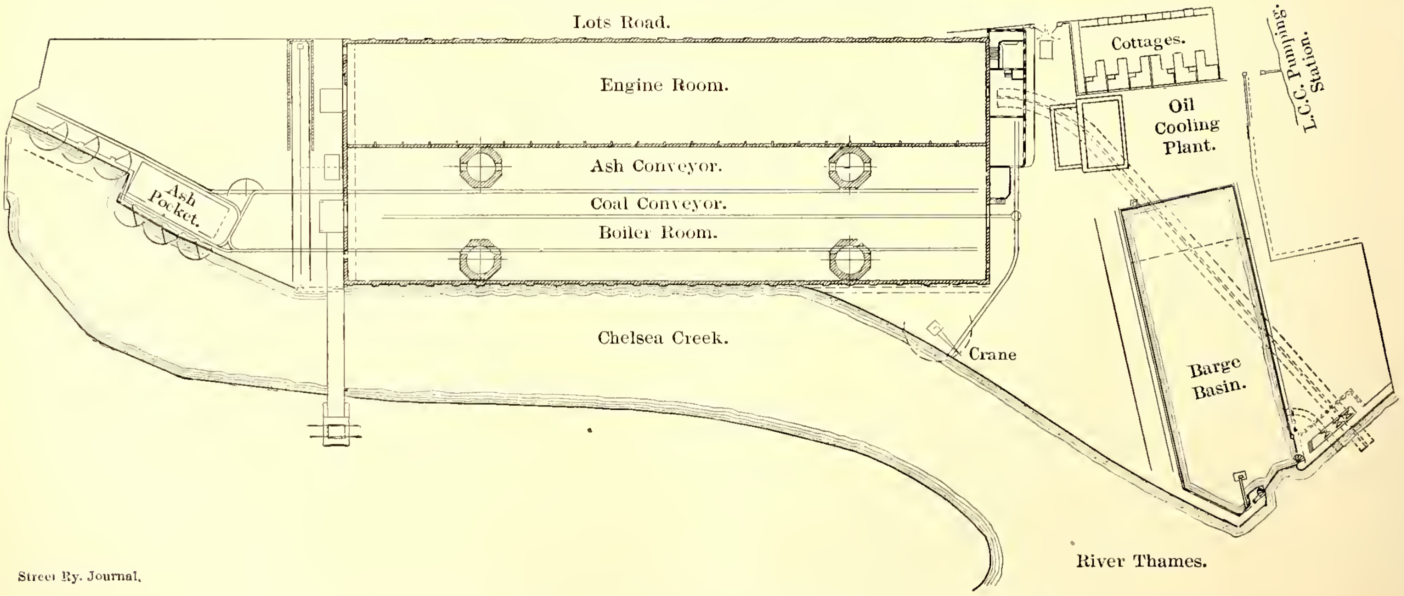


FIG. 5.—OUTLINE OF PROPERTY, CHELSEA GENERATING STATION

floors, other than the engine room, which is floored with checkered steel plates. Figs. 12 and 13 show, respectively, a cross section and plan of the engine and boiler rooms, with the general arrangement of apparatus, steam and exhaust piping.

Great care was necessary in the construction of the concrete piers and foundations required for the support of the building, chimneys, dock walls and turbo-alternators. A grand total of approximately 220 piers were required, these being carried down to the London clay at an average depth of 30 ft. to 35 ft. below the ground floor level. An aggregate of about 40,000 cu. yds. of concrete was used in the construction of these foundations, necessitating over 100,000 cu. yds. of excavation. The building is arranged for ten 5500-kw turbo-alternators and one split unit of 2700 kw, a total normal full load capacity of 57,700 kw. On this basis the cubic feet per kilowatt (including office building) is 139, and the square feet per kilowatt is 1.36.

STEAM PLANT

The boiler room is designed for an ultimate equipment of eighty Babcock & Wilcox horizontal water-tube boilers, each boiler having 5212 sq. ft. of heating surface and 672 sq. ft. of superheating surface.

They are carried directly on the steel frame of the building, entirely independent of the brick work, arranged two stories high, and are piped in groups of eight, with no steam connections between the several groups, except one supplemental header between two groups for supplying steam to the exciter engines, air compressor and house pump. With this exception, the main generators are arranged on the "unit" system, each unit consisting of one turbo-alternator and condenser, eight boilers and one boiler feed-pump.

The working pressure is 175 lbs. with 150 degs. of superheat, the steam from each group being collected in one header and led direct to its turbine.

Each boiler is fitted with two electrically-operated Babcock & Wilcox chain-grate stokers, the two grates having 85 sq. ft. of surface. A general view of the boiler room and apparatus is shown in Figs. 14 and 15.

A large tank in the oil-cooling house is used for the storage of feed-water, this tank being supplied either from an artesian well on the premises or from the city mains. River water can be turned into a secondary suction pipe connected to each pump in the event of failure from both the above sources of supply.

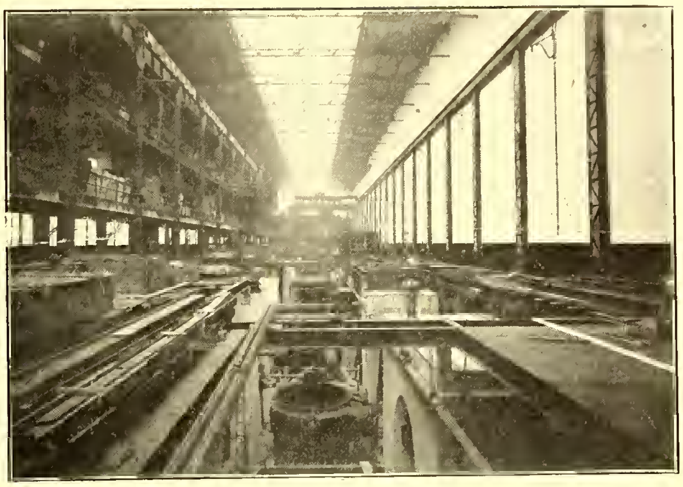


FIG. 8.—CONDENSER PITS AND APPARATUS

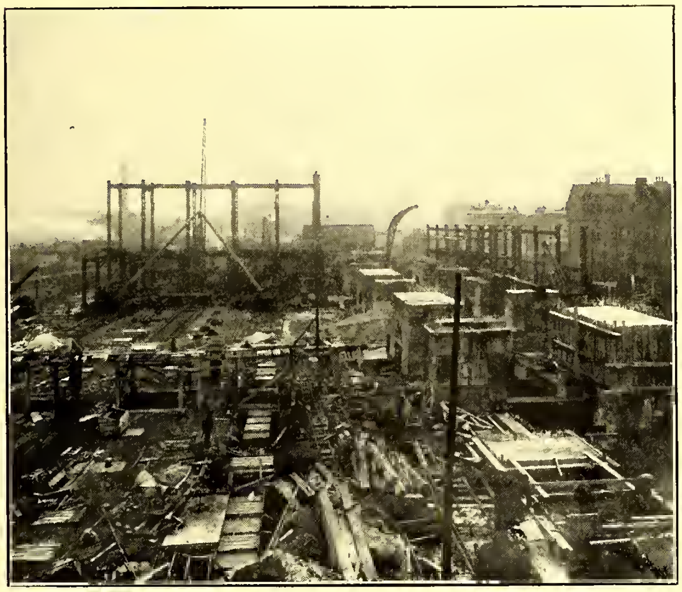


FIG. 6.—ENGINE AND BUILDING FOUNDATIONS, CHELSEA GENERATING STATION, LOOKING WEST

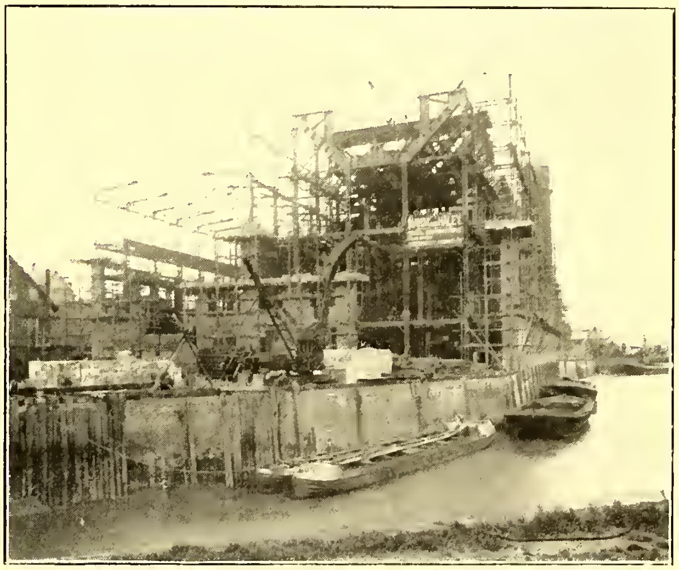


FIG. 7.—THAMES RIVER ELEVATION, WEST END

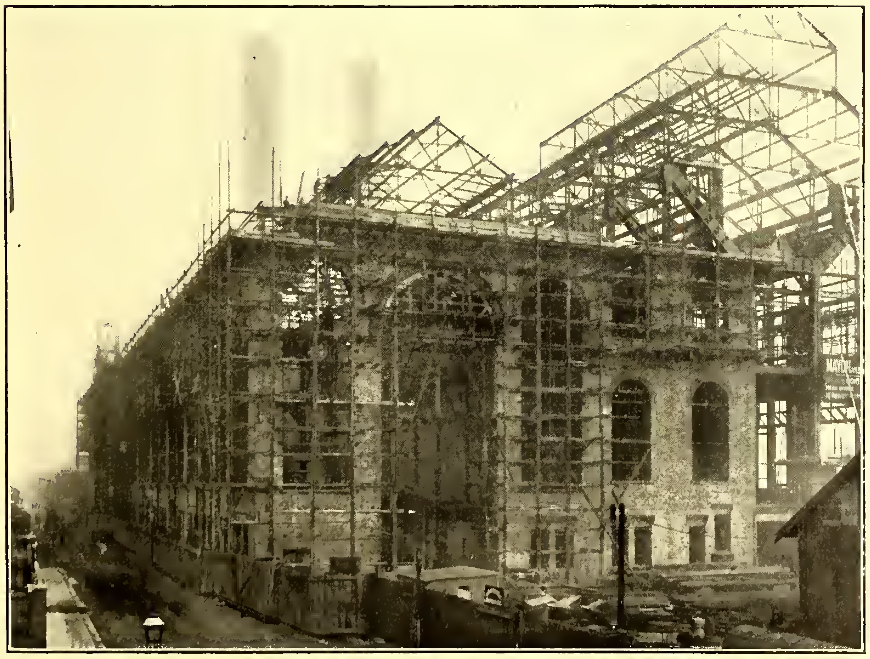


FIG. 9.—WEST ELEVATION OF CHELSEA GENERATING STATION

The boiler feed-pumps are located on the basement floor and supply ring mains on both boiler room floors. While each pump has sufficient capacity for two groups of boilers, the arrangement is such that for test purposes one pump will supply the group from which its steam is obtained. Under normal conditions only alternate pumps will be in service. Each ring main header is supplied by two pumps and so arranged that either pump may supply either of two groups or both when the turbines are running on light load.

Green economizers are installed, these being constructed with tubes further apart than the usual practice, and arranged in nests behind each group of boilers with the usual by-pass flues, 1540 sq. ft. of heating surface being provided for each boiler.

All the brick work for the boilers, economizers and flues is carried on the steel frame.

Vertical condensers, each with 15,000 sq. ft. of cooling surface, are located in pits between the engine foundations, and are designed to work on the dry vacuum principle, the air and condensed water pumps being separate.

The circulating water is supplied by two 66-in. pipes, which extend to the edge of the Thames channel, and are arranged on the syphonic principle. The intake and discharge mains are

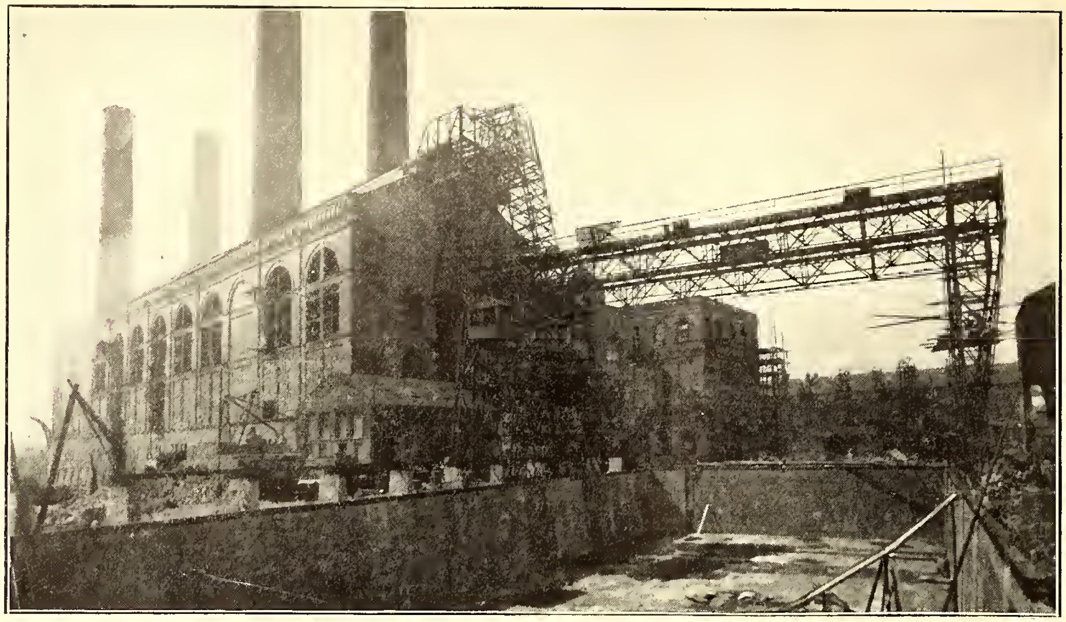


FIG. 10.—EAST ELEVATION OF CHELSEA GENERATING STATION

further arranged for reversible flow, so as to dispose of any sediment which may collect, there being no screens at the mouth of the pipes to stop floating material.

Provision has been made for the delivery of coal either by barge or rail and at opposite ends of the building. Barge coal will be received at the east end of the building, unloaded by two traveling cranes spanning the barge basin and weighed in the tower constructed on each of these cranes. From the weighing machines it falls on to the belt conveyor, passes through the coal crushers and is thence raised 140 ft. by duplicate inclined elevators to the coal conveyors in the top of the building. Rail coal will be taken from a hopper under the coal cars by an inclined elevator at the west end of the building, and in either case the distribution over the coal bunkers is made by duplicate belt conveyors so arranged that the direction of travel of either belt can be reversed as required. The storage capacity of the bunkers is 15,000 tons and the average daily consumption will be about 800 tons.

The ashes will drop into self-dumping skips and be removed by a storage-battery locomotive to the dock wall at the west end

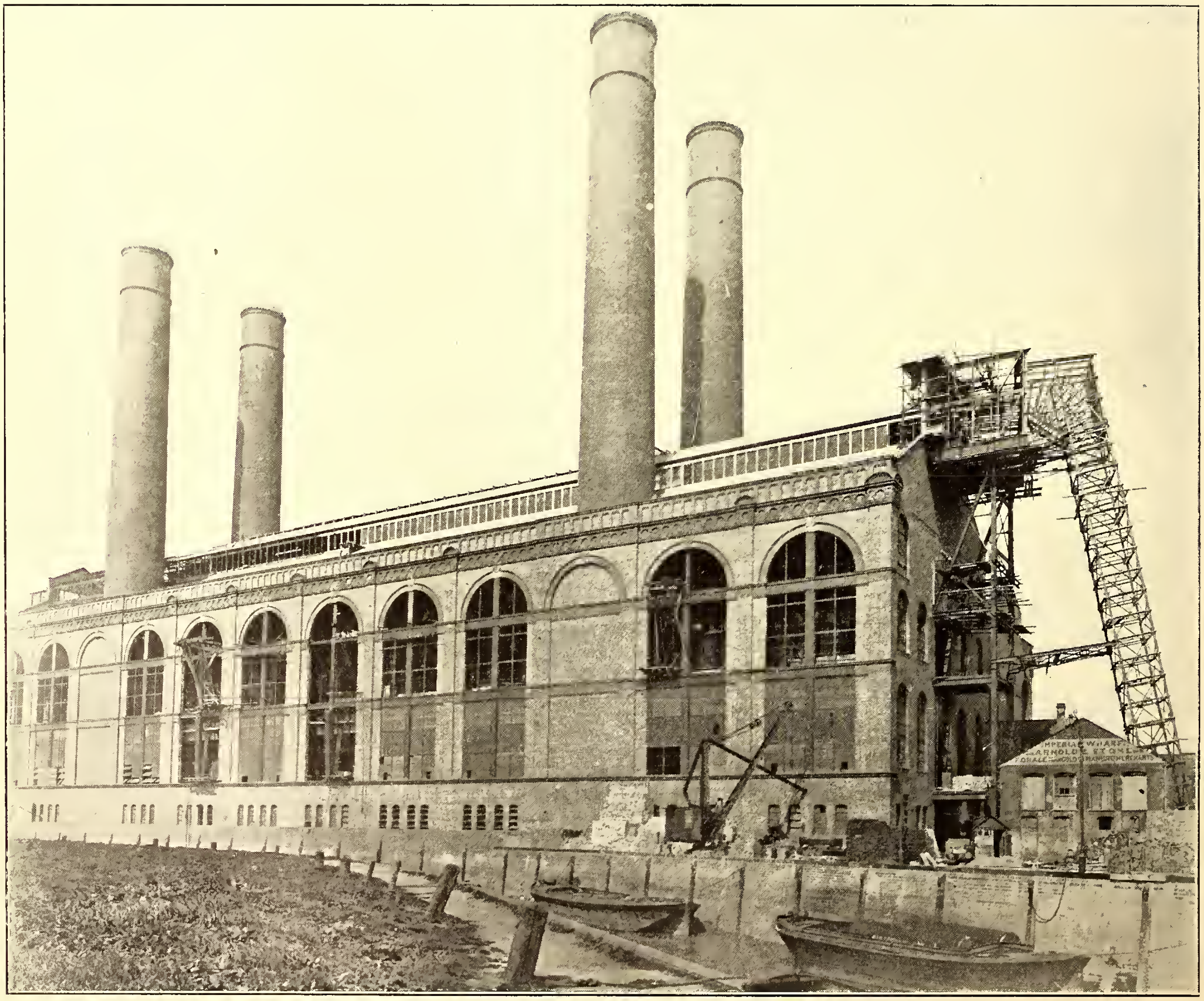


FIG. 11.—RIVER ELEVATION OF CHELSEA GENERATING STATION

of the premises, thence loaded into barges by pneumatic hoists or stored in the ash pocket if no barge is available. The coal handling apparatus at the east end of the building is illustrated in Figs. 16, 17, 18 and 19, and the construction of the coal bunkers in Fig. 20.

An oil-cooling plant, with a total capacity of about 20,000 gals., has been erected adjacent to the main building, and contains three coolers, each of which has approximately 686 sq. ft. of cooling surface. The oil flows by gravity from the storage tanks in the top of the oil house through the engine bearings back to a second set of tanks in the basement, and from which it is forced by centrifugal pumps, through the coolers, to the tanks located in the top of the building.

The working capacity of this plant is 350 gals. of oil per minute, about 5 per cent of which is by-passed through filters.

TURBO-ALTERNATOR SETS

The turbo-alternators are of Westinghouse manufacture and consist of a single-cylinder, double-flow, steam turbine direct connected to a rotating field, turbo-generator. The present installation will consist of eight units, the normal full load of each machine being 5500 kw, with a guaranteed overload capacity of 50 per cent for two hours. The coupling connecting the turbine and generator is of the flexible claw type of forged steel and runs in oil. This coupling, although transmitting the full power of the shaft, has sufficient latitude to allow the generator and turbine shafts to revolve about independent centers without the one affecting the other. Fig. 21 shows the general arrangement of the turbo-alternator complete, mounted upon its own cast-iron bed-plate.

TURBINES

These machines are designed to operate at a speed of 1000 r. p. m. with a steam pressure at the throttle of 165 lbs. per square inch and 100 degs. F. of superheat. When operating under these conditions and exhausting into a vacuum of 26 ins. and 27 ins. of mercury, the approximate steam consumption per electrical horse-power per hour is as follows:

Output		Pounds of Steam per E. H. P. per hour 26″ Vacuum	27″ Vacuum
One and one-quarter load..	6,875 kw.	16	13.6
Full load	5,500 kw.	15.6	13.2
Three-quarter load	4,125 kw.	17.2	15.0
One-half load	2,750 kw.	18.4	16.0

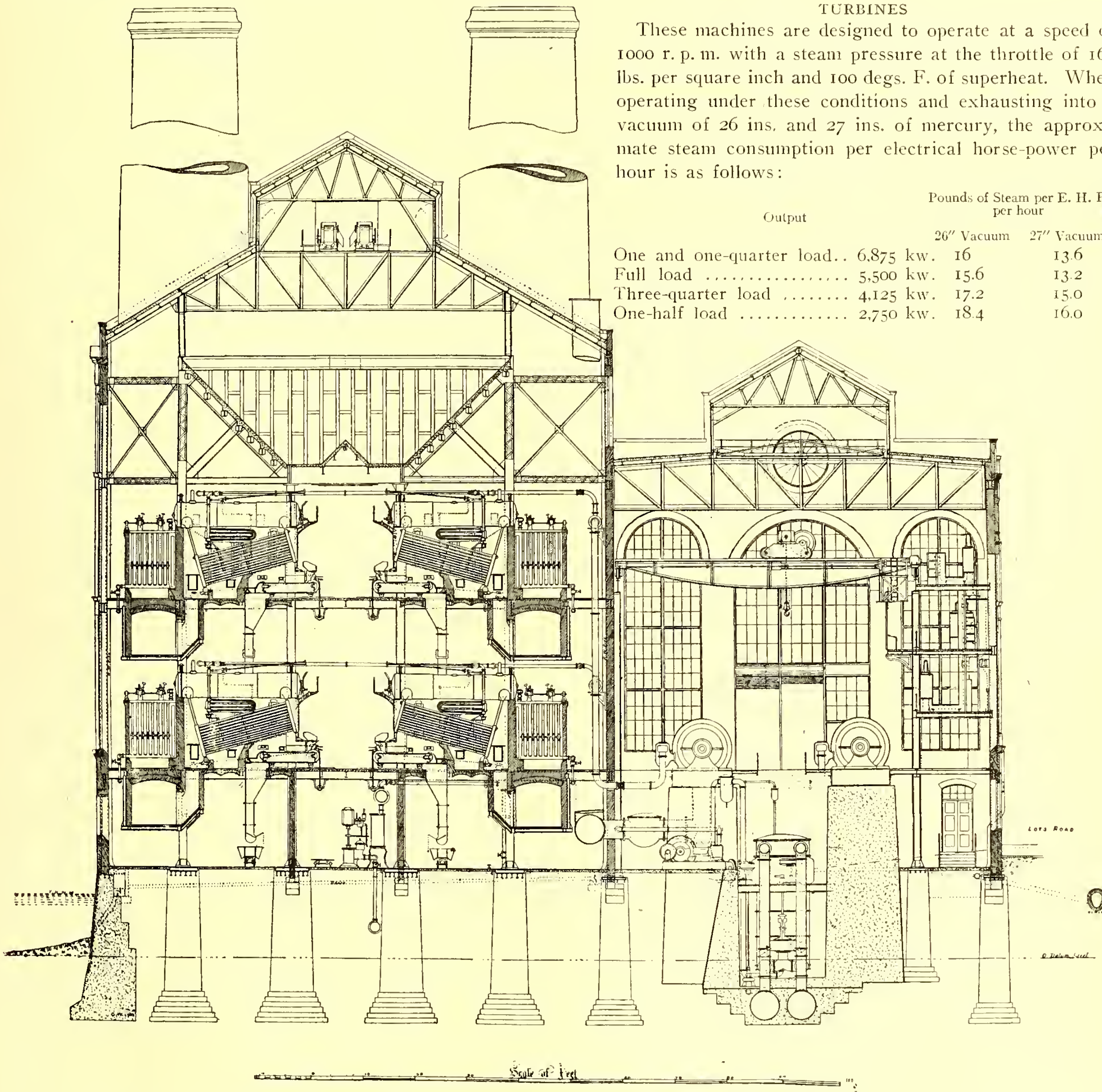


FIG. 12.—TRANSVERSE SECTION THROUGH ENGINE AND BOILER ROOMS

The spindle barrel, Fig. 22, is a rolled steel drum 77 ins. in diameter, into each end of which is shrunk a forged steel, umbrella-shaped disc. The spindle ends are made of high carbon steel and pressed into these discs, thus making a light and strong construction. Each part can be machined all over, and the balancing difficulties usually encountered are thereby largely eliminated. The first series of blades are of drop-forged steel and let into the dove-tailed grooves of the cylinder and spindle. The low-pressure blades are constructed of delta metal so as to prevent any corrosion due to wet steam at the point. The cylinder is of ordinary close-grained cast iron. Steam enters

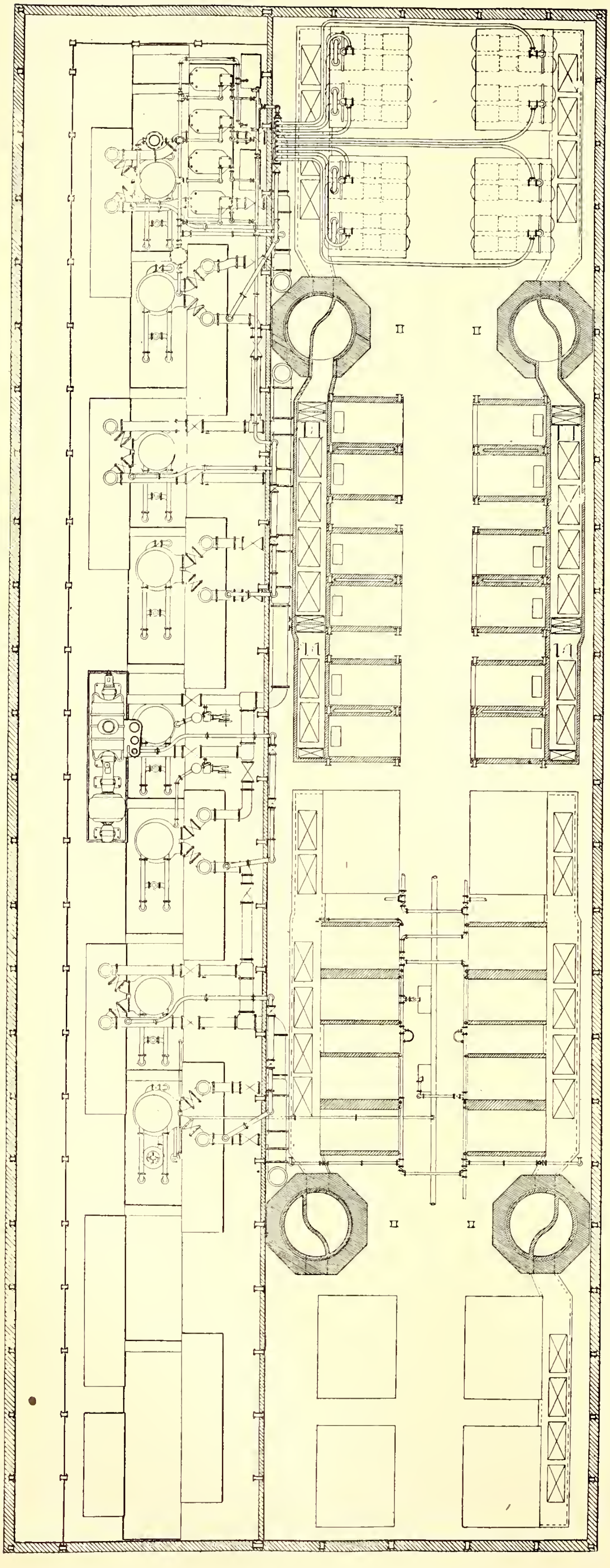


FIG. 13.—DIAGRAM SHOWING ARRANGEMENT OF STEAM AND EXHAUST PIPING, CHELSEA GENERATING STATION

through a main stop valve of the disc type, which is operated by gear wheels connected to handles on the platform, then passes through an emergency shut-down valve, steam strainer and governor valve of the double-seat poppet type into the center of the cylinder. A centrifugal governor directly driven through gearing from the turbine shaft operates this poppet valve through a small steam relay, and the admission valve is therefore under the direct control of the speed of the turbine. An emergency governor is fitted at the opposite end of the spindle to which the centrifugal governor is attached, and is set so that, should anything happen to the governor and the speed of the turbine reach a predetermined maximum, this governor comes into operation and opens a small valve, which closes the emergency throttle valve before referred to. From the center of the cylinder the steam issues through a series of nozzles and impulse blades (until it has been expanded to about atmospheric pressure), and thence through a series of blades, on the Parsons principle, to the exhaust at either end. Each turbine, in addition to the condenser connections, will have an atmospheric exhaust connection to one of the four 60-in. free exhaust pipes rising from the basement up through the roof. The steam entering at the center and flowing both ways will eliminate end thrusts and keep the shaft in equilibrium, but a thrust block is provided at the extreme end of the cylinder for the adjustment of the spindle relative to the cylinder. About 30 gals. of oil per minute will be supplied from the central gravity oiling system to the bearings of each machine, the bearings being provided with an emergency water-jacket requiring approximately 40 gals. of cooling water at 65 degs. F. per minute. The speed may be varied 10 per cent above or below the normal without otherwise disturbing the operation of the turbine, this adjustment being made electrically from the generator control board. The maximum variation in speed will not exceed 5 per cent when the full load is instantly thrown off the machine, and when operating under normal conditions the variation will not be greater than two and one-half natural degrees in one revolution.

GENERATORS

The normal output of the alternators is 5500 kw—i. e., 289 amps. per phase at 11,000 volts on non-inductive load. These are four-pole machines, with the armature stationary and exterior to the field, and are wound for three-phase current, the frequency being 33⅓ cycles per second. The revolving field, Fig. 23, is made from a solid forging of Whitworth fluid pressed steel, having high magnetic properties combined with strength. This steel is manufactured from the best brands of Swedish iron, melted in a Siemens-Martin furnace, then run into an extra strong and specially prepared steel mold and subjected, while still in a fluid state, to hydraulic pressure so as to obtain a better casting than is possible when done in the ordinary way. These castings are then reheated and forged by a powerful hydraulic press so as to insure the metal being thoroughly and uniformly worked, rough machined and carefully annealed before the finishing machine work is done. The normal excitation current is about 180 amps. when the armature is delivering its full current of 289 amps. per phase at 11,000 volts pressure and unity power factor. The armature winding consists of copper bars in partially closed slots, and is of the "built-up" type, with nine slots per phase per pole. After completion, the insulation of the armature winding from the main frame is subjected to a puncture test of 30,000 volts for one minute. Figs. 24 and 25 illustrate, respectively, the armature construction of the turbo-alternator and a general view of the alternators in the engine room. The guaranteed electrical efficiencies of these machines on non-inductive load is as follows:

Full load	97.25 per cent
Three-quarter load	96.50 "
One-half load	95.00 "
One-quarter load ..	90.00 "

When full load is thrown off the machine, the rise in electromotive force is approximately 6 per cent at unity power factor with constant speed and excitation. The temperature rise in any part of the machine will not exceed 35 degs. C. when operating under the above conditions.

EXCITER SETS

The exciter engines are of the compound, two-crank, double-acting, vertical-enclosed, high-speed type with forced lubrication, and were supplied by W. H. Allen, Son & Company. These engines are capable of indicating 200 hp with a steam pressure of 165 lbs. and 100 degs. superheat when exhausting into a condenser with a vacuum 4 ins. less than the barometric pressure. They operate at a speed of 375 r. p. m. and are direct connected to British Thomson-Houston 125-kw, 125-volt, compound-wound generators. Four of the above sets comprise the exciter system, these machines to be used for excitation only under normal conditions.

AUXILIARIES

The auxiliary electrical installation includes one 125-kw synchronous motor-generator set, nine single-phase 11,000-220-volt transformers, aggregating 1500 kw, and two small 125-volt storage batteries. The motor-generator set consists of a 125-kw, 125-volt, compound-wound, d. c. generator direct connected to a 220-volt, three-phase synchronous motor, and will be used primarily for charging the storage batteries and the supply of direct current for miscellaneous purposes. The transformers supply power to motor-generator set and the 220-volt, three-phase induction motors operating the various pumps, coal-handling machinery, stoker mechanism, etc., the storage batteries supplying current for operating the oil-switch motors.

FIG. 14.—BOILERS AND ECONOMIZERS IN PROCESS OF ERECTION

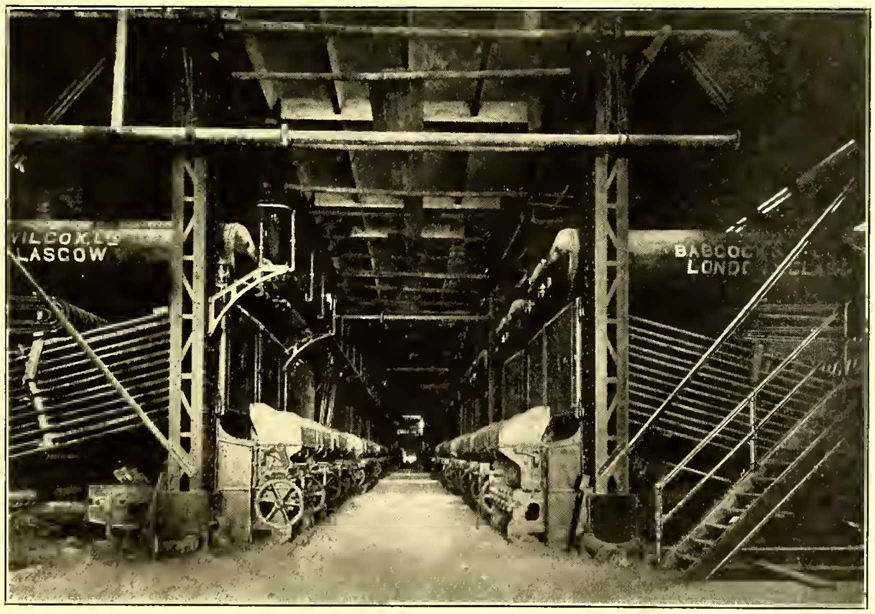


FIG. 15.—BOILERS AND CHAIN GRATE STOKERS IN PROCESS OF ERECTION

HIGH-TENSION SWITCHBOARD

All the equipment for both the main and auxiliary switchboards has been supplied by the British Thomson-Houston Company, this apparatus being essentially of standard Schenectady design and construction. Fig. 30 shows a general diagram of the main 11,000-volt circuits, and Fig. 31 is a similar diagram, showing the arrangement adopted by the Rapid Transit Subway Construction Company, of New York. This latter is reproduced from the Street Railway Journal of Oct. 8, 1904, for easy comparison with the scheme adopted by this company, as the two stations probably represent the latest practice in Great Britain and America. Constructed for the same purpose, equipped with similar switching apparatus, and essentially of the same magnitude, this comparison should be an interesting one, particularly in view of the recent discussion by the American Institute of Electrical Engineers on "The Use of Group Switches in Large Power Plants." Only one set of main bus-bars is installed, and therefore the two generator selector switches and one group switch are not required. Bus junction switches are used, however, so that it is possible for the main bus-bars to be divided into five sections and the generators operated in groups of two or all in parallel if desired. The feeder cables are in duplicate, and so arranged that no two cables to the same sub-station are connected to the same set of feeder bus-bars, or—with two exceptions—to the same section of the main bus-bars. In no case are the cables to adjacent sub-stations on the same group switch, and all duplicate feeder cables are, furthermore, symmetrically arranged on opposite sides of the center point of the main bus-bars. For example, this latter feature is clearly illustrated in the general diagram of connections by the position of the feeder cables to the Earls Court and Holloway sub-stations. The general arrangement of the high-tension switching apparatus therefore provides that any of the generators, group switches or individual sections of the main bus-bars may be shut down without seriously interfering with the operation of the system. Motor-operated, type-H oil switches are used for the control of all 11,000-volt alternating-current circuits, the normal capacities being 1200 amps., 500 amps. and 300 amps. for the group and bus junction, generator and feeder switches, respectively. The generator, bus junction and group switches are non-automatic and entirely under the control of the operator. The generator switches are equipped with one reverse-current relay designed to light an alarm lamp should any generator fail, but not to operate the switch automatically. The automatic reverse-current feature can, however, be made operative at any time should it seem desirable.

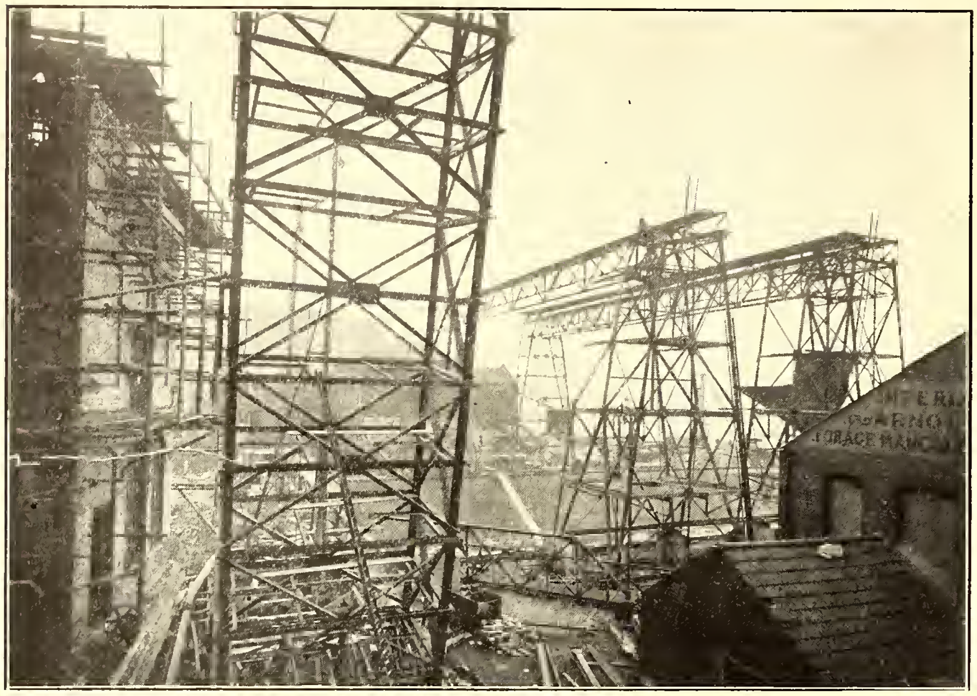


FIG. 16.—BARGE UNLOADERS AND COAL CONVEYORS

The individual feeder switches are the only automatic high-tension oil switches, these being equipped with overload time-limit relays. The time feature is obtained by an air dash so designed as to allow the relay contacts to close instantly in case of a short-circuit, while a moderate overload will only close the contacts after an adjustable time limit of several seconds. A relay is connected in each of the three phases of each high-tension feeder, so as to provide for operation with the neutral point earthed, and to take care of any possible break-down between conductors and the lead sheath. The three relay contacts are connected in parallel to supply the motor of the corresponding oil switch, and therefore a break-down to earth on any one of the three phases will completely disconnect the feeder at the generating station end. The relay contacts for all feeders are supplied through an alarm relay, which in turn rings a gong in case any high-tension switch opens automatically, this alarm relay being inactive when the switches are opened by hand control. One of the ten alarm lamps is simultaneously illuminated by this alarm relay, thus

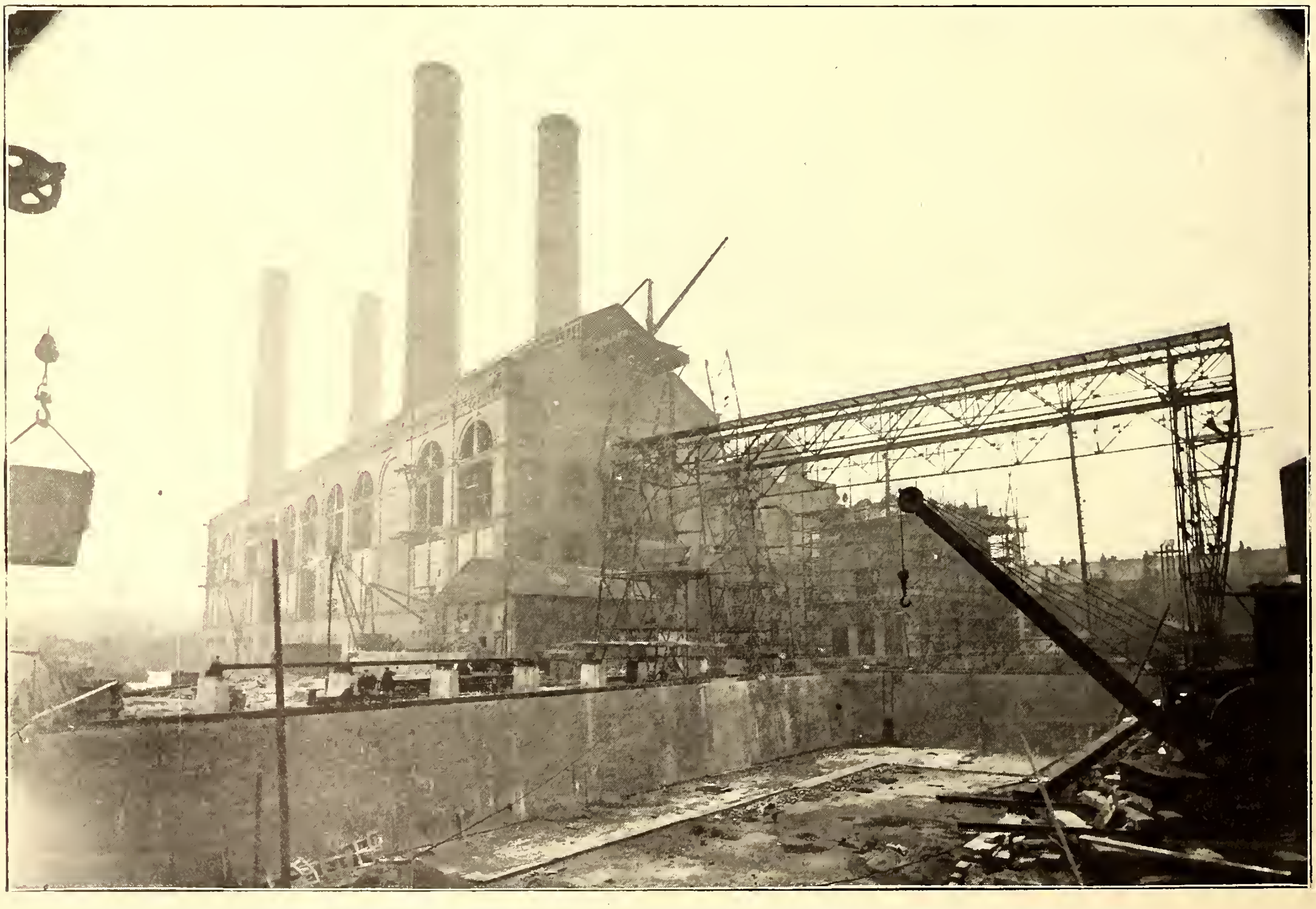


FIG. 17.—BARGE UNLOADERS AND COAL CONVEYORS AT CHELSEA GENERATING STATION

enabling the operator to readily see to which of the ten groups the faulty feeder belongs. A cast-iron grid resistance of about 6.5 ohms is inserted between the neutral high-tension bus-bar; i. e., the center point of the turbo-alternators and earth. The duty of automatically breaking any excessive current will fall entirely on the feeder switches, and the object of this protective resistance is, therefore, to limit the rush of current in the event of a dead short-circuit to earth, and so tend to preserve the continuity of supply from the main generators. The pressure between the neutral high-tension bus-bar and earth is approximately 6350 volts, and the maximum current to flow in the event of a ground will therefore be about 1000 amps. This earthing resistance is capable of carrying 75 amps. continuously, or 1000 amps. for ten seconds, without dangerous overheating. This resistance is, of course, not necessarily operative should the trouble by some remote chance occur entirely between phases. Isolating knife switches of the hook type are installed in connection with all high-tension type-H oil switches, instrument transformers, etc., so as to permit of all high-tension apparatus being completely disconnected for inspection and repairs at any and all times. Each phase of every high-tension circuit, whether in the oil switches or bus-bars, interconnections, etc., i. e., from the alternator terminals to the end bells of the individual feeders, is completely separated from the others by either brick or stone barriers. Soap-stone slabs are used for the oil-switch settings, molded stone and brick being used entirely in the construction of the switch and bus-bar compartments and for all high-tension barriers.

Small iron doors for inspection and maintenance are provided in the construction of all bus-bar chambers opposite the bus-bar isolating switches and supports and for all potential transformer compartments and oil switches. Protection doors are also provided for the static dischargers and all exposed interconnecting cables and terminals between the feeder bus-bars and oil switches, these doors being constructed of molded fire-resisting material.

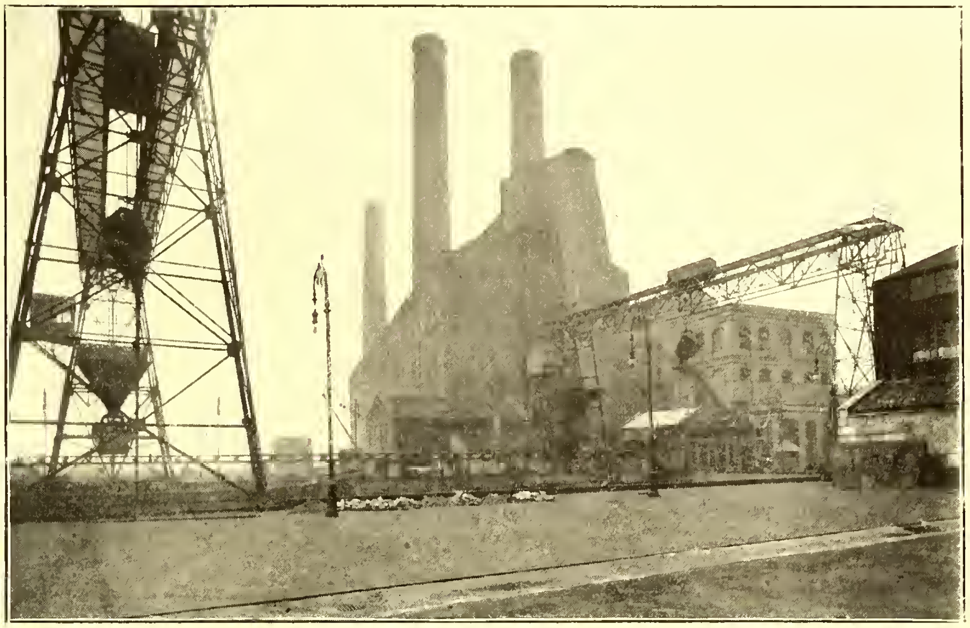


FIG. 18.—BARGE UNLOADERS AND COAL CONVEYORS

The three main high-tension switchboard galleries run the entire length of the building, and are extended across the office end of the building for the auxiliary station transformers, motor-operated generator rheostats (Fig. 37) and auxiliary switchboard (Fig. 36).

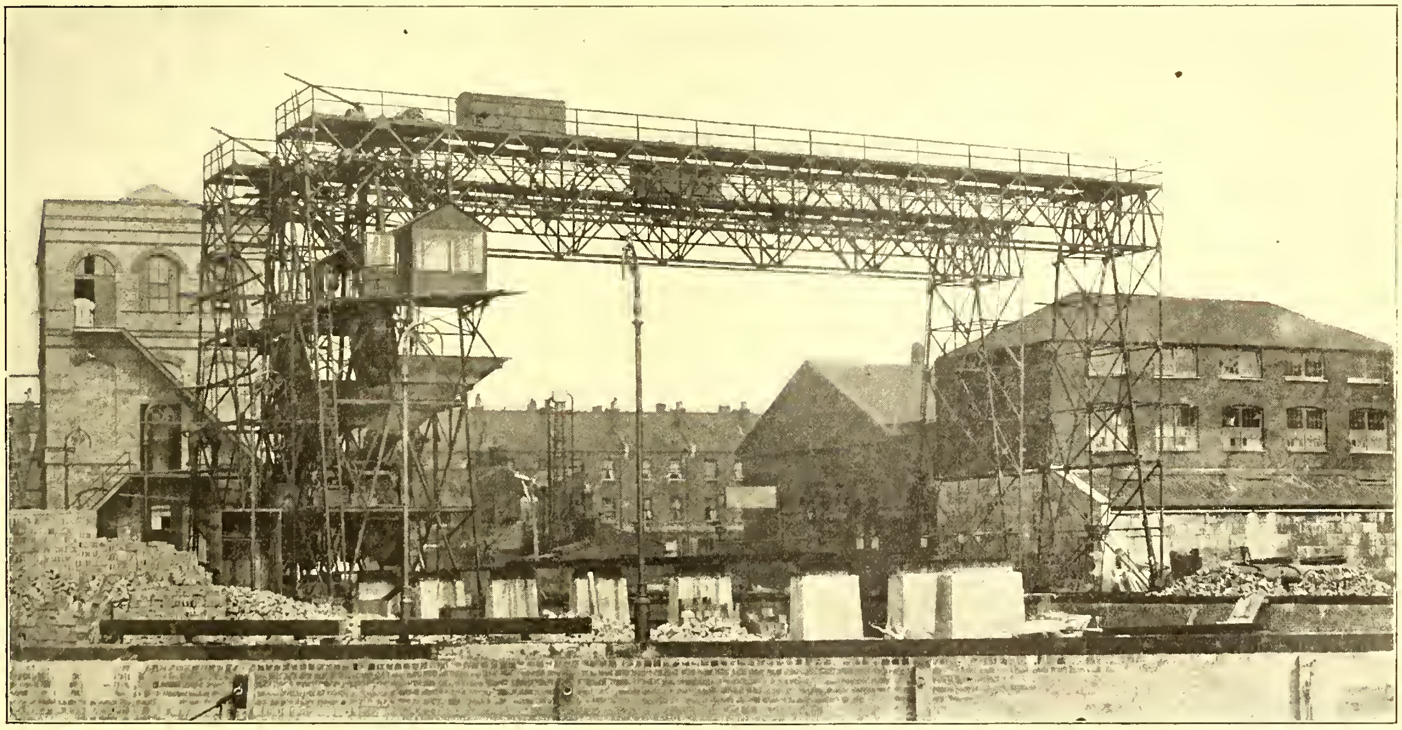
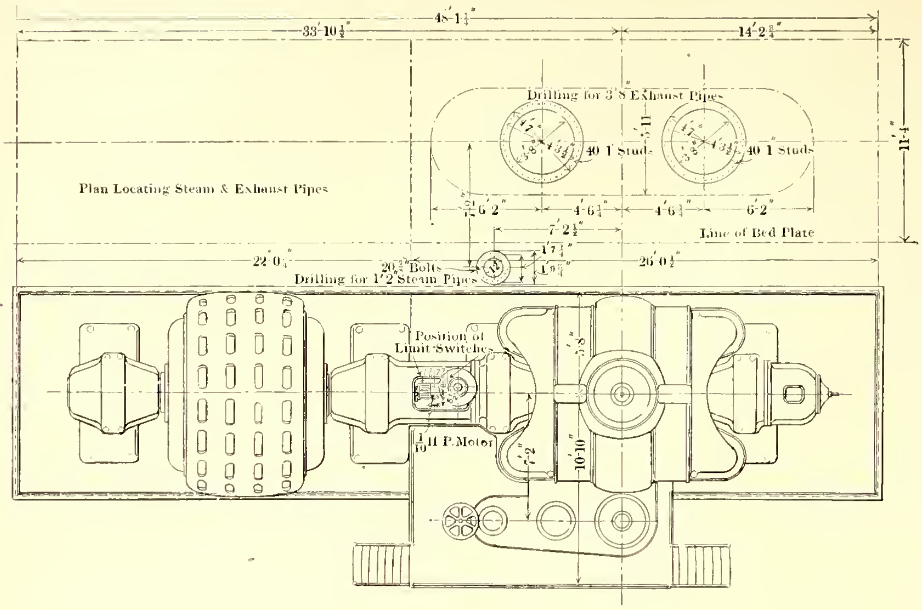


FIG. 19.—OIL COOLING HOUSE, BARGE UNLOADERS AND CHELSEA CREEK RETAINING WALL AT CHELSEA CREEK GENERATING STATION, EAST END

INSTRUMENT AND CONTROL BOARDS

The generator and feeder instrument and control panels (Fig. 34) are located in the center of the house on the middle switchboard gallery, all high-tension switching and apparatus being controlled from this point. All the instrument and control leads from the three galleries to these central controlling



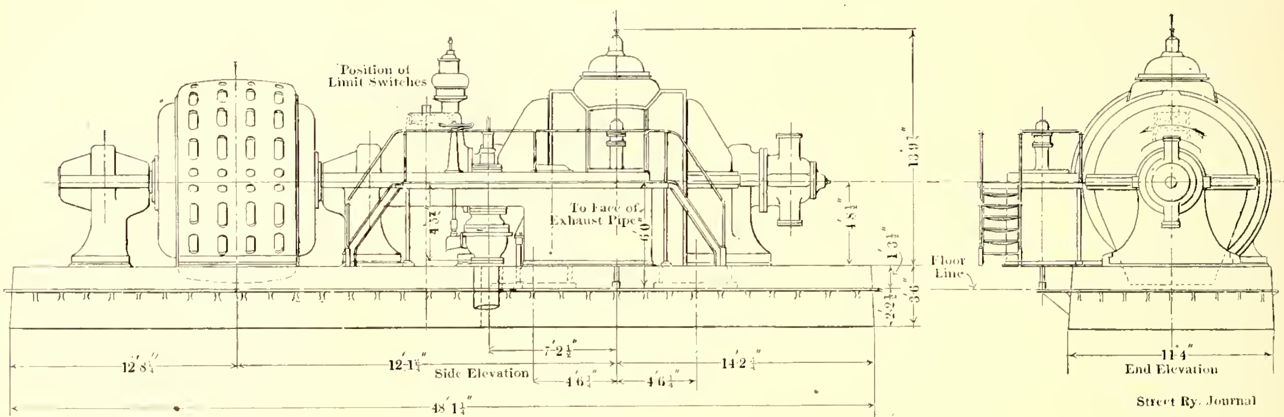


FIG. 21.—PLAN, LONGITUDINAL AND END ELEVATION OF 5500-KW TURBO-GENERATOR

boards are run in extra heavy screwed piping laid on top of the gallery floor joists and embedded in the concrete floors. This piping is laid without junction boxes of any kind from beginning to end, all necessary crossing of leads being effected by crossing the individual pipes themselves in the concrete

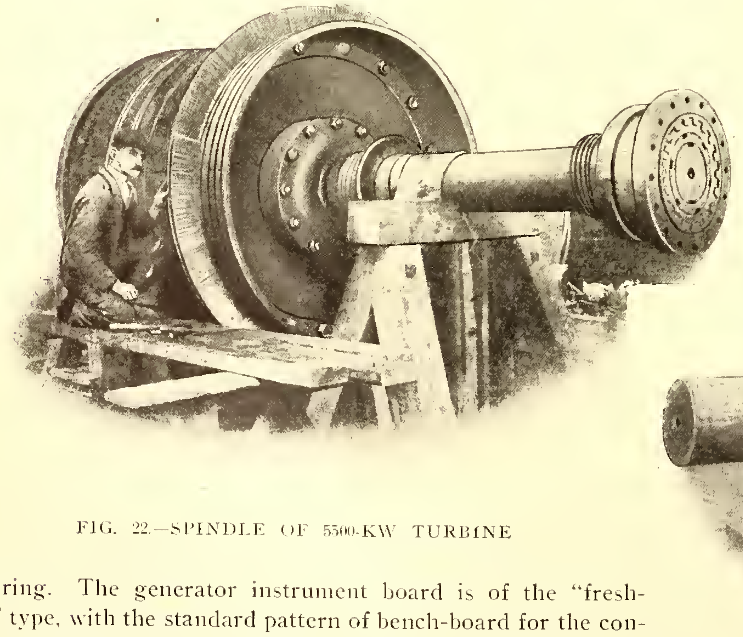


FIG. 22.—SPINDLE OF 5500-KW TURBINE

flooring. The generator instrument board is of the "fresh-air" type, with the standard pattern of bench-board for the control of the generators immediately in front, this combined board being mounted on a projecting bay of the gallery, from which the operator has a full and uninterrupted view of the engine-room floor. On each of the eleven generator-instrument panels are mounted three a. c. ammeters, voltmeter, indicating wattmeter, integrating wattmeter, power-factor meter and field ammeter. The generator-controlling panels contain the necessary controlling switches for the generator, bus-junction and group oil switches, indicating lamps, field rheostat controller, field-discharge switch, engine governor-control switch, engine signal, synchronizing plugs and receptacles. The combined instrument and control board for the sixty-eight feeders is located immediately behind the generator board—the two boards facing each other—four feeders being controlled from each of the seventeen panels comprising this board. These panels are equipped with one ammeter and integrating wattmeter per feeder, in addition to the necessary controlling switches, indicating lamps and overload time-limit relays. An additional panel is installed at the extreme left end of this board, on which is mounted the necessary instruments, switches, etc., for the distribution and control of the direct current required for the operation of all the type-H oil-switch motors. The usual red and green indicating lamps are provided on both the generator and feeder control boards, to indicate that the corresponding switch is closed or open. A large electric gong is mounted on the controlling circuit panel, in connection with each feeder-switch control circuit, so as to provide an audible

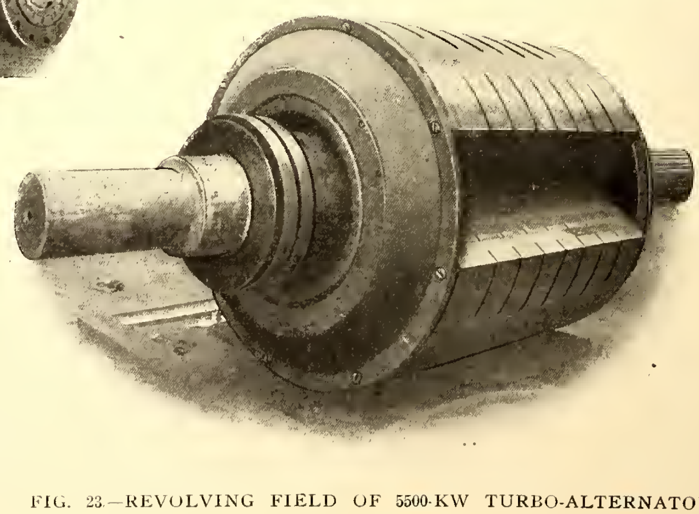


FIG. 23.—REVOLVING FIELD OF 5500-KW TURBO-ALTERNATOR

signal for the operator—in addition to the indicating lamps—when the feeder switches open.

AUXILIARY SWITCHBOARD

The auxiliary switchboard collectively (Fig. 36) consists of two batteries, two d. c. feeders, two motor generators, one load, four exciters and thirteen a. c. panels, a total of twenty-four panels. It is installed on the lower-end gallery and arranged for the control and distribution of the current from four 125-kw exciter sets, nine single-phase, 11,000-220-volt transformers arranged in sets of three, one 125-kw synchronous motor-generator set and two small storage batteries. This board is

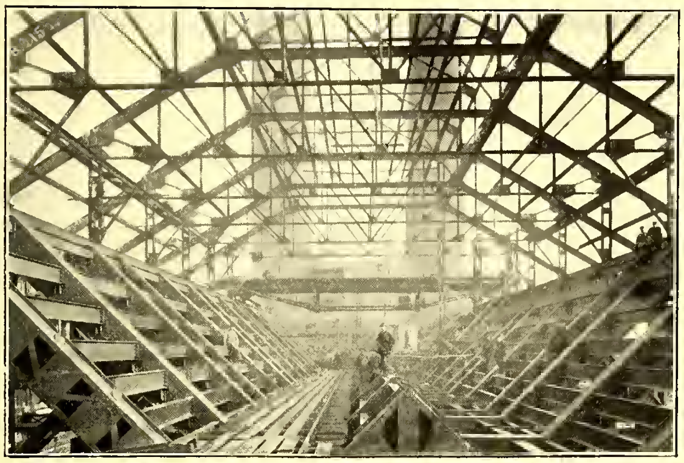


FIG. 20.—COAL BUNKERS IN PROCESS OF ERECTION

arranged for distributing power to eighty-nine three-phase, 220-volt and twelve d. c., 125-volt motors, aggregating about 1900 hp, to the 93 type-H oil-switch motors, and for station lighting and miscellaneous purposes. The exciter panels are single pole, the positive bus only being mounted on these panels. The negative bus runs direct from the exciters to the generator fields, and this polarity, together with the equalizer, is controlled by switches mounted on pedestals adjacent to the machines. The exciter bus is sectionalized into two parts, so that continuous service can be given by the plant while alterations or repairs are being made on either part of the bus at times of light load. Three high-tension feeder cables are used for supplying power to the three banks of transformers—one

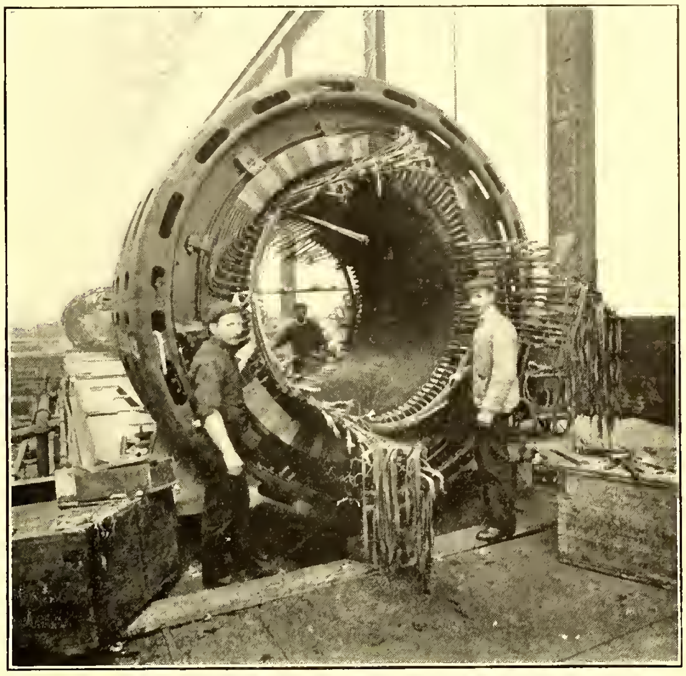


FIG. 24.—ARMATURE OF 5500-KW TURBO-ALTERNATOR

for each bank—and three transformer panels for controlling the supply of low-tension current to the a. c. bus-bars. The controlling switches for the three individual oil switches supplying power to these transformers are mounted on these panels. The 220-volt a. c. bus-bars are located under the gallery floor, immediately below the panels, and are likewise sectionalized into two parts. The low-tension connections are so arranged that one bank of transformers normally feeds each half of this bus, while the third bank can be connected to either or both sections as desired. The a. c. feeder panels are equipped with hand-operated oil switches fitted with straight overload release, the individual motor switches and starters being mounted on or adjacent to the distributing panels and near the machines. The battery panels are provided with suitable end-cell switches for charging and regulating purposes, the connections being such that either the motor-generator or one of the exciters may be used for charging. Emergency switches are provided, so that current for operating the oil-switch motors may be obtained either from the motor-generator or one of the exciters, in the event of accident to either or both batteries.

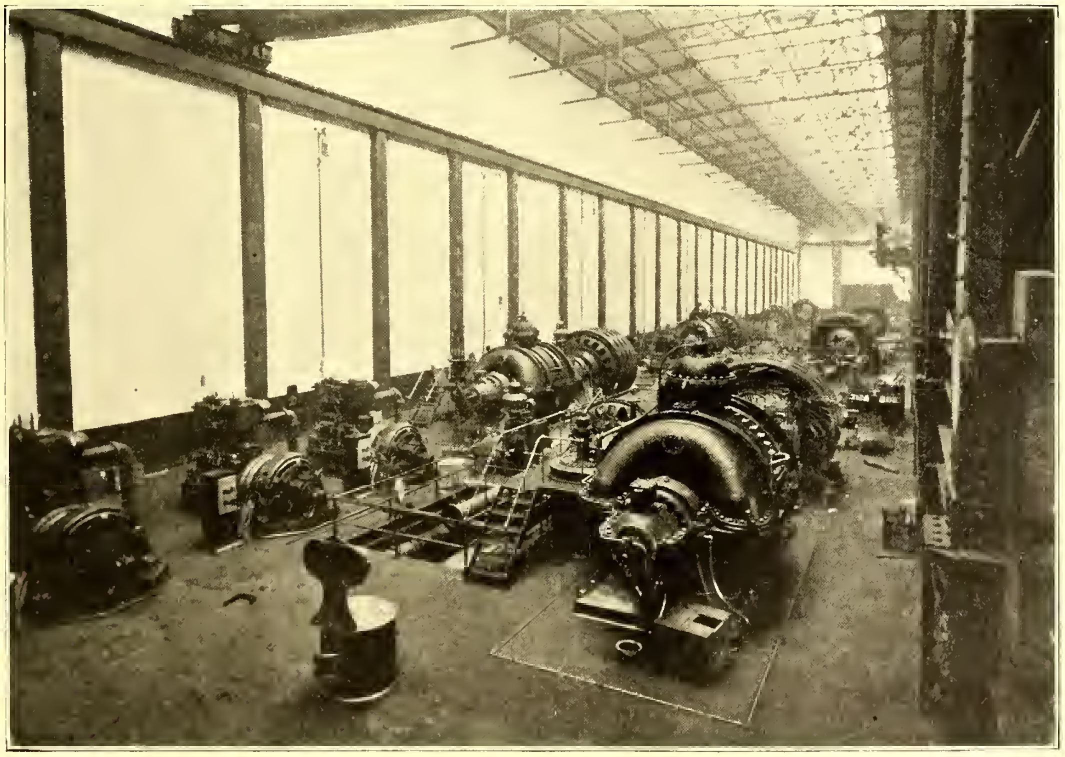


FIG. 25.—GENERAL VIEW OF 5500-KW TURBO-ALTERNATORS AND ENGINE ROOM OF THE CHELSEA GENERATING STATION

HIGH-TENSION CABLES

The high-tension three-phase cables are installed in duplicate, with one exception, between the generating station and each sub-station, the total final installation aggregating about 365 miles. There are four cables to the Whitechapel, Charing Cross, Earls Court, Mill Hill Park and Golders Green sub-stations, and two cables each to all others, East Ham excepted. East Ham and Campbell Road sub-stations jointly have but two cables, but in all other cases one-half the total number of cables to any sub-station can safely carry the normal full-load current for the total ultimate equipment. They are carried from the generating station to the District Railway at Earls Court in a cableway consisting of sixty-four earthenware ducts laid in concrete, the section of this pipe line and type of manhole being shown in Fig. 38. The duplicate cables are carried on opposite sides of the 9-in. longitudinal wall forming the double manholes, and from Earls Court on opposite sides of the railway, either in conduits or on the tunnel walls, so that the cables to any sub-station are practically run by two independent routes. Provision has been made for a maximum of eighteen high-tension cables on either side of the tunnel walls eastward from Earls Court, the details of the troughing, supports and general arrangement of the cables in the troughing being shown in Figs. 39 to 45, inclusive. The cables are protected from one another in the manholes and at the joints on the tunnel walls by asbestos tape about ⅛ in. thick, with the

FIG. 28.—ALTERNATOR FIELD DURING ERECTION

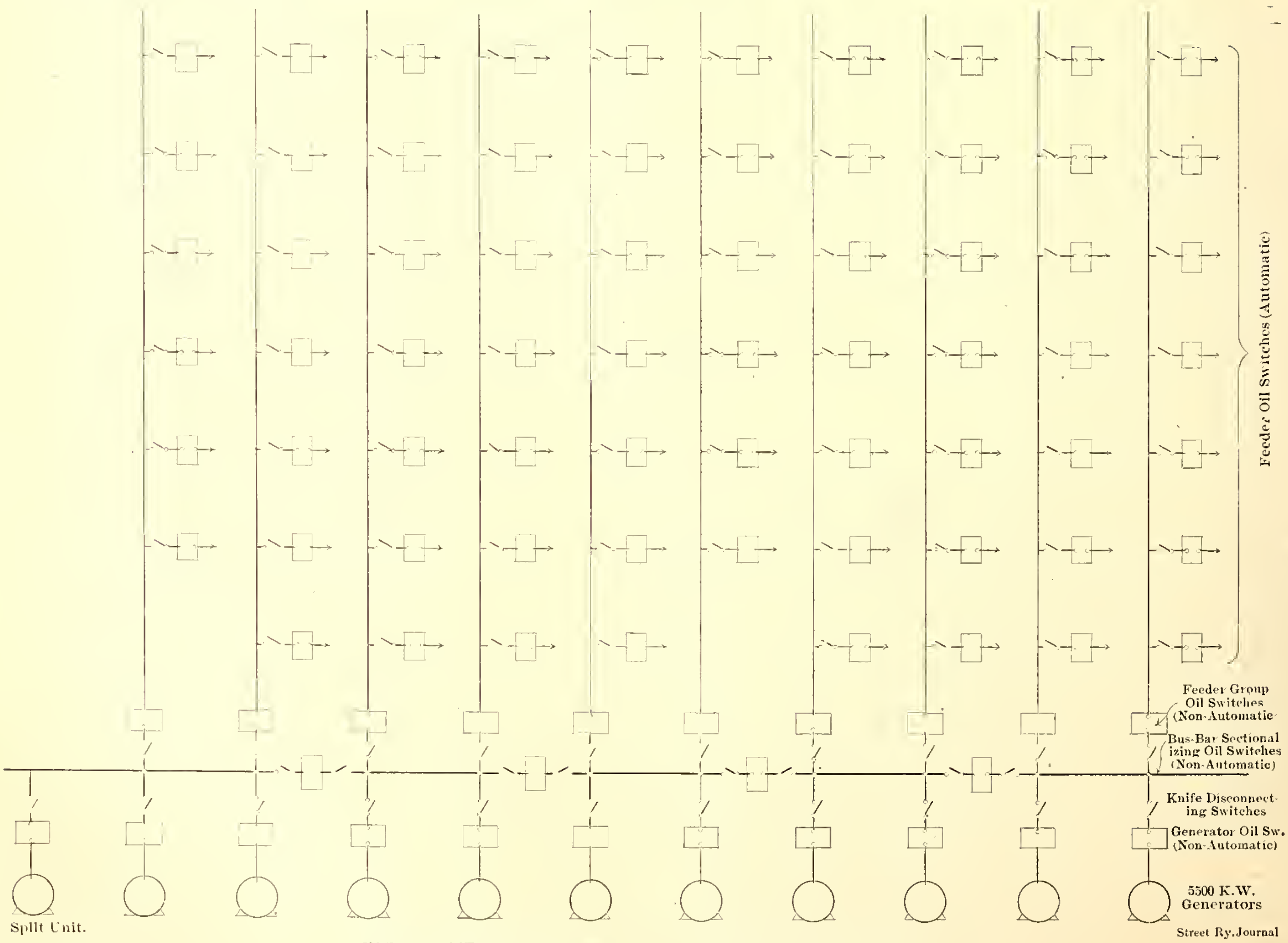


FIG. 29.—KEY DIAGRAM OF SWITCHBOARD CONNECTIONS

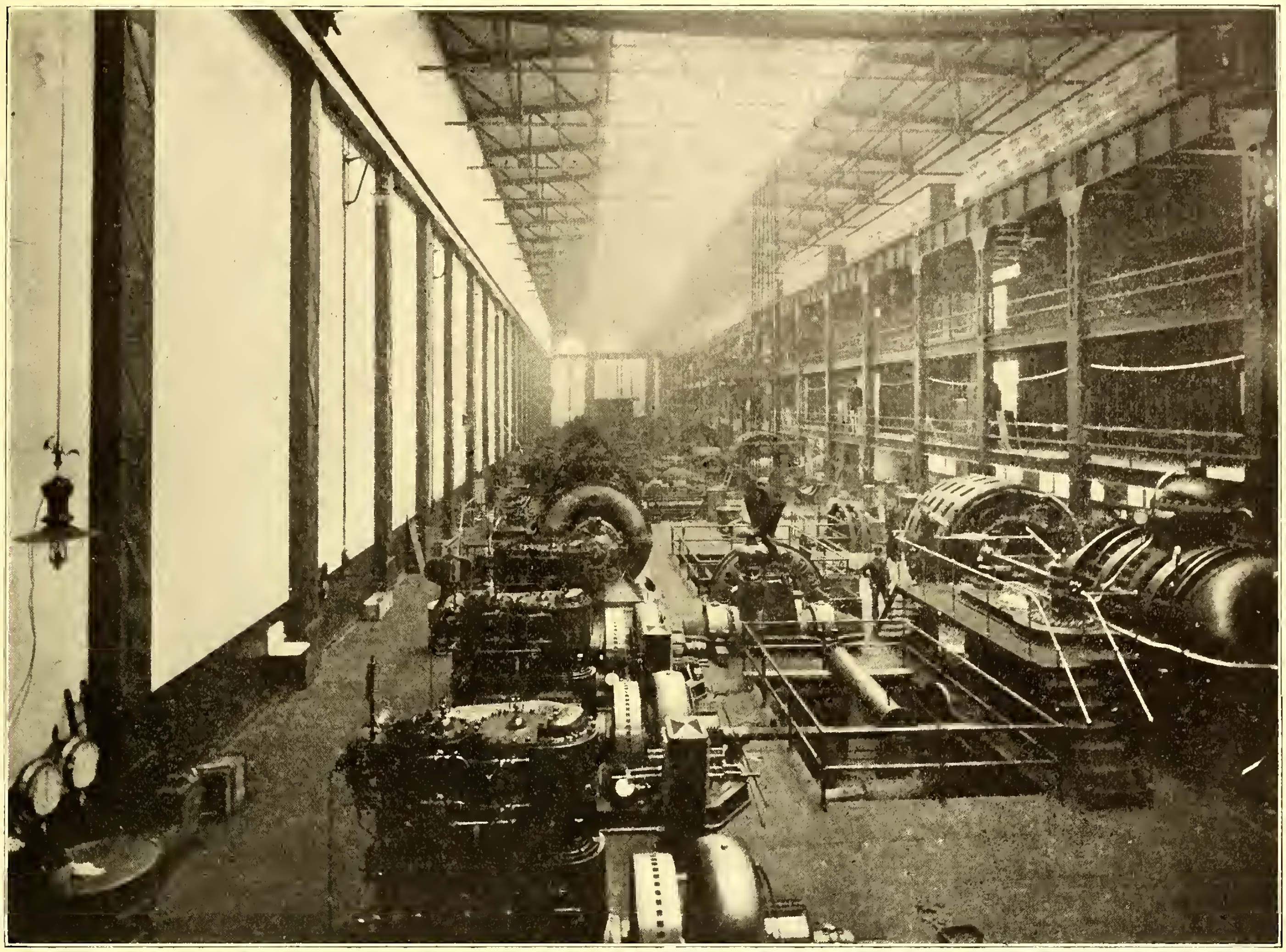


FIG. 26.—ENGINE ROOM AND SWITCHBOARD GALLERIES OF THE CHELSEA GENERATING STATION

FIG. 27.—TURBO-ALTERNATORS BEING ASSEMBLED

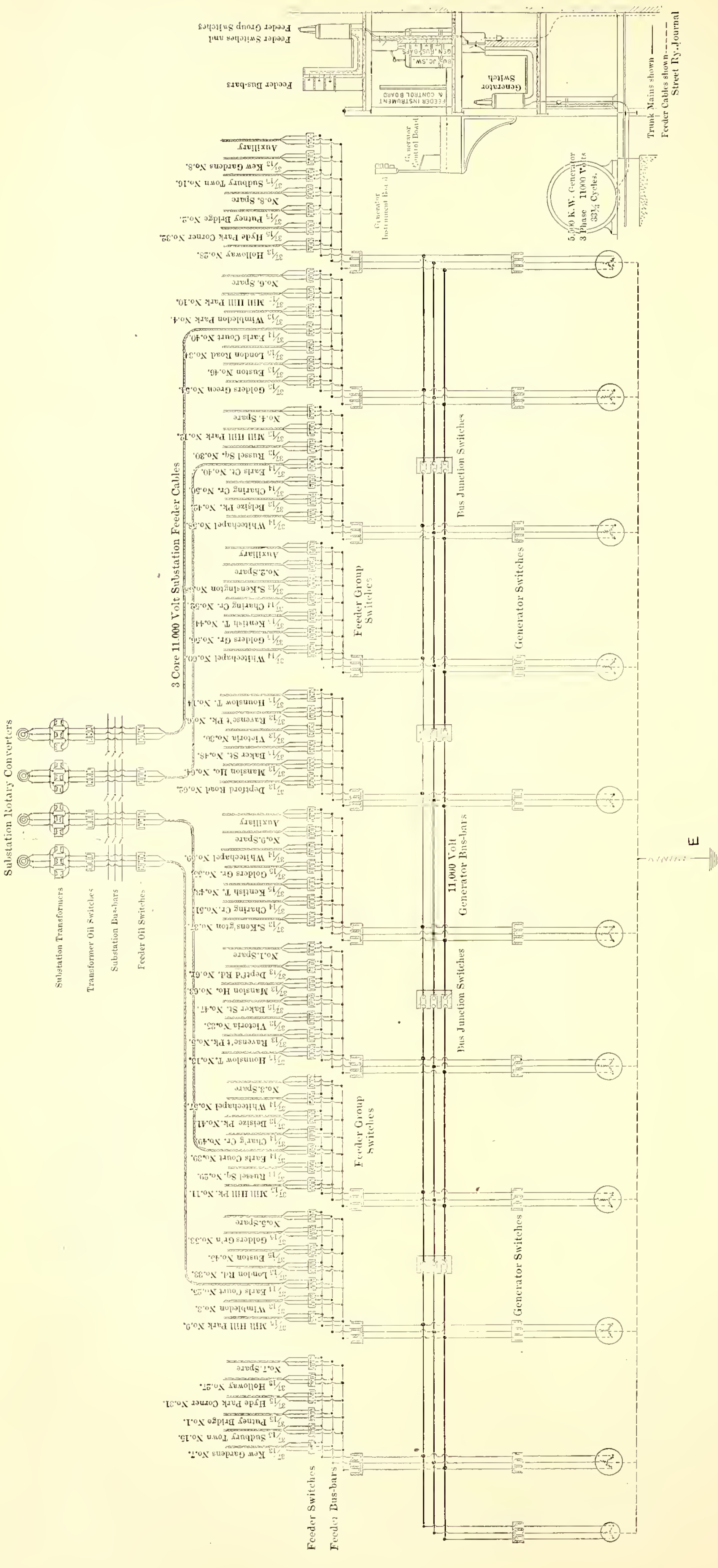


FIG. 30.—GENERAL DIAGRAM OF 11,000-VOLT CIRCUITS, CHELSEA GENERATING STATION

edges overlapping, and then served with an asbestos paint to make the covering waterproof. Three-core, paper-insulated, lead-covered cables are installed, the conductors being of the standard English or "clover leaf" pattern, substantially as shown in Fig. 46. They are subjected to a factory pressure test of 33,000 volts, and again tested at 22,000 volts after being laid and jointed. The particulars of the three sizes used will be found in the table on page 406.

The insulation resistance of these cables will probably average 300 megohms per mile at a temperature of 60 degs. F., a value much less than the usual English and Continental practice. The contracts for this work include the laying, jointing and testing, with the usual one-year maintenance guarantee, have been placed with the British Insulated & Helsby Cables, Callenders Cable & Construction Company, W. T. Henley's Telegraph Works Company, Western Electric Company and The Electrical Company. Considerable difficulty was experienced in the installation of the cable on the tunnel walls, so as not to interfere with the regular traffic in any way, and because of the limited storage room and facilities for loading drums. The time allowed for the actual installation of cable in the tunnel was limited to two and one-half hours for six nights of the week and about four and one-half hours on Saturday nights. Care was necessary in loading the cables intended for the tunnel walls so as to have the drums in proper sequence, due consideration being also given to the direction of the moving train and the particular side of the tunnel for which the cable was intended. On arriving at the site, the lower trough was turned down, drum jacked up and the cable end brought over and placed in position in the trough. The engine moved slowly forward, unreeling the cable, with the men following and pushing the cable into position. Two men closed the trough and prepared the one above for the next cable. In this way three to five drums were installed per hour, depending upon the nature of the track, and the maximum number of drums disposed of in one night of four and one-half hours was fifteen, containing 8000 ft. The conditions under which the jointing was done were exceptionally trying, owing to the limited time and the necessity of protecting the unfinished joint from damp during the hours of traffic. Each man made two joints in three nights, an average of six hours per joint. The major portion of the work for which

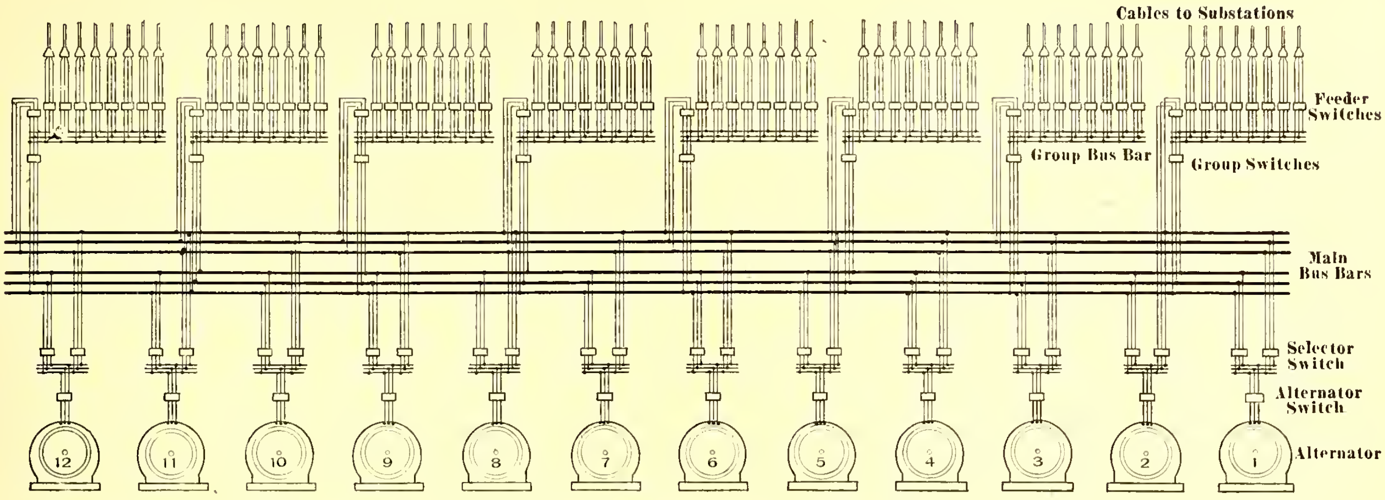


FIG. 31.—GENERAL DIAGRAM OF 11,000-VOLT CIRCUITS IN MAIN RAPID TRANSIT GENERATING STATION, NEW YORK

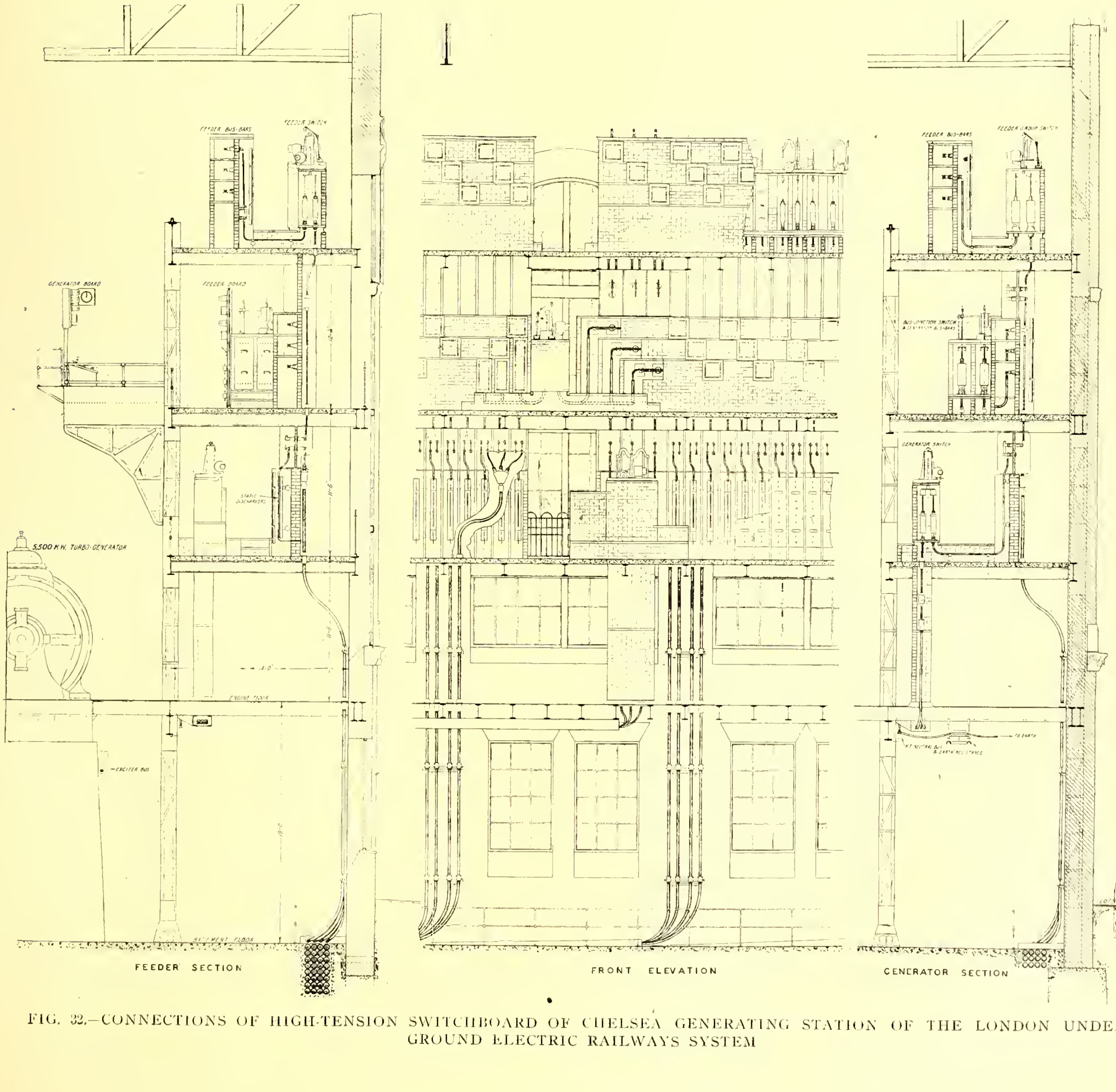


FIG. 32.—CONNECTIONS OF HIGH-TENSION SWITCHBOARD OF CHELSEA GENERATING STATION OF THE LONDON UNDERGROUND ELECTRIC RAILWAYS SYSTEM

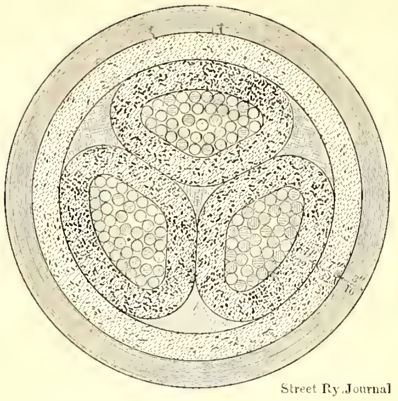


FIG. 46.—TYPICAL SECTION OF 11,000-VOLT THREE-CORE CABLE

contracts have now been let—from the Chelsea Generating Station to Charing Cross, and from Whitechapel to East Ham, an aggregate of about 190 miles—has been installed by the British

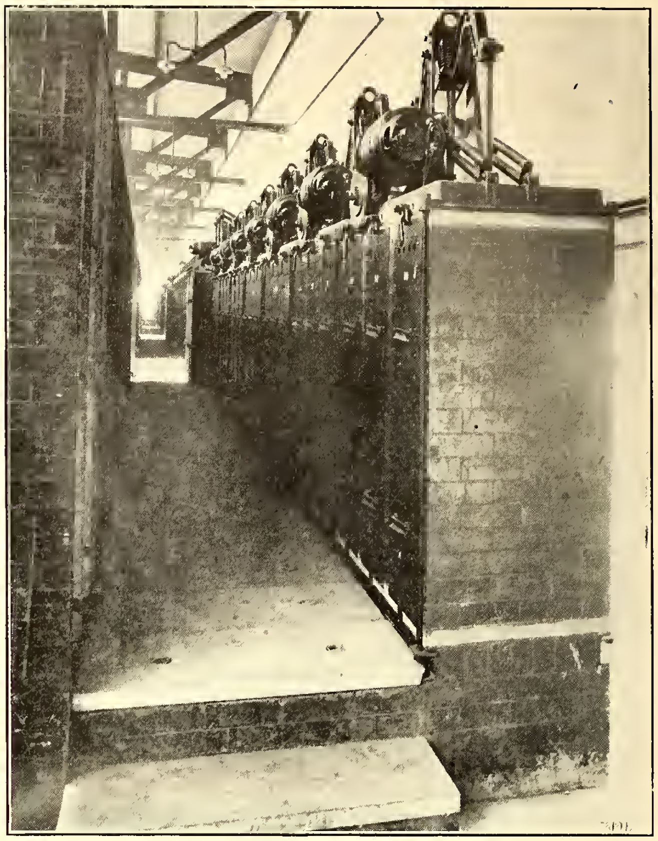


FIG. 33.—LINE OF OIL SWITCHES IN CHELSEA POWER STATION

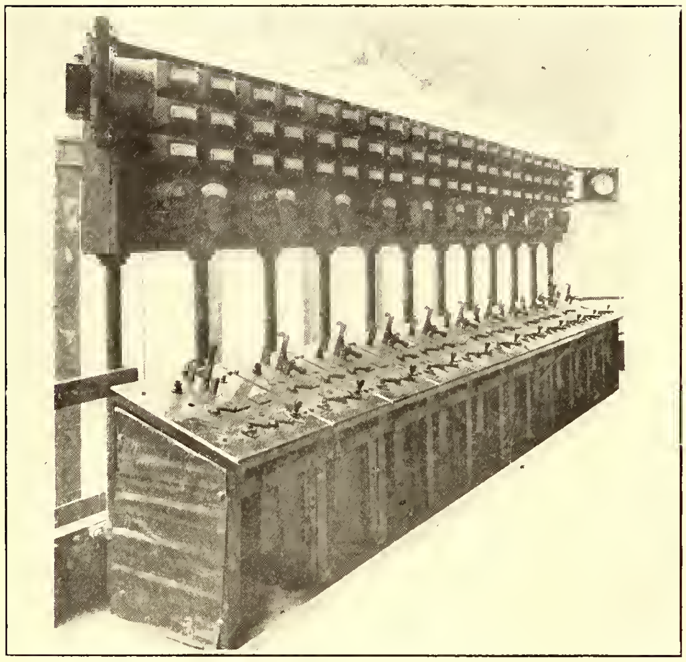


FIG. 34.—GENERATOR INSTRUMENT AND CONTROL PANELS

Insulated and Helsby Cables, of Prescot. This company has thus far completed and tested over 100 miles of cable, including

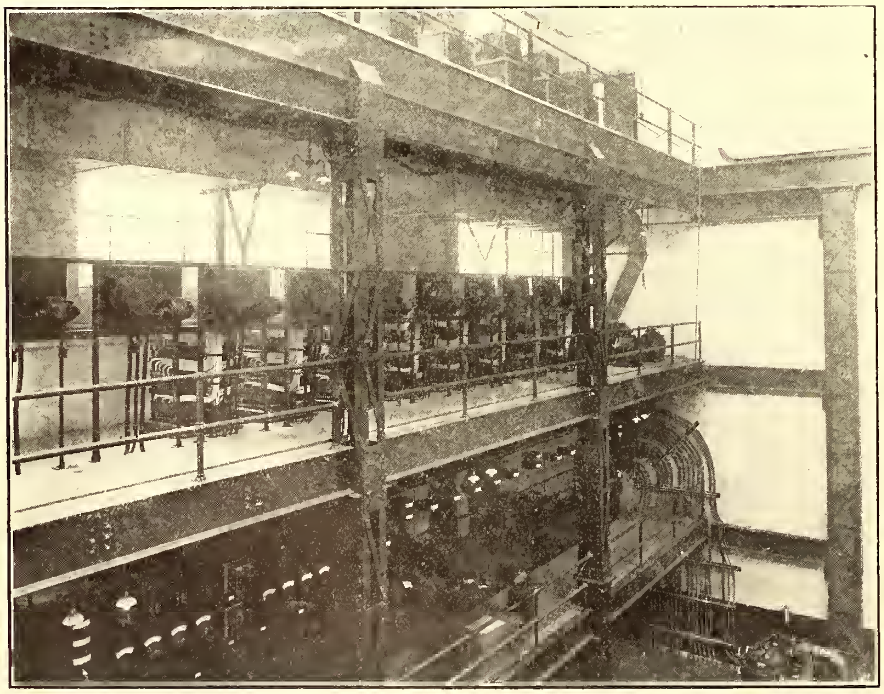


FIG. 37.—MOTOR OPERATED MAIN RHEOSTATS IN GALLERY

FIG. 35.—SWITCHBOARD FOR HIGH-TENSION FEEDERS, CHELSEA POWER STATION

1800 joints and 56 terminal connections, with the loss of but one joint and five cable lengths. The methods and apparatus employed by the several companies in making the final acceptance tests were radically different in several essential details. Contrary to the usual English and Continental practice, no charging devices of any kind have been installed at the generating station for gradually applying pressure to the three-core feeder cables.

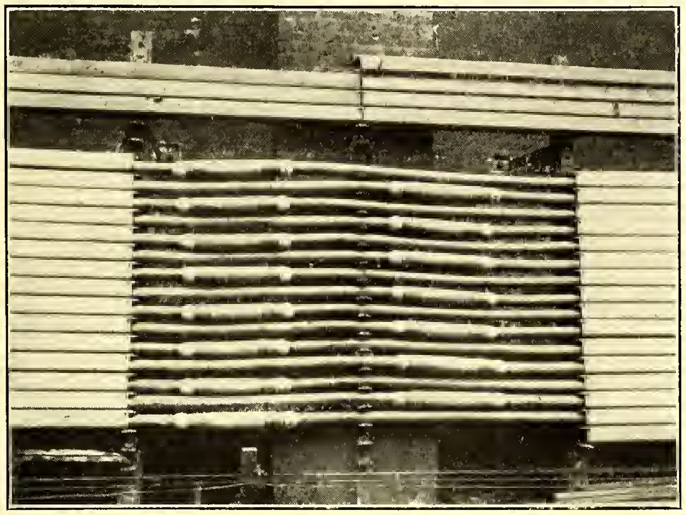


FIG. 40.—HIGH-TENSION CABLE JOINTS AND TROUGHING, EAST END OF EARL'S COURT STATION

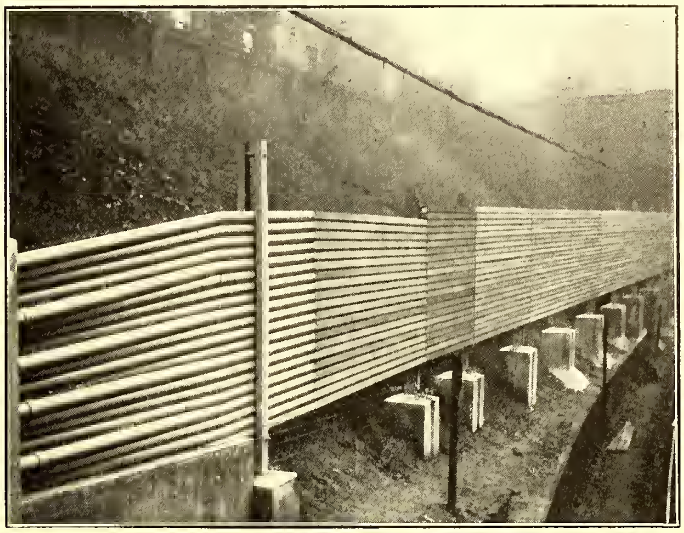


FIG. 41.—CABLE TROUGHING CONSTRUCTION, HIGH STREET TUNNEL, LOOKING WEST

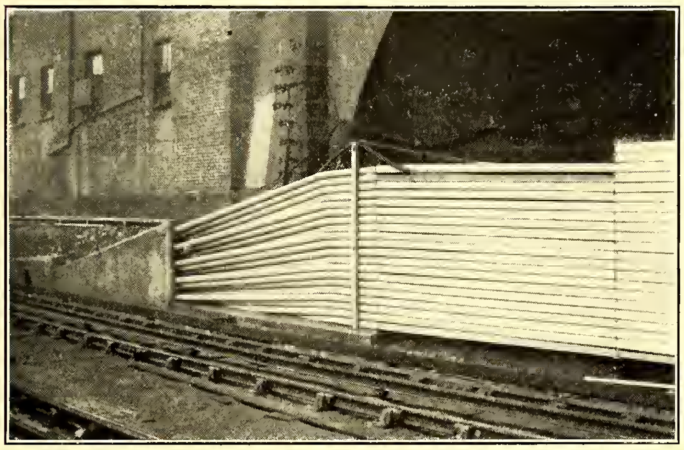


FIG. 42.—CABLE TROUGHING CONSTRUCTION UNDER HIGH STREET BRIDGE, EAST END

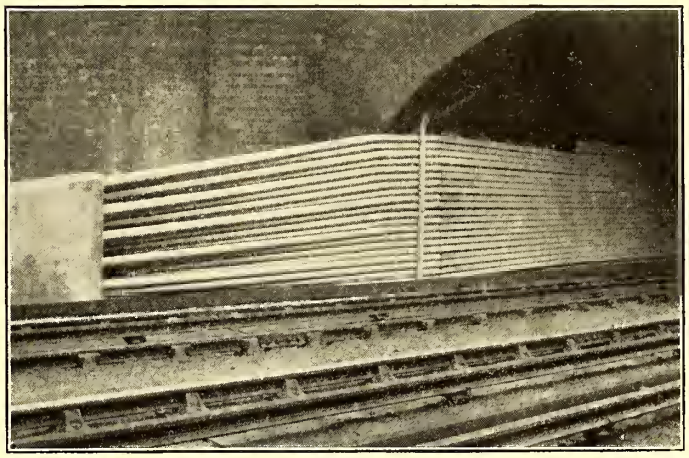


FIG. 43.—CABLE TROUGHING CONSTRUCTION UNDER HIGH STREET BRIDGE, WEST END

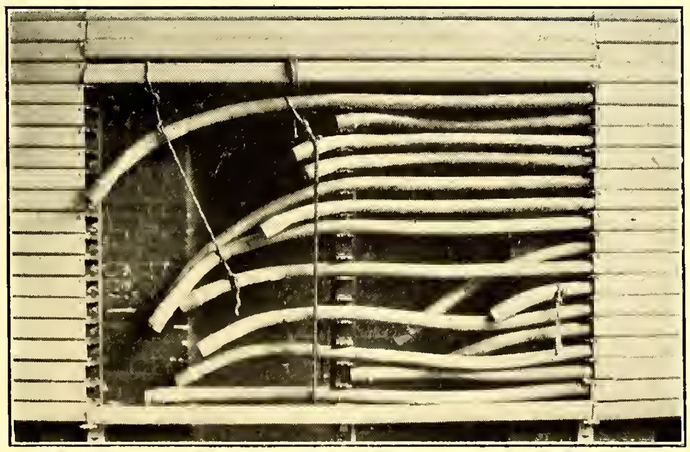


FIG. 44.—HIGH-TENSION CABLES IN TROUGHING BEFORE JOINTING, HIGH STREET TUNNEL

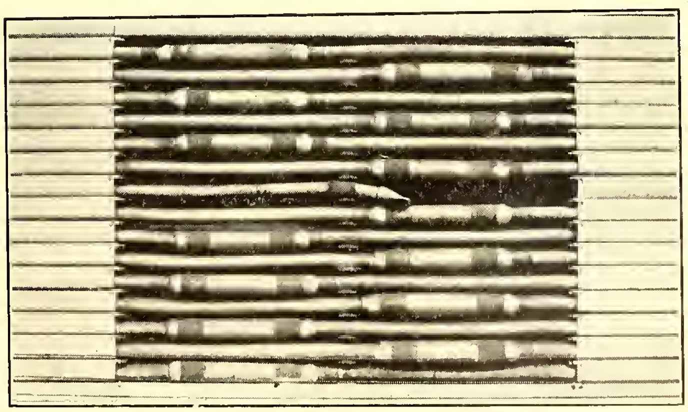


FIG. 45.—CABLE JOINTS, EARL'S COURT STATION

A cast-iron end bell or three-way dividing box (Fig. 47) is used for the feeder end connections at the Chelsea generating station and at all sub-stations. A wiped joint is made between the cable sheath and brass gland, the three individual conductors of the three-core cable passing through the box without joints to the terminals above. The stranded conductors are carefully filled with solder well below the level of the insulating compound so as to prevent the entrance of moisture along the

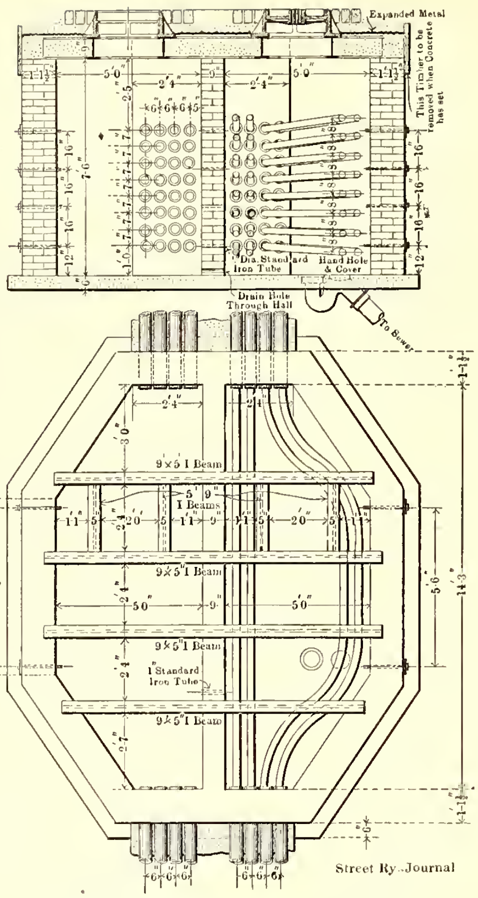


FIG. 38.—DESIGN FOR MANHOLE

GENERAL DETAILS OF THREE-CORE, PAPER-INSULATED LEAD-COVERED CABLES

General exhibit	No. 37/15	No. 37/14	No. 37/13
Sectional area of each conductor, square inch	.15	.19	.25
Insulation between conductors and between conductors and earth	7/16"	7/16"	7/16"
Thickness lead sheathing	3/16"	3/16"	3/16"
Approximate diameter of cable	2.7"	2.8"	3.0"
Approximate diameter of joints	4.0"	4.25"	4.5"

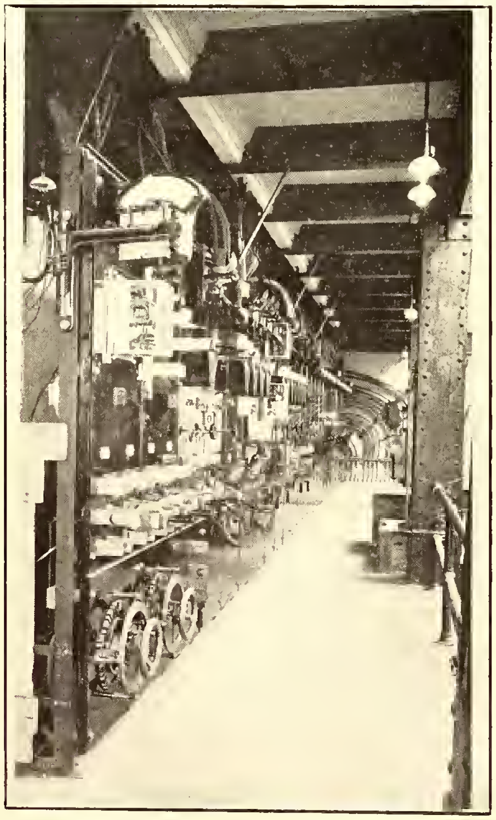


FIG. 36.—AUXILIARY SWITCHBOARD

individual strands, and then reinsulated above the box as a protection against accidental contact. Fig. 48 shows the general distribution of the high-tension feeder cables.

SUB-STATIONS

The Chelsea generating station will supply power to a total of twenty-four sub-stations. The location of these sub-stations,

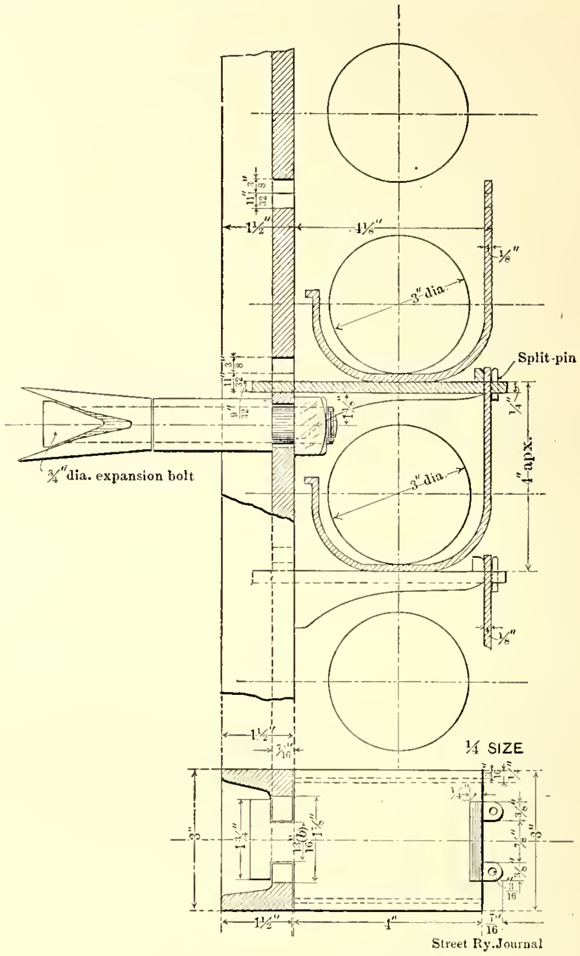


FIG. 39.—SHOWING METHOD OF SUPPORTING CABLES IN TUNNEL WALLS

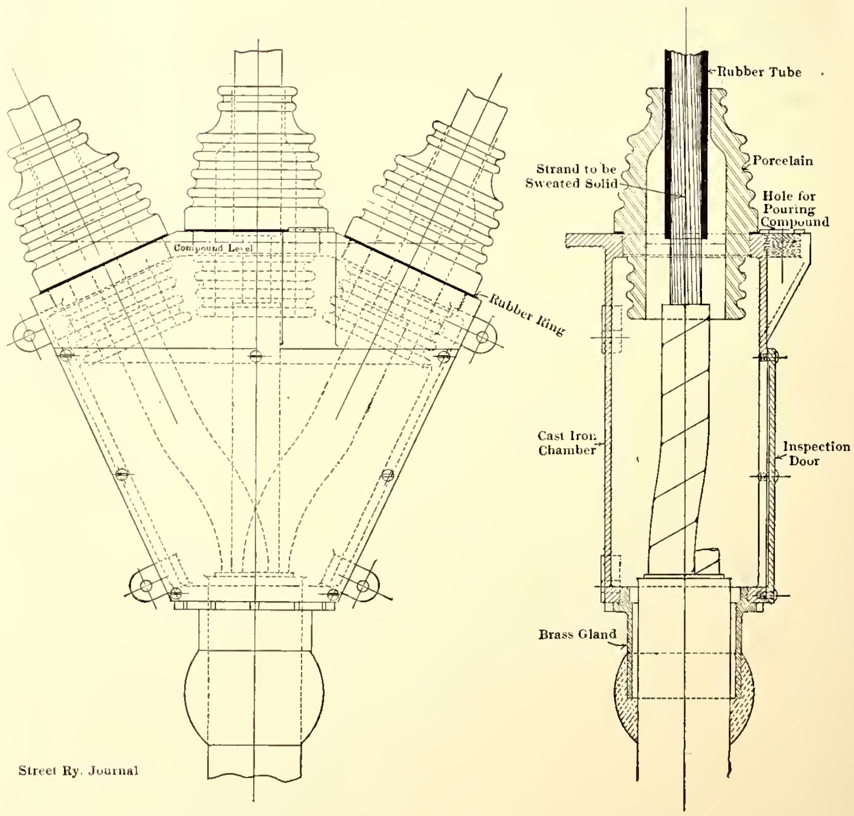


FIG. 47.—END CONNECTION FOR THREE-CORE CABLE. ONE-SIXTH ACTUAL SIZE

together with the ultimate proposed equipment and approximate distance from the generating station, is as follows:

Location of Sub-stations	Distance from Generating Station, Miles	Rotary Converters Number	Rotary Converters Total KW Capacity
East Ham*	13.34	3	3,600
Campbell Road Junction*	10.35	3	3,600
Whitechapel	8.15	4	6,000
Mansion House	6.37	3	4,500
Charing Cross	5.07	4	6,000
Victoria	3.72	3	3,600
South Kensington	2.31	3	4,500
Earls Court	1.30	4	6,000
Putney Bridge	3.29	3	2,400
Wimbledon Park**	5.83	3	3,600
Ravenscourt Park	3.27	3	4,500
Kew Gardens**	6.10	3	3,600
Mill Hill Park	5.45	4	4,800
Hounslow Town	9.90	3	2,400
Sudbury Town	9.59	3	2,400
Euston Station	6.62	3	2,400
Kentish Town	8.30	3	2,400
Belsize Park	9.15	3	3,600
Golders Green	11.36	4	3,200
Hyde Park Corner	3.34	3	2,400
Russell Square	5.62	3	3,600
Holloway	7.83	3	3,600
Baker Street	7.37	3	2,400
London Road	6.42	3	2,400
Totals	160.05	77	87,500
Averages	6.67	—	3,646

*London, Tilbury & Southend Railway. **London & South Western Railway.

The arrangement of apparatus will be practically the same previous to the construction of the Victoria Embankment—was originally part of the Thames River bed, and considerable difficulty has therefore been experienced in the construction of the retaining walls and basement floor in order to prevent the entrance of moisture. There are no surface openings to this sub-station, the entrance being from the District Railway platform. The other nine sub-stations will supply current only for the "tube" railways now under construction, and of these only the Hyde Park Corner sub-station will be entirely below the surface. The London Road sub-station will be built on heavy girders spanning the yard tracks, this construction being essentially the same as that used for the Mansion House and Victoria sub-stations. All the buildings are of brick and steel construction, fireproof and without ornamental features, the general arrangement being clearly shown in Figs. 49 to 51, inclusive. The rotary converters, low-tension switchboard, high-tension oil switches, signal apparatus and blower sets are all on the first floor. A shallow basement is used for the cable installation between the rotaries and switchboard and the switchboard and tracks. A gallery about 23 ft. in width extends along one side of the building and on which is located the high-tension bus-bars and lowering transformers. The transformer air duct is constructed of galvanized iron and suspended from the under side of the gallery immediately below the transformer openings. Hand-operated traveling cranes are erected in each sub-station for the installation and any subsequent handling of the rotaries and transformers.

All sub-station machinery and apparatus—exclusive of the cranes and main cable installation—is being supplied and erected by the British Westinghouse Electric & Manufacturing Company, Limited.

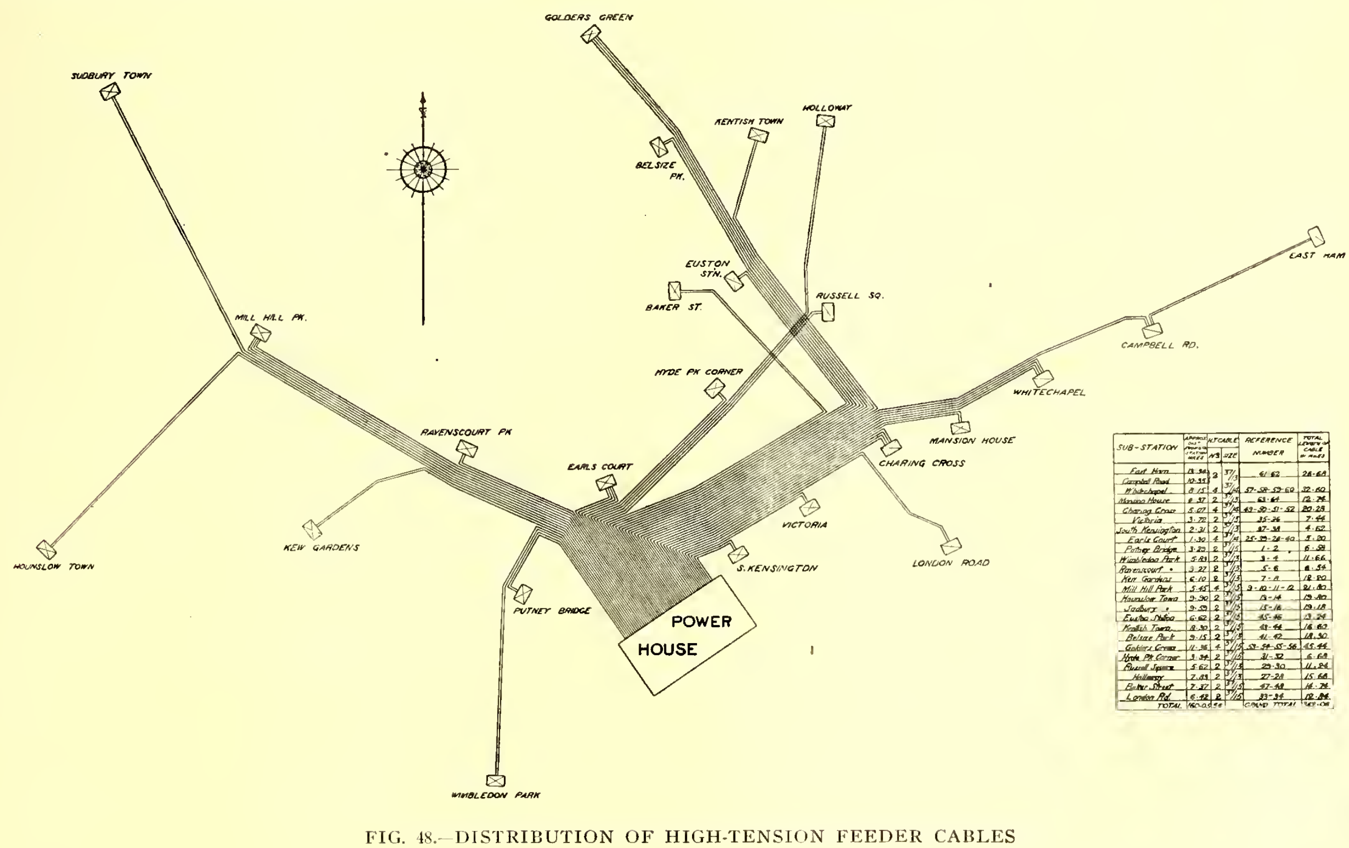


FIG. 48.—DISTRIBUTION OF HIGH-TENSION FEEDER CABLES

in all cases, the sub-stations differing only in size and number of units, except where local conditions necessitate changes in the general design. Two of the fifteen sub-stations—Mansion House and Victoria—to supply current for the District Railway trains are built on heavy steel girders spanning the tracks. The Charing Cross sub-station is entirely below ground, the rotary floor of this station being 20.5 ft. and 33 ft. below the District rail level and mean high tide, respectively. This location—

ROTARY CONVERTERS

Each of the rotary converters with its starting motor is a self-contained unit (Fig. 52), the two bearings and the lower half of the field frame being mounted on a common bed-plate. They are started by induction motors, the revolving part of the motor being mounted directly upon an extension of the armature shaft. The fields are compound wound, the series and shunt coils being separated by air spaces and the pole pieces beveled at the edges in order to support massive copper shields. These shields consist of heavy copper rings around the pole tips, with lips extending from both edges of the pole toward the center, the arrangement being such as not to interfere with the ventilation. The fly-wheel capacity of these machines is relatively small, and they are guaranteed to stand an overload of not less

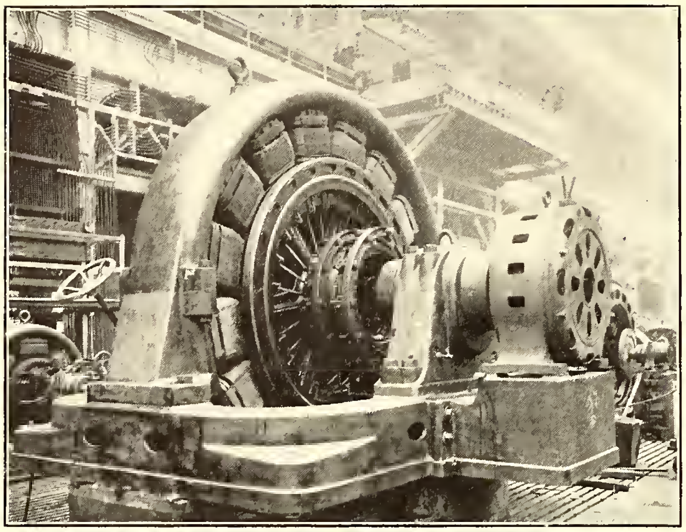


FIG. 52.—ALTERNATING-CURRENT END OF 1500-KW ROTARY CONVERTER

than three times the normal full load without falling out of step. No adjustment of the brushes is necessary between the limits of no load and 50 per cent overload, and no injurious sparking or permanent injury will result from occasional momentary fluctuations reaching two and one-half times the normal full load. All windings are subjected to a puncture test of 3500 volts alternating for one minute. The particulars of the rotary converters are as follows:

ROTARY CONVERTERS

	Kilowatt Capacity		
General Exhibit	800	1,200	1,500
Number of poles	10	12	16
Speed—r. p. m.	400	333	250
Alternations per minute	4,000	4,000	4,000
Efficiency, one and a quarter load	95.3	96.2	96.25
Efficiency, full load	95.0	95.7	96.00
Efficiency, three-quarter load	94.3	95.0	95.25
Efficiency, one-half load	92.3	93.5	94.00

POWER TRANSFORMERS

The transformers are of the vertical, air-blast type, with the primary and secondary coils wound in sections, each section being encased in a slot of insulating material. They are assembled by alternating the primary and secondary sections, suitable ventilating spaces being provided between coils so as to distribute a flow of air along all parts of the coils. Each transformer is assembled on an iron base containing dampers for regulating the supply of air, and is also provided with a ventilating damper or shutter on the top. A number of taps have been provided on the primary winding for adjusting the ratio of transformation, so that the potential of the current delivered to the rotaries shall be essentially the same in all substations. These transformers are delta connected on both the high and low-tension sides, the three transformers with their rotary being connected and operated on the "unit" system.

LIGHTING TRANSFORMERS

Two 11,000-220-volt, single-phase, 150-kw transformers of the same general design and construction as the main power transformers are installed in the majority of the sub-stations

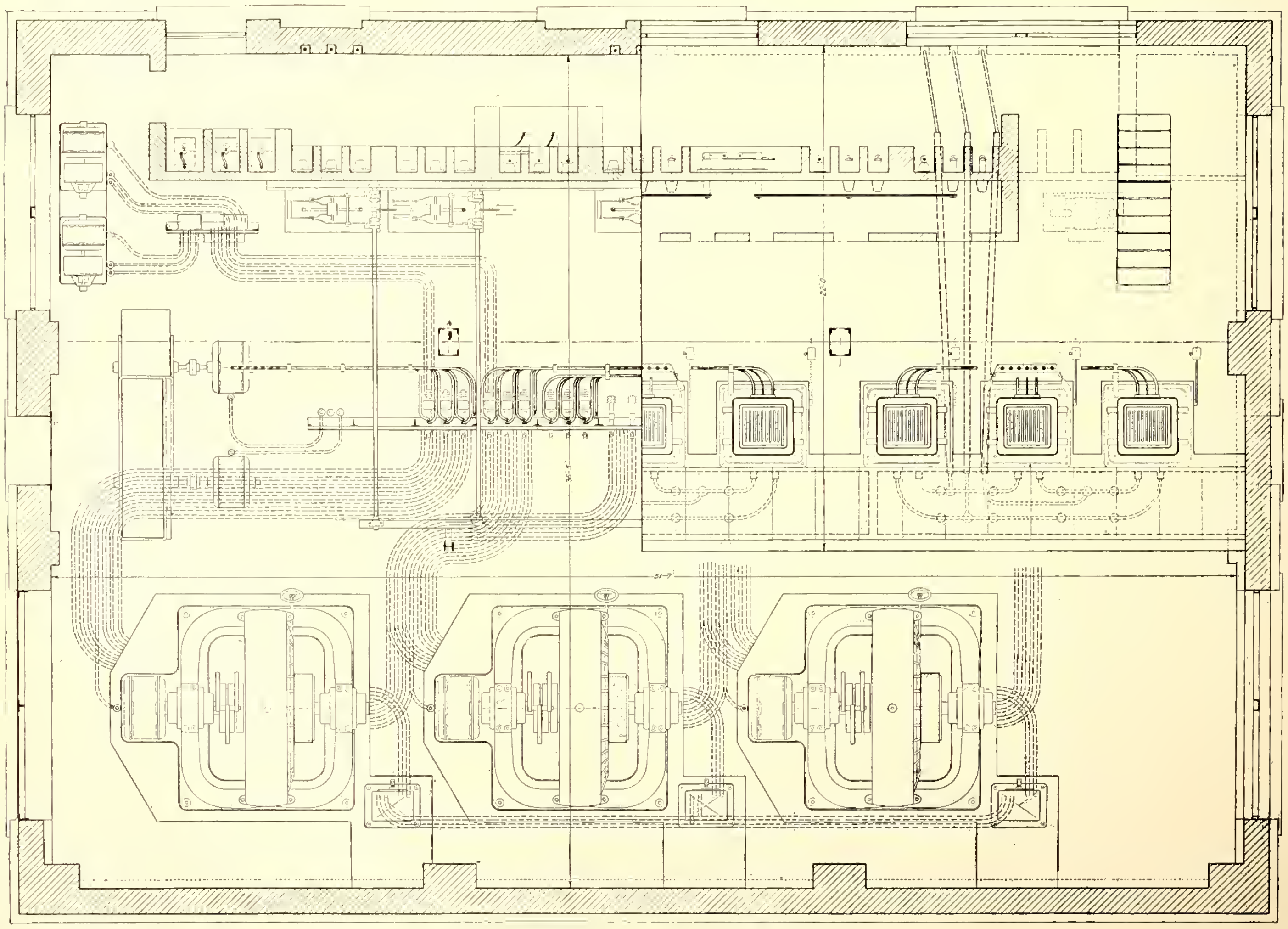


FIG. 49.—SECTIONAL PLAN, PUTNEY SUB-STATION

so that the station and tunnel lighting will be practically independent of the sub-station power circuits. These transformers are "V" connected so as to balance the load on the high-tension side, power being supplied direct from the center point of one of the high-tension bus junction switches. The temperature rise is guaranteed not to exceed 35 degs. C. for continuous lower portion of the fan. Each fan is driven by a direct-connected, constant-speed induction motor operated and controlled from the sub-station switchboard. These motors are supplied with power from the low-tension side of the main power transformers, the two motors being connected to different sets so that one blower unit is available when one rotary unit is shut down.

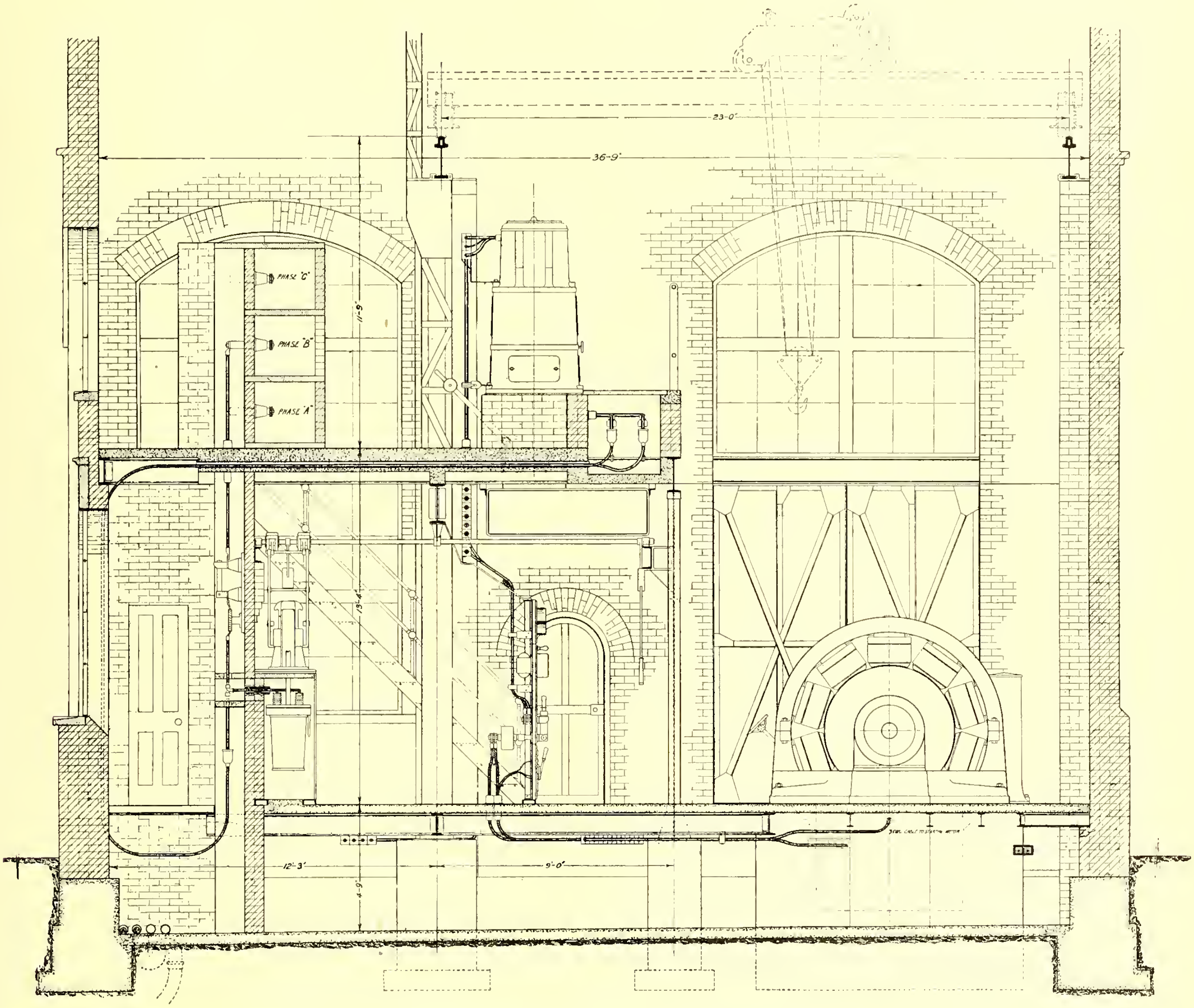


FIG. 50.—CROSS-SECTION OF PUTNEY SUB-STATION

operation at normal full load output, the guaranteed efficiencies of these transformers being as follows:

TRANSFORMERS

Efficiencies	Kilowatt Capacity 300	435	550
One and one-half load...........	97.6	97.85	98.0
One and one-quarter load........	97.7	97.9	98.0
Full load	97.7	97.9	98.0
Three-quarter load..............	97.5	97.7	97.85
One-half load...................	96.9	97.1	96.9
One-quarter load	94.5	95.0	95.2

BLOWER SETS

Blower sets have been provided in duplicate in each sub-station for the ventilation of the air-blast transformers, each set being capable of ventilating all the transformers under normal working conditions. The fans are of the three-quarter housing type—that is, the sheet steel housing stops at the floor line and the masonry foundation forms the housing for the

SWITCHING APPARATUS

The switching apparatus is designed for the control of the incoming 11,000-volt feeders, single-phase lowering transformers, three-phase rotary converters, direct-current traction and lift feeders and a. c. station and tunnel lighting. Figs. 53 and 54 shows a rear elevation of the high-tension switchboard and an outline diagram of connections for a two and four-feeder station, respectively. The 11,000-volt, three-conductor cables from the power house enter the sub-stations approximately on the basement floor level, and as such terminate underneath the rotary floor in a cast-iron end bell or dividing box similar to those used in the power house. The three separate conductors pass through these boxes without joints to the feeder isolating switches, thence through the feeder oil switches to the high-tension bus-bars on the gallery. Bus junction switches are installed so that the high-tension bus-bars may be divided into sections—one section for each rotary unit—either for inspection or repairs, or so that the feeder cables may be operated

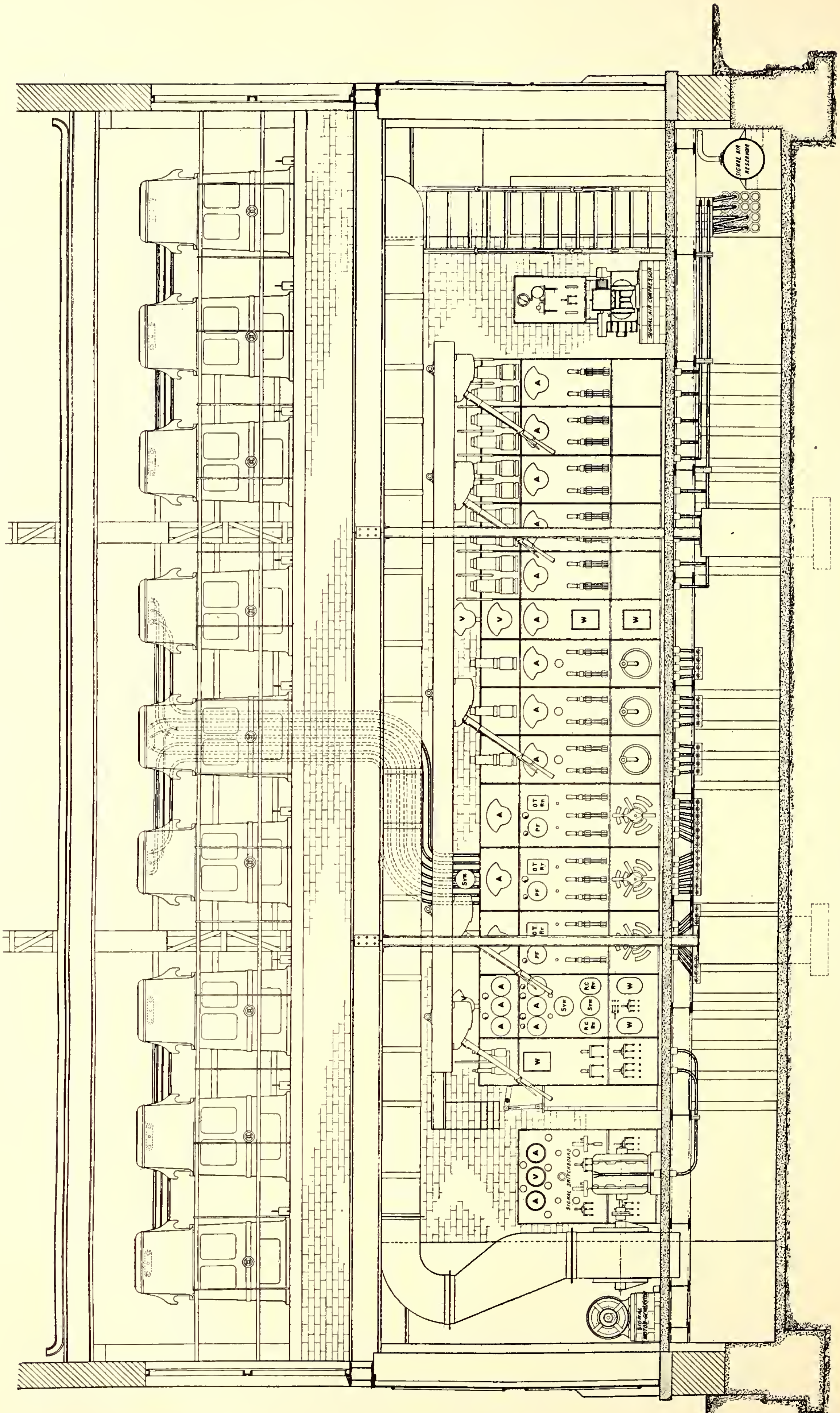


FIG. 51.—LONGITUDINAL SECTION OF PUTNEY BRIDGE SUB-STATION

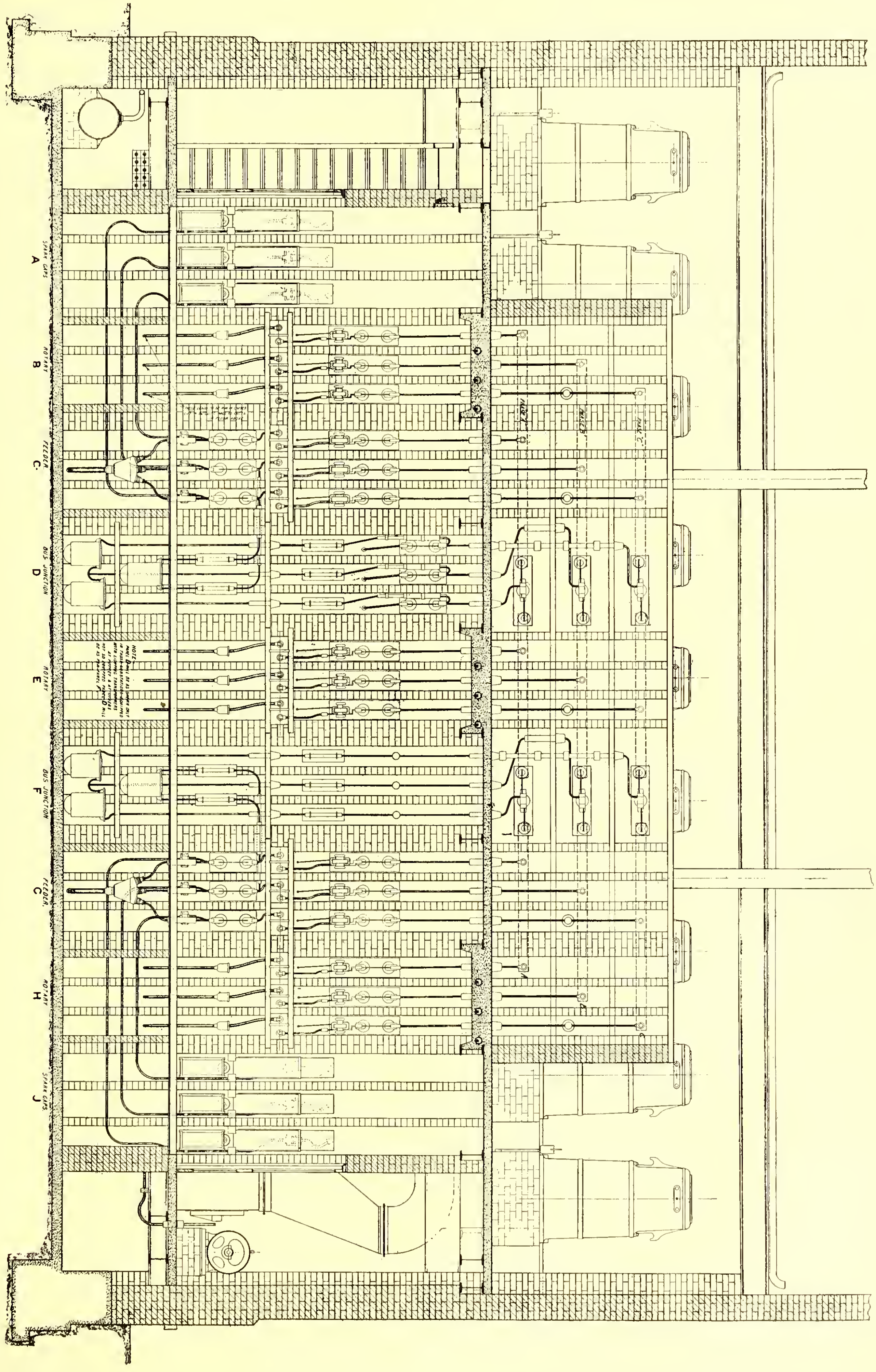
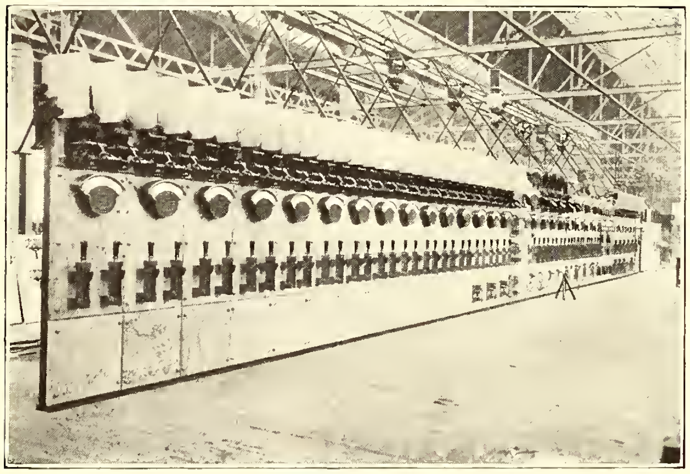
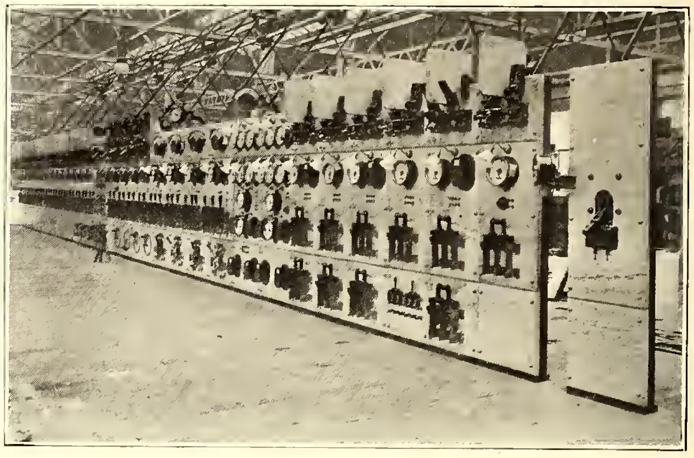


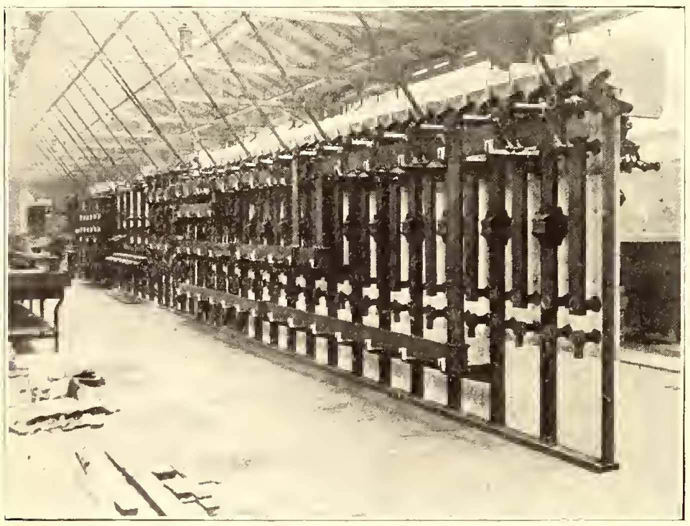
FIG. 53.—REAR ELEVATION, HIGH-TENSION SWITCHBOARD OF PUTNEY BRIDGE SUB-STATION

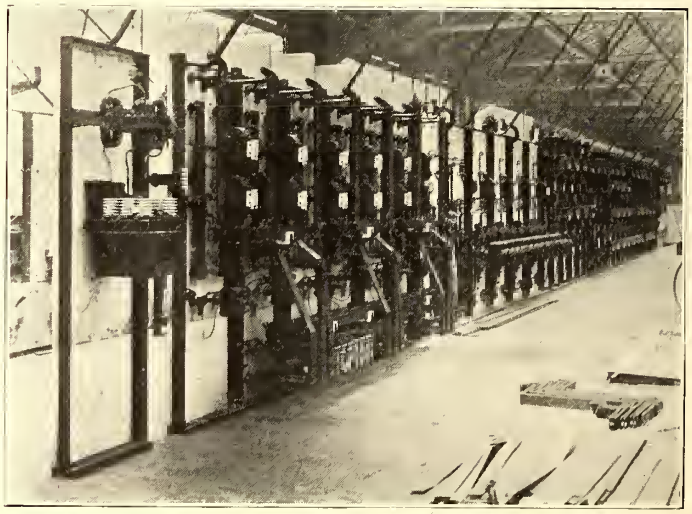
separately or in multiple. Isolating switches are installed in connection with all high-tension feeder and rotary oil break switches, transformers, static dischargers, etc., so that it is possible at any time to inspect or repair any piece of high-tension apparatus with safety and without interfering with the general operation of the sub-station. The high-tension oil break feeder and rotary switches are hand-operated through the medium of levers suitably connected to the switch proper by a link mechanism, the construction and arrangement of the levers being similar to those used in railway signal work. These switches are erected in a masonry structure, with each pole and the oil tank, in which it is immersed, in a separate fireproof compartment. There are two stationary contacts per pole, one connected to the incoming lead and the other to the outgoing lead of the same phase, while the movable contact for each pole consists of a U-shaped copper piece fastened to the end of a stout wooden rod. The wooden rods are fastened at their upper ends to a common cross bar, which, through a system of levers giving a straight line of motion, is raised by means of the levers assisted at the beginning of its motion by a pair of balancing springs. A toggle joint automatically locks this system of levers when the switch is in a closed position. The toggle is released by a blow from the tripping magnet, which, by gravity and the assistance of a powerful spring, causes the cross bar with the movable rods and contacts to drop to the open position. The oil tanks are constructed of heavy sheet metal, the interior being lined with insulating cement, and each is provided with a small sight gage to show the oil level. The feeder and rotary switches, respectively, are automatically tripped by reverse current and overload time limit relays connected to the series transformers in the main circuits. The rotary switches can also be electrically tripped by a push-button on the rotary panels. All high-tension cables, series and potential transformers, static dischargers, etc., are mounted on the rear of the high-tension brick wall, each in its own brick cubicle and quite isolated from adjacent apparatus. In the four feeder stations the static dischargers are installed in front of the high-tension wall in fireproof chambers fitted with inspection doors, these being adjacent to the main oil switches and similar in appearance.





FIGS. 55 AND 56.—TWO VIEWS OF CHARING CROSS SWITCHBOARD





FIGS. 57 AND 58.—TWO REAR VIEWS OF THE CHARING CROSS SWITCHBOARD

SWITCHBOARD PANELS

One-third of the total number of sub-stations supply current to two or more contingent or independent railways, making it necessary to meter separately the power supplied to each road, whether for traction, tunnel and station lighting or elevators. The use of an insulated return, in addition to these metering requirements, makes the construction and operation of the low-tension switchboard much more extensive and complicated than is usually the case for this class of work. All panels are of blue Vermont marble and somewhat wider than the usual standard practice, owing to the double-pole construction. The general arrangement of the panels and apparatus is clearly shown by Figs. 55 to 60, inclusive, the number varying from fourteen to thirty-three, and depending upon local conditions and the number of independent roads to be supplied from any individual sub-station. All high-tension feeder panels are arranged for the control of two feeders, these being equipped with three ammeters, one integrating wattmeter, one synchroscope, indicating

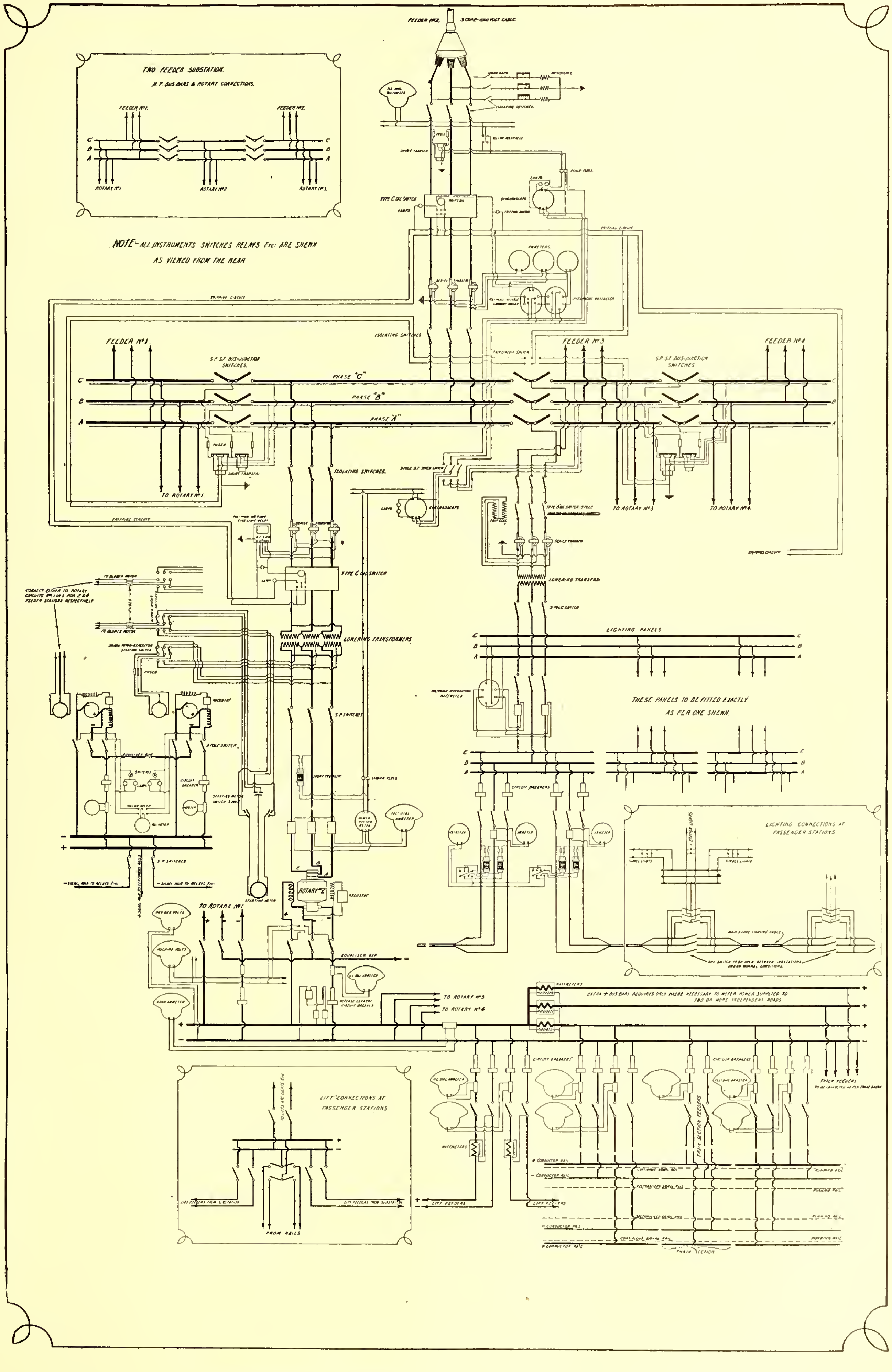
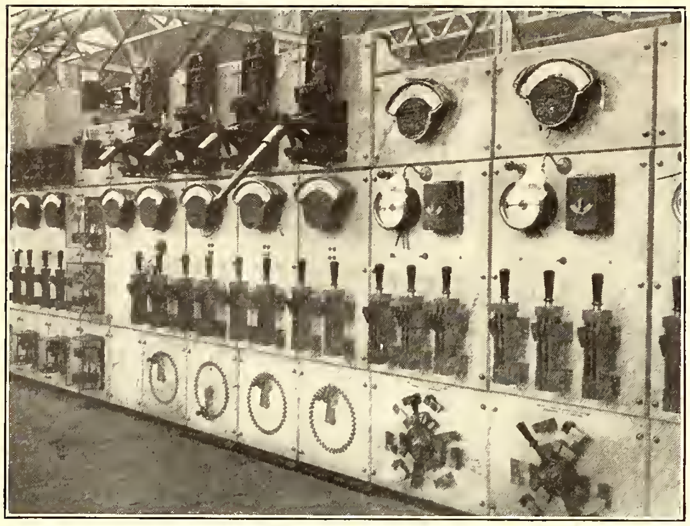
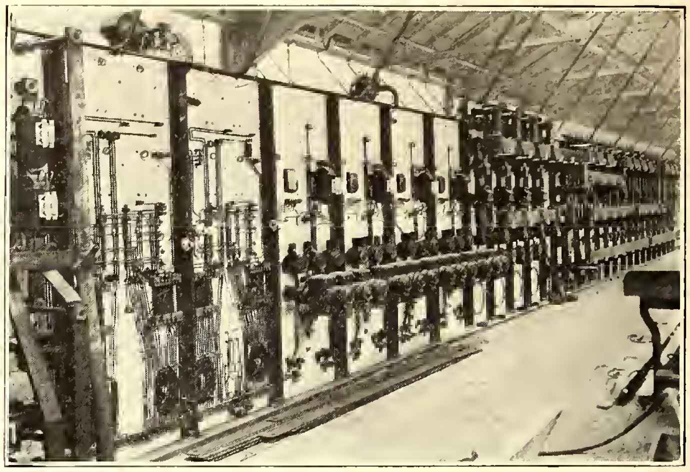


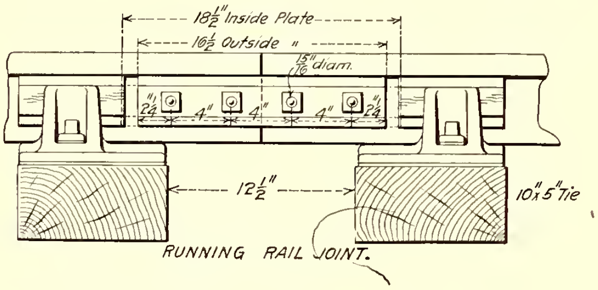
FIG. 54.—TYPICAL OUTLINE DIAGRAM OF SUB-STATION CONNECTIONS

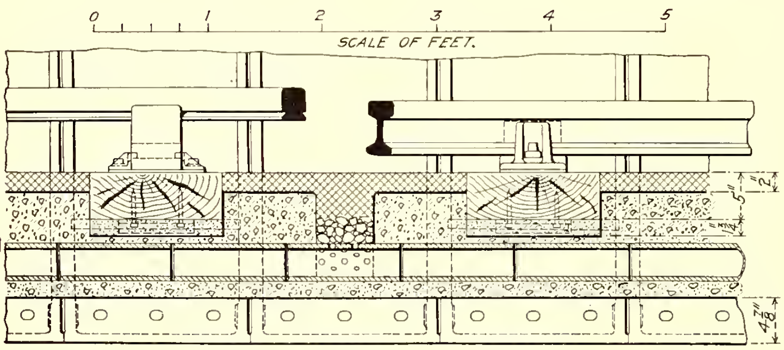
lamp and reverse current relay for each feeder. Two push-buttons for electrically tripping the feeder switches and a common voltmeter are also mounted on these panels. The low-tension a. c. lighting panels are arranged in pairs for the control of two circuits to each railway, each pair of panels being supplied with current from a common bus and equipped with an integrating wattmeter. Where current is supplied to two or more independent roads from any one sub-station, a second set of bus-bars is used, in order that any individual feeder or set of feeders may be disconnected from the main supply without in any way affecting the other circuits. On the base of these panels is mounted the switch connecting the transformers to the main bus-bars as well as the group switches between the main and auxiliary bus-bars provided for each road. The switches controlling the individual circuits are connected to these auxiliary bus-bars, each circuit on the individual panels being equipped with its own ammeter and a double-pole circuit breaker. The transformers in the Charing Cross sub-station supply power to three independent roads, and, in the event of these transformers being out of service, it is possible for the adjacent sub-stations on any or all of these roads to independently or collectively feed through this station. A voltmeter common to all circuits, together with two three-pole, double-throw switches for the control of the blower motors, complete the equipment of these panels. The a. c. rotary panels are each equipped with the usual ammeter, power-factor meter, overload time-limit relay and three single-pole switches. On the load panel is mounted the d. c. bus-bar and machine

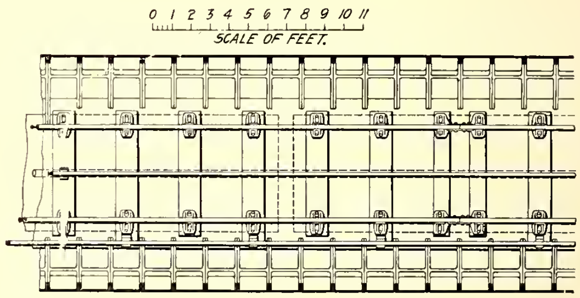




FIGS. 59 AND 60.—FRONT AND REAR ELEVATIONS OF SWITCHBOARD AT CHARING CROSS







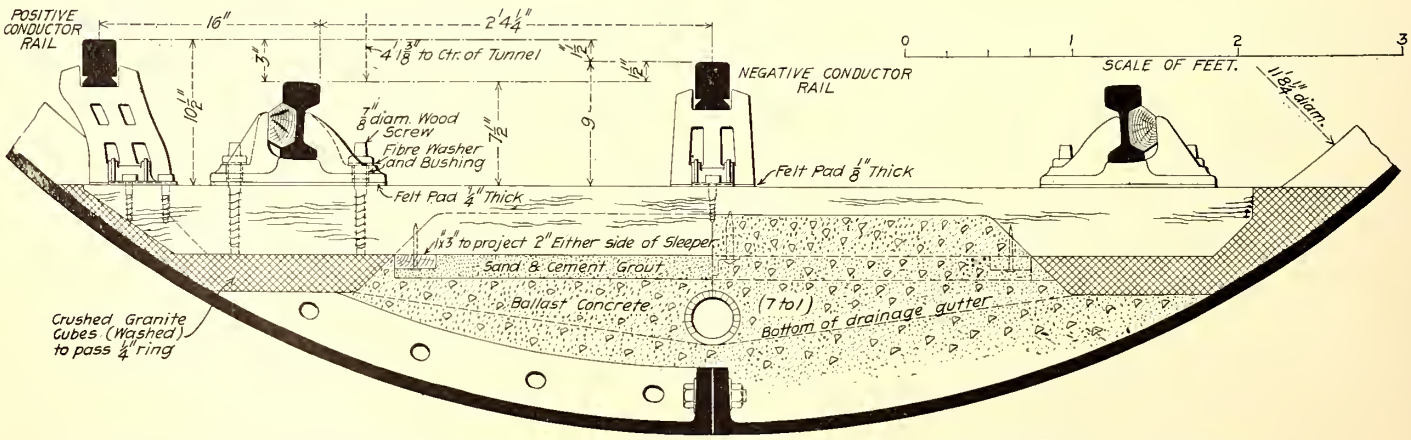


FIG. 61.—PLANS, SECTIONS AND SIDE ELEVATIONS, ILLUSTRATING TYPE OF CONSTRUCTION OF PERMANENT WAY

voltmeters, main ammeter for the total d. c. output and the traction wattmeters. The d. c. rotary panels are each equipped with one single-pole circuit breaker with reverse current attachment, but all other d. c. panels have a circuit breaker in both the positive and negative side of the circuit. Each lift panel is equipped with an integrating wattmeter connected so that the power supplied to the lifts will be metered independently of the traction circuits. Illuminated dial instruments are used on all rotary and d. c. feeder panels. A triple-pole automatic oil switch is used to protect the lighting transformers, this switch being mounted on a standard switchboard panel and installed between the rotary and feeder oil switches.

SIGNAL APPARATUS

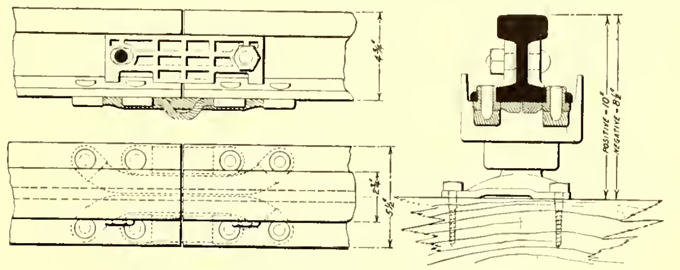
Duplicate motor-generator sets and an air-compressor equipment are installed in each sub-station for the operation of the signal system. Each motor-generator set consists of a 7.5-kw, 70-volt, compound-wound, d. c. generator, direct connected to a three-phase, 365-volt induction motor. The armatures of the two machines are mounted on a common shaft and the frames on a common bed-plate. The main rotary transformers supply power for the operation of these sets, connection being made to two independent transformer sets through the rotary starting motor switches on the base of the a. c. rotary panels. An independent two-panel switchboard is installed for the control of the current to and from this apparatus. A 550-volt, d. c. motor direct connected to a Christensen air compressor, together with the necessary controlling panel, air reservoir, etc., completes the signal equipment installed in the sub-stations.

TUNNEL AND STATION LIGHTING

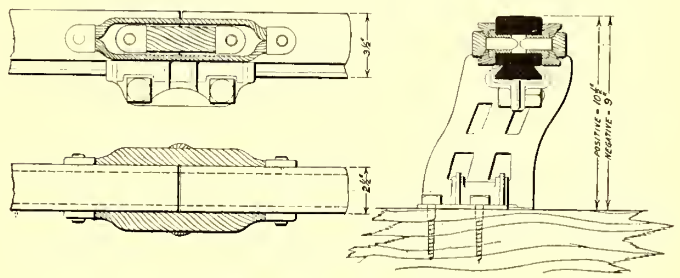
The incandescent lighting for the passenger stations and tunnels is arranged so as to be practically independent of the sub-station traction circuits. Independent lighting transformers are installed in the various sub-stations, the high-tension current supplying these transformers being taken directly from the sub-station bus-bars. The distribution system is arranged operated in series and supplied from the elevator and traction, 550-volt, d. c. circuits.

PERMANENT WAY

The permanent way of the District and "Tube" Railways is of standard English construction, with the bull-head type of



100 LB: RAIL — DISTRICT RAILWAY



85 LB: RAIL — TUBE RAILWAYS

FIG. 62.—BONDING AND SUPPORTS FOR CONDUCTOR RAILS

running rails. Figs. 61 and 62 illustrate this type of construction in addition to the arrangement and location of the two conductor rails.

CONDUCTOR RAILS

The position and protection of the "third" rail (see Street

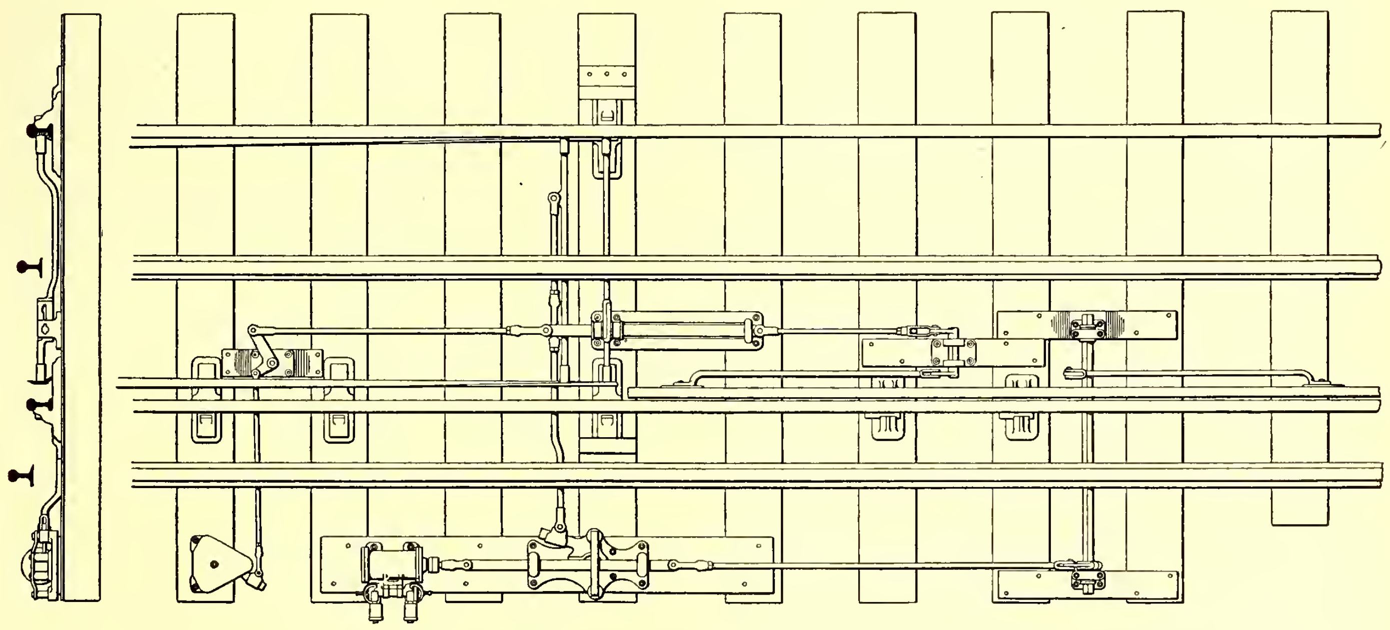


FIG. 63.—ELECTRO-PNEUMATIC FACING POINT

for emergency interconnection between sub-stations. All "tube" passenger stations will, in addition, be provided by an independent lighting system from some outside and entirely independent source, these emergency lights to be in continuous service.

The tunnels and stations generally will be lighted by incandescent lamps supplied from the three-phase, 220-volt mains. Arc lamps will be used for the general illumination of the station platforms, booking halls or ticket offices, etc., these to be

Railway Journal, July 4, 1903; also June 25, 1904), as adopted by the Mersey, Lancashire & Yorkshire, North Eastern Metropolitan and Metropolitan District Railways, leaves much to be desired in the way of "standard" construction. The question of uniformity in the location of the conductor rail is apparently a matter largely determined by local or existing conditions, and unfortunately is no nearer solution in Great Britain than in the United States or on the Continent. Two insulated conductor rails, positive and negative, are used per track, the former being placed 16 ins. outside the running rail and the negative centrally between the track rails. They are 3 ins. and 1½ ins., respectively, above the running rails.

A 100-lb. T-section, with an extra broad and thick base, is used for the conductor rails on the District Railway, while a section similar to that designed by W. B. Potter, of the General Electric Company, is used for the "Tube" Railways. The latter is of rectangular section, with dove-tails at the bottom, and weighs 85 lbs. per yard. The dove-tail or V-groove construction provides an easy and satisfactory method of securing the rails by a special design of fish-plates.

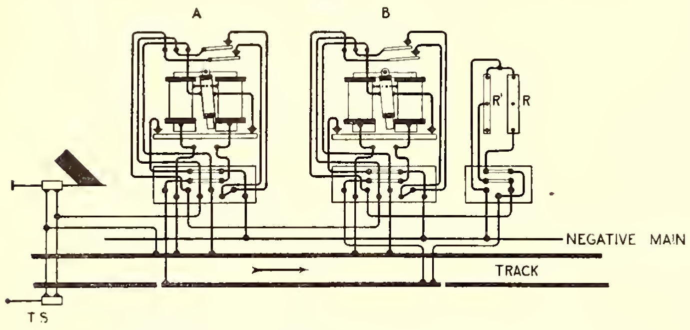


FIG. 65.—TWO RELAY CIRCUITS OF ELECTRO-PNEUMATIC SIGNALING

The resistance is guaranteed to be not more than 6.4 times the equivalent section of copper; the chemical constitution necessary to obtain the above figure is about as follows:

Carbon	.05
Manganese	.19
Sulphur	.05
Phosphorous	.05
Silicon	.03

Individual analyses and tests of these rails show essentially the results as above given, and that they are easily the best electrical conductors of some forty-five samples tested in the laboratory of the General Electric Company, the results of these tests having been given in a paper presented to the New York meeting of the American Institute of Mining Engineers by J. A. Capp, Oct. 15, 1903 (see Street Railway Journal, Oct. 24, 1903). From actual tests it was found that the relative resistance of this conductor rail, six months after being bonded and ready for service, including bonds, bond contacts, etc., was 7.76 to 1, compared with Matthieson's standard of conductivity.

The bonds are of the "Crown" type, as manufactured by the American Steel & Wire Company, the diameter of the heads being 1 in., and the total effective sectional area of the four bonds 2,000,000 circ. mils and 1,700,000 circ. mils for the 100-lb. and 85-lb. rails, respectively. The total contact area is 9.4 sq. ins. and 10.5 sq. ins., and the ratio of contact to rail area, based on the guaranteed conductivity, is 6.1 to 1 and 7.9 to 1 for the T and rectangular sections, respectively.

The main line conductor rails are separated by an isolated "train section" opposite all sub-stations and at all main line junctions. The connections to this section are substantially as shown on the typical diagram of sub-station connections, all special work incidental to cross-overs, etc., being included in this section.

TELEPHONE SYSTEM

A complete and independent telephone system is being installed, each of the several railways and the generating station to have its own exchange. These will be interconnected by trunk lines, the exchange at the generating station to have through communication with each of the twenty-four sub-stations independently of and in addition to the connection through its local exchange. The general scheme provides for telephone instruments at every passenger station, signal cabin, sub-station, offices, etc., on the system, the main exchange being located on the ground floor of the signal cabin, which is situated at the west end of Earls Court station.

A 300-line board and distributing frame, the latter being fitted with fuses, test jacks and facilities for cross connecting, is installed in this exchange, to which will be connected all the District Railway instruments, together with the trunk lines from the other exchanges. Each tunnel of the several "Tube" roads will be equipped with an emergency telephone system, in addition to the general scheme briefly outlined. The essential features of this emergency system are: A central telephone set placed at any desired location, two bare copper wires supported from the tunnel shields opposite the motorman's window, and a portable set without batteries in the motorman's cab on each train. The portable set is provided with a flexible connection terminating in two specially constructed contact clips, by means of which the instrument can easily and quickly be connected to the lines when occasion arises. When connected, the motorman can either send or receive a call from the central instrument, and therefore establish communication with the general system.

TIME SYSTEM

A time system is being installed along lines similar to those employed for the telephone system, all clocks to be regulated by one master clock at the Chelsea generating station. Both single and double-dial clocks will be used, each one of which will have its own independent movement and be electrically wound. They will be arranged to operate on a metallic circuit in groups of about twenty, this circuit to be supplied with current from the signal motor-generators in the sub-stations at approximately 70 volts pressure. Any number of circuits can be synchronized from the master clock by the insertion of a relay or relays in series with the synchronizing line at the end of any circuit and making a new tap to the 70-volt mains at this point.

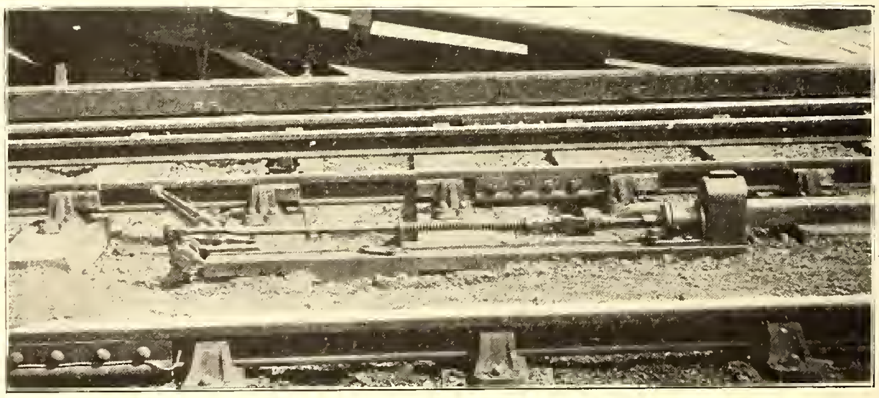


FIG. 64.—AUTOMATIC TRAIN STOP

AUTOMATIC SIGNALING

The Westinghouse electro-pneumatic systems of automatic signaling and power interlocking have been adopted. The power interlocking is similar to that installed in the United States, one of the more important differences being in the switch layouts. In Fig. 63 it will be seen that the detector bar, bolt lock and indication box are in series; also that the plunger passes through two blades, one blade being fixed to each switch point. This insures the proper position of both switch points before the plunger passes through the lock blades and prevents a return indication being received if any part of this series is defective.

The block system is on the normally clear principle, compressed air holding the signal clear as long as its valve magnet is energized. A train entering a track section de-energizes the track instruments, thereby opening the circuit, including the valve magnet. The valve magnet being de-energized, closes the port admitting air to the signal motor, at the same time opening the motor cylinder to the atmosphere and causing the signal to go to danger by gravity.

Each signal is provided with an automatic train stop, Fig. 64. When the signal goes to danger, the stop arm is raised to a vertical position near the right-hand running rail. Should a train attempt to pass a signal at danger, this arm would engage with and open a cock on the train, causing an emergency application of its brakes. When the signal goes clear, the train stop arm is lowered, allowing the train to pass without interference. An overlap averaging 400 ft. has been allowed so that a signal cannot go to safety until the tail end of the train is the length of the overlap beyond the next signal. A train stopping anywhere therefore has the signal at danger behind it, never nearer than the length of the overlap, a distance greater than is required to stop the train with an emergency application of the brakes when at maximum speed.

The connections of the track circuits controlling the automatic signals are shown in Fig. 65. The track circuit as ordinarily applied to steam roads would be unsafe on a road using electricity for motive power. The presence in the track rails, forming part of the track circuit, of current extraneous to the signal system would cause false indications of safety.

The track rails do not normally carry any of the traction current, a second and negative conductor rail being used; but defective insulation of train apparatus, cables or conductor rails, although possibly infrequent, would create extraneous current conditions prohibiting the use of any system not beyond their influence.

The track-circuit system adopted was invented by H. G. Brown, one of the Westinghouse Company's engineers, this system being selective between the normal signal and extraneous currents. One of the running rails is electrically continuous throughout the entire length of the road, and constitutes the positive conductor from the signal generator to the individual track sections. The other rail is divided into block sections by insulated joints, all other uninsulated rail-joints being bonded to insure good electrical continuity. Power is supplied from the signal motor-generator sets installed in each sub-station at 70 volts pressure, the negative terminal of these machines being connected to an insulated conductor running the entire length of the system. This main is connected to each section of the sectionized track rail at a point near the latter end of the block—that is, the end at which the train leaves the section. Resistances are interposed in the connections between the negative main and the sectionalized rail, which reduce the potential difference between the rails to 3 volts to 6 volts, according to the length of block and local conditions. These resistances prevent the short-circuiting of the generators when a block is occupied, and are sufficient to prevent the generators being overloaded when all the blocks are occupied by trains.

There is considerable variation in the resistance of the roadbed, according to weather conditions, but the operation of the signals has in no wise been interrupted by repeated and extensive flooding of the tracks. The relay track coils are permanently connected across the rails, and are therefore energized and close the local signal circuit when a difference of potential exists in the normal direction between the rails—that is, when no train is on the block. The polarized relays are energized in the normal direction by the signal current when the section is clear, and when so energized close the local signal circuit, as shown in Fig. 65. When a train enters a section, the relays are short-circuited, thereby opening the local signal circuit, causing the signal to go to danger.

Fig. 66 shows the mounting of the relays, these being in multiple in relation to the signal current.

When a train is in the section they are in series in relation to extraneous currents flowing in the continuous rail, and therefore one of them is reversed when illegitimately energized and the signal circuit thereby opened at that point. With a grounded train in a section, the current flowing from the sectionized rail to the continuous one would reverse both relays. The local signal circuit is always open when the section is occupied, as one relay is always shunted from or reversed by an extraneous current, and in the majority of cases both are either shunted or reversed.

Small air compressors are located in the sub-stations, which deliver air at 80 lbs. pressure to the automatic signals and

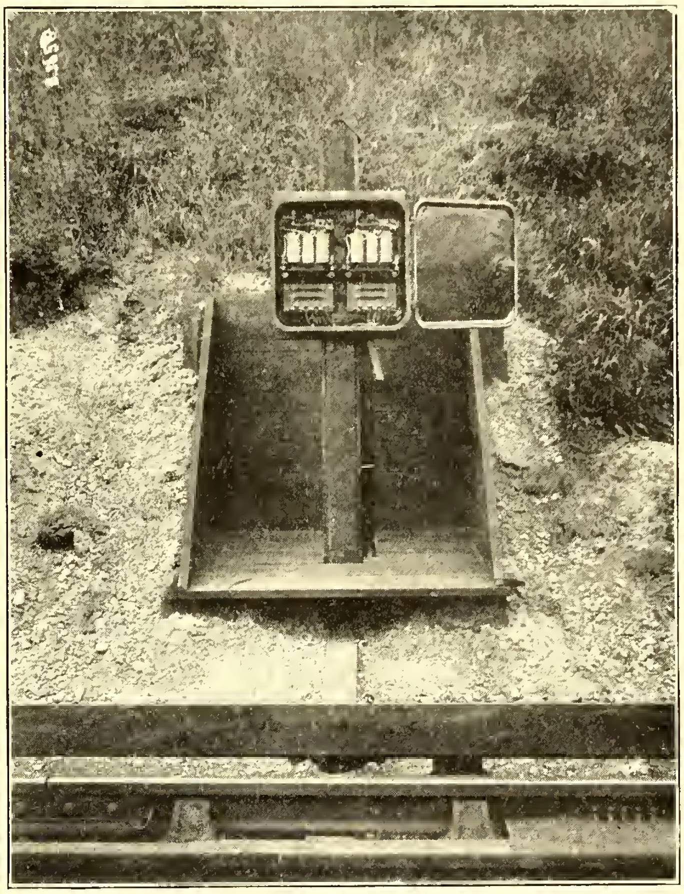


FIG. 66.—MOUNTING OF SIGNAL RELAYS

power interlockings by means of a pipe extending the entire length of the system.

TRAIN DESCRIBER

A magazine train describer is being installed in connection with the signal system, the line between the sending and receiving stations having a capacity varying from five to twenty trains. Illuminated signs will be erected on the station platforms, these to indicate the three next trains in the order of their arrival. The departing train cancels its own description, the remaining two descriptions moving up simultaneously with a new announcement. For illustration we will assume that cabin A is sending descriptions of passing trains to cabin F, and that B, C, D and E are intermediate stations. Cabin A may send ten descriptions to F, providing the line has sufficient capacity, before the first train reaches F, these descriptions being automatically stored in their proper sequence in the receivers at B, C, D, E and F. The cancellation of the passing trains by cabin F causes the next description stored within the instrument to be displayed, this operation at the intermediate stations being done automatically, as previously described. It is expected that this method of announcing arriving trains will greatly facilitate the loading, and thereby shorten the station stops.

TRAINS

Seven-car trains, consisting of three motor cars and four trailers, will be used on the District Railway; six-car trains, with two end motor cars and four trailers, on the Great Northern Piccadilly & Brompton and the Baker Street & Waterloo Railways, and five-car trains, with two end motor cars and three trailers, on the Charing Cross, Euston & Hampstead Railway. The seating capacity of these trains is 364, 304 and 250, and the estimated train weights, without passenger load, are 137.5 tons, 135.7 tons and 116.9 tons (2244 lbs. per ton), respectively. The Board of Trade regulations in regard to "tube" railways do not permit the use of a motor car in the center of the train, and all tube trains therefore have but two motor cars, one at either end of the train.

The District cars are constructed mainly of Oregon pine and white ash, with mahogany trimmings, all woodwork being thoroughly treated and thereby rendered absolutely non-inflammable. The automatic couplers are of the vertical plane type, with manganese steel jaws. The buffers are of cast steel, with horizontal corrugations, the object of this construction being to effectively lock the couplings and so prevent any individual car from rising in case of accident. Both ends of the cars are protected by a ¼-in. steel plate, extending from the end sills to the roof carlines, with an arched center opening and no door.

Luggage accommodation is required by statute on a portion of the District trains, a compartment for this purpose being provided in the driving end of the end motor cars only. The motorman's cab is located in one corner of this compartment, the design being such that the cab in the trailing motor car may be easily and quickly folded back when not in use. The platforms of these cars are entirely enclosed and constructed with side and end sliding doors instead of the customary gates. Double sliding doors are provided in the middle of the cars for the exit of passengers at the same time that they are being loaded from the end doors. All side doors are opened and closed by compressed air controlled by a lever on the end of the car, this operation being performed by the train guards. The cars for the "tube" railways will be of steel construction throughout, without luggage compartments, and with the usual platform gates. Figs. 67 to 71 show the general construction and arrangement of the District cars.

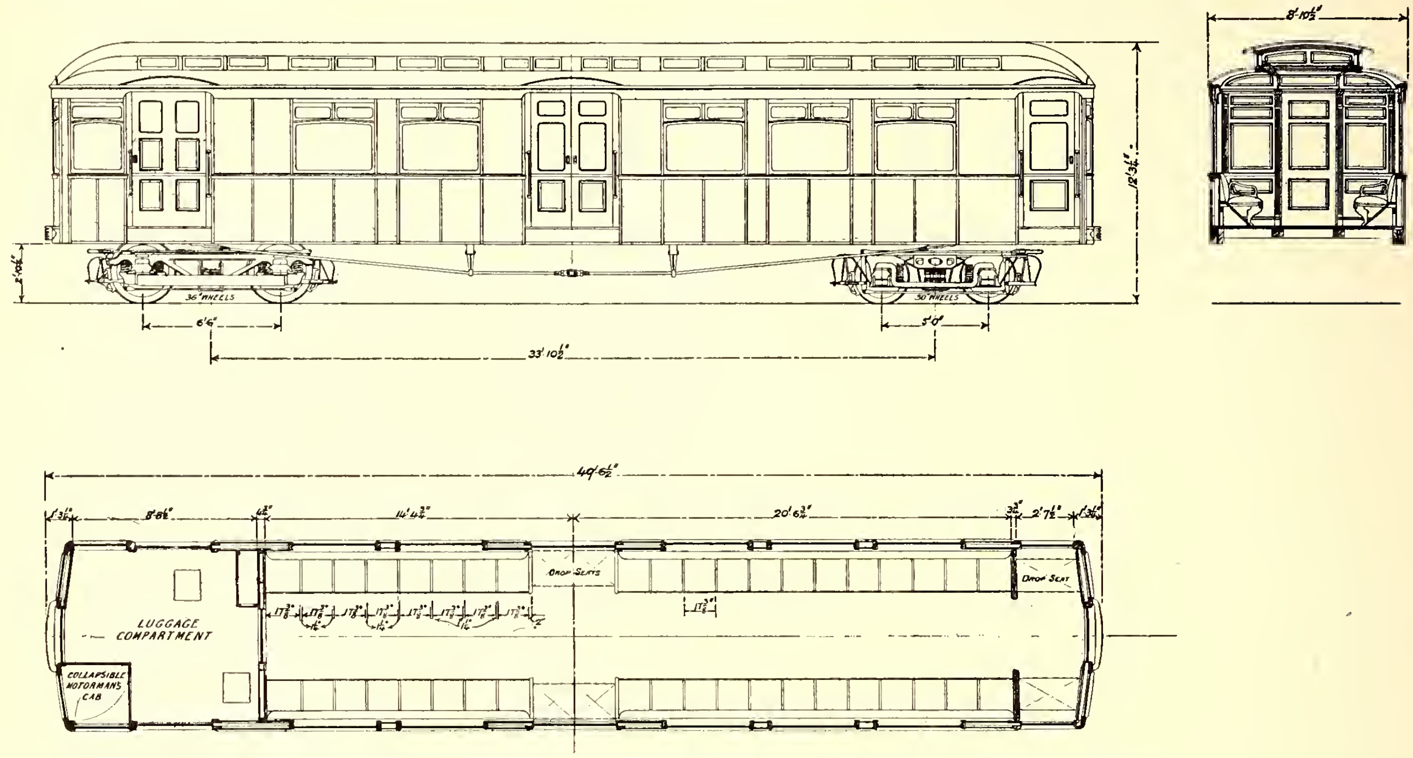


FIG. 67.—SIDE ELEVATION, PLAN AND CROSS-SECTION OF DISTRICT RAILWAY END MOTOR CAR

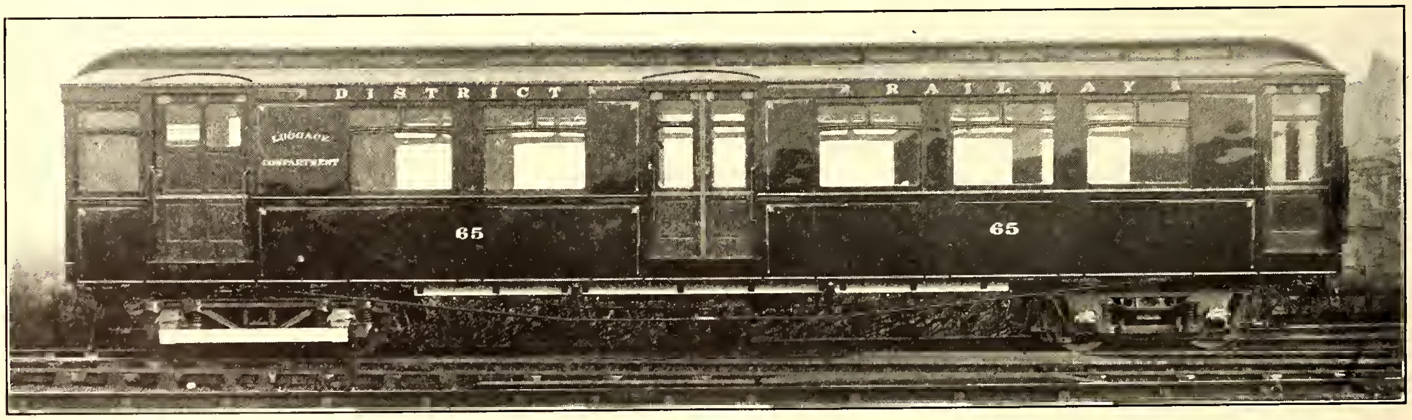


FIG. 68.—SIDE VIEW OF DISTRICT RAILWAY END MOTOR CAR WITH LUGGAGE COMPARTMENT

CAR EQUIPMENT

The main equipment for the trains is being supplied by the British Thomson-Houston Company, Limited, and consists of the standard 200-hp GE 69 motors and type "M" control. The motor frame is not split, but is of the well-known box frame type, with frame heads carrying the armature shaft bearings. The motors are mounted on a cast-steel struck of the Hedley type, with 6-ft. 6-in. wheel base and 36-in. wheels. The motor is arranged for nose suspension, and is also provided with safety lugs to prevent the motor from falling in case the nose should break. The motor is mounted on or removed from the truck from above when the truck is out from under the car, no pit being required. Each motor is provided with a suitable connection box, in which the motor leads are connected to the car wiring. The motor leads are protected by flexible metallic armouring, one end of which is sweated into a brass plug tapped into the motor frame, while the other end is secured to the connection box by standard pipe unions. This provides mechanical protection for the motor leads, and can be easily uncoupled when desirable to remove a motor. The gear is split in halves with a 7-in. bore and designed to go directly on the axle. Each motor car will be equipped with two motors, the weight of one motor complete, including gears and gear case, being about 6100 lbs.

The type "M" system of control consists in general of two parts: First, a series-parallel motor controller composed of a number of electrically-operated switches called "contactors," and an electrically-operated reverse switch for the motors called the "reverser." The contactors make the different electrical combinations of the motors and regulate the starting resistance in circuit with them. Second, a master controller which operates the motor controlling contactors and reverser, this being located at one end of each end motor car and at both ends of each middle motor car. The control cable which connects each master controller with the contactors is extended the entire length of the train, connecting the control circuits of the several motor cars together by means of flexible couplers between the cars. The position of the master controller handle indicates to the operator the exact resistance and motor combinations on all of the motor cars. The master controller is manually operated and non-automatic. The motorman therefore has the train under his immediate control and can utilize the full power of the motors in either direction in an emergency. The master controller is designed so that in case the motorman removes his hand from the operating handle for any cause, the control circuit will be opened, thus shutting off all power from the train; releasing this knob at any position of the handle will also open the air valve in the controller and the air brakes will be applied on all the cars of the train. After applying the brakes by means of this device, they may be released by simply depressing the knob at the off position of the handle, and to render this air brake feature inoperative it is only necessary to move the reverse handle to the mid position. For reversing the motors the master controller is provided with a separate reversing handle, and a mechanical interlocking device prevents this reversing handle from being thrown unless the main handle is in the off position. The operating circuit is so arranged, that unless the reverser is thrown for the direction of car movement indicated by the master controller reverse handle, the contactors and motors on that particular car are inoperative. All current for the operation of the contactors on each of the different cars throughout the train passes through the single master controller under the immediate control of the motorman. This current may be taken directly from the collector shoes on the leading car or from the shoes on the following motor car by means of the bus line on the District trains, or by means of the lighting mains on the "tube" trains, but in either case it is controlled by the single master controller in use. Should the train break in two, the control current is automatically and instantly cut off from the detached rear portion of the train without affecting the ability of the motorman to control the front part of the train. There are four rheostatic and one running point in series and three rheostatic and one running point in parallel, the relative resistance for each step being such as to insure smooth acceleration of the train. A smooth transition from series to parallel combination is insured by making the necessary circuit changes without short-circuiting or open-circuiting either motor. A series parallel arrangement of rheostats is used which produces the best possible proportioning of resistance sections, and at the same time gives uniform distribution of current per contactor. It is worthy of mention that these trains are the first in England to use the so-called bridge method of changing from series to parallel combination of motors. The change is effected by this method without interrupting the current in either motor, which is maintained at

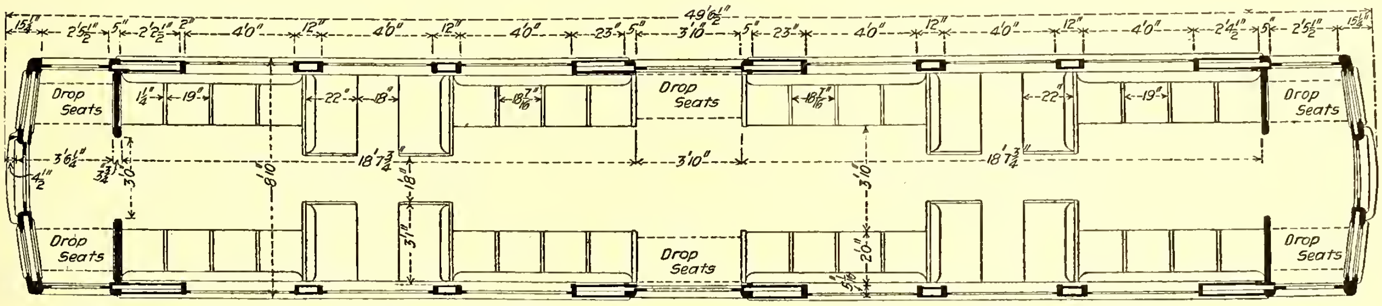


FIG. 70.—PLAN OF TRAIL CAR FOR THE LONDON UNDERGROUND DISTRICT RAILWAY

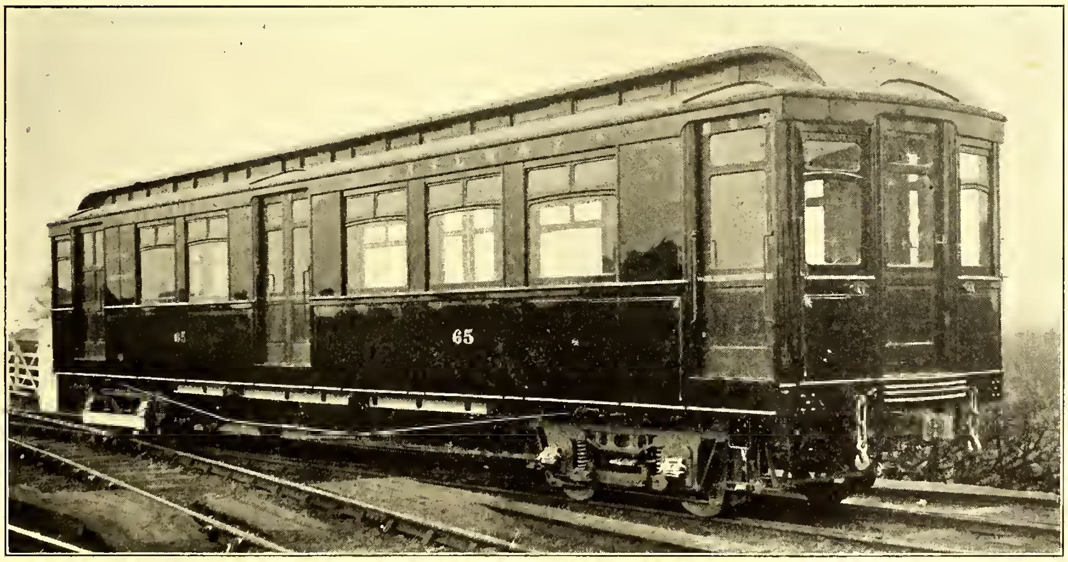


FIG. 69.—DISTRICT RAILWAY END MOTOR CAR WITH LUGGAGE COMPARTMENT

practically a constant value throughout the whole range of rheostatic acceleration. This eliminates entirely the somewhat unpleasant sag in speed which is noted when the motor current is interrupted while the motors are passing from series to parallel relations.

Another of the recently developed features with which these equipments are provided is the electrically-operated carbon break circuit breaker for the protection of the motor circuit on each motor car. Each circuit breaker is provided with a setting coil, by which it is closed; also a shunt and an overload tripping coil. Once closed by the setting coil the circuit breaker is held in the closed position by a mechanical lock. Either one of the tripping coils will open the circuit breaker by releasing the mechanical lock. The circuit breaker is built in the form of a contactor and is enclosed in a separate sheet-iron asbestos-lined cover. All circuit breakers throughout the train are closed by the setting coils energized from one of the control

FIG. 71.—INTERIOR OF MOTOR CAR WITHOUT BAGGAGE COMPARTMENT FOR DISTRICT RAILWAY

wires at the off position of the master controller, this wire being energized by the circuit breaker setting switch in the driving cab. All circuit breakers may be instantly tripped, irrespective of the position of the master controller, by merely closing the tripping switch in the cab, thus energizing the shunt trip coil of each circuit breaker. In addition, any circuit breaker may open automatically through an overload in the motor circuit without affecting the remaining circuit breakers in the train, merely cutting out of service the motors on that particular car. Magnetic blow-out, ribbon type fuses are used for the protection of the main circuits on the motor cars. Each positive collector shoe is protected by a shoe fuse mounted on the shoe beam. The motor circuit is protected by a positive and a negative fuse in addition to the circuit breaker, the negative fuse being considered advisable, as the negative conductor rail is not earthed. These fuses are of the ribbon type and are mounted beneath the car close to the contactors. The positive leads of the bus-line coupler sockets on the District trains are protected by coupler fuses, which prevent an abnormal flow of current through the bus line should the train run from a live to an earthed section of the conductor rail. These fuses are also of the ribbon type and are mounted beneath the car.

The copper strands of the heavy car wiring cables are first wrapped with paper tape, then rubber insulated, taped and served with one cotton and one asbestos braid. A slate-colored lead paint, containing very little oil and practically non-inflammable, is used to finish these cables. Standard Westinghouse automatic air-brake apparatus, with Christensen compressors, made by the National Electric Company, of Milwaukee, Wis., completes the train equipment.

ARRANGEMENT OF EQUIPMENT

On the District trains all of the controlling apparatus, air compressors and governors are installed under the car between the trucks. The control apparatus is all enclosed in well insulated metal covers supported from hard wooden beams. The main wiring is all run in drawn steel tubes, the rheostat and contactor leads being supported in wooden troughs lined with uralite. On the "tube" trains all the control apparatus, as well as the air compressors, is carried in a steel cab at the driving end of the car. Here the contactors and circuit breakers are hung from horizontal slate panels supported by rigid steel framework. This framework also carries the rheostats. This form of construction was adopted because the small diameter of the tunnel does not allow sufficient room for the apparatus to be carried under the car. It is also considered safer on the "tube" lines to have the apparatus enclosed in a steel cab in case of any fault developing in the equipment while a train is running in the tunnel.

CAR SHEDS

The District car sheds are located between the Mill Hill Park and Ealing Common stations parallel to the tracks, and cover a little over 4 acres. The building is divided into three equal bays by longitudinal fireproof walls, the over all length and width being 802.5 ft. and 216.5 ft., respectively. The structure is of steel construction with brick walls, each bay being spanned by a trussed monitor roof of corrugated iron and patent glazing. A total of eleven tracks, four in the paint shop, five in the inspection shop and two in the repair shop, are provided for housing the trains, inspection and repairs, entrance to the sheds being obtained from either end of the building. There is accommodation for about 150 cars under cover and 200 cars on the sidings. Working pits are provided under all tracks in the inspection and repair shops, the latter being equipped with the necessary machine tools and electrically-operated traveling cranes.

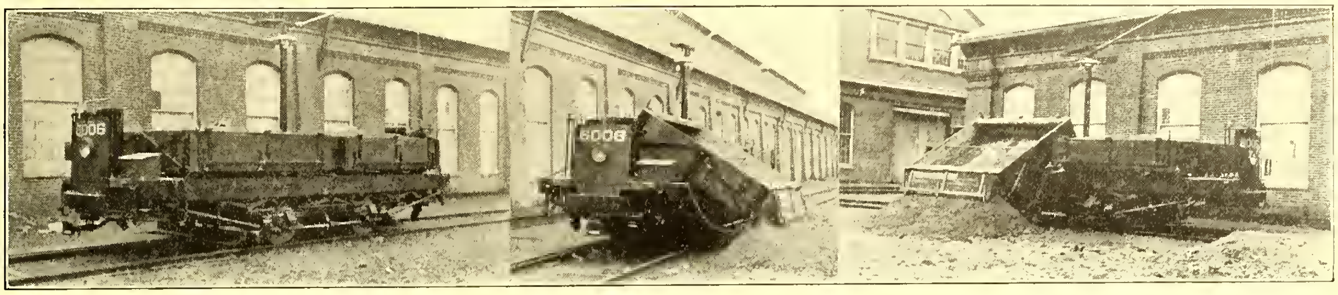
The writer is greatly indebted to the British Westinghouse Electric & Manufacturing Company, British Thomson-Houston Company, Babcock & Wilcox, Brush Electrical Engineering Company and Mayoh & Haley for photographs used to illustrate the text; also to F. T. Wright for assistance in the preparation of maps and drawings.

A RECORD OF COMPANIES AND MILEAGES CONSTITUTING THE PENNSYLVANIA RAILROAD

The Pennsylvania Railroad has recently published a record of the transportation lines owned and operated by, and associated in interest with it, for the year of 1904. This record forms a basis for a very interesting study, indicating, as it does, much of the organization of this great railroad system and its constituent lines. It is interesting to note that this great system now embraces a total length of lines of 10,588 miles, passing through twelve States of the Union and the District of Columbia. The State embracing the greatest mileage is Pennsylvania, in which there are 3900 miles of lines. Of this mileage, 5857 miles lie east of Pittsburg and Erie, embracing twelve different railroad companies, and 4731 miles west, embracing ten companies. It is interesting to note that it owns 66 miles of canal and operates seven ferry lines. The record is also of service in tracing the connection of the early railroad companies with the present organization; the pioneer roads which are of historic interest in the development of railroading in this country are separately enumerated. The record occupies 41 pages of a 9-in. x 12-in. pamphlet, which contains also a comprehensive map of the system.

SIDE DUMPING CARS FOR BALLASTING TRACK IN BALTIMORE

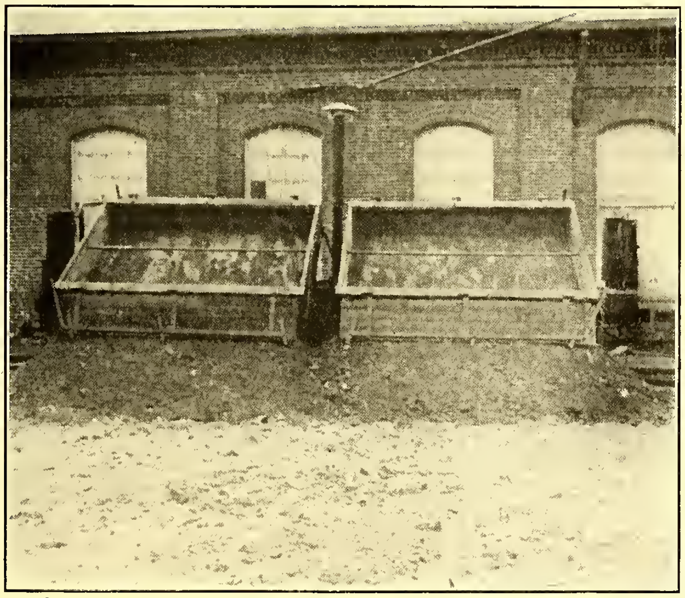
The United Railways & Electric Company, of Baltimore, Md., is doing considerable reconstruction of track work and has found need for an efficient dump-car equipment to facilitate the handling and distribution of ballast. To fill this need a novel type of dump-car has been designed and built at the company's shops under the direction of H. H. Adams, master mechanic.



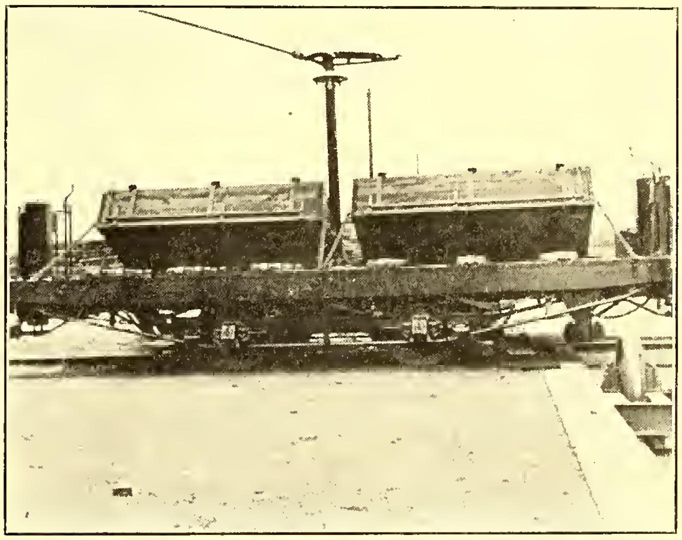
BALTIMORE DUMP CAR IN DIFFERENT POSITIONS

The car is illustrated in the accompanying engravings. The capacity of each car is about 8 cu. yds. and the weight of car, light, is 18,910 lbs. The cars are mounted on Lord Baltimore single trucks, with two Westinghouse 49 motors and K-10 controllers to each car.

The dumping feature of the car consists essentially of two boxes arranged with three channel irons on the bottom of each, these irons resting upon rollers, there being four rollers under each channel. The boxes may be dumped by pushing them upon the rollers toward the side of the car from which it is desired to unload. Each box has a chain fastened to each one of its lower corners, this chain being attached to the sides of the car as shown. On each end of the box there is also a chain, one end of which is fastened at the center of the box and the other end is fastened in the center of the car. This chain is just long enough to allow the box to pivot on the three outer rollers when it is in position to be dumped. The angle the box is allowed to take in dumping is regulated by the length of the check chains on the corners of the boxes.



SIDE VIEW, SHOWING BOTH BOXES TIPPED



BOTH BOXES TIPPED, SHOWING CHECK CHAINS

The doors on the side of the boxes are fastened at three points, and are so pivoted that when released they will swing outwardly and permit the contents of the boxes to slide to the ground when boxes are tipped. These doors are connected to a common lever at one end of the car and all the doors can be operated by this one lever.

The boxes are held in normal position upon the body of the car by a heavy latch, which is operated by a lever, shown in the end view of the box in one of the engravings. In addition to this latch, the center check chains on each side are drawn over a heavy forged hook, thus holding the box so that it cannot go either way until released.

The boxes can be operated easily by two men, who can readily push the loaded boxes to dump material. However, the floor of the car is arranged with two plates having holes in them to receive the end of a bar, in order to provide means for moving the boxes more easily. With the use of a bar one man can dump the boxes. One of these plates is placed across the car as near the center of each box as possible. After the load has been dumped, two men can readily place the box back in position again. It is stated that this type of car has been of the utmost service and convenience to the track department in distributing materials for ballast and filling.

INDIANA ELECTRIC RAILWAY GUIDE

A monthly publication of thirty-two pages bound in attractive cover is to be issued under the direction of a committee of three from the Indiana Electric Railway Association. It is to be known as "The Indiana Electric Railway Guide." The editor and manager is to be Paul Richey, for three years assistant in the office of the chief engineer of the Indiana Union Traction Company, and previous to that in the newspaper business. In addition to time-tables, etc., there will be printed in the Guide considerable reading matter of general interest.

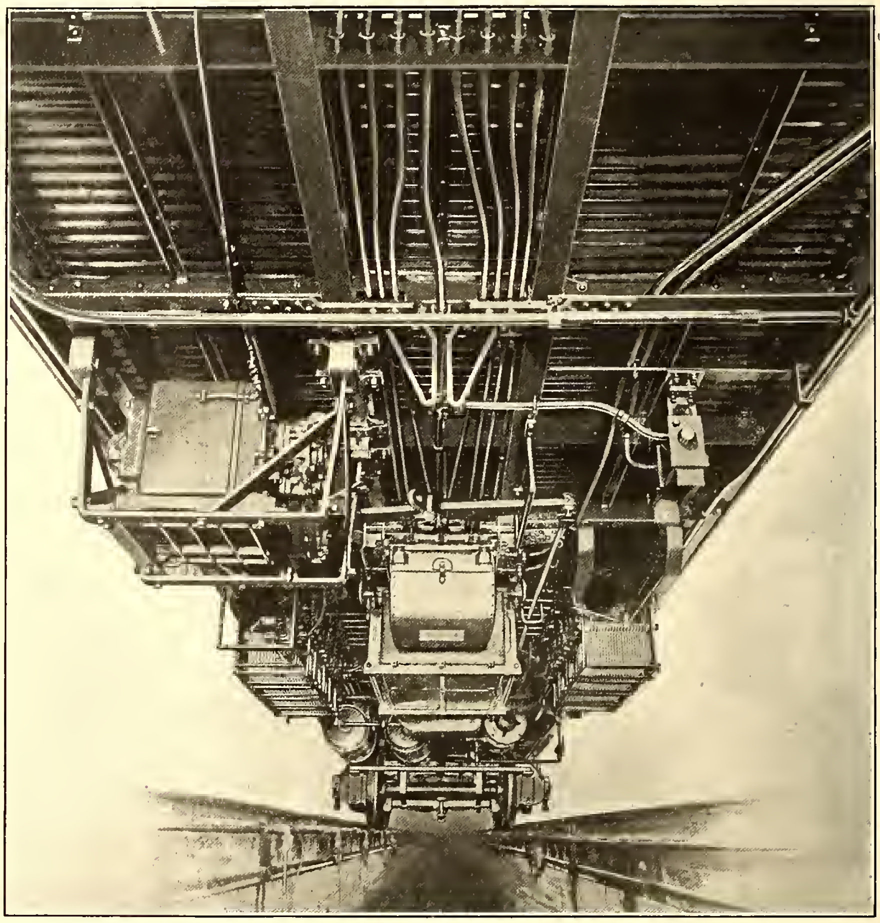
THE ELECTRICAL EQUIPMENT OF THE NEW STEEL CARS FOR THE NEW YORK SUBWAY

BY L. B. STILLWELL

Many engineers, especially those whose viewpoint is mechanical rather than electrical, have recognized the fact that in the remarkable development of electric traction systems the wiring of cars in general has by no means kept pace with the advance in motor construction and in systems of control. It has been repeatedly demonstrated in practice that insulation of rubber and cotton braid is not satisfactorily effective when subjected to abrasion or other mechanical injury, and that insulation of average quality as ordinarily installed deteriorates rapidly under the very severe conditions which it is called upon to meet in service. Even in cases where competent engineering advice has directed the car equipment and where skilful and faithful work has been done by the wiremen, the practical difficulties encountered in meeting the conditions imposed by the nature of the service have not always been satisfactorily and successfully met, and in the very many cases where short-sighted management has sought to economize by eliminating the engineer and purchasing cheap wire, rapid deterioration and frequent failure of the car wiring have been the natural and, indeed, inevitable consequences. A glance at the wiring of an average street car that has been in service for five years is sufficient to convince any practical man that this part of electric car equipment has been relatively neglected, and the frequent partial or even total destruction of electric cars by fire originating in the wiring has attracted general attention to the importance of radical improvement in respect to this important feature of the equipment.

In the equipment of the new steel cars of the Interborough Company, the organization, mechanical support and protection and electrical effectiveness of the car wiring have been the subject of careful investigation and much special study, with the result that improvements have been introduced which mark a distinct advance in the art of car wiring. The investigation by the electrical department of the company covered all classes of electric railway service, both here and abroad; the causes of difficulties encountered in actual service were carefully studied, in order to eliminate, so far as practicable, possibilities of similar troubles in the subway cars, and the results obtained as herein described are both interesting and highly commendable. This article will thus supplement the description presented in the recent "Souvenir" issue (Oct. 8, 1904) of the STREET RAILWAY JOURNAL, which contained interesting details of the mechanical construction of the steel cars.

The adoption of car bodies employing steel exclusively for not only framing, but also flooring, made it impossible to support the wiring beneath the car floor by any of the methods usually adopted. The use of wood, which more satisfactorily than any artificial substitute combines mechanical strength and "workableness" with good insulating properties, was prohibited by what was regarded as the primary consideration in the design and construction of these cars, viz., elimination of fire risk. Other methods of wiring, involving the carrying of wires above the floor of the car, were disapproved, as it was the aim of the company's engineers to keep all wiring and apparatus, so far as practicable, beneath the under framing; or in other words, outside the steel box which constitutes the car body. The problem presented, therefore, involved the construction of adequate mechanical supports for the large amount of wiring required by two motors of 200-hp each and a control system of twelve rheostatic steps, these supports to be attached to the steel under framing of the car; the protection of this wiring against abrasion and other mechanical damage; the use of insulation having an ample margin of safety with reference to the potential employed, and still the reduction of the amount of insulating material to an absolute minimum. This last particular requirement was emphasized by recognition of the fact that while actual risk to passengers inside the car which might result from any possible burning of wire insulation underneath the car was negligible; there remained risk of accident by reason of panic which might be caused by smoke from burning

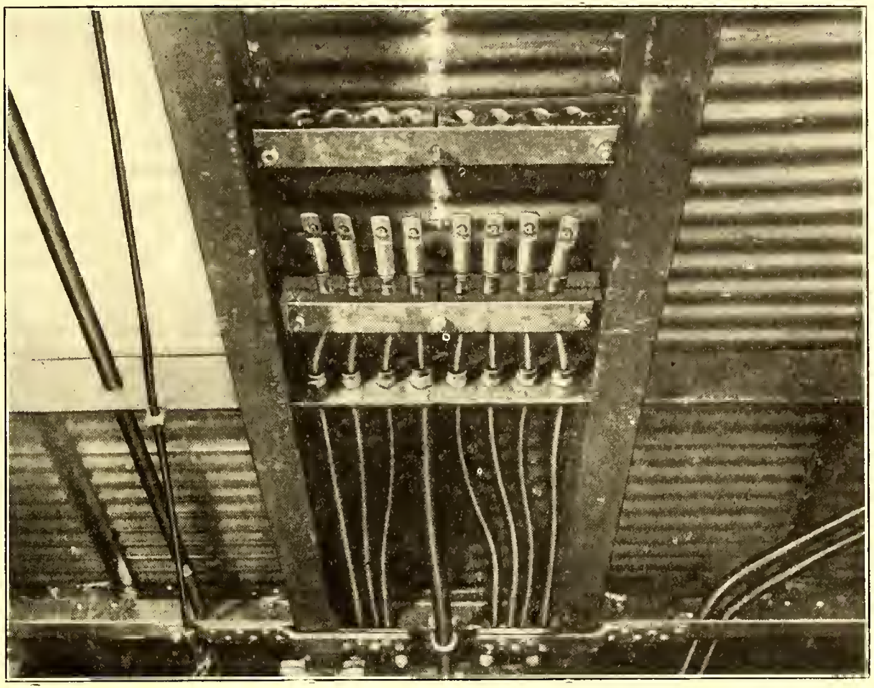


VIEW UNDERNEATH ONE OF THE STEEL CARS USED IN THE INTERBOROUGH SUBWAY IN NEW YORK CITY, SHOWING LARGE AMOUNT OF APPARATUS FOR THE MOTIVE POWER AND BRAKING SYSTEMS

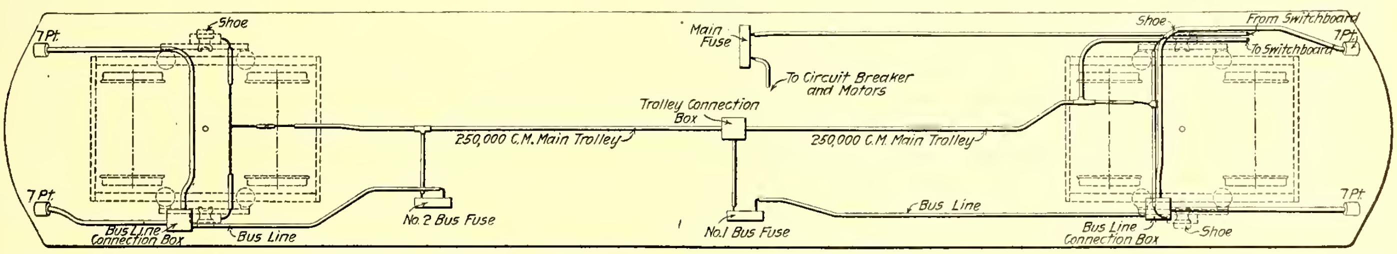
insulation. Obviously, since our best insulating materials are inflammable and in burning give off much smoke, it was necessary to balance against the requirement of insulation adequate from an electrical standpoint the equally obvious advantage of minimizing the insulation in view of the fire or smoke risk. In view of these considerations, the insulation selected for the wiring is of very high grade and moderate thickness, the insulation of conductors of larger sizes being 4-64 in., while that of the smaller conductors is 3-64 in. As to quality, the specifications of the company's engineers called for not less than 30 per cent pure Para rubber. This insulation is covered and protected by a single "weatherproof" braid, and in the case of all of the larger wires carrying comparatively heavy currents, this braid is in turn covered and protected by a heavy braid of asbestos. The thinnest insulation was subjected at the factory of the manufacturer to a test of 2500 volts for five minutes, the working potential in service being 570 volts. It may be mentioned here that it is the practice of the company to test the aggregate insulation of each car when completely equipped by applying momentarily an alternating potential of 2000 volts between copper and ground. This test is repeated every time a car goes through the shop for a complete overhauling. I established this practice in connection with the equipment of the Manhattan Railway, and to it, together with the use of sheet asbestos between the electrical apparatus and the car floor, and the careful work done by the car equipment department, I attribute the immunity from fires which hitherto that company has enjoyed. This immunity is certainly remarkable in view of the fact that the equipment of the Manhattan division comprises over 1400 cars, of which more than 800 are motor cars, and that these cars are operated in a daily service exceeding 170,000 car-miles.

In equipping the steel cars, the method adopted conforms to the best approved principle of interior wiring of buildings, viz., the use of metal pipe conduits thoroughly grounded. This method has been used before in some cases. An obvious objection is the fact that it is not easy to provide effectively against abrasion of insulation where wires enter or leave the conduits. An apparent, though from some points of view not real, objection is the fact that the insulation of the wire itself is not reinforced, as in cases where wiring is cleated against wood undersheathing. Its principal advantages are ample mechanical strength, durability and consequently low cost of maintenance and effective protection of the wires against mechanical injury. Furthermore, in the opinion of the company's electrical advisers, the fact that a possible failure of the insulation will result in immediate and harmless grounding of the circuit and blowing of fuses is a valuable safeguard.

Study of the requirements of train operation led to the adoption of an equipment comprising for express trains five motor cars and three trail cars, and for local trains three motor cars and two trail cars, each motor car being equipped with two motors rated 200-hp each. The Sprague-General Electric multiple-unit system of train operation, employing twelve rheostatic steps, was chosen to regulate the supply of power to the motors. The problem presented, so far as wiring motor cars for power was concerned, was the determination of the best method of providing electrical connections for two motors mounted upon one truck, the multiple-unit control apparatus,



DETAIL VIEW OF CABLES LEADING TO THE MOTOR TRUCK, SHOWING METHOD OF SUPPORTING CONDUITS AND ARRANGEMENT OF "BELL-MOUTH" OUTLETS

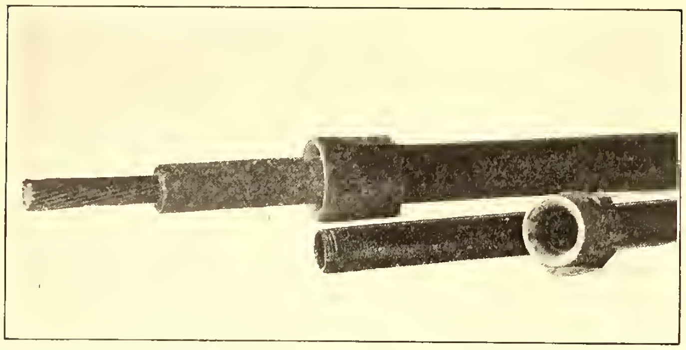


GENERAL PLAN OF THE STEEL CAR, TO SHOW ARRANGEMENT OF MAIN TROLLEY CONNECTIONS BETWEEN CONTACT SHOES AND OF BUS LINES TO JUMPER BOXES

together with the necessary circuit breakers, fuses, reverser, and the electrically-driven air compressor and its governor for the air-brake system. In addition to the power circuits, it was necessary also to provide circuits for heating and lighting the car, which circuits, as has been noted in a previous article, are arranged to be controlled from the switchboard in one of the platform vestibules of the car.

The multiple-unit system, as adopted for the subway, comprises a number of improvements upon its earlier forms. A description of the modified and improved system of control has been published in the March 14, 1903, issue of the STREET RAILWAY JOURNAL, and as the essential features of the system, together with the improvements introduced, were outlined in the above-mentioned article, they will not be referred to in detail in this connection. It may be noted, however, that the apparatus pertaining specifically to the power-control system which is placed beneath the car body, includes the following: A circuit breaker, sixteen contactors with rheostats, a reverser and the necessary connecting boxes for the multi-conductor cables. The cab equipment of each car comprises the master controller and its energizing switch, the circuit breaker resetting switch and the marker and cab heater switches. The multiple-unit control cut-out switch, as well as the main switch for connecting the motors to the trolley line, together with relay for automatically regulating the motors, is located upon the car switchboard in the vestibule, which switchboard also carries the lighting, heating, air compressor and governor control apparatus.

The above engraving illustrates in a striking manner the fact that the amount of electrical apparatus required in the equipment of one of these motor cars is considerable, and no additional evidence is necessary to support the statement that the arrangement, electrical insulation and mechanical attachment of this apparatus beneath the car is a problem calling for skill and careful study in its solution. All inflammable material except wire insulation being eliminated in the construction of this apparatus, it is obviously important that the relative location of the various parts comprising the aggregate equipment should be such as to minimize the lengths of insulated connecting wires, thus minimizing the amount of insulation which may by any possibility burn and evolve smoke. At



VIEW OF A 1-IN. AND A ¾-IN. "BELL-MOUTH" OUTLET BUSHING, THE FORMER WITH A 250,000-CIRC. MIL CABLE IN PLACE

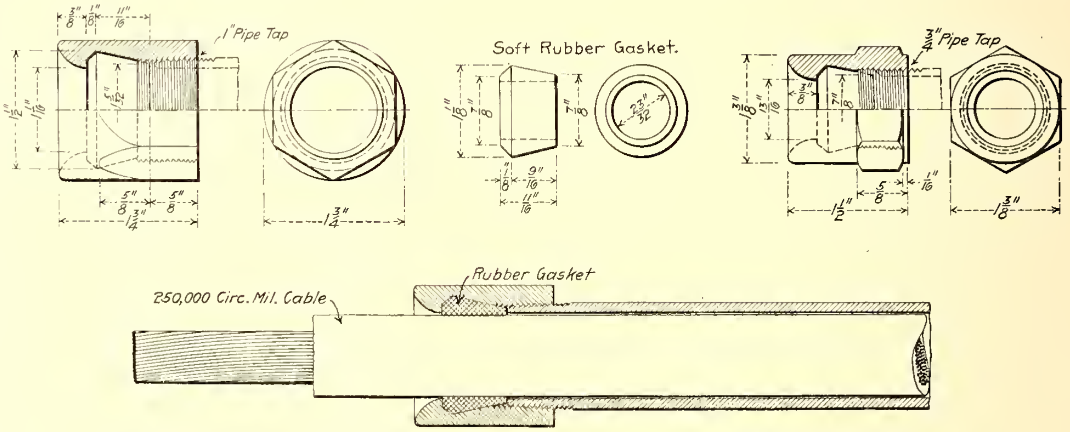
the same time it is obviously necessary that the apparatus be so arranged as to permit effective and reasonably convenient inspection and maintenance, which consideration prohibits undue crowding of the apparatus. With these considerations in mind, the engineers of the Interborough Company finally adopted an organization and arrangement of the apparatus which is believed to constitute a marked improvement upon previous practice.

The arrangement of apparatus chosen is shown in the large drawing reproduced upon the accompanying inset, which is a complete drawing of arrangement of the apparatus and the conduit system beneath the car under framing. An excellent idea of conditions beneath the car and the locations of apparatus is also given in the accompanying photographs, which were taken looking upward from a pit in the repair shop. The innovation in respect to arrangement of apparatus lies mainly in the location of the resistances in relation to the contactors, and in the assembly of the contactors. It will be noticed that the contactors are enclosed in a protecting box located beneath the middle line of the car, and the resistances are located in two rows of four each on either side of the contactors. This arrangement results in bringing the resistances as close to their respective contactors as they can be placed without material sacrifice of effective inspection, the result being that the lengths of the leads between contactors and resistances is reduced to a minimum.

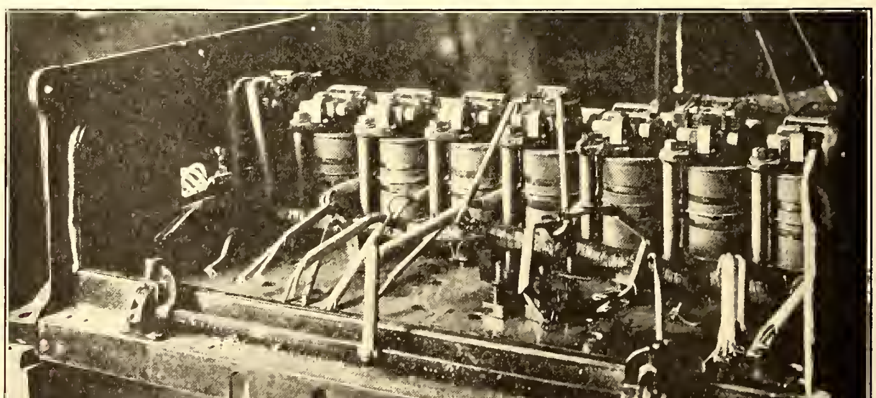
Another important feature of the wiring arrangement is to be noted in the scheme of connections between the main trolley and the bus lines: these connections are for clearness outlined in a separate sketch presented on page 423, which shows diagrammatically the connections between the four collector shoes upon the two trucks, the bus lines and the switchboard. The bus lines are connected directly to the main trolley through enclosed fuses furnished by the D. & W. Company, thus reducing the amount of insulated conductor as compared with the plan of carrying the bus line entirely through from one end of the car to the other, as has been done in some cases. It will also be noted that the connection from the main trolley to the switchboard is short.

The iron pipes in which the insulated conductors are enclosed are of the kind known as "Loricated" conduit, and were furnished by the Armorite Conduit Company, of Pittsburg, Pa. This conduit, which has of recent years been largely used in interior wiring for buildings, is a wrought iron tube heavily covered both inside and out with a hard and durable enamel, which not only serves as a protection against rust, but also tends to prevent abrasion of insulation of wires as they are drawn into place. The enamel is also of some value as insulation; the protection against rust, however, is itself a most valuable property.

The arrangement of the conduits for the various motor, control and light wiring leads beneath the cars is well shown in the drawing upon the accompanying inset. The main trolley and the two bus line connections are always alive when the collecting shoes are in contact with the third rail; the main leads from the collecting shoes upon each truck are connected together by the "main trolley," from which a branch is carried to the main cut-out switch located upon the vestibule switchboard through which the motor circuits are supplied. The bus lines which carry current through the seven-point jumper cables to adjacent cars are tapped off the main trolley as nearly as possible to the truck connections. Between them and the main trolley enclosed fuses are located, as shown. The general scheme of the auxiliary car wiring will be evident upon further reference to the large drawing on the inset supplement. The

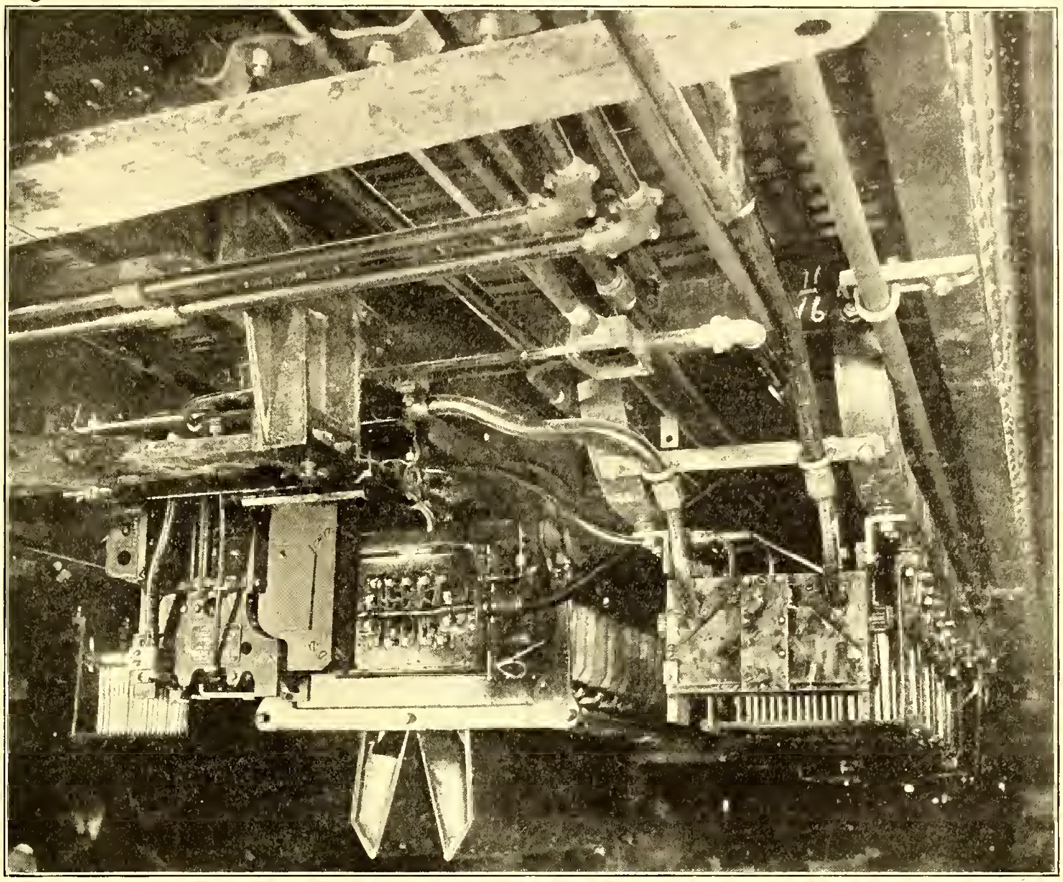


DETAILS OF TWO SIZES OF THE "BELL-MOUTH" OUTLET BUSHINGS AND OF ONE OF THE SOFT RUBBER GASKETS USED TO PREVENT ABRASION TO THE CABLE INSULATION



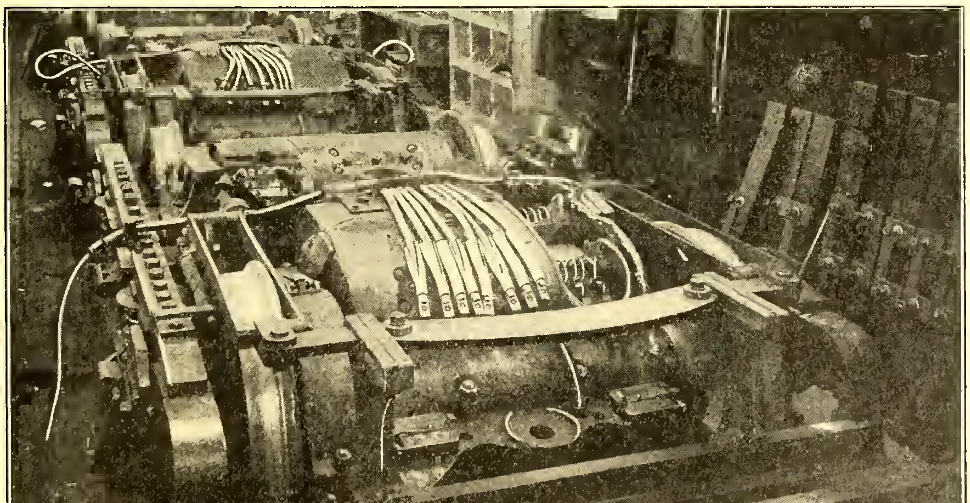
VIEW OF ONE OF THE NEW MULTIPLE-UNIT CONTROL CONTACTOR BOXES, PARTLY ASSEMBLED, TO SHOW METHOD OF WIRING feeder cable leading from the switchboard to the motors passes first to the main fuse box, and from thence to the circuit breaker. After leaving the circuit breaker, this feeder passes directly to the contactor boxes through which, by connection in the various combinations formed by the contactors, current is supplied to the motors. Seven conductors are required to make the necessary connections between the contactors and the motors upon the motor truck. Connection is made from the main trolley connection box through a fuse beneath the car to the switchboard, supplying the current for operation of the air-brake compressor motor, light and heat circuits.

The other important series of connection is the set of control cables. The main train line control cable comprises ten wires, and is carried in a system of conduits easily traceable in the large drawing. Connections to this cable are made in a train line connection box near the body bolster at each end of the car, from which branch cables are run to ten-point jumper connections, and also to the switchboard for the cut-off switch and to the platform for the master controller. The heater circuits which are carried beneath the car are also shown in the engravings.



VIEW BENEATH THE STEEL CAR, LOOKING TOWARD THE CIRCUIT BREAKER AND CONTACTOR BOX, SHOWING TYPICAL ARRANGEMENT AND METHOD OF SUPPORTING WIRING CONDUITS

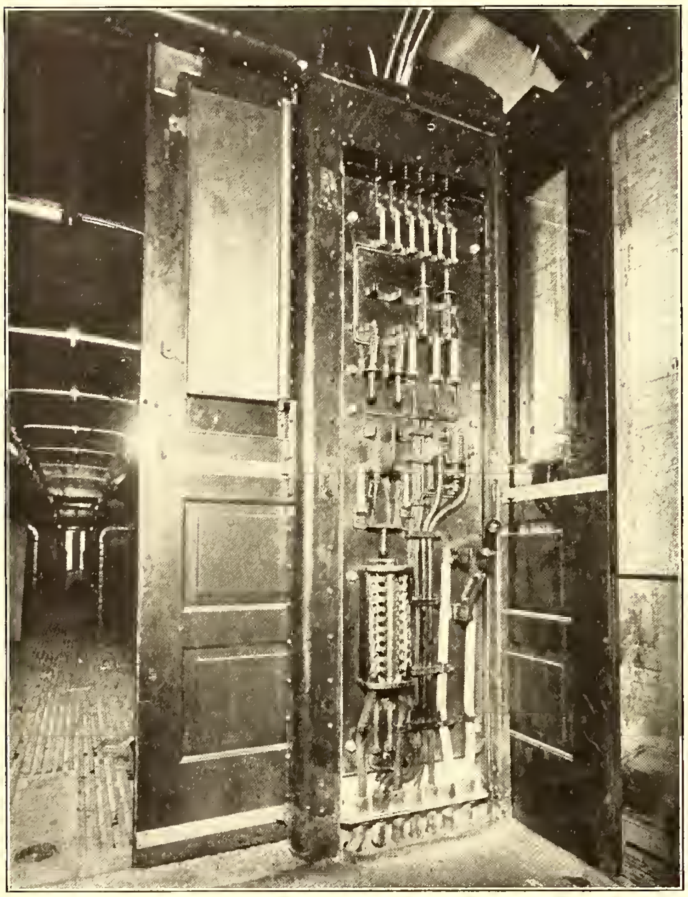
The particular location of each unit of the conduit system is, it is interesting to note, the result of careful investigation of the mechanical conditions to which it is subjected in service. A serious difficulty was encountered early in the development of plans for the new system of wiring, in spite of the proposed use of loricated conduits throughout, with the resulting effective mechanical protection to the insulation of the wires. It was foreseen that, unless some provision was made for holding the wires rigid at their outlets from the conduits, chafing and abrasion of the insulation would result at these points, due to the natural vibration and jarring of the cars when in service, even in spite of the use of the usual smooth-edge outlet bushings which are in common use in interior wiring of buildings. The solution of this difficulty which was worked out is interesting. A special type of outlet cap or bushing seemed to be necessary, and accordingly one was designed for covering the ends of all conduits, which should combine the advantages of gripping the wires so tightly that movement would be impossible, and at the same time furnishing additional insulating properties at the gripping point.



THE ARRANGEMENT OF WIRING FOR THE MOTOR LEADS AND CONTACT-SHOE CONNECTIONS, AS APPLIED TO THE MOTOR TRUCKS USED UNDER THE STEEL CARS

The style of outlet bushing adopted is similar in design to those used in marine wiring, this having a special "bell-mouth" shape of opening, the flaring edges of which favor the wire at its exit by compelling an easy curve. The details of one of these "bell-mouth" bushings as adopted for use upon the wiring of the steel cars is shown in an accompanying engraving. The body of the "bell-mouth" proper is made of malleable iron, with a hexagonal shoulder at one end. That end is threaded for the standard pipe sizes, as shown, so that in screwing the bushing upon the conduit the contained rubber ring or washer meets the end of the latter and is thereby compressed. It is evident from the accompanying views that no harm can possibly come to the wiring insulation from this source, yet the wires will be held rigidly, and vibration at this point, which might otherwise be particularly dangerous, will be effectually eliminated.

It will be noted that the means adopted to prevent mechanical injury of insulation at points where the wires leave the conduits involve also effective protection against access of moisture to the interior of the conduit. The construction in this respect is closely analagous to the best practice in marine wiring, in the installation of which it is necessary to provide not only rigid supports for the wiring, but also to secure effective protection against moisture.

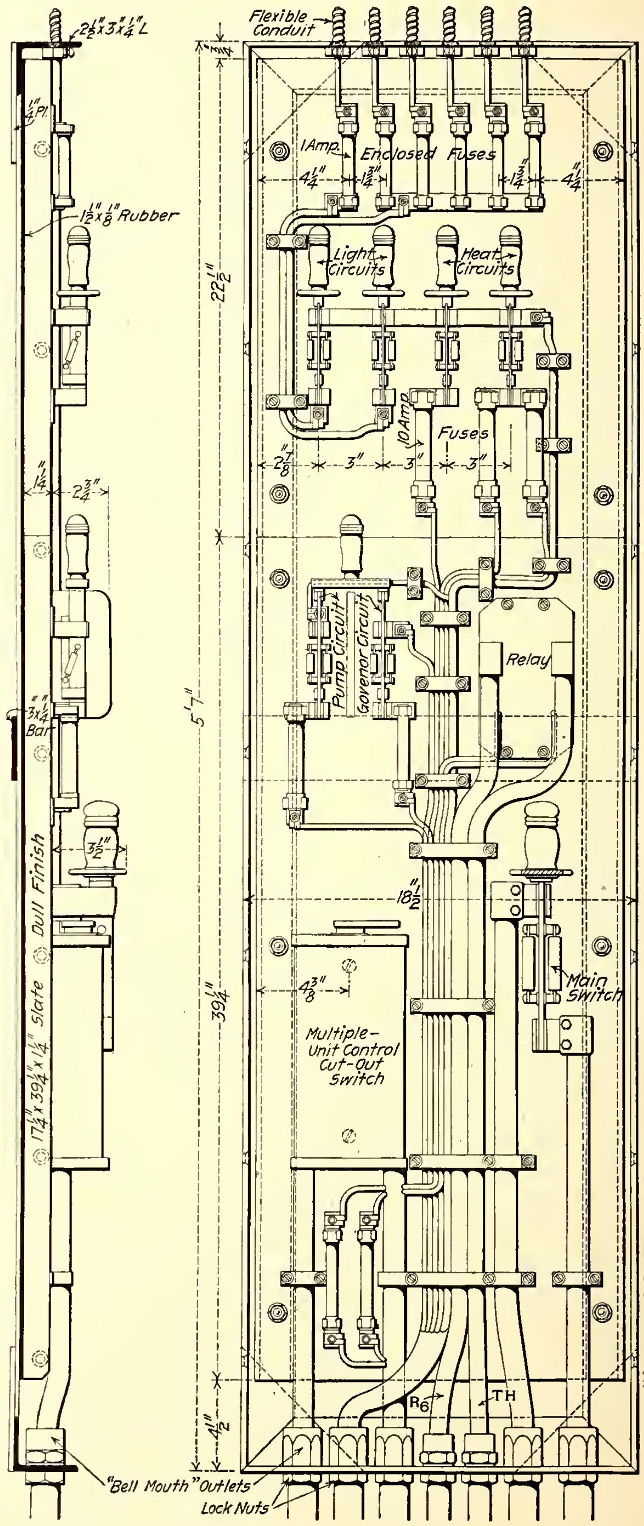


THE VESTIBULE SWITCHBOARD USED ON THE STEEL CARS FOR THE HEAT AND LIGHT CIRCUITS AND THE MOTOR-CONTROL SYSTEM

ARRANGEMENT OF CONDUITS

The methods of supporting the electric wiring conduits beneath the under framing varies, of course, with the location, but in general, it may be stated that supports of the most rigid and secure order are in all cases applied. In some cases the conduits are supported by passing through openings in needle beams or other beams or plates in the under framing structure which serve as very successful means of support. In other cases, the conduits are held up against the under frame members by strong clamps. This construction is clearly shown in the accompanying illustrations, taken beneath one of the steel subway cars, as well as also in the longitudinal section drawings in the inset.

One of the illustrations shows the outlets from which the motor leads and "trolley" connection pass down from their conduits to the truck below. An interesting construction is to be noted here; the eight conduits end in one of the cross buildings, each passing through a hole drilled for the purpose, and are rigidly secured in position there by a nut on the conduit side at the rear and the "bell-mouth" cap on the end. This forms a most rigid and secure means of support. At this point, moreover, a special construction is made use of to protect the cables where they leave the conduits to connect with the motor leads. As at this point they are inevitably subjected to a large amount of flexure, the protruding cables are arranged to be firmly carried in insulating clamps before and after connecting with the truck cables; these, which end in similar two-piece connectors to those shown upon the cables from the contactors, are swung up through the empty insulating (electrobestos) clamps in the foreground above in connecting up. They are bent to the shape of a letter S in dropping to the truck so as to provide most easily the flexure needed.



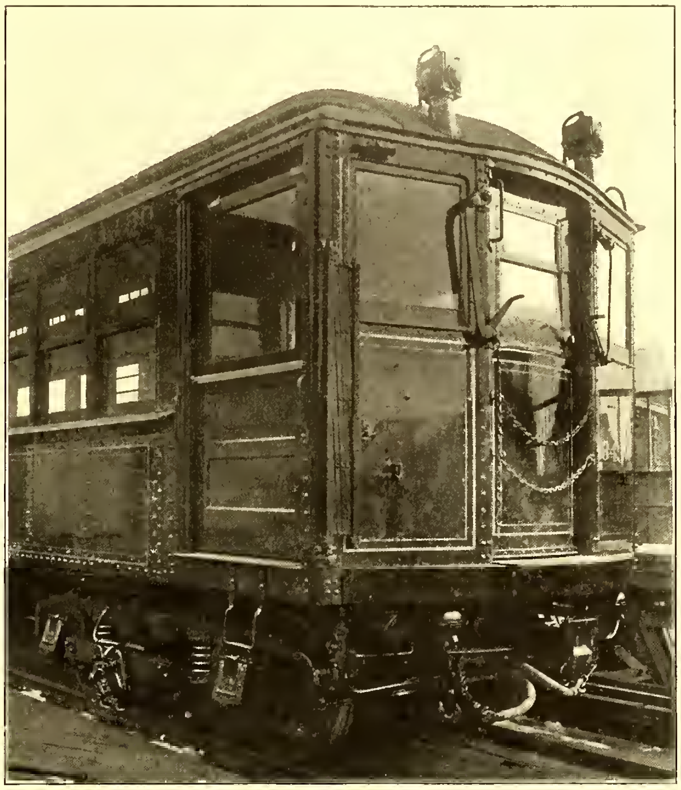
DETAILS OF THE SWITCHBOARD, SHOWING ALSO THE ARRANGEMENT OF APPARATUS

The truck connections are shown in a separate view. The eight leads which join those shown in the preceding view are each covered with a closely-wound helix or brass wire, which serves very effectively in protecting the insulation from the undesirable abrasion. After the leads from the truck have been connected with corresponding leads on the car, the connectors are insulated by means of rubber tubing, which, after being slipped on, are in turn carefully covered with several layers of adhesive tape. The only use of conduit upon the truck is for the cable connecting the two third-rail collecting shoes. The leads from No. 2 motor are carried across the truck bolster in a fibre trough suspended from the truck transoms. After leaving this trough the leads are carried on top of No. 1 motor, where they, together with the leads from this motor, are held firmly in position by means of electrobestos cleats reinforced by iron straps.

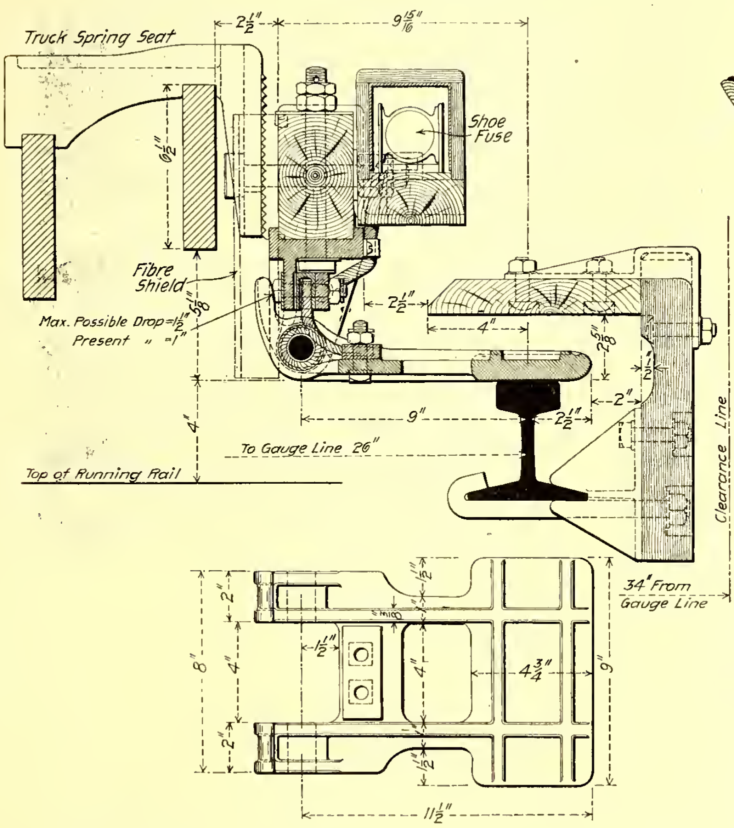
In the view beneath the steel car upon page 425 is shown the arrangement of conduits at the circuit breaker end of the contactor box. This view shows various methods of supporting conduits, and also shows the interesting scheme of using halved elbow fittings for the conduit where short bends have to be made. In the latter cases the wire is passed through one of the connecting conduits and then bent and introduced into the other, the exposed bend then being taped and covered with this two-piece elbow, as shown. These halved elbows are tapped and the threads fit upon those of the conduit when applied, so as to make a tight joint. In the latter view is also shown the use of the junction box in making interconnections in the system.

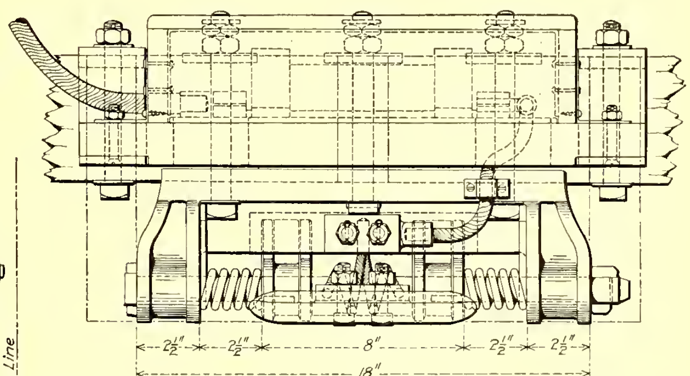
The vestibule switchboard used for the control of the car heater and lighting circuits and motor control circuits is well shown in an accompanying view and in detail in the drawing. This board is built up in two sections, as shown, the upper section 22 ins. high and the lower section 39 ins. high, both having a width of 17 ins. The upper panel is devoted to the heater and lighting circuits for use in the car, while the lower panel contains the switches for the control, motor and air-compressor circuits. The arrangement of the various instruments is indicated in the drawing. It will be noted that upon this switchboard is the only appearance of the main trolley connections above the car floor, this circuit being necessarily brought at this point to the main switch through which current passes from the main trolley line to the motor circuits. This switch is located at the lower right-hand side of the board.

The two panels are carried in a special angle-iron frame which is bolted to the end framing of the car. In the space provided between the switchboard frame and that of the car, soft rubber washers are inserted to take up vibration. The panels are of slate, with dull finish, and no connections appear at the rear of the board, all bolt holes upon that side being filled with insulating compound. The wires and cables entering from beneath the floor of the car are carried up through sections of conduit of the type used beneath the car, and the methods of supporting the protruding ends of the same are clearly shown in the drawing. The "bell-mouth" outlet bushings with which each of the conduits are capped, together with the lock ends beneath the angle-iron frame, serve to hold them rigidly in position. The lighting circuits which leave the board at the top for distribution in the hood and roof of the car are carried in flexible conduits, as shown.



END VIEW OF ONE OF THE STEEL CARS, TO SHOW ARRANGEMENT OF COLLECTING-SHOE DETAILS AND OF JUMPER BOXES

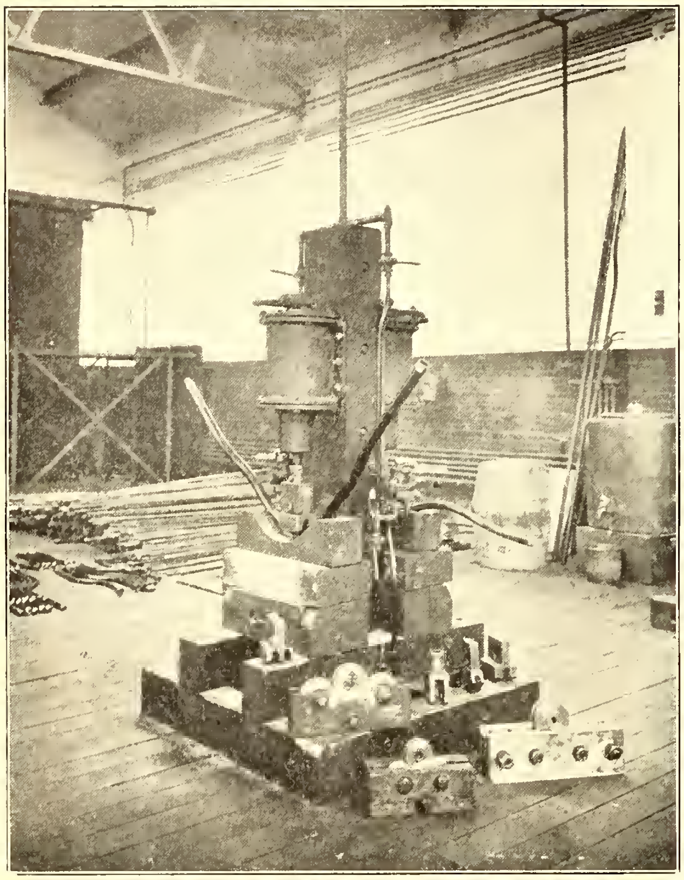




DETAILS OF NEW TYPE OF THIRD-RAIL COLLECTING SHOE AND ITS METHOD OF SUPPORT

DETAILS OF COLLECTING SHOE

An important detail of the electrical equipment of the cars, which is in fact closely related to the wiring system, is the third-rail collecting shoe equipment. On account of important improvements embodied in the design of collecting shoe as adopted for use in the subway, it is illustrated herewith, both as applied to the car and in the detail drawing. As is well known, the third-rail arrangement in the subway consists of the use of a protected third rail, the rail being covered by a 2-in. plank 10 ins. wide, supported 2⅝ ins. above the contact rail throughout. The contact device is accordingly of the so-



THE DOUBLE PIPE AND CONDUIT BENDING MACHINE USED IN THE EQUIPPING SHOPS OF THE INTERBOROUGH COMPANY, FOR PRODUCING THE SPECIAL SHAPES REQUIRED

called slipper type, as indicated in the drawing. It is pivoted at a distance of 9 ins. from the contact rail center, being held normally in its lower position by a spring on the pivot shaft. As may be noted, the wearing surface of the shoe is carried from the hinged portion by two slender prongs, which are webbed as indicated. An improvement is embodied in this shoe in that these prongs are purposely made somewhat weaker than the balance of the casting, so that in case of meeting with an obstruction the breakage will occur at that point, throwing the shoe out of service, instead of breaking the supporting hanger and subjecting the contact-rail system to possible short-circuit.

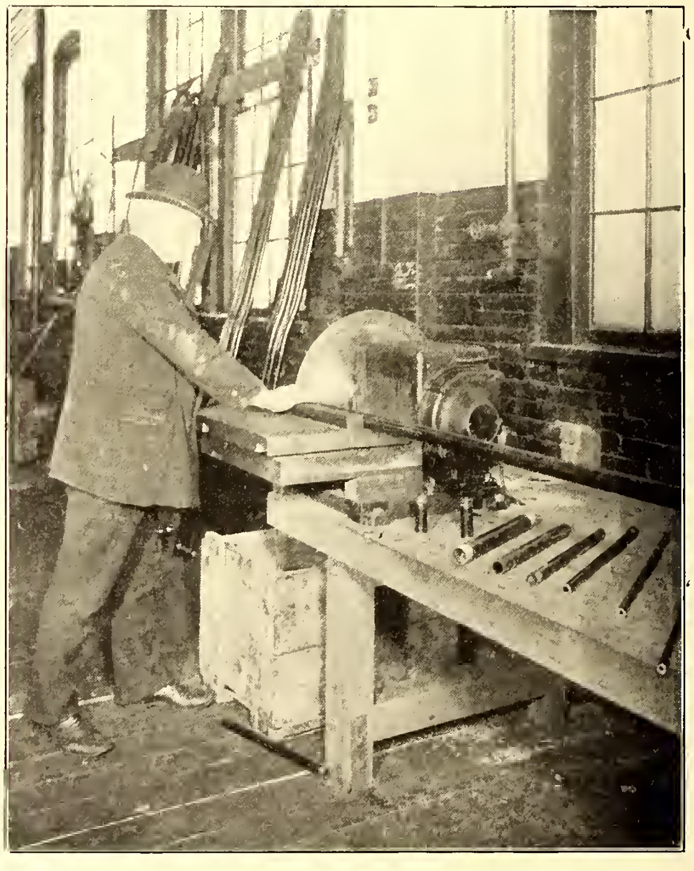
The method of pivoting the shoe is well shown in the cross section view. The shoe is arranged with limit stop, by which the downward movement of the shoe proper is limited and may be adjusted by means of shims. The maximum possible drop with the construction shown is 1½ ins., although a ⅛-in. shim is used to reduce the drop to approximately 1 in. Connections from the shoe to the supporting brackets are made through a flexible cable which is wound around the shaft, as shown; this method of winding is of importance, as the vertical movement of the slipper will not affect the connected cables. Other mechanical features of importance are to be noted in the mounting of the shoe, one of which is the arrangement of the pivoted shaft, which is fastened in place by a key for quick removal.

SHOP AND ERECTING METHODS

The methods employed in the shop in handling the important problem of conduit pipe cutting and bending, as well as the erection of the conduits beneath the cars, are of more than usual significance in relation to the general subject of conduit installation. In the first place the entire installation was seen to be a strictly mechanical work and demanded a mechanical treatment in order to secure the desired results of strength and permanency. Furthermore, as the installation of the conduit systems upon the steel cars involved the equipping of 300 cars, it was obvious that a large force of men would be necessary and that a systematic treatment of the problem would be essential. The result has been the equipment and organization of a large shop force and introduction of many labor-saving methods, which has not only kept the labor costs down to a minimum, but has also resulted in a great saving of time.

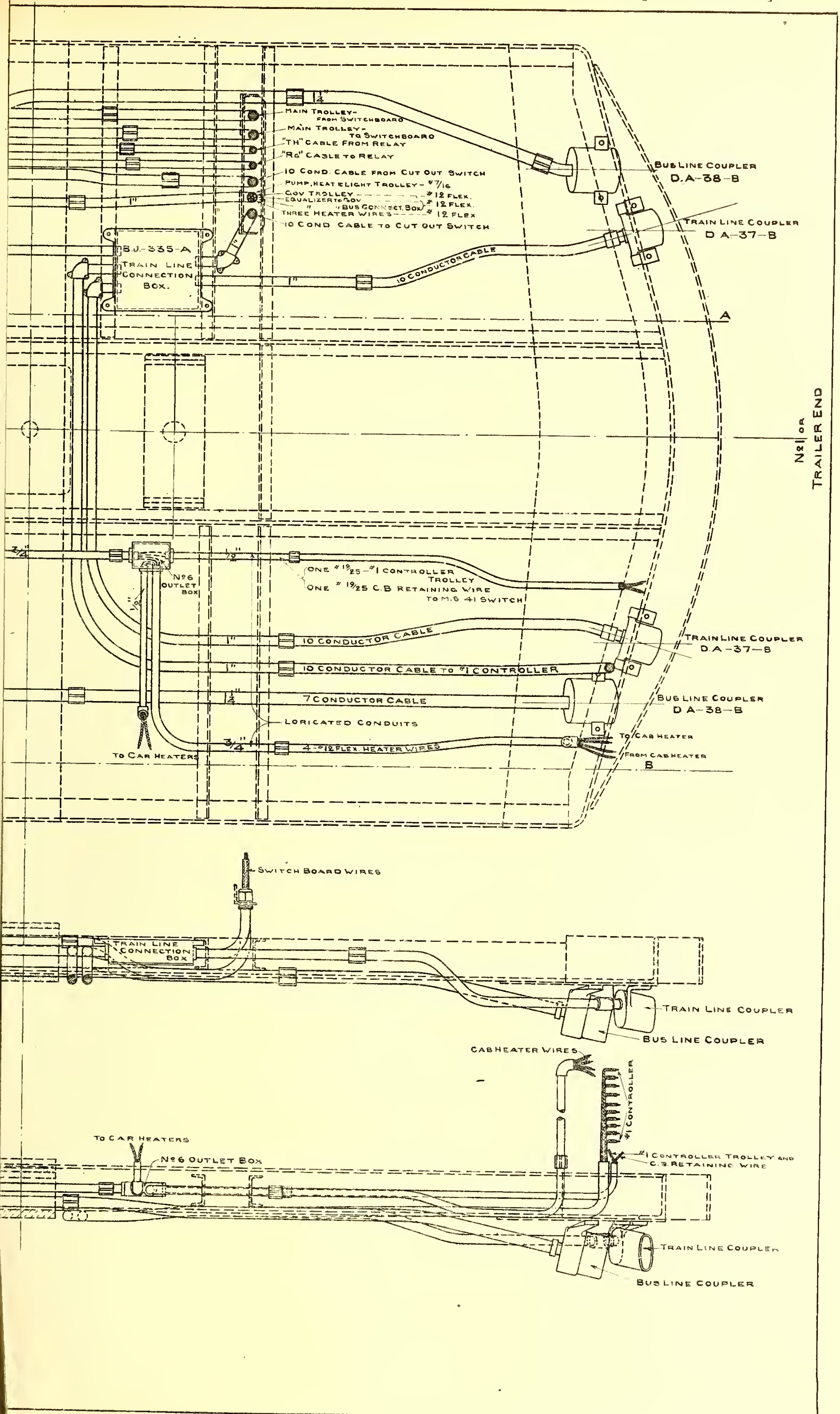
A shop was provided for the pipe bending and fitting work, including both the air-brake piping and the conduit work, while the electrical equipment was assembled in another shop. The assembling of the various details of the equipment upon the cars is carried out in one of the repair shop buildings of the elevated division of the company, where adequate facilities were to be had and excellent daylight qualities were available. This erecting shop is provided with four longitudinal tracks with pits, each track having a capacity for five of the steel cars. The view underneath the cars were obtained from points of vantage in pits in this shop.

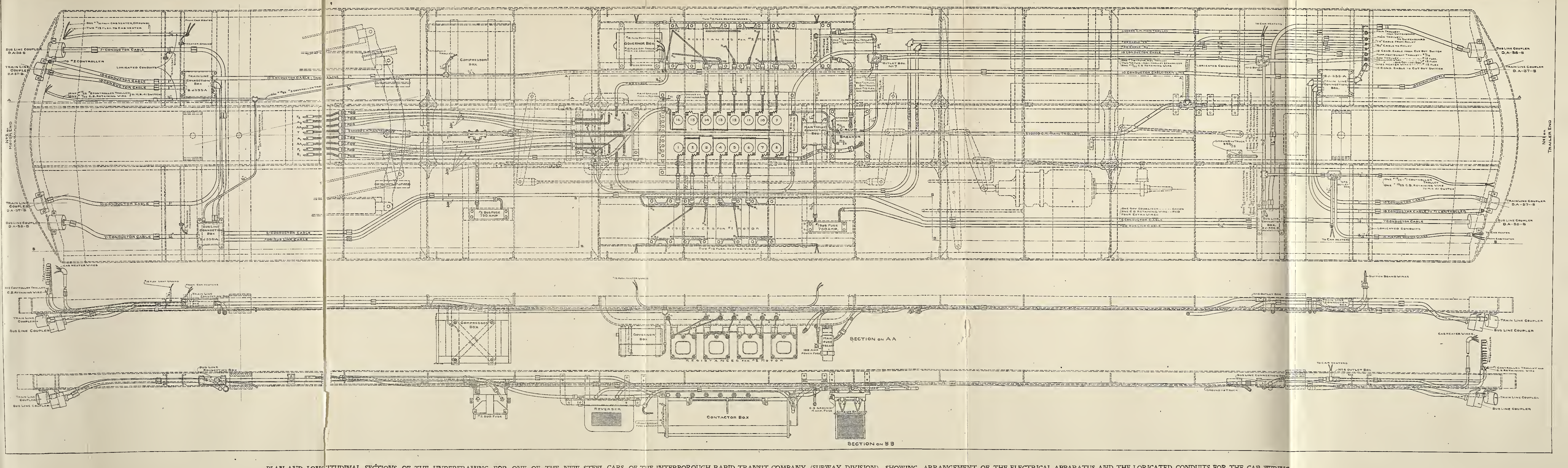
The importance of the pipe shop is evident from the view of



THE NOVEL DISC-CUTTING MACHINE USED AT THE SHOPS FOR CUTTING PIPES AND CONDUITS TO LENGTHS

the various bends in the conduit and air-brake piping which are necessary in the equipment of the cars. It was arranged to bend the various pipes to templates and thus make them interchangeable, so that they might be made up in stock quantities, and consequently drawn out for use as required—this being, in fact, one of the most important features of the entire work in greatly reducing the cost of the labor. Templates were prepared for all of the various bends, and all the stock sections are made in quantities to fit the models, each section being an exact duplicate of the model or template section, so that they


MAIN TROLLEY- FROM SWITCHBOARD
MAIN TROLLEY- TO SWITCHBOARD
"TH" CABLE FROM RELAY
"RG" CABLE TO RELAY
10 COND. CABLE FROM CUT OUT SWITCH
PUMP, HEAT & LIGHT TROLLEY - #7/16
GOV TROLLEY #12 FLEX.
EQUALIZER TO GOV " BUS CONNECT. BOX #12 FLEX.
THREE HEATER WIRES #12 FLEX
10 COND CABLE TO CUT OUT SWITCH
BUS LINE COUPLER D.A-38-B
TRAIN LINE COUPLER D A-37-B
B.J.-335-A TRAIN LINE CONNECTION BOX.
10 CONDUCTOR CABLE
A
No. 1 OR TRAILER END
ONE #19/25-#1 CONTROLLER TROLLEY
ONE #19/25 C.B RETAINING WIRE TO M.S 41 SWITCH
No. 6 OUTLET BOX
10 CONDUCTOR CABLE
TRAIN LINE COUPLER D.A-37-B
10 CONDUCTOR CABLE TO #1 CONTROLLER
7 CONDUCTOR CABLE
BUS LINE COUPLER D A-38-B
LORICATED CONDUITS
TO CAB HEATER
4-#12 FLEX. HEATER WIRES
FROM CAB HEATER
B
TO CAR HEATERS
SWITCH BOARD WIRES
TRAIN LINE CONNECTION BOX
TRAIN LINE COUPLER
BUS LINE COUPLER
CAB HEATER WIRES
#1 CONTROLLER
#1 CONTROLLER TROLLEY AND C.B. RETAINING WIRE
TO CAR HEATERS
No. 6 OUTLET BOX
TRAIN LINE COUPLER
BUS LINE COUPLER

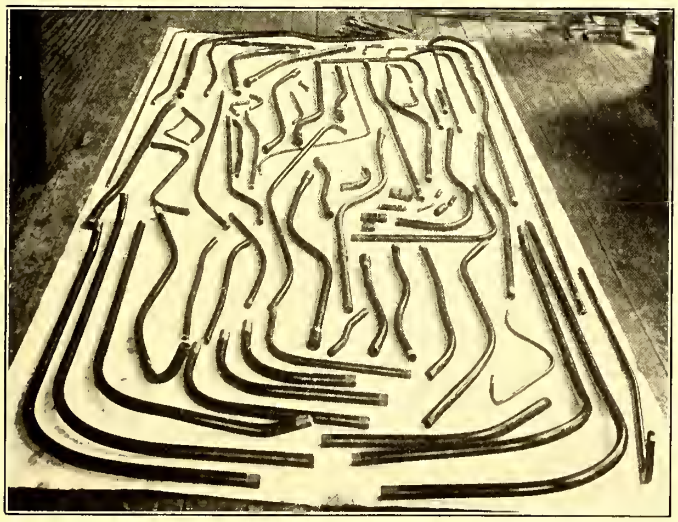


PLAN AND LONGITUDINAL SECTIONS OF THE UNDERFRAMING FOR ONE OF THE NEW STEEL CARS OF THE INTERBOROUGH RAPID TRANSIT COMPANY (SUBWAY DIVISION), SHOWING ARRANGEMENT OF THE ELECTRICAL APPARATUS AND THE LORICATED CONDUITS FOR THE CAR WIRING.

may be placed on any car, thus reducing the cost of installation to a minimum.

The bending of both conduit and air-brake pipes is facilitated by the air bender illustrated herewith. This bender consists of two air-brake cylinders mounted upon a stand and fitted with forms by which all sizes of pipe and any style of bend may be quickly and cheaply made. The bender is illustrated in the act of making a very difficult bend. The air cylinders are controlled by motorman's brake valves for admitting air and holding or releasing. In accompanying views are shown the wide range of bends which are covered in this work.

VIEW IN THE INSPECTION AND STOCK ROOM DEPARTMENT OF THE EQUIPPING SHOPS, SHOWING TEMPLATES FOR STANDARDIZATION OF ALL SPECIAL HANGERS, FITTINGS, ETC., USED



A FEW OF THE SPECIAL SHAPES OF LORICATED CONDUIT WHICH ARE SHAPED IN THE BENDING MACHINE FOR THE STEEL CARS

An important accessory in the pipe shop is to be noted in the form of a novel type of pipe cutter which was devised for rapidly and efficiently cutting the conduit into sections of the desired length. It consists of a plain iron disc with smooth edge, which is mounted upon the end of a motor shaft for direct driving, and is operated at high speed in cutting, the pipe being merely held up against the edge of the rapidly revolving disc with moderate pressure. The effect in cutting is to be noted in a partial fusing of the portion of the pipe which is cut, as evidenced by the fact that large fins are produced, although they are readily removable and no harm results therefrom. One of the marked advantages of this type of cutter is that it cuts the conduit straight across without leaving the objectionable burr which results from many forms of pipe cutters.

This tool was made up in the shop from materials available, the motor having been removed from a Westinghouse air-compressor outfit as used on the subway cars, and was adapted to the work by the mounting of the cutter disc upon the extension of the armature shaft. The disc is of iron plate 24 ins. in diameter, mounted between heavy brass stiffening plates 20 ins. It may seem strange that iron is used for this purpose, but it is found that it is fully as serviceable as steel, and is in fact very efficient. The motor operates at a speed of 2500 r. p. m.

A feeding table is built up in front of the cutter disc, as shown in the accompanying view, upon which the pipe is held in, forcing it against the cutter. The table is arranged to move freely backward and forward directly against the cutter, so that in cutting it is merely necessary to press it against the disc. The guide block is arranged upon the table so as to bring the pipes against the cutter at right angles in all cases. It is to be noted that the action by this pipe cutter is very rapid and efficient. All of the pipe cutting which has been necessary in the equipping of the steel cars has been easily handled by this single cutter.

The further equipment of the pipe shop consists of a large equipment of power reamers, pipe-threading die-stocks, and also two automatic power threading machines. The two power thread cutters are of the Forbes type of automatic adjustable pipe die, which is built by Curtis & Curtis, Bridgeport, Conn. These machines have capacities for all sizes of pipe from ¼ in. to 2 ins., and are very rapid and effective.

THE INSPECTION SYSTEM

Another important and essential feature of a work of this character, to be carried on in such large quantities, is the inspection department. The inspection of all parts entering into the equipment of the cars has been made an especial feature. In the same manner as applied to the bent sections of pipe, all hangers, brackets, braces, etc., used in connection with the equipment of the cars for service, are made in large quantities to templates, and are carefully inspected and gaged for absolute interchangeability. As above noted, this greatly facilitates the work.

The view in the inspection room illustrated herewith will give an idea of the method of carrying stock for the various classes of brackets, hangers, etc., and also shows the styles of templates used for gaging the various parts. The forms of the various brackets, hangers, etc., are laid out upon boards painted in various colors, to readily distinguish them, as indicated in the view. It is thus possible to compare each completed part with the form upon the template and ascertain if the holes are properly located, etc. All parts are required to compare with the templates within a very small limit of error, or they are thrown out.

The various parts, not only in sections of pipe, but also in hangers, brackets, etc., are made up in advance and kept in large quantities, so that they may be requisitioned for as needed. For the small brackets and clamps, bins of large capacity are provided, as shown at the right of the inspection room, while the other parts are stored at one side of the room. Furthermore, a careful record is kept of all parts made and delivered from this department, as well as drawings of details for ready reference. This system has proven of great assistance in the work of equipping the cars, particularly on account of the usual details that are almost inevitable where such large quantities of material are handled.

To J. S. Doyle, superintendent of car equipment, credit for the marked advance in methods and in workmanship described in this article is chiefly due. He has been effectively assisted in the work by Hjaimar Wallerstedt, engineer of car construction.

A SUBWAY SUGGESTED FOR CLEVELAND TO RELIEVE TRAFFIC CONGESTION AT THE PUBLIC SQUARE

A subway through the Public Square is the latest suggestion for the betterment of the street car system in Cleveland. It has long been contended that something should be done to relieve the congestion at the square. The delays that are occasioned there are such that the schedules all over the city are interfered with. The company has tried deviating a number of lines away from the square, but the public objects to this method.

The point of greatest trouble is in the center of the square, where a number of lines cross each other and where there are several loops. The city engineer and the engineers of the company believe that the trouble at this point could be relieved by depressing Superior Street, which runs through the square east and west. This would remove the surface crossing, enabling all through east and west cars to run under Ontario Street. The plan is looked upon with considerable favor.

BOOSTERS IN CAMDEN

The Public Service Corporation has just installed in its Camden & Suburban power station, at Camden, a 120-kw Westinghouse series booster, and has placed an order for four other boosters of the same size. In the use of these boosters the company is following out the policy of former General Manager W. E. Harrington in substituting a boosted feeder in many cases where additional copper might be installed by some other companies. One use of the booster equipment will be to maintain an equal voltage in the two stations of the company at Camden, 5 miles apart. One of these was the station formerly owned by the Camden, Gloucester & Woodbury Railway, while the other is the main power station of the Camden & Suburban division. The normal output of the Camden & Suburban station is 5000 amps., and that of the Camden, Gloucester & Woodbury, 1500 amps. It is now proposed to shut down the Gloucester station and to supply the railway feeders at that station through a tie from the Camden & Suburban station. This tie will consist of six 500,000-circ. mil cables.

The switchboard connections at the Camden & Suburban station differ radically from those in general use, and were described in detail on page 974 of the STREET RAILWAY JOURNAL for Dec. 5, 1903. It will not be necessary to repeat this description here, except to state that the equalizer is on the negative side of the generators, that the board is of the single-pole type and that two positive bus-bars are used, one of higher potential than the other. This board is now being extended so that any one of the boosters now being installed can be thrown on any of the boostable lines. That is, each feeder is so arranged that it can be supplied off the regular bus-bar, or it can be thrown on to a higher voltage bus-bar, or can be fed independently through a separate booster, or if necessary it can be supplied through two boosters operated in series.

The company believes in the use of boosters for an indeterminate load, where the extra load does not exceed three hours out of the twenty-four, as is very often the case. A degree of safety can also be secured by the booster, because in case the feeder breaks down it is possible to put two boosters in series on a parallel feeder and raise the voltage up to 1000 if necessary for temporary service. A commentary on its use of boosters is the fact that the company has not had a single line tied up in four years by any station difficulty that could not be averted at the switchboard.

ELECTRICITY FOR DAMASCUS

It is reported from Constantinople that the syndicate associated with M. Empain, the Belgian financier, who is connected with the Paris Metropolitan Railway and other electrical enterprises, has acquired from Izzet Pasha the concession granted to the latter by the Sultan for the construction of electric light and power works and tramways at Damascus. The "Frankfurter Zeitung" states that the syndicate has paid for the transfer of the concession $130,000 in cash and $20,000 in shares of the company to be formed to carry out the scheme, with a shape capital of $1,250,000. The concession carries with it the right to utilize for the production of electrical power all the available water-power within 18 miles of Damascus.

The Northern Pacific Railway Company has announced that it proposes to equip with electricity its line between Spokane and Cœur d'Alene, Wash., 34 miles long. About a year ago an electric railway was opened between these cities. Since the building of this line, which was described in detail in the STREET RAILWAY JOURNAL of Feb. 11, 1905, the steam railroad has done very little business between the cities.

THE QUESTION BOX

In this issue are published answers to questions pertaining to the protection and abolishing of steam and highway crossings; methods of attaching trolley rope to pole; treating car roofs; treating motor brushes; superheating steam; and proper weight and section of rails. Additional answers, suggestions or discussions on any of these topics are requested.

A—GENERAL

A 31.—On a high-speed interurban electric railway, what precautions should be taken to protect crossings where the line cuts a public highway? Please describe the precautions you take at such points.

On high-speed, interurban roads, such as we operate, we require motormen to slow down to 4 m. p. h. at all street crossings, blowing whistle 500 ft. before coming to such crossings, and ringing gong continually while going over and passing street.

H. C. PAGE, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

Do not exceed 4 m. p. h. when approaching crossings. If necessary, put up stop signs.

W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

At each highway we put a cross-board sign reading, "Railroad Crossing," and on the post itself the words, "Stop, Look, Listen." Each approaching car is under orders to blow four blasts of the whistle, corresponding to steam railroad practice. I wish we had less whistling to do, and have considered the omission altogether of any whistling during full daylight hours at crossings where the view is unobstructed for some distance in both directions.

THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

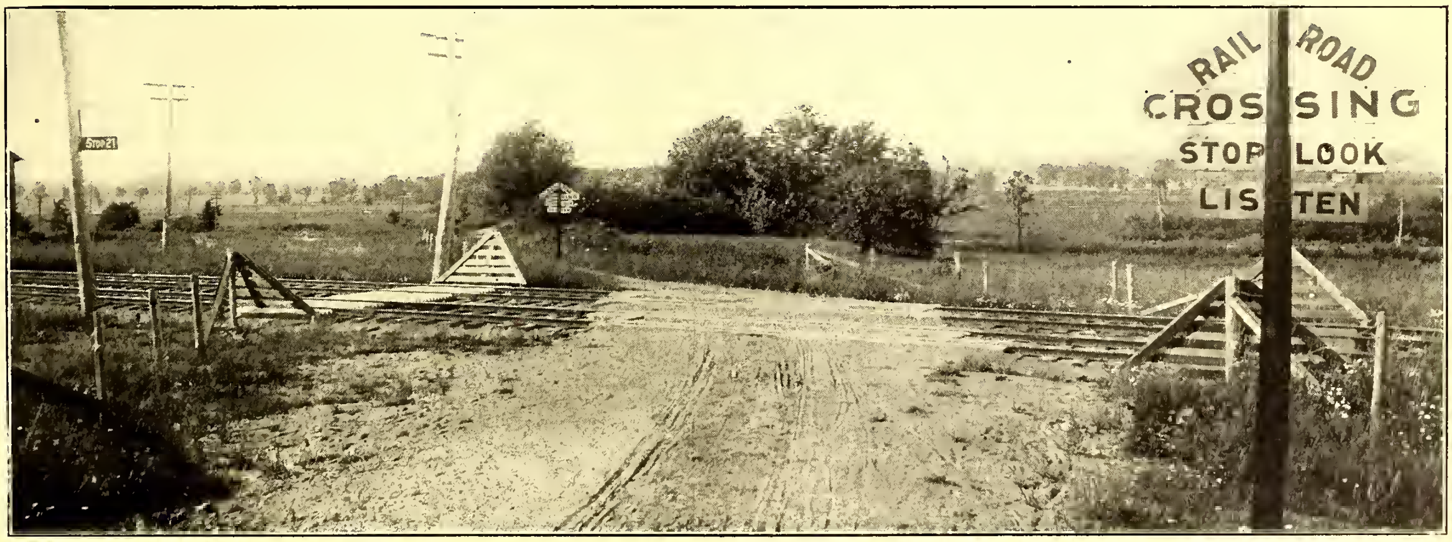
Cars should be made to slow down to 10 miles an hour and motorman required to blow whistle at the approach to such crossings.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Slowing down of cars to 8 or 10 miles per hour, blowing whistle and proper crossing signs.

H. A. TIEMANN, New York City.

All highway crossings at grade on the Utica & Mohawk Valley Railway are planked 24 ft. in width with hardwood plank, next to



SIGNS, PLANKING, FENCE AND CATTLE GUARDS FOR PROTECTING HIGHWAY CROSSINGS, UTICA & MOHAWK

and adjoining the rails of the track, and the space between the planks and for 50 ft. on either side of the crossing is filled with crushed stone rolled compact. This is done so as to give a good smooth approach to the crossing and make as level and smooth as possible the crossing itself for teams and pedestrians. Fifty feet on either side of the center line of the crossing and in line with the fence on either side of the right of way, are erected crossing signs bearing the legend "Railroad Crossing, Stop, Look, Listen." Cattle guards are placed between the rails, and for 4 ft. on either side of the outer rail. The cattle guards are made of tile. Immediately adjoining the cattle guards is erected a sloping fence, placed at an angle of 45 degrees, which in combination with a stretch of straight fence connects the cattle guards with the fence bounding the right of way. The cattle guards and the fences approaching the same are placed as nearly as possible to the line of the fence bounding the highway. All these are shown in the photographs. We are trying at crossings an automatic gong operated through a battery circuit actuated by a track instrument, which in turn is oper-

PROTECTING HIGHWAY CROSSINGS, UTICA & MOHAWK

ated by a lever and pressure when cars are passing. To date its service has not been satisfactory. Our feeling is that all highway crossings should be protected by some device of this kind, if such device can be found that is positive and will work.

C. LOOMIS ALLEN, Gen. Mgr.,
Utica & Mohawk Valley Ry. Co.

Standard steam-road crossing signs warning persons to "look out for the cars," and all cars give the crossing whistle 500 ft. from the crossing.

FRANCIS G. DANIELL, New York City.

A 32.—Where an electric railway crosses a steam road, what is the usual arrangement between the electric road and the steam road for the maintaining of a flagman at such points?

Each should have a flagman.

W. T. NARY, Supt.
Hoosac Valley St. Ry. Co., North Adams, Mass.

Where an electric road crosses a steam road, in this State, if the steam railroad does not maintain a flagman, the Railroad Commissioners have made it a rule that the street railroad shall maintain a flagman and bear the total expense. If a flagman was maintained at the crossing before the street railway was built the steam railroad maintains the flagman who flags only the steam trains. We maintain a flagman at all steam railroad crossings where we cross the steam railroad, and the flagman flags all cars, the conductor staying on the rear end of the car, and the motorman starting (on a box car) with a signal from the flagman on the crossing, without receiving any bells. This puts all the responsibility onto the motorman and the flagman. On an open car we have the conductor give the usual signal of two bells to start as soon as the car comes to a full stop, and the flagman drops the white flag, indicating that it is all right for the motorman to proceed, he starting car on the signal of the flagman, rather than the conductor's signal, the conductor's signal only being used to indicate to the motorman that there is no one getting on or off the car.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

In two cases, we have overway crossings, in another case an interlocking signal tower, and in about eight or ten other cases the car stops, the conductor proceeds to the steam railroad track and signals the car over.

THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

We do not maintain flagmen at any steam railroad crossings, but in some cases we maintain a derailer which is maintained jointly by the steam road and the electric road.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Expense is usually borne by the second road built.

FRANCIS G. DANIELL, New York City.

A 33.—When grade crossings are to be abolished or avoided, what portion of the expense should be borne respectively by the electric railway company, the steam railroad and the municipal authorities?

When grade crossings are abolished in the State of Massachusetts the State law is that the street railroad shall bear not more than 15 per cent of the total expense of abolishing the grade crossing, the steam railroad bearing 65 per cent, and the State, town and cities interested bearing the balance.

H. C. PAGE, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

It should be borne equally; in other words, a third of the expense to be borne by each.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

A 34.—What have you done toward abolishing grade crossings on your system?

We had three grade crossings on our system, but have abolished two of them the past year, and expect to abolish the third one the coming season.

H. C. PAGE, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

A 35.—What precautions do you take to avoid accident to persons getting on or off at points where it is necessary for conductors to go ahead to flag over crossings or other dangerous points?

We do not allow the conductor to go ahead of the car at any point.

H. C. PAGE, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

The conductor does not signal the car to go ahead until he is absolutely sure that no passengers are getting on or off the car.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We maintain our own flagman at every grade crossing. We do not believe in having the conductor leave his place on the rear platform to go ahead and flag the car.

UNITED TRACTION CO., Albany.

Motorman must look back at rear platform before starting the car.

FRANCIS G. DANIELL, New York City.

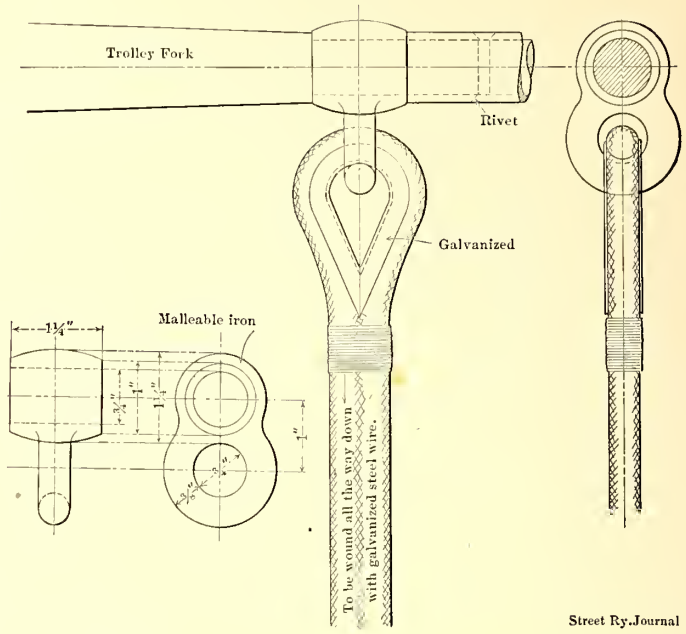
E—MASTER MECHANIC'S DEPARTMENT

E 70.—A road has had trouble with trolley rope leaking current when very wet; also with the trolley rope becoming detached from the pole. How can some of these trolley rope troubles be remedied?

We attach the trolley rope to the pole by a spring snap, but have had trouble when the trolley jumps the wire with the snaps unsnapping and thereby losing control of the pole. We issued a general order to the effect that on every car the trolley rope is to be wound once around the pole and then fastened with wire, so the snap cannot pull off. We have had no more trouble from this source.

Schenectady Ry. Co., Schenectady, N. Y.

To overcome trouble caused by the trolley rope pulling away from the pole, we are using the attachment shown in the drawings for connecting the rope to the pole. At the junction of the trolley fork there is a malleable-iron ring, which is slipped over the spindle of the fork before the fork is put on the pole. The malleable-iron ring thus has bearing against the end of the pole and the end of the fork, so that it cannot move up or down. This malleable iron ring has a projecting ring or eye through which the trolley rope passes, there being a galvanized thimble or cleat



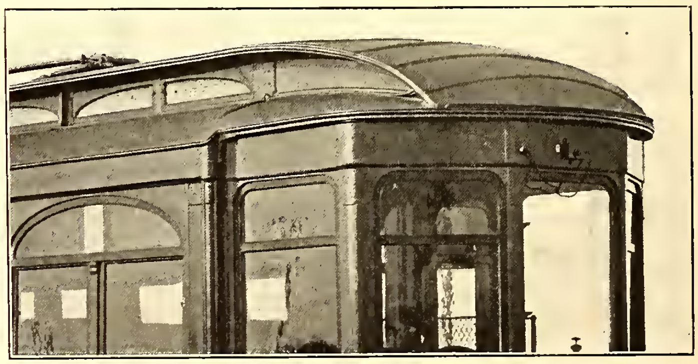
METHOD OF ATTACHING TROLLEY ROPE TO POLE, BROOKLYN

on the under side of the rope to prevent it from chafing. The end of the rope is brought down for about 8 ins., and the two strands are bound together with galvanized steel wire, wound in the manner shown on the drawing. The company is now trying a new metal clip or clamp for holding the end of the rope, and this promises to supplant the galvanized steel wire used for binding.

BROOKLYN RAPID TRANSIT CO.

E 99.—What is the best method of treating car roofs for securing tight roofs?

In order to strengthen car roofs and prevent possible injury to passengers of the car by reason of the trolley pole becoming detached and being forced down through the roof, the International Railway Company, of Buffalo, now reinforces the roofs of all cars by placing layers of No. 18 sheet steel over the hoods. The sheets of steel are curved to fit the contour of the hood, as shown in the engraving, and they are screwed into the carlines. In order



REINFORCED HOOD, BUFFALO

to exclude moisture, the steel plates are painted underneath and on top before they are placed in position.

EDITORS.

It is not a painter's job to cover roofs, but he should paint the roof with a good thick mineral paint, made with slop varnish and slop turpentine before the canvas is put on. Canvas should be put on while the paint is wet, and pressed and smoothed. The canvas should then be painted with two or three coats of good paint—not pure linseed oil and white lead paint, however.

E. W. SELKIRK, Chicago, Ill.

E 129.—Have you found any scheme for securing better contact between motor commutators and the carbon brushes?

As an experiment we tried boiling two sets of motor carbon brushes in paraffine for eight hours, and then dried them out at a temperature of 85 degs. C., which is several degrees higher than the temperature of the motors in service. The brushes so treated after four weeks running showed but ¼-in. wear. The life of the same type of brushes untreated had been previously limited to six days. We now boil all carbon brushes in paraffine, and find not only that the brushes last about five times as long, but that the commutator wear is much less, and the commutator does not wear black. We have a large kettle in which we can boil about 200 brushes at a time. Schenectady Ry. Co.

F—STEAM ENGINEERING

F 41.—Can superheating be applied to existing electric railway power houses? What changes in piping, valves, engines, etc., are necessary? What advantages will follow? Cite instances.

Superheating can be applied to existing railway power houses with the greatest facility, and the case is exceptional where the application is not extremely advantageous. In case the boilers are installed the superheaters may be applied to one at a time without interrupting the operation of the others, or if the circumstances are favorable to a separately fired superheater, it would only be necessary to stop to make connection to the steam pipe. As to changes in piping, valves and engines, it is only necessary for moderate superheat, or say up to a total temperature of 500 degs., to make such changes as would be required for modern good construction for a pressure of 150 lbs. of saturated steam. The advantages which follow will be the increase in fuel economy of the station; a better regulation of the engine by the governor; the facilitating of starting up as the engine will move off promptly with thoroughly dry steam and be quickly warmed up and free from the nuisance of water in the cylinders; ability to straddle peaks without straining the boilers, and the general satisfaction and comfort of a dry, clean system of steam piping and engine cylinders free from dripping and petty leaks. Instances where superheat has been applied to existing power houses may be cited as follows: Power house of the Williamsport Passenger Railway Company, at Williamsport, Pa.; of the Jersey Shore Electric Railway Company, at Jersey Shore, Pa.; of the Omaha Electric Company, at Omaha, Neb.; of the Laclede Power Company, at St. Louis, Mo.; of the Milwaukee Electric Railway & Lighting Company, at Milwaukee, Wis.; of the Hartford Electric Light Company, at Hartford, Conn.

E. H. Foster, Vice-Pres.,
Power Specialty Co., New York City.

F 42.—What is the limit in size of station in which superheating can be used with economy?

The limit to stations in which superheating can be used with economy is not expressed in the size of the station. There certainly can be no limit so far as size is concerned where superheating is not economical. A small station is just as important in this respect as a large station, and the advantages of superheating must be classified under two distinct heads: First, the physical advantages such as the increase in power and improvement in operating features of the plant, which cannot be limited by the conditions; second, the financial consideration which places a limit on the economy of installing superheaters by the cost of fuel. With fuel at 50 cents to 75 cents per ton it is difficult to make out a strong argument in favor of the economy of installing superheaters, but as the cost of fuel increases from this point the economical advantage is very material, increasing in proportion to the cost of fuel. These considerations, however, are only to be taken in conjunction with the other advantages of superheating.

E. H. Foster, Vice-Pres.,
Power Specialty Co., New York City.

F 43.—Do you recommend separately fired or boiler contained superheaters for moderate size plants?

This question cannot be answered in a general way, and each case must be decided upon its merits. The points to be considered are the existing arrangements of boilers and engines, the steam piping, and the cost of making the necessary changes for either the boiler contained or separately fired superheater installations. There cannot be said to be any decided advantage so far as fuel economy is concerned in favor of either arrangement, nor is there a great difference in the cost. A separately fired apparatus must be protected so far as possible from heat radiation, and it is therefore advantageous to place it in between settings of boilers; frequently the side walls of the superheater are combined with the walls of the boiler setting. For power plants we should say that the decisions in favor of boiler contained superheaters, as compared with separately fired, are about as 3 is to 1.

E. H. Foster, Vice-Pres.,
Power Specialty Co., New York City.

I—TRACK DEPARTMENT

I 1.—In the construction of a suburban or interurban electric railway, what are the deciding factors in determining the weight and section of rail to be used? State what weight and section you prefer, and why.

The determining factors in selecting the weight and section of rail to be used on interurban or suburban roads are two, namely, the weight of the cars to be operated, and the character of the paving or other material used in filling in between the rails. With such cars as are being operated to-day on the interurban roads, I would not use a rail lighter than 70 lbs. per yard. If the roadbed is on private right of way where the track is exposed and can be well ballasted, I would recommend the A. S. C. E. section 70-lb. rail, for cars of 50 tons and under; and 80-lb. rail for cars over 50 tons. If the tracks are laid on streets that are unimproved, but where the top of the rails must be flush with the street so as to allow travel over them, I would recommend a T-rail 7 ins. high, with a 6-in. base, and weighing 80 lbs. per yard. This construction contemplates the track being filled in to top of rails with earth, broken stone, macadam, or some similar material. If the tracks are laid in paved streets, I would suggest a 9-in. 90-lb. semi-groove rail.

W. H. Glenn, Supt. Roadways,
Georgia Ry. & Elec. Co., Atlanta, Ga.

In determining the weight of rail, consideration must be given to the weight, speed and wheel base of car, the size and spacing of ties, the length and section of rails and the kind of rail joint. A rail weighing 70 lbs. to the yard, 30 ft. to 33 ft. in length, with ties spaced 24 ins. on centers, is considered best adapted for suburban cars weighing 30 tons. Many favor 80 lb. and 85-lb. rail for such service, but it would seem a better investment to expend the difference in a better joint and joint support. For present practice a 70-lb. T-rail, 33 ft. long with 36-in. joint having a base plate, laid with joints staggered, ties spaced 18 ins. centers at joints, and 24 ins. centers between, fulfills my idea of good construction. However, if 50-ton to 60-ton cars are to be expected in the near future nothing lighter than an 80-lb. rail would seem advisable.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

The deciding factors are amount of traffic, speed, schedules it is expected to maintain, and type of car to be used. We prefer a 70-lb. A. S. C. E. section. We believe 70-lb. rail is amply heavy for heavy interurban traffic.

Geo. H. Harris, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

The maximum weight of cars to be used. We prefer 70-lb. rail in 30 ft. or 33 ft. lengths.

Columbus, Buckeye Lake & Newark Trac. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 2.—What is the best type of rail for city service in unimproved streets?

My idea is that the best rail for city service in unimproved streets is the 7-in. 80-lb. T, with 6-in. base.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Ordinary T-rail. It is fair to presume that an "unpaved street" is one having natural earth or broken stone filling on the railroad strip. In such a case there would be no advantage in using a tram-head girder rail, as attempts to run heavily loaded wagons on the trams shortly make deep ruts along either side of the rail. The consequent exposure to the weather, the natural tendency of the side bearing rail to tip outward under the weight of the car, the liability of tie-rods becoming bent or broken, and the opportunity for water to readily reach and rot the ties, would all work to the detriment of girder rail. Where ordinary T-rail is used, a teamster has no inclination, opportunity or excuse for driving upon the rails, the gage remains permanent and maintenance is reduced to a minimum.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Seven-in. T Lorain section in 60-ft. lengths, because it is the cheapest to maintain.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Nine-in. girder rail.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 3.—What advantages, if any, does a 9-in. girder rail possess over a 7-in. girder?

The 9-in. girder rail has two advantages over a 7-in. girder. First, it is more rigid, if rigidity be desired; second, it will permit the usage of types of pavement which cannot be used with a 7-in-rail. For instance, in many cities the streets are paved with granite blocks 7 ins. deep. If these are used in connection with 7-in-rail, then some of the blocks must necessarily rest on the ties, and when subjected to wagon traffic the blocks between the ties will sink, while those on the ties will not. This will make the pavement present a very uneven appearance. If, however, a 9-in. rail be used, a 2-in. cushion of sand can be utilized, and the blocks will sink more uniformly.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

The greater depth of concrete above the base of rail, together with the additional vertical stiffness of a 9-in. rail, affords a more stable construction, but the same weight per yard of 7-in. rail, having a greater proportional depth of head and a wider base, should give longer life. So that where the depth of paving material, such as asphalt, does not exceed half the depth of the rail, the 7-in. rail would seem to be preferable; with paving block over 4 ins. deep the 9-in. rail should be used.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

We prefer a 9-in. girder rail in city work, providing we are able to select the right kind of paving block.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

The 9-in. rail gives less liability to heaving of paving from frost and longer life of the ties.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 4.—If the conditions require a girder rail, which type would you prefer, semi-groove, full-groove, tram, center-bearing or Trilby section? Please state your reasons in full for the preference.

Either the semi-groove or Trilby section makes a first-class track. The full groove rail is harder to clean, consequently wears the wheel flanges. The tram rail allows a wheelway for wagons and thus prevents an opportunity for accidents. As a consequence of this wagon travel it will be found always that the pavement immediately on the inside of tram rails wears considerably. The center-bearing rail has this same fault doubled. A semi-groove rail with a heavy durable lip makes an ideal track.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

If the high T-rail be classed as a center-bearing high-girder rail, as it really should be, that type is preferable, as the tendency to spread under heavy traffic is reduced to a minimum. A longer life is afforded by a greater depth of head, and a greater proportion of metal is placed in essential parts. The shallow and narrow flangeway of the grooved types precludes the use of M. C. B. flanges upon suburban cars entering cities, except at considerable damage to both rails and wheels, and reduced life of rails results because the allowable wear is but 1/8 in. to 1/4 in. before the flange begins to cut the neck, and the rails are forced to wide gage through the car riding upon the flanges outside the center of gravity of the rail.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Semi-groove is preferable, because with this type of rail less power is required to move cars than with the full groove or Trilby sections. The semi-groove is also easier to keep clean than the other sections.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Our experience is in favor of the center-bearing rail.

Columbus, Buckeye Lake & Newark Tract, Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 5.—When laying tracks, what space should be left between the ends of the rails for contraction and expansion?

If the tracks are laid in permanent pavement, I would allow no space whatever, butting the rails closely together. If the tracks are exposed allow 1-16 in. for every change of 25 degs. F. in temperature of rail of 30-ft. lengths. The maximum variation, of course differs with the locality. If the track is laid during the lowest temperature, then the maximum spacing is left; if at the highest temperature, no spacing is left; at intermediate temperatures space proportionately.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Where only the wearing face and gage are exposed to the weather, no space should be left. In T-rail construction the coefficient of expansion, together with the rail length and temperature at time of laying determine the open space at joint.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

In city paved street would not leave any space between rails. In unpaved streets in extreme hot weather would leave 1-16 in. open. In Southern climates during the cold weather, joints should be laid 1/4 in. open.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

This depends largely on the temperature of the air and the length of the rail.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

At temperature of 96 degs., 1-16 in.; at 76 degs., 1/8 in.; at 8 degs., 1/4 in.

C. C. WOOD, Mgr.,
Angola (Ind.) Ry. & Power Co.

ADDITIONAL QUESTIONS

The following questions have been received from correspondents during the past month. Replies to these from any reader of the paper who can supply the information requested will be heartily appreciated. Address answers to Question Box Department, STREET RAILWAY JOURNAL:

A 5a.—Who are entitled to free tickets from street railway companies?

A 35a.—Can a fifteen-minute service be successfully given upon a single-track interurban road? What conditions are necessary to make this possible?

A 36a.—Based upon experience, what is a proper rate per mile for interurban passenger business, and to what extent should these rates be reduced by the sale of commutation tickets, monthly tickets, coupon books, etc.?

A 48.—Information is requested regarding the sprinkling of streets by street railway companies, and particularly the proportion of street usually sprinkled, and the amount paid by the cities and municipalities for this service. Does your company sprinkle streets? If so, on what terms?

A 49.—Information is requested relative to best ways of despatching cars on interurban roads.

(a) What is the proper method of numbering trains?

(b) Should odd and even numbers be used for opposing trains?

(c) How are train numbers changed at the end of the run?

A 50.—Please describe a simple board for despatcher's use, showing location of all trains at all times.

E 82a.—What is the best remedy for preventing sleet and ice forming on car windows, particularly on the vestibule windows?

MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

About sixty members were present at the meeting of the Ohio Interurban Railway Association at Lima, Feb. 23.

The principal topic for discussion at the morning session was the baggage question, which had been discussed at previous meetings. F. G. Green, chairman of the committee on this subject, reported that the committee had corresponded with practically all the managers of the State and had found that, as reported at the previous meetings, there was a wide diversity of opinions as to the advisability of charging for baggage. Personally, Mr. Green said, he favored charging for baggage, but he had been forced to admit, by reason of figures obtained from other roads, that the free checking of baggage seemed to stimulate traffic. He said that the committee had decided that it would be almost impossible to make interline business a success unless this class of baggage at least was handled free of charge. It was the sense of the committee, therefore, that 150 lbs. of baggage should be checked free on interline tickets, with an excess fare of 25 cents per 100 lbs. or fraction thereof for pieces weighing over 150 lbs. Tickets upon which baggage was checked, to be properly stamped or punched. The baggage check to be a double card, containing the number, date, originating point, destination and route; one section for the passenger, the other to go with the baggage. Free checks to be white and excess fare checks to be blue. The form is illustrated. The baggage way-bill to consist of a uniform card, containing the date, train, time, shipping agent's name, receiving agent's name, initial point, number, destination and description of baggage. Conductors, messengers or motormen to make daily reports of baggage handled, and similar records to be kept by station agents, using the form illustrated on page 436. Where transfer of baggage is necessary, the transfer charge to be paid by the transferring road. This plan to apply only to interline baggage; baggage on individual lines to be handled as each road elects.

NAME RAILWAY
O Date
....
Original Check
From ....
To ....
State ....
Route Junction Pt.
Via to ....
.... to ....
.... to ....
.... to ....
.... to ....
No.
....
NAME RAILWAY
Passengers O Duplicate
From ....
To ....
State ....
Junction Pt.
....
Via to ....
.... to ....
.... to ....
.... to ....
.... to ....
No.

FORM ADOPTED FOR CHECKING BAGGAGE

The subject was then opened for discussion. Mr. Spring, of the Dayton, Covington & Piqua, said he was satisfied that some of the roads in the southern part of the State could not afford to carry all baggage free, not only on account of their lower rates, but because some of them have no competition and they can just as well as not make a little additional on baggage.

Mr. Morrell, of the Dayton & Western, said that the Indiana roads with which they connect are opposed to free checking, and he had found it impossible to change their views. While his company is able to handle through business to Indianapolis, it would be unable to check baggage free beyond Richmond.

Mr. Paxton, of the Dayton & Troy, inquired if the scheme of charging on one road for a short haul and carrying baggage free over several roads would not be contrary to interstate commerce laws.

Mr. Wilcoxon, of the Western Ohio Railway, thought the interstate commerce laws did not apply to traction lines, at least to those lying wholly within one State.

Mr. Green, of the Springfield, Troy & Piqua, said his road would not want to carry local baggage free because it had no competition and derived quite a little revenue from baggage. But to get the scheme started he was willing to carry interline baggage free. He said some difficulties might result from the fact that all roads do not have combination cars, but handled baggage on express cars. He urged the necessity of having baggage compartments on all cars, and in event that this could not be accomplished, he urged that connecting lines arrange their express runs so that they would make connections with as little delay as possible.

Mr. Carpenter, of the Western Ohio, which has always charged for baggage, urged the adoption of the scheme, as he said it would be impossible to get people to pay a charge to each road on a long trip covering several roads. He thought also that the plan must be uniform or it would be unsatisfactory.

Mr. Clegg, of the Dayton & Troy, said he could see how it would be possible for a passenger to defeat the scheme of charging on a local haul and carrying free on an interline ticket. For instance, a man going from Dayton to Piqua on their road could buy an interline ticket to a 5-cent point beyond their line on the Western Ohio, thus securing the free checking of his baggage and saving 20 cents.

Mr. Green, of the Springfield, Troy & Piqua, said that records kept for several weeks indicated that the average weight of each piece of baggage was 90 lbs., and that the money derived from excess amounted to very little.

Mr. Coen, of the Lake Shore Electric, urged the adoption of the report, as he said interline business could not be made satisfactory under present conditions. He thought the general sentiment was favorable, and that if adopted, pressure could be brought to bear to make the plan universal throughout Ohio at least.

Mr. Clegg, of the Dayton & Troy, said that he had always charged for baggage, but that he was willing to be coerced into going with the majority, and he moved the adoption of the report. It was passed without a dissenting vote.

Eight new members were elected.

Treasurer DeWeese reported that all expenses of the recent annual meeting had been paid and that the association was in good financial condition.

J. H. Merrill, of the transportation committee, reported on his recent conference with the Indiana Electric Railway Association on the subject of making the Ohio coupon books good throughout Indiana. He said an Indiana committee had been appointed to investigate the matter, but that it seemed to be the sense of the committee that the Ohio discount of 16⅔ per cent was greater than the Indiana roads could afford, in view of their lower rates of fare. He thought the committee would decide in favor of 10 per cent or possible a 12½ per cent discount. Two of the Indiana roads have authorized their conductors to accept the Ohio books. A resolution was adopted instructing the transportation committee to attend the next Indiana meeting and to use its best efforts to prevent another form of coupon book from being adopted, and the committee was given power to act.

Meetings for the spring season were announced as follows: March, Cincinnati; April, Springfield; May, Cleveland; June, Cedar Point (Sandusky). Committees for the year were announced as follows: On subjects, F. J. J. Sloat, H. C. Lang, J. W. Brown; transportation, Theodore Stebbins, J. H. Merrill, F. W. Coen, F. W. Adams; legislative, Dr. J. E. Lowes, C. H. Bosler, Warren M. Bicknell.

During the noon intermission representatives of the roads in the Ohio coupon book agreement met to discuss the plan suggested by some of making the books good for several persons to be named in the agreement, instead of good only for the individual owner. The general idea expressed was that a number of the roads desire to drop their present forms of commuter's mileage and adopt the Ohio book, which gives a somewhat better rate and would relieve the necessity of having several forms. The only objection to the change is that the local mileage books are usually good for several persons or for members of a family. In the discussion it was brought out the books were intended primarily for the use of traveling men, and that if the privilege was extended to cover several persons on one book, it would lead to dishonest use of the book and would render it possible for scalpers to buy the books and sell transportation at lower rates than the roads themselves. An informal vote indicated that the majority were in favor of limiting the book as at present. But the matter will be taken up fully with each road and a mail vote taken. It was developed at the meeting that more than a thousand of the books were in use.

AFTERNOON SESSION

The afternoon session was devoted to a discussion of the subject, "Uses and Abuses of Equipment." The discussion was opened with a paper by G. H. Kelsey, electrical engineer and master mechanic of the Western Ohio Railway. He spoke in part as follows:

USES AND ABUSES OF EQUIPMENT

The all day operation of a railway motor is one extremely varied in its requirements as imposed upon the motor, extending from conditions of rolling or coasting when the motor is practically inert, to the extreme condition of rapidly accelerating a heavy car when the motor is handling currents several times as large as its normal all day rating. The amount of work a railway motor will perform is limited by its mechanical strength, its commutation and heating. Its mechanical strength is governed by the chemical and physical properties and relative size of the various parts that go to make up the mechanical details of the machine. All machines, no matter for what purpose they are built, are designed with a factor of safety in view; thus a bridge will require six times its normal load to break it down. So it is with railway motors, the design must be amply strong. Take the condition which is one that sometimes happens, that a motorman is called upon to protect himself, car and passengers from the collision with some object. He acts quickly and sometimes without reason, he sets his brakes, and at the same time reverses his car. Possibly his circuit breaker will not stay in and he holds it in. This in turn will possibly open the power house breakers. The stress exerted in a motor under these conditions may be extremely severe.

I stated that he acts without reason, because I have seen time and again that he will apply his brakes and reverse his car. The common failure of a gear bolt, passing between the pinion and the gear, produces very heavy mechanical stresses on a motor. A case recently came under my observation where the shaft of a 50 to 60-hp motor was reduced at the end to receive the pinion. There was no excuse in having any more reduction than the taper to make a fit with the pinion; but as a result many shafts were bent and broken, and not necessarily by abuse to the equipment. The trouble was corrected by substituting a shaft that was not reduced so much at this position, but leaving one-half inch more stock.

A railway motor as a machine is possibly subjected to conditions in operation as far above normal rating as any class of machines made; so it is very important that its details should be carefully designed, and when machines are put in operation that they should receive extreme care in maintenance. Inspection of a most thorough nature is money well invested, Gears, pinions, bearings, brush holders and all bolts in and about the motor equipment should be inspected once each week when cars are subjected to hard service.

Motors may be designed to commutate their normal rated current without appreciable sparking or heating, but with lack of careful brush inspection and adjustment, excessive current due to various causes that come up in every day service will cause more or less sparking accompanied by flashing, and a dirty machine results in damaging commutator, brush holder and motor winding. Great stress should be laid upon careful inspection of brushes, brush holders and in maintaining a smooth and even commutator. It is foolish economy to operate a commutator with flat spots, on the theory that machining cuts off a useful lot of copper. Flat spots once started develop at an accelerating rate.

A very great proportion of our motor troubles are due to copper and carbon accumulating on all parts of the interior of the motor. The accumulation is augmented by rough commutators and poor brush and brush holder adjustment.

The operation of double-end equipments makes the question of commutation a much more severe one, as it is quite hard to maintain a contact the full width of the brush when cars run from either end. The brush holders have to be made a little larger than the brush, in order to let the brush go up and down freely. When the machine is reversed it goes against the other side; that twists the brush and it will wear two faced. That is not always the case if the brush holders are kept up in extra good condition and not allowed to wear. We should not let the brush have too much play in the brush holder, and it is a pretty hard proposition to remedy.

REPORT OF BAGGAGE. TRAIN NO. DATE, ..., 190

Initial	No.	Received	Time	Delivered	Time	Desc. Bg.	Final Dest.	Rec'd by Bg. Master

Conductor.

BAGGAGE WAY BILL

The third limitation to the work of a railway motor is its heating. The heating of a motor comes from six sources.

1. I^2 R in the fields.
2. I^2 R in the armature.
3. I^2 R from eddy currents.
4. Hysteresis.
5. Friction in bearing and commutator.
6. Friction in air.

A motor when starting in a day's service has a temperature the same as the surrounding air, but its temperature will begin to rise due to the six causes indicated, and will continue to increase until the difference of temperature between itself and the air is so high that the rate of radiation is equivalent to the rate of generation of heat in the motor. The final temperature then, at which a machine will run, depends on the magnitude of the losses, and they in turn depend on the mean current and voltage on which the machine is operated. In other words, there is a limit as to how warm a machine will get. It will keep increasing in temperature until the temperature is high enough above the surrounding air that the rate of radiation balances the rate of generation or the heat due to the losses. The rating of machines as now given by builders is hardly ever indicated by so many horse-power. To say a machine has so many horse-power, doesn't mean very much now.

I might illustrate a condition or two that came under my observation where the temperature got very high. We had a car that was about 50 miles from the shop, possibly not that far, and the motorman had trouble with one of the machines. His instructions were to get out two machines. He did so, but from some cause another machine broke down, throwing him on one machine. He ran from a point a few miles north of Sidney, south through Sidney to a heavy hill and back to Wapakoneta on the one machine. The weather conditions were dry. That machine got so hot that the solder began to run on the commutator.

The resistance losses in armature and field winding are equivalent to their ohmic resistance times the square of the current. The ohmic resistance of the motor is slightly variable, becoming a little greater as the motor gets warmer.

The iron losses vary as the 1.6 power of the magnetization, which in turn depends on the value of the current and the voltage at which the machine operates.

If it were possible to operate motors without their heating, the question of rewinding armatures and fields would be a small one.

The continued operation of machines at high temperature sooner or later weakens the insulation to such a point that its insulating qualities and dielectric strength are weakened, and the armature is much more susceptible to break-down from any electrical disturbances. Accumulation of copper and carbon dust all over the armature undoubtedly aids very materially in breaking down the armature.

A possible solution for a portion of this trouble may be in the use of asbestos insulated wire, for which great claims are made by the D. & W. Fuse Company, of Providence, Rhode Island. I have a little sample of this wire here, which I will pass around for inspection. This wire, they say, has been operated at 600 deg. C., without destroying the insulation.

Mr. Kelsey then gave the results of a test made with the "Theodore," one of the sleeping cars owned by the Holland Palace Car Company. Considerable interest attaches to these results, as the cars were until recently in operation on an Ohio road. Originally the cars were equipped with four 150-hp motors, and they weighed about 50 tons. Mr. Kelsey stated they had removed two of the motors, leaving one on the front of the front truck and one on the rear of the rear truck, reducing the weight to about 46 tons. On its first trial the car was run from Piqua to Lima, a distance of about 49 miles. Readings were taken on the car at intervals of fifteen seconds. The car was in regular service as a limited. It was fitted with heaters which used about 4 amps. The average current consumption was 134 amps. The voltage was maintained well up to 600. In accelerating, the current rise was very rapid, because there were no low points on the controller. The most severe pull was on a 4½ per cent grade, 1800 ft. long, where the voltage dropped to 475 and the current jumped to 460 amps.

On the return trips the average voltage was 482; average current, 151 amps.; average miles per hour, 25.2; kw-hour per car-mile, 3.06.

In reply to inquiries, Mr. Kelsey said they had 494,000 circ. mils of copper on portions of the line and 566,000 circ. mils on the balance, and the voltage is well maintained at all times. On their regular limited runs they use a 30-ton car fitted with four 50-hp motors. On tests covering two weeks, the average current consumption was 2.23 kw-hours per car-mile. He admitted that the larger car consumed less current per ton-mile than the regular car. He thought that the two-motor equipment was more efficient electrically, but that the four-motor equipment was superior from the mechanical standpoint.

W. E. Rolston, chief engineer of the Dayton & Troy Railway, urged the better education of motormen in the handling of controllers. Too many men feed up rapidly, which increases the temperature and reduces the efficiency of the motors. Such men invariably claim they cannot make schedules unless they accelerate rapidly. He had seen men use 420 amps. in accelerating, while other men used 320 amps. on the same track and under the same conditions. He had had men cover the distance from Dayton to Troy in forty minutes, and use less current and arrive with motors in a cooler condition than other men who required forty-eight to fifty minutes for the same distance, both having the same equipment and conditions. On a 4 per cent grade which he has watched, men that went up in series used 60 per cent less current than those that threw the controller into multiple. In instructing motormen, they turn the applicant over to old men and allow them to run under several different instructors. They have a class and use instruments on cars and show the men exactly what current they are taking. They use every precaution to keep their feeders up to the same capacity on all portions of the system. They use direct current and boost to the ends of the lines. He said the large majority of car troubles occurred near the ends of the lines, where the voltage is the lowest. On their limited car, which makes 95 miles in two hours and forty-five minutes, they have four Westinghouse No. 76 motors, with a car weight of 34 tons. On a recent test on this run they used 2.8 kw-hours per car-mile. On a test with the Holland car "Francis," a companion of the "Theodore," tested by Mr. Kelsey, they averaged 3.2-kw-hours per car-mile.

A. M. Frazee, superintendent of motive power of the Columbus, Buckeye Lake & Newark Traction Company, gave some figures on equipment. They use oil and waste lubrication for armature bearings, and the average wear is 160,000 miles and the diameter is reduced not to exceed 1-32 in. They use 240-lb. solid steel gears. They have been using steel-tired wheels, with tires 2½ ins. thick. These run from 30,000 miles to 50,000 miles before requiring re-turning, and their life has been about 140,000 miles. They are now putting on tires 3½ ins. thick, which will allow for five turnings. Flanges wear sharp on the gear side, and they frequently change wheels to match them up. They use Diamond S brake-shoes on steel tires and get 18,000 miles to 20,000 miles. Their lubricating oil is furnished by the Viscosity Oil Company, of Columbus. Their power station has a capacity of 3100 kw, and their average output is 15,000 kw-hours per day for 84 miles of city and interurban road. Their output figures 5.6 kw-hours per car-mile at bus-bar. This is higher than at present, because at that time they were operating the two Holland cars with the heavy equipment. They use natural gas as fuel, and for a recent month their current cost 0.41 cent per kw-hour at the station bus-bar, including labor, lubrication, fuel and repairs, but not interest or depreciation.

Mr. Hilton, of the Griffin Wheel Company, Chicago, said that steel-tired wheels were becoming very popular not only for interurban but for city service. He said that recently the Metropolitan Street Railway, of New York, had ordered 500 pairs for city service. He described a grinding outfit installed by the Boston Elevated with which they are now grinding wheels twice a month instead of turning them as heretofore.

President Bicknell, of the Lake Shore Electric Railway, said that new men were first sent to the shop for a week and given instruction about equipment under a foreman. Then they are sent out on the road for a week under an old motorman; on their own time in both cases. If either old or new men get careless and lay up cars where they should have been able to remedy the difficulty themselves, they are sent to the shop for a week on their own time. Illustrating the fact that many troubles come through lack of power, he said that a year ago they were attempting to run four 75-hp equipments on 100 miles of road with a power station that was designed for 65 miles of road cars using two 75-hp motors. They had numerous boiler troubles, and the boilers designed for 150 lbs. would drop to 75 lbs. or 100 lbs. The engines would slow down and the voltage would drop all along the line. For three months before they got in a new generator their car maintenance cost 5 cents per car-mile. Now with ample power it averages .028 cent per car-mile. They use a trolley wheel designed by F. Heckler, their master mechanic, and produced in their own foundry. It has a large oil chamber, which is filled with Dixon's graphite grease and does not require reoiling during its entire life.

C. O. Scranton, of the Stark Electric Railway, described his company's plan of giving every motorman his own car and making him responsible for unusual wear and tear on equipment. This plan was described in a recent issue of the STREET RAILWAY JOURNAL.

TWO-MOTOR VERSUS FOUR-MOTOR EQUIPMENTS*

BY N. MC D. CRAWFORD

It is manifestly impossible to consider judiciously the relative commercial efficiency of two-motor versus four-motor equipments, or to reach any absolute conclusion unless certain conditions under which the equipments are to be operated have

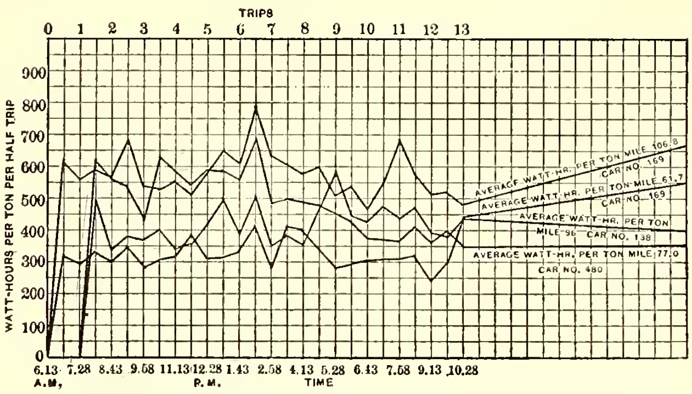


FIG. 1.—AVERAGE WATT-HOURS PER TON-MILE OF ALL CARS TESTED

first been determined. For the purpose of this paper a line was selected having light grades and reasonably small line losses, a line passing through the business center of a city and reaching the residential section, thus at all hours of the day calling

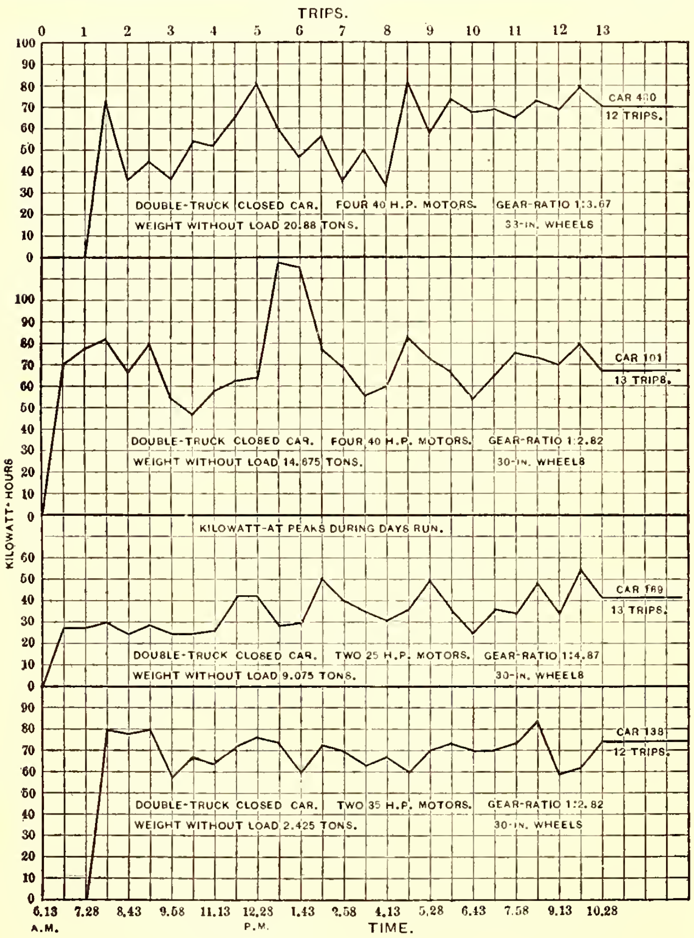


FIG. 2.—KILOWATTS AT PEAKS DURING DAY'S RUN

for a fair average number of stops and therefore reasonably rapid acceleration, in order to make the time schedule.

Four types of equipment were selected for this service, as follows: Car 169, having a 20-ft. body, single trucks, two 25-hp motors, and a gear ratio of 1 to 4.87; car 138, having a 26-ft. body, two trucks, two 35-hp motors, and a gear ratio of 1 to 2.82; car 101, having the same length of body and number of trucks as car 138, but having four 35-hp motors and a gear ratio of 1 to 2.82; car 480, having a 29-ft. body, two trucks, four 40-hp motors, and a gear ratio of 1 to 3.67.

The service required of these four equipments was exactly the same, namely, 136.5 miles per day at an average schedule of 8.45 m.p.h. The runs were made on succeeding speed days

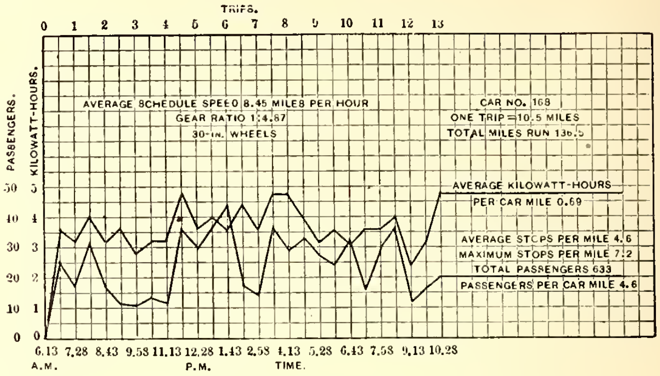


FIG. 3.—PASSENGERS AND KW-HOURS PER HALF TRIP, CAR NO. 169

and during the same relative hours. Each car was equipped with a wattmeter, an ammeter and a voltmeter; the wattmeter readings at the end of each half trip were recorded, and at the end of the run checked by the ammeter and voltmeter readings. The wattmeter was also carefully calibrated with a standard meter, using a water rheostat as a load. The peaks were noted at times of acceleration and on grades. These tests have been tabulated as follows:

Fig. 1, the average watt-hours per ton-mile.
Fig. 2, kilowatts at peaks during day's run.
Fig. 3, passengers and kw-hours per half trip.
Fig. 4, passengers and kw-hours per half trip.
Fig. 5, passengers and kw-hours per half trip.
Fig. 6, passengers and kw-hours per half trip.

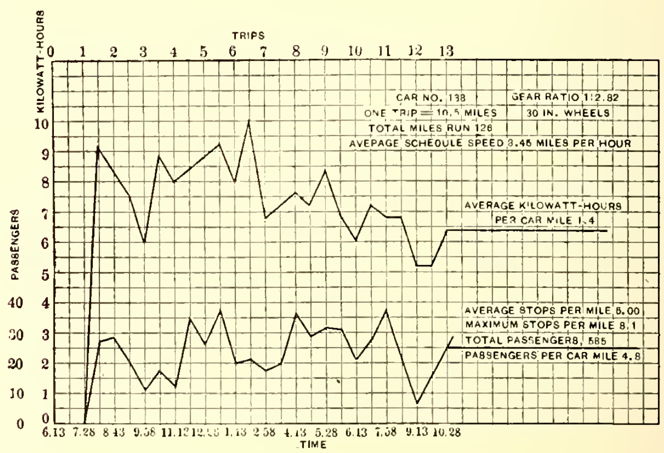


FIG. 4.—PASSENGERS AND KW-HOURS PER HALF TRIP, CAR NO. 138

Table 1 has been deduced from the sheets given.

TABLE I

Car No.	Capacity Seats.	Horse-power Motors.	Gear-ratio.	Total Tons.	Total Cost.	Cost per Seat.	Cost per Ton.	Commercial Efficiency.
					$	$	$	%
169	26	two 25	1:4.87	9.075	2710	104.23	298.62	17
138	34	two 35	1:2.82	12.425	3275	96.38	263.59	13.11
101	34	four 35	1:2.82	14.675	4360	128.23	297.10	12.53
480	42	four 40	1:3.67	20.680	5040	120.00	243.71	10.66

The commercial efficiency, E, was obtained as follows: $A + B + C + D = E$, and $\frac{H}{E} =$ commercial efficiency.

The same formula, substituting B for H, will give greatest

* Paper presented at a meeting of the American Institute of Electrical Engineers, New York, Feb. 24, 1905.

commercial efficiency. The letters used in the above formula represent the following:

A. Cost of current per watt-hour at station switchboard.
B. Value of seated load.
C. Platform labor per mile-run.
D. Interest and depreciation per mile-run, figured at 8 per cent.
H. Value of actual passengers carried per mile.

In obtaining the commercial efficiency, line losses and repairs of equipments and track have purposely been omitted, because it is almost impossible to determine what these values should be; the value of the standing load has been omitted for the same reason.

Applying the above formula and substituting values obtained during the test, the results are as follows:

CAR NO. 169

$$0.0006787 + 1.30 + 0.0475 + 0.0043 = 1.3525$$

$$\frac{0.23}{1.3525} = 0.1698 \text{ per cent}$$

$$0.0006787 + 1.30 + 0.0475 + 0.0043 = 1.3525$$

$$\frac{1.30}{1.3525} = 0.96 \text{ per cent}$$

CAR NO. 138

$$0.001056 + 1.70 + 0.0475 + 0.0056 = 1.7542$$

$$\frac{0.23}{1.7542} = 0.1310 \text{ per cent}$$

$$0.001056 + 1.70 + 0.0475 + 0.0056 = 1.7542$$

$$\frac{1.70}{1.7542} = 0.96 \text{ per cent}$$

CAR NO. 101

$$0.001174 + 1.70 + 0.0475 + 0.0070 = 1.7557$$

$$\frac{0.22}{1.7557} = 0.1253 \text{ per cent}$$

$$0.001174 + 1.70 + 0.0475 + 0.0070 = 1.7557$$

$$\frac{1.70}{1.7557} = 0.97 \text{ per cent}$$

CAR NO. 480

$$0.000847 + 2.10 + 0.0475 + 0.0087 = 2.1570$$

$$\frac{0.23}{2.1570} = 0.1065 \text{ per cent}$$

$$0.000847 + 2.10 + 0.0475 + 0.0087 = 2.1570$$

$$\frac{2.10}{2.1570} = 0.97 \text{ per cent}$$

An examination of Table 1 readily shows that car 169 is the most efficient for the service selected. This apparent efficiency must, however, be modified when the number of passengers carried, as shown in Fig. 3, is considered, because it will be seen that many times during the day's run the number of passengers was greater than twenty-six, the excess constituting a standing load.

Car 138, although showing a lower commercial efficiency, probably on account of its greater weight, yet accommodates the passengers much better throughout the entire day.

Car 480 was the least efficient of those tried, although there was only a short time when all the passengers could not be seated. This car was provided with 33-in. wheels and could have made the time schedule easily with a lower gear ratio.

Temperatures were taken at the end of each day's run; these were not excessive, except possibly in the case of car 138, due no doubt to the weight of the equipment and the greater number of stops to the mile, as shown in Fig. 4. (See appendix for record of temperatures.)

The tabulated records point to the superiority of the light two-motor, single-truck equipments for service on the line and

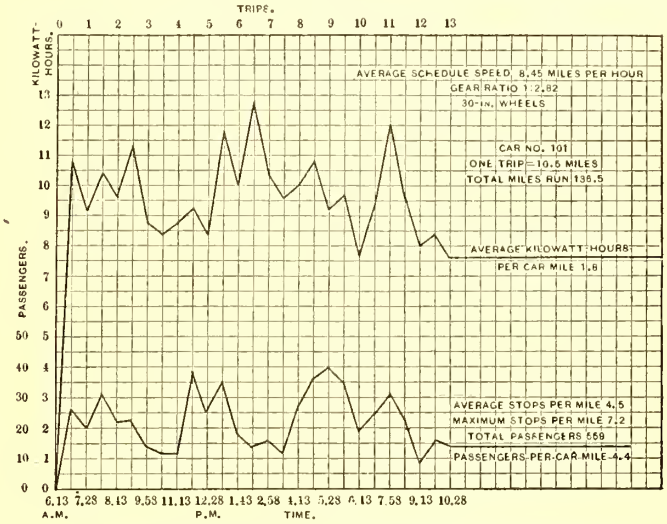


FIG. 5.—PASSENGERS AND KW-HOURS PER HALF TRIP, CAR NO. 101

under the conditions selected. With longer trips, heavier grades, greater speed in miles per hour and greater density of population, requiring more rapid acceleration, there is no doubt but that a car of the 480 type would show the greatest efficiency.

The operating manager is looking not only for an equipment

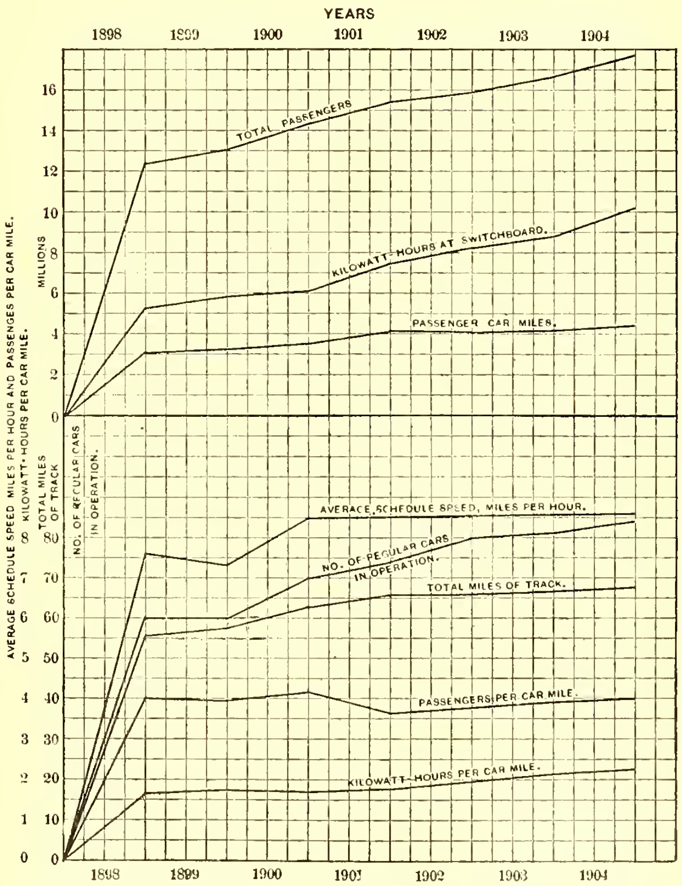


FIG. 8.—MISCELLANEOUS CURVES FOR SEVEN YEARS' OPERATION

that will fulfil all the requirements of any particular service with the least cost for repairs, and the minimum demand on the power station, but also for one that will combine these advantages at the greatest speed with safety to the public and the distance to be traveled per trip will allow. If the distance is, say, 6 miles per half trip, or 12 miles per round trip, requiring four cars for fifteen-minute service at 12 m.p.h., and three cars for the same headway at 16 m.p.h., the platform labor per mile in the first instance will be 0.0335 × 4 = 0.1340, and in the second instance 0.025 × 3 = 0.075, a saving in labor of 0.059 per mile, and 0.0085 per car-mile. This great saving in cost of operation appeals to the operator, but not so greatly if the operating costs are increased by excessive demand on power-station equipment and by added interest charges due to increased line copper and rail-bonds. In selecting motors and cars for a given run, it will be found necessary to consider the following:

Density of population, as governing the size and seating capacity of the car body; the number of stops per mile, and consequently the acceleration; the frequency of service; and the speed in miles per hour.

The number of trucks and motors, as determining the size and weight of cars selected; the tractive effort; and the acceleration.

The speed in miles per hour, as determining the number of cars in service; the platform labor; the demand upon power-plant equipment; the increased interest charge for line and power plant.

The gear ratio, as determining the size of motors; the acceleration; the number of stops per mile; the heating of motors, and consequent repairs; and additional power station and line requirements.

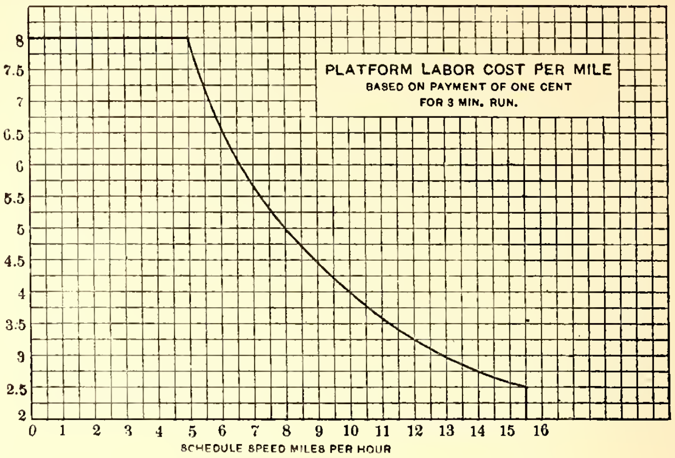


FIG. 7.—PLATFORM LABOR COST PER MILE

TABLE I

	1899	1900	1901	1902	1903	1904
Passenger-car miles, per cent increase	0.07	0.082	0.171	—0.0122	0.0247	0.051
Total passengers, per cent increase	0.06	0.021	0.0772	0.031	0.052	0.065
Passengers per car-mile, per cent increase	—0.009	0.058	—0.112	0.0375	0.0154	0.035
Kilowatt-hours at switchboard, per cent increase	0.012	0.051	0.222	0.094	0.081	0.146
Kilowatt-hours per car-mile, per cent increase	0.038	0.028	0.0462	0.105	0.085	0.06
Total miles of track, per cent increase	0.016	0.096	0.0408	0.0	0.0142	0.0153
Number regular cars operated, per cent increase	0.0	0.167	0.058	0.081	0.0125	0.037
Schedule speed, per cent increase	—0.021	0.142	0.0058	0.0	0.0116	0.0

TABLE J

	1904	1903	1902	1901	1900	1899	1898
Passenger-car miles	4,420,873	4,206,435	4,104,488	4,155,414	3,546,564	3,278,314	3,063,705
Total passengers	17,726,397	16,735,071	15,900,325	15,434,068	14,319,252	13,043,728	12,304,639
Passengers per car-mile	4.00	3.96	3.87	3.73	4.2	3.97	4.007
Kilowatt-hours, switchboard	10,204,480	8,896,924	8,226,905	7,520,852	6,148,588	5,849,584	5,225,010
Kilowatt-hours per car-mile	2.3	2.17	2.00	1.81	1.73	1.78	1.715
Total miles of track	67.573	66.546	65.614	65.614	63.045	57.533	56.638
Number regular cars operated	84	81	80	74	70	60	60

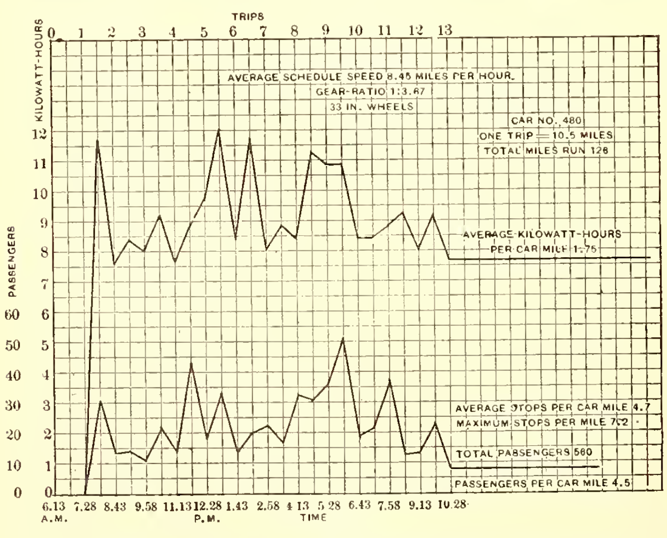


FIG. 6.—PASSENGERS AND KW-HOURS PER HALF TRIP, CAR NO. 480

Too much care cannot be exercised in determining the gear ratio for given service, for there can be no doubt that in many cases lack of power-station equipment and excessive motor repairs can be traced to the use of wrong gear ratio. In the first place, cars should be selected of ample capacity for the service requirements, and then motors should be selected with a rating only slightly greater than the service requires, and with a gear ratio so designed that the schedule may be made without resorting to rapid acceleration on starting, and, as a consequence, running the motors on low-efficiency points in order to kill time. The additional tables contained in this report show the various conditions existing in Hartford, and may be of general interest.

AVERAGE SCHEDULE SPEED MILES PER HOUR

1898	7.6
1899	7.44
1900	8.5
1901	8.55
1902	8.55
1903	8.56
1904	8.56

APPENDIX

Car No.	Motor No.	Car in at	Temperature in Degrees C.			
			Of Air.	Of Armature Iron.	Of Field.	Of Barn at 6 a.m.
138	1	10.35 p. m.	0	68	63	..
101	1	10.35 p. m.	1	70	46	17
480	4	10.35 p. m.	1.5	29	25	23
169	1	10 35 p. m.	5	5	27.5	20

In all the above temperature readings the temperature of the field coils was obtained by placing a thermometer on the top right-hand field coil at about the same point. The armature temperature was obtained by placing the thermometer on the iron core.

The following letter was received from Mr. Crawford relative to the term *A* mentioned in his paper:

MR. CRAWFORD'S LETTER

HARTFORD, CONN., Feb. 24, 1905.

In looking over my paper to be read to-night, I desire to explain term *A* in the submitted efficiency formula. The definition of term *A* may be misleading; its value is obtained by multiplying the average watt-hours per ton-mile by ton weight of car, and the result by the cost of power per watt-hour at the switchboard.

It has also seemed to me important to use the cost of current per ton-mile at switchboard; the value of seated load; the platform labor per mile run, and the interest and depreciation per mile run; considering these terms as input, and the returns per mile as output in determining this efficiency.

It is manifestly true that it would be extravagant practice to run a heavy, high speed, expensive car of large seating capacity over a line from which—due to the density of population and other causes—a small earning would be returned, when a lighter, slower speed, less expensive car with smaller seating capacity would fully accommodate the travel and produce an efficiency more nearly ideal—100 per cent.

I have endeavored, possibly erroneously, to name the efficiency obtained "commercial efficiency." It has been suggested that possibly "load factor" or "earning efficiency" would be better. I am looking at this matter, however, from the standpoint of a street railway manager, and not from an engineering standpoint.

Yours truly,

NORMAN McD. CRAWFORD.

DISCUSSION

A. H. Armstrong, being called upon, said that the contest between two-motor and four-motor equipments was one of long standing, but that it seemed to have settled itself rather definitely in the majority of cases in favor of the four-motor equipment. Mr. Crawford had brought out the fact that each case must be considered by itself, the local conditions being the governing element. Perhaps the fundamental reason for adopting four-motor equipments, assuming a double-truck car, is the need of increased traction. This is felt in a number of different ways, in the North largely to climatic conditions, the presence of excessive grades and an exacting schedule calling for rapid acceleration. In the latter class might be included all city railways. The frequency of stops in a densely traveled district is very great, and the schedule called for is also very high, especially in towns not favored with the rapid transit facilities given by underground and elevated lines. In these cases it is necessary to resort to as high an acceleration as the comfort of passengers will permit. This can be secured only by the adoption of motors on every axle, making all driving axles. In such cases there is no dispute of the superiority of four-motor over two-motor equipments. On elevated, subway or other city roads enjoying especially good conditions as regards rail surface, the adoption of either type of equipment is open to discussion. In the case of the subway, sufficient traction can be obtained with two motors before reaching the limit of comfort of passengers—that is, without equipping all axles. Suburban work presents different conditions, as we have single cars and infrequent headway. We have hills that would not be tolerated in steam railroad practice, and in the North climatic conditions made more severe through the infrequency of cars. The high speed often required and the resulting large power demand can be met in many cases only by resorting to four-motor equipments. The modern high-speed road, running 50 m.p.h. to 60 m.p.h. with cars from 35 tons up, can only be accommodated by having every axle equipped. The total power in such cases is from 500 hp up, and to design two motors of 250-hp each is impracticable with the limitations imposed by the standard gage of 4 ft. 8½ ins. and a wheel base which can negotiate the sharp curves of city streets. The two-motor equipment seems to be relegated to light city traffic lines (of the type mentioned by Mr. Crawford) with fairly level profile, having a schedule which can be accommodated with a moderate amount of acceleration, and where the climatic conditions are not too severe to destroy the tractive effort available with two-motor equipments.

He noted in the paper one or two discrepancies, or perhaps different ways of looking at the same subject. It seems that in arriving at the efficiency, the numerator is taken as the actual nickels earned per mile, while the denominator is largely made up of the possible earnings per mile—that is, the author assumes that at the end of every mile an entirely new set of passengers is taken on board with a new set of nickels. If instead of a 1-mile basis a 2-mile basis had been taken, the 17 per cent in the case of car No. 169 would have been nearly doubled without in any way changing the factors entering into the case. Again, in Figs. 3, 4, 5 and 6 it is shown that the energy consumption (in kw-hours per car-mile) of the two-motor equipments is somewhat less than for the four-motor equipments. To make an absolutely satisfactory comparison, the same schedule and the same total horse-power per car should be taken in each case. What should be done is to compare, for instance, two 70-hp motors with four 35-hp motors. In any other comparison it is obvious that one set of motors would be either underloaded or overloaded. The watt-hours per ton-mile assumed in any given service are independent of the motor-power of the car—that is, they are practically independent and only affect the situation when there is a considerable amount of free running, viz., when a very heavy motor car is permitted to run on the very light load efficiency part of the motor curve. The service in question does not take up any considerable amount of free running, and therefore the results given in Figs. 3, 4, 5 and 6 should coincide more nearly than they do. The reason they do not is perhaps because only one or two cases were taken instead of the average of a large number of trials. All those who have had anything to do with railway tests know the unreliability of the results of one or two tests. Reliable results can be obtained only by correlating the data of many tests.

S. T. Dodd took the floor after Mr. Armstrong. He said that Mr. Crawford in writing about the term commercial efficiency did not mean efficiency in the ordinary engineering sense, but that he desired to get a general term which would express the carrying value of different cars. The criticism that Mr. Dodd desired to make in regard to Mr. Crawford's method of deriving the quantity called commercial efficiency was his introduction of the seat value. If the author had gone a step further by dividing up the seating capacity of the car, and had given the cost per seat-mile instead of the cost per car-mile, he would have shown that the cost of operation per seat-mile with a four-motor equipment was less than that with a two-motor equipment. If Mr. Crawford wished to introduce, in addition, this question of earning capacity as compared with earnings, he could have introduced a separate formula, dividing the earnings by the possible earning capacity, and he would have given a clearer idea by making a distinction between the different types than by attempting to combine results in one formula. Regarding the cost of repairs, considerable data are needed. We have more or less data on the cost of repairs per car-mile, but not on the cost of repairs per motor, and if operating men would watch more closely the cost from this standopint it would tend to give more definite information. Referring to the belief that under similar conditions, two-motor equipments will heat up more than four-motor equipments, on account of their less radiating surface, he said that the ordinary designer, when designing a motor of any size, designs it along the same general lines, so that the radiation of different motors is proportional to their size. In a stand test which he had made on eight motors taken at random, he added up the carrying capacity for one hour and the carrying capacity for two hours. Calling the carrying capacity of each motor for one hour 100 per cent, he ascertained what the capacity of the motors would be for two hours, and compared the average carrying capacity of four 35-hp motors with that of four 75-hp motors for one hour and two hours. The difference between the average carrying capacity for two hours of both sets of motors was only 0.7 per cent. On this question of heating, he had examined with interest the tables in the paper to see if there were any differences in the heating of the two-motor and four-motor equipments. He found that cars Nos. 138 and 101 were running at an armature temperature of approximately 70 degs., while cars Nos. 480 and 169 were running at armature temperatures of approximately 30 degs. and 40 degs. These differences must arise from some other cause than those due to the use of two-motor or four-motor equipments. An examination of Figs. 4 and 5 for the two-motor and four-motor cars Nos. 138 and 101 show that their average kw-hours per car-mile is far in excess of the other two, and the curves in Fig. 2 show again that the two-motor equipment of car No. 138 takes a maximum input of 80 kw several times, which is also true of car No. 480, which has an equipment of four motors of nearly the same capacity, makes the same schedule and seats forty-two passengers as against thirty-four. This difference is in the gearing, because the equipments on cars Nos. 138 and 101 are geared with the ratio 1:2.82, while cars Nos. 169 and 480 are geared 1:4.87 and 1:3.67. In other words, two of the sets are geared too high. If the two 35-hp motors of car No. 138 had been geared 1:3.94 instead of 1:2.82, they would have been perfectly capable of carrying 7 tons per motor with perfectly reasonable and economical heating.

Calvert Townley, assistant to the president of the New York, New Haven & Hartford Railroad, was the next speaker. He said that the question as to which was the best car to use for city railway work was not so much a question of two-motor or four-motor equipments as it was on the local topographical conditions and density of traffic. Having determined the proper carrying capacity, the question of two or four motors can be treated as a separate thing. Within ordinary limits any gear ratio can be applied to either size of motor. As Mr. Dodd pointed out, the motors having the greatest reduction consume the smallest amount of energy per ton-mile, which is to be expected in a service with frequent stops and low schedule. As a previous speaker had pointed out, no fair comparisons could be made unless the total horse-power of the motors was the same for similar service. Assuming, then, exactly the same capacity on a car, the four-motor equipment will be slightly heavier and additional energy must be taken in proportion to this extra weight. Similarly, the first cost of the four-motor equipment must be greater. The maintenance charges will also be greater, as more units must be provided for. All this being admitted, the unmistakable tendency toward four-motor equipments must be due to their increased traction. For interurban roads, as Mr. Armstrong had pointed out, four motors were necessary. Admitting the value of increased traction, let us see to what extent it is needed. The two-motor equipment will have from 55 per cent to 60 per cent of the total weight of the car on the drivers; 60 per cent will give 1200 lbs. on the drivers for every ton in the weight of the car. This would give, with 20 per cent adhesion, which is safe for the conditions, an available tractive effort of 240 lbs. per ton to provide for acceleration. Taking a car up a grade as severe as 8 per cent would require 180 lbs., leaving 60 lbs. for acceleration. Coming to winter service with its attendant ice and slush, we are likely to reach a point where instead of 1200 lbs. on the drivers we have only 600 lbs. and 10 per cent adhesion instead of 20 per cent, and it is under such conditions that the two-motor equipment falls down.

Bearing in mind these two extremes, it is important that we should not be carried away by the trend or fads of the time. It was his observation that engineers were not entirely free from the weakness of following the fashion. With ordinary conditions of summer service—no snow, greasy rails from mist or severe grades—there are few places where a two-motor equipment will not give all the traction which can possibly be used. We should draw our conclusions after studying the limiting conditions of the locality.

ON TRACK BONDING*

BY C. W. RICKER

In the earliest days of electric railway work with crude apparatus and light loads, track resistance was neglected. As the need became evident, auxiliary return wires were run and connected to the rails at frequent intervals, but of a size which now seems absurdly small. Joint bonds were first of small iron wire like railroad signal system bonds, then pieces of copper wire with the ends riveted in holes in the rail-web, then pieces of trolley wire with channel pins and so on, until specially designed terminals were developed.

About eight or ten years ago the real usefulness of high track conductance began to be understood. The work of F. H. Farnham regarding the electrolysis of buried metals called attention strongly to the return circuit losses in what was then a well equipped electric railway system. Since then the progress has been along the general direction of utilizing the track metal to best advantage for the return circuit, and except in the case of rather complex city networks and single lines fed from a power plant unfavorably situated, this course has proved more economical than the installation of copper return cables. In the special case of elevated railways using steel structures, the metal of the latter has been used to excellent advantage, though this presents some peculiar problems in bonding and a serious risk of electrolysis of anchor bolts.

With the prospective use of alternating currents and the six to sevenfold increase of apparent track resistance, an increased use of copper may become necessary; but with all direct-current operation the engineering problem is to use the rails to best advantage, and this is largely a matter of the selection and installation of track bonds

The first condition to determine the character of the bonding is the rail-joint, which in turn is determined by the roadbed. Track joints are of two general types, rigid and flexible. The first is applicable only to track laid on continuous rock or concrete foundation, with the rails buried in hard pavement, and includes electrically-welded, cast-welded and riveted joints. Electrically-welded joints require no secondary electrical connection, but their availability is limited and they have not attained great use. Cast-welded joints are widely used in large cities, and unless the current density is high need no additional bonding. Riveted joints, used somewhat abroad, are similar to cast-welded. The majority of all track, including all not buried in pavement, must have flexible joints of either bolted or wedge types, and the electrical conductivity must depend upon bonds installed for that sole purpose, that of the rail-joint itself being slight.

Conditions Governing Material, Form and Structure of

* Abstract of paper presented at a meeting of the American Institute of Electrical Engineers, New York, Feb. 24, 1905.

Bonds.—To get the necessary conductivity, bonds are nearly always of copper, about the only exception being those of tin amalgam. To reduce cost and resistance, they must be as short as practicable, and the manufacturing cost must be kept low, to preserve the scrap value as near the first cost as possible. For durability they must be flexible enough so as not to break or lose contact by the allowable relative motion of the rails. They must be formed so they may be applied to the types of rails in ordinary use, in such position as to be protected from accidental damage and from theft. They should be readily accessible for inspection and repair. The cost of application must be kept low, and to this end it is very important that the process shall be so simple and easy that no highly skilled labor or extraordinary care is required to install them with certain and uniform results. The bond that satisfies all these conditions has not yet been devised.

The ordinary process of selection has developed a form of bond made of annealed copper and consisting of a flexible stranded or laminated shank about 8 ins. to 12 ins. long, welded to solid terminals of considerable mass, which are attached to the rail-web under the joint plates, or less frequently under the base of the rail. Accessibility for inspection and repair, however, is almost wholly sacrificed, and the importance of good work in manufacture and application is thereby greatly increased.

Pure copper is a very plastic material of low strength and elastic limit, and under moderate pressures behaves almost like a liquid. The surface oxidizes slowly at ordinary atmospheric temperatures, but very readily at high temperatures, and so it is very difficult to weld. The result is that the union between the shank and terminals of a composite bond is always subject to suspicion, and not the less so that the outside of the same and all the welds that show at or near the surface may be very nice and neat to look at and the resistance moderate, as the unwelded interior contacts are still bright when the bond is new. Under the smooth exterior may be defective welds that will corrode, and weakened strands that will soon be broken by the motion of the rails, either of which will materially diminish the utility of the bond.

It is a common practice to saw partly through a terminal and split the copper with a wedge. In some cases this will open up defective welds, in other cases the soft metal will tear close to a bad joint without showing the same. The writer has seen some bonds of excellent appearance that when compressed much harder than in ordinary practice developed open cracks in the upper parts of the terminals. Perhaps the most satisfactory inspection of the workmanship is made by sectioning the terminals in various planes, polishing the cut surfaces with a smooth file, emery and crocus, to remove all burrs, and then etching with a mixture of strong sulphuric and nitric acids, when the defective welds will show as fine black lines, and the actual welds and the form of the various component parts of the bond at that surface can be traced by the different colors of the metal after etching.

With a good process carefully followed out, bonds of good and uniform quality can be produced, but the material is delicate and a little carelessness may spoil many bonds. Considering the cost of copper bonds and the importance of their function, it would seem worth while to have their material and manufacture inspected in the shop, in much the same manner as is done with structural steel and machinery, by the engineering inspection bureaus. The writer has not heard of any great amount of inspection of electrical apparatus by these bureaus, but the quality of their work in other directions would suggest their probable usefulness in this one.

Area of Contact.—Discussion of the ratio of contact area to cross section of bond has not lead to the adoption of any standard. Practice seems to be to get as large contact area as convenient and make the best of that. The ratio increased as the size of bonds increased, till with No. 0000 short bonds with 0.875-in. cylindrical terminals it became about 9.33, while with 500,000-circ. mil bonds of later design it is only 4.5. The smaller ratio seems ample to secure a negligible contact resistance, if the contact is only close enough. Unfortunately, the full possible contact area is seldom realized, because of rough or dirty surfaces and insufficient compression or soldering.

Failure of Bonds in Service.—The failure of a bond is that condition in which the resistance of the joint made by the same is seriously increased, which may occur without interruption of the continuity of the bond itself. The general cases are: 1. Breakage of bonds; 2. Disintegration of the bonds; 3. Impairment of contacts.

Breakage of Bonds.—Breakage may occur because of defects in manufacture, as in copper bonds with welded terminals, the strands may be weakened by overheating where they enter the terminals, and a slight but continuous motion of the joint will cause them to break, one by one, at this place. Long continued jar and repeated flexures will produce fatigue in the metal (what has been called the Bauschinger effect in steel). Such breakage in the case of either welded or solid bonds is, of course, most frequent where the flexure of the bond due to rail movements is too great for its flexibility, which means ill-selected bonds or badly-kept track.

A less common manner of breakage occurs in laminated under-plate bonds which are too large for the space between the joint-plate and the rail, the bond shank is pinched and the working of the joint under passing wheels tears off the outer strands by a kind of ratchet effect, working them into the narrowing space at top or bottom of the rail-web, and sometimes squeezing them out of the joint in thin ribbons. Bonds secured under the base of the rail may be frozen in the ballast and torn off by the movement of the rail.

Disintegration.—The surfaces at the imperfect welds in composite bonds corrode, increasing the resistance greatly and loosening and weakening the bonds so that they may be pulled apart.

Tin amalgam used at contacts or in masses, hardens and shrinks, losing flexibility and contact with the bonded surfaces. In the case of amalgam plugs enclosed in cork boxes, the cork sometimes breaks, allowing the soft amalgam to run out.

Impairment of Contact.—By far the most important cause of impaired contact is oxidation. This is greatly facilitated by the presence of moisture, so that the slightest crevice into which moisture may penetrate and lodge is dangerous. Soft-soldered contacts underground are not to be trusted, especially on track laid in streets, which is sure to be wet with dirty water, though there is no apparent reason why soldered contact entirely above ground should not be durable, if all traces of corrosive flux are removed. Brazed joints seem to give no trouble. Amalgamated steel surfaces are not durable and soon rust in track exposed to dampness. Expanded or compressed terminal bonds, which have not been properly applied, may be loosened by the movement of the rail, and well soldered bonds may be loosened or torn off by the same means if they are too rigid. No mention has been made of accidental breakage of bonds. Of course, bonds which are improperly located may be knocked off by rolling stock and various local external conditions may operate to destroy any kind of bonds.

Importance of Good Contacts.—The rapid deterioration and general unreliability of track bonding has been a favorite subject of complaint. Impairment of contacts and breakage are the most common grievances, and while the latter is easily traced to improper selection or ill-kept track, the former is no less due to poor work in applying the bonds, which too often is left to cheap workmen; with poor supervision, and as the work is usually covered up as soon as done and is seldom tested at all, it gets no more attention till trouble develops. The writer knows of one case in which the suprintendent of a rather notable electric railway made public a letter praising the performance of a certain kind of bond used on his road, and in less than three months careful tests showed the condition of the bonding to be so poor that it had to be completely renewed.

The importance of clean and tight contact between bond and rail cannot be insisted upon too strongly, both for immediate effect upon track conductivity and for its still greater effect upon deterioration, yet the importance of this is not generally enough understood. The apparatus most commonly used for applying bonds throws light upon this. In two recent jobs using compressed terminal bonds, the screw presses for applying which were got from large and highly reputable makers and were selected for the bonds used, the writer was able to get reasonably good contact only by overworking the presses to such an extent that two presses were always being repaired for each one on the work. A press would seldom do 200 terminals without breaking down. The makers of the presses said merely that the presses were used too hard.

The resistance at the terminal of a bond depends upon the area and intimacy of the actual contact; with good bonds of ordinary design this may be made negligible if proper care is taken. If contact by pressure is to be used, both copper and steel surfaces must be smooth, clean and dry; if soldered, they must be clean, well tinned and free from corrosion flux when the operation is finished. As large a proportion as possible of the surfaces must be brought into contact and kept there.

The writer has inspected many compressed terminals, some applied with ordinary care, some with greater care, and usually a considerable part of the copper surface, sometimes more than one-half, shows plainly that it has never touched the steel. In a short time that part of the contact surface becomes oxidized and is of little further use. A film of oil, such as is left in holes in which oil is used to lubricate the drills, decreases the conductivity seriously and increases the deterioration. Such holes show in time a black deposit from the decomposed oil, and ultimately rust. Rough surfaces require greater pressure to get good contact and allow more crevices into which moisture may penetrate with resulting corrosion. In the case of soldered bonds complete contact between the terminal surface and the rail is seldom obtained, no matter how carefully the work is done.

The heat capacity of the rail is so great that it is difficult to get any considerable part of it to soldering temperature by external heat application, without excessive expense and possibly damage to the rail, so the edges of the terminal surface are usually well soldered and the middle portion but imperfectly.

Large flat surfaces held in contact by bolts have been tried, though they have never attained great vogue. The cost and bulk of any arrangement of bolts and plates which could maintain intimacy of contact similar to that of an ordinary compressed terminal, together with the cost of finishing and fitting the flat surfaces, would be prohibitive. In some cases such bonds have been used in joints where there is supposed to be enough motion to keep the surfaces rubbed bright, but here there would seem to be little advantage in using copper, as the joint-plates fill the same office. The following data illustrating the foregoing may be of interest:

A track laid with 87-lb., 60-ft. girder rails on concrete base in unusually substantial manner, with joints driven tight and made as rigid as possible, was bonded with two 0000 bonds with 0.875-in. terminals expanded with a steel drift left in the hole. On account of the rigidity of the joints the bonds were very short, of horseshoe type, 4 ins. and 2.5 ins. between terminals. Bond holes were punched at the mill and reamed bright with taper reamers just before applying the bonds, which were set with the shank at the small ends of the taper holes. Measurements of fifteen joints by comparison of fall of pressure through the joint with that in 10 ft. of rail made with a millivoltmeter, showed the mean joint resistance equal to that of 1 ft. of rail. The same joint measured in the same manner with the same instruments one year later showed no perceptible increase in resistance.

A double-track railway laid with 60-lb. T-rails, rock ballasted and maintained unusually well for an electric railway, was bonded with masses of tin amalgam enclosed in washers of treated cork, pinched between the rail-web and joint-plates. After the road had been in operation about four and a half years and parts of it one and two years less, measurements were made upon joints in the various sections by the same method as the preceding test.

Number of Joints.	Years in Service.	Mean Resistance of Joints		Res. too High to Read (Over 500 Ft. of Rail)
		No. Measured	Equiv. Ft. of Rail	
13	4.5	8	15.7	5
6	3.5	5	12.4	1
18	2.5	17	8.4	1

About forty joints of various ages were opened for inspection, and in none of them were the amalgamated surfaces unimpaired, while the older joints were nearly or completely rusted over. The amalgam masses were (with one exception) either dry and crumbly or hard and brittle. The cork washers were generally intact, though a few were broken.

In a single-track interurban electric railway laid with 70-lb. T-rails on private right of way, the joints were each bonded with one 0000 copper bond 10 ins. long with 0.875-in. welded terminals. In the earlier part of the work, the bond holes were drilled with oil lubrication and the bond terminals were upset with a screw compressor by one man using a wrench about 36 ins. long. To estimate the improvement possible, the resistance of 633 ft. of one rail containing twenty joints was determined in the condition described, then the bond terminals were thoroughly compressed with a similar compressor using a wrench about 66 ins. long, with a heavy man on the end applying the pressure slowly and steadily. Then a similar section of one rail 425 ft. long, containing fourteen joints, was drilled with soda-water lubrication, the holes carefully wiped and the bonds compressed thoroughly as above. The sections of rail when measured were disconnected at both ends and the ballast scraped clear. The readings were taken at night in dry weather and very nearly uniform temperature. Pressure readings were taken with a low reading voltmeter. Only switchboard ammeters were available for current measurements, but they were new, and three were connected in series and the mean readings used. They checked very closely and were reliable enough for comparative measurements.

	Ohms per Ft. Rail	% Increase R
Drilling with water, bonds well compressed,	1.29×10^{-5}	0
" " oil, " " "	1.47×10^{-5}	14
" " " " poorly "	1.96×10^{-5}	33

Cost of Applying Bonds.—Two cases are presented in detail, as it is proposed to try to derive from them some conclusions regarding the most economical expenditure for bonding in two typical roads.

On a single-track interurban railway quoted herein, it was necessary to organize a bonding gang of entirely green men, none of whom had ever seen a bond before. It contained twelve men at $1.75 per day and a foreman at $3, total of $25 per day. The work consisted in unplating the joints which were half bolted up, drilling two 0.875-in. holes in the rail-web, compressing one bond per joint, and replating and bolting up the joints in permanent shape with four bolts each. The equipment consisted of three portable rotary track drills, three screw compressors, about sixty 0.875-in. twist drills and the necessary track tools, costing altogether about $350, in which the salvage was about $150. The capacity was 100 bonds per day, making a labor cost of 25 cents per bond. Grinding drills cost about $1 per day, and repairs to compressors about $1.50, making total cost 27.5 cents per bond, of which 5 cents was chargeable to plating and 22.5 cents to bonding. The work was continually interrupted by construction trains, and the temperature was so high that several men were overcome by heat. With clear track and decent temperature the daily output could be increased 20 per cent at the same total cost.

On a larger installation in somewhat more favorable conditions, the bonding gang consisted of ten or eleven men and a foreman, with a total pay-roll of $23 to $25 per day. The drilling apparatus consisted of a gang drill driven by an electric motor which made two 0.875-in. holes at once, piercing the rail-web in one minute and drilling an average of thirty joints per hour when smartly handled. The position of the drills was determined by a jig, so that no time was lost in adjustment. The machine used an average of 2000 watts when drilling, derived from the trolley wire used by the construction trains. It weighed about 1500 lbs. and had to be removed from the track by the bonding gang about four times per day to allow construction trains to pass. The capacity of this gang was 200 bonds daily, making the labor cost about 12 cents each, of which 3 cents was chargeable to plating and 9 cents to bonding. The machine contained a drill grinder, so there was no additional expense for sharpening drills. The equipment included six screw compressors of the best type obtainable, but they were too light, and three or four were always crippled, adding 1 cent to 2 cents for repairs to the cost per bond. The drilling machine was built especially for this job and required considerable changes after work was begun, so the cost of tools was rather large, about $2,000, on which the salvage was probably $1,000.

Economical Bonding.—It is at once evident that the proportion of the resistance of the rail circuit due to the bonds is small; in the first case cited, using 60-ft. rails, it is a little less than 2 per cent; in the third case it is about 13 per cent, and as the resistance of the rail circuit is usually not over 25 per cent of the whole resistance, the saving by a considerable increase in bonding is relatively small.

In order to reach some general conclusions regarding the economical expenditure for bonding in cases similar to the two described, by means of Kelvin's law, it is necessary, in order to make the law apply, to make certain assumptions, which are not strictly true, but which, if carefully adjusted to the case taen up, may be near enough for the purpose.

The following data of equipment may be taken as typical of the interurban electric railways of moderate size and capacity built extensively in the Middle Western States. The 0000 copper bond, 12 ins. long, with solid 0.875-in. terminals, is selected as a unit, because it is a convenient market size and well adapted for use with the rails assumed:

Single track	two 75-lb. T-rails
Cost of power in line	0.02 cents per kw-hour
Mean current in track	200 amps.
1 joint bond	0.19 cents per 1000 circ. mil
(based on No. 0000 × 12-in. bond at 40 cents)	
Applying same	0.094 cent per 1000 circ. mil
(based on 20 cents per bond)	
Scrap value of bond	0.056 cent per 1000 circ. mil
Net cost of bond	0.23 cents per 1000 circ. mil
Useful life of bond	10 years
Annual cost of bond at 15 per cent	0.034 cent per 1000 circ. mil
Resistance of bond	0.0116 ohms per 1000 circ. mil
(12-in. 0000 copper + 8 per cent for contacts)	
Annual (7300 hours) loss in one bond	847 kw-hour per 1000 circ. mil
Cost of same at 2 cents	$16.94 per 1000 circ. mil

$$\frac{0.00034 \text{ circ. mil}}{1000} = \frac{16.94 \times 1000}{\text{circ. mil}}$$

circ. mils = 223000

The equipment described would correspond to that of a road operated by rotary converter sub-stations having an average traffic of two 40-ft. cars per section. Such a road would usually have one 0000 bond per track joint, which would seem to be a little too small.

For a road of somewhat heavier construction and traffic, and operated at high speed, the following data may be assumed; items which are the same as in preceding case are not repeated:

Double track	four 80-lb. T-rails
Mean current in track	800 amps.
1 joint bond	0.19 c. per circ. mil
Applying same	0.057 cent per 1000 circ. mil
(based on 12 cents per bond)	
Scrap value of bond	0.056 cent per 1000 circ. mil
Net cost of bond	0.203 cent per 1000 circ. mil
Annual cost of bond at 15 per cent	0.0304 cent per 1000 circ. mil
Annual (7300 hours) loss in bond	3.387 kw-hour per 1000 circ. mil
Cost of same at 2 cents	$67.76

$$\frac{.000304}{1000} = \frac{67.76 \times 1000}{\text{circ. mil}}$$

circ. mil = 472000

This case is fairly comparable with the Aurora, Elgin & Chicago Railway, which is bonded with two 250,000-circ. mil bonds per joint.

If this method indicates a cross section of bonding varying greatly from a multiple of the typical bond selected, a second approximation will be necessary, as the cost of bonding will not vary with the cross section unless the unit size is practically adhered to. In a more precise solution the square root of the mean square of the current should be used instead of the mean current. It would be interesting to compare the results obtained by this method, carefully carried out, with those obtained by the summation of annual cost and annual loss curves covering all the elements of the conducting circuit in the above typical cases, but the brief time at the writer's command does not permit.

The cost of applying bonds stated by the writer may be criticised as unduly low, and is intentionally very close, but in work of great enough size to permit of a good organization, such costs are practicable for compressed or expanded terminal bonds. Of course, delay by interference of other work will increase the cost. The use of reliable hydraulic compressors might reduce the figures a little, but the amount would not be great, as the copper must be compressed rather slowly, and the hydraulic machines are heavier and more difficult to handle; so the net saving of labor cost is probably small, though the quality of work is probably improved by their use.

The expression for the economical cross section of bonding may be stated conveniently:

$$\text{C M} = 1000 \sqrt{\frac{\text{annual loss}}{\text{annual cost}}}$$

or the economical cross section varies inversely as the square root of the annual cost. In the first case considered, the net cost per 1000-circ. mil of bond was 0.33 cents, of which 0.09 cents was for application, about .4 of the whole (based on cost of application of 20 cents per bond). It is evident that any considerable increase in the cost per 1000 circ. mil of applying bonds will decrease the economic section of the same rapidly, and much more so than a proportionate increase in the price of the bond.

In this case, increasing the cost of application 50 per cent would decrease the economical cross section 10.4 per cent, and doubling the cost of application would decrease the economical cross section 19 per cent. This is worthy of attention in view of the increased cost of application of various soldered bonds for which lower contact resistance is claimed. Unless a considerably greater saving is made than the 8 per cent herein allowed for contact resistance of compressed terminal bonds, which seems also to accord with the results of tests by Mr. Burton, of J. G. White & Company, the greater cost of soldering to the rails would seem a rather doubtful investment.

DISCUSSION ON BONDS

Mr. Lardner opened the discussion by congratulating Mr. Ricker on the thoroughness of his paper, stating that his only regret was that after Mr. Ricker had stated so well the qualities of the ideal bond he had not presented one which filled the requirements. The difficulties were certainly very great, and they seemed so largely due to the difficulty in obtaining good contact between the bond terminal and the rail that he believed some radically different method of bonding will have to be devised. The proper welding of the bonding strip to the terminal can be worked out, and he believed that it could be done with proper inspection. The attainment of good contact depends largely on the individual applying the bond. It is practically essential that all rails be drilled or reamed, and it is a question whether or not the bond terminals themselves should not be actually machined so as to give a much more accurate fit and require less expanding than is possible with the bonds now on the market. If this fit is not very close, the bond must be expanded to such an extent that the copper in some instances may become as hard as the rail itself. He believed that, especially with the heavier traction we are approaching, the plugged or expanded bond must be replaced by some form that will insure better contact. This is especially true in the case of heavy traction where the bonds must be installed under the plates of an existing track. The placing of bonds under these conditions becomes very serious, owing to the lack of time for properly drilling or reaming holes in the rails and installing the bonds with all the care and attention necessary. It is also a matter of great expense where nut locks or special bolts are used for keeping the joint tight, practically meaning the throwing away of the old bolts and providing new ones. Unless some radical change is introduced, he believed that it would be essential to utilize the splice bars themselves in some way with connections to the rail which can be made outside and without the removal of the bolts or splice bars.

Mr. Knudson, the next speaker, gave some instances of electrolysis caused by poor bonding.

Mr. Pestell, following Mr. Knudson, spoke of the use of the expanded or compressed terminal bond under different conditions. Deterioration is much more rapid where a track is exposed to moisture or where streets are paved than where the bonds are on private right of way and not subject to moisture.

Calvert Townley, when called upon, said that one point had not been considered in Mr. Ricker's paper, namely, the effect of an increased bond on the reduction of electrolysis. He had the feeling that the electrical engineer of the future, and his client, the street railway company, will have to make a considerable change on the question of electrolysis, so that in calculating the value of a bond, account should be taken of the electrolytic action, which, of course, makes it difficult to present the problem in mathematical shape, depending so largely on the number of water pipes, etc., along the line.

R. D. Mershon asked Mr. Ricker as to data bearing on the contact resistance itself in relation to the bond.

Mr. Ricker, who closed the proceedings, said in reply to Mr. Mershon's question, that in some cases where he had tried to compute the probable contact resistance of compressed or terminal bonds by measuring the actual resistance of the length of track and subtracting from that the resistance of the rail and the length of the copper between the centers of terminals, the resistance per contact averaged in a considerable number of contacts, in the case of 0000 bonds with ⅞-in. terminals (with the contacts in good condition), about ½ in. of the copper shank of the bond.

The Indianapolis & Eastern Interurban Company has been selected by the United States postal authorities as the line on which trial postal cars will be placed this season. The new service will begin soon after March 4.

LOS ANGELES-PACIFIC RAILWAY

Owing to the greatly increased traffic on the interurban railway system of the Los Angeles-Pacific Railway Company, the officers of that company have decided to increase the capacity of their central power house at Vineyard and to install an additional sub-station in Los Angeles. The new electrical equipment has recently been contracted for with the Crocker-Wheeler Company through its Pacific Coast managers, the Abner Doble Company, of San Francisco. The contract comprises one 1200-kw, three-phase, 50-cycle, 2300-volt, engine-type generator with a speed of 125 r. p. m.; one 300-kw motor-generator set; one 400-kw motor-generator set; three 400-kw transformers; three 160-kw transformers; three 120-kw transformers, and a 60-kw engine-type exciter. The 1200-kw alternator will be of the Crocker-Wheeler Company's new revolving field type, similar in construction to the three 4000-kw alternators recently ordered by the California Gas & Electric Corporation. The Los Angeles generator will be driven by a 2000-hp compound-condensing McIntosh & Seymour engine. The motor-generator sets will consist of 2300-volt synchronous motors driving 600-volt direct-current railway generators. The transformers will be built for 15,000 volts on the primary and 2300 volts on the secondary, and will be of the water-cooled, oil-insulated type.

The interurban railway system of the Los Angeles-Pacific Railway Company is one of the most extensive in the country, embracing as it does nearly 200 miles of up-to-date lines. The company owes its growth largely to the energetic and untiring work of the president and manager, E. P. Clark, who was one of the pioneer railway men of Southern California, and who has seen his system develop from a very small beginning to its present commanding position in the traction field. The system extends from Los Angeles in a fan shape to Santa Monica, Ocean Park, Playa del Rey, Hermosa, Manhattan Beach and Redondo on the ocean, and passes through the intermediate towns of Hollywood, Colegrove, Sawtelle, Sherman and Palms. In other words, the lines cover thoroughly the territory lying south of the Santa Monica Mountains and between Los Angeles and the ocean. Most of the lines have been double-tracked and are constructed in conformity with the best steam railroad practice. About a year ago a new central steam plant was installed at Vineyard, about 5 miles west of Los Angeles, and from this station transmission lines at 15,000 volts carry the power to several sub-stations located at intervals over the system. It is to increase the capacity of this central station and to supply additional power for the operation of the lines in Los Angeles that make necessary the additional machinery named.

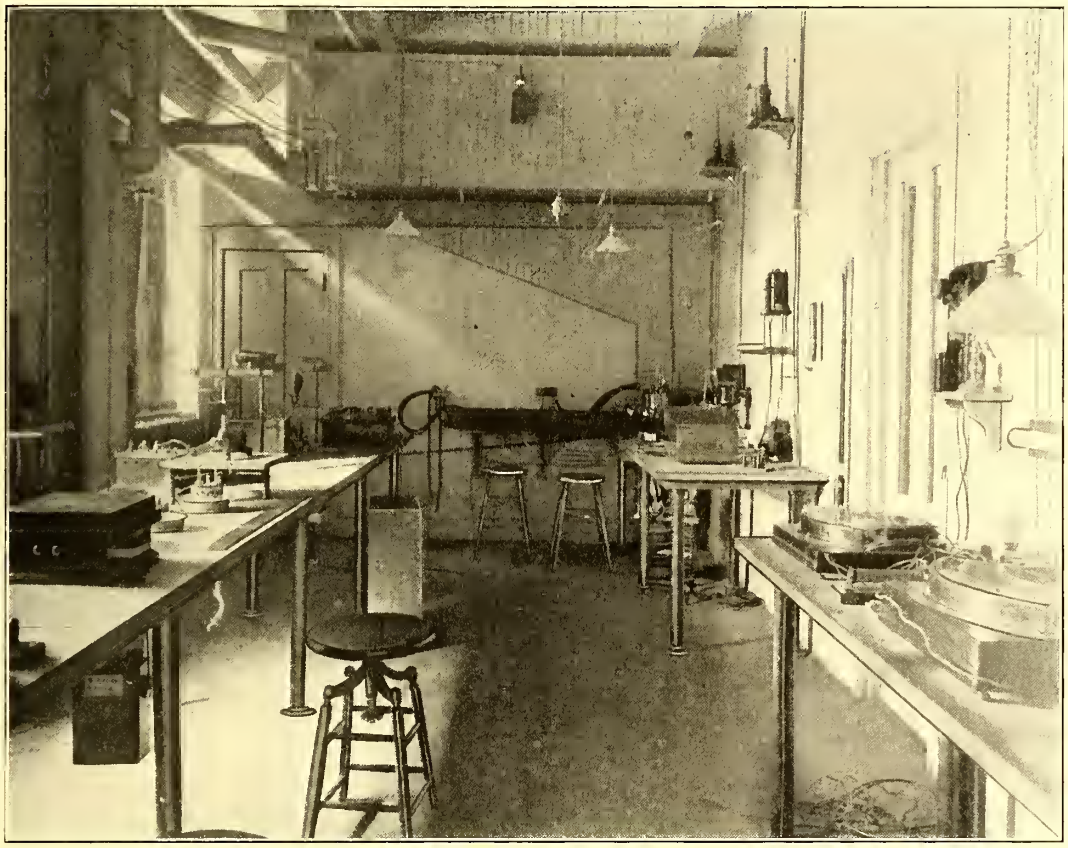
HANDLING CAR ADVERTISING IN CAMDEN

The South Jersey Division of the Public Service Corporation and its predecessor, the Camden & Suburban Railway Company, have differed from most companies in handling their own car advertising. As most of the advertisers are local mercantile houses, it seems quite as easy and even more efficacious to approach them through local agents than through an outside house. In Camden, the advertising solicitor for the display cards works on a commission and, with the assistance of one boy, attends to all the work of placing the cards in the cars, changing them, etc. The solicitor reports directly to the general manager and hands him a statement each day of the cars in service and of the number of spaces available, their rate and the total amount received, and the same figures for the spaces to rent, with totals and grand totals for each class of space sold on the cars. There are five such spaces, viz.: Main compartments, smoking compartments, end frames, end roof signs and side roof signs. The advertisers supply their own cards, and the net receipts to the railway company have averaged for some time $55 annually per car.

AN IMPORTANT ACQUISITION TO THE ELECTRICAL INDUSTRY—THE ELECTRICAL TESTING LABORATORIES

The history of every phase of the electrical industry, and particularly that of the electric railway field, is one of constant and comparatively rapid improvement. Apparatus has been constructed and tested in the laboratory and work shop, or in actual service. Its weaknesses have been discovered and crudity in manufacture has given place to refinement. But the rapidity with which improvements have taken place has depended very largely upon the testing which has been done. Before remedies could be applied weaknesses had to be discovered; this could be done only through tests. After weaknesses were found, the remedies which were applied may have been insufficient or they may have been entirely effectual; the results could be known only through tests.

In the past, improvements in electrical apparatus have been due very largely to the efforts of large manufacturers, who could afford to maintain expensive testing laboratories for carrying out investigations and testing models of new and improved apparatus. The small manufacturer has been greatly handicapped, having to rely largely upon tests which were made while his apparatus was in actual service. Small purchasers of electrical apparatus and supplies have suffered in a similar manner because of the lack of testing facilities; such purchasers have been obliged to rely entirely upon manufacturers' statements, until by actual experience they could come to some conclusion concerning the merits of the supplies purchased. Some few far-sighted large purchasers have, on the other hand, established testing laboratories and have purchased all their supplies subject to strict tests. In this manner they have secured the cream of the product of the various manufacturers, and the small purchasers have been obliged to take what the manufacturer offered them, which might represent his first-class product, or might represent material which had been discarded by a larger purchaser having testing facilities, as the case might be.



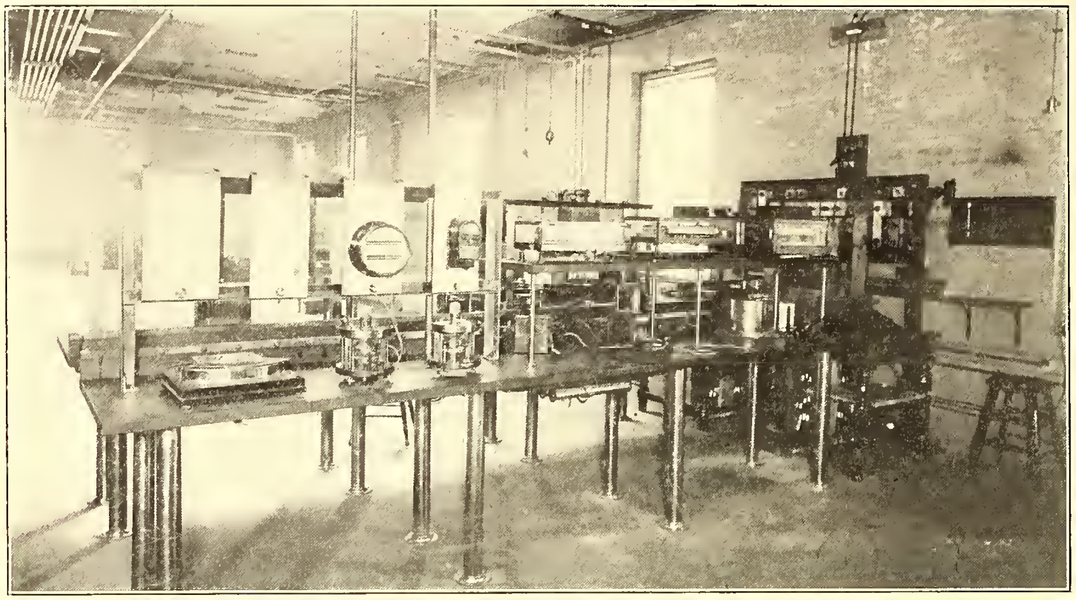
THE STANDARDIZING LABORATORY WHERE HIGH PRECISION TESTS OF RESISTANCE, CONDUCTIVITY, ETC., ARE CARRIED OUT

As a remedy for the evils which underlie these conditions, the establishment of commercial testing laboratories, under the name of the Electrical Testing Laboratories, comes as a boon to all, manufacturers and purchasers alike. In these laboratories electrical tests of any description can be made for anyone. To purchasers they afford a means of protection against unscrupulous manufacturers, of whom there are always a number ready to work off inferior goods. Purchasers, both large and small, can now have the products of various competing manufacturers tested at a moderate cost, and can thereby insure the securing of the best apparatus and supplies which the market affords, and furthermore, after having placed a contract, as the result of careful consideration of the results of accurate and impartial tests, may provide against deterioration in manufacture, and may be assured concerning the quality of the material delivered under the contract, by purchasing under intelligently drawn specifications subject to periodical tests. That such assurance is well worth the proportionally small expenditure involved cannot be doubted.

The Electrical Testing Laboratories are an outgrowth of the Lamp Testing Bureau, which formerly maintained a laboratory at 14 Jay Street, New York, for the commercial testing of incandescent lamps. With the rapid development of the electrical industry, however, the scope of its work continually increased, and it soon became necessary to enlarge its equipment and provide apparatus for every conceivable kind of electrical test. It also became necessary to have a corporate name more in keeping with the work done by the company and a building large enough to house the apparatus, leave room for expansion and provide comfortable quarters. Accordingly, the name of the company was changed to the Electrical Testing Laboratories, and large quarters were obtained at Eightieth Street and East End Avenue, New York City, where the work is now carried on.

The building occupied, fortunately, combines fireproof construction with the strength and solidity so advantageous in this class of work, as it was built primarily as a power plant for one of the early lighting companies in New York. Its location is also very favorable in being well removed from the external disturbing influences of electric cars, heavy street traffic or adjacent heavy machinery. The main portion of the building is 50 ft. x 120 ft., three stories high, while the rear addition, two stories in height, is 30 ft. x 120 ft. in size. The top floor of the three-story section is devoted to office and general electrical testing work, the second floor of both sections to the incandescent-lamp life-test racks and general photometry of all kinds of lamps, and the lower floors to the generating and transforming apparatus and storage-battery equipment for the current supplies. The primary electrical supply is secured from the New York Edison Company, current being delivered through direct cables; this obviates the disturbing factor of a local generating plant.

In the arrangement and equipment of the laboratories, the purpose for which they are intended was kept strictly in view. The work for which they are designed primarily is commercial testing, not research in pure science. The requirements of commercial testing demand that such work shall be carried out with promptness, at low cost and with a degree of accuracy sufficient to meet the needs of each special case. Having in view the minimizing of the labor cost of testing, the plan has been followed of laying out all the frequently recurring tests in advance. All requisite apparatus for such tests is put permanently in position and all electrical connections made, so that it is necessary only to connect the material or instrument to be tested into the circuit, close a switch or two and proceed to make measurements. In cases were tests are required less frequently, so that it is not found possible to set apart all the necessary apparatus for their exclusive use, a place has been assigned to the tests and the electrical connections have been made, so that but little preliminary work remains to be done.



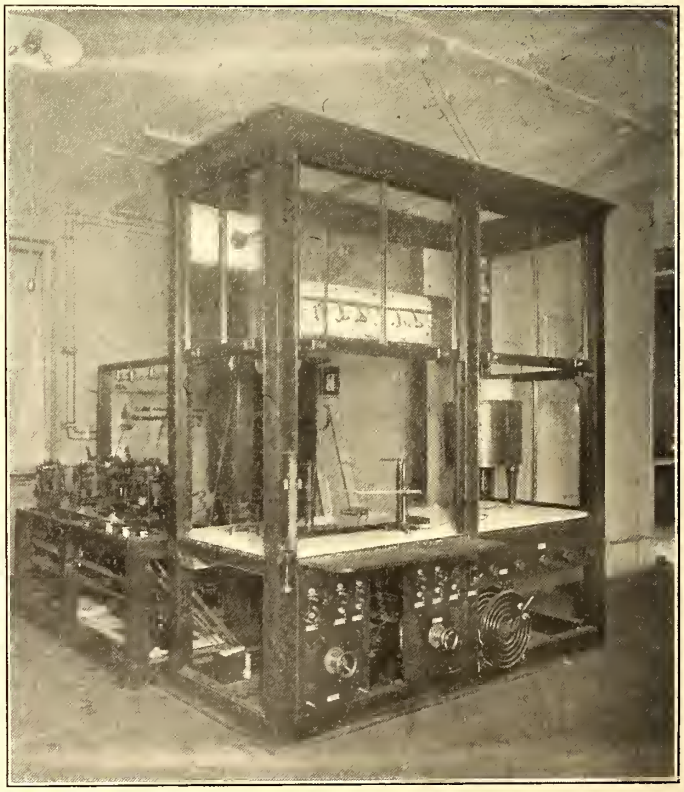
THE AMMETER AND WATTMETER TESTING TABLE IN THE ELECTRICAL TESTING LABORATORIES

Most of the work of delicate electric testing is carried out in the elaborately equipped laboratories upon the third floor of the building. In one of the rooms upon this floor, known as the "standardizing laboratory," which is illustrated in the engraving on page 447, work of high precision is provided for, including frequent intercomparisons of standards and the checking of instruments used as working standards. This room is equipped with special refrigerating apparatus for reducing the relative humidity of the air within it, which greatly facilitates the delicate testing work, by preventing the inevitable formation of imperceptible conducting films of moisture upon all portions of the apparatus.

The purpose of the standardizing laboratory is chiefly for the measuring of resistance and electromotive force, the electrical equipment provided embracing the best and most accurate standards known to electrical science. Here also the conductivity of samples of wire, bonds, etc., may be tested in a specially designed apparatus by which the greatest accuracy is obtainable. The latter measuring apparatus is arranged to be emersed in an oil bath when in operation, the oil for which can be warmed or cooled as desired, so that the temperature of the wire may be brought to any desired point and maintained during the measurements; the results are obtained in terms of percentage conductivity. Measurements of the resistance of insulating materials of cables, etc., are made here by the usual galvanometer method. For special cases where the usual high-resistance d'Arsonval galvanometer is not adaptable, a high-resistance duBois armored galvanometer is used, which cuts out the effects of outside magnetic disturbances to the greatest possible degree.

Another important feature of the laboratory equipment is the special arrangement of testing tables, as illustrated in an engraving below, for the checking up of ammeters and wattmeters. The current supply is derived from special large cells of storage battery which can be connected in any combination, and are capable of delivering 5000 amps. By this equipment, stationary as well as portable ammeters may be tested by comparison with the most delicate apparatus. This facility will be of importance to power plant operators, as by this equipment all classes of commercial electrical measuring instruments may be tested and recalibrated with the least possible delay.

Another interesting equipment is that for the high-tension tests. An equipment consisting of a 10-kw transformer and five direct-current dynamos is provided, by which voltages up to 10,000 volts direct current and 120,000 volts alternating current may be delivered for testing purposes, the actual application of which in testing is made in a closed glass cabinet provided for this work, as illustrated in the engraving above. An important feature of this equipment is the arrangement for measuring the high-tension current directly; the ordinary practice in such testing is to determine the high secondary voltage from



THE HIGH-VOLTAGE TESTING CABINET, WITH ITS EQUIPMENT OF GENERATORS, TRANSFORMERS, CONTROL AND MEASURING APPARATUS the primary voltage, which may be a source of considerable error. Here a Kelvin electrostatic voltmeter is used, which measures the high tension directly. A spark gap is also provided when it is desired to use that method of high-tension measurement. This latter point illustrates the predominating feature of the equipment of the laboratories, in that apparatus is provided for all possible variations of electrical testing so that all known methods may be utilized for the accurate determination of measurements.

Among some of the tests which may be made here that will be of interest to those engaged in electric railway work are: Resistance and conductivity tests of samples of wire, bonds, etc.; checks of indicating, recording and integrating instruments over a wide range of frequencies, power factors, volts and amperes; high-potential and break-down tests with alternating current or direct current; tests of fuses and circuit breakers; permeability and hysteresis measurements; measurements of distribution of light and illumination; photometric and life tests upon incandescent lamps, arc lamp carbons and gas mantles.

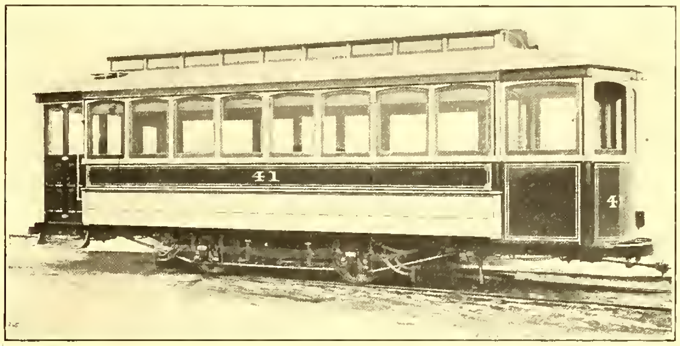
An innovation which will no doubt be of considerable convenience to the electrical public is the setting aside of three rooms as private laboratories, to be leased to responsible and competent persons for conducting private tests and researches. These rooms are equipped with tables, with gas and with wires leading to the distribution switchboard. Having leased one of these rooms an electrical engineer has all the facilities of the laboratories at his disposal. Electric currents of various descriptions and abundant apparatus are at hand for carrying out any such researches as he prefers to conduct personally. Of the nature of the work which he is doing no one but himself need have any knowledge. Researches of this sort are, of course, not necessarily confined to these rooms, but may by special arrangement be made in any available part of the building.

The electrical public is to be congratulated upon the establishment in this country of these testing laboratories devoted to commercial testing work. Community of interest on the part of a number of manufacturers and purchasers of electrical supplies and apparatus has led to a demand which the establishment of this institution has recognized, and has made possible the establishment on a basis of moderate charges. Increase in this demand which is sure to follow will make possible a still further decrease in the charges which it is necessary to make in order to provide for the maintenance of the laboratories.

The effect of such an institution upon the electrical industry in this country cannot be but beneficial. This has been found to be the case in European countries, and may be readily observed in this country in those phases of the electrical industry in which the influence of the Electrical Testing Laboratories has been felt. Continual testing must result in improvement in quality and in the elimination of inferior goods. Every careful test which is made must therefore, either directly or indirectly, result in raising the standard of quality, and the laboratories should receive a hearty welcome and consistent support from the electrical public.

ROLLING STOCK FOR URBANA AND CHAMPAIGN, ILLINOIS

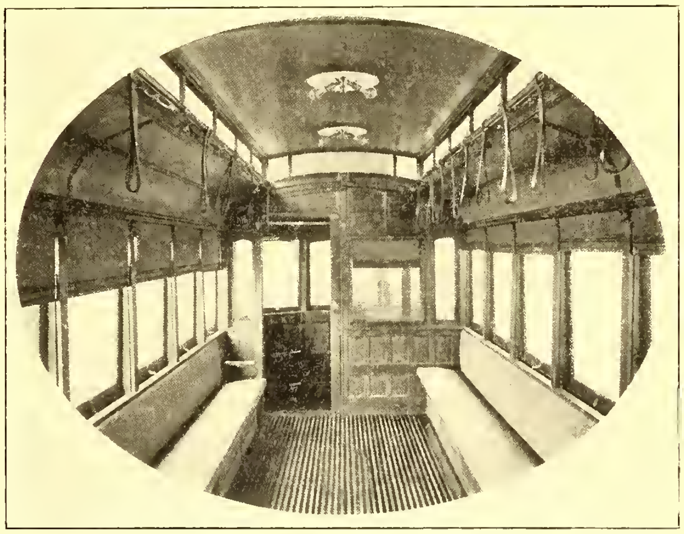
The American Car Company has delivered a number of substantially built and well finished single-truck cars with 22-ft. bodies to the Urbana & Champaign Railway, Gas & Electric Company. The lines at Urbana and Champaign are a part of the extensive system operated by the McKinley Syndicate, extending across the central part of Illinois, and are connected with the high-speed lines operated by the syndicate between Danville, Decatur, Springfield and other principal cities. Though comparatively small (Champaign has a population of 10,000, and Urbana, 6000), they are important railway and commercial centers. The interior illustration shows the seating arrangement and the type of doors used in the ends, known as the Brownell "semi-accelerator." The advantage claimed for this style of door, in connection wi h entrance from one side of platform, is the great facility with which passengers may enter and leave the car, both as to position—being close to the platform step—and the fact that the arrangement prevents, in a large measure, passengers from standing upon the



SINGLE-TRUCK CAR FOR URBANA & CHAMPAIGN RAILWAY, GAS & ELECTRIC COMPANY

platforms in such a way as to obstruct the passageway. A large amount of standing space is afforded in these cars and on their platforms, the platforms being 5 ft. long over end panels from vestibule sheathing. The interiors are finished in cherry, and the ceilings are birch, tinted a light green.

The general dimensions of the cars are as follows: Length over the end panels, 22 ft., and over the vestibules, 32 ft. The width over the sills is 8 ft. 1 in., and over the posts at the belt,



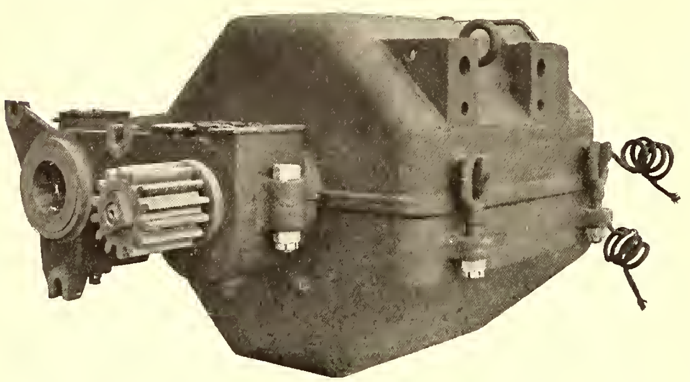
INTERIOR OF CAR, SHOWING SEMI-ACCELERATOR DOOR

3 ft. 3½ ins. The sweep of the posts is 1¾ ins.; centers of posts, 32½ ins.; size of side and end sills, 4 ins. x 7 ins. The sill plates are 7 ins. x ½ in.; thickness of the side posts, 2¾ ins., and of the corner posts, 3¾ ins. Height of the platform steps from the trucks, 16 ins., and height of the risers, 14 ins. The wheel base of the No. 21-E trucks is 8 ft., and the wheel diameter, 33 ins. One 50-hp motor is used to each truck.

The electric tramways at Colombo, India, are to relay their rails. The weight of the present rail is 67 lbs. per yard, and for this it is proposed to substitute one of 95 lbs. per yard. For the curves a special heavy section will be used, weighing 101 lbs. per yard. It is proposed to adopt the Thermit process in welding the rail-joints.

PEEBLES (TYPE S) TRAMWAY MOTOR AND CONTROLLER

The Peebles (type S) tramway motor, manufactured by Bruce Peebles & Company, Limited, Edinburgh, is a good example of the more powerful class of motor used on British tramway systems, being adapted for use either with medium weight cars making fast schedules over hilly routes or for heavy cars on easier systems. It will be seen from the performance curves that on a one hour's rating, tested stationary and totally enclosed, the output of the motor is 35 hp, measured at the car axle, the efficiency with gears at this load being about 85 per cent. Of course, the rating of the tramway motor by horse-power in this manner does not give complete information with regard to its service capacity as the loads are continually fluctuating through such wide limits, but an examination of the curves shows excellent characteristics in the motor. The efficiency, which reaches 85.5 per cent as a maximum, is maintained very high over an unusually long range.



MOTOR COMPLETE, SHOWING OCTAGONAL FRAME

In external form and in the arrangements for suspension, etc., this motor is in conformity with the best modern practice such as has been practically standardized. The frame is of cast dynamo steel of the best quality, of octagonal form divided horizontally, the upper half of the frame carrying the journals both for the motor bearings and the car axle bearings. Large doors both in the upper and lower half provide access to the commutator and brush gear. By loosening one or two bolts the lower half of the field frame may be swung away from the upper half, and the motor is thus completely opened out for inspection over the pits in the car shed. It is, further, a simple matter to remove the lower half field and also the armature in its bearings if required.

Each of the motor bearing journals is provided with two lubricant boxes fitted with spring lids and gaskets, and thus either oil or grease can be used, or both. The motor bearings are of gun metal, each 7½ ins. length x 3¾ ins. in diameter, the maximum diameter of the motor shaft being 4⅛ ins. The axle bearings are babbitted, and are 4 ins. x 7½ ins. in standard motors, but the axle boxes are so arranged that a different size of shaft can readily be taken. The motor bearings are made of gun metal on account of the desirability of avoiding wear in these bearings, so as to prevent any liability of the armature touching the fields. The bearing surface is very long and the lubrication has been skilfully arranged; carefully designed oil-thrower rings on the shaft within the bearings prevent any possibility of oil getting on to the armature of the motor and injuring the insulation.

The leads are as usual brought out independently through insulating bushings from the lower halves of the field, in order to avoid trouble when opening up the motor. The motor has inwardly projecting solid poles fitted with long extended pole-shoes of a form which absolutely prevents sparking, except at the very heaviest overloads. The field coils are of copper, of ample section, carefully wound, taped and varnished, baked several times and insulated from the frame with press-spahn and mica. The weight is kept off the pole tips by the use of substantial cast-iron clamps. It will be noticed that laminated poles are not used. Bruce Peebles & Company have never believed in the lamination of field circuits for continuous-current machines, regarding this practice as a survival from the days when continuous-current armatures were made with a small number of teeth and large slots, and when in consequence the eddy currents caused in a solid pole face were quite considerable. With such armatures, however, as are used with this motor, having a large number of slots, these eddy currents are reduced to a negligible quantity. From a commercial point of view the use of solid poles has the advantage of making a somewhat more liberal design of the other portions of the motor possible, and thus improving the output commutation and efficiency of the motor. The armature has forty-nine slots, and there are 147 segments in the commutator. The commutator is of ample depth and allows about ¾ in. reduction in diameter; owing to the special form of pole pieces which is adopted with the solid poles, the sparking is reduced to a minimum, which greatly prolongs the life of the commutator.

The armature core plates are clamped between end plates of the form usual in traction motors, and the windings are held in place by four bands insulated from the core and windings by mica. Additional bands over the ends of the conductors, both at the commutator and at the other end of the armature, prevents spreading of the coils should the armature attain an undue speed. The armature has further been designed with very small fly-wheel action, thus reducing the amount of energy dissipated at every stop and reducing the amount again stored up in the armature at starting. The brushes, which are of carbon, slide off machined surfaces in substantial box type brush holders and are pressed down on the commutator by suitable trig-

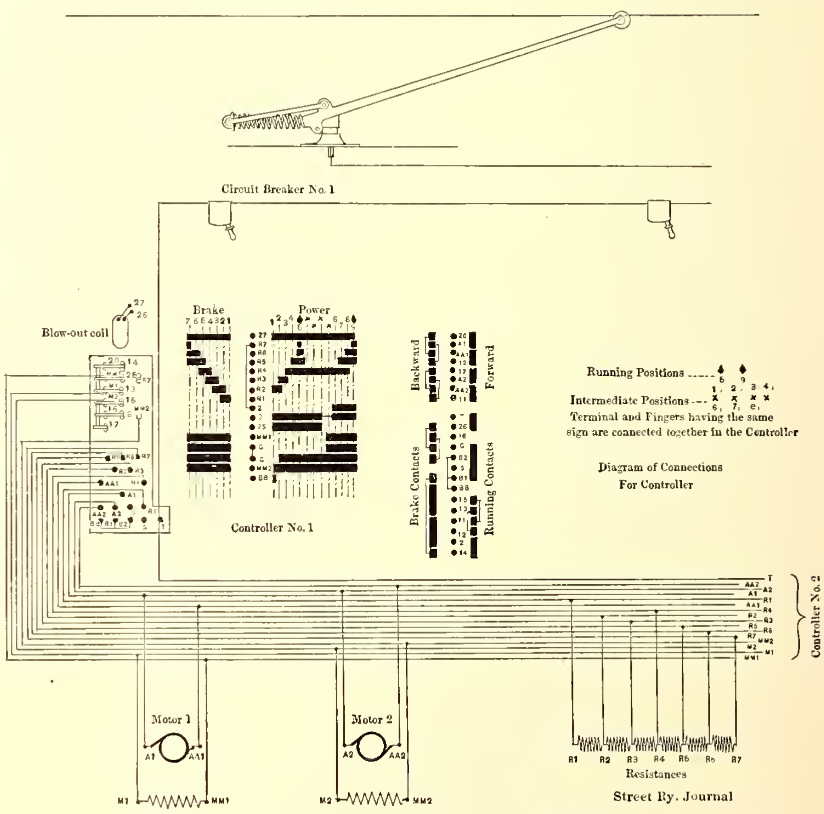
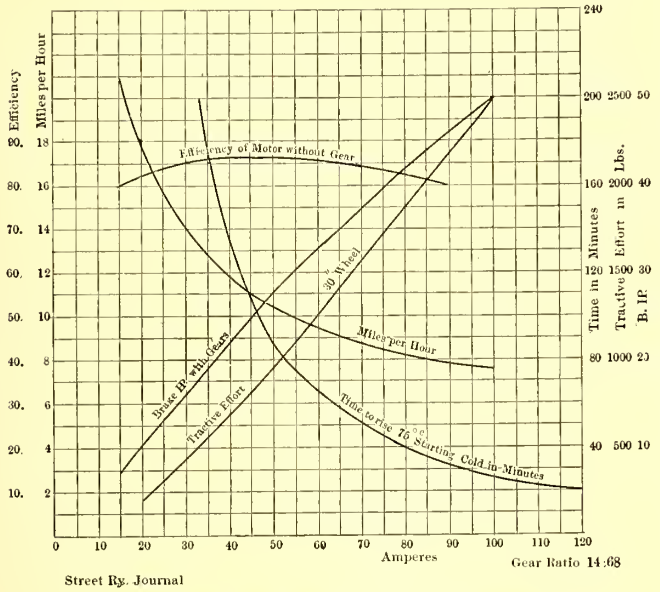


DIAGRAM OF CONNECTIONS FOR CONTROLLER

gers. The brushes are very easily removed, the type of brush holder being the simplest possible.

The weight of the motor complete, together with bearings, brasses and pinion gear and gear case, is approximately 1 ton. Any type of suspension can be arranged for if required. As a

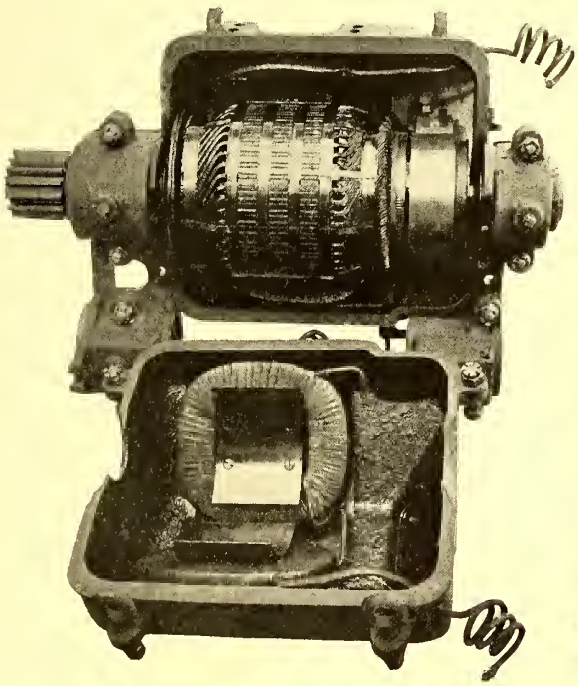


APPROXIMATE PERFORMANCE CURVES

general rule, however, the "nose" type of suspension is found most satisfactory.

The controller used is of the magnetic blow-out type, and has in all three drums, namely, a main drum, at which the breaking of the circuit in service always takes place; a reversing drum, and a further small drum actuated by a rack from the main drum, the position of the contacts on which to determine whether the motors are connected for braking or running. The controller has five series and four parallel running positions, besides four positions intermediate between the first parallel and the last series notch, and there are also seven braking positions for use with the ordinary service, rheostating braking or with an electromagnetic brake.

The diagram of connections will clearly indicate the connections of the controller, which can readily be traced out, remembering the fact that all contacts, fingers and leads having the same symbol are permanently connected in the controller. A large blow-out coil is fitted to reduce sparking at the contacts, and a number of breaks in series are arranged for when a heavy current has to be broken; for instance, in turning from the first series notch to the "off" position, the current is broken at six points in series under the influence of the magnetic blow-out. Provision is made for cutting out either motor should it be injured, and with one motor cut out it is impossible to move the main handle of the controller beyond the last series position with no resistance in circuit.



MOTOR OPEN, SHOWING ARRANGEMENT OF ARMATURE AND FIELD

CARS FOR THE NEW HOPE & LAMBERTVILLE RAILWAY, NEW JERSEY

The New Jersey & Pennsylvania Traction Company has just placed in commission four handsome cars built by the J. G. Brill Company on a division of its system extending between Lambertville, a thriving manufacturing town and commercial center in Western New Jersey, and New Hope, Pa. A large amount of the traffic between these points is due to the fact that New Hope is the terminus of a branch of the Philadelphia & Reading Railway, and Lambertville, the other side of the river, is at the junction of two divisions of the Pennsylvania Railroad.

The cars are of the vestibuled suburban type, with eleven windows to each side, and are mounted on the American Car Company's No. 23-A type of M. C. B. trucks. The upper sashes of the windows are stationary, the lower drop into pockets in the side walls, and the openings have hinged covers. A transverse seating arrangement with longitudinal seats at corners provides for forty-four passengers. The seats are of the builder's type, upholstered in cane, and have step-over backs. The interior woodwork and the doors and sash frames are of cherry, and the ceilings are three-ply birch veneer, decorated. The framing of bodies and vestibules is substantial, and includes inside trusses shouldered high upon the posts, and 6-in. x ½-in. plates on the insides of the side sills. The platform timbers are re-inforced with angle irons and capped with angle-iron bumpers. The vestibule sashes are composed of single lights and are arranged to drop into pockets. Tongued and grooved poplar boards constitute the outside sheathing of the vestibules. The cars are furnished with platform gongs, signal bells and

VESTIBULED SUBURBAN CAR FOR THE NEW JERSEY & PENNSYLVANIA TRACTION COMPANY

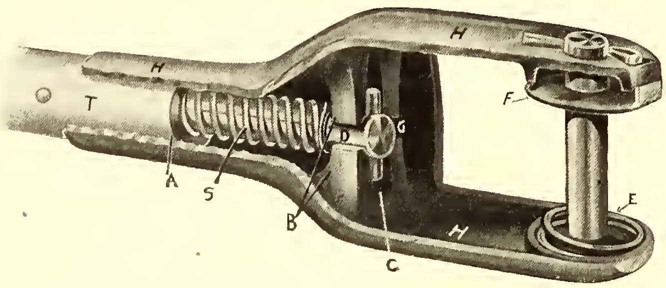
vestibule door controlling devices of the builder's manufacture.

The length of the cars over the end panels is 30 ft. 8 ins., and over the vestibules, 40 ft. 1 in.; length of the platforms, 4 ft. 8½ ins.; width over the sills, including the panels, 7 ft. 10½ ins., and over the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 1¾ ins. The long leaf yellow pine side sills are 4¾ ins. x 7¾ ins.; white oak end sills, 5¼ ins. x 6⅞ ins. The corner posts are 3¾ ins. thick, and side posts, 2¾ ins.; from center to center of the window posts, 2 ft. 8 ins.

DETACHABLE TROLLEY HARP

Within the last two years the "Bayonet" detachable trolley harp, made by the Bayonet Trolley Harp Company, of Springfield, Ohio, has become so popular for all classes of electric railway service that a description of its construction and operation may prove beneficial to those who have not yet had the opportunity to try this harp on their own lines.

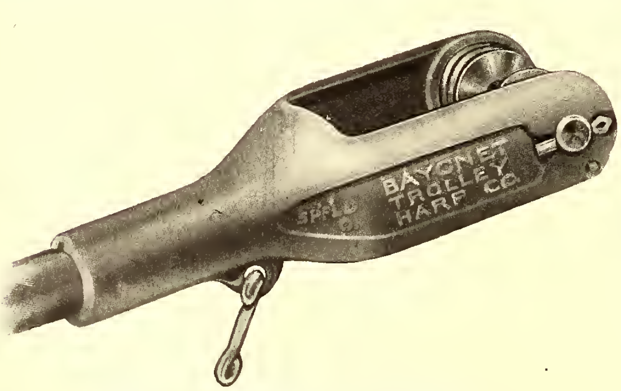
As shown in the accompanying sectional view, the complete harp consists of the head *H* and the stem *D*, the latter being firmly riveted in the pole. The pole extends 1 in. into the sleeve of the head, and the end is flush with the slight shoulder *A* in the middle of the stem. The lower end of the lock spring *S*, coiled about the stem, rests against the end of the pole and



SECTIONAL VIEW, ILLUSTRATING CONSTRUCTION OF HARP

shoulder at *E*. The upper end of the lock spring *S* rests against the under side of the flange *B* at the upper end of the sleeve. This flange has a central aperture of the same diameter as the reduced extension of the stem. At *C* is shown the lock pin in the end of the stem, resting in the locking recess after the lock pin has been passed up through the vertical internal grooves *G*, which are diametrically opposite and at right angles to the locking recess, and the head has been given a quarter turn either to right or left. The lock spring keeps the lock pin firmly seated in the recess. To change heads it is simply necessary to compress the lock spring until the lock pin disengages the locking recess, give a quarter turn until the pin engages the grooves and remove the head. By reversing the operation, the head can be put on again.

At the point *E* is shown a protected centering spring seated



DETACHABLE HARP IN SERVICE

in its groove around the axle, and at *F* a contact washer, showing the extended lip in perfect contact with the end of the head. When the wheel and the washer are in position the spring is completely protected from all injury. The stems are made to fit all standard poles.

The simple, reliable construction of this detachable harp results in many important advantages. Only ten seconds are required to change or replace a damaged wheel either in the daytime or at night. To do this work even while the car is moving, no tools other than human hands are required—hence there is no loss of schedule time on account of broken wheels or harps. By carrying on the car an extra head properly fitted with wheel, axle and washers, it is possible to replace quickly any that may become broken. The claim is made for this harp that it wears longer than others, because all axles are a driving fit, the centering springs are protected from all damage, the washers are extra heavy and all repair work and adjustments are made in the repair shop by experienced mechanics—hence there is no opportunity for patchwork on the top of the car by an inexperienced motorman. With this harp the wheels should therefore wear longer and jump less frequently than with others.

The detachable head is fitted with a sleet wheel or cutter, which is instantly interchangeable with head with the regular wheel. There is no loss of time in icy weather or on account of stopping to bolt on a sleet cutter or change to a sleet wheel.

The adaptability of this detachable harp to both urban and interurban work is well shown by reference to the following partial list of railway companies, most of whom are reported to be using it exclusively: Columbus (Ohio), Newark & Zanesville Railway; Washington Railway & Electric Company; Pennsylvania & Mahoning Valley Railway, New Castle, Pa.; Jamestown (N. Y.) Street Railway; Lexington (Ky.) Railway Company; Salem (Ohio) Electric Railway Company, and the Oklahoma City Railway Company.

THE MAGNET WIRE COMPANY TO MANUFACTURE FIELD AND ARMATURE COILS

An important departure has recently been made by the Magnet Wire Company, of New York, in the establishment of a department for the manufacture of field and armature coils for electric railway motors. The magnet wire manufactured by this company has become well and favorably known, and in consequence, the company has found that there is a large market for complete coils, not only among the smaller roads which do not have large shop facilities, but also among the large systems whose coil winding facilities are often inadequate for the demands made upon them. Excellent facilities for electrical repair work and the manufacture of field coils have been secured through the recent purchase by the Magnet Wire Company of the business and plant of a large electrical manufacturing and repair company, which has been consolidated with that of the already large plant of the company. The company was also fortunate in securing the services of H. S. Williston, who will take charge of this new manufacturing department. Mr. Williston, who is a technical graduate and a member of the American Institute of Electrical Engineers, had five years experience with the General Electric Company in charge of the manufacture of railway motor armature and field coils, and is therefore especially fitted for this class of work.

The new department of the company is prepared to manufacture both field and armature coils for all existing types of railway motors. Those for the motors which are in more general use in electric railway work will be manufactured in advance, in accordance with the usual specifications for this class of work, and kept in stock so that they may be shipped without delay upon emergency orders. The company will also, of course, be prepared to build coils to order upon all classes of specifications with special requirements. It is now building large quantities of field coils to special specifications for several of the largest city railway systems in the East, and is also supplying coils to numerous smaller systems. It has also considerably enlarged its present manufacturing facilities, in addition to the new department added. The former president, Mr. Valentine, is succeeded by Edwin W. Moore as president. F. H. Cowles is now secretary, and J. Nelson Shreve, treasurer of the company. These young men are well and favorably known in the street railway field. It is the intention of the company to meet the ever-increasing demand for and, at the same time, maintain the present high-grade standard of the magnet wire manufactured.

LONDON LETTER

[*From Our Regular Correspondent.*]

In this column last month I mentioned that there was a great and growing development of the petrol omnibus in London, and it is interesting to note that during the past month there have been aroused the most interesting discussions, pro and con, as to whether petrol omnibuses will succeed in driving out the electric tramway. The daily newspapers, and even the technical press, have printed columns on the subject, and most of the tramway magnates have been interviewed and their opinions carefully published. There is not the slightest doubt that there will be in the next year a tremendous accession in the numbers of petrol omnibuses, not only in the streets of London, but in those of nearly every city in Great Britain. It is the general opinion, however, of all those who ought to know, and have made a careful study of the situation, that this petrol omnibus will not prove, and is not intended to prove, a serious competitor to the electric tramways. There is no more economical method of operating a tramway to-day, in the ordinary thickly settled municipal area of any city, than by electricity. Wherever there still remain, however, horse omnibuses, as in London, where there are still something like twenty thousand, the petrol omnibus will form a most formidable competitor, and without doubt will oust the horse omnibus from existence within the next few years, or just as fast as the petrol busses can be made and paid for. As the whole subject, however, has been so carefully ventilated in the press lately, it might be as well to state that there is also little doubt that the motor omnibus will come to be used as auxiliaries by the electric tramway companies, or by the municipalities operating the tramways themselves, in many cities where there are outlying districts where it would not pay to lay steel rails or put up the necessary overhead construction. In these cities, the motor omnibus will be employed to collect people from these sparsely settled districts, and so act as feeders to the tramways. In proof of this, there already appears a motion in the agenda in a number of the municipalities making applications for the use of such omnibuses. The same use will also be given to motor omnibuses by the large railways, and it would appear that the railway companies especially are really hailing with delight the approach of a substantial and economically operated petrol 'bus, which will enable them, in their judgment, to regain some of their lost local traffic. The advent of the motor 'bus is also having a certain effect on the cabmen of London, and the Cabman's Union are already investigating the subject of the best way of introducing motor cabs, so as to compete on more level terms with motor omnibus. Summarizing, therefore, it might be well to state simply and emphatically that much of the present talk of the supersession of electric trams is simply "scare" talk and likely to be the prelude to the flotation of a large motor omnibus industry; that while there is a large field for the growth of the motor omnibus industry, the idea of their ever displacing electric tramways is almost too ridiculous for serious argument.

The subject of allowing the London County Council to operate tramways on the Victoria Embankment, and also to permit these tramways to cross Blackfriars Bridge so that the Northern and Southern lines may be connected, is again a burning question. It was thought a little time ago that the Corporation of London would be on the side of granting the privilege of the tramways on the Embankment, but it would now appear that they have voted strongly against it. The feeling is becoming so strong now that some of the morning papers have inaugurated petitions which have been signed by many thousands of London's working classes, who have to walk across the bridges morning and evening before they can get to the cars which take them near their homes.

Major Von Donop, one of the inspectors of the Board of Trade, paid a visit to Edinburgh recently and went over some of the principal cable lines with the view of reporting on the expediency of permitting an acceleration of the present rates of speed. At the present time motor cars, carriages, and cabs travel on the average at greater speeds than the cables, and as electric cars are allowed to run in other towns at considerably higher speeds, it is urged that a further concession ought to be made in the case of cable lines.

Mr. Frederick Coutts, general manager of the Ayr Corporation Tramways, has been appointed manager of the Paisley Tramways at a commencing salary of £400 per annum. Mr. Coutts came to Ayr from Dundee when the tramways were inaugurated in 1901, and his management of the system has been characterized by conspicuous success.

The Lambton collieries in the county of Durham, managed by Sir James Joicey, Bart., M. P., are about to be equipped with electric power supply. This power is to be supplied by the Sunderland District Electric Tramways, Ltd., and will be used for hauling, pumping, coal cutting, lighting and winding purposes, as well as for the engine works at Philadelphia. These collieries employ over 10,000 men, and have an output of over three million tons per annum.

Mr. T. B. Holliday, the engineer and manager of the Brighton Corporation Tramways, has resigned that position and has accepted that of engineer and manager to the Hastings & District Tramways Company. For a number of years he held a responsible position in the service of the Imperial Tramways Company, and supervised the laying of its tracks in London, Bristol, Stockton-on-Tees, Middlesborough, and other towns; and he was previously for eleven years with the Melbourne Cable Tramways Company. He was appointed engineer and manager of the Brighton Tramways in August, 1900, and the work of constructing the first route was commenced on January 25, 1901.

Speaking at the half-yearly meeting of the London, Chatham & Dover Railway Company, the chairman (Sir Edward Leigh Pemberton, K. C. B.), in an allusion to the experiments of the London & Brighton Company, said that if these proved successful—as there was reason to hope they would—the London and Chatham shareholders would certainly see steam ousted from their metropolitan sections.

The Metropolitan Tramways, Ltd., hope in a short time now to open another section of their tramways in the north of London. The line in question extends from Highgate, northwards in the county of Middlesex, and will enter Hertfordshire, near Barnet, and continue to the town of Hertford. When the whole system is completed, this company will have a vast network of tramways lying in the various suburbs to the north of London.

The Corporation of Manchester has now pretty well developed its tramways system for the collection, conveyance and delivery of parcels over the whole of its routes. The central receiving office will be established in the city near the Infirmary, where excellent facilities have been procured for handling a large volume of traffic. The receiving office will take parcels weighing up to 56 lbs. in weight, and will not only receive these parcels over the counter, but will use collecting vans in the city proper. It is intended to establish twenty-six depots at various points of the tramway system, where messengers will be stationed, who will immediately deliver the parcels to the addresses in the vicinity, the outlying districts being served by means of vans. In addition there will be also appointed a number of smaller agents along the lines of route, who will receive the parcels on behalf of the Corporation and deliver them to the Corporation cars.

We have dealt rather largely above with the subject of tramways versus motor omnibuses, and have touched rather lightly on the subject of the great railways of the United Kingdom endeavoring to use them. There has, however, been held recently in London a conference of the Municipal Tramways Association at which many representatives of the various local authorities and municipalities and tramway companies operating tramways were present. It appears that, at least, three of the most important railway companies, namely, the Midland Railway Company, the North Eastern Railway Company and the Great Western Railway Company, are intending to apply to Parliament during the present session for powers to use motor omnibuses in connection with their railways, for the avowed purpose of distributing their passengers from the various stations in cities to any parts of the town. This, of course, has aroused the tramway people to energetic opposition, as they naturally consider that the conveyance of passengers in cities belongs to them, and not to the railway companies, and resolutions to oppose these bills were accordingly passed.

Mr. C. R. Bellamy, general manager of the Liverpool Corporation Tramways, has again been going very thoroughly into the question of halfpenny fares, and has recommended very strongly that they be not instituted in Liverpool. Mr. Bellamy estimates that were halfpenny fares to be introduced in that city, it would be a result in reduction of something like £95,000 per annum in the receipts, and therefore, in his opinion, the introduction of halfpenny stages would seriously jeopardise the commercial stability of their undertaking.

A. C. S.

NEW WORK IN WHEELING

The Wheeling Traction Company, of Wheeling, W. Va., will build about 3 miles of new track and purchase about ten double-truck cars during the coming year. The Steubenville & Wheeling Traction Company, a constituent, plans to build 8 miles on the Ohio side of the River from Martin's Ferry north, which will be about one-half of the unfinished line from Wheeling to Steubenville, Ohio. The new line to be built this year will, of course, necessitate the purchase of rolling stock. The Wheeling & Western Railway, which is being extended into Ohio, from Bridgeport, just opposite Wheeling, will probably build 4 miles between Barton and St. Clairville, and will require additional cars. Outside of a small storage battery to be installed for the Wheeling & Western, no additional power station apparatus will be needed, as the company has recently completed two direct-current stations with sufficient capacity to care for all extensions at present contemplated.

PARIS LETTER

(From Our Regular Correspondent.)

The Gardner-Serpollet Company has been turning out some steam omnibuses recently for transport of passengers in localities where a tramway system would as yet not be able to reach a paying basis. Some little time ago this firm supplied several steam omnibuses for the postal service of Guadeloupe, one of the French Colonies. An omnibus destined for regular service between Nice-La Turbie-Menton, a very hilly district, has just completed trials in and around Paris. It made some successful attempts to climb the formidable grades of Montmartre. The omnibus will hold 16 passengers, and is furnished with a motor of 20 hp. It weighs, empty, some 5874 lbs., and loaded 8536 lbs. The trials are held to have been very successful.

The special commission appointed to inquire into the conditions relating to the passage under the Seine of No. 4 line of the Paris Metropolitan has just awarded the contract to M. Chagnaud. The double-tube scheme has been put aside, and also because of the disturbance to traffic the caisson system of construction. The tunnel will be quite shallow, and will be constructed in a manner similar to the remainder of the Metropolitan, that is, mainly of masonry arch with iron tube lining. The contract amounts to Frs. 10,629,000, and will be executed in 18 months. Several prizes of small sums have been awarded to unsuccessful bidders.

The Tramway Sud, one of the few remaining horse tramways of Paris of any extent, is undergoing transformation to electric service. The system is quite considerable and extends for a considerable distance south of the city. Within the principal streets the conduit type of construction has been adopted, with trolley line on the outskirts. The French Thomson-Houston Company is undertaking the work.

The progress within the past three or four years in French tramway construction has not been very rapid. The period of great activity in this direction ended with 1901, and only a few hundred kilometers have been built since this time. The situation is somewhat better as regards interurban tramways or light railways, which have increased by 2000 km since 1902. The average net profits in the French provinces for this class of undertaking is 4 per cent, whilst in Paris the net earnings do not amount to more than 3 per cent. The following is a summary of the French tramway situation to the end of 1904:

Length in service, about 2150 km.
Capital invested, about f.665,000,000.
Gross receipts, about f.107,000,000.
Net profits, about f.24,000,000.

The average fare per passenger is about 10 centimes in the provinces, and slightly higher for Paris. These figures give a capital expenditure of about Frs 321,000 per km, with Frs 50,000 receipts per km. The low fares charged are held responsible for the poor financial condition of many of the tramways, and the low receipts per kilometer, compared with Germany or England.

The city of Paris has had no reason to regret its bargain with the Metropolitan Railway, with respect to its capital expenditure on the tunnels of this system. The city by means of a loan raises the necessary capital for the construction of tunnels, and the operating company pays a certain percentage of its gross receipts as payment for interest on the loan. This percentage of gross receipts has in the past amounted to about 10 per cent of the capital expenditure of the city, and the operating company has had left only 6 per cent on its expenditure. It is true that in view of the capital expenditure of the Metropolitan Company for material and equipments not yet in use, a part of the money is unproductive at present, but the percentage remaining is after all not a very favorable figure compared with the good bargain made by the municipality.

A lawsuit against the city of Paris has recently been brought before the Council of State by the Paris General Omnibus Company for damages (dommages-interets) occasioned by the disturbance in its regular traffic and lines of route over which its trams and buses run, and under which the Metropolitan Railway lines have been or are under construction. The works have been in some cases carried out on the cut and cover plan, and in others by overhead viaduct. This has, of course, caused cessation of traffic on the tramway routes, and a deflection of the usual omnibus routes. The council of the Seine, to which the suit was first presented, has recognized the claim of the Omnibus Company to damages as regards the obstruction of the tramway routes, and has named experts to consider the amount of indemnity which should be awarded to the Omnibus Company. It rejected, however, the claim for indemnity as regards losses of traffic, receipts, damages to material, loss of horses, and even accidents to persons occurring on the routes where omnibuses passed along, as distinct from the tramway routes. The Omnibus Company appealed to the Council of the State, and the general verdict has now been given which is favorable to the claims of the Omnibus Company, although the exact amount of such indemnity has not yet been stated. The matter will probably be referred to experts.

DETROIT TROLLEY SONG CONTEST DECIDED

The award has been made of the special prize of $200 offered by the Detroit United Railways Company for the best "trolley song." Strangely enough, a Detroit man, Paul Hoffrichter, is the winner. The title of his composition is "Come Along." The contest was opened Sept. 29 last, and was closed Jan. 7. Only last week did the judges complete their work of going over the manuscripts and announce the decision. As previously stated in the Street Railway Journal, the song is dedicated to the Detroit United Railways Company, which retains the right to use it for advertising purposes. The copyright and royalties, however, are the composer's. As soon as the copyright is secured, the song and verses will be given to the public. Competing for the prize were contestants from nearly all the large cities. The key to the names of the writers, which was not looked into until after the decision had been reached, showed that a number of writers of successful light operas and musical comedies were among the competitors.

A SYSTEM PROJECTED FOR YORK

Another step in the project of building an electric railway in York, Pa., was taken recently, when Howard W. Stanford, of Philadelphia, and Edward S. Preston, of Moylan, arrived in the city to secure data and take measurements from which to estimate the cost of the 30 miles of electric railway to be laid in the city and county, according to plans already made under the instruction of Philadelphia and New York capitalists. John B. MacAfee is at the head of the construction, and William Hall is engineer and the president of the company.

About the beginning of the year, charters were granted at Harrisburg to the York Electric & Western Company, whose line will run east and west on Philadelphia and King Streets; to the York Intramural Railway Company, the line running north and south on Duke and Beaver Streets, and to the York & Hanover Western Company, this line running from the western end of the city to Hanover. On Jan. 18 a charter was granted to the King Street & Carlisle Avenue Street Railway Company for a loop to connect the King and Philadelphia Street lines by running around through Eberton. Its course will be from West King Street to Dewey Street, north to Market Street, west to Highland Street, north to Stanton Street, west to Adams Street, north to the Carlisle road and southwestwardly to the terminus at the main entrance to the fair grounds.

Certain extensions of these lines have since been filed. The principal one starts at the main entrance at the fair ground on Carlisle Avenue, and runs the entire length of Madison Avenue to Farquhar Park. At the northern corner of the park it goes into Newberry Street, thence to Jefferson Avenue, to Beaver Street, to the northern terminus of the Intramural line, which is at North Street.

The Intramural line will start at the Northern Central Railway depot, at Duke Street, run south on Duke Street to Springetsbury Avenue, then to Beaver Street, to Jackson, to Cleveland Avenue, to Lafayette Street, to Water, to Princess, to Beaver and thence to North Street.

The extension from the fair grounds over Madison Avenue and over Farquhar Park is considered to be the only feasible route of tapping that resort, as at the northern portion the grade is not so steep as at any other portion.

In the east end, the Philadelphia Street and the King Street lines will be connected by a line across Hartman Street.

The line to Hanover will follow the Gettysburg turnpike generally until it reaches the Five-Mile house. It will then follow the York and Hanover road into York Street, Hanover, and then on to Franklin Square. The Spring Grove spur will leave the main line just beyond Nashville, run through the town of Spring Grove and then rejoin it at another point. Several routes are under consideration for this line.

Millet, Roe & Hagen, of New York, are offering $500,000 New Jersey & Hudson River Railway & Ferry Company first mortgage 4 per cent gold bonds. A detailed circular, together with a map, showing the company's lines and connections, is issued by the firm.

THE STREET RAILWAYS OF CONNECTICUT FOR THE YEAR

There is much that is of interest in the annual report of the Railroad Commissioners of Connecticut, although it deals with conditions in that State as they were on June 30, 1904. First of all, the report treats of the situation in general, reviewing the progress during the previous year. Mention is made of extensions to existing systems, and of plans in contemplation for new work to be done. These considerations, however, are almost purely local, and of little interest, except that they tend to increase the aggregate mileage within the State. Special mention is made of the Consolidated Railway Company, organized in the interest of the New York, New Haven & Hartford Railroad Company, to operate its electric railway properties. At the date of the commissioner's report this company was in control of only the local New Haven system, the Meriden Street Railway, the Worcester & Connecticut Eastern Street Railway, the Danielson & Norwich Street Railway, and the People's Tramway Company. Its aggregate of mileage, as reported at that time was 190.6 miles, as compared with 366 miles, as given in the STREET RAILWAY JOURNAL of Dec. 24, 1904.

Perhaps of greatest interest are the data covering mileage, capitalization, etc. According to the report, the mileage is arranged as follows: Length of road (first main track), 560.247 miles; length of second main track, 109.087 miles; total length of main tracks, 669.334 miles. Length of sidings and turnouts, 31.521 miles; total, computed as single track, 700.855 miles. The three companies controlling the greatest mileage of main tracks are the Consolidated Railway Company, representing 181.805 miles, the Connecticut Railway & Lighting Company, 168.269 miles, and the Hartford Street Railway Company, 76.868 miles; leaving 242.392 miles operated by the other companies, although some of these companies are owned by the three first named, but are reported under a separate management.

The total capital stock of the companies, outstanding, is $30,659,748.00, representing 631.825 miles of street railway owned; also, in some instances, gas and electric properties. If this stock was all considered as applicable to street railways, and was divided by the 631.825 miles owned, upon which it was issued, it would show the average stock per mile to be $48,525.69.

The total bonded debt of the street railway companies is $22,207,342.27, and, like the stock, covers not only street railway, but also gas and electric light properties. If divided by the number of miles of all street railways owned, viz., 641.653, it would show an issue of $34,609.58 per mile. As a matter of fact, however, these bonds cover only 610.620 miles of the roads owned, showing an average bonded indebtedness of $36,380.43 per mile on the roads so covered.

The floating indebtedness of the companies is $2,540,189.30, and the total stock, bonds, and floating indebtedness $55,407,279.57.

The cost of construction and equipment reported is $55,575,086.57, which also includes the cost of the street railways and gas and electric light properties. If this amount was divided by the entire number of miles owned, viz., 641.653, it would give $86,612.37 per mile, including the cost of gas and electric light properties.

The gross earnings for the past year have been $4,924,151.46, being $420,580.17 more than for the preceding year. The gross earnings of the Consolidated Railway for the year were $1,533,- The number of miles operated were 685.128. The gross earnings per car hour were $3.23. The largest gross earnings per mile operated were $10,819.24, on the New London Street Railway; the second largest, $9,704.49, on the Hartford Street Railway; and the third largest, $8,432.98, on the Consolidated Railway. The gross earnings of the Consolidated Railway for the year were $1,533,158.60, the Connecticut Railway & Lighting $1,248,670.54, and the Hartford Street Railway $897,122.59.

The operating expenses for the year were $3,287,113.55, being $122,514.48 more than for the previous year, and are $4,797.81 per mile operated and $0.1445 per mile run. The expenses were 66.75 per cent of the gross earnings.

The net earnings for the year were $1,637,037.91, as compared with $1,338,972.22 for the preceding year, and were $2,389.39 per mile operated and $0.0719 per mile run.

Eight companies have paid $120,050.00 in dividends upon capital stock amounting to $1,900,000.00, while no dividends are reported as paid on $28,759,748.00 of capital stock. This is $249,766.24 less than the amount paid last year, arising principally from the fact that none are reported as paid by the Fair Haven & Westville and Winchester Avenue Railroad Companies, which last year amounted to $245,486.24.

The sum of $876,658.99 in interest has been paid on a total bonded and floating indebtedness amounting to $24,747,531.57.

The amount of taxes paid to the State by the various companies is $260,046.07.

Number of miles run, 22,750,560. The gross earnings per mile run have been $0.2164, operating expenses $0.1445, and net earnings $0.0719. The number of miles run, as reported, was 1,720,671 more than last year; the gross and net earnings per mile run slightly more and the operating expenses slightly less.

The number of fare passengers carried were 93,111,402, compared with 96,857,782 last year, a decrease of 3,746,380, contrasted with 64,315,374 carried by the steam railroads, which number was also a decrease of 603,098 in the number carried the previous year. The number of fare passengers per mile of main track operated was 135,903, compared with 146,213 last year, and the number of fare passengers per mile run 4.09.

The number of employees was 3297, averaging about 4.8 per mile of road operated.

The number of persons injured in the operation of the street railways during the past year was 383, compared with 370 for the previous year, of which number 23 were killed, four more than last year. The number of passengers injured was 212, of whom 4 were killed; the number of employees injured 20, of whom 2 were killed; and the number of other persons injured 151, of whom 17 were killed.

REPORT OF CHICAGO UNION TRACTION COMPANY

The earnings of the Chicago Union Traction Company, for three months ending Dec. 31, 1904, and the corresponding period of the previous year, as shown by the statement filed by the receivers, are as follows:

Quarter ending Dec. 31, 1904:

Earnings—	West Chicago	North Chicago	Both	Consol. Traction
*Passenger	$474,051	$253,457	$727,508	$110,169
Miscellaneous	2,801	3,152	5,953	522
Gross	$476,852	$256,609	$733,461	$110,692
Operating expenses	323,424	177,148	500,572	115,070
Net	$153,429	$79,461	$232,890	†$4,378
Other income	4,243	1,949	6,192	6,664
Total income	$157,672	$81,410	$239,082	$2,286
Charges	118,523	64,564	183,087	59,424
Balance	$39,140	$16,846	$55,995	†57,138

Quarter ending Dec. 31, 1903:

Earnings—	West Chicago	North Chicago	Both	Consol. Traction
*Passenger	$432,899	$240,837	$673,736	$97,911
Miscellaneous	2,982	3,555	6,537	688
Gross	$435,882	$244,392	$680,274	$98,599
Operating expenses	332,872	181,601	514,473	89,234
Net	$103,010	$62,791	$165,801	$9,366
Other income	3,237	2,534	5,771	6,656
Total income	$106,247	$65,325	$171,572	$16,022
Charges	123,727	67,893	191,620	64,699
Balance	†$17,480	†$2,568	†$20,048	†$48,677

* Includes mail and chartered cars. † Deficit.

PERJURER CONVICTED IN CHICAGO

The long-drawn-out trial at Chicago of Inga Hanson, for perjury, has terminated in her conviction. Miss Hanson claimed to have been injured, in March, 1898, while alighting from a car of the Chicago City Railway. Several months later she began suit for $50,000 damages for personal injuries. Her claim was that, as a result of the accident she had been made deaf, dumb and blind, and that paralysis had also resulted from the fall. The jury at the first trial stood 11 to 1 in her favor. The second trial was begun Nov. 3, 1903. At each session Miss Hanson was carried into the court room on a cot. This trial came to a sudden termination when private detectives, after spying on her in her room in the Sherman House, testified that when she believed herself to be alone her eyesight, speech and hearing returned. After her second trial Miss Hanson disappeared. She was afterward arrested in New York, free from all afflictions. She said she had been cured by prayer. When returned to Chicago to stand trial for perjury, her paralysis, she claimed, returned. The perjury trial began Dec. 28, and after continuing for six weeks ended in a verdict of guilty.

It was asserted in court that the Chicago City Railway Company expended nearly $50,000 to convict the woman.

COMPANY TO HOLD NEW YORK CENTRAL'S TROLLEY LINES

The opinion seems to prevail in Central New York that the Mohawk Valley Company, now seeking incorporation with a capital stock of $100,000 is to be the holding company for the New York Central, of its electric railway properties. The incorporators and directors, according to the certificate on file at Albany, are William A. Greer, of New York; Milton S. Barger, of Newport, R. I.; Frederick H. Meeder, of New York; Charles H. Chambers, of White Plains; William Hutchinson, of New York; William S. Langford, of Yonkers, and Landreth H. King, of Dobbs Ferry. Only three are subscribers for stock, Messrs. King, Hutchinson and Greer. The properties coming under the Mohawk Company's control in the event of its being the holding company for the Central, are the Syracuse Rapid Transit Railway Company and the Utica & Mohawk Valley Railway Company, the Schenectady Railway Company, which is jointly controlled by the Central and the Delaware & Hudson; the Oneida Railway Company, the Rome Street Railway Company and the sections of the West Shore Railroad which will be equipped with electricity; also whatever new roads to the west and branch roads which will be acquired to complete the cross-State system.

ADDITIONAL SUBWAY PLANS IN NEW YORK

The committee on plans and contracts of the New York Rapid Transit Commission recommended at the meeting of the commission on Tuesday, Feb. 28, the building of more than a dozen new subway and elevated lines, with a number of alternate routes. The Bronx, Westchester, Williamsburg, East New York and Staten Island are to be tapped by the lines, all of which have been so planned that they may be operated either independently or in conjunction with present lines. To build the systems as proposed would cost, approximately, $250,000,000. It is expected that the recommendations will be placed before the full board about March 9.

WASHINGTON RAILWAY & ELECTRIC EARNINGS

The annual report of the Washington Railway & Electric Company to its stockholders for the year ended Dec. 31, 1904, says that the "properties have continued to show a gratifying increase in earning capacity." It shows a progressive increase in gross earnings since 1900 as follows: 1901, 7.90 per cent; 1902, 7.54 per cent; 1903, 5.87 per cent; 1904, 7.40 per cent. In 1900 there was, after fixed charges, a deficit of $158,509.55, but since then there has been each year a handsome surplus, as follows: 1901, $118,535.19; 1902, $201,128.76; 1903, $221,878.97; 1904, $356,522.75.

The report says:

"Your particular attention is directed to the balance sheet dated Dec. 31, 1904, appearing on page 10, from which it will be seen that the financial condition of your company is excellent. After payment on Dec. 1, 1904, of a dividend of 2½ per cent on $8,500,000 preferred stock amounting to $212,500, there remained on Dec. 31, 1904, a profit and loss surplus of $720,902.59. You will note that this is not simply a book surplus, but an actual surplus in cash or its equivalent."

An instructive exhibit of the report is the comparative income account for the years 1900 to 1904, inclusive, as follows:

	1900	1901	1902	1903	1904
Gross earnings	$2,004,142	$2,162,559	$2,325,775	$2,462,294	$2,644,360
Oper. expenses	1,313,383	1,187,449	1,251,814	1,328,051	1,355,822
Net earnings...	$690,759	$975,110	$1,073,961	$1,134,243	$1,288,537
Miscel. income	16,510	16,016	19,644	32,905	49,024
Gross income..	$707,269	$991,126	$1,093,605	$1,167,149	$1,337,562
Fixed charges—					
Taxes	$97,333	$104,145	$124,030	$146,032	$148,377
Interest	*768,445	*768,445	768,445	799,237	832,662
Total	$865,779	$872,591	$892,476	$945,270	$981,039
Surplus	......	$118,535	$201,128	$221,878	$358,522
Deficit	$158,509	......	......	......	......
Per cent of oper. exp. to gross earnings	65.52	54.90	53.84	53.95	51.29

* Note: For comparison, shown in 1900 and 1901 the same as in 1902.

ELIMINATING GRADE CROSSINGS IN CLEVELAND

The city of Cleveland has laid out an active campaign for the elimination of grade crossings the coming summer. Work will be started on eleven crossings which will cost about $1,000,000. Some work in this direction has already been done, and an extensive undergrade crossing has just been completed under the tracks of the Lake Shore & Michigan Southern Railway at Detroit Street, eliminating a crossing which has been particularly dangerous for the Cleveland Electric Railway. Work is already under way for an overhead crossing over the Nickel Plate Railway on the same street. Of the eleven crossings which will be built this year, five of them will eliminate crossings for the street railway company. The plans laid out have all been agreed to by the steam roads, which will pay half the expense, the city bearing the other half. This arrangement is in accordance with a law passed by the Ohio Legislature last year. Consistent with his policy in the demand for lower fares, Mayor Johnson has not demanded that the street railway company pay any portion of the cost of eliminating such crossings, further than that the company shall remove its tracks and arrange to keep the line open during construction. In the case of the Detroit Street crossing, recently completed, the company was obliged to build a temporary line on private right of way. Its outlay in connection with the work was about $12,000.

McGANN BRAKES FOR TORONTO

The Toronto Railway Company, of Toronto, Ont., has decided to equip its system with McGann air brakes. The Street Railway Journal hopes to be able soon to publish details as to the number of equipments and the charging stations.

NEW YORK, WESTCHESTER & BOSTON ORGANIZATION

At a meeting of the board of directors of the New York, Westchester & Boston Railway Company, on Thursday, Feb. 23, Andrew Freedman, a director of the Interborough Rapid Transit Company, controlling the elevated and the subway lines in New York, was elected to the Westchester board. John B. Jackson, president of the Fidelity Title & Trust Company, of Pittsburg, has also been elected to the board of directors. The full board, as now constituted, is as follows: William Lanman Bull, president; Evans R. Dick, of Dick & Robinson and Dick Brothers & Company; Samuel Hunt, vice-president; Charles B. Lewis, of New York; John B. Jackson, president Fidelity Title & Trust Company, of Pittsburg; John H. McAllister, president Franklin National Bank, of Philadelphia; William Barclay Parsons, engineer; Robert C. Pruyn, president National Commercial Bank, Albany; Robert E. Robinson, of Dick & Robinson; Frederick E. Whitridge, of New York; Andrew Freedman, director Interborough Rapid Transit Company; William H. Buckley of New York; H. Carroll Winchester, secretary, New York.

For purposes of building the road, the engineering corps has been practically completed as follows: William A. Pratt, formerly chief engineer of the Staten Island Rapid Transit Railroad, will be the chief engineer. The consulting engineers will be William Barclay Parsons, formerly engineer of the Rapid Transit Commission, and John Bogart, formerly State Engineer. George Tatnall has been engaged as the principal assistant engineer. He will have charge of all general engineering matters, under the supervision of the chief engineer. He has had wide experience in building railroads in the United States and Central America, having been for the past twenty-three years with the Pennsylvania Railroad in its design and construction departments. James Leland Crider has been chosen division engineer of that portion of the line in the borough of the Bronx and the "annex" district. He will have immediate charge of the field corps on location and construction. To accept this position, he resigns the general direction of elevating the tracks and eliminating grade crossings of the Baltimore & Ohio Railroad in Pittsburg. E. V. Maitland, who has had charge of the work of elevating the Pennsylvania Railroad tracks through the cities of Chester and Wilmington, will be resident engineer in the borough of the Bronx. E. B. Naylor, who has been engineer in the construction of the subway tunnel for the Rapid Transit Subway under the Harlem River, is to be resident engineer in charge of the branch of the road from the city limits to White Plains. On March 1 a corps of engineers will be put to work in laying out details of the line between the city limits and Portchester. The names of the engineer of structures and the electrical engineer, as well as additional resident engineers, will be announced shortly, so the company informs the Street Railway Journal.

TROLLEY RUINS BROOKLYN-NEW YORK FERRY TRAFFIC

According to the Brooklyn Union Ferry Company, the losses in patronage it has sustained within the past few years through the trend of traffic to new channels make it absolutely impossible for the company to continue to operate under the basis of its present grant from the city. So marked have been the losses that the company has actually notified the city that unless some definite arrangement is reached whereby it shall pay to the city a small percentage of its earnings, instead of the 7¾ per cent of gross receipts, arranged for under the lease of 1901, the company will withdraw service from the five lines it now operates between New York and Brooklyn. To substantiate its contention that a rearrangement of its agreement with the city must be had if it continues to operate, the company has published figures of its Fulton Ferry line which show the falling off in traffic to have resulted in a reduction of the number of passengers carried from 10,000,000 in 1898 to 3,800,000 in 1904. This remarkable decrease is attributable in the main to the operation of trolley cars directly into New York over the Brooklyn Bridge. It was in 1898 that this service was begun. Previous to that time the terminus of most of the lines now operated over the bridge was at Fulton Ferry, the traffic of which is cited by the company in substantiation of its plea for less onerous operating conditions. Before the Brooklyn Bridge service was begun, Fulton Ferry was closed to vehicles during the rush hours so that the passenger traffic might be cared for. Even at this the service on the ferry was indifferent, and the turning of traffic to the bridge soon greatly affected Fulton Ferry, as it did also the other lines operated by the company. A similar condition of affairs confronts the ferry company operating the lines from the foot of Broadway, Brooklyn, to New York, which serve the territory in the vicinity of the terminal of the new Williamsburg Bridge. Surface lines formerly terminating at the foot of Broadway are now diverted to the bridge to meet the demands of traffic, and the ferries are carrying only hundreds of passengers when before they carried thousands. Further losses of traffic over the ferries operating from Broadway will most likely follow when the elevated lines are run over the new bridge.

THE AUTOMOBILE IN WASHINGTON

George H. Harris, vice-president of the Washington Railway & Electric Company, of Washington, D. C., which proposes to operate an automobile service in connection with its street car lines in the district, as previously noted in the Street Railway Journal, says that but one route has been decided upon for the new service. This is for a crosstown line from the vicinity of the connection of New York Avenue and P Street Northeast, along P Street to Dupont Circle, returning by the same route, and the operation also of a line from Eleventh and G. Streets southeast up Eleventh Street and Maryland Avenue to the vicinity of Fifteenth and H Streets northeast, returning by the same route. Other routes will, of course, be opened as traffic demands. For the operation of the new service, it has been decided to use an electric vehicle with a seating capacity of twenty-four persons.

CHICAGO PROPOSITION FOR RAPID TRANSIT

The local transportation committee of the City Council has finished the City Railway franchise extension ordinance, and it will be voted on by the Council Monday evening, March 6. It provides for the surrender of the ninety-nine-year claims by the company, municipal ownership after thirteen years, universal transfers, underground trolley north of Eighteenth Street, and the payment of 5 per cent of gross receipts to the city for thirteen years, and 10 per cent thereafter.

UNION OF TROLLEY AND STEAM IN MARYLAND

The Cumberland & Pennsylvania Railroad has made a proposition to the Cumberland Electric Railway Company, of which ex-Senator George L. Wellington is president, to connect with this line the Cumberland & Pennsylvania and to turn its Eckhart branch line into an electric road. This branch, now used exclusively for transporting coal, is of easy grade, and runs between Cumberland and Eckhart. The road would be extended from Eckhart to Frostburg over land controlled by the Cumberland & Pennsylvania. This plan, it seems, is part of the campaign against the Cumberland & Westernport Electric Railway, which runs into Cumberland over the Cumberland Electric Railway Company's tracks, the two lines having a traffic agreement.

BOSTON & PROVIDENCE RAILWAY PLANS CRYSTALLIZE

The plans for a high-speed electric railway between Boston, Mass., and Providence, R. I., which have been making for some months, have crystallized in the organization of a new company to be known as the Boston, Pawtucket & Providence Street Railway Company. The new organization is backed by the Boston & Suburban Railway, the Shaw and the Kidder-Peabody interests in the Boston Elevated Railway Company, and the Massachusetts Gas Companies. The striking feature of the scheme from an operating standpoint is the plan to connect with the Boston elevated's new elevated terminal at Forest Hills, cars running thence by private right of way to the Rhode Island State line, and through Pawtucket to Providence. It is estimated that from twenty minutes to half an hour will be saved over the slower plan of entering Boston by the tracks of surface lines. On the Boston & Worcester Electric Railway about one-fifth of the running time between the termini is occupied in traversing the distance from Park Square, Boston, to Chestnut Hill.

The details of the route are not as yet definitely settled, except that the line will probably cross to the west of the present Boston-Providence steam line after leaving Forest Hill and then proceed through Dedham, Sharon, Foxboro and the Attleboros to the State line. The preliminary plans for this projected line were published in the June 11, 1904, issue of the Street Railway Journal, although it will be noted that the plans for entering Boston have been materially changed. It is hoped to make the run in about an hour and forty-five minutes. The rate of fare between the two cities will, it is thought, be forty-five cents.

LOS ANGELES COMPANIES NOT OBLIGED TO GIVE TRANSFERS

The Supreme Court of California has decided that the Pacific Electric Railway Company and the Los Angeles Railway Company are not obliged to issue or accept interchangeable transfers. This decision comes as a reversal of the judgment of Judge Conrey, of the Superior Court of Los Angeles County, in the case of the people, represented by D. S. Reynolds, to compel the street railways to comply with rights which were supposed to exist under the franchises by virtue of which the companies operate. This case was one of a number arising about a year ago in the attempt of the citizens of East Ninth Street, Los Angeles, to secure transfers from the Pacific Electric Company, which operates along that thorougfare, to intersecting lines of the Los Angeles Railway Company. The Reynolds case was the only one in which the writ of mandate was invoked.

When the city of Los Angeles granted a franchise to one Kays, in 1897, to operate a street railway line on East Ninth Street, the following clause (section 6) was inserted: "Provided, further, that said grantee and his assigns will issue to and receive from the present line of street railway located on Mateo Street and Santa Fe Avenue, and all other lines of street railways in said city operated by said grantee or his assigns, transfers good for continuous single trips thereon in said city."

The Los Angeles Railway Company first operated under this franchise on East Ninth Street. Later the franchise was transferred to the Pacific Electric Railway Company. Transfer privileges with the Los Angeles Railway Company were then cut off.

Interpreting the above clause the Supreme Court says: "The Pacific Electric Railway Company has never issued transfers to passengers entitling them to ride upon the cars of the Los Angeles Railway Company, nor has the Los Angeles Railway Company ever issued transfers to passengers entitling them to ride upon the cars of the Pacific Electric Railway Company on East Ninth Street. The plain and obvious meaning of section six is that the person or corporation owning and enjoying the franchise to operate cars upon East Ninth Street shall be bound to the performance of certain obligations by reason of that ownership and enjoyment. We have failed to bring to light one case where it is held that the liabilities and burdens remain when the full enjoyment of the franchise and privileges have been legally passed to another.

"While the Los Angeles Railway Company was the assignee of Kays, it admittedly fulfilled all obligations. When it transferred the franchise by valid legal sale, as the court finds, to the Pacific Electric Railway Company, the Los Angeles Railway Company ceased to be the assignee of the franchise, and the Pacific Electric Railway Company then became the assignee.

"It is found that the two corporations defendant are independent, and no right existed to compel an interchange of transfers between them. The judgment appealed from is therefore reversed."

The East Ninth Street people contemplate taking an appeal to the United States Supreme Court.

LARGE BRAKE ORDER FOR BROOKLYN

In the Street Railway Journal of Feb. 25, an item was published relative to the 200 surface cars ordered by the Brooklyn Rapid Transit Company of the J. G. Brill Company and the Jewett Car Company. Word has just come to hand that every one of these cars will be equipped with the "Peacock" mechanical brakes made by the National Brake Company, Inc., of Buffalo, N. Y., covering a total of 400 brakes. This order is particularly noteworthy, because the cars on which these brakes are to be used are 41 feet long, weigh upward of 30 tons, and seat forty-eight passengers. The cars will be designed along the lines of the Brooklyn Rapid Transit Company's elevated type, modified to meet surface railway conditions, which, of course, involve frequent stops.

Not only have a large number of traction companies shown their confidence in the value of this brake for use on heavy cars, but car builders like the J. G. Brill Company and the Cincinnati Car Company have ordered numerous equipments for cars they are furnishing to different traction companies.

AUSTRALIAN TRAMWAY SYSTEMS

In no part of the world, in proportion to the number of population, writes John Plummer, of Sydney, are street tramways more extensively used as a means of passenger transit than in the leading Australian State capitals. In Sydney the tramways were originally worked by steam power, the cars being double-decked, like the railway carriages on several of the Paris suburban lines, but subsequently the cable system was introduced, and later on electricity became utilized as the motive power, and with such success that it is only a question of time when the locomotive and cable will be found dispensed with. The various tramlines, which, like the railways, are the property of the State, form a complete network of communication between nearly every part of Sydney and its suburbs, thus assisting in counteracting the tendency to overcrowding which forms one of the evils associated with large centers of population. The total length of tramlines open on June 30, 1903, was 124½ miles, representing an expenditure of £3,371,587 for construction and equipment, the number of passengers carried during 1903 being 130,405,402. The Melbourne system, embracing a length of 48 miles, 43½ miles of which are worked by cable and 4½ miles by horse power, was constructed by a municipal trust at a cost of £1,705,794, and is leased to a company. The number of passengers carried during the year was 47,564,942. There are also several suburban lines worked by limited liability companies as follows: Horse, 8½ miles; electricity, 4 miles, and cable, 2¼ miles. In Brisbane the tramlines were originally worked by horse power, but in 1897 it became replaced by electricity, the tramways being the property of an English company and covering a total length of 28 miles. As the traffic increases, extensions are effected. At the close of 1902 there were in the State 65 miles of tramways, including those in Brisbane, the number of passengers carried during 1903 being 18,125,302.

In Adelaide there are several tramway lines worked by horse power, but an attempt is being made to secure the introduction of the electric system. The lines are owned by private companies. In Western Australia Perth has a well-organized system of electric tramways, which, like that in the Kalgoorlie Municipalities, is the property of a private company. Fremantle and Boulder City also will shortly be in possession of electric tramway systems, constructed by private enterprise under municipal supervision. The only State-owned tramway is that running between the port of Roebourne and the town of Cossack, a distance of 8½ miles, in the northwestern portion of the State. In Tasmania the Hobart tramways are worked by electricity, and extend a distance of about 9 miles. They are owned by a private company, and were opened in 1901, in which year they carried 1,432,176 passengers. There is also a steam tramway in the northwest portion of the State, connecting Zeehan with Williamsford, a distance of 11 miles, its summit being 1500 ft. above sea level. Compared with other Australian tramway systems, that of Sydney is considerably the most efficient, there being a continuous succession of trams from early morning until midnight, an all-night service being established on several lines.

All the Australian electric systems are on the overhead wire principle, which is not found to interfere with the work of fire brigades to anything like the extent originally anticipated. The cost of the New South Wales tramways was defrayed out of loan revenue, and they constitute one of the most valuable assets of the State.

BOSTON & WORCESTER TO ISSUE STOCK TO RETIRE DEBT

At a special meeting of the stockholders of the Boston & Worcester Electric Companies, held Feb. 16, it was voted to authorize the issue of 1000 shares new preferred and 1500 shares new common stock to retire the floating debt.

It is understood that this new stock has already been sold at a good price. The larger part of the floating debt of the company represented 5 per cent notes, which were issued to purchase the stock of the Boston & Worcester Street Railway Company.

The earnings of the Boston & Worcester Street Railway Company for the quarter ended Dec. 31, 1904, compare with same quarter in 1903, as follows:

	1904	1903
Gross	$90,387	$77,704
Expenses	58,474	52,528
Net	$31,912	$25,176
Charges	23,851	24,234
Balance	$8,061	$942

CAN'T TAX RAILWAY FOR PUBLIC IMPROVEMENTS

The Supreme Court of California has decided that the city of Los Angeles cannot place an assessment upon the railway rights of way passing through it for the purpose of raising money to pay for improvements made upon streets intersected by those rights of way.

The opinion is in the form of a decision affirming the judgment of the lower court in the case of the Southern California Railway Company vs. City Treasurer, W. H. Workman and E. R. Fox, to whom a bond was sold by the city. The decision is of interest to all street railway companies in California holding railway franchises, as many companies in all parts of the State do hold such grants.

The city of Los Angeles decided upon street improvements on Pasadena Avenue. The work was done and an attempt was made to assess the railroad company on the ground that its property adjoined the improved land. The company refused to pay the tax, and the city issued a bond upon a portion of its holdings which was sold to E. R. Fox. An attempt was made to sell the property in order to realize the amount of the assessment. The company sought an injunction to prevent such action. This was granted temporarily and in the proceedings which followed was made permanent. Mr. Workman and Mr. Fox appealed to the Supreme Court. In its decision that body states that the city cannot make an assessment, because the railway company's franchise expressly states to what extent it shall be responsible for street improvements, to wit:

"That it will see that its right of way is kept in accordance with the remainder of the street between the rails and for a fixed space on either side, its share of the expense being born in this provision, the cost of the remaining improvements developing upon the property owners on either side of the street."

ST. LOUIS PRIZES FOR DESIGNERS OF GENERAL ELECTRIC APPARATUS

The International Committee of the Louisiana Purchase Exposition has recognized the engineering ability of the designers of the apparatus exhibited by the General Electric Company, in awarding grand prizes, as follows:—

To Elihu Thomson, Swampscott, Mass., for various applications of electricity; also to Charles P. Steinmetz, Schenectady, N. Y., for electric lighting; and to Frank J. Sprague, New York City, for the application of electricity to transportation.

The committee has also awarded gold medals to C. G. Curtis, of New York City, "the originator of the Curtis multi-stage steam turbine;" to W. L. R. Emmett, of Schenectady, "designer of the vertical type of Curtis steam turbine and generator;" and to W. B. Potter, Schenectady, N. Y., for applications of electricity to transportation.

Silver medals have been awarded to W. S. Moody, Schenectady, N. Y., for transformers; to M. M. Hewlett, Schenectady, N. Y., for distribution of energy, switchboards, etc.; to H. F. T. Erben, Schenectady, N. Y., for apparatus for generating electricity; to H. G. Reist, Schenectady, N. Y., for apparatus for generating electricity; to L. T. Robinson, Schenectady, N. Y., for scientific apparatus, measuring apparatus and laboratory and standard instruments; and to F. P. Cox, Lynn, Mass., for measuring instruments, indicating, recording and integrating.

CHANGE OF OWNERSHIP IN BUFFALO

A syndicate, headed by Henry J. Pierce, of Buffalo, has secured control of the International Railway Company, operating in and about Buffalo, through the purchase of a majority of the capital stock. As a result of this purchase, Henry J. Pierce has just been elected president of the company to succeed W. Caryl Ely, resigned. Mr. Pierce, the new president, is a capitalist and financier whose name is prominently identified with the business and commercial interests of Buffalo and the western part of New York State. He is president of the Wood Products Company, whose activities include the manufacture and sale of most of the wood alcohol produced in this country. He is a member of the Board of Trade, and president of the Chamber of Commerce in the city of Buffalo, and has always taken a lively and active interest in the welfare of his home city. In addition to local enterprises in which he is interested, he is president of the Netherlands Tramways Company, which has recently completed an up-to-date interurban electric railway from Amsterdam to Haarlem, Holland. He has been a director of the International Railway Company since its organization.

NEW PUBLICATIONS

Letters From an Old Railway Official to His Son, a Division Superintendent. By Charles De Lano Hine. Chicago: The Railway Age; 179 pages. Price, $1.50.

This volume is written in a most entertaining way, and consists of twenty-four letters which the reader is invited to believe were written by an old railway official to his son, who has just been promoted to the position of division superintendent. They treat of a variety of subjects, including discipline, operation and ethics, and while devoted to steam railroad topics there are many points which are equally applicable in electric railway practice. The advice offered is extremely practical, and is given in such a pleasant form as to make the volume very readable.

The Railway and Engineering Review. Railroad Transportation Number. Chicago, Ill.

"Railroad Transportation at the Universal Exposition," is the theme of the World's Fair number of The Railway and Engineering Review. It may seem rather late in the day to publish a description of the Fair exhibits, but the subject has been treated so comprehensively in this number that earlier publication would have been impossible. The striking feature of this issue is the logical order in which the steam railroad exhibits are described. Beginning with the cars and apparatus for the earthwork and ballasting, track construction and track tools are considered, then bridges, tunnel construction, buildings, water service, signals, railroad terminals—in fact, every department of a steam railroad's activity. In addition, considerable attention is given to the historical exhibits, the testing plants, traffic exhibits, etc., so that the whole may be said to form an excellent epitome of steam railroad practice from its early beginnings to the present time.

PERSONAL MENTION

MR. L. B. WARNER, vice-president of the Jamestown Street Railway Company, of Jamestown, N. Y., is dead, aged 77 years.

MR. CHARLES D. MATLACK, for many years secretary and treasurer of the Second & Third Streets Railway, of Philadelphia, now part of the Philadelphia Rapid Transit Company system, died suddenly of heart disease a few days ago at his home in that city.

MR. FRANK H. HARRIS, formerly connected with the light and power department of the Birmingham Railway & Light Company, of Birmingham, Ala., has accepted the position of superintendent of the Anderson Traction Company, of Anderson, S. C., which includes in its operations the street railway, electric light and power interests of that city.

MR. EDGAR ANDERSON and MR. P. H. M'CARTHY have formed a partnership to engage in engineering work in Dublin, Ireland. Mr. Anderson is a recent graduate of Trinity College, where he studied electrical engineering. He is a son of Mr. William Anderson, J. P., whose name has been so long associated with the Dublin United Tramways.

MR. J. E. ANGER, general superintendent of the Electric Railway & Tramway Carriage Works, of Preston, England, is spending a short vacation in this country after a residence of some six years abroad. Before going to Preston, Mr. Anger was prominently identified with a number of the principal car building companies in this country, including the Jackson & Sharp and the Jones and Gilbert companies. In all this work he has been associated with Mr. E. A. Stanley, who is now general manager of the Preston works. Mr. Anger expects to return to Preston during the next month.

MR. FRANK H. GALE, who for several years has conducted miscellaneous publicity matters for the General Electric Company, has succeeded the late Mr. E. H. Mullin in charge of the company's advertising. Mr. Gale managed the company's exhibits at conventions, and at the Pan-American, Charleston and St. Louis expositions. His headquarters have been at Schenectady, but he will now spend part of each week in New York.

MR. CAMPBELL SCOTT, who was for many years prominent in the management of the C. & C. Electric Company, and whose resignation therefrom was announced recently in these columns, has now assumed the position of manager of the main works of the Otis Elevator Company, at Yonkers, N. Y. Mr. Scott has had considerable experience as a works director, and has many special qualifications for the responsible duties which he now takes up.

MR. JAMES A. BLAKE has just been appointed amusement manager of the Consolidated Railway Company, which is the holding company of the electric railway properties owned by the New York, New Haven & Hartford Railroad Company. Mr. Blake will have charge of Savin Rock Park, New Haven; Rye Beach, New York; Hanover Park, Meriden; Crystal Park, Middletown; Fairview Park, Southbridge, Mass.; Pinehurst Park, near Worcester, Mass.; Wildwood Park, Putnam, Conn.; Berkshire Park, Pittsfield, Mass., and several other enterprises.

MR. EUGENE F. PHILLIPS, the founder of the American Electrical Works, succumbed to pneumonia and heart failure on Feb. 22, at his home in Providence, after an illness of some three weeks. Mr. Phillips was born in Providence Nov. 10, 1843. While still a pupil in the high school he enlisted in the civil war, finishing his education when he returned from the front. He was engaged at first in banking, but afterwards turned his attention to the manufacture of insulated telegraph wire, a small shed constituting his workshop. From this modest beginning he built up one of the largest industries of the kind in the country, being at the time of his death, general manager of the American Electrical Works and president of the Washburn Wire Company, both of which have large plants at Phillipsdale, East Providence. Mr. Phillips is survived by a widow and the two sons, Frank N. and E. Roland, who will now carry on the great industry committed to their care.

MR. HENRY M. SPERRY has resigned as signal engineer and agent for the Union Switch & Signal Company, to become consulting signal engineer for the Hudson Companies, recently formed to complete the construction of the four tunnels under the Hudson River between Jersey City and New York. The scope of Mr. Sperry's work with the Hudson Companies will be very broad, involving considerations of traffic and track arrangements, and of questions which are affected by the use of the most refined methods of automatic and block signaling. Mr. Sperry's experience in this important field has been very extensive, begining in 1881, upon the Pennsylvania Railroad. Until 1884 he was connected with the engineering corps of the New York Division of that railroad, after which he was promoted to the position of supervisor of signals upon the same division, in charge of construction and maintenance; during this time the line from Philadelphia to New York was changed from a two to a four-track system, which required the construction of a large number of interlocking plants, all of which came under his supervision. From 1891 to 1894 he held the position of general agent of the Johnson Railway Signal Company, having general charge of the installation of block signals upon the New York Central & Hudson River Railroad. From 1894 to 1899 Mr. Sperry was signal engineer and agent of the National Switch & Signal Company, in charge of the Western District, in which capacity he designed and constructed a large interlocking plant of 137 levers at State Line, Ind., and subsequently the signaling system of the elevated railroads of Chicago, the most important of which was that for the Union Elevated Loop in that city. Since 1899 he has held the position of signal engineer and agent of the Union Switch & Signal Company, for which he has had charge of many important installations. Perhaps his most important work while with the company was that of planning the block signal system for the subway system of the Interborough Rapid Transit Company, in New York City. For this system he prepared the preliminary plans, which were adopted. While the greater part of Mr. Sperry's time will hereafter be given to the preparation of traffic plans for the uptown and the downtown tunnels under the Hudson River, of the Hudson Companies, a portion of his time will be available for consulting purposes in the field of railway signaling. Mr. Sperry is a member of the American Society of Civil Engineers, the Western Society of Engineers, and the Railway Signal Association.

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. ‡ After allowing for other income received.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m. Jan. '05	65,465	37,092	28,373	22,917	5,456
	1 " " '04	59,607	37,098	22,509	22,467	43
	12 " Dec. '04	895,731	486,980	408,751	273,664	135,087
	12 " " '03	882,276	482,575	399,701	268,132	131,569
BELOIT, WIS. Rockford, Beloit & Janesville R. R. Co.	1 m., Jan. '05	8,196	------	------	------	------
	1 " " '04	7,463	------	------	------	------
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Jan. '05	18,238	------	------	------	------
	1 " " '04	16,764	10,812	5,952	------	------
	7 " " '05	155,866	------	------	------	------
	7 " " '04	144,951	75,003	69,949	------	------
BUFFALO, N. Y. International Tr. Co.	1 m., Jan. '05	296,970	201,389	95,581	136,703	†41,122
	1 " " '04	320 069	203,834	116 235	137,104	†20 869
	7 " " '05	2.549.699	1,350,673	1.199 025	970,044	228.982
	7 " " '04	2,494,834	1,368,611	1,126,223	933,548	192,674
CHICAGO, ILL. Chicago & Milwaukee Elec. R. R. Co	1 m., Jan. '05	21 826	14,654	10,173	------	------
	1 " " '04	18,987	10,812	8,175	------	------
	12 " Dec. '04	464 655	179,038	285,618	------	------
	12 " " '03	292 247	98,627	193,620	------	------
Metropolitan West Side Elev. Ry. Co	1 m., Jan. '05	179,820	------	------	------	------
	6 " " '04	174,240	------	------	------	------
Northwestern Elev. R. R. Co	1 m., Jan. '05	114,278	------	------	------	------
	1 " " '04	108,816	------	------	------	------
South Side Elev. R. R. Co	1 m., Jan. '05	131,221	------	------	------	------
	1 " " '04	135,781	------	------	------	------
CLEVELAND, O. Cleveland Painesville & Eastern, R. R. Co.	1 m., Jan. '05	13,346	9,737	3 609	------	------
	1 " " '04	11,740	9,024	2,716	------	------
	12 " Dec. '04	225,751	136,021	89,730	80,250	9,480
	12 " " '03	214,631	127,149	87,482	78,007	9,475
Cleveland & Southwestern Traction Co	1 m., Jan, '05	34,760	22,777	11,983	------	------
	1 " " '04	27,852	22,557	5,294	------	------
	12 " Dec. '04	445,362	293,615	181,746	------	------
	12 " " '03	445,168	264 232	180,936	------	------
DETROIT, MICH. Detroit United Ry.	1 m., Jan. '05	356,195	* 229 205	126.990	93.437	33,553
	1 " " '04	311,440	* 226.103	85,337	87,567	†2,230
	12 " Dec. '04	4,584.582	*2763092	1,821,490	1,075,786	745,704
	12 " " '03	4,425,836	*2613976	1,811,860	1,000,000	811,860
DULUTH, MINN. Duluth St. Ry. Co	1 m., Jan. '05	47.593	27,908	19.685	16.729	2,956
	1 " " '04	45,543	28,795	16,748	16,374	374
	12 " Dec. '04	619,172	326,049	293,123	202,602	90,521
	12 " " '03	622,044	345,327	276,717	186,590	90,127
FORT WORTH, TEX. Northern Texas Traction Co	1 m., Jan. '05	44.109	26,225	17,885	10,224	7,661
	1 " " '04	37.630	25,469	12,162	9,333	2,828
	12 " Dec. '04	564,711	316,529	248,181	121,043	127,138
	12 " " '03	465,394	261,357	204,037	111,371	92,667
HAMILTON, OHIO. Cincinnati, Dayton & Toledo Trac. Co	1 m., Dec. '04	37,300	------	------	------	------
	1 " 03	36,939	------	------	------	------
	12 " " '04	496,319	------	------	------	------
	12 " " '03	514,787	------	------	------	------
HANCOCK, MICH. Honghton County St. Ry. Co	1 m., Dec. '04	17,079	13,493	3,587	3.333	254
	1 " " '03	13,756	12,008	1,748	2.697	† 949
	12 " " '04	199 513	135,414	64,098	40,444	23,654
	12 " " '03	189,404	122,840	66,564	34,933	31,631
HOUSTON, TEX. Houston Elec. Co	1 m., Dec. '04	38 106	23,481	14,625	8,269	6,356
	1 " " '03	29 707	24,956	4.752	8,109	†3,358
	5 " " '04	178,032	113,770	64,262	41,464	22,798
	5 " " '03	176,179	121,447	54,732	38,143	16,589
INDIANAPOLIS, IND. Indianapolis & Eastern Ry. Co	1 m., Jan. '05	15,126	10.240	4,886	4,166	720
	1 " " '04	13,523	8,453	5,070	4,166	904
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Jan. '05	256,458	130,228	126,230	74,351	51,880
	1 " " '04	259,413	139,552	119 862	74.719	45,143
	12 " Dec. '04	3 285,378	1,592,414	1,692,964	916,460	776,505
	12 " " '03	3,096,324	1,526,910	1,569,414	871,685	697,730
Milwaukee Lt., Ht. & Tr. Co	1 m., Jan. '05	38,523	19,781	18 742	18.943	† 201
	1 " " '04	30 082	17,819	12,263	14,220	†1.958
	12 " Dec. '04	492,228	216,964	275,264	203,731	71,533
	12 " " '03	452,931	213,020	239,911	168,990	70,921
MONTREAL, QUE. Moatreal St. Ry. Co.	1 m., Jan. '05	203,235	151,676	51,560	19,035	32,524
	1 " " '04	183,708	131,487	52,221	16,482	35,739
	4 " " '05	841,350	553,982	287,367	75,328	212,039
	4 " " '04	769,136	486,837	282,299	68,848	213,451
NEW YORK CITY. Coney Island & Brooklyn R. R. Co	3 m., Dec. '04	348,810	294 963	53,847	71,431	†17,455
	3 " " '03	358,474	276 938	81,536	67,392	‡14,385
	6 " " '04	860 648	597,761	262,887	144,080	‡119,085
	6 " " '03	875,044	570,643	304,401	135,020	‡169 809
	12 " " '04	1,633,570	1,095,402	538 168	281,765	‡256,281
	12 " " '03	1,618,820	1,053,263	565,557	269,564	‡297,225
PHILADELPHIA, PA. American Rys. Co.	1 m., Jan. '05	107,588	------	------	------	------
	1 " " '04	98,945	------	------	------	------
	7 " " '05	884,267	------	------	------	------
	7 " " '04	851,540	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co.	1 m., Jan. '05	134.951	77,591	57,360	26,986	30,374
	1 " " '04	113.454	70,865	42,589	26,125	16,464
	12 " Dec. '04	1,496,593	824,489	672.104	------	------
	12 " " '03	1,280,373	656,071	624,303	------	------
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Jan. '05	543 371	------	------	------	------
	1 " " '04	526,910	------	------	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Dec. '04	48,454	32,855	15 599	10,552	5,047
	1 " " '03	45,143	23 980	21,163	10,454	10,709
	12 " " '04	544,144	316,784	227,360	126,121	101,239
	12 " " '03	519,774	307,699	212,075	119,327	92,749
SEATTLE, WASH. Seattle Electric Co.	1 m., Dec. '04	208,727	150,500	58,227	25,320	32,908
	1 " " '03	193 592	127,127	66,465	16,347	50,118
	12 " " '04	2,321,235	1,609,639	711,596	295,472	416,123
	12 " " '03	2,096,726	1,497,905	598,821	280,375	318,447
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., Dec. '04	79,282	45,524	33,758	20,258	13,499
	1 " " '03	73,650	43,067	30.583	20,246	10,337
	6 " " '04	440.611	248,457	192,154	121,725	70,429
	6 " " '03	424,645	239,156	185,488	121,706	63,782
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Dec. '04	52,070	32,510	19,561	9,221	10,339
	1 " " '03	45,524	34,405	11,119	9,480	1,639
	12 " " '04	569.429	369.005	200,424	113,873	86,550
	12 " " '03	474,250	312,084	162,167	87,385	74,782
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Jan. '05	150,944	*76,090	74,854	42,701	32,153
	1 " " '04	137,517	*73,806	63 711	41,312	22,399
	12 " Dec. '04	1,752,833	*923,208	829.625	499,874	329,751
	12 " " '03	1,663,794	*856,526	807,268	488,200	319,068
UTICA, N. Y. Utica & Mohawk Valley Ry. Co	3 m., Dec. '04	186,758	129,269	57,489	44,244	‡14,191
	3 " " '03	170,349	113,350	56,999	40,589	‡17,416
	6 " " '04	412,495	265,227	147,268	88,879	‡60,303
	6 " " '03	386,586	238,203	148,383	81,638	‡68,749

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NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft or money order in favor of Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given as well as the new, and notice should be received a week in advance of the desired change.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1905, *to date,* 82,950 *copies—an average of* 8295 *copies per week.*

The Strike on the New York Elevated and Subway

As this paper goes to press the trains on the New York Elevated Railway are passing regularly by this office, and while the service on both the elevated and subway has not yet reached its regular proportions, the Interborough Rapid Transit Company has amply demonstrated its ability to handle both divisions with absolutely no assistance from its striking employees. The strike, which began at 4 a. m. on March 7, will go down in the history of other miserable affairs of its kind as one of the most absurd and unreasonable which has ever been called. The motormen were receiving wages very much larger than those paid on any other electric railway system in the world, while the conditions of operation, both on the elevated and in the subway, owing to the perfectly clear track on which the cars run, are much easier than on the average surface railway. Moreover, the men were under a signed contract with the management which bound them not to strike before September, 1906. During the first day of the strike the New York traveling public was put to some inconvenience, but as soon as the strike was announced the offices of the company were besieged with applicants for positions, and before it was twelve hours old the nominal presidents of the unions involved were busy explaining that they had not been consulted about the strike and that it had been instituted, against their advice, by some local leaders. We consider that the managers of the Interborough Rapid Transit Company have performed a great service, both to the city of New York and to the electric railway industry as a whole, in refusing to put the control of their road into the hands of their ex-employees and in denying their absurd demands. That the correctness of their position in this matter is recognized by the public at large is indicated by the hearty support which they are receiving from the daily press.

Street Railway Parks and Amusements for Them

It is at this time of the year, while the snow is still on the ground, that most street railway companies take up the subject of parks. The park season begins in earnest in the Northern latitudes about the middle of June, and three months are by no means too long a time to make preparations for it. It was not many years ago that the American Street Railway Association was gravely debating whether street railway parks paid. Hesitation about engaging in this class of business has largely disappeared, and it is the exception now to find a street railway company which does not own at least one pleasure resort on its line.

No set rule can be laid down as to the most desirable way of conducting a street railway park; in some instances, where the parks are naturally attractive, little is needed in the way of artificial stimulants to travel during the heated season. But such instances are the exception and not the rule, especially where the patronage to the park must come principally from persons who are employed during the day time. While it is usually desirable to retain many of the rustic features of a naturally attractive pleasure resort, dense woods are not suitable for evening entertainments, and most companies agree that artificial forms of amusements are not only more popular but more profitable. For this reason we devote considerable space in this issue to describing a number of the attractions—many of them new this year—which are suitable for street railway parks. A great deal of ingenuity has been devoted to the subject of attractions during the past four or five years, and there has been almost as complete a revolution in the art of providing people with cheap amusements and in attracting their money as was involved in the change from animal to electric power in street railway transportation. It is true that many of the old-time attractions are as popular now as ever. The carousel, or "merry-go-round," with the small number of attendants required and the large number of patrons which it can accommodate, is as good a money earner as when the readers of this paper rode upon the horses, although modern improvements have greatly changed its outward appearance. But other forms of amusement to win the nimble nickel or dime have come into general use and offer strong competition to the earlier forms which were popular twenty or more years ago. To certain companies a summer theater will appeal with special emphasis, and some very profitable entertainments of this kind have been provided. As a rule, however, these theaters are possible only in the neighborhood of large cities, as the expense of providing the entertainments is considerable, while the minor attractions, to which the greater part of the park article in this issue is devoted, are possible in either large or small resorts.

Passes to Power Plants

The practice of street railways in issuing passes to visitors wishing to inspect power plants or other company property varies widely in different localities. In some cases no official permission is required, while in many others the matter of giving a pass is simply a meaningless form. Large city roads are generally more particular as to the responsibility of visitors upon their premises, while the smaller systems are seldom as strict when it comes to the point of denying an unauthorized person admission to the power house or the sub-station. While local conditions must ultimately determine the amount of latitude a company can reasonably allow, there is little doubt that the safest course from the standpoints of possible damage claims in case of accident and the possibility of harm being done to the equipment by evilly disposed persons is to require each person admitted to a plant to sign a printed statement agreeing to abstain from interfering with the apparatus and to absolve the company from all blame in case anything happens to injure him. In the case of a party, the printed slip should require but a single signature covering all the visitors present.

Probably the simplest and best method of issuing passes is to supply them from a pad or book, leaving a numbered stub as each pass is torn out. Such a book saves a great deal of time and trouble, compared with the plan of keeping numbered tickets in various places, or issuing specially dictated letters as the need arises. As soon as the official concerned—manager, superintendent, engineer or chief clerk—has decided that the would-be visitor may be given the freedom of the premises, it ought to be a simple matter to supply him with the proper credentials. The pass question would scarcely be an important one, as far as the delivery of the permit is concerned, if it were not for the loss of time incurred in the dictation, typewriting and copying of letter passes—a proceeding which costs money if repeated many times during the year. Sometimes it takes ten or fifteen minutes to prepare such a document, when, if a numbered series were used, a couple of minutes at the outside would suffice. Passes should be signed or countersigned in ink by the official responsible, in order that the whole transaction may be carried out on a business basis.

In very small towns where everybody knows everybody else, it may seem like going to needless trouble to require visitors to present passes at plants, but in case of trouble at the stations a signed statement freeing the company from responsibility is a first-class asset to hold. Since it is really a favor on the part of a company to allow visitors on its premises, there can be no reasonable objection on the part of such persons to assuming the responsibility of personal safety during the time they are upon the company's precincts. When the rules of the company require the use of passes, the permits should always be taken up or "lifted," as the saying is in Pullman circles, and returned to the office at once. Otherwise the whole scheme becomes a farce.

How to Secure Good Foremen

A great deal has been said and written on the subject of the relations between the street railway manager and the men, but in an address made by Mr. Vreeland last week at an open meeting in Boston of the welfare department of the National Civic Federation, a point was emphasized which is very often overlooked in questions of this kind. On a small system, the street railway manager knows all of his men individually, they work largely under his direction and his personality enters largely into his relations with the men. On a large system, however, a different condition of affairs prevails. A great deal of the supervision and discipline must necessarily be left in the hands of foremen of the different divisions, who, as Mr. Vreeland points out, are usually selected for their ability to show good financial results from operation rather than that of handling men. No matter how fair-minded the presiding officer of a company may be, his influence may be entirely counteracted, without his knowledge, through lack of judgment on the part of one or all of the division superintendents. It is a characteristic of some men who have been given a little brief authority, to exercise it to as great an extent as possible, and these men, by domineering conduct or rules which do no real good, are often responsible for a great deal of mischief. The causes are often too small to create attention at the main office until there is such great dissatisfaction as to result in open revolt. When matters have gone so far, the complaints by the men usually take a shape entirely foreign to the real cause of the trouble. There can be no doubt that in a great many cases the principal causes of strikes are not those on which emphasis is finally laid, but that they are the result of a series of small matters, with a feeling on the part of the men that there is no means of redress available.

Mr. Vreeland has demonstrated his great ability in the handling of men, and as chairman of the welfare department of the National Civic Federation his discussion on the subject of foremen is of the greatest interest. Although addressed primarily to manufacturers and employers of labor in industrial establishments, his remarks have a peculiar bearing upon railway work and, coupled with the description, which is also published in this issue, of his method of requiring reports from all foremen of divisions as to changes in the operating force during the previous month, will prove of the greatest value.

The present century is essentially one of large aggregations of capital in transportation and other enterprises. Each has its army of thousands and, in some cases, of tens of thousands of employees, including men representing every phase of intellectual and physical energy, and often of every class of scientific and technical knowledge. The problem of how to direct the energies of the operating force in any one of our large industrial or railway organizations so as to secure the maximum degree of benefit to the company and insure justice and fair treatment to the employee, is one which demands the highest degree of executive skill. The men employed on one large railway system often exceed in number those in many an army, but the task of directing their energies is much greater than in a military force, because the freedom of the individual must be retained, and because there is no ability to compel action. It is to aid in the solution of this problem that the National Civic Federation was formed, and Mr. Vreeland's address discusses a topic which affects the question in a most vital way.

Some Continental Tests

The first practical data from a road using single-phase commutating motors have recently been given respecting the Stubai Valley road running up into the mountains from Innsbruck, and described in the STREET RAILWAY JOURNAL for Nov. 26, 1904. This line has been in operation, apparently with good success, since the first of last August. It is a light mountain road, a dozen miles long, with an average grade for half its length of more than 200 ft. to the mile. It is equipped with Winter-Eichberg motors, four of 40-hp each on each motor car, taking 2500-volt current at 42 cycles from a trolley wire, which is in turn fed by a 10,000-volt transmission line. Each motor car usually draws two trailers, and the average speed is about 15 m.p.h. The energy required, on the basis of four months of wattmeter readings, was 70 watt-hours per ton per kilometer at the car, while the actual power required at the wheels was computed from various experiments as 48 watt-hours per ton-kilometer, giving thus an efficiency for the car equipment of about 68 per cent. This certainly does not compare badly with the results obtained from direct-current operation as regards the gross power required, and ought to be encouraging to friends of alternating-current traction in this country. We have no means of knowing what troubles were encountered on the Stubai Valley line, but it certainly does not appear to have been in any sense a failure.

Another interesting report of experiments comes along from the Valtellina line. This, as our readers will doubtless remember, is a three-phase line with 3000 volts between the trolley wires, worked by induction motors. From an operative standpoint, it has done excellent work. The motors are worked in parallel at full speed and in cascade at reduced speeds. The power factor in these connections is a matter of special interest. In the motors at full speed it rises to about .9, which is certainly a most creditable figure for railway motors wound for high voltage, and ought to be a lesson to those who condemn induction motors on account of alleged low power factor. At reduced speed, however, when the motors are in cascade, there is a very different state of things. The power factor drops to .5 on the level and rises only to .75 under the stimulus of the output required on grades. Obviously, the cascade connection is not all that it should be for reduced speeds, and we question indeed whether upon the whole rheostatic control would not give better operative results, considering the relatively small number of stations. In this connection it is worth noting that in two new locomotives ordered for this road a radical change in control has been made. The motors are connected so as to use either 16 poles or 8 poles, the former giving a normal speed of 20.5 m.p.h., the latter 41 m.p.h. In starting, the 16-pole system is delta-connected. If the design of the motors has been properly worked out this arrangement ought to give considerably better average results than the arrangement now used. These locomotives are big affairs, weighing 62 tons, and rated at 900 hp, the normal tractive force rising to 13,000 lbs. and the maximum to very nearly 20,000 lbs. Numerous experiments on the energy required in hauling trains gave for the average of many runs a value of 40 watt-hours per ton-kilometer for the motor car running alone, while the normal train of motor car and four or five trailers gave about 31 watt-hours per ton-kilometer. On a level track at 36 m.p.h., the energy required for a train was about 13 watt-hours per ton-kilometer.

The total copper iron and rheostat losses on the line as worked showed that the aggregate of these was only about 20 per cent of the total energy, so that the losses in starting and in control were of very minor magnitude. This is natural in a line with few stops, and the conditions might be quite otherwise in work more nearly approximating tramway conditions. Another interesting point in the experiments was a measure of the energy returnable to the line. The saving thus made possible with certain kinds of equipment has often been considered, but there have been thus far very few experimental values obtained. On this Valtellina line it was found that on a down grade exceeding 0.417 per cent with a 110-ton train, the motors would work as generators. On a grade thus favorable to returning energy it was found that 54 per cent of the potential energy of the train could be returned to the line. How far this operation would prove practicable in everyday working of the line does not appear. It seems probable that on certain lines a very material gain might be made, but we are rather inclined to the belief that such cases are rather exceptional on lines outside the range of heavy railroading. It certainly must be acknowledged that the Valtellina line, in spite of various obstacles, has made a very good showing. The engineers who made the tests not only say that the three-phase system has proved completely satisfactory, but that in efficiency it is rather superior to a direct-current system with third rail. In our own country the objection to two trolley wires seems well-nigh unconquerable, but with a single-phase distribution up to the motors this objection disappears. The case is now up to the exponents of single-phase traction, and may we soon hear equally good reports from them. The foreign work with alternating currents is certainly encouraging, and it is high time for more work to be undertaken here. The opportunity and the rewards are great.

Automatic Acceleration

Automatic acceleration appears now to have come to stay, so far as heavy cars, operated by heavy train-control system, are concerned; and its equivalent on hand controlled cars, namely, an automatic restriction on the controller handle, is being looked upon with increased favor. On the two train-control systems which are now on the market, the rate of acceleration is regulated by the amount of current flowing in the armature circuit of one of the motors. As soon as the current in this circuit falls below the predetermined amount for which the limiting device is set, another step of the resistance is cut out automatically. The effect of this is to produce as nearly a uniform starting torque in the motors as it is possible to secure with a step by step resistance. Where the resistance is subdivided into small sections, as it is in the modern systems of train control, the acceleration is very smooth and pleasant, and from a passenger's standpoint in striking contrast to the acceleration given a car or train by a careless motorman, or on cars where the resistance steps are not properly proportioned. Where, as in the case of a device adapted for use on ordinary controllers, the rate of controller advancement is determined by time rather than by current flowing, the action is not theoretically as perfect as if it were determined by current, but practically, if the resistance points are properly proportioned, the results will be much the same.

INTERESTING POWER PLANT AT OLYMPIA, WASHINGTON

Olympia, the capital of the State of Washington, is a city of 4300 population, and is fortunately situated at the head of Puget Sound. The lighting, power and railway business of the city is in the hands of the Olympia Light & Power Company, which for several years has received its power from a hydro-electric station on the Des Chutes River at Tumwater, an historic village about 4 miles from the city. The demands for current had grown beyond the capacity and equipment of the old station, and this fact necessitated an additional installation, which has taken the form of a new, larger and thoroughly modern water-power plant, built recently on a site a short distance down stream from the older one.

Water is taken from the Des Chutes River by means of a concrete intake at one end of a concrete and masonry dam, about 120 ft. long and 20 ft. high. A portion of this dam was built of rubble masonry, and another portion was constructed of concrete with large stones embedded in it. For this work forms were first erected, and the concrete was mixed very wet, dumped inside of the forms, and large stones, weighing as much as 300 lbs. to 500 lbs., which had first been washed clean, were dropped into the concrete, great care being taken to insure that the stones were completely embedded in the concrete and that no voids were left through which leakage might occur. After the forms were removed and the water was allowed to rise to the height of the top of the dam, it was found that no leakage whatever occurred.

From the intake to the old power house, a distance of about 700 ft., the water is carried in a square enclosed wooden flume, built about five years ago for the first plant. The construction of this flume is unique, for it is built of 3-in. x 10-in. fir planks, spiked face to face in such a manner as to give a closed conduit 10 ft. square inside dimensions, the walls being the thickness of the width of the planks, viz., 10 ins. The flume is naturally very solid and substantial. It rests upon four 10-in. x 14-in. stringers, which rest upon mud sills embedded in the banks of the stream. This construction could hardly be possible except in places like Washington, where lumber is comparatively cheap. The flume carried about 100 ft. of water per second, and gave a head, at the old plant, of 48 ft.

The supply line for the new plant begins at the lower end of the wooden flume, and consists of about 700 ft. of steel pipe, 9 ft. in diameter, varying in thickness from 3-16 in. at the upper end to ⅜ in. at the power house. The round seams are single-riveted and the longitudinal seams double-riveted. Near the lower end of the line the pipe is carried across the river on a steel truss bridge of 84-ft. span, and from the lower end of the truss to the power house, a distance of 120 ft., it is supported on steel I-beam trestles, resting on concrete piers. On all the bridge and trestle work the pipe rests in wooden saddles, made of 12-in. x 12-in. timbers, and spaced 5-ft. 4-in. centers, which is the same as the width of each pipe course. At the power house the pipe line terminates in a 9-ft. diameter vertical standpipe, which connects with a receiver, of the same diameter, in the rear of the station. The standpipe has a vertical steel overflow, 7 ft. in diameter, which rises slightly higher than the level of the water above the dam. When the load on the plant is suddenly thrown off and the Lombard governors close the water-wheel gates, the water rises in the overflow pipe and flows over its top without causing any appreciable water ram at the wheels.

VIEW AT THE CORNER OF FOURTH AND MAIN STREETS, OLYMPIA, WASH.

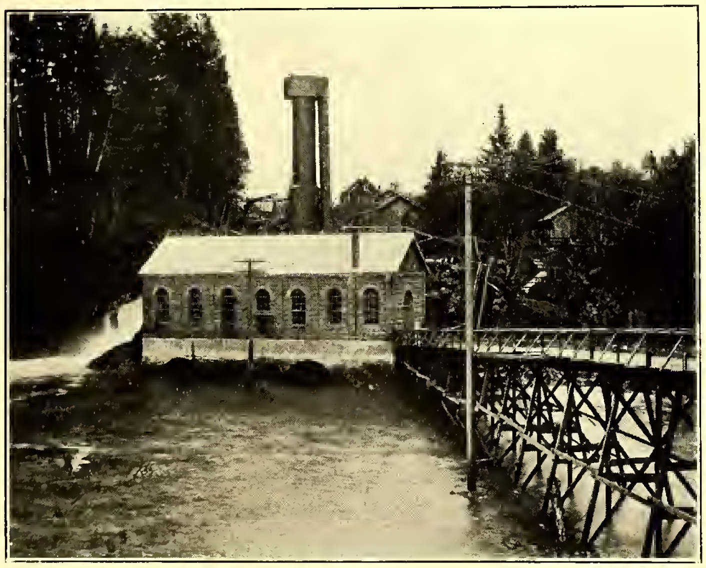
The power house, which is illustrated in the accompanying views, is located on tide water, at the foot of Tumwater Falls. It is built of Tenino standstone, quarried in the vicinity, and has ground dimensions of 74 ft. x 30 ft. The building sets out over the water and rests upon foundation walls of concrete, which are carried down to bed rock. The floor is formed of concrete arches, sprung between 10-in. I-beams, and has a top surfacing of ½-in. thickness of cement mortar. The roof trusses are of steel, and the roof itself consists of tongued and grooved planking, covered with tarred felt and galvanized iron tiling. A 10-ton hand traveling crane spans the entire width of the building, and is carried upon an I-beam track, running the length of the building and supported by I-beam posts.

The hydraulic equipment consists of two pair of Stilwell-Bierce & Smith-Vaile inward-discharge turbines, mounted on horizontal shafts and enclosed in ⅜-in. steel cases. Each pair of turbines has a capacity of 800 hp when operating under a head of 80 ft. Each turbine set is connected to the receiver by a feeder pipe, 54 ins. in diameter, passing through the rear wall of the power house. In each one of the feeder pipes a 54-in. single-face Ludlow gate valve is placed so that the water can be shut off from the wheel cases entirely when it is desired to make any necessary examination or repairs.

The average head under which the wheels operate is about 86 ft., it being 80 ft. at mean high tide and 92 ft. at mean low water, advantage being taken of the rise and fall of the tide by means of draft tubes. The difference in head between high and low water is very noticeable when a vacuum gage is attached to either of the draft tubes.

Each turbine set is regulated by a type D oil-actuated Lombard governor, the oil pumps and governor heads being driven by belts run from the water-wheel shafts. The water-wheel gates are actuated by wire rope transmission between the gate gearings and the gearing on the governors. One of the turbine sets is direct connected to a 500-kw, 550-volt, two-bearing type Westinghouse direct-current generator for furnishing the railway power. The other set is direct connected to a 500-kw, 2300-volt, revolving-field, two-bearing type Westinghouse two-phase alternator for the lighting service. Between the two generator units is a 200-kw Westinghouse rotary converter, wound for 550 volts on the direct-current side and 385 volts on the a. c. side. This converter is used to equalize the load on the generators feeding onto the railway circuit or the two-phase alternating-current system, according to which is the more heavily loaded. It is generally brought into service when the demand on one of the generators is excessive and when the other machine is carrying a comparatively light load. Two 125-kw, 2300-385-volt, oil-insulated transformers are used in connection with the alternating side of the rotary.

DAM, INTAKE AND SQUARE WOODEN FLUME OF OLYMPIA PLANT

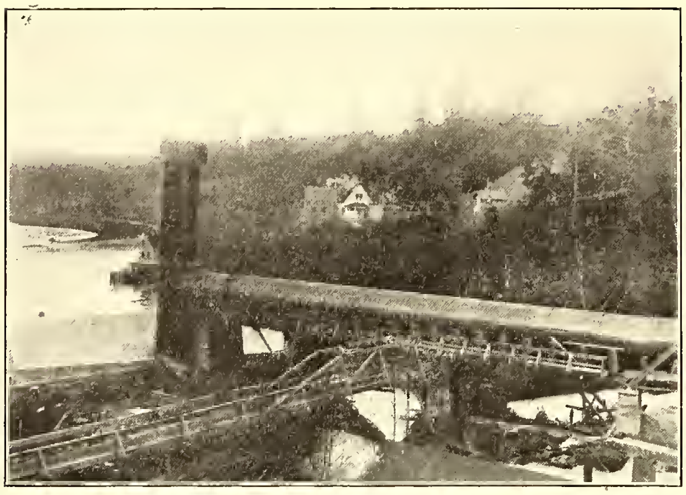


POWER HOUSE AND TUMWATER FALLS

POWER HOUSE, STANDPIPE AND PIPE LINE

For distributing current and controlling the different machines there is installed a gray Vermont marble switchboard of eight panels, made up as follows: One a. c. generator panel, upon which are mounted a non-automatic oil-break switch, combination rheostat, field switch, voltmeter and synchroscope plugs, indicating wattmeter, two 200-amp. ammeters and one 75-amp. ammeter, and, supported by brackets attached thereto, one synchroscope and two 3000-volt voltmeters, one for each phase; one feeder panel, carrying one 200-amp. automatic oil-break switch and two 300-amp. ammeters; one transformer panel, carrying one 60-amp. automatic oil-break switch, voltmeter, plug switch and two 80-amp. ammeters; one a. c. panel for rotary, carrying a Westinghouse polyphase regulator, 400-amp., 4-pole, double-throw, quick-break switch, synchroscope plug switch, 100-amp. field switch, synchronizing lamp and two 500-amp. ammeters; one d. c. panel for rotary, carrying a starting rheostat, 400-amp. positive and negative single-pole, single-throw switches for d. c. terminals, combination rheostat, 600-volt differential voltmeter, 600-amp. double-reading ammeter and automatic circuit breaker with equalizer contact; one d. c. generator panel, carrying a starting rheostat, voltmeter plug switch, 1000-amp., single-pole, single-throw switches for positive and negative terminals, one 1500-amp. ammeter and one automatic circuit breaker; one d. c. power feeder panel, carrying one 1000-amp., single-pole, single-throw switch, one 1500 amp. ammeter and one 1000-amp. automatic circuit breaker, and attached to a swinging bracket one 600-volt voltmeter. An equalizer switch is mounted on a pedestal at the d. c. end of the switchboard. The switchboard and fixtures were furnished by the Westinghouse Electric Manufacturing Company. All of the indicating instruments are of the new round-dial type.

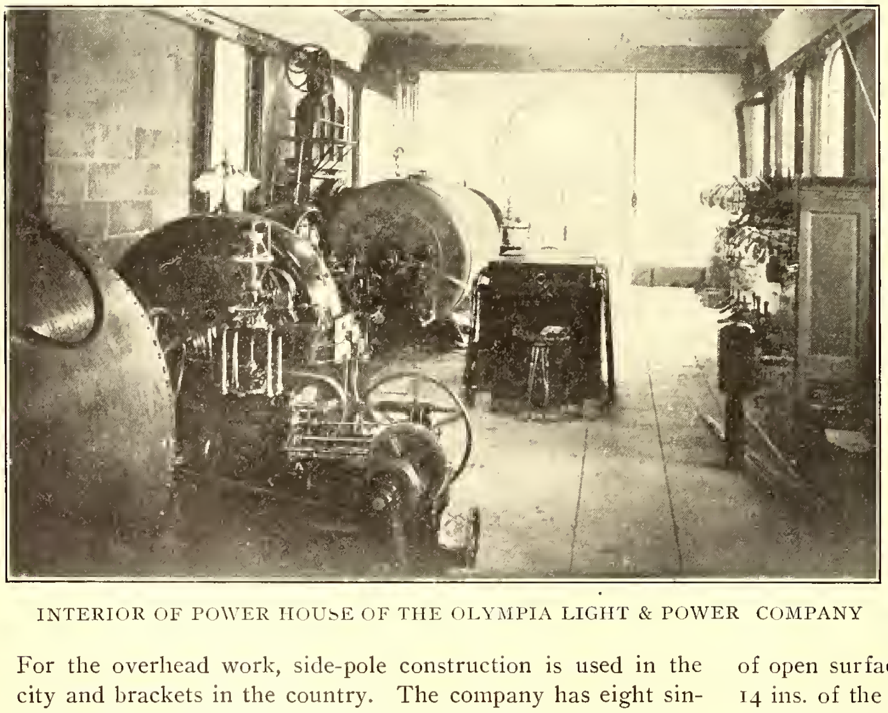
A series arc-lighting service in the city is operated from a fifty-light General Electric Company's series arc transformer, located in the power house. The lighting load on the station consists of 2200-volt, two-phase, 60-cycle primaries, distributing as 104-volt, single-phase secondaries, and also the series arc-



PIPE LINE AND STANDPIPE AT POWER HOUSE

lighting system. The power load is practically all on the 550-volt, direct-current railway system, and is made up of motors operating a large brewery at Tumwater, pumping the city water supply for Olympia, and driving printing presses and saw and planing mills.

The railway system comprises a little over 4 miles of standard gage track, laid through the principal streets of Olympia and extending to Tumwater. The rails are 40 lbs. and 60 lbs.



INTERIOR OF POWER HOUSE OF THE OLYMPIA LIGHT & POWER COMPANY

For the overhead work, side-pole construction is used in the city and brackets in the country. The company has eight single-truck cars, and gives a fifteen-minute service, which is a very good schedule, considering the size of the city. Considerable freight business is also handled.

In the way of future development the company plans, when the capacity of the present installation is reached, to double the equipment and draw the additional water necessary from a storage lake, which can be easily created to store the flood waters of the river, by means of a dam at a point about 27 miles above the present plant.

The new power plant was designed by E. W. Cummings, consulting engineer of Seattle, Wash., and was installed under his supervision. The Pacific Bridge Company, of Portland, Ore., was the contractor for the construction. The latter's superintendent, in charge of the installation of the hydraulic and electrical machinery, was F. N. Averill, now superintendent of the Baker City Electric Power Company, at Baker City, Ore. The officers of the Olympia Light & Power Company include the following-named gentlemen: President, Hazard Stevens; vice-president, N. W. Jordan; secretary, John F. Souther; all residing in Boston, Mass.; manager and treasurer, L. B. Faulkner; superintendent and chief electrician, H. C. Ranft; chief engineer, F. M. Cooper; the last three gentlemen all residing in Olympia, Wash.

A NEW TYPE OF CONVERTIBLE CAR FOR THE BROOKLYN RAPID TRANSIT COMPANY

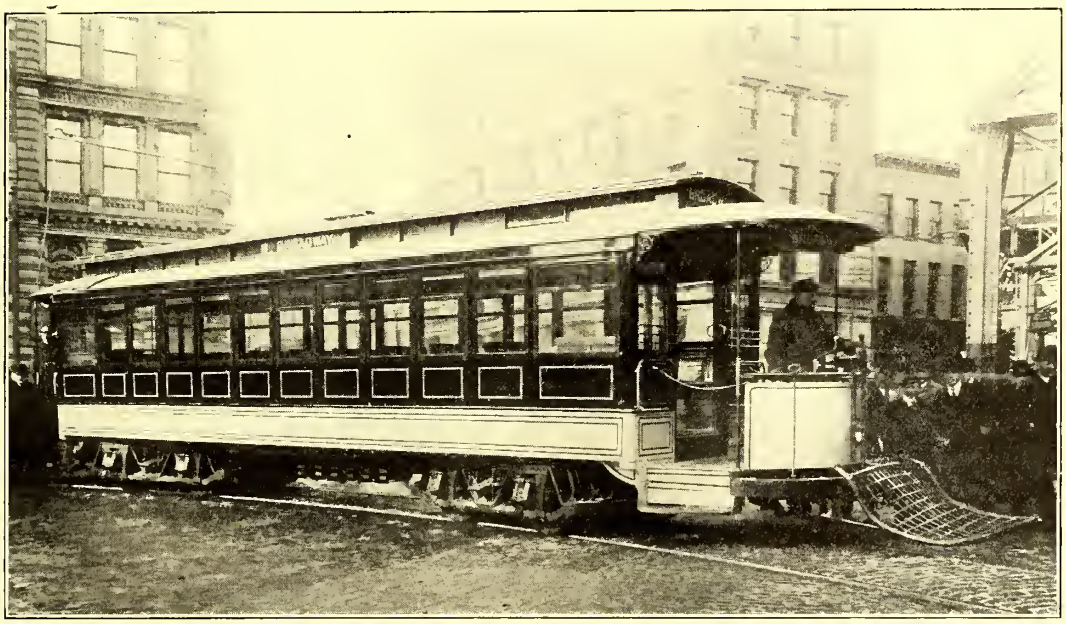
Something of an innovation will be inaugurated by the Brooklyn Rapid Transit Company in the use of a new type of convertible car for operation upon its surface lines during the coming summer. In the selection of the type of car for a large order of new surface cars recently placed by the company, a careful study was made of the problem of electric railway rolling stock, which has resulted in the adoption of a type of car radically different from usual types of convertible surface cars. A novel type of convertible car had been used with great success for the past two summers upon the elevated lines leading to Coney Island and the other ocean resorts, the introduction of which was due to the extremely heavy and trying character of the summer service of this company on account of the through service from New York and all parts of Brooklyn directly to the various ocean resorts. An open type of car seemed very desirable for use upon the through elevated trains, while the usual side entrance type of open car would, of course, have been entirely inapplicable to elevated service; this type of convertible car, however, proved to entirely meet the requirements and has been so successful in service that it was decided to adapt this type of construction to the new open cars.

As will be remembered from an article presented in the Dec. 20, 1902, issue of this journal, descriptive of the new type of convertible elevated car, this car was built with removable side panels, which are taken out in the summer and replaced in the winter, thus making a very comfortable and desirable car for summer traffic, particularly as the interior of the car is arranged on the cross-seat plan. Of these cars, 120 were placed in service, particularly to care for the summer traffic, for which they have been found to be very popular with the public. They proved to be very comfortable to ride in, not only on account of the cross seating, but also of the open feature; they are practically as completely an open type of car, when the side panels are removed, as are the usual style of open surface cars, inasmuch as the panels extend to within 14 ins. of the floor. Furthermore, when closed for winter service they are also very comfortable and convenient.

The new style of surface car adopted follows the lines of construction of this elevated convertible car very closely, as may be noted from the accompanying photographs; the side panels are here also removable to within about 12 ins. of the floor line, so that the resulting summer car will be as strictly an open type of car as those of the usual side entrance open type now so commonly used. The usual style of cross seating is made use of, and the aisle is unusually wide, so that ample standing room will be provided without restricting the conductor from easily passing through in collecting fares. Very heavy curtains of pantasote material will be used, so that under summer conditions, when the side panels are removed, the curtains may be drawn in case of rain and serve as an effective protection to passengers. The pinch-handle fixtures of the Curtain Supply Company will be used, but with important improvements which will prevent the lower part of the curtain from being accidentally pulled out of the groove. As may be noted from the interior view, straps will be provided only at the ends near the doors, three being provided on each side at each end.

This car, which was built by the John Stephenson Company to serve as a sample from which the final design for an order of 200 was to be settled, is 41 ft. in length and has a seating capacity of forty-eight persons. This particular car is equipped with Westinghouse air brakes and four Westinghouse 68 motors, while the trucks are an improved design of the type 45 truck built by the Peckham Manufacturing Company for heavy surface traffic. Many other improvements will be used upon these cars, including electric headlights, a new style of universal destination sign and other interesting features.

The selection of this type of convertible car to supplant the usual type of open summer car with side running board is one of more than usual importance. The use of a convertible type of car, which is thus available for both summer and winter service, has many attractions and has been carefully studied by the mechanical officials of the Brooklyn Rapid Transit Company.



THE NEW TYPE OF CROSS-SEAT CONVERTIBLE SURFACE CAR, TO BE USED BY THE BROOKLYN RAPID TRANSIT COMPANY

It is, of course, practically impossible to abandon the use of the open car for the very heavy and profitable summer traffic above referred to, particularly as the comfortable side seating features and cooling breeze available in the open car are as great an attraction to the public in the hot summer weather as are the attractions at the ocean resorts reached by these lines. On the other hand, the shortcomings of the usual side entrance open car have long been fully realized, particularly under the operating conditions met by the Brooklyn company, upon which long runs from the suburbs to the beach resorts are made at comparatively high speeds. Under these conditions it is found very difficult for the conductors to properly collect fares, especially as with crowds hanging on the running boards, their movements are badly obstructed and are, in fact, made with considerable danger to themselves; there have, in fact, been a large number of serious accidents from this cause in particular, as many as a dozen conductors having lost their lives in this way during the last summer season.

The new type of convertible car with the middle aisle will, obviously, secure immunity from these troubles, and at the same time retain the attractive features of the ordinary open type of car.

INTERIOR VIEW OF THE SAMPLE CONVERTIBLE CAR FOR BROOKLYN

It offers very many desirable features, particularly for the conditions met in Brooklyn, and will, it is thought, do much to relieve some of the trying difficulties of their very large summer traffic.

As stated in the STREET RAILWAY JOURNAL of Feb. 25, the J. G. Brill Company has received an order for 175 and the Jewett Car Company for 25 of these cars. The motors will be the Westinghouse type No. 101, controlled by the new Westinghouse No. 28-A hand controller. The trucks are of a special design of short wheel base for surface operation, but which will conform to the M. C. B. standards for heavy service; they were designed by the Brooklyn Heights Railroad Company, will be furnished by the Peckham Manufacturing Company and will be known as the "No. 25 Brooklyn Heights Special." The brakes for the surface cars will involve, besides the National Brake Company's "Peacock" hand brakes, a complete equipment of air brakes, which, including compressors and brake equipment, will be supplied by the Westinghouse Traction Brake Company. The heaters will be supplied by the Consolidated Car Heating Company. The seats, 5200 in number, will be supplied by the Heywood Bros. & Wakefield Company. They are of the Wheeler type and are upholstered in rattan. The length over all is 34 ins., leaving a 24-in. aisle. The backs of the seats being made offset at both ends, gives ample clearness for reversing the back at the wall end and increases the aisle width above the seat line by about 3 ins. The wall end casting is made with an offset which allows the pinch curtain fixtures to operate beneath the line of the top of the casting. The seats measure 19 ins. from floor to top of cushion, and are made with a single foot rail.

A more complete description of this car, together with its details of construction, will be presented in a later issue.

CAR WHEELS—A STUDY OF THEIR COSTS

BY D. F. CARVER

The traction industry has advanced beyond the purely experimental stage in the development of its technical component parts, and many things are rapidly approaching a standard, in fact would be so considered, except that the indorsement of the properly constituted association has not been given. This applies to car wheels for the three varieties of traction service—city, interurban, and the combination of the two. This article will deal particularly with those for city service, as it is here that there is the greatest necessity for a consideration of the most practical way to reduce the cost.

The demands made by the patrons of street railway companies for a continuously improving service often entail an additional expense to an account already heavily burdened. The revenues per passenger per mile must decrease because of the growth of our communities and the extensions of the single fare limits. These conditions combined make it necessary for the mechanical men employed on street railway properties to give close attention to the costs per unit of material used. This includes the initial cost, and also the cost of wear and tear of service.

The recently published annual report of the New York Board of Railroad Commissioners for the year ending June 30, 1904, indicates that the amount of money available from earnings for the operation and maintenance of street railway properties is now limited. Judging from experience gained in the development of other leading industries which are now older in years than the electric traction industry, it is reasonable to assume that the city railway companies will be called upon to do in the future a continuously increasing volume of business at a diminishing margin of profit per passenger carried. This condition calls for an analysis, by the engineer, of the costs of wear and tear as well as the initial costs, to find if possible a more economical combination of first cost and rate of destruction; or a combination of first cost, cost of wear and tear, and finally, the selling value of that which is left as "scrap"; or a more economical combination of cost of labor plus cost of material; or other combinations which arise always as special features to special cases. It must be that these analyses have at times something of general interest to those interested in the industry, and hence this article.

Car wheels for city railway use—cast-iron, steel-tired and rolled-steel—are highly developed mechanically, but restricting conditions, which require narrow treads, thin and shallow flanges, prevent improvements which are obviously proper but impossible with the grooved rail now so common. The very short-lived part of the city railway wheel is the flange, and until the restrictions imposed by the full grooved rail are removed, the city railway wheel will always cost more in wear and tear than suburban and steam wheels. This cost when reduced must be done without any reduction in reliability of operation or in factors of safety. The full grooved rail has advantages to those who ride in something else than the trolley, but that it is imposing a heavy burden on the trolley companies in the maintenance of wheels can be shown by comparison with the costs of car-mile or wheel-mile service to steam railroads who do not have these restrictions to contend with and who can make their wheels run economically.

Quoting from notes copied some four or five years ago from figures of cost given by one of the leading steam trunk lines running out of Chicago, these companies in certain test cases have run 33-in. cast-iron wheels till worn to safe limits at a cost of 2.81 cents per 1000 wheel-miles' run. If this were at all possible on city traction systems, it might mean to some of them the saving to them of the interest on $100,000 at 5 per cent. This is rather an unusual run, but it is interesting to one studying costs of wear and tear.

Cast-iron car wheels in hard city service wear away at about 1 lb. in weight of wheel per 1000 wheel-miles' run, and although the metal worn away costs only a little more than 1½ cents per pound in the new wheel, the scrap value of the remaining part of the used up wheel is approximately 65-100 cent per pound. This difference in value between new metal and scrap metal, plus the first cost of that which has been worn away, shows that for all practical purposes to the railway company, the part of the rim which has been destroyed has cost 14.95 cents per pound (including labor at shops and material), or $5.23 per wheel, made up of

Depreciation	$3.74
First cost of that worn away	.54
Labor	.95
Total	$5.23

That is to say, the depreciation in value to the railway company of its unconsumed worn out cast-iron wheel is seven times more than the actual first cost of the part that has been destroyed.

An analysis made of several cases in years past shows that where phenomenally low costs per 1000 wheel-miles were obtained, it has been done largely by creating some special condition which reduced this proportion of 1 to 7. The first instance quoted, where the cost was 2.81 cents per 1000 miles, was largely due to the reduction of the proportion, but by a method not applicable to city trolley service.

In a consideration of wheel costs, some basis of comparison must be used, and for comparison only it has been assumed that the wheels will average (for 33-in. cast-iron, chilled, spoked type) 450 lbs. in weight when new; that the new wheel costs 1.55 cents per pound; that its scrap value, f. o. b. car shops, is 65-100 cent per pound, and that the average life of such a wheel at this cost should be 35,000 miles.

In the diagram, Fig. 1, the axis of x, or abscissas, represents 1000 miles' run per wheel. The y ordinates represent on the left $1 for each horizontal line, and on the right 10 cents for each horizontal line. The line A then shows the value of the wheel at the successsive mileages of its life, or its weight for the time being, at 1.55 cents per pound. The line B represents the value of the wheel at the successive mileages of its life, or its weight for the time being, at its scrap value of 65-100 cent per pound—both referred to the left-hand ordinates.

The line C represents the cost per 1000 wheel-miles of the wheel, both labor and material, at the successive stages of its wear, and the line D represents the cost per 1000 wheel-miles of the wheel only, f. o. b. company's shop, at the successive stages of its wear. The values of the ordinates of both of these curves are those at the right of the diagram.

Suppose that a wheel breaks after running 20,000 miles and is, of course, practically useless. A reference to line D at the 20,000-mile vertical shows that for the time the wheel in question was in actual service its cost rate to the company—wheel only—for the time it could be used was 20.8 cents per 1000 wheel-miles, and a reference to line C on the same vertical shows that the total cost of labor and material has been at the rate of 25.6 cents per 1000 wheel-miles. It also appears that for a 35,000 miles' run, which is the assumed life of the average wheel, the rate per 1000 miles for labor and material has been 14.96 cents per 1000 miles, and that the cost per 1000 miles of wheel only has been 12.25 cents.

This line C shows a number of things. It shows that if the track is bad at special work and is breaking flanges, every wheel that is broken at 6000 miles' run, for instance, has cost the company 84 cents per 1000 miles. It also shows why it is economy to spend some money to grind up a comparatively new wheel, but rather doubtful economy to spend very much on a wheel that has done 28,000 miles or 30,000 miles.

If the line A were a horizontal one, that is to say, if there was no loss in weight of the wheel as it wore out, then the line C, describing the cost per 1000 miles' run, would be a rectangular hyperbola, with the formula

$$xy = 501{,}000$$

and the cost in cents per 1000 miles—y—for any value of x, in miles, would be

$$y = \frac{501{,}000}{x}$$

But the diminishing weight must obviously be provided for in an equation of this kind. It is covered by the cost of the metal worn away per 1000 miles' run, at its scrap value, in this case, 1 lb. of metal at 65-100 cent per pound. Therefore, to the above must be added $.65 \times x$ (in miles)
and the equation becomes

$$y = \frac{501{,}000 + (.65 \times x)}{x}$$

For the line D the rectangular hyperbola is

$$xy = 406{,}000$$

and the cost of the wheel only (no labor) per 1000 miles—y—for any value of x, in miles, would be

$$y = \frac{406{,}000}{x}$$

plus $.65 \times x =$

$$y = \frac{406{,}000 + (.65 \times x)}{x}$$

It is therefore evident that the cost of the wear and tear on car wheels is governed by a very simple natural law, and that an equation can be derived for any conditions, anywhere, which will instantly and accurately show the cost of wear and tear, or of destruction by "flats" or broken flanges.

The line E, Fig. 1, shows the value of a wheel at different mileages run, computed on the assumption that standard wheels at a first cost of $6.98 per wheel (1.55 cents per pound) should run 35,000 miles. If one bought with such a contract, he would want to know how much a wheel that had only run, say, 32,000 miles, was worth to him. To determine this point, follow the 32,000 vertical line to its intersection with line E, and this point, on the left-hand ordinates, will be found to be $6.63. Conversely, if it ran over its guarantee, or, say, 40,000 miles, the intersection of line E with 40,000 will be found at $7.60, the equitable value of the wheel. Of course, line E is straight, and it is interesting to note that its origin at $x = 0$, is at $y =$ $2.92, equal to the scrap value of the wheel, for it is obvious that if the wheel could not be run, its value was only scrap.

It will be noted from this line that, in establishing a base rate of price per 1000 miles' run, it is well to establish the standard of price at some point close to the limit of wear of the average wheel, because if taken at 28,000 miles, for instance, the amounts payable for wheels showing long life would be quite considerable. That is to say, the base price for wheels on a mileage basis should be computed at an average, which is as near, as may be judged, to the cost price per wheel per 1000 miles' run, when scrapped.

It will also be noted that in relation to the line E, for any value of x in 1000 miles

$$y \text{ (in cents per wheel)} = x \times .0116 + 292$$

where the mileage cost per wheel is on a 35,000-mile basis. So much for the cast-iron wheel.

TABLE SHOWING PROGRESSIVE COSTS OF OBTAINING 175,000 MILES FROM CAST-IRON WHEELS

First cost cast-iron 450-lb. wheel, $6.98; scrap value, $2.70; cost of pressing wheel on or off axle, $0.48.

Cost New Wheel	Cost Labor Pressing on and off, etc.	Scrap Value at 35,000 miles	Net Cost at End of	Total Cost
$6.98	$0.48	$2.70	35,000 miles.	$4.76
4.76 6.98 $11.74	0.95	2.70	70,000 "	9.99
9.99 6.98 $16.97	0.95	2.70	105,000 "	15.22
15.22 6.98 $20.20	0.95	2.70	140,000 "	20.45
20.45 6.98 $27.43	0.95	2.70	175,000 "	25.68
	0.48	....	....	26.16

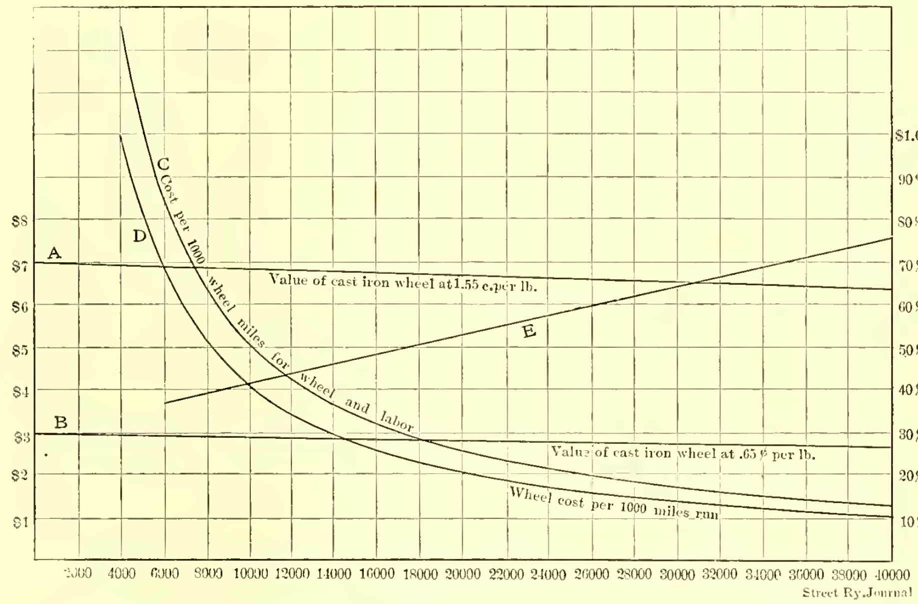


FIG. 1.—DIAGRAM FOR DETERMINING SERVICE AND SCRAP VALUE OF NEW AND WORN CAST-IRON WHEELS

The steel-tired and rolled-steel wheels are coming into common use, and a comparison of their costs with cast iron has some interesting features. As the life of a single steel wheel is equal to several cast-iron ones, it is necessary in making comparisons to accumulate the costs against several cast-iron wheel, as shown in the foregoing table.

That is to say, wheel No. 1 has run 35,000 miles at a net cost of $4.76; wheels Nos. 1 and 2 have together run 70,000 miles at a net cost of $9.99; wheels Nos. 1, 2 and 3 have together run 105,000 miles at a net cost of $15.22; wheels Nos. 1, 2, 3 and 4 have together run 140,000 miles at a net cost of $20.45; wheels Nos. 1, 2, 3, 4 and 5 have together run 175,000 miles, and wheel No. 5 has been pressed of and scrapped at a net cost of $26.16, and

$$\frac{26.16}{175} = 14.95 \text{ cents per 1000 miles.}$$

This progression is shown graphically by line F in Fig. 2.

The cost of a new rolled-steel wheel may be assumed at $20, and it will cost 47 cents to press it on and handle necessary material in connection therewith. At the end of 50,000 miles' run its net cost to the company, if it has run, as is perfectly fair to assume it will, is $20.47. Now, if it is taken out of service, turned down and trued at a cost, say, of $1.50, which is reasonable, and it runs for an additional 40,000 miles, so that its net cost to the company at the end of 90,000 miles' run is $21.97, when it is again trued up at an additional cost of $1.50, its net cost to the company when it is worn out at 127,000 miles will be $23.47; but it costs another 48 cents to get it off and the scrap value approximates $5, so by the time it is scrapped it has cost a total net of $18.94.

$$\frac{18.94}{127} = 14.91 \text{ cents per 1000 miles' run,}$$

approximately the cost to run cast-iron wheels. This is a hypothetical case, but it is well within the range of immediate possibilities, and shows what may be expected.

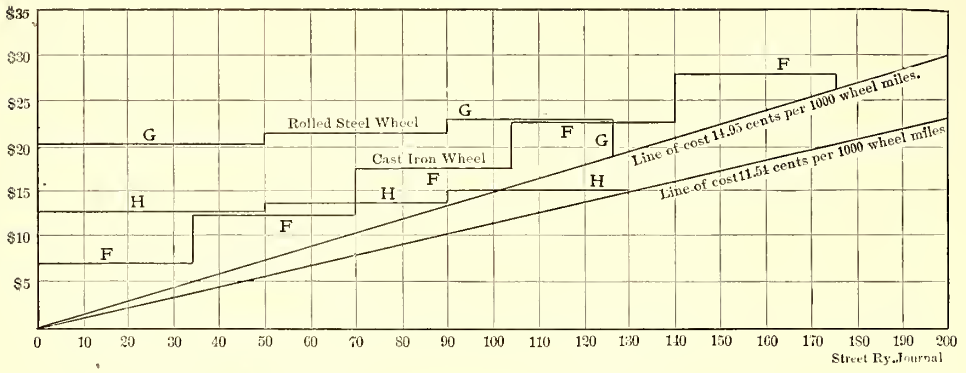


FIG. 2.—DIAGRAM FOR COMPARING COST OF IRON AND STEEL WHEELS AND STEEL TIRES

This progression is shown by line *G* in Fig. 2. On the face of it and from superficial consideration only, a 33-in. steel-tired wheel, at a first cost of $36, with an ultimate scrap value of $6, would have to run more than 200,000 miles to give a service at equal cost with cast iron. But methods have already been devised by which it is not necessary to part with $24 worth of wheel center and some rim value at a depreciated market value of approximately 80 per cent. There are many cases of a combined city service and suburban service in which it is dangerous to use cast-iron wheels. In fact, it is probable that the steel-tired wheel may yet enter into strong competition with cast iron on the basis of cost of wear and tear alone.

Line *H*, Fig. 2, shows the progression of costs of a rim for a steel-tired wheel at an initial cost per rim of $12 and a net cost to the company after running 130,000 miles of $15, or 11.54 cents per 1000 wheel-miles.

As will be noticed in Fig. 2, the diagonal or final cost lines per 1000 miles, start from $x = 0$ and $y = 0$, showing that it is ultimately immaterial whether the investment is made as first cost, as in steel wheels, or whether it is a slowly accumulating cost, as in cast iron. For this reason, if the steel wheel line terminates on the line 14.95 cents, as shown, independent of the value of x, the cost of steel wheels must be equal to that of cast iron—with this additional risk, that breakages in new steel wheels are much the most costly.

It is also apparent from this diagram that a steel tire will have to run 100,500 miles to become equal in cost to cast iron, and further, that but for the scrap value of rolled wheels they would have to run 157,000 miles with two turnings to bring them down to a cost equal to cast iron in wear and tear. As a matter of fact, the economies which the changeable steel tire is able to show are due to its ability to run long mileages at slowly accumulating expense, for the scrap value of the rim is small. For the purposes of comparison, a price of 95 cents per wheel has been used as the cost of taking off the old wheel and putting on the new. This is the price averaged in shops with ordinary facilities for doing the work.

There are three lines along which to work to reduce the cost per 1000 miles, or the wear and tear on car wheels in city service: One is to increase the latitude of the restriction upon the flange; another to improve the metal in the flange of present shape is to make its mileage greater between turnings, and the third is to increase the value to the railway company of the wheel center, which does not wear out with the rim. Thanks to the efforts of the wheel makers, many economies have already been given to the railway company by improvements in the latter items.

But it seems probable that the further economies to the users of wheels are to come from a development of the art of adding to the value of the equivalent of the scrap of today.

All of the above conclusions are derived from hypotheses that are definitely stated, but many cases will perhaps arise in service where the hypothesis does not correspond to the practice, and consequently the conclusions do not correspond to specific results obtained. However, there is some proportion governing the relation of one to the rest, and the method of reasoning by which these conclusions have been derived, if applied by anyone to his actual conditions, will give him the results he may know will follow from any line of action as an economic proposition.

CREATING TRAFFIC—I. THE TRAFFIC AGENT

BY E. P. HULSE

Traffic creating is beginning to receive more of the attention to which it is entitled from both city and suburban electric railway managements. They now feel that there is more to the business than striving to operate cars satisfactorily, however desirable that difficult end may be; additional means must be taken to keep the benches full and prevent red figures from showing on the statement of earnings and operating expenses. This work is traffic creating—originating new reasons why the public should use the lines and part with its nickels, and stimulating the desire to travel and directing the impulse by means of implanting the proper suggestion.

As electric railway operation takes on more and more of the character of steam railway operation, the methods that experience has found profitable for the latter in drawing the dollar to their lines are being adopted. Many electric systems that now rival in equipment and service the longer established steam roads have found that they must learn some of these methods if they would maintain their growing advantage in the tug-of-war for passengers and freight. For it is a recognized competition, and one that is growing stronger every day as the little street railway units that formerly centered their interests in a single city are stretching out and speeding their electric shuttles from one population center to another in ever-increasing distances and combining in systems that think nothing of 100-mile runs.

The passenger agent of a steam road that crosses several States excitedly exclaimed recently, when discussing the point that electric lines increased traffic over his road by acting as feeders from new territory: "Yes, but they draw more travel away from us. You have no idea of the number of business men that now use the electric lines for long distances."

Some of these modern long-distance electric railway lines, that are to be found particularly in the Middle West, are the cause of much wonderment to those who view them for the first time and who have not kept in touch with the speedy development in this branch of public service. Running over a roadbed laid out for the most part on private right of way, perfectly graded and heavily ballasted, and banked at the necessary curves with the most scientific engineering skill, on rails as heavy as those used by the steam roads, such a line is enabled to claim a right to compete for traffic with the steam roads. On many of them the rolling stock is the most modern and expensive that is built, the best and latest in every way. Their cars are large, double-truck ones, easy riding, handsome and comfortable, each equipped with four high-power motors; air brakes, supplemented with hand brakes; arc headlights which illuminate the track far ahead; warning signals, both gong and whistle; and all the appliances that long experience and due regard for safety could suggest. Some have double track; but the single-track lines are protected by a complete equipment of block signals of the most reliable make and type, showing red when a car is on the block and white for a "clear line," as well as a private telephone system, and these are supplemented by the most painstaking routine of despatch sheets or of verbal checks, exchange of "key of the road" and other right-of-way signals between motormen and conductors of passing cars, with experienced starters on guard at all junction points and a despatcher, perhaps with the assistance of a "pin-board," in charge over all.

But it is one thing to build a roadbed, and quite another to build up the traffic, and to increase to its greatest proportions the travel that might go over it. I have several lines in mind the country over that connect large cities, but where such apparently jealous care has been taken in guarding this fact that all that the citizens in each terminal place know of the road is that it runs along a certain street and then disappears into the country. The road's managers know where the cars go to and how often they run, but they forget that this has never been brought to the attention of the public—frequently, insistently, convincingly, as it should be. The "exploring" bent is strong in only a small percentage of the population; they must be directed and have all made plain by maps and descriptions.

Road managers become so interested in the details of operation that they are too prone to concentrate all their attention on what might be termed the mere "mechanism" of public service, and they neglect all effort to increase passenger and freight business. They would rather have the praise of another electric railway official to the effect that they are operating a fine road than to know what the public thinks about it. They necessarily get a bias in this particular direction. To be sure, the best advertisement a road can have is convenient schedules, closely maintained; roadbed in fine condition, and comfortable cars in good repair; a safe system of operation, and alert and courteous men; line kept open in all conditions of weather, and few shut-downs of the power. A line cannot enter strongly into competitive bidding for traffic unless it can deserve praise on its operation. But having all these, it is possible to draw far more travel than would naturally voluntarily offer itself.

Mankind is subject to influence by the proper suggestion. Psychology probably never will be included in the course of training that fits an electric road manager to operate his line, but he must remember that all his travel comes from a "suggestion" in one form or other. How best to present this suggestion to the greatest number of possible riders with the utmost economy is the important point. Printer's ink will engulf dollars beyond all hope of return if printing is injudiciously done. While steam roads make the dollar their unit, the electric road manager must keep in mind that he is getting his by the nickel; therefore the steam road methods must be modified with this in view. An elaborate publication that a steam road could afford to give to a prospective passenger who might return forty or more dollars would be out of all proportion in bidding for the nickel passenger, even though his patronage might be constant thereafter. There are classes that it pays to go after, however—the exploring tourist and the student of history, the lover of nature and city sightseer, the pleasure seeker, the picnicker, the enthusiastic "trolleyer"—that devotee of the most enjoyable and inexpensive of sports and one with a thousand fascinations. The electric road that has no amusement resort or historic spot on its line is handicapped, for the pleasure travel should form a large part of its receipts, and it is this class that is the most susceptible to suggestion and direction, although much business travel may be proselyted from the steam roads where there is competition. The suggestions that follow, however, apply equally well to the traffic that can be influenced independently, or where no competition exists.

I would advise any road to give the business of traffic creating into the hands of a special man, at least during the spring and summer months. If he exerts himself in all the directions that are possible, and is backed up by a sufficient appropriation, he cannot fail to make his position a remunerative one to the company. Give up the idea at the start that your road or park or beach resort or picnic ground will advertise itself. It will not. This has been thrashed out already in analogous lines that are as necessary as transportation. Note how such staples as sugar, coffee, flour, biscuit, etc., are now being advertised, where the suggestion that it would be profitable to do so would have been laughed at ten years ago.

Your traffic man should have some qualifications outside of a knowledge of the electric railway business. He should know the preferences of the public in matters of amusements, sports, holidays. He ought to be familiar with the show business, the best booking agencies, the best acts, what their accustomed prices are, etc. Not that he should book direct for his theater or circuit of theaters necessarily—unless he wishes everyone connected with the management to contract heart failure—but that he should be able to know when the road is getting value received for the amount that it is putting out for amusements. Knowledge here will sometimes save a road many dollars. Your traffic man should be aware of the respective value of the newspapers in his territory as advertising mediums. He should know paper, ink and type; for instance, he should know when an s. and s.c. (sized and super-calendered) paper will do as well for his printed matter as a more expensive coated stock, etc.; know what qualities of red ink will stand the sunlight on his displayed posters without fading entirely in three days, etc.; know what printing offices in his territory are equipped for different classes of trade and be aware of the ones that have wood type, especially of 7½-in. and 10-in. sizes; know what printing concerns have cylinder presses capable of handling a dasher sign or a one-sheet poster; know what places will make a night or Sunday run, or where he can get his matter out the quickest, for traffic creating is sometimes a mushroom matter, and public attention must be nailed immediately when an opportunity presents itself. He must be able to "fight fractions" in keeping down the cost, for nowhere can he "swap" an old dollar for a new one so easily as in eating up traffic profits by the printing expense that brought it. These may be details for the purchasing agent, but it would be better if the traffic man knew his business along these lines. So much the better if he knows photography and the requirements in photographs taken for half-tone cuts. And better yet, if he have imagination and the creative faculty (which will enable him to get up excursions, carnivals, field days and to originate other big features) and the ability to write. So equipped, there are many things that he can do.

I will treat of his mediums of publicity next week and will then describe the events that he can advertise through them.

After March 15 all street cars in the city of Baltimore will stop on the far side of cross streets, and not the near side, as now.

A special cable from Berlin says the Bavarian Government is planning the introduction of electric traction on several trunk line railroads like the Munich & Lindau, which is 136 miles in length.

HOW TO MAKE A GOOD FOREMAN

A very interesting address, with this subject as a title, was delivered by H. H. Vreeland, president of the New York City Railway Company, at an open meeting of the welfare department of the National Civic Federation at Young's Hotel, Boston, on Feb. 27. The invitation was extended to Mr. Vreeland, as chairman of this department of the Civic Federation, by a large number of prominent manufacturers and other employers of labor on an extensive scale. Although the address was intended to cover all industrial enterprises, many of Mr. Vreeland's remarks have an especially interesting bearing upon railway work, and in connection with the highly successful methods employed on the New York City Railway Company in handling the labor problem, are of the greatest value.

Mr. Vreeland first referred to the great gulf which separates the independent employer of the middle ages, and even of the middle of the last century, with his two or three apprentices, and the head of a great industrial or railway enterprise of the modern day, with its thousands of employees, and in which the directing heads rarely come into direct contact with the men who carry out the details by physical labor. The theory that labor is but a commodity to be purchased in the market as any other at what is its market price, has largely disappeared. The vast majority of the larger employers, and those concerned in the financial management of the great corporate systems, recognize that supply and demand are not the only factors in the determination of the amount of wages they shall pay, and that the American workman is entitled to be treated as a social being, having the right to rear a family, educate them according to American conditions and fit them to enjoy the advantages which he sees so abundantly distributed around them. Continuing, Mr. Vreeland said:

"The question of wages is not the only dominating factor in the solution of the labor question. There is another factor which I deem of almost equal if not greater importance, and that is the relations between the directing mind or immediate superior of the employers and the employees.

"We want no labor controversies if they can be avoided, and in this, as in all other cases, an ounce of prevention is worth a pound of cure. As long as human nature remains unchanged—and, in its essential qualities, it has undergone but very little variance, as history teaches—there always will be differences between employer and employee, and these will be sometimes too acute for immediate amicable settlement, and, during this period of heated controversy, strikes and lockouts may occur. But we can minimize these differences instead of accentuating them, and we may foster and engender relations of good will so close and intimate between employer and employee that when unavoidable differences do part them for a time their disputes may be adjusted with as little acrimony and delay as possible. In inspiring and creating this good will no single factor is of such consequence as the careful and judicious selection of those who are put over and have the immediate direction of the employees, from the most subordinate grade of authority to the highest. For but little reflection will disclose that nearly every crime arises from a wound to someone's vanity, and that once men are insulted or offended it is virtually impossible to bring them to reason, no matter how just our claims upon their obedience may be; but if we have their respect and good will, causes of contention are readily compromised.

"The selection of properly trained men for promotion to the position of foreman in charge of employees is, or should be, one of the most important factors in organizations. Every consideration is given to the qualifications of a man for the position of foreman in the interest of the corporation when the closest scrutiny is made of his ability to so organize forces as to secure the greatest output. Very seldom is consideration given to the question, 'What are his qualifications for handling men?' After his appointment, the most careful scrutiny is made of the results of the work under his charge in dollars and cents; little or no consideration is given to the equally important question of methods of discipline and consideration for those who are under his charge.

"We gain our experience from association and intimate relations with men. A man trained under an incompetent foreman, incompetent so far as relates to his ability to handle men, knows no other course and uses the same methods when he gets the opportunity. In a large organization, how can this be known? Either by close supervision on the part of the general manager or, what is better, the appointment of a well-equipped man to the position of head of the labor department. In the present day of large corporate enterprises, employing thousands of men, many important questions come up every day to tax the time and physical strength of the general manager and do not admit of his giving the necessary time for consideration of the question at issue, and what he does is done in a perfunctory way, and his decisions can only be made on reports of interested parties. A well-equipped man at the head of a labor department has ample time not only to study the system of workings of the organization as a whole, but to study the traits and characteristics not only of foremen but of individual employees. He is in a position to detect any irregularities in the system, as well as to discover what the feeling of employees is, what complaints are in the minds of subordinate employees if not openly expressed, to study causes for same, to suggest remedies, and in cases where matters are brought to an issue with the management to be able to advise with a full understanding of all details from both the corporate side and the side of the employees; also to suggest where improvements can be made in the interest of improved sanitary or working conditions to the benefit of both the employer and the employee. In a word, to care for the welfare department of the organization.

"I have made a very careful study of this subject and have followed the principles I have enunciated in connection with the working of the property of which I have charge. We employ a very large number of men and have to do with all the conditions that appertain to manufacturing and industrial establishments as well as operating a railroad, as we have large shops in which are employed men of different trades. We have no head of a labor department of the character I have described, but we have an organized bureau for the appointment of men in which every effort is made to secure a uniformity of character and experience. As I desired to make a personal study of the value of such work to the organization, I have taken direct charge of what might be termed the labor department, and thus have been able to put into effect my ideas and to follow their workings and see the result. One of the features of this department was the organizing of a system of reports in which the capacity and qualifications for handling of men and proper methods of discipline is shown by a system of records which checks one department or branch of the service against another, not only in like work, but also the total number of employees under one department head against that of another. I started with the theory that where all employees were appointed through references and qualifications examined into by one man and these employees distributed through the organization by a system of requisitions on the appointment bureau, secured a uniform standard of employees throughout the system, subject to the orders of subordinate department heads, and under them the foremen. I believed that there was no reason why foreman 'A,' having 500 men subject to his orders, under one well-defined system or management, with one set of rules and regulations, should find it necessary to suspend or discharge more men in a month, or covering any period of time, than foreman 'B,' with a like number of men working under like conditions. This is worked out on a table of percentages, so that at a glance the manager can tell what each foreman is doing in this direction, and gives him just as safe a method for calling attention to defects in this line as easily as a study of output and financial results of any particular branch or department of the organization.

"This system incites heads of departments and all subordinate managers to greater consideration for their men, and at the same time fosters the desire in them to learn the art of managing men. It also enables the company to develop a system of civil service by which, as their fitness for greater responsibilities is shown on the part of foremen, they may become superintendents, heads of division, and subsequently departmental managers; for it is indisputable that as the modern industrial system requires the co-operation of large bodies of men in common undertakings, if it is to be operated without unnecessary friction, hope of advancements must be held out to aspiring, ambitious and capable minds as a reward for their fidelity and devotion.

"The American workman is the most intelligent of all men of his class, and if his hearty co-operation is given to the development of any enterprise it is certain of success. Having his hearty sympathy and his good will, the settlement of all differences with him can readily be reached. No one can measure or estimate the vast amount of financial loss to both employers and men without reference to the great hardships inflicted upon the men and their families, inflicted by the great strikes and lockouts; and any system which will foster feelings of good will and friendship between employer and employee and minimize these losses and hardships is to be welcomed, and is worthy of the earnest effort and thought of every man who loves his fellow men and is desirous of seeing this great Republic progress and maintain that position of pre-eminence in the civilized world as the Home of Freedom and the Land of Plenty and Prosperity which it to-day holds, and, we trust, will always maintain."

REPORTS ON EMPLOYEES IN NEW YORK CITY

In connection with the address on "How to Make a Good Foreman," by Mr. Vreeland, printed above, a brief description of the methods of reporting the number and character of the discharges on the New York City Railway system will be of interest. The object of this series of reports, as described in the address mentioned, is to gage the efficiency of the heads of all the different departments in handling their men. Each department is obliged to file with the president a monthly report of all men who have resigned or have been discharged during the preceding month, with causes for discharge, and in all cases where the men have been in the service of the company for one year or more, the name of the man and a short history of his case. For example, in the transportation department, which is, of course, the largest employer of labor, the report takes the following form:

(Sheet No. 1.)

NEW YORK ....190..

CONDUCTORS, MOTORMEN AND DRIVERS.

The following men were discharged from the different divisions during the month of .... 190.... for causes given below:

CONDUCTORS.

Intoxication ....

....

MOTORMEN.

Intoxication ....

....

DRIVERS.

Intoxication ....

....

(NOTE.—This statement covers the total number of men in each capacity discharged on the entire system for violations of the various rules governing them. In effect it is a summary of the statement next attached.)

(Sheet No. 2.)

..................Division....Conductors ....
(Cause for dismissal.)

....Motormen ....
(Cause for dismissal.)

NOTE.—This statement shows the number of men in each capacity discharged on each division, with the cause of their discharge. In this statement resignations are also included. There are separate reports for each division. At the foot there is a recapitulation of the total number of men discharged for the various offenses, as follows):

Failing to register fares ....

Intoxication ....

etc., etc.

(Sheet No. 3.)

The following named men were in service of company one year or more, and have been dismissed during month of..........190.., for causes as specified.

....

....

(NOTE.—This report is made out for each division and gives the name of the man discharged, his date of appointment, and cause for his discharge, with any comments which may be necessary. At the foot of the report is a summary showing the total number of men discharged on each division, capacity of employment, and a further summary of the total men discharged in each capacity. The company is much more interested in having a record of those men who are discharged and have been in its employ for a year or more, than for those who have been in its service a shorter time. Hence, this report.)

(Sheet No. 4.)

Statement of motormen, conductors and drivers, both regular and extra, working during the month of .... 190...

....

....

(NOTE.—This statement shows the number of regular and extra men employed in each capacity on each division of the system, with a total at the bottom of the number of men employed in each capacity and a grand total of the number of men employed.)

(Sheet No. 5.)

Percentage of conductors, motormen and drivers discharged from each division during month of .... 190...

....

....

(NOTE.—This statement shows the percentage of discharges of the men in each capacity on each division of the system.)

From these statements as a basis, the president can take up the question of discharges with the foreman of any department which may show too strict, or possibly too lax, a discipline.

COLUMBUS-DAYTON THROUGH SERVICE PLANNED

Manager Theodore Stebbins, of the Appleyard system, is preparing a schedule for limited cars between Columbus and Dayton, and expects to inaugurate the through service in the near future. There will be four cars a day each way, making the 77 miles in less than three hours. The schedule will be arranged so that the cars will connect with the limited cars of the Dayton & Western Traction Company at Dayton and with the Columbus, Newark & Zanesville Traction Company at Columbus, making possible a continuous trip with limited car service from Indianapolis to Zanesville, 250 miles.

The first recognition on the part of the Lake Shore & Michigan Southern Railway (steam) of the existence of parallel electric lines, comes in the shape of a reduction of fares between Cleveland and Norwalk. The round-trip rate has been reduced from $2.80 to $2, which is about equal to that of the electric line. The limited cars on the Lake Shore Electric have unquestionably caused a tremendous loss of business to the steam road.

THE QUESTION BOX

The answers in the mechanical department of the Question Box this week relate to best ways of securing regulation of electric heaters in cars, best methods of moving armatures around the shops and keeping records of motormen's outfits. In the track department are published numerous answers to questions I 6 to I 8, inclusive, which refer to ballast; a suggestion is also given for an inexpensive derrick car for handling pieces of special work and other bulky material. The remainder of the Question Box is devoted to the subject of express and freight.

E—MASTER MECHANIC'S DEPARTMENT

E 19a.—Where electric heaters are used what is the best way of insuring that employees have the proper degree of heat turned on in all cars?

It is the practice on several roads to hang out at some central point a sign bearing a number, 1, 2, or 3, indicating to conductors of passing cars just what point of the heater switch should be used, whether first, second or third. This arrangement places the responsibility for proper heat regulation on some one official who is competent to decide, and does not leave the matter to the caprice of individual conductors.

We enclose the electric heater switches in a box fitted with a special lock. The inspectors have keys to this box, and as each car passes a central point the inspector on duty opens the box and regulates the current supply to heaters in accordance with the temperature. The box is then locked and the car crews do not have access to the heater switches. This insures that the heaters in all cars will be regulated uniformly in relation to the weather.

Schenectady Ry. Co.

E 127a.—What are good methods of moving armatures around the shops quickly and without damaging the windings?

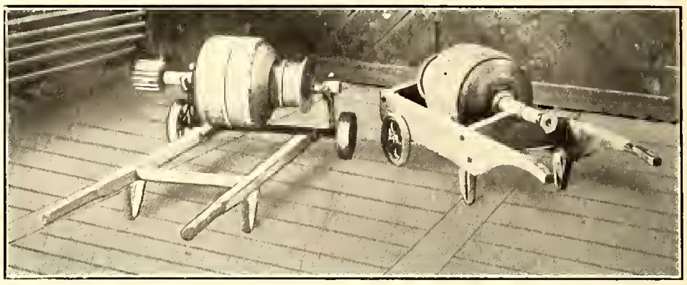
For handling armatures in parts of the shop not served by the overhead runways, we use a small, solidly built truck mounted on

ARMATURE TRUCKS AND RACKS USED AT DETROIT

four castors, as will be seen in the reproduction from the photograph, which shows one corner of our armature-testing room. The trucks are pushed about by hand, and the armatures are carried at a sufficient height above the floor to prevent accidental damage to them. Instead of leaving armatures indiscriminately around on the floor where they are subject constantly to injury, we stack them in racks, as indicated in the illustration. These racks are served by the overhead trolley runway in combination with claim drop and fall, and armatures can be brought from various parts of the shop and deposited in the racks, or removed therefrom, with maximum dispatch and convenience.

Detroit United Ry. Co.

The accompanying engraving shows two forms of armature trucks that have been used for handling armatures in the shops.



TWO FORMS OF ARMATURE TRUCKS

The truck at the right is a box arrangement that affords protection to the armature from possible jams and knocks while it is being moved. The truck at the left has the advantage that with it the armature can be picked up direct from the floor, whereas with the other form the armature has to be lifted into the box.

Anonymous.

E 110a.—What is the best method of keeping track of motormen's outfits?

Schenectady Railway Co.

TOOL RECEIPT.

Date.................19......

Time..................

.... Headlights No..........

.... Markers No..........

.... Lanterns No..........

.... Tool Boxes No..........

.... Switch Bars

.... Controller Handles

.... Reverse Handles

.... Air Brake Handles

.... Broom

Conductor..................

No..................

Motorman..................

No..................

RECEIPT FOR TOOLS

On our road every motorman before going on duty is required to have on his car, a headlight, markers, lanterns, a tool box filled with a complement of tools for making car repairs, switch-bar, controller handle, reverse handle, air brake handle and a broom. These outfits are kept in a separate room known as the lamp room, which is in charge of a man who fills in his time cleaning and filling lamps and lanterns, etc. The headlights, markers, lanterns, tool boxes, etc., are numbered for identification. When a motorman takes his outfit he signs a receipt (shown herewith), which receipts are kept in the lamp room, and trainmen are instructed to see that their receipt is destroyed when the articles are returned, as they are charged with articles lost through negligence. If any article receipted for is not returned within 24 hours, notice to this effect is sent to the superintendent's office and the cost of the article is deducted from the man's wages. Articles damaged by accident must be returned to the lamp room with a proper report in order to secure credit there-

WEEKLY REPORT OF LAMP ROOM — Week ending ......

ARTICLES	Total on hand last report	Number now in lamp room	Number now out on receipts	Number missing since last report	REMARKS
Headlights					
Markers					
Lanterns					
Tool Boxes					
Switch Bars					
Controller Handles					
Air Brake Handles					
Brooms					

REPORT OF LAMP ROOM, SCHENECTADY RAILWAY COMPANY

for. Trainmen are cautioned to keep with them extra copies of the blank receipts, so that in case they are relieved before returning to the car house they can take a receipt from the one to whom the articles are turned over. This receipt properly executed is accepted at the car house in lieu of the articles themselves. The keeper of the lamp room accounts weekly for stock in his charge on a report blank prepared for that purpose (reproduced herewith).

Schenectady Ry. Co.

I—TRACK DEPARTMENT

I 6.—What are the determining factors in selecting ballast for a new suburban or interurban electric road?

The determining factors are accessibility and cost. In my estimation, however, the question of cost (within reasonable limits) should not prevent the securing of a good ballast, as the best is none too good. Broken stone I regard as the best ballast in use to-day. However, a road with fine gravel pits on its right of way would hardly be warranted in using broken stone if the stone must be hauled 500 or 1000 miles.

W. H. GLENN, Supt. Roadways, Georgia (Atlanta) Ry. & Elec. Co.

Cost of the material generally determines the matter.

M. J. FRENCH, JR., Roadmaster, Syracuse Rapid Transit Ry. Co.

The expense of obtaining and handling it and the material of which the roadbed is built.

Columbus, Buckeye Lake & Newark Tract, Co., and Columbus, Newark & Zanesville Elec. Ry. Co.

It depends upon the policy of the company and the cost of available material. If the road is built for speculative purposes the cheapest ballast that shows up well temporarily should be used.

Asst. Eng. Ry. Dept.

I 7.—What is the best material for ballast on a suburban or interurban electric road?

Broken stone varying from ½ in. to 2½ ins.

W. H. GLENN, Supt. Roadways, Georgia (Atlanta) Ry. & Elec. Co.

Giving economy and results equal consideration, clean gravel is not excelled by broken stone, and it is more easily tamped. The ideally ballasted track would have a 12-in. layer of 2-in. broken stone with about 3 ins. of ¼ in. to ¾ in. stone or screened gravel for tamping. Cinders and earth should be used only as a last resort.

M. J. FRENCH, JR., Roadmaster, Syracuse Rapid Transit Ry. Co.

Depends on location and the kind of ballast that is obtainable. In Birmingham, Ala., and surrounding sections, slag is used because it is the refuse from the furnaces that manufacture pig iron, and can be obtained at low cost. It makes a satisfactory ballast.

GEO. H. HARRIS, Supt. Ry. Dept., Birmingham (Ala.) Ry. Lt. & Power Co.

Screened gravel.

Columbus, Buckeye Lake & Newark Tract. Co., and Columbus, Newark & Zanesville Elect. Ry. Co.

Broken stone.

Asst. Eng. Ry. Dept.

Crushed stone or cinders.

H. A. TIEMANN, New York City.

I 8.—Please give comparative costs of ballasting track with different materials.

Perhaps the best way to answer this question is to give the cost per cubic yard of the material used, and the expense of putting in this same amount. It would be manifestly unfair to figure the cost per foot of track, as some engineers may use 6 ins. of ballast under the ties, while others may use 12 ins. Here again the question of proximity of material comes in, so in order to get some idea of the cost it is best to eliminate the item of freight and consider the materials in their original locality. In this section, broken stone costs 50 cents per cubic yard at the crusher, cinders 10 cents at power houses, slag 20 cents at furnaces, and gravel 25 cents at pits. These prices assume that the materials must be bought. Many companies make enough cinders for their own use, and others have their own gravel pits. Some are located near furnaces where the furnace owners are anxious to be rid of the slag, and consequently give it away in many cases. The cost of labor in putting cinders and gravel in place under track is 12½ cents per cubic yard, while that of broken stone is 18 to 20 cents per cubic yard. With broken stone ballast the cost of renewals of ties is much greater than in other forms of ballast, and the wear and tear on the ties is greater. Grass and weeds are very hard to clean from this ballast, but it presents a fine bearing surface for the ties, is not affected by water, and is not dusty like cinders and gravel. It also holds the track in line better than other ballasts, and makes an excellent roadbed when properly laid.

W. H. GLENN, Supt. Roadways, Georgia (Atlanta) Ry. & Elec. Co.

Broken stone ballast costs 60 per cent more, and the cost of tamping stone is about 30 per cent more than gravel.

M. J. FRENCH, JR., Roadmaster, Syracuse Rapid Transit Ry. Co.

In Birmingham, Ala., and surrounding sections, slag can be delivered for ballast at 25 cents per cubic yard on the works. Could not say about other kinds of ballast.

GEO. H. HARRIS, Supt. Ry. Dept., Birmingham (Ala.) Ry., Lt. & Power Co.

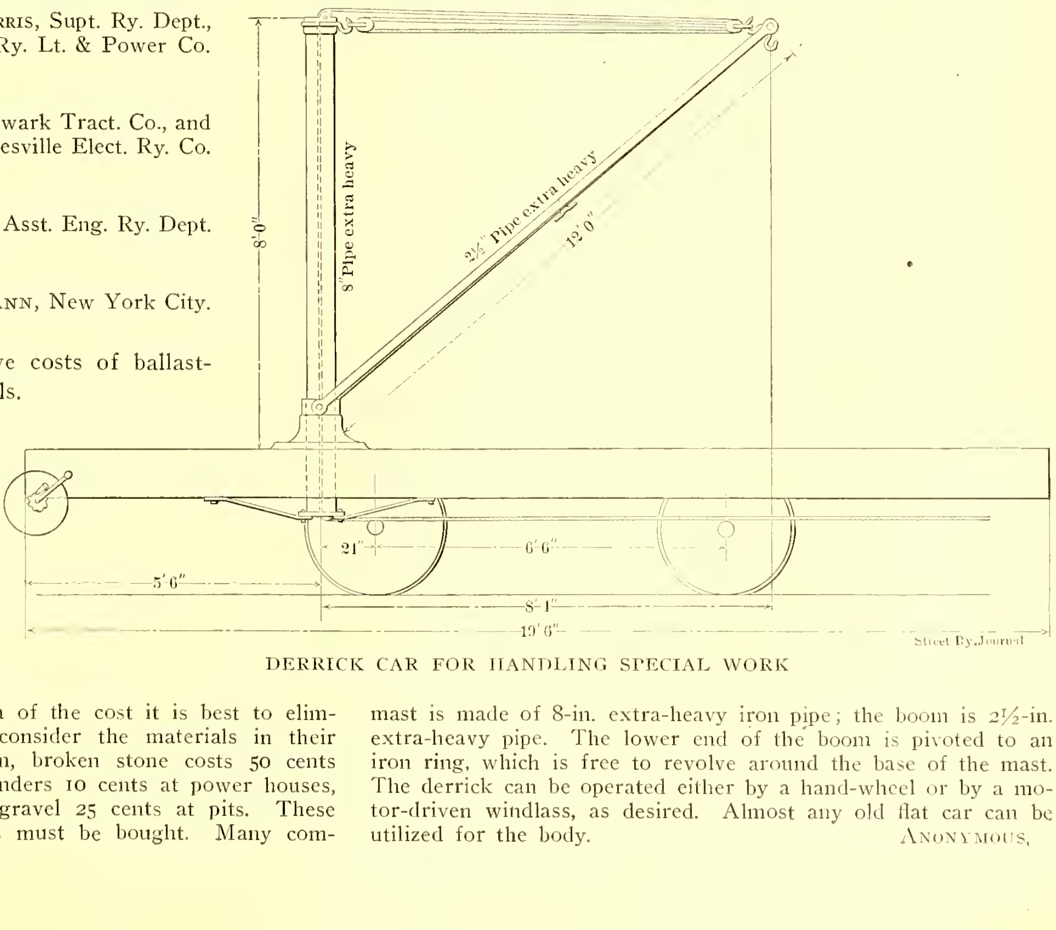
Broken stone in this city costs, for limestone, $1.10 per yard, and for granite, $1.50 per yard, crushed to a size to pass through a 2-in. ring. Gravel is not available, except by long haul on carts, and costs about 80 cents per cu. yd., delivered.

Asst. Eng. Ry. Dept.

I 9.—What means, machines, devices, special rigged cars, etc., do you know of for expediting or cheapening the work of ballasting and laying track? Please give sketch or photograph and detailed description, including cost.

A convenient home-made derrick car for handling special work and other bulky material can be rigged up at almost any shop for small cost, and will greatly reduce the cost of handling and transporting rails, special work and track material in general. The sketch gives a suggestion for a derrick car for this purpose. The mast is made of 8-in. extra-heavy iron pipe; the boom is 2½-in. extra-heavy pipe. The lower end of the boom is pivoted to an iron ring, which is free to revolve around the base of the mast. The derrick can be operated either by a hand-wheel or by a motor-driven windlass, as desired. Almost any old flat car can be utilized for the body.

ANONYMOUS.



DERRICK CAR FOR HANDLING SPECIAL WORK

D.—THE EXPRESS AND FREIGHT QUESTION.

D 1.—What general advice and suggestions would you give to the manager of an interurban road who is thinking of starting an express and freight business—particularly on the subject of rates and classification?

To the management of an electric railway who contemplates the inauguration of an express service I would say, investigate the matter very thoroughly before starting. A great deal of expense can be incurred and the management discouraged in the express and freight business by getting the wrong start. It is not always advisable to follow the rules adopted by other companies, as it has been proven beyond a doubt that rates and arrangements successfully adopted by one company cannot be successfully used by another. It depends entirely upon the competition, and the kind and volume of business to be handled in arriving at a decision on this point. The handling of freight and express by an electric railway is different than by steam railroads and old-line express companies, whose territory and possibilities are not so limited. With the electric railway the territory and traffic are usually limited to the local business only, on account of being cut off from the general interchange and long haul traffic. I would not advise the adoption of the steam railway freight rate and official classification unless investigation shows this to be the only arrangement that can be made. An electric railway cannot handle freight and express as cheaply as the steam road, and the adoption of such rates are usually unsuccessful from a revenue standpoint. The service given by an electric railway is much better than the steam railway freight, and usually is equal to the regular express service, but the regular express rates cannot be adopted from the fact that the volume of business handled between local points on which a regular express rate can be charged is usually so small that it would not pay an electric line to handle this business only. It is, therefore, necessary to study the situation and adopt such rates as will enable the shippers to make use of the service, and will at the same time create a business of its own. A. EASTMAN.

Be sure that there is express and freight to handle in quantities that will warrant your undertaking the business on the basis of making both ends meet, and remember that such a business calls for intelligent organization and facilities necessary to conduct the business.

GEO. W. PARKER, G. E. & P. A., Detroit United Ry.

First study the conditions at terminals and intermediate points. Find out the amount of freight business being done between your terminals by steam railroads. If it is necessary to meet steam rates to get the business, meet them. It costs almost as much to operate a 30,000-lb. capacity car carrying 10,000 lbs. as it does to carry 30,000 lbs. Some classes of freight should not be accepted. Use the "official classification," same as steam railroads. If steam rates are not used, make your own freight tariffs, in connection with the official classification. Maintain a regular train schedule.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

My general advice to a manager of an interurban line who is thinking of starting an express and freight business would be, first, to ascertain the volume and class of business which his road might be called upon to handle, and then establish his rates and classification to meet the requirements of the situation. The conditions in different localities vary, and I think this is a matter which is purely a question of good judgment.

E. J. RYON, Supt. Schenectady Ry. Co.

The manager must first become familiar with the territory to be served by his road, both in the matter of competition and the different classes of freight and express he would be likely to handle. The next step would be the installation of an express and freight classification. Rates should be too high rather than too low, as a rate can be lowered or a special rate adopted much more easily than a rate, once introduced, can be raised.

GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Provide terminal facilities for loading directly into cars. Adopt steam railroad "official classification" for all shipments and meet steam railroad rates where conditions are equal. Adopt express rates covering shipments under 50 lbs.

H. J. CLARK, Interurban Elec. Exp. Co., Auburn & Syracuse.

In my opinion no electric railway company can carry on an exclusively express business with profit to itself. In other words, it must carry a certain amount of freight to help out. The point is just this: Granted, that there is a given amount of express business that can be secured at the terminal station; now, if enough express cars are run out of that station to give a service sufficiently quick and frequent to attract the bulk of the possible business, some of the cars are bound to run a great many trips only partially loaded, and those trips will be made at a loss. The company must have enough freight business, in addition, to send the cars out full, or nearly so. (In further answer to this question, see the writer's answer under D-5.)

J. W. GIBNEY, Supt. Ex. Dept.,
United Tract. Co., Albany.

In establishing rates and classification, use as guide the tariffs of the steam roads and express companies as applied in the particular locality, and follow their methods.

SOUTHERN SUPERINTENDENT.

Would recommend using the "official classification," and making equal rates to points competitive with steam lines.

C. C. COLLINS, Gen. Supt. Exp.
The Appleyard Lines in Ohio.

D 2.—To what extent does an express or freight business assist the development of the passenger business?

When the territory reached has to depend entirely on the electric railway to transport merchandise and supplies, the express service will tend to develop the country, and this will be followed by an increase in the passenger business. Increased facilities for receiving and shipping goods always have a tendency to stimulate other branches of business. A. EASTMAN.

Problematical. Probably does not affect the passenger business at all.

GEO. W. PARKER, G. E. & P. A., Detroit United Ry.

Difficult to determine to what extent. If a merchant living at one terminal buys goods at another, and his goods are shipped by trolley, he probably will travel by trolley, if passenger train service is quick and reliable, though he may be a steam road traveler. Usually freight car service on trolley roads is better than freight car service on steam roads.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

I do not believe that express or freight business have very much to do with the development of passenger business.

E. J. RYON, Supt. Schenectady Ry. Co.

Only in the carrying of trunks and baggage.

H. J. CLARK, Interurban Elec. Exp. Co., Auburn & Syracuse.

The carrying of express matter assists the development of the passenger business to the extent that people will go more frequently to the shopping centers to buy goods if they know their purchases will be delivered to them promptly and cheaply by electric express. The express department is also an important factor in building up and developing communities, as it contributes one more convenience to the residents, and constitutes an additional inducement for people to settle in the district served by the company's lines. More population means more passenger business.

J. W. GIBNEY, Supt. Ex. Dept.,
United Tract. Co., Albany.

It encourages people to locate on the line, as it furnishes means for them to secure their supplies without inconvenience, and facilitates reaching markets with farm products without delay and at small cost. SOUTHERN SUPERINTENDENT.

D 3.—As far as the electric railway business is concerned, what is the difference between "express" and "freight" matter?—in other words, define each term. How do you classify various material?

Express matter can be defined as such shipments as are given express service, rapid transit, careful handling and wagon service at points of shipment and destination. Freight can be defined, as such shipments as are transported from point of shipment to destination with wagon service eliminated. With the exception of carload business, it is difficult to give a freight service on an electric line, as the service is usually an express service, but sometimes handled at freight rates. A. EASTMAN.

In theory, express matter is that character of goods ordinarily transported by old line express companies. Freight matter is that character of goods ordinarily transported by railroads at their convenience. The classifications of the old line companies apply. In practice, express matter is any old thing that the shipper wants to forward, and the rates applying are generally in competition with the rates in effect on the competing railroad.

GEO. W. PARKER, G. E. & P. A., Detroit United Ry.

Ordinarily, express and freight matter on interurban roads are the same kind of goods, the difference generally being that express matter is called for and delivered, and freight is not; express rates should be higher than freight rates.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

The distinction between freight and express matter ordinarily is determined by whether or not the goods are handled on passenger or freight cars. Inasmuch as both freight and express are handled in the same cars on the lines of the Schenectady Railway Company, the distinction which we make is merely a matter of wagon service. All business which is handled by our wagons at both terminals is considered as express matter, and goods which are brought to us and called for at destination are classified as freight.

E. J. RYON, Supt. Schenectady Ry. Co.

"Express" matter is given the preference in the matter of time, and is called for and delivered at the end of the route by the wagons of the express company. "Freight" matter is delivered to the warehouse by the shipper and called for at destination by the consignee.

GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Consignments are all billed according to weight and for convenience only; we classify 1 lb. to 10 lbs., 11 lbs. to 50 lbs., and 51 lbs. to 100 lbs. as express, the rates for 51 lbs. to 100 lbs. being the minimum one for freight. All shipments are classified according to the "official classification."

H. J. CLARK, Interurban Elec. Exp. Co., Auburn & Syracuse.

In our express and freight business we have three classifications: Class A, which is a distinctly express service, including collection and delivery at both ends; class B, including cartage at only one end; and class C, which is purely freight, and does not include cartage at either end. The bulk of our business comes under class A. Class B represents a small portion of the total business, less than 10 per cent, and consists largely of beer, which is delivered to us at our terminal in Albany, and which we distribute throughout Troy, Watervliet, Cohoes and Waterford. Class C is a small, although very important part of the business, on which we make a low rate, but for which we act merely as carriers between our terminal depots.

J. W. GIBNEY, Supt. Ex. Dept.,
United Tract. Co., Albany.

Think express and freight matter should be handled and treated in the same way by electric, as by steam lines, as far as possible. Express should be handled on passenger trains, and quick delivery made, and rates should be made on profitable basis for this service. Freight matter should be handled on slow trains, or at night when it interferes least with other traffic; it should be accepted subject to delays, and rates should be made on lower basis than express. We follow the practice of steam lines and express companies in the matter of classification.

SOUTHERN SUPERINTENDENT.

With us the term "express matter" covers shipments handled by our delivery wagons at one or both ends. The term "freight" represents shipments received and delivered at our freight houses.

C. C. COLLINS, Gen. Supt. Exp.
The Appleyard Lines in Ohio.

D 4.—Do you recommend the adoption of regular official classification class rates, or special rates to meet circumstances?

I would not recommend the adoption of the regular official classification class rates. I think special rates to meet circumstances are preferable.

A. EASTMAN.

I recommend the present official classification with rates established so as to bring second-class matter into first-class, third-class matter into second-class, fourth-class matter into third-class, fifth and sixth-class matter into fourth-class, and such special rates as will meet the situation with a minimum rate sufficient to warrant the handling of the goods. I recommend that rates be established so as to prohibit the forwarding on electric cars of certain classes of goods.

GEO. W. PARKER, G. E. & P. A., Detroit United Ry.

Use official classification. At times it is advisable to make some special rates for special commodity. This is only practical locally. Should not be done if you interchange with foreign roads, unless an agreement is made.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

I do not recommend the adoption of regular official classification rates for electric service, but prefer to make a flat rate, which is easy for the patrons to understand, and much more popular than classification. Special rates can then be issued covering low-class business where it is necessary to compete with steam roads.

E. J. RYON, Supt. Schenectady Ry. Co.

Both regular official classification class rates and special rates to meet circumstances should be adopted.

GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

"Official classification" has nothing to do with the rate. Make your rates for each class, according to local conditions.

H. J. CLARK, Interurban Elec. Exp. Co., Auburn & Syracuse.

A company doing such a miscellaneous business as ours, where the bulk of the goods handled comes under the term "express," cannot adopt class rates, and must have a special classification. For instance, a grocer in Albany will send in a diversified shipment consisting of pickles, matches, soap, barrels of sugar, etc. These goods must be accepted at a uniform rate, because it would cost too much to separate them into classes.

J. W. GIBNEY, Supt. Ex. Dept.,
United Tract. Co., Albany.

See the writer's answer to D 1.

SOUTHERN SUPERINTENDENT.

As a large part of interurban freight business is secured in competition with steam lines, would recommend the adoption of class rates as provided in the "official classification." While flat rates may save work in educating agents, they are not revenue gainers.

C. C. COLLINS, Gen. Supt. Exp.
The Appleyard Lines in Ohio.

D 5.—Is it advisable for an electric railway to compete with a steam railroad in carrying freight at or below the rate made by the steam road?

No.

A. EASTMAN.

No.

GEO. W. PARKER, G. E. & P. A., Detroit United Ry.

Make same rate, if necessary. If merchants are satisfied to receive their goods by steam road, say two days after they order, they will not pay a higher rate to a trolley road for a quicker delivery.

J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

It is quite necessary for electric railroads to compete with steam roads where there is competition, but we do not advise offering rates below those of the steam road. My opinion is that the proper flat rate to be adopted by the electric road is the first-class rate of the steam road. Business taken lower than first-class rate by the steam road may be handled either by a special rate or by fixing a flat rate covering such business, which can be arrived at by taking the average of, say, the first four classes of the steam road rates.

E. J. RYON, Supt. Schenectady Ry. Co.

Electric roads should adopt a freight rate to compete with steam roads, but not a lower rate, as the electric road has the advantage in being able to transport the freight much more quickly than the steam road.

GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Make your rates no lower than the steam railroads.
H. J. Clark, Interurban Elec. Exp. Co., Auburn & Syracuse.

Yes, a small road is forced to compete for freight in order to fill out. For instance, we run seven express cars into Troy, and if we did not have considerable freight matter the cars on some trips would run nearly empty. We aim to fill our cars on each trip, and, as a matter of fact, such freight business as we obtain is largely clear gain, because the cars otherwise would run partly empty, and the express department is charged with the cost of power on the express car mileage, whether the cars are full or not.
J. W. Gibney, Supt. Ex. Dept., United Tract. Co., Albany.

It is necessary to meet rates made by steam lines in order to secure business; but I do not think it advisable or profitable to cut under established rates. Southern Superintendent.

While the steam lines in many cases have better facilities, we find that our time enables us to compete at equal rates.
C. C. Collins, Gen. Supt. Exp. The Appleyard Lines in Ohio.

D 6.—Is it advisable to compete with a regular express company in carrying express matter at or below the rate made by such express company?

Yes.
A. Eastman.

Modified rates, so as to equalize the call and delivery charges, capitalizing the greater convenience offered by the electric companies.
Geo. W. Parker, G. E. & P. A., Detroit United Ry.

Necessary to make at least same rate and usually lower. Express service on steam roads is as quick and often quicker than on trolley roads.
J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

I think it is very advisable to compete with regular express companies in the carrying of express matter, but do not believe in cutting the rate below that of the regular express companies provided the same service is given, unless there is very good reason for making a reduction.
E. J. Ryon, Supt. Schenectady Ry. Co.

Where the old line express companies have a frequent service and are well established it is necessary to establish a rate lower than the rate charged by these companies.
George Dunford, Gen. Ex. Agt., Utica & Mohawk Valley Ry. Co.

Make no lower rate than the express companies, providing you give the same service.
H. J. Clark, Interurban Elec. Exp. Co., Auburn & Syracuse.

We make a slightly lower rate in order to get the business.
J. W. Gibney, Supt. Ex. Dept., United Tract. Co., Albany.

The old express companies' rates are generally very high to local points. I believe electric companies can handle at less cost, and it pays to make rates low enough to increase tonnage.
Southern Superintendent.

D 7.—Do the steam railroads and regular express companies interchange traffic with you? If not, why not? What can be done to bring about interchange relations between electric railway companies and steam railroads and old line express companies?

It is not profitable to the electric companies to do so. They are not equipped to handle the current business of the steam railroad, and there is no reason why they should divide their rates with the express companies.
Geo. W. Parker, G. E. & P. A., Detroit United Ry.

No. No occasion for interchange with steam roads on our lines.
J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

This company interchanges business with steam railroads to a very small extent, and with the regular express companies only when the charges are prepaid by our company. It is the practice of the large express companies to refuse to interchange business on any pro rata basis with competing lines, and also to do everything within their power to prevent competing companies from securing business in competition with the old line companies.
E. J. Ryon, Supt. Schenectady Ry. Co.

We have no trouble with the railroad company in exchanging freight, but the old line express companies will not advance any charges to us.
George Dunford, Gen. Ex. Agt., Utica & Mohawk Valley Ry. Co.

We have no exchange of traffic with foreign companies, having no track connections with the steam railroads, and our territory is covered also by the old line express companies.
H. J. Clark, Interurban Elec. Exp. Co., Auburn & Syracuse.

ADDITIONAL QUESTIONS

The following questions have been received from correspondents during the past month. Replies to these from any reader of the paper who can supply the information requested will be heartily appreciated. Address answers to Question Box Department, Street Railway Journal:

A 5a.—Who are entitled to free tickets from street railway companies?

A 35a.—Can a fifteen-minute service be successfully given upon a single-track interurban road? What conditions are necessary to make this possible?

A 36a.—Based upon experience, what is a proper rate per mile for interurban passenger business, and to what extent should these rates be reduced by the sale of commutation tickets, monthly tickets, coupon books, etc.?

A 48.—Information is requested regarding the sprinkling of streets by street railway companies, and particularly the proportion of street usually sprinkled, and the amount paid by the cities and municipalities for this service. Does your company sprinkle streets? If so, on what terms?

A 49.—Information is requested relative to best ways of despatching cars on interurban roads.

(a) What is the proper method of numbering trains?

(b) Should odd and even numbers be used for opposing trains?

(c) How are train numbers changed at the end of the run?

A 50.—Please describe a simple board for despatcher's use, showing location of all trains at all times.

B 26.—Should each company keep records of employees and answer all questions about a man who has left its employment?

B 27.—What do you consider the best system for keeping records of conductors and motormen?

B 28.—Do most large companies keep the employees' records on the card system or in a book?

B 29.—Do you think all misses, quarrels and accidents should count in the employees' record?

E 82a.—What is the best remedy for preventing sleet and ice from forming on car windows, particularly on the vestibule windows?

I 28.—What is a good method of testing rail-bonds?

I 29.—What is the best method of keeping records of individual rail-bond tests?

I 30.—What has been the experience with soldered bonds?

I 31.—In using bond tester on special work in which each joint is bonded in addition to long bonding, what is the method of procedure in case the tie-rods span two or more joints?

I 32.—What is the best form of portable rheostat to use in connection with bond-testing instrument.

I 33.—Has the conductivity of the zinc joint held up?

I 34.—What is the best method of preventing switches from "kicking"?

I 35.—How many renewals of hard centers can be made on modern special work before the abutting rails are worn out?

REPORT ON ILLINOIS STREET RAILWAYS

The annual report of the Railroad and Warehouse Commission of Illinois for the year ending June 30, 1904, shows that the total length of main line and branches of the electric railways in the State for the year mentioned was 586.42 miles, which is an increase for the year of 221.1 miles. The total mileage of second, third and additional main track was 160.28, making an increase of 12.86 miles over the previous year. The total mileage of all kinds of tracks is 794.06 miles, which is an increase of 240.72 miles.

The capital stock and funded debt for the year ending June 30, 1904, was $135,013,961, which is an increase of $12,528,101 over that reported in 1903. The total capitalization of surface and elevated electric railways is $222,615 per mile of road, and is divided as follows: For surface roads, $82,964 per mile, and for elevated roads, $1,981,148 per mile.

The total income from the operation of the surface and elevated electric railways was $9,722,176, which is an increase over the previous year of $1,766,952. The income account was as follows:

	1903	1904
Gross earnings from operation..........	$7,955,224	$9,722,176
Operating expenses	4,217,120	5,162,293
Income from operation	3,738,104	4,559,883
Income from property and other sources	12,420	9,201
Total income	3,750,524	4,569,084
Expenses assignable to fixed charges.....	2,971,787	3,291,875
Net income	778,737	1,277,209

The total dividends paid were $497,952, which is a decrease from the previous year of $214,419.

The total assets and liabilities were: Assets, $145,270,381, an increase of $17,050,874 for the year, and liabilities, $143,415,293, an increase over the previous year of $15,714,406, showing a net surplus of $1,855,088 and a net increase of $1,336,468 from the previous year.

The total amount of income from passenger service was $8,379,481, which was an increase of $1,324,296 over the previous year. The total amount received from freight service was $334,816, which was an increase of $232,350 over the previous year. The total earnings and income for this class of roads from all sources for the year ending June 30, 1904, was $9,663,573, which was an increase for the year of $1,735,725.

The total expenditures for maintenance of way and structures was $429,187; maintenance of equipment, $569,128; operation of power plant, $1,132,922; conducting transportation, $1,728,792, and general and unclassified expenses, $1,255,954, which with fixed charges of $3,276,826 amount to a total of $8,393,810, which is an increase over the previous year of $1,243,125.

The number of revenue passengers carried was 151,308,786, which was an increase over the previous year of 16,145,416. The transfer passengers carried were 3,846,586. The number of tons of freight hauled was 660,530 tons, which was an increase over the previous year of 310,611 tons.

The number of officers and employees on the surface and elevated electric railways was 4126, an increase of 646 over the previous year. There was paid in salaries to these employees the sum of $2,787,594.69, which was an increase over the previous year of $464,023.57. The compensation ranged from a general average of $7.69 per day for general officers to an average of $1.57 a day for station agents. The total average for all classes of employees increased from $2.07 per day in 1903 to $2.85 in 1904.

Under description of equipment, the commission states that there are 10 locomotives in service, 824 motor cars and 1449 all other cars, making a total of 2283, and a total increase of 431. Of these, there are 207 fitted with fenders, 204 fitted with vestibules and 1721 fitted with train brakes. This is an increase of 14 fitted with fenders and 178 fitted with train brakes.

During the year, 2808 tons of steel rails were laid and 88,662 new ties laid. There are 18.5 miles of road equipped with block signals. The number of highways crossed at grade was 683, an increase for the year of 351. The number of under highway crossings was 394, an increase of 20 for the year. The number of overhead highway crossings was 8, an increase for the year of 4.

The number of electric railways crossed at grade was 30, an increase for the year of 1, and the number of steam railroads crossed at grade was 98, an increase for the year of 5. The number of under railway crossings was 17, an increase for the year of 3.

There are 78.24 miles of stone ballast, 198.49 miles of gravel ballast, 86.16 miles of cinder ballast, 135.70 miles of earth, 45.79 miles of pavement and 41.79 miles of superstructure. There are 7 bridges of masonry, 56 of steel, 5 of wood and 4 of combination structure, with an aggregate length in feet of 6551.

The total number of passengers killed by the surface and elevated electric railways for the year ending June 30, 1904, was 8; number of employees, 2; number of others, 27, making a total of 37, being an increase for the year of 9. The total number of passengers injured was 279; employees, 139; other persons, 72, making a total number injured of 490, being an increase for the year of 49.

The amount of taxes paid by these corporations for the year ending June 30, 1904, was $586,853.82, making an increase of $145,044.03.

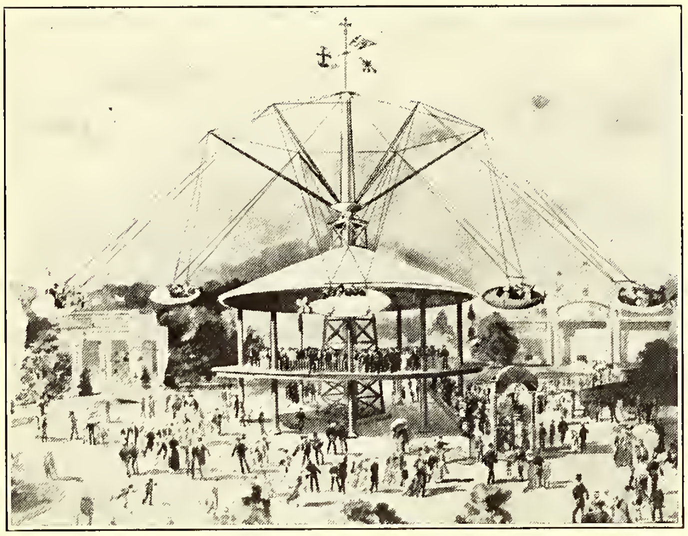
IMPROVEMENTS IN OHIO INTERURBAN ELECTRIC RAILWAY SERVICE

The Dayton & Troy Electric Railway and the Western Ohio Railway, whose combination limited service has been referred to in these columns, have announced some improvements to the service. The magnificent chair car "Harriet," heretofore used in the "Clover Leaf Special" run from Dayton to Delphos, giving connection for Toledo, will be used in regular limited service, leaving Dayton at 5:25 a. m., 11:18 a. m. and 5:18 p. m., running through to Delphos on the last run. Excess fare will be charged on these runs. The plan gives an early morning limited and does away with an extra run in the evening. Another chair car will be installed in the near future, when excess fare will be charged on all limited runs. It is also the intention to put on a morning run to Delphos, giving another connection for Toledo.

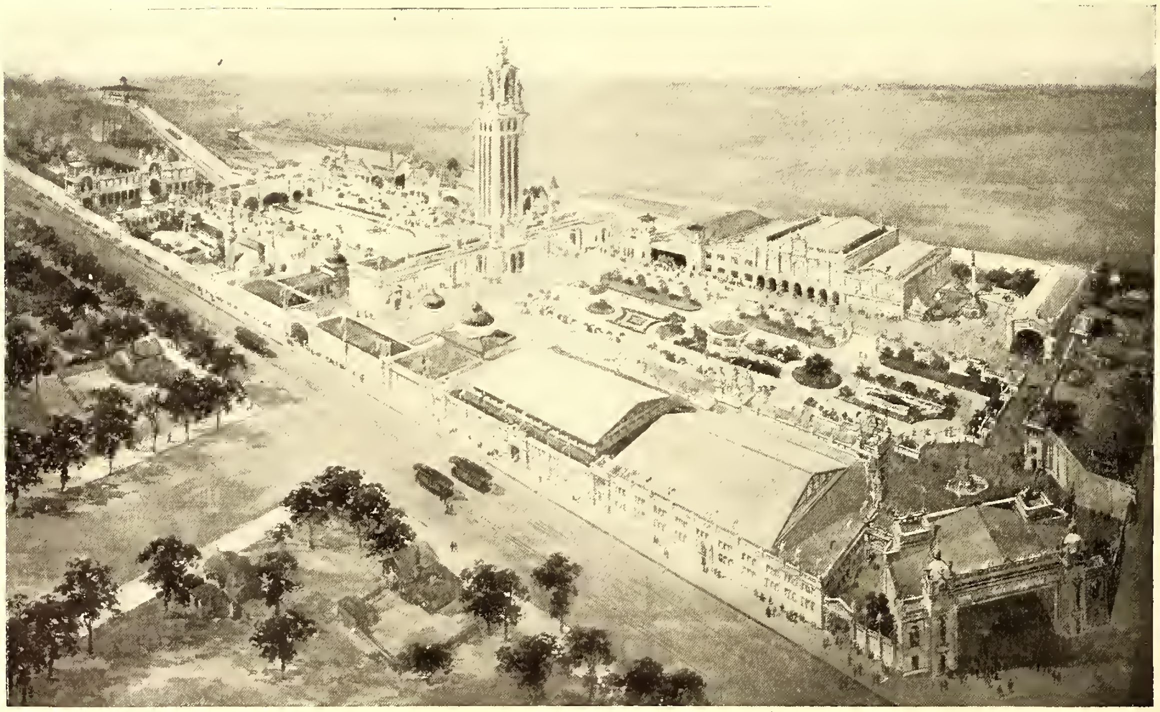
Robert H. Derrah, general passenger agent of the Massachusetts Electric Companies, delivered a lecture before the Salem Board of Trade recently on "Transportation Systems, Old and New." He discussed more particularly the relations between the public and the companies, and pointed out the tendency now in electric railway work to follow in the paths blazed by the publicity and advertising departments of the steam railroads. Mr. Derrah entered the street railway field in Boston some sixteen years ago, and while he discussed the subject generally, still he recited a number of happenings during the pioneer days of electric railroading in New England that were especially interesting. His account of some of his experiences on the trip that he made from Boston to Detroit and other Western cities proved a revelation to his hearers. More than 200 views were thrown upon the screen by the stereopticon during the lecture. As a finale were shown portraits of Henry M. Whitney, General Bancroft, president of the Boston Elevated Railway, and P. F. Sullivan, general manager of the Massachusetts Electric Companies, all of whom have been largely responsible for the development of street railways in Massachusetts.

AMUSEMENTS FOR PARK RESORTS

The growth of pleasure traffic through the stimulating medium of cheap electric railway transportation has caused the introduction side by side with this development of a wide variety of amusement devices for various types of parks. It has been the custom of the Street Railway Journal for a number of years past to publish in one issue descriptions of some of the latest of these forms of amusement, as well as some of those which have proved most popular in past years.



SIR HIRAM MAXIM CAPTIVE FLYING MACHINE



THE WHITE CITY, CHICAGO

Since the opening of another park season is so close at hand, the accompanying descriptions will prove of benefit for railway companies looking for paying attractions.

THE CONSTRUCTION OF PLEASURE GROUNDS

Among the leaders in the design and execution of those pleasure resorts, the attractiveness of which is due more to the mechanical ingenuity of man rather than the work of nature, may be mentioned Edward C. Boyce, of New York. The ideas of Mr. Boyce in this field have borne fruit in the construction of such magnificent resorts as "Dreamland," at Coney Island, N. Y.; "The White City," at New Haven, Conn., and more recently another "White City," a 13-acre pleasure ground, to be opened to the people of Chicago on June 1. One of the principal features of this vast entertainment ground will be the electric tower 300 ft. high, which appears in the accompanying view. Of course, pleasure grounds designed to cater to millions of visitors offer many forms of entertainment too expensive for small cities, but this very consideration proves the wisdom of having work of this kind carried out by a specialist.

SIR HIRAM MAXIM CAPTIVE FLYING MACHINE

The American public, ever seeking for novelties, should find the captive flying machine recently invented by Sir Hiram Maxin a very interesting device. The first of these machines was erected at Earl's Court, London, in May, 1904. It attracted wide attention, not only by reason of its inventor's fame, but also because of its novel character as an amusement enterprise. So pronounced was its success that another was soon installed at the Crystal Palace, London. Quick to discern the possibilities of this remarkable contrivance, Thomas J. Ryan, the well-known amusement purveyor of Philadelphia, acquired the American rights and arranged to have the first installation in the United States in "Dreamland," Coney Island. Contracts, however, will be taken for other resorts throughout the country. The machine consists of a central structure 100 ft. high, with ten extending arms, from each of which an "airship" is suspended by cables. When the huge arms begin to revolve, the ships move off in widening circles, reaching very high speeds, and the momentum acquired carries the ships high into the air at the ends of the steel cables. Naturally the utmost care has been taken to design these machines with a high safety factor to prevent all possibility of accident to those who will patronize them.

THE CIRCLE SWING

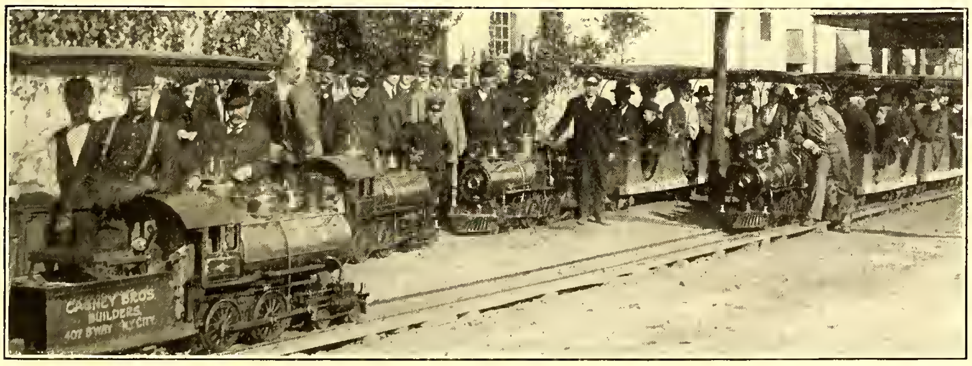
Among the new devices which have sprung rapidly into public popularity is the Travers circle swing, of which a description was published in the Street Railway Journal of Oct. 1, 1904. It is made by the Travers Circle Swing Company, of New York. This swing has proved very popular on account of its revolving, expanding and contracting motion. It consists, briefly, of a central steel shaft, to the hub of which are attached projecting arms. From these arms, cables are suspended for carrying small cars. The whole structure is revolved by an electric motor within the tower, the acceleration being so rapid that in less than a minute the passengers enjoy the exhilarating sensation of sailing through the air at 30 m.p.h. without jar or shock of any kind. At night, illuminated by hundreds of incandescent lamps, the circle swing is even more interesting, especially when revolving, as it then

THE CIRCLE SWING AND CAPT. BALDWIN'S AIRSHIP AT LOS ANGELES

looks like a huge shimmering umbrella. The view presented shows the circle swing installed at "Chutes Park," Los Angeles, and is remarkable also for its representation of a successful flight of Captain Baldwin's airship.

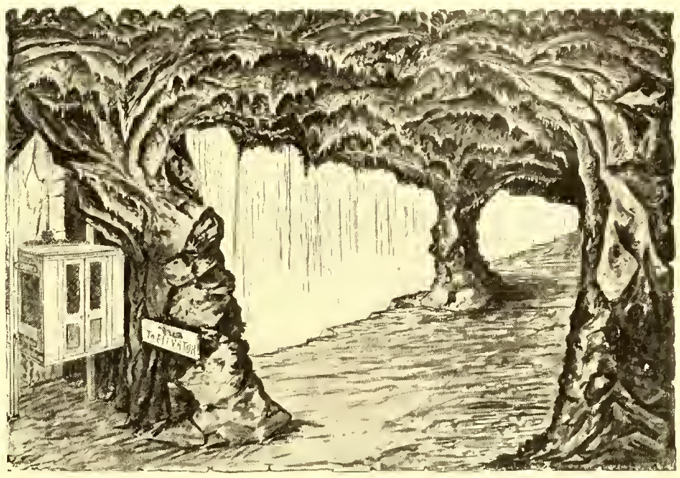
A TRIP UNDER NIAGARA FALLS

What promises to be one of the most remarkable attractions during the coming season has been perfected recently by Joseph Turner, of New York, who has made arrangements to produce at Steeplechase Park, Coney Island, a spectacle unequaled for realistic effects. It will be a representation of a trip under Niagara Falls, combining therewith a series of dissolving views which will accompany the guide's version of the Maid of the Mist legend. The front of the building in which this production is to be housed will appear as a great golden frame, show-



ASSEMBLY OF MINIATURE LOCOMOTIVES AND CARS IN ACTIVE SERVICE

ing the Falls as seen from the cliffs of the Victoria Park Hotel on the Canadian side. Elevators will be installed, which will descend to the base of the cliffs, while the realism of the scene will be enhanced by the shouts of the "ballyhoos," inviting the onlookers to purchase tickets and step into one of the elevators. As the door of the elevator is closed, the occupants will enjoy the sensation of descending a great depth, the air will gradually become moist and chilly, and on stepping out at the bottom the visitors will find themselves in a cavern hewed out apparently from the solid rock. Following the guide through tortuous slippery passages, they will reach the back of the Falls at the base of a seething whirlpool, amid the dripping waters and deafening thunders of the giant cataract. Here the guide will relate the famous legend of the Maid of the Mist, whose spirit is said to haunt the environs of the Falls. As the guide continues his relation, the cavern becomes darker and darker, ominous flashes of lightning play to and fro, accompanied by roars of thunder, and, to crown all, the beholders are



VIEW OF GROTTO IN "A TRIP UNDER NIAGARA FALLS"

startled to see the form of a beautiful Indian maiden slowly rising through the falling water and apparently murmuring some chant of her people. This vision is but the first of a series of dissolving views intended to illustrate the chief incidents of the legend, and culminating in a grand panorama symbolizing the entrance of the Maid to the happy hunting grounds. Following this remarkable exhibition, the Falls resume their former appearance and the visitors retrace their steps, regretting their departure from this grotto of wonders to the prosaic upper world.

MINIATURE RAILWAYS

A diversion which appears to be as pleasing to old folks as to young ones is riding on miniature railways. The Miniature Railroad Company (Cagney Brothers), of New York, holds a prominent place in the development of this class of apparatus. The manufactures of this company are not mere toys, but well constructed locomotives and cars, capable of being operated on any length of straight or curved track, the locomotives having a drawing capacity varying from 10,000 lbs. to 20,000 lbs., and attaining a speed of about 10 m.p.h. When the railway operates in a conspicuous locality, the money received simply for advertising privileges upon the sides of the cars and locomotives will often pay for the entire outlay. The miniature railway is especially well patronized when it is used in a large resort as a connecting link between the various attractior when it runs through tunnels, over bridges, etc. This co had a large number of its trains in regular passenge portation service at the St. Louis Exposition, and wa a grand prize and gold medal by the jury of awards the St. Louis convention of the American Street Rail ciation, the Miniature Railroad Company extended the courtesy of its service to the delegates and their families. The electric railway men did not fail to take advantage of this opportunity to study the miniature railway at first hand, and afterward showed their appreciation by passing a resolution of thanks to Cagney Brothers.

Another miniature railway which has made great progress in pleasure resorts is the type manufactured by the Armitage-Herschell Company, of North Tonawanda, N. Y., of which a most interesting feature is the use of air brakes. The No. 1 train, which draws sixty people, is equipped with them throughout, including both the locomotive and cars; while the No. 2 train, which is lighter, has air brakes only on the locomotive. These brakes are thoroughly practical, being capable of stopping the loaded train at full speed (about 15 m.p.h.) in less than its own length. It is apparent that this arrangement secures great safety, besides lengthening the life of the equipment. The locomotives usually employed for trains Nos. 1 and 2 develop 7.5 hp, but a heavier type, developing 18 hp at 15 m.p.h., is made for train No. 3, which is also completely equipped with air brakes.

ROLLER COASTERS AND LAUGHING GALLERIES

Those who seek pleasures of the thrilling sort have found that the figure 8 roller coaster meets their demands fully without endangering life and limb. This popular amusement is a specialty of the Ingersoll Construction Company, of Pittsburg, Pa., which has built and installed a large number throughout the country. The Ingersoll roller coaster is now so well known that it is scarcely necessary to describe its construction, but the following covers the essential features: The ground required for the structure is 85 ft. wide x 225 ft. long. Ten massive, handsomely decorated cars are carried up a 70-ft. incline by a heavy chain. On either side of the cars, three in number, are safety arms which drop back behind them, preventing all danger by making it impossible for the car to run backward in case the chain breaks. The cars run on a hard maple track, while the structural lumber is long-leaf heart Georgia pine. In connection with the roller coaster there is built also a handsome entrance pavilion. These coasters, as well as other of its amusement devices, are generally erected on the grounds by the Ingersoll Construction Company, the ·al arrangement being to give a stipulated percentage of the receipts to the company controlling the park.

her of this company's money makers is its laughing gal- ·ich consist of glass mirrors arranged to give the most and grotesque distortions. Twenty-six different ·e made, producing nearly 100 effects. Each mirror is 40 ft. x 70 ft. in size, and ten to fifteen are enough to make a good laughing gallery.

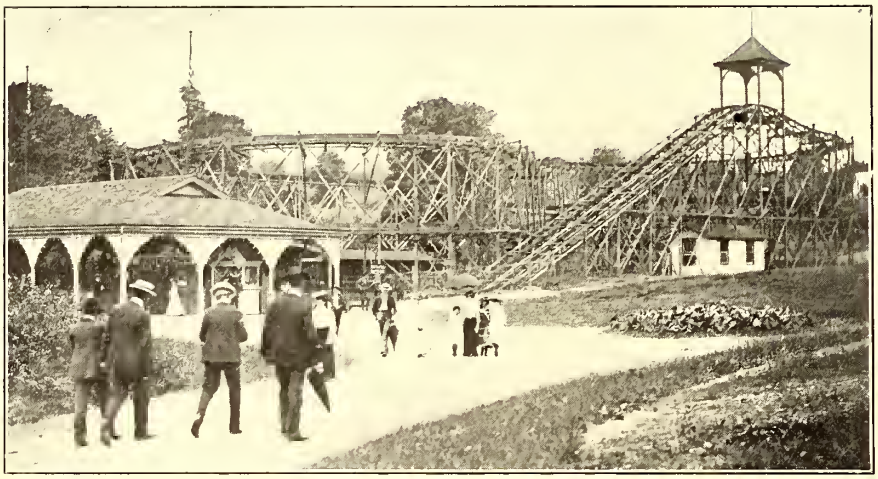
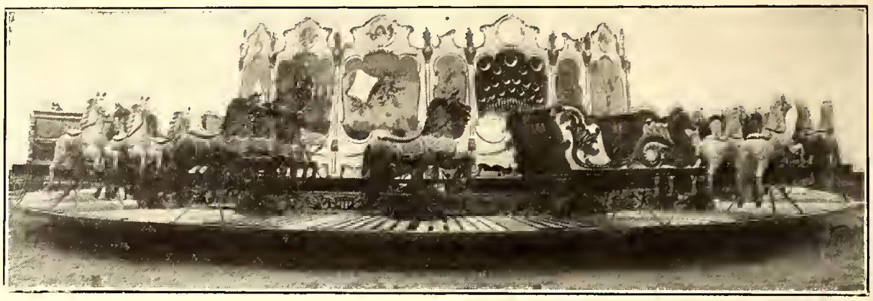


FIGURE 8 ROLLER COASTER AT NEW CASTLE, PA.

RIDING GALLERIES

Despite the large number of new amusement devices, the makers of "merry-go-rounds" find that their apparatus is more popular than ever, particularly where children constitute a large percentage of the park visitors. The galleries are made in a great variety of forms at costs ranging from a few hundreds to thousands of dollars, the more expensive styles having their attractiveness increased by elaborate carvings, fine organs and other accessories.



VIEW OF A MODERN RIDING GALLERY, SHOWING THE FINELY CARVED HORSES AND CARS, ORGAN, ETC.

The illustration above shows a view of a handsome "merry-go-round" made by the Armitage-Herschell Company, of North Tonawanda, N. Y., whose products in this line are too well known to require any extended description. It may be stated, however, that while the company's models for 1905 follow along time-approved lines, some important changes have been made in the mechanical details. Chief among these is the use of ball bearings for the main bearings of the machine, thereby permitting a much easier running.

Among others who have been largely instrumental in developing this branch of the amusement business to its present extent is E. Joy Morris, of Philadelphia. To demonstrate the popularity of this manufacturer's designs of riding galleries, it is only necessary to refer to the prominent parks where they have proved profitable attractions. Among these are: Exposition Park, Pittsburg, Pa.; Chutes Park, Chicago, Ill.; Woodland Beach Park, Ashtabula, Ohio; East Lake Park, Birmingham, Ala., and Willow Grove Park, Philadelphia, Pa.

A TYPICAL FIGURE 8 TOBOGGAN INSTALLATION AT WASHINGTON PARK, N. J.

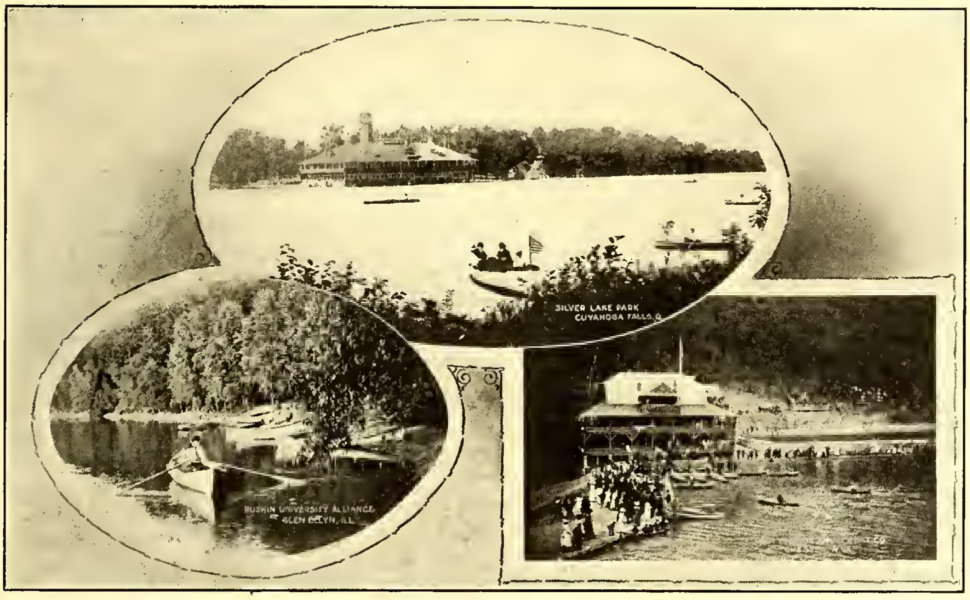
Mr. Morris also builds figure 8 toboggans, of which he has installed quite a number. The lowest illustration on page 482 shows some of his work at Washington Park, N. J.

Herschell-Spillman & Company, of North Tonawanda, N. Y., have found that the improvements brought out on their "merry-go-rounds" and ocean wave galleries last season have proved even more satisfactory than they expected. They confidently believe that their long experience in this field enables them to produce a most attractive and durable outfit. Owing to the large increase in their business it has been found necessary to add a great deal of space to the storage department. The old office has been taken for this purpose and a building having 7000 sq. ft. of storage room erected. A new and larger office has been built, new machinery acquired and extra help employed to handle all orders with facility.

Modern high-class riding galleries are also made by Wm. F. Mangels & Company, of Coney Island, N. Y. In addition, this company builds electric targets, automatic shooting galleries and safety rifle ranges. At the present time it is constructing an immense riding gallery for Feltman Brothers, of Coney Island, which fact is an additional proof that this form of entertainment is still very popular, even in a place which has become world famous for the immense scope of its amusement projects.

THE CORDILLERO SLIDE

The Cordillero slide, which promises to be one of the real novelties of the coming season, is being promoted by Clark Ball, of New York. It consists of two pyramidal towers set 400 ft. apart, one tower being 300 ft. and the other 200 ft. high. Cables will be slung between the towers and from them cars suspended for transporting passengers. These cars will descend by gravity and return by electric power. The interior of the towers may be used for some other amusement purpose, and the cables themselves may be suspended over a lake, river or other interesting area. The details of this new device will be perfected within a few weeks, at which time a more extended description will appear in this journal.



THREE SUMMERING PLACES WHERE STEEL BOATS ARE USED

HOUSE OF TROUBLE AND METAL LAUGHING GALLERY MIRRORS

Among the new things of the coming season will be a "house of trouble," designed by the J. M. Naughton Amusement Construction Company, of Columbus, Ohio. This is an improvement on the wooden maze that has mystified so many at the leading amusement resorts. It will contain in addition to the maze, a haunted chamber. The building is designed with a very attractive front, is suitable for both small and large parks and can be built at little cost in accordance with plans and specifications furnished by the Naughton Company.

This company also designs metal mirrors for laughing galleries, and furnishes them in sizes 3 ft. wide x 6 ft. high. They are made of a composition with a reflecting surface that is said to compare favorably with the finest glass. The curves of the mirror surfaces embody the results of long experience, and the qualities of the metal are such as to permit a wide variety. As the metal can be polished on both sides, one mirror may be made to serve for two.

THE GAME OF BOX BALL

The ingenious modification of bowling, known as "box ball," was placed on the market by the American Box Ball Company, of Indianapolis, less than three years ago, yet over 2000 alleys are in use at the present time in picnic parks, hotels, club rooms and private residences. Although a bowling game, it is quite distinct from ten pins. The alley, which is usually from 24 ft. to 30 ft. long, can be installed at about one-half the cost of a first-class regulation bowling alley. The balls return by gravity of their own account, and the players can set up the pins by the slight jerk of a lever, so that no attendant is required, nor are there any annoying delays. The five pins used are placed side by side, and as one pin is not depended upon to knock down another, the game itself is purely one of skill. The alley bed is covered with a composition of ground cork, which greatly eliminates noise and causes the balls to roll more evenly than on an ordinary wooden surface. They are built completely in the company's shops, shipped in strong crates and can be placed in operation by an ordinary workman within three hours after reaching their destination. The ease with which they can be removed from place to place makes it possible to use them at different seasons of the year wherever they will give the most profit. This game does not require the exertion of ordinary bowling, and may therefore be played by ladies and children with as much benefit as vigorous men derive from the regular game.

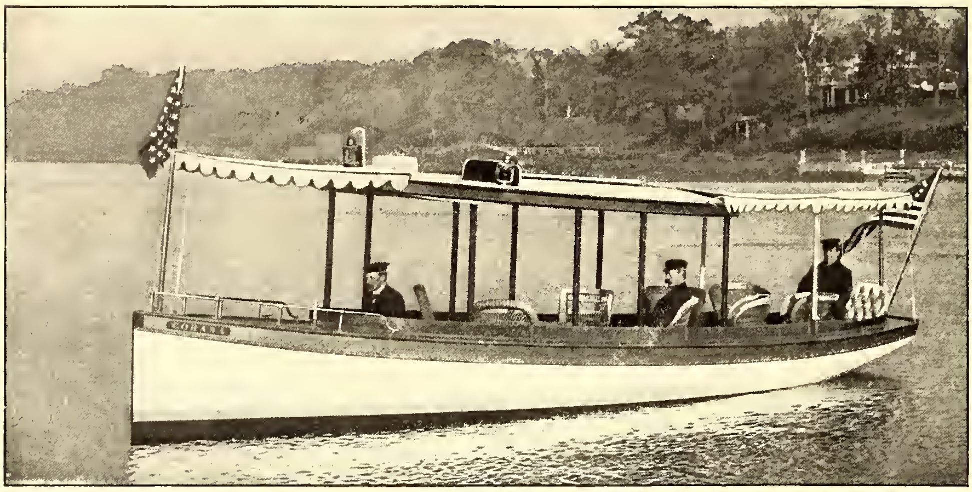
PLAYERS INDULGING IN THE GAME OF BOX BALL

STEEL BOATS AND LAUNCHES

Wherever the operators of a pleasure ground are fortunate enough to have a body of water therein or along its borders, every effort should be exerted to make boating as safe and pleasing as possible. Few pleasures are more agreeable than those incident to gliding over lake or river, but as long as the danger of drowning is present many people will hesitate to accept for themselves and their children the risks and unpleasantness incident to using leaky wooden boats. The recognition of this fact is bringing non-sinkable steel boats into great favor for use in parks, hunting and fishing parties and the like. The pioneer advocate of this type of boat construction, the W. H. Mullins Company, of Salem, Ohio, has furnished thousands of stamped steel boats for both sporting and commercial purposes.

The accompanying group of illustrations shows Mullins boats in use in three noted outing places. Besides rowboats and canoes, the company also builds various styles of steel motor boats, all of which have air-tight compartments.

For park service the electric launches made by the Electric



ELECTRIC LAUNCH WITH METALLIC AIR TANKS BELOW DECK TO PREVENT SINKING

Launch Company, of Bayonne, N. J., have become deservedly popular on account of their safety, speed, cleanliness, noiselessness and simplicity of operation. Sinking is practically impossible, owing to the installation of metallic air tanks below deck, and in the larger boats the placing of the motor and batteries beneath the floor gives considerable extra space. There are no stiff, uncomfortable side seats, but instead easy chairs, which can be moved about to suit one's personal convenience, cosy settees, table, book racks, etc. One of this company's most popular styles is its 30-ft. electric charter launch seating twelve to twenty-two passengers. The length over all is 30 ft.; beam, 6 ft. 4 ins.; freeboard, 24 ins., and draft, 24 ins. The stem is made of hackmatack or oak, the upper stroke and planksheer of oak and quartered oak coaming. The decks are of oak or mahogany laid in narrow strips. The interior is finished in oak or mahogany. The standing roof is of light wood construction, covered with waterproof canvas and fitted with storm curtains. The motive apparatus consists of a special type battery, with motor, speed controller, voltmeters, etc. Its radius of action varies from 35 miles at the medium speed of 6½ m.p.h. to 60 miles with the largest battery equipment used for this size.

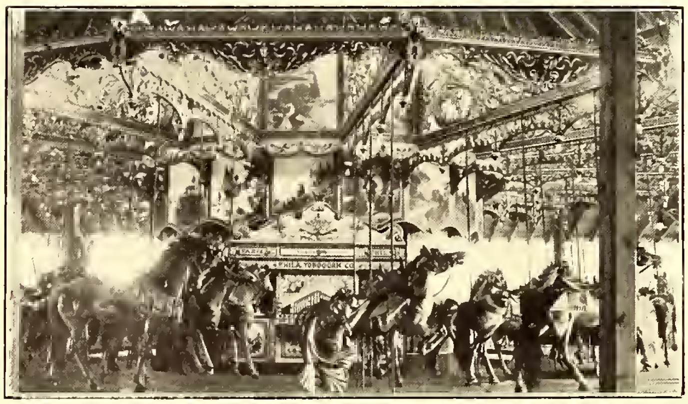
A large line of rowboats, canoes, sailing yachts and motor boats is made by the Racine Boat Manufacturing Company, of Muskegon, Mich., whose long experience in this line has enabled it to perfect some graceful types which are widely used. A specialty of this company is its 15-ft. to 40-ft. motor boats, which are well adapted for park service.

PARK MUSIC

Those who have observed the large crowds that attend the fine band concerts given during the summer months in the public resorts of large cities like New York, Philadelphia and Chicago, where good music can be heard almost any time throughout the year, must admit that a good military band should prove an exceptional attraction in less favored communities. To furnish this kind of entertainment Henry Morin, the conductor of the New York Franco-American military band, has arranged to take this well-known organization on a tour throughout the country, making engagements to play for several days or weeks at popular picnic grounds. During the coming summer Mr. Morin's band will give concerts at the Louisville Jockey Club Park, Cincinnati Zoological Garden, Winona Lake Assembly and similar resorts. The extended exerience that Mr. Morin has had among different classes of people has enabled him to master the difficult art of arranging programmes to please the lovers of both light and serious music. Mr. Morin was formerly a member of the Garde Republicaine Band of Paris, and has associated with him a number of prominent soloists.

FOREST COASTERS, TOBOGGAN SLIDES AND RIDING GALLERY INSTALLATIONS

The work accomplished by the Philadelphia Toboggan Company, of Philadelphia, Pa., may be cited as an example of the broad field of operation of modern amusement outfitters. This

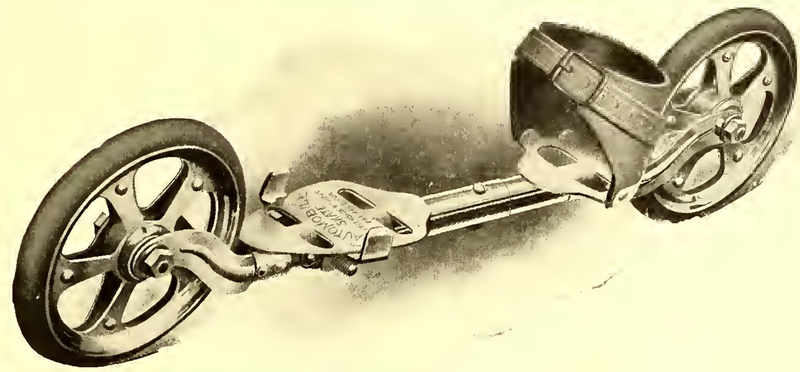


RIDING GALLERY AND TOBOGGAN COASTER INSTALLED AT A PROMINENT PLEASURE RESORT IN MILWAUKEE, WIS.

company has successfully installed modern apparatus of its own design in such widely-separated cities as Denver, Topeka, Milwaukee, New Orleans, Norfolk, Columbus and Philadelphia. One of the accompanying illustrations shows a toboggan coaster installed by this company at Milwaukee, and the other a riding gallery in the same park. The latter is certainly a remarkably fine specimen of what can be accomplished in this line. The horses are artistically carved and arranged in various life-like attitudes, the center above the ornate grand organ is covered with handsome paintings, and at night the illumination of the whole must appear like a scene from Fairyland. The toboggan coaster, which is shown in the other view, is apparently very popular, judging from the number of people in its vicinity.

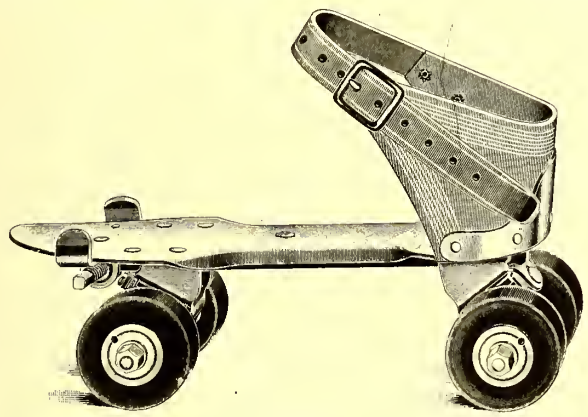
ROLLER SKATING

Judging from the experience of the Northampton Traction Company, of Easton, Pa., with roller skating at Bushkill Park, this excellent combination of pleasure and exercise is renewing its former hold on public favor. Some time ago, W. O. Hay, the secretary and purchasing agent of the company, conceived the idea that the time had arrived for a roller skating revival, and the park dancing pavilion accordingly was adapted for use as a roller skating rink. The success of this experiment was so remarkable that it was soon necessary to enlarge the rink, which now comprises some 1400 sq. ft.—this despite the fact that Bushkill Park is 3 miles out in the country. At present 375 pairs of skates, made by the Samuel Winslow Skate Manufacturing Company, of New York, are in use, but the number will shortly be increased to 600. The traction company charges 10 cents for the use of a pair of skates, either afternoon or evening, and during the winter months no special attraction is offered other than band music. The crowd is noticeably larger when there is no ice skating, and no doubt the spring season will make roller skating more popular than ever. The success of this revival is of particular interest, as it opens up a profitable source of income demanding a comparatively small investment.



AUTOMOBILE CYCLE SKATE, WITH RUBBER TIRES

Since the days of its early popularity, the roller skate has undergone many improvements. This fact is especially exemplified in the automobile cycle skate made by the Cycle Skate & Sporting Goods Company, of New York, which is furnished with either 4-in. or 5-in. solid cushion rubber tires. The constituent parts are formed in dies from sheet steel, and Sh[illegible]eamless tubing is employed. An important feature of the new skate is



A STANDARD SKATE OF THE UNION TYPE

the positive fastening of the telescoping tubes, which are adjustable from 10 ins. to 12 ins., inclusive. The tires are rigidly held in position by substantial inner lugs, which are a part of the tire itself, screws with nut fastenings passing through the lugs and clamping the steel spokes and tires in one solid wheel, which runs on steel ball bearings. The center of gravity lies below the center of the axle so that the skates are not top heavy. All metal parts are polished and nickeled. This type is designed particularly for high-speed work, but the company also builds an extensive line of regular roller skates for rink use.

A model of the line of these goods manufactured by the Union Hardware Company, Torrington, Conn., is reproduced in the above illustration. This company has been making roller skates ever since they were first designed, and was among the larger producers during the last skate craze of twenty years ago. These skates are made of the very best material, and are thoroughly high-grade goods in every detail. They are made in either plain or ball-bearing models, as desired. The ball-bearing skates, however, have been preferred for rink use, because of the ease with which they run. They are also made in styles for men and women, the men's skate being of two patterns, an all clamp model and a half-strap model.

SOUVENIR POST CARD SLOT MACHINES

During the last three years the souvenir post card business has assumed immense proportions, the cards proving especially popular where they picture local places of note. To facilitate the sale of these cards at the least cost, the Rogers Manufacturing Company, of New York, has placed on the market three styles of souvenir postal card slot machines. The machines are made from quartered-sawed oak, highly polished and carved. As many as 3000 cards have been sold in one week through one machine.

This company also builds an extensive line of other slot devices, like scales and punching machines, as well as disc talking machines.

STRENGTH-TESTING AND OTHER COIN-OPERATING MACHINES

To please the instincts of those who like to show their physical prowess and are willing to pay for that privilege, the Caille Brothers Company, Inc., of Detroit, Mich., has developed a large number of lung-testing, combined lung and grip-testing, punching, lifting machines, etc. One of its latest contrivances in this line is the "Mickey Finn" combined tug-of-war and grip machine, which, since its introduction last season, has met with great success. The dial of the last-named device indicates up to 1000 lbs., but at 750 lbs. a devil's head shows at the top. The machine is made entirely of enameled metal, is mounted on a heavy oak platform, weighs boxed, 125 lbs., and is 5 ft. 10 ins. high. The "Ajax" puncher illustrated is the result of many requests for a large machine. It is about 7 ft. high, has a 22-in. dial and registers 2000 lbs. A large electric bell rings at 1000 lbs.

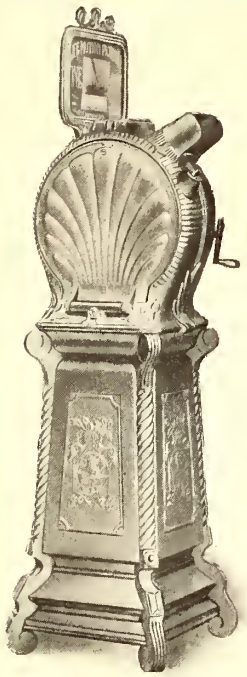
PUNCHING MACHINE

In addition to apparatus of the above-named styles, this company builds quite an array of card, cigar, roulette and other chance machines which are intended to appeal to the sporting fraternity. Another of this company's mechanical novelties is an automatic singing bird machine, which consists of two skilfully mounted canaries perched in a brass cage among small shrubbery. When operated, the birds whistle some popular air, the head and tail of each bird moving in a life-like manner.

One of the latest novelties introduced by this company is a coin operating machine, known as the "Log Cabin." It is loaded with 500 marbles, and when a coin is dropped into the slot one of these marbles is delivered automatically to a throwing device operated by the player. The marbles fall into one drawer and the coins into another, allowing the owner to check up receipts.

THE MUTOSCOPE

The mutoscope, made by the American Mutoscope & Biograph Company, of New York, is one of those novelties which appeal equally to all classes. The mutoscope is a handsome silver gilt cast-iron cabinet, provided with a coin slot and a crank. When a coin is dropped in the slot the beholder views some interesting scene, embracing the use of over 700 moving pictures, greatly magnified and brilliantly illuminated by electric light. When one subject has lost its earning power, another can be substituted in a few minutes. The mutoscope does not use films, the pictures being bromide photographs mounted on reels. The mechanism of this device is extremely simple. The parts are few and are all interchangeable, so that repairs can be made readily.



THE MUTOSCOPE

The weight of the boxed machine is 325 lbs.; the height to the eye piece is 4 ft. 6 ins., and the floor space needed is 2 ft. square.

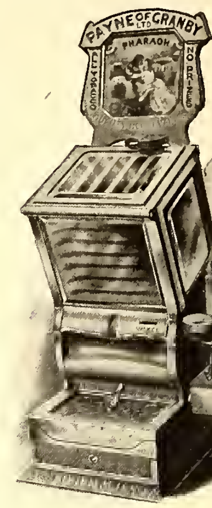
"PUSS IN BOOTS" SLOT MACHINE

Roovers Brothers, of Brooklyn, N. Y., whose aluminum name plate machine has proved a most profitable slot device, have placed on the market an amusing and ingenious vending or fortune-telling apparatus known as "Puss in Boots." This machine is mounted on handsomely carved legs, which, however, are not shown in the accompanying illustration. By placing a coin in the slide recess, drawing down the handle on the right-hand side of the machine and then letting it return, the cat is caused to greet the customer with a bow, then to move its left paw, which holds a pan, to the chute containing the article to be delivered, the head moving in unison with the pan so as to see that the latter is in the correct position to receive the article from the chute delivery opening; next the cat moves its head toward the right paw, which holds a nickel-plated rod, with which it carefully opens the lid of a basket in front, the paw holding the pan containing the article having taken a position over the lid. On lowering the pan, the article drops on the lid, then the pan is raised again to allow the lid of the basket to be closed a second time. The cat follows these movements with its head, and ends with a bow of thanks. The article falls through the basket into a receptacle in front of the machine. The figure is dressed in satin, and the seat and floor are covered with velvet. The net weight of the complete machine is 136 lbs., and the weight crated, 190 lbs. The size of the case is 32 ins. high x 14½ ins. square. The stand is 30 ins. high x 16 ins. square. The full height with sign is 6 ft. 2 ins.

PUSS IN BOOTS SLOT MACHINE

CIGAR AND CANDY VENDING MACHINES

The "Doremus" cigar selling machine, made by the New York Vending Company, of New York, is an inexpensive, efficient salesman, especially useful where it is not convenient or profitable to carry a large stock. The machine is 8½ ins. long, 7 ins. wide x 13 ins. high, and is handsomely finished in oxidized copper or heavy nickel plate. The cigars are visible through bevel-plate glass, are delivered without damaging the wrapper and are sold directly from the original box by simply inserting the requisite coin. A valuable feature of this machine is the combination cigar cutter and match box. The machine handles cigars of different sizes, and can be constructed to deliver two or more cigars for one coin. A simple arrangement is provided for locking the machine to any convenient stand or shelf.



SLOT MACHINE FOR SELLING CIGARS

A modification of the above-mentioned machine is made for selling sticks of candy, chewing gum, etc., which, owing to its cleanliness and attractive appearance, has become a popular standby in many public places.

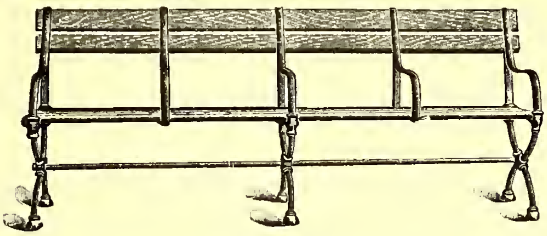
FOLDING STEEL LAWN SWING

The swing is a pleasure-giving device which will always find a place on outing grounds. The old wooden swing, however, is being replaced rapidly by steel swings, which are more economical in the long run, owing to their greater safety and longer life. One of the illustrations herewith shows the "Eagle" steel lawn swing, built by A. Buch's Sons & Company, of Elizabethtown, Pa. It is constructed entirely of high carbon steel, with the exception of the slats in the seats and platform, and can be set up or taken down in five minutes and folded very compactly. The chairs or seats can be placed at any angle in a moment so that the occupants can sit erect or lie down as they desire. This swing is built extra heavy for public use and can be furnished in all cases with table or steel head rests.

FOLDING STEEL LAWN SWING

OUT-OF-DOOR BENCHES, TABLES, ETC.

In a survey of park attractions the question of park furniture should not be overlooked. Benches, tables and the like should be not only of substantial build, but designed in harmony with the surroundings. One of the largest manufacturers in this line is the Bethlehem Foundry & Machine Company, of South Bethlehem, Pa. The Central Park settee, which is one of the company's most popular types, has been officially adopted as standard for use in the New York public parks. It is strongly built, attractive in appearance and withstands weather and hard usage remarkably well. The length of this bench is 7 ft.; height of seat, 17½ ins.; height of back, 32 ins.; extreme width,

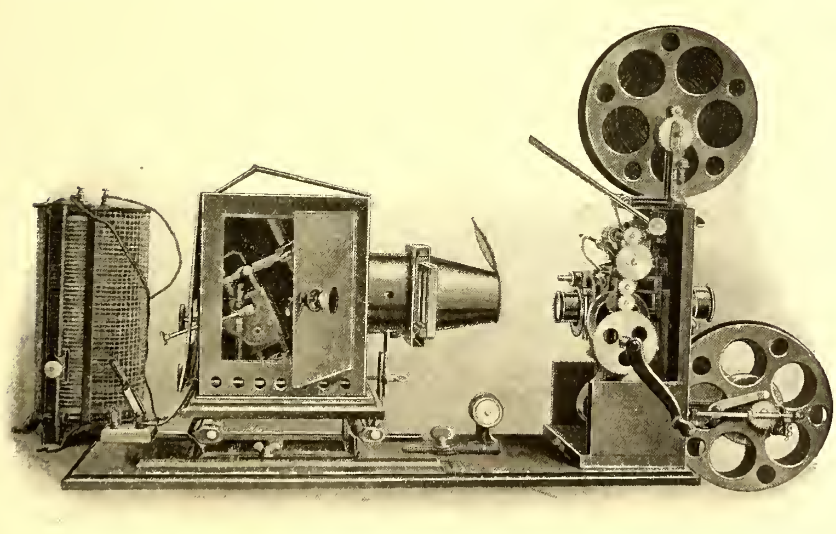


CENTRAL PARK SETTEE

23 ins., and width of seat, 14 ins. The company also builds folding seat benches pavilion benches, etc., as well as café, picnic tables and folding chairs.

THE KINETOGRAPH

Electric railway companies that are operating theaters and vaudeville attractions in connection with their parks are apt to overlook the great money-making possibilities of moving pictures. The number of companies using moving pictures as park attractions is, however, constantly growing, and the increased profits secured by their employment has been very gratifying to the companies that have given the matter a trial. The Kinetograph Company, of New York, which acts as sales agent for the Edison stereo-projecting kinetoscope and films, either leases the moving picture machine with an operator and a weekly change of films, or sells the machine outright, contracting to furnish new films as often as may be desired. The working of the machine is very simple and does not require a skilled operator. The Kinetograph Company does not manufacture slot machines of any kind, but makes a specialty of the large projecting machines, and has been furnishing films for these during the past season to about forty parks throughout the United States and Canada. Some of the largest vaudeville houses of New York City, including Proctor's theaters and the Hurtig & Seamon's houses, are using the Kinetograph service. Of special interest to electric railway companies are the reports received from roads which have been using moving pictures in their park theaters, one representative road having reported an increase in receipts for park traffic of 65 per cent, which is attributed to the use of the Kinetograph service.



OPERATING DETAILS OF THE KINETOGRAPH

AUTOMATIC WEIGHING MACHINE

The blue enamel confection and silvered weighing machines, made by the Automatic Vending Company, of New York, have established themselves firmly in parks, railway stations, stores, hotels, theater lobbies and other places. These machines are leased by the Automatic Vending Company to agents and must be forfeited by said agent if any other confections except those furnished by the company are offered or sold through them. These machines are free to all who wish them, the only obligation being to purchase and keep them filled with the confections specified by the vending company. The accompanying illustration represents the company's weighing scale, which is a light, attractive machine, giving correct weight up to 300 lbs.

AUTOMATIC WEIGHING MACHINE

The compactness of these machines and their reliability in spite of the vibration caused by passing trains has prompted the extensive use of both of these machines on the stations of the elevated lines of New York, Brooklyn, Boston and Chicago.

OTHER AMUSEMENT APPARATUS

While the devices described in the foregoing pages embrace a wide scope, it is hardly possible to do justice to this important topic in the limits of one article. Arrangements are being made, therefore, to describe in an early issue a number of other attractions suitable for pleasure resorts.

STEAM RAILROAD ASSOCIATION TO CONSIDER EXCHANGE OF FREIGHT TRAFFIC WITH ELECTRIC LINES

Announcement is made that Chairman Tucker, of the Central Freight Association, has called a meeting of the interested lines to be held at Chicago next Wednesday to consider the exchange of tariffs between the steam and electric lines at Toledo. The call is significant as showing that the question which has been agitating the Central Passenger Association for some time past has at last reached the freight association. The difference is this: More than a dozen lines of the Central Passenger Association are known to have more or less dealings with the interterurbans, while not more than two or three lines of the Central Freight Association are known to be exchanging freight with the trolleys. The Wabash makes no secret that it is exhanging tariffs with the Toledo & Western (traction line) via Adrian, and it is said that the Detroit Southern has been exchanging freight with the trolley lines for some time. The Wabash has established a class rate tariff with the Toledo & Western via Adrian, where there is a track connection between the two roads, and announces that it will pro rate the same as with steam line connections. Adrian is the only point where the Wabash has a track connection with the Toledo & Western.

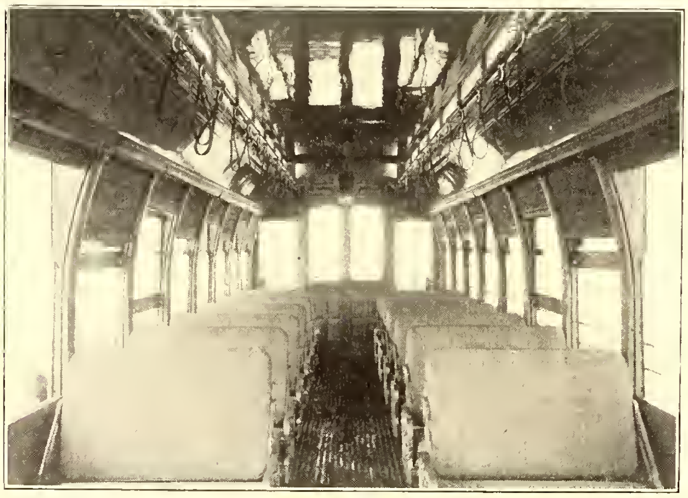
The freight business of the Toledo & Western is assuming large proportions, and it is said the management is now considering the advisability of purchasing a steam locomotive with a view of handling large freight trains during the hours of the night when passenger traffic is suspended. With such motive power the company would be enabled to get the bulk of its freight out of the way, and practically give a clear track for the trolley passenger cars during the day time and the first half of the night.

SEMI-CONVERTIBLE CARS FOR PHILADELPHIA RAPID TRANSIT COMPANY

The Philadelphia Rapid Transit Company is receiving several cars daily on its order for eighty-one Brill semi-convertible cars. The order was first for sixty cars, but was supplemented recently by another for twenty-one. The cars are all mounted on the trucks of the builder's No. 27-G type. The cars are of

DOUBLE-TRUCK CAR FOR THE PHILADELPHIA RAPID TRANSIT COMPANY

unusual interest on account of being the first built with the improved window system. The builder has worked out an arrangement whereby the metal runways formerly used and the sash trunnions which moved in them are dispensed with. The general plan of a large lower sash carrying the upper upon it into a roof pocket remains the same, the difference being a simplified method of sliding the sashes into the pocket and doing away with grooves in the posts. There are two guides of flat steel about ¾ in. wide, spaced about 14 ins. apart, secured at the lower end to the letterboard and at the upper end to the ventilator rail. These guides are bow-shaped and are close under the roof. Two small castings attached to the top of the upper sash are slotted and have roller bearings on either side of the slots, and these slide upon the guides. The lower



INTERIOR OF PHILADELPHIA CAR

sash is attached to the upper by a sliding connection, consisting of a tongue on either side of the upper sash, which moves in a groove on either side of the lower sash. The upper sash is held in its lower position by a lock, which is automatically released when the top of the lower sash reaches the height of the top of the upper sash. When the upper sash is drawn down, metal pieces with inclined faces at the lower corners of the frame bear against other inclined metal pieces upon the posts, which wedges this sash closely against the lower, making the connection weatherproof.

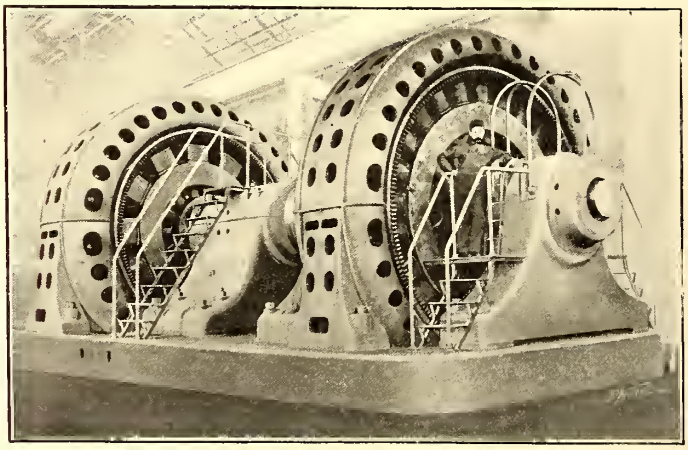
The grooveless posts are, of course, the unique feature of the new arrangement, and to one who knows nothing about the guides in the pockets, it is exceedingly mystifying to see a pair of sashes under perfect control, but which apparently slide upon nothing. The sashes can be held at any desired height by lock stops, as formerly. These stops are of metal set into the posts, and other than the small chiseling for the lock stops the posts are not cut into, and have all the strength of their full thickness. The arrangement has been in actual service for several months and the efficiency of every part thoroughly tested. A further description with diagrams and illustrations will be given in an early issue.

The length of the cars over end panels is 28 ft., and over the crown pieces, 37 ft. The length of the platforms is 4 ft. 6 ins.; width over the sills, 7 ft. 8½ ins.; width over the posts at the belt, 8 ft. 3 ins.; sweep of the posts, 3¼ ins.; height of the car from the rail over the trolley board, 11 ft. 6 ins.; distance between the centers of the posts, 2 ft. 8 ins.; size of the side sills, 4¾ ins. x 7¾ ins.; end sills, 4¾ ins. x 5⅞ ins.; sill plates, 12 ins. x ⅜ in.; thickness of the corner posts, 3⅝ ins., and side posts, 3¼ ins. Metal sash stiles are used. The interiors are finished in ash, with ceilings of decorated birch.

LARGE MOTOR GENERATOR SET FOR A CANADIAN POWER COMPANY

The largest electric motor ever built is now being installed at the plant of the Shawinigan Water & Power Company, Shawinigan Falls, Quebec. This was recently constructed by the Allis-Chalmers Company at its electrical works in Cincinnati, and embodies in its design the characteristics of the Bullock alternators, which have proven singularly successful in their application. It is a synchronous motor of 8000 hp. The rating of the generator operated by this motor, on standard specifications, is 5750 kw at 300 r. p. m. The combined machines, in addition to their enormous capacity, are remarkable for concentrating in an exceedingly small floor space a volume of 12,000 kw.

The illustration of the machines which is shown herewith was taken while they were being tested at the shops by the



MOTOR GENERATOR SET FOR SHAWINIGAN FALLS

Behrend system, under full load conditions corresponding to 7200 kw on the generator, with the expenditure of no more than 300 kw, in order to produce the same losses in the machine which exist under full load conditions.

The working of the generator and motor forming the frequency changer at Shawinigan Falls will be carefully noted by electrical engineers in all parts of the world, and if it is as successful as the builders confidently anticipate, the result will be a valuable addition to existing data on the subject of alternating-current machinery.

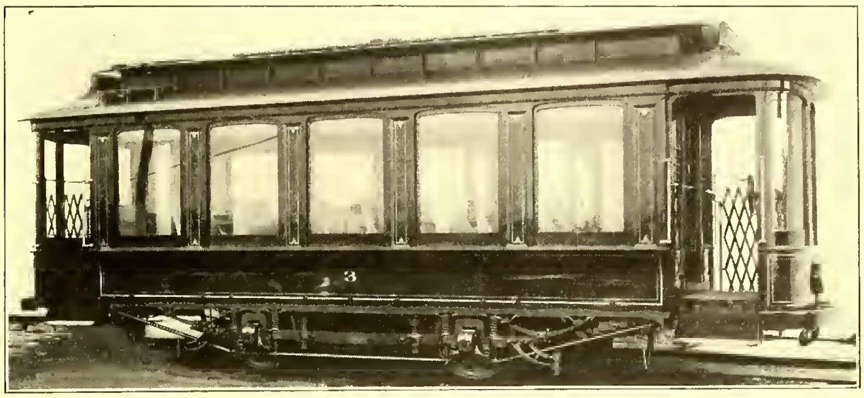
The Indianapolis & Cincinnati Traction Company has appointed a physician at each of the towns and cities through which the line runs, with instructions to attend the injured in case of accident upon the line.

INTERESTING CAR FOR JACKSON, MISS.

The American Car Company, of St. Louis, has recently delivered the handsome car shown in the illustration to the Electric Railway, Light & Power Company, of Jackson, Miss. The Jackson system operates chiefly within the city and has an extension to an amusement park. The city is one of the important cotton shipping points in the South, and a number of main steam lines converge here. It is the capital of the State, and is located near its center.

As one may imagine from its appearance, the car was originally intended for special service, but the company which ordered desired a double-truck car, and the builders completed the shorter car fitted up for regular service. The Jackson Railway has therefore obtained an exceptionally attractive appearing car. The interior is richly finished in mahogany, handsomely carved, and the ceilings are tinted light green and decorated with gold. Four elongated beveled mirrors are on each side of the car, and the windows are fitted with 1/4-in. polished French plate glass. Wire screens are placed behind the low curved glass windows in the vestibules to protect them against breakage.

The seats are 31 ins. long, and the aisle, 17 1/2 ins. wide. The length over the end panels is 20 ft. 11 3/4 ins., and over vestibules, 28 ft. 5 3/4 ins. The platforms are 3 ft. 9 ins. long; width over the sills, including the panels, 6 ft. 10 3/4 ins., and over the posts at the belt, 7 ft. 5 5/8 ins. The sweep of the posts is 3 1/2 ins.; distance between the centers of the posts, 2 ft. 11 3/8 ins. The side sills are 4 ins. x 7 1/2 ins., and the end sills, 4 1/2 ins. x 7 1/2 ins.; thickness of corner posts, 4 ins., and side posts, 2 1/2 ins. The car is mounted on a Brill No. 21-E truck, with 8-ft. wheel base and 33-in. wheels. Among the furnishings are angle-iron bumpers, sand boxes and gates of Brill manufacture, gongs and steps of the American Car Company's types.



A REMARKABLE CAR FOR THE JACKSON (MISS.) STREET RAILWAY SYSTEM

SEATING ARRANGEMENT OF JACKSON CAR

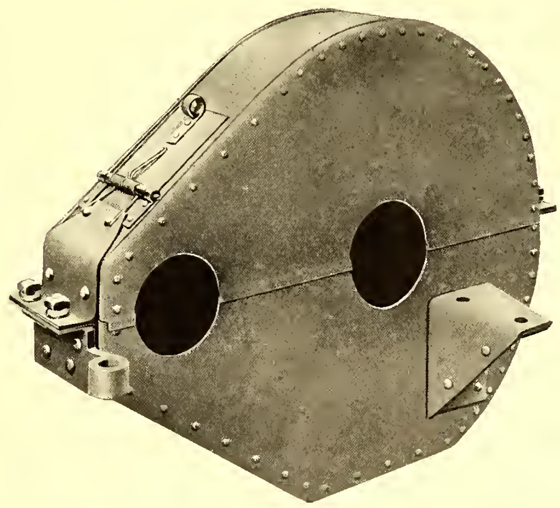
In addition to many theater parties by trolley to attend the recent opening performance in Indianapolis of "The Gentleman from Indiana," was one from Dayton, Ohio, in a special car in charge of Valentine Winter, president of the Dayton & Western Traction Company, which carried society people and newspaper men. The car left Dayton at 2 p. m., arriving in Indianapolis at 6 p. m. It was the first interstate trolley theater party.

INSULATING TYPE

The Morgan & Wright bicycle tire has long been recognized as a standard, but it is not so generally known that this enterprising Chicago firm also manufactures a tape which is said to be peculiarly adapted for electrical work. The good qualities claimed for Morgan & Wright insulating tape are: Exceptional adhesiveness; does not dry out easily; unrolls smoothly; uniform and high insulation resistance; capable of withstanding extreme heat, and an uncommonly high percentage of insulation composition. These statements, the company says, are borne out by the increasing popularity this product is finding in electrical work.

SHEET STEEL GEAR CASE FOR STREET RAILWAY SERVICE

The all important subject of gear cases for street railway motors is very effectively met by the sheet steel gear case of the Lyon Metallic Manufacturing Company, of Chicago. This case, while incomparably stronger than one of wood construction, is from 75 lbs. to 100 lbs. lighter than one of cast steel. It is made entirely of sheet steel, each section riveted and seamed so as to give strength where needed. At both ends it is reinforced by heavy plates both inside and out. The brackets are triple reinforced, and vibration will not cause them to work loose. Should the case become bent in an accident it can readily be hammered back into shape.



SHEET STEEL GEAR CASE

The company carries in stock cases for practically all the standard makes of motors, and has so much faith in them that it offers to ship one to any traction company for tests. If the tests should not prove satisfactory, the case may be returned at the Lyon Company's expense.

FINANCIAL INTELLIGENCE

WALL STREET, March 8, 1905.

The Money Market

Extreme dullness prevailed in all branches of the money market this week, and despite the further heavy loss in bank reserves, rates for all maturities have displayed a declining tendency. This was due in part to the extremely light demand from stock commission houses, nothwithstanding the recent activity and strength in the securities market, and partly to the heavy offerings of funds from out-of-town institutions and from international banking houses against exchange transactions. In the early part of the week demand money was in fair demand at rates ranging from 2½ and 3 per cent, but later on heavy offerings by local banks and trust companies the rate declined to below 2 per cent, but subsequently recovered to 2½ per cent. In the time loan department business was practically at a standstill, and rates were for the most part nominal. There was a fair inquiry for contracts, both for the short and long maturities at 3 and 3¼ per cent, respectively, but there was no disposition on the part of the local institutions to place their funds, except at 3¼ and 3½ per cent. As a result, borrowers generally continued to draw their immediate wants from the call money department at the prevailing low rates, rather than to pay the interest charges asked by the local institutions. At the close the market was in favor of borrowers, and they seem confident that the banks and other lenders would be compelled to meet their views. It is pointed out that while the banks will soon be called upon to meet the usual spring demand for funds from the interior points, and also to provide the necessary funds for various bond issues, the receipts from other sources will be more than sufficient to offset these requirements. On March 15 the national banks will be called upon to pay into the National Treasury about $15,000,000 of government funds, but it is likely that circulation will be taken out against the government bonds thus released, which will add greatly to the already large supply of lendable funds. The statement of the associated banks, published last Saturday, was decidedly unfavorable. Loans increased $13,143,000, due largely to syndicate operation. The loss in cash amounted to $3,720,100. Deposits increased $10,155,100. The reserve required increased $2,536,275, which, added to the loss in cash, shows a loss in surplus of $6,256,375. The surplus was $8,389,750, as against $29,943,350 in 1904, $666,975 in 1903, $3,958,425 in 1902, $10,717,272 in 1901, and $5,676,375 in 1900. At the principal European centers the situation remained easy, without any material change in discount rates.

The Stock Market

There was a considerable falling off in the dealings on the Stock Exchange this week, and although prices displayed more or less irregularity, the undertone was firm. The opening was fairly active and strong, but shortly afterward the reported collapse of the Southern Iron deal, which was subsequently confirmed, led to greater or less reactions from the previous high level of prices, particularly in the stocks of the Tennessee Coal & Iron, and the Sloss-Sheffield companies. Doubts as to what President Roosevelt might have to say in his inaugural address, and fear that the poor showing made by the bank statement also prompted caution and induced more or less profit-taking. The principal feature of the week, however, was the decision of the United States Supreme Court in the Northern Securities case reaffirming the judgment of the Circuit Court of Appeals, and permitting the distribution of the assets on the pro-rata plan. While the action of the stock market in response to the decision was somewhat disappointing, inasmuch as it did not immediately advance, there was no doubt that it served to strengthen bullish sentiment, as it has removed one of the unsettling features in the situation. Unfavorable reports of gross railroad earnings for the month of February, reflecting the decidedly adverse weather conditions during that period, also induced more or less profit-taking, and checked to a great extent the buying on the part of the outside public. There was, however, no serious set back to prices, but, on the contrary, some issues exhibited decided strength and touched the highest figures of the season. The settlement of the railway rate war, and the fact that the President's inaugural address was more conservative than expected, together with a decidedly easier tendency in money, and the highly satisfactory conditions of affairs in all the leading industries, notably the iron and steel trade, prevented any liquidation, as did also the prospect of an early declaration of peace between Russia and Japan. The bond market was less active than in the preceding week, and prices reflected to a great extent the irregularity in the stock market. The tone, however, was generally firm. The features were Union Pacific convertible 4s, Atchison general 4s, Chicago, Burlington & Quincy 4s, and American Tobacco 4s.

The local traction issues were generally strong, especially Metropolitan Securities and Metropolitan Street Railway, which rose 3⅝ and 1⅝, respectively, on reports of increased earnings. Brooklyn Rapid Transit was also strong on an extremely gratifying increase in gross earnings for the month of February, despite the adverse weather conditions. Manhattan Railway was steady, despite the strike on the Interborough lines.

Philadelphia

There was a fairly active market for the local traction stocks this week, but the dealings were accompanied by more or less irregularity in prices. The opening was generally firm, but in the subsequent dealings there was considerable selling to realize profits which resulted in sharp recession. Philadelphia Rapid Transit was the leader in point of activity, but the stock was under pressure nearly all of the week. Initial transactions were made at 31⅝, and on reports that another assessment of $5 per share would be levied on the stock in June, the price declined nearly 2 points to 29⅝. It was stated on good authority that no assessment would be called on the stock until the latter part of the year, if then, but this statement failed to have any influence on the price of the stock. The closing was at 29¾, or ⅛ of a point above the lowest. Upward of 20,000 shares were dealt in. United Gas & Improvement common was comparatively quiet, but strong, about 8000 shares changing hands at from 114 to 116⅜, an advance of 1⅜ points. Philadelphia Electric displayed moderate activity, but the price fluctuations were extremely narrow, about 23,000 selling at 10½ and 10⅞. Philadelphia Company common sold to the extent of about 6000 shares at from 44⅜ to 43⅜, the final transaction taking place at 44⅛. The preferred stock sold at 47½ and 47¾. Philadelphia Traction ruled strong. Early transactions were made at 100⅞ to 101, but later in the week the stock sold at 99¼ ex-dividend, from which it rallied to 99¾ at the close. Other transactions included Consolidated Traction of New Jersey at 82 to 82½, United Railways Investment preferred at 78⅜, Union Traction at 58¾ to 58⅞, American Railways at from 52¼ to 53, Fairmount Transportation at from 20 to 23, and Railways General at 4.

Chicago

There was no material change in the city railway situation this week, and none is expected until after the April election, when the people will vote upon the extension ordinance. The ordinance was submitted to the Council at its meeting this week, and was ordered deferred and published.

It is said that a large number of stockholders of the Metropolitan West Side Elevated Railway Company have already sent their proxies to the independent committee to be voted at the annual meeting to be held on April 4, and that from present indications it is believed that enough stock will be obtained to control the annual meeting. In a circular issued to the stockholders, the committee declares for a general change in policy, and that four new directors be elected whose efforts will be to make it the most satisfactory elevated road in the country for its patrons and its stockholders. The proxies accompanying the circular names three directors for election: F. A. Delaus, Charles A. Requa and Charles C. Adset. It is said that the opposition element was largely instrumental in forcing the resignation of President McAllister, and a hard fight to name his successor is expected.

Trading in the local street railway issues was extremely light, but prices generally held strong. The feature was the sharp advance in Metropolitan Elevated from 21½ to 23 on the exchange of about 600 shares, while the preferred advanced from 61 to 63 on limited transactions. South Side "L" was also strong, the price advancing a point to 96. Northwest "L" sold at 24½ for 100 shares. A small lot of West Chicago brought 63, and odd amounts of North Chicago and Chicago Union Traction brought 99 and 11, respectively. In the bond department the transactions included $9,000 Lake Street "L" 5s at 97½, $11,000 Metropolitan "L" extension 5s at 95, $3,000 Northwestern "L" 4s, at 95 to 95⅛, and a few odd North Chicago 4 per cent consols at 88.

Other Traction Securities

By far the overshadowing feature of the Baltimore market was the enormous dealings in United Railway income bonds, trading in them being stimulated by the efforts making by holders to compel the company to pay the coupon now in arrears, and for the practical establishment of the income bonds on a regular interest basis. A committee of seven, representing about $4,000,000 of the incomes, has issued a call for deposits of additional bonds before March 15. Over $1,000,000 of the income bonds were traded in at from 68¾ at the opening, down to 65, but at the close there was a recovery to 67½. The stock and the first 4s were also active, the first named advancing from 13⅞ to 16⅞, on the exchange of about 25,000 shares, while upward of $200,000 of the 4 per cents changed hands at prices ranging from 97½ to 94¾. Trading in the other issues was comparatively small and included $40,000 Norfolk Railway & Light 5s at 95 to 94¾, $10,000 Indianapolis Northern Traction 5s at 96⅞, $6,000 Macon Railway & Light 5s at 99, and North Baltimore Railway 5s at 120⅝ to 120½. The feature of the Boston market was the strength in Massachusetts Electric common and preferred stocks, on reports of substantial increase in earnings. It is said that for January and February last the gross earnings have increased at the rate of $1,000 a day, or about $70,000. The common stock advanced from 14½ to 17, but at the close there was a slight reaction. The preferred advanced from 58 to 62⅝ and closed at 62. Boston Elevated was weak, the price declining a point in the early dealings to 155, but subsequently there was a partial recovery. West End common and preferred ruled about unchanged at 98 and 115½, respectively.

In the New York curb market Interborough Rapid Transit continued to fluctuate widely on a comparatively small volume of business. From 207 at the opening, the stock ran off to 203½, but later there was a sharp advance to 212. In the subsequent dealing the stock developed weakness, and on the declaration of the strike on the company's lines, the price dropped back to 203¼. This was followed, however, by a sharp recovery to 210, on the report that a number of the company's employees had returned to work, which was taken as an indication of an early settlement of the questions at issue on the company's own terms. About 12,000 shares were traded in. Other transactions on the curb included $10,000 International Traction of Buffalo 4s at 81½, $65,000 Public Service Corporation certificates at 72½, $110,000 Public Service Corporation 5 per cent notes at 98 and interest, $17,000 United Electric at 77⅜, $35,000 Jersey City, Hoboken & Paterson 4s at 79⅞, and $30,000 North Hudson extension 4s at 108.

Security Quotations

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

	March 1	March 8
American Railways	52¼	52½
Boston Elevated	155	155
Brooklyn Rapid Transit	65½	66
Chicago City	188	198
Chicago Union Traction (common)	11½	11¾
Chicago Union Traction (preferred)	49	48¼
Cleveland Electric	82½	82½
Consolidated Traction of New Jersey	81½	81
Consolidated Traction of New Jersey 5s	110¼	110¼
Detroit United	77½	80
Interborough Rapid Transit	205½	209
International Traction of Buffalo	—	25
International Traction of Buffalo (preferred)	—	70
International Traction of Buffalo 4s	77	81
Manhattan Railway	171	171½
Massachusetts Electric Cos. (common)	16¾	17⅛
Massachusetts Electric Cos. (preferred)	64	62
Metropolitan Elevated, Chicago (common)	21	22½
Metropolitan Elevated, Chicago (preferred)	63⅝	64½
Metropolitan Street	121½	122¾
Metropolitan Securities	81	84⅝
New Orleans Railways (common)	4¼	3½
New Orleans Railways (preferred)	15	14
New Orleans Railways, 4½s	81½	81
North American	101¼	102
North Jersey Street Railway	22½	23
Philadelphia Company (common)	43½	43½
Philadelphia Rapid Transit	30¼	29⅛
Philadelphia Traction	101	100
Public Service Corporation 5 per cent notes	—	97¾
Public Service Corporation certificates	—	72½
Public Service Corporation 50 per cent notes	—	97¾
South Side Elevated (Chicago)	94	94
Third Avenue	132	131½
Twin City, Minneapolis (common)	107½	109
Union Traction (Philadelphia)	58¾	58½
West End (common)	98	97½
West End (preferred)	115½	115¼

Iron and Steel

The "Iron Age" says that the monthly blast furnace returns reveal a continuance of the strong statistical position of the pig iron industry. The February production covering, as it did, only four weeks, was only 1,597,000 tons, as compared with 1,780,000 tons in January. It fell below the normal, because a considerable number of plants were affected by troubles incident to the handling of materials in winter weather. Roughly, this amounts to about 25,000 to 30,000 tons, and it is a curious fact that the stocks in the hands of merchant furnaces declined about 25,000 tons. In other words, consumption apparently during February was proceeding at a rate which would have taken care of the normal output of the furnaces in blast. Productive capacity on March 1 was very close to that of February 1, so that for the present it is stationary.

While in the Eastern markets the feature is still the buying, for prompt delivery, in moderate quantities by the general foundry trade, the Western distributing markets report a larger movement among some of the leading melters, the jobbing foundries, however, participating also. For steel making, the volume of pig has not been large. It is understood that the Steel Corporation may need 10,000 tons more for March, and there were indications of requirements aggregating 40,000 tons for April.

There has been a further movement in steel rails. It is understood that the Atchison, Topeka & Santa Fe Railroad has bought 25,000 tons, and that negotiations with the St. Paul and other Northwestern and Southwestern roads are pending which will involve about 100,000 tons.

In the structural trade an interesting new feature is the appearance of a considerable number of inquiries for steel buildings for manufacturing purposes.

A NEW LINE OUT OF SCRANTON, PA.

The Scranton, Factoryville & Tunkhannock Railway Company, which is now perfecting plans for building an electric railway from Scranton to Tunkhannock, Pa., will be an important system. The line will run from the center of Scranton to Notch, thence to Chinchilla, to Clark's Green, Clark's Summit, Glenburn, Waverly, Dalton, La Plume, Factoryville, East Mountain, Lithia Springs, Bedel's Glenn, Lake Winola, Dixon's and Tunkhannock. The main power house will be on the outskirts of Scranton. Sub-stations will be built at points along the line, to be decided upon in the future. In construction the road will embody all that is standard in recent practice. In order that high speed may be attained, construction will be for the most part over private right of way. Of the Scrantonians connected with the enterprise may be mentioned James P. Dickson, J. Selden Swisher, Lewis B. Carter, C. W. Seeley and Frederick E. Scott. These gentlemen have been closely identified with the project from the start. It is understood the full board of directors will be announced in the course of a few days. The president of the company is J. Selden Swisher, and the secretary, Charles Seely. The attorney is Lewis B. Carter, of Scranton.

NORTH AMERICAN COMPANY SECURES CONTROL OF UNITED RAILWAYS OF ST. LOUIS

A definite statement is made of the plan of the North American Company to enter United Railways, of St. Louis. The agreement is the result of negotiations extending over several months, and referred to from time to time in the STREET RAILWAY JOURNAL. It is a controlling interest in the United Railways that the North American Company has secured. The details as to the consummation of the deal are withheld, however. North American stock will be exchanged for holdings of the United Company, where it is possible to do so, and cash will be given when an exchange cannot be satisfactorily arranged. When this transaction is completed the North American Company will have a controlling interest in the public utility corporations of St. Louis and Milwaukee, beside having an interest in the Detroit Edison Company, and the Cincinnati, Newport & Covington Light & Traction and other similar concerns. What the effect will be of this move on the management of the company is not known.

STRIKE ON THE ELEVATED AND THE SUBWAY LINES IN NEW YORK—STRIKE DECLARED OFF

The presses on which the Street Railway Journal is printed were held to record here that at 5 o'clock p. m. on Thursday the announcement was made in the daily press that the leaders of the several national associations, in conference in New York, had called upon the local labor leaders in the city to call off the strike of the motormen, guards, ticket sellers, ticket choppers and porters of the Interborough Rapid Transit Company, operating the elevated and the subway lines in New York. In deference to this order, the Brotherhood of Locomotive Engineers at once ordered the men to return to work. The other bodies are expected to follow this lead at once. The lateness of this news precludes more than this bald mention of the facts.

The trouble between the company and its employees was precipitated at 4 a. m. on Tuesday, March 7, when in compliance with instructions from their respective unions all the men quit work. Those operating trains ran them to the end of the line, where they were abandoned.

The men and the company have been at loggerheads for some time. In fact, the indifference of the men in doing their work became so noticeable a few months ago that public notice was directed to the performance of men in service. Shortly thereafter a conference was held between committees of the motormen and the management of the company, at which the questions of their relations was discussed. To be exact, this was on Jan. 19. At this conference the men said that the promise of the company to give them a relay of 15 minutes at the northern terminal was not being fulfilled. The whole question was thrashed out, however, to the satisfaction of the motormen, and it was agreed at the time that conductors and guards be given one-half straight runs, instead of swing runs. Things went well for a time. Then the stories of dissensions were renewed. Finally there came the consummation. This was on March 3, when the employees aired their grievances publicly, and made demands of General Manager Hedley, of the company, for the readjustment of the agreement between the men and the company.

The demands made of the company can best be given by quoting them as they are embodied in the official statement issued by the joint committee of the Amalgamated Association of Street Railway Employees of America and the Locomotive Engineers. This statement follows:

1. That the present physical examination now in force against motormen and other employees shall be eliminated and a practical road test substituted, instead, above to take effect Jan. 1, 1905.

2. A day's work for motormen and other trainmen to be nine hours or less, motormen's mileage not to exceed 100 miles a day.

3. Relay for motormen, when headway is less than six minutes, should be allowed at southern terminals, loop or no loop.

4. All road work on trains, with or without passengers, shall be done by qualified motormen.

5. For all employees, excepting tower switchmen, nine hours shall constitute a day's work, with time and a half for overtime.

6. Tower switchmen, eight hours or less to constitute a day's work, with one day off duty a month with pay; time and a half for overtime.

7. Ten per cent increase in pay for all employees excepting motormen.

Following is a table of the wages paid to the subway and elevated employees of all grades:

Motormen, $3 a day for the first six months, $3.25 for the second six months, and thereafter $3.50.

Conductors, $2.10 a day for the first year, $2.25 for the second year, and thereafter $2.40.

Guards, $1.55 a day for the first year, $1.70 for the second year, $1.85 for the third year, and thereafter $1.95.

Ticket agents, $1.75 a day for the first year, $2 for the second year, and thereafter $2.25.

Switchmen, $2 a day for the first year, and thereafter $2.55.

Towermen, $2.45 for the first year, and thereafter $2.50.

Ticket chopper, $1.40 for the first year, and thereafter $1.55.

Porters, $1.40, with an increase for length of service.

The company's reply to these demands was transmitted to the men at 10:30 o'clock on Monday. It is understood to have been a flat refusal of the concessions asked, although General Manager Hedley has not made the text of the letter public. At any rate, the reply was taken as being the final word from the company, and at 11 o'clock a. m., the men began to vote as to whether or not they should strike as a body, in order to force the company to meet their demands. Their decision was to go out, and, as previously stated, they quit their posts at 4 a. m. on Tuesday.

But the company was not to be caught napping. It hurriedly manned its subway trains with skilled operators who had been engaged for the emergency, and when the morning rush came a fair service was given in the tunnel. Except for an occasional train, service was entirely abandoned on the elevated lines. The difficulty came in securing men to man the stations. This, however, was partially overcome with the opening early on Tuesday morning of general employment bureaus. Applications were received by the score, and by noon the service on all lines was fair. The evening rush on Tuesday saw the east and the west side elevated lines operating intermittently, and a service in the subway that was all that could be expected, in view of the peculiar conditions that prevail there. Unfortunately there came at 5 p. m., the height of the rush, a collision in the subway, between trains at Twenty-Third Street that caused traffic to be suspended for some time.

One local ran into another from the rear. The last car of the first train and the first car of the second train were of steel, and neither was damaged to any extent. The force of the impact was so great, however, that the second car from the rear of the first train, which was of wood, was telescoped by the steel car behind it. Twenty-nine persons are known to have been injured, two of them perhaps seriously. In the confusion that followed, the motorman of the second train, thoroughly appalled at the terrible disaster, made good his escape.

Wednesday morning saw conditions considerably improved. The headway on nearly all lines had been cut down appreciably, and on the West Side but little difficulty was experienced in making the trip down-town from Harlem. According to an official statement of the Interborough Company, the Sixth and the Ninth Avenue lines were operated on a six-minute schedule, while on the several subway divisions the longest headway was not more than 7 minutes. The East Side elevated lines, it must be confessed, fared badly. On Wednesday morning little improvement was to be noticed over the day before on these lines, but conditions were considerably improved throughout the day. It all takes time to get things running smoothly, but the results already obtained with the new men dismayed the strikers. Express trains were run in the subway on Wednesday afternoon for the first time since the strike was declared.

Wednesday afternoon the strikers seemed to realize that they had failed most dismally to paralyze the entire system. Moreover, they were conscious that slowly the thing must peter out, as the company was fully prepared to cope with the situation. An overture from the Mayor in the interest of the public to settle the strike by arbitration was readily accepted by the men. The company, however, firmly but courteously refused the offer, reviewing briefly in its reply to the Mayor its relations with its employees since it took over under lease the system of the Manhattan Elevated Railroad. In this letter was mentioned the pact entered into on Sept. 7, 1904, by the company and the Brotherhood of Locomotive Engineers and Brotherhood of Locomotive Firemen in respect to hours of labor, pay and other matters, which agreement, by its terms, was to continue at least until Sept. 8, 1906.

The motormen secured by the company to take the place of the strikers are all men experienced in railroading, and were carefully examined by the company before being put to work. They are being cared for at the company's expense. Some of them are quartered temporarily at the car houses at One Hundred and Forty-Ninth Street and the Harlem River. Others are quartered on the steamer "Northam," lying moored close by the car houses. The other men who have taken the places of the strikers are also being cared for by the company. The car houses might easily be mistaken for the commissary department of an army about to decamp for the scene of a battle. The wages to the new men are the same as those in effect before the strike, as follows:

Motormen, $3 to $3.50 per day, according to length of service; conductors, $2.10 to $2.40; guards, $1.55 to $1.90; agents, $1.75 to $2.40; switchmen, $2 to $2.35; trackmen, $2 to $2.50; porters $1.40.

A volume might be written about improvised rapid transit. Naturally the surface lines, operated by the New York City Railway Company, were soon taxed beyond their capacity. Recourse was had to cabs by those who could afford them. Fortunately, owners of hacks, wagons, 'buses and other vehicles pressed them into service, and many who found it impossible to get on the surface cars rode down town in one of these vehicles. It seemed to matter not to the business man what the means was, as long as he got to his destination. This condition prevailed only for the first day. The street cars were crowded as they never were before. It was not unusual to see six or more persons riding on the bumper of a car. As for the rule against standing on the front platform, that was disregarded entirely. Quite frequently venturesome ones scrambled to the roofs of the cars and rode while perched there. In the face of existing conditions conductors were powerless. The rain of Tuesday and Wednesday prevented President Vreeland from operating open cars. As a fact, the headway was so reduced on some of the lines that it is a matter for speculation how more cars could have been crowded onto the streets.

THE CHANGE IN BUFFALO

The change in control of the International Traction Company, which was briefly mentioned in the last issue of this paper, was consummated at a meeting held at the office of J. P. Morgan & Company, of New York, on March 2. At that meeting the following were elected officers of the International Traction Company: H. J. Pierce, president; Daniel S. Lamont, vice-president, and Frank L. Slocum, secretary and treasurer. Mr. Lamont is also vice-president of the Northern Pacific Railroad.

The following board of directors was elected: Henry J. Pierce, Pendennis White, Robert L. Fryer, Henry M. Watson and Thomas E. Mitten, of Buffalo; Daniel O'Day, formerly of Buffalo, but now of New York; G. L. Boissevain, Thomas Dewitt Cuyler, of Philadelphia; Arthur Robinson, of New York; T. G. Blackstock and E. B. Osler, of Toronto.

These officers retired from the company: W. Caryl Ely, president; Van Horn Ely, assistant to the president; R. F. Rankine, secretary and treasurer; Edward McDonnell, assistant to the general manager, and H. M. Pease, auditor. Mr. Mitten, who resigned his position as general manager of the company recently, to accept

HENRY J. PIERCE

W. CARYL ELY

the position of vice-president of the Chicago City Railway Company, is succeeded by Thomas W. Wilson, who was chief engineer of the International Railway Company. A portrait and biographical sketch of Mr. Wilson appear elsewhere in this issue. As will be seen from the directorate, Mr. Mitten remains a director of the company.

These officers were elected for the Crosstown Street Railway Company, one of the principal sub companies of the International Traction Company; president, H. J. Pierce; vice-president, Daniel S. Lamont; secretary and treasurer, J. F. Slocum. Directors, H. J. Pierce, W. B. Rankine, G. L. Boissevain, Robert M. Fryer, W. H. Cuyler, D. S. Lamont.

These officers were elected for the International Railway Company, which is the operating company for all the lines owned or controlled by the International Traction Company: President, H. J. Pierce; vice-president, Daniel S. Lamont; secretary and treasurer, J. F. Slocum. Directors, H. J. Pierce, G. L. Boissevain, Pendennis White, Arthur Robinson, T. E. Mitten, T. Dewitt Cuyler, Daniel S. Lamont, Archibald M. Robinson, Charles Steele, Boyd Osler, T. G. Blackstock, Robert M. Fryer, Henry M. Watson, Daniel O'Day, E. T. Stotesbury.

Nearly all the new directors, who are from Buffalo, are known as Marine Bank men. Mr. Fryer is the only exception. He is from the Manufacturers & Traders Bank. Mr. Ely was requested to take a place on the board of directors, but declined, owing to his desire to give his attention to other business. Mr. Ely stated in an interview, however, that he expected to retain his large holdings in the company, on account of his faith in its future. The capital stock of the company is $10,000,000 common and $5,000,000 preferred. The common stock has recently risen from 15 to 31, and the preferred from 45 to 65. The present purchasers are said to have secured their stock in the open market, and to be in no way associated with the New York Central or other outside transportation interests.

As mentioned in the last issue, Mr. Pierce, the new president, is a prominent capitalist and financier in Buffalo, and is president of the Wood Products Company, which manufactures most of the wood alcohol produced in this country. He was born in Bath, Me., Aug. 29, 1857. While very young his parents moved to New York, where his father was for many years president of Rutgers Female College. Mr. Pierce moved to Buffalo at the age of seventeen, and in 1880 helped to organize the Wood Products Company. His other business connections were mentioned last week.

Mr. Ely has been one of the most prominent members of the American Street Railway Association, and as its president this year has had charge of the reorganization of that body. His ability, high character and unfailing courtesy have made him one of the best known, as well as one of the most popular members of that body. The high regard in which he is also held in Buffalo is evinced by the editorials in all the papers which chronicle his retirement from the management of the transportation system of that city. While it is impossible to quote in extenso from them, the following extract from the "Express" is characteristic of them all, as indicating the high regard felt for Mr. Ely in Buffalo: "No large body of workers ever were more loyal to their chief than the street railroad men of this community have always been to Caryl Ely, and no head ever better deserved such loyalty. He has not only been a good, and, best of all, a just employer, but he has treated the motorman like a man every time, and like a man whom he liked. His courtesy and open-handed sympathy have not been kept by this big man for display to his social intimates. If there were nothing else to say about Mr. Ely, a wealth of encomium could be piled upon him as an employer and a manager of employees. Such encomium would be of vital interest to the public, for the men who know how to treat those who are working under them as men should be treated are the public benefactors who are giving the real help in solving the labor question. He goes out of an exacting office with a record of fairness and friendliness to all three parties to whom he owed a duty—to the men who worked under him, to the shareholders for whom he worked, and to the public whom he served. It is a fine record that he takes with him. It is a splendid heritage that he leaves to his successors. Characteristically, he shows his faith in the property he has built up by retaining his stock holdings, while retiring from the active management."

EQUIPMENT OF THE NEW ELEVATED CARS FOR BROOKLYN

In the Feb. 25 issue of the Street Railway Journal a reference was made to the large contract for surface and elevated cars which has recently been placed by the Brooklyn Rapid Transit Company. The contract, which includes 100 elevated cars, fifty surface freight cars and 200 convertible surface cars, is considered to be one of the largest orders for cars that has ever been placed at one time by a single railway company.

The equipment for the surface passenger cars is given in detail on pages 467 and 468 of this issue, in connection with the description of the specimen car built for the company. The elevated cars will be equipped with Westinghouse type 50-L motors, according to the company's present standard arrangement of elevated motive power equipment, which embodies the use of two motors per motor car, both mounted upon the same truck. The motor control to be used will be the new Westinghouse unit-switch-group system of multiple-unit control, which system has been previously referred to in these columns, and which will make 249 motor cars equipped with this type of control owned by this company. The trucks will be of the type 40 Peckham M. C. B. trucks, known as the Brooklyn Heights Standard, which are standard for all elevated cars upon this system. Of these forty are to be purchased new, while 160 are in use in another service by the company, and are to be transferred to the new cars when delivered. The brakes are to involve the usual equipment of "New York" motormen's valves and brake cylinders, but the compressors and governors will be furnished by the Westinghouse Traction Brake Company. The heaters for the elevated cars will be supplied by the Consolidated Car Heating Company, and will be of the company's standard for cross-seat cars on the elevated division, i. e., type 192, single coil heaters, twenty-four to a set.

The seats are of the Wheeler type and are to be furnished by Heywood Bros. & Wakefield. These will number 2000, and will be similar to those supplied by this company for the new surface car. The curtains are to be made of Pantasote of the company's regular standard patterns, but the fixtures, which will be supplied by the Curtain Supply Company, of Chicago, will be a departure from the usual type, being of a special automatic style which is standard upon the closed cars, but made to serve as storm curtains. The curtains will be stiffened with battens, and posts will be arranged so that the fixtures cannot be removed from the grooves by passengers.

The fifty new freight cars are to be built by the Laconia Car Works, Laconia, N. H., 38 ft. long 7 ft. 6 ins. wide, for a capacity of 25 tons. The trucks are to be diamond frame M. C. B. type, modified to carry the motor equipment, which is to be of 4 Westinghouse No. 68 motors per car. The controllers will be of the Westinghouse No. 28-A type. The braking equipment will consist of Westinghouse motor compressors, together with the Peacock hand brake made by the National Brake Company, Inc., Buffalo, N. Y. All of the other heavy freight cars already owned by the company, 106 in number, are to be standardized and equipped as above.

CHICAGO TRACTION SITUATION

At the meeting of the Chicago City Council on Tuesday, March 7, the report of the committee on local transportation containing the proposed ordinance for an extension of the Chicago City Railway Company's franchises was presented. The report was ordered to be published. Mayor Harrison in a communication to the council, which was referred to the committee on local transportation, called attention to the need of requiring in a settlement of the franchise question with the Chicago Union Traction Company a guarantee that the company has a right to dispose of the rights of its underlying properties.

MASSACHUSSETTS LAW UPHELD—WORCESTER COMPANY'S VICTORY OVER CITY

In the STREET RAILWAY JOURNAL of March 4 brief mention was made of the decision handed down by the Supreme Court of the United States in the cases of the city of Worcester vs. the Worcester Consolidated Street Railway Company. Below will be found an extract giving the gist of this decision, the text of which has just appeared. In explanation it may be said that the city of Worcester sought to compel the Worcester Consolidated Street Railway Company to carry out certain provisions in its franchises subsequent to the passage of the street railway law of 1898 by the Massachusetts Legislature. The cases were taken to court on the ground that there existed between the company and the city a contract which the Legislature could not annul without the consent of the parties to the agreement. The decision of the court is in favor of the company, thus sustaining the general law governing street railways in the State. The court holds, in the main, as follows:

Enough cases have been cited to show the nature of a municipal corporation as stated by this court. In general, it may be conceded that it can own private property, not of a public or governmental nature, and that such property may be entitled, as is said, "to constitutional protection."

Property which is ruled by these corporations upon conditions or terms contained in a grant and for a special use, may not be devested by the Legislature.

This is asserted in Commissioners, etc., vs. Lucas, treasurer (93 U. S., 115), and in Mount Hope Cemetery vs. Boston (158 Mass., 509), the Supreme Court of Massachusetts ruled that cities might have a private ownership of property which could not be wholly controlled by the State Government.

It seems, however, plain to us that the asserted right to demand the continuance of the obligation to pave and repair the streets, as contained in the orders or decrees of the Board of Aldermen, granting to the defendant the right to extend the locations of its tracks on the conditions named, does not amount to property held by the corporation, which the Legislature is unable to touch, either by way of limitation or extinguishment. If these restrictions or conditions are to be regarded as a contract, we think the Legislature would have the same right to terminate it, with the consent of the railroad company, that the city itself would have.

These restrictions and conditions were of a public nature, imposed as a means of collecting from the railroad company part or possibly the whole of the expenses of paving or repaving the streets in which the tracks were laid, and that method of collection did not become an absolute property right in favor of the city, as against the right of the Legislature to allow or abolish it, or substitute some other method with the consent of the company, even though as to the company itself there might be a contract not alterable, except with its consent.

If this contention of the city were ruled valid it would very largely diminish the right of the Legislature to deal with its creature in public matters in a manner which the Legislature might regard as for the public welfare.

In City of Springfield vs. Springfield Street Railway (182, Mass., 41), this question was before the Supreme Judicial Court of Massachusetts, and in the contention of the city, to the same effect as the plaintiff in error contends in this case, was overruled.

It was therein ruled that the city acted in behalf of the public in regard to these extensions of locations, and that the Legislature had the right to modify or abrogate the conditions on which the locations in the streets and public ways had been granted, after such conditions had been originally imposed by it.

The case at bar was decided at the same time as the Springfield case (182 Mass., 49), and the proposition that the Legislature had the power to free the company from obligations imposed upon it by the conditions in the grant of the extended locations was adhered to, and the Springfield case cited as authority for the same. We concur in that view.

There is no force in the contention that the city of Worcester has a proprietary right in the property of the defendant in error, reserved to it under the original statute incorporating the Worcester Horse Railroad Company (chapter 148, Mass. laws of 1861). These sections simply give the city of Worcester the right during the continuance of the charter of the corporation and after the expiration of ten years from the opening of any part of said road for use, to purchase all its franchise, property rights, etc.

That right is not affected by the legislation in question, even assuming (which we do not for a moment intimate) that the act of 1898 affected the right of the city to make the purchase under the sections above cited.

We see no reason to doubt the validity of the act of 1898, and the judgments of the Supreme Judicial Court and the Supreme Court of Massachusetts are, respectively, affirmed.

SYRACUSE & SOUTH BAY EQUIPMENT

The Syracuse & South Bay Railway Company, to operate between Syracuse and Oneida Lake, a distance of 11 miles, has placed orders with the J. G. Brill Company for 10 car bodies, the trucks to be supplied by the Peckham Manufacturing Company. The orders are for June 15 delivery. The motor and other equipment will be bought soon. The cars will be 49½ ft. long, 8¼ ft. wide, 9½ ft. high; their weight will be 35 tons; seating capacity, 56 persons; and schedule speed, 45 miles an hour, every car being equipped with four 70-hp motors. The balance of the rolling stock to be purchased soon, includes 10 trailers, 5 flat and 5 box freight cars, and two electric locomotives. The rail order is also to be placed early. In addition to the summer resort business at Oneida Lake, the company is planning to do a large freight business, with a new line of steamers on the lake opening up a territory in the country north of the lake, which hitherto has not been well served in this regard as far as Syracuse is concerned. The name of the company is to be changed to the Syracuse Northern Traction Company as soon as the State Board of Railroad Commissioners grants the pending application for an amended route. Lieutenant Governor W. M. Brown, of Pennsylvania, is largely interested in the project. W. R. Kimball is the general manager, and George C. Towle the engineer.

THE CENTRAL PASSENGER ASSOCIATION AND THE ELECTRIC ROADS

Opinion seems to differ as to what the action will be at the next meeting of the Central Passenger Association regarding the relations between the steam roads and the electric railways. As is well known, the affiliation of steam roads with traction lines is forbidden by the rules of the association. Despite this embargo operating agreements have been entered into by several members of the passenger association in open defiance of that body. Foremost among the steam roads to make alliances with the electric railway was the Clover Leaf, mention of whose operations has frequently been made in the STREET RAILWAY JOURNAL. This company and several others have found the interlining of business most satisfactory. In fact, these companies are in no position to abrogate the agreements they have entered into with the electrics. Thus does the situation confront the association of holding these companies strictly to account for the infringement of the rules of the association, or of letting the matter slide in oblivion without any radical action. It is admitted that outright recognition of the electric companies is impossible without effecting a change in the whole rate situation.

IMPORTANT PURCHASE IN THE INTEREST OF THE LAKE SHORE

A syndicate represented by Warren M. Bicknell and E. V. Hale, of the Lake Shore Electric Railway, and composed of the larger stockholders of that company, has purchased the Lorain Street Railway Company, which operates 12 miles of street railway in Lorain, Ohio, with an interurban line to Elyria. The property will be acquired by the Lake Shore Electric, within two years, this being agreed to, as the Lake Shore is not willing to increase its indebtedness at this time. After their absorption by the Lake Shore, the Lorain lines will be operated as a part of the former system. The syndicate will furnish money to build a five-mile line from Avon Beach Park, on the Lake Shore Electric, to South Lorain. The opening of immense tube works at South Lorain will make of that place an important center, and the new line will give the town direct connection with Cleveland. At the same time the business between Elyria, South Lorain and Lorain City will be controlled by the line which has been purchased.

The present power station of the Lorain company will be turned into a sub-station, and power will be furnished by the Lake Shore Electric. The new cut-off to Beach Park will reduce the distance from South Lorain to Cleveland by about five miles. It will also place the Lake Shore Electric in a position to compete with the Cleveland & Southwestern Railway for Elyria business if it desires. The new line will be built at once, and it will necessitate the erection of a large steel bridge over Black River at South Lorain.

The Lorain Street Railway has a capital stock of $750,000, and a bond issue of $550,000, of which $200,000 is issued and draws interest at 6 per cent. The road was owned largely by Mayor Tom L. Johnson, of Cleveland, and was operated on an alleged 3-cent fare basis; three cents was charged in either Elyria or Lorain, and three cents between towns, or nine cents from center to center. The earnings for the year ending April 30, 1904, were about $96,000.

TENNESSEE-GEORGIA ELECTRIC RAILWAY INCORPORATES

The incorporation a few days ago of the Tennessee-Georgia Interurban Electric Railway Company insures the construction at an early date of the proposed electric railway from Chattanooga, Tenn., to Ducktown, via Ringgold and Catoosa Springs, Ga. The preliminary capital of the company is $300,000. Already plans are well under way for building, and it is hoped soon to begin active construction work. Interested in the company are several men well known to the electric railway industry. Foremost among them, perhaps, is S. W. Divine, Chattanooga, formerly vice-president of the Rapid Transit Company of Chattanooga. Others interested in the company are: J. H. Walker, Jr., J. C. Bryan, J. R. Jones, W. E. Biggen, J. M. Robinson, W. E. Bryan and J. W. Clark.

THE LATEST SUBWAY PROPOSALS FOR NEW YORK LOOP TO CONNECT BRIDGES

As the Street Railway Journal for March 4 was on the press when the recommendations were made to the New York Rapid Transit Commission by the committee on plans of that body for additional subway lines in Manhattan, Bronx, Richmond and Brooklyn Boroughs, it is proposed here briefly to review the routes so as to supplement the information already given. In all, more than a dozen new lines are proposed, with a number of alternate proposals. All of these are so planned that they may be operated independently of or in conjunction with existing lines. The estimated cost of building is $250,000,000. No less than four cross-town lines are proposed. These are to extend across the city from river to river under Grand Street, Fourteenth Street, Fifty-Ninth Street and Thirty-Fourth Street. The last of these it is proposed to operate as a moving platform line. The most pretentious of the recommendations is for a line from Pelham Bay Parkway, in the Bronx, to the Grand Central Station, at Forty-Second Street, thence to the Battery and back to Forty-Second Street. An alternative to this route is proposed, but is not of sufficient importance to justify its presentation here. A recommendation that is of especial interest to Brooklyn provides for a line beginning at the Manhattan terminal of the Williamsburg Bridge, west in Delancy Street, to Centre Street, to Brooklyn Bridge; to William Street, to Old Slip; crossing under East River by a double two-track tube; in Montague Street, to Fulton Street, to Willoughby Street; to Manhattan Bridge; to Fulton Street, to Lafayette Avenue, to Bedford Avenue, to Brooklyn terminal of Williamsburg Bridge. An alternative to this has been recommended. Another route for Brooklyn provides for a line in Fulton Street, to Willoughby Street, to the Manhattan Bridge, to Fulton Street, to Lafayette Avenue, to Bedford Avenue, in Bedford Avenue to the Brooklyn terminal of the Williamsburg Bridge. There is also an alternative to this. Other recommendations provide for routes as follows:

A route from the East River tunnel and Montague Street, in Court Street to Atlantic Avenue, to Fourth Avenue to Fort Hamilton.

A route beginning at the Brooklyn terminal of the Williamsburg Bridge, through Broadway, to East New York loop, and through Pitkin Avenue, in Brownsville, to Eastern Parkway. This is proposed for a four-track route throughout.

A route beginning at East Fourteenth Street and the river, Manhattan, under the East River, to North Seventh Street, through North Seventh Street to Union Avenue, to Broadway, Brooklyn.

A route in the Bronx as an extension of the present subway, beginning at the Harlem River and running north in Broadway to Kingsbridge. An elevated structure for the greater part of the way.

A route beginning at Eighth Avenue and 155th Street, across the Harlem River, to Jerome Avenue, to Woodlawn. The Woodlawn section to be an elevated structure.

A route (as an alternative to the route in the Bronx extending the present subway) beginning at the Bronx terminal of the Interborough road, north by the Boston Road and Morris Avenue, to White Plains Road, to Wakefield.

The commission, after an exhaustive discussion of the pressing need of relieving traffic congestion at the Manhattan end of the Brooklyn Bridge, has decided to build an elevated loop by cutting a new short street through from the present terminal site to Baxter Street, which is just east of Centre Street, and continuing it in Baxter Street to Delancey Street, thence to a connection with the Williamsburg Bridge, thus completing a loop between the bridges. It is understood that President Winter and the directors of the Brooklyn Rapid Transit Company are willing to rent this elevated loop.

MEMPHIS SYSTEM SOLD

Confirmation could not be secured in New York of the statement coming from Memphis, Tenn., to the effect that a deal has just been closed in that city, whereby the entire capital stock of the Memphis Street Railway Company has passed to the control of Isidore Newman & Sons and Ford, Bacon & Davis, of New York. Attempts at verification elicited the information that parties to the deal were all in Memphis, but that knowledge of the consummation of the sale had not yet come to hand. From unofficial sources The Street Railway Journal learns that the sale has been made, and that Geo. H. Davis, of the purchasers, has been elected president of the company to succeed C. K. G. Billings, of Chicago, who was the principal owner of the system. There are some 90 miles of standard gage track in the city. The rolling stock comprises 180 cars. The vice-president and general manager of the company is F. G. Jones.

LECTURE BY C. F. SCOTT BEFORE THE BROOKLYN RAPID TRANSIT EMPLOYEES' BENEFIT ASSOCIATION

The course in electricity which has been offered by the Brooklyn Rapid Transit Company during the past winter to its employees was terminated Monday evening, Feb. 27, by an interesting lecture upon "Single-Phase Railway Apparatus," by C. F. Scott, consulting engineer of the Westinghouse Electric & Manufacturing Company. An unusual opportunity was afforded to the employees of the company to familiarize themselves with the remarkable developments that have been made in this rapidly developing branch of the field of electric traction, and it was greatly enjoyed and appreciated. The lecture was held in the large auditorium of the Railroad Men's Building, at the Eastern Division shops of the company, at East New York, the attendance being over 360.

Although dealing with the technical side of electric railway work, the lecture was not confined to the interest of the engineering staff only, but was made to appeal to all employees of the company, particularly the motormen and employees in the electrical departments. Mr. Scott discussed the application of the alternating-current motor to railway work, first from an elementary standpoint, pointing out the particular requirements of present systems of electric traction, which make the use of alternating-current power desirable, and later, from a more technical standpoint, describing the apparatus that has been designed for the new system and enumerating the advantages to be obtained by its use. While nothing was touched upon in his talk which he had not included in previous lectures or papers upon the same subject, still Mr. Scott brought out many of the points in a new light and rendered them in a very lucid manner. His discussion of the advantages of the alternating-current system for heavy traction was especially interesting and instructive. The lecture was profusely illustrated by stereopticon views, showing all features of car and line equipments that have been designed by the Westinghouse Company for the new system of traction.

Prof. Edward Taylor, engineer of experimental work and testing of the Brooklyn Rapid Transit Company, who has had charge of the employees' school of electrical instruction given by the company, states that the results have been very satisfactory. The course commenced Oct. 10, 1904, and ended with Mr. Scott's lecture, Monday evening, Feb. 25. Nearly 200 pupils were enrolled, and the average attendance was over 80, exclusive of the last evening, when an audience of about 360 turned out. The early part of the course consisted of lectures and demonstrations by Mr. Taylor, including a large number of experiments with electrical apparatus and instruments, in which the pupils themselves were encouraged to take part, acting as assistants. Although the lectures dealt chiefly with applied electricity, the instruction went more fully into the laws and theory of physics and mechanics than is usually done in classes of this sort, and excellent results were secured.

After the thorough groundwork in the elements of electricity, the class was better prepared to appreciate the latter part of the course, consisting of lectures by a number of prominent educators and engineers, on various phases of electrical work, and which were largely attended. The course as a whole has, it is felt, been most beneficial, both to the employees themselves and to the company, and the interest and enthusiasm aroused this year should insure an even larger attendance and success in the next season's class.

CINCINNATI FRANCHISES

The Supreme Court of Ohio has handed down a decision sustaining the validity of the franchises under which the Cincinnati Street Railway Company, of Cincinnati, is operating. This brings to an end, in favor of the railway company, the long litigation over franchises pushed by Theodore Horstman. The franchises rest upon the so-called Rogers fifty-year franchise act, passed eight years ago and repealed by the next legislature. The court in its decision reversed the decision of the lower courts and dismissed the petition. There was no dissenting vote on the decision. The Rogers law was passed in April, 1896, and was a clause of an act regulating the granting of franchises to street railroad companies and the operation of street railroads in Ohio municipalities. The clause empowered municipal councils of Ohio cities or the equivalent body in Cincinnati (the board of administration) to extend railroad franchises for periods not exceeding fifty years, in consideration of certain minor concessions on the part of companies operating under existing franchises. In Cincinnati alone, of all Ohio cities, advantage was taken of this act to grant a fifty-year franchise, conferring upon the company privileges for fifty years from 1896. The next State Legislature repealed the clause permitting the extensions of franchises for fifty years. After the repeal, the Cincinnati franchises were thrown into litigation, and the Superior Court of Cincinnati decided that the franchises were invalid because the law had been repealed. The Legislature of 1902 passed a municipal code which contained a provision for twenty-five year franchises in all cities. It also contained an act separate from the code called a curative act, which sought to make valid all the franchises granted in Cincinnati under the Rogers law. It really is this curative act which the Supreme Court now holds to be valid in affirming the validity of the Cincinnati franchises. The decision affects only what was done nine years ago, and concerns Cincinnati alone.

NEW YORK CITY RAILWAY COMPANY'S REPORTS FOR QUARTER AND THE SIX MONTHS

The New York City Railway Company, operating the surface street railway lines in Manhattan and Bronx Boroughs, New York, has reported its earnings for the quarter and the six months. The reports for the quarter cover that period in which the company's lines first came into competition with the New York Subway. The report follows.

	1904	1903
December 31, quarter:		
Gross receipts	$4,286,275	$4,397,775
Operating expenses	2,354,407	2,173,336
Net earnings	$1,931,868	$2,224,439
Other income	318,731	367,459
Total income	$2,250,599	$2,591,898
Charges	2,791,543	2,633,216
Deficit	$540,944	$41,318

From this it appears that these lines have only lost $1212 in average daily gross earnings, as compared with the corresponding quarter in 1903.

July 1 to Dec. 31:	1904	1903
Gross receipts	$9,850,851	$9,409,819
Operating expenses	5,143,525	4,637,707
Net earnings	$4,707,276	$4,772,112
Other income	617,509	559,305
Total income	$5,324,785	$5,331,417
Charges	5,926,806	5,207,024
Deficit	$602,021	*$124,393

* Surplus.

SYRACUSE COMPANY SOON TO ORDER CARS

The Syracuse Rapid Transit Railway Company is to be in the market soon for eighteen semi-convertible cars. General Manager E. G. Connette announces that the Dudley and East Genesee Street and the Solvay lines of the company are to be equipped with new roling stock this year. The company is planning on a considerable extension of its double trackage this season.

THE REORGANIZATION OF THE COLUMBUS, DELAWARE & MARION RAILWAY

The reorganization of the Columbus, Delaware & Marion Railway will shortly be perfected. The company was organized a short time ago for the purpose of taking over the Columbus, Delaware & Marion Electric Railway, the Marion Railway, Light & Power Company, owning the city lines and lighting plant in Marion, and the Columbus Northern Railway, Power & Equipment Company, which was formed a short time ago for the purpose of erecting a large central power station, stringing new high-tension lines, and purchasing additional rolling stock. The capital of the new company is $2,500,000 of stock, and $2,500,000 of 5 per cent 40-year gold bonds. One million of these bonds will go to retire an equal amount of 5 per cent 20-year bonds of the Columbus, Delaware & Marion Electric Railway Company; $300,000 will retire an equal amount of Marion Railway, Light & Power Company's bonds; a like amount will retire an equal amount of bonds issued by the Columbus, Northern Power & Equipment Company; $300,000 will be held in trust for future improvements and extensions, and the remaining $600,000 will retire the preferred stock of the Columbus, Delaware & Marion Electric Railway Company, and pay the floating debts of the various companies.

The gross earnings of the consolidated properties last year were $260,000. It is estimated that with extensions and improvements now under way these will be increased by $100,000. The net earnings of the properties are estimated at $162,000, and the fixed charges are $110,000. As soon as the preferred stock has been exchanged, the consolidation will be complete.

KITTANNING & LEECHBURG COMPANY'S NEW PLANT—GAS ENGINES A FEATURE

The Kittanning & Leechburg Railway Company has placed in operation its new power plant at Garrett's Run, Pa., a mile south of Kittanning, and a place central for development in the district. The building is of buff brick, 45 ft. x 95 ft., with a clearance of 18 ft. from floor to roof trusses, and was designed to accommodate four 500-hp gas engines. In the center of the building, in the basement, is installed a 20-hp gas engine, which furnishes power for the air compressors and water pump. A 1000-barrel tank is supplied from a well 15 ft. from the building, which is fed from the Allegheny River, always assuring a sufficient supply of water. The machine referred to is a three-cylinder, vertical 500-hp engine, manufactured by Struthers, Wells Company, of Warren, Pa. The generator is of 250 kw., direct connected to the engine, which is supplied by natural gas, the electric railway having a ten-year contract with the largest gas producers in the district. Provision has also been made for a producer gas plant in case it should become necessary at any future time. The consumption of gas per horse-power-hour shows, on a test in the shops of the manufacturer of this engine, a smaller consumption than any known record, considering the size of the engine. A lively interest has been created in this plant by all power and light interests in the vicinity of Kittanning, as it promises to be the most modern and economical in the State. Upon the successful operation of this unit, orders for additional equipments will be given at once. The Kittanning & Leechburg Railways Company has 9 miles of line in operation.

INCREASE IN DUES OF THE INTERNATIONAL TRAMWAYS & LIGHT RAILWAYS ASSOCIATION

The secretary of the International Tramways & Light Railways Association, which is composed largely of street railway companies on the Continent of Europe, has issued a circular announcing the increase of dues decided upon at the last meeting of the association at Vienna. There are three classes of members, and the new annual dues are as follows:

For railway companies having annual gross receipts of less than fr.1,000,000, fr.50; between fr.1,000,000 and fr.2,000,000, fr.100; between fr.2,000,000 and fr.3,000,000, fr.150, between fr.3,000,000 and fr.4,000,000, fr.200; between fr.4,000,000 and fr.5,000,000, fr.250; above fr.5,000,000, fr.300.

The second class of members consists of engineering or manufacturing firms or companies who are interested in the tramway industry. Their annual dues are now placed at fr.100 The third class of members consists of individuals whose annual dues are fr.20.

BROOKLYN EMPLOYEES ENTERTAIN

The engineers and firemen of the Brooklyn Rapid Transit Company, constituting Kings County Division 419 of the Brotherhood of Locomotive Engineers and Atlantic Lodge No. 219 of the Brotherhood of Locomotive Firemen, held their annual ball at the New Labor Lyceum, Myrtle and Willoughby Avenues, Brooklyn, Tuesday evening, March 1. Between 500 and 600 members of the two associations and their friends were present, and enjoyed a programme of some thirty numbers. A feature of the order of dance was the dedication to special interests of certain numbers of the order. The two-step, "Fooling You," for instance, was dedicated by the members "to our master." Another two-step, "Coax Me," was dedicated to the superintendent. Among the prominent officers of the company present were: Dow S. Smith, general superintendent; W. O. Wood, superintendent of the elevated division; A. K. Stone, trainmaster of southern division; E. D. Newly, mechanical department of southern division; Frank McMurrough, general foreman of air brakes. Others of prominence in attendance were: Warren S. Stone, grand master of the Brotherhood of Locomotive Engineers; Albert Green, of the Galena Oil Company, and L. T. Gibbs, G. Ransom and George Curtain of the Westinghouse Company.

NEW YORK CENTRAL'S ELECTRIC PLANS IN CENTRAL NEW YORK—TURBINE STATION PROPOSED

John J. Stanley, of Cleveland, vice-president of the Utica & Mohawk Valley Railway Company, and a member of the Vanderbilt-Andrews syndicate, spent the greater portion of last week in Utica and Syracuse, and made several trips of inspection in company with officials of the New York Central & Hudson River Railroad over the West Shore Railroad, which is to be electrified between Little Falls and Syracuse. Mr. Stanley says that the plans for electrifying the West Shore, which have been under consideration for some time, will soon be ready, and that the work of electrifying that portion of the line between Frankfort and Mohawk, a distance of 3¼ miles, will be begun at once.

While in Syracuse Mr. Stanley made public the statement that it is the plan of the syndicate to erect a steam turbine power plant at Utica to take care of that part of the system. Mr. Stanley said that it had not been decided yet in what form the power will be applied to the motors of the cars. He said that the probabilities were that the cars on the West Shore would have a side contact trolley, as the third rail is dangerous and subject to interference from snow and ice. An overhead trolley would interfere with the continued use of the West Shore for locomotive-drawn freight trains.

THE INTERNATIONAL RAILWAY EXHIBITION AT WASHINGTON

Up to the present delegates have been appointed to the International Railway Congress from railways in the United States, Canada and Mexico, representing a mileage of over 150,000 miles. In nearly every case, the delegates chosen include officials of the mechanical and maintenance of way departments, and there will be over 400 accredited delegates to the congress from American railways. As already announced, this congress will be held May 3 to 14, and in connection with it there is to be an exhibit of railway appliances. The exhibition building is expected to be ready by April 15, but exhibitors proposing to erect their own booths or buildings will have access to the ground on or before March 20.

WELL-KNOWN RAILWAY AND MANUFACTURING INTERESTS IN A NEW COMPANY

The Electric Bond & Share Company, of Schenectady, N. Y., has been incorporated with the Secretary of State, at Albany, with a capital of $4,000,000, to construct and equip railroads, street surface railways, hydraulic, gas and electric plants. The stock is divided into $2,000,000 of preferred and $2,000,000 of common stock. The preferred stock is to bear 5 per cent cumulative dividends. The directors are: Charles A. Coffin, Charles W. Wetmore, Alden M. Young, Sydney Z. Mitchell, S. Reding Bertron, William M. Barnum, Louis M. Stanton, of New York; Marsden J. Perry, of Providence, R. I.; Jacob K. Newman, of New Orleans; Philip L. Saltonstall, Robert T. Paine, second, of Boston, Mass.; Homer B. Johnson, of Cleveland, Ohio; William B. McKinley, of Chicago; Hinsdill Parsons, of Schenectady; William H. Alms, of Cincinnati; Dwight W. Morrow and Graham Sumner, of Englewood, N. J. The main office of the company will be located in New York.

TRACTION AND POLITICS IN CHICAGO

The political campaign preceding the city election in Chicago has begun, and, as for eight years past, the traction franchise question takes a prominent part. The Democratic candidate, Judge Dunne, favors an attempt at immediate municipal ownership of the street railways by bringing condemnation proceedings against the street railway companies to secure their tracks. John Maynard Harlan, the Republican candidate, favors the making of a deal with the companies whereby municipal ownership may be possible in time. He is for a peaceable settlement of the present difficulties rather than an attempt to fight them out in the courts, which is sure to take years. In the first speech of the campaign, Mr. Harlan referred to the traction problem as having been a veritable old man of the sea, hanging on the neck of Chicago, the city being taken up so much with the thought of the traction problem that it has neglected other important matters. In conclusion, he said regarding this matter:

"We must shake loose from the thrall of this traction problem. Something soon must be doing, and if the people and the Council and the Mayor stand together, and push together, and pull together, something soon will be doing. We have companies of all ages, some hoary with years, and others scarcely weaned; we have securities of different names, and of different character, piled in layers one on top of the other; we have securities filtered and unfiltered, securities digested and undigested, and now is the time when we must all join together and dig down until we touch rock bottom, and find out where the traction question is, and what property is really there."

ANOTHER OHIO ROAD IN TROUBLE

Delay in floating bonds has precipitated financial troubles for the Springfield, Charleston, Washington C. H. & Chillicothe Traction Company. The line was projected by Springfield people, and was deigned to extend from Springfield to Chillicothe. It was placed in operation to Charleston about a month ago. Entrance to Springfield was provided over the tracks of the Springfield & Xenia Traction Company, from which it was supplied with power. Liens aggregating $60,000 have been filed against the property by the General Electric Company, American Steel & Wire Company, and others who furnished material. Failure to pay for current caused the Springfield & Xenia Traction Company to shut off current. The stopping of the cars resulted in an arrangement whereby the Springfield & Xenia Company will operate the road temporarily, paying the crews and other expenses and keeping the balance of the receipts until claims are paid. Several parties are now looking over the property with a view to purchasing it.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEB. 21, 1905

782,982. Fender for Street Cars; William O. Mundy, St. Louis, Mo. App. filed March 14, 1904. Details of construction.

782,998. Track Bed Constructiion; Frank M. Turner, Dayton, Ohio. App. filed Aug. 22, 1904. Filler-brick so disposed in contact with an ordinary T-head rail that it may be used to serve the purposes of the flanged-head rail.

783,027. Electric Railway; Joseph DelaMar, New York, N. Y. App. filed March 8, 1904. The third rail is hollow and serves as a carrier for a feed wire so that the rail will be normally out of circuit and dead. When a train passes along it will automatically cut in the current at the part of the rail opposite the train and cut it out as the train passes.

723,028. Electric Railway; Joseph DelaMar, New York, N. Y. App. filed June 9, 1904. The contact shoe carries a roller adapted to engage a sliding switch arm in the housing for the feed wire, and close the circuit to the latter, while another roller following the first, in a similar manner, opens the circuit.

783,080. Electric Coupling; Edward F. Ruth, Baltimore, Maryland. App. filed June 2, 1903. A coupling whereby a disabled car may be provided with light and heat from a [illegible] car.

783,228. Trolley; Charles J. Sosenheimer, Allegheny, Pa. App. filed Aug. 11, 1904. Relates to the construction of the harp.

783,326. Tramway or Light Railway Car; Ethelbert A. Stanley, Preston, England. App. filed Oct. 1, 1904. Relates to that type of car convertible from a closed to an open car, or vice versa, and has special reference to the disposition of sliding panels, and to ventilation.

UNITED STATES PATENTS ISSUED FEB. 28, 1905

783,449. Street Car; William P. Michel, New York, N. Y. App. filed Aug. 17, 1904. An open car in which the handles are placed forward of each seat at the side where the passengers dismount, in lieu of being placed opposite the ends of each seat.

783,458. Trolley; James A. Norton, Wilkesbarre, Pa. App. filed Dec. 23, 1904. Relates to lubrication and provides means whereby the trolley wheel may be readily removed and replaced.

783,507. Emergency Device; Fred B. Corey, Schenectady, N. Y. App. filed June 16, 1904. Automatic means whereby the power is cut off and brakes applied when the controller handle is released by the operator.

783,537. Motor Controller; William A. McTaggart, Schenectady, N. Y. App. filed Aug. 15, 1904. Consists of an arc-deflector section comprising a thin deflecting plate having laterally projecting spacing bosses.

783,715. Circuit Controller; Rollin A. Baldwin, New Haven, Conn. App. filed Sept. 29, 1904. Comprises a shoe or frame to be applied to the trolley wire by clamping over the same, the trolley passing over the exterior surface of the shoe and in contact with a metal face thereon, so that current will, for the instant, be drawn through a branch circuit for the operation of signals or switches.

783,735. Ratchet Brake for Street Cars; Jacob Roediger, St. Louis, Mo. App. filed July 15, 1904. Details of a quarter-turn ratchet brake.

783,757. Street Car Construction; James Paton, St. Louis, Mo. App. filed July 11, 1904. In a vestibule car, an outer wall which carries the car headlight, an inner wall adjacent to said outer wall, and a removable panel in the inner wall opposite the headlight.

PERSONAL MENTION

MR. CHARLES W. CROSS, formerly electrical engineer for the Eastern Ohio Traction Company of Cleveland, has entered the employ of the Crocker-Wheeler Company at its Cleveland office.

MR. ORPHA JACKSON has resigned as superintendent of the Springfield Railway Company, of Springfield, Ohio. It is understood that he will go with the McKinley syndicate, which operates electric railway properties in a number of Illinois cities.

MR. CHARLES G. LOHMAN, a division superintendent of the Indianapolis Traction & Terminal Company, operating the city lines in Indianapolis, Ind., and the terminal station in that city, has resigned from the company to accept the position of superintendent of the Indiana Railway Company, of South Bend, Ind.

MR. W. T. PIERCE, of St. Louis, has been appointed general superintendent of the Mexico Electric Tramways Company, Ltd., of the City of Mexico, to succeed Mr. S. S. Neff, resigned. Mr. W. W. Wheatly, the general manager of the company, has been acting in the dual capacity of general manager and general superintendent since Mr. Neff resigned.

MR. HORACE E. ANDREWS, president of the Cleveland Electric Railway Company, and a member of the Andrews-Stanley syndicate, was in New York the latter part of last week accompanied by a party of prominent Cleveland citizens, who came to inspect the subway as being relevant to the talk of putting in a short underground railroad in Cleveland to relieve congestion on the public square. It is proposed by the party to visit Boston before returning home.

MR. ARTHUR C. RALPH, for several years in charge of the Marlboro Street Railway, of Marlboro, Mass., as superintendent, and formerly general superintendent of the Boston & Worcester Street Railway, has been appointed general manager of the Taunton & Pawtucket Street Railway and Middleboro, Wareham & Buzzards Bay Street Railway, operating in Massachusetts and Rhode Island. Mr. Ralph will have headquarters in Taunton, and in his new capacity will have 50 miles of street railway to look after.

MR. J. C. HENDERSON has been appointed assistant to President Samuel Insull, of the United Gas & Electric Company, of New Albany and Jeffersonville, Ind., which operates the public utilities of both cities, including the traction line of the Louisville & Southern Indiana Traction Company. Mr. Henderson will have charge of the construction and the technical branch of the operating department of the gas and electric light plants of New Albany and Jeffersonville, the New Albany waterworks, the street railway lines of New Albany and Jeffersonville and the interurban line between the two cities, which is now being extended over the Big Four bridge at Jeffersonville to Louisville.

THE PARTY ACCOMPANYING MR. W. T. VAN BRUNT, formerly general manager of the St. Joseph Railway, Light & Power Company, of St. Joseph, Mo., which is visiting South America, has reached Rio Janeiro. It consists, besides Mr. Van Brunt, of Dr. Eugenio Dahne, who was Brazilian commissioner to the Louisiana Purchase Exposition; Mr. E. I. Robinson, general manager of the LaClede Car Works; Mr. O. U. Von Schrade, St. Louis; Mr. J. C. Roberts, of Niagara Falls; Mr. M. R. Scherrerd, of Newark, and Dr. Thurlow W. Reed, of New York. The party sailed for Brazil in the yacht "Margaret," which was chartered from Col. Emerson, of Baltimore, and visited a number of the West Indian Islands on the way to Brazil.

MR. GEORGE W. PIERCE, superintendent of the Stamford Street Railway Company, of Stamford, Conn., has been appointed general manager of the New York & Stamford Railway Company and the Greenwich Tramway Company, which have just been formally transferred to the Consolidated Railway Company, representing the New York, New Haven & Hartford Railroad. Mr. Pierce has been connected with the Stamford Company since 1893, and was with the Norwalk (Conn.) Tramways when that company was interested in the Stamford system. When the latter was taken over by the New York, New Haven & Hartford Railroad, he was made superintendent of the lines. Under his direction the change in motive power from horses to electricity was made, and extensions were built to the system increasing it from 7 to 17 miles. Assistant Superintendent Webb, of the Stamford Company, will be continued in that capacity as lieutenant to Mr. Pierce.

MR. THOMAS W. WILSON, the new general manager of the International Railway Company, of Buffalo, was graduated from Lehigh University in 1894. In vacation periods prior to that time he pursued the study of street railway construction in the drafting room of the Pennsylvania Steel Company at Steelton, Pa., and on the company's lines. Upon leaving college Mr. Wilson entered the permanent employ of the Pennsylvania Steel Company as engineer of survey and special work. In 1896 he resigned to become assistant engineer of the Charleston (S. C.) Railway Company. One month later he was made chief engineer of the system, and while with the company supervised the construction of the lines to electricity, and did much construction work. Early in 1897 Mr. Wilson returned to the Pennsylvania Steel Company, but resigned a few weeks after to enlist in the Eighth Regiment of Pennsylvania Volunteers. His transfer to the engineering corps soon followed, and at the close of the war he was chief topographer of the Second Army Corps. After a few months service with the Pennsylvania Steel Company, following his muster-out, Mr. Wilson went to Buffalo as assistant engineer of the International Railway Company. After serving in that capacity for four years he was appointed chief engineer of the company. His promotion to the general managership followed the resignation of Mr. Thomas E. Mitten. Mr. Wilson was born in New York City in 1872, and is a member of the American Society of Civil Engineers and American Institute of Mechanical Engineers, and is first vice-president of the Engineers' Society of Western New York.

THOMAS W. WILSON

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1905, to date, 90,950 copies—an average of 8268 copies per week.

Ticket Rates in Ohio and Indiana

The Ohio Interurban Railway Association, after some five or six months of consideration and reconsideration of the question of an interchangeable coupon ticket good on different Ohio interurban roads, came finally to a decision, as announced in these columns some months ago. The Indiana Electric Railway Association is now in the midst of a similar dilemma, for dilemma it can truly be called when all of the points to which attention must be given are considered. As the regular rates of interurban roads per mile vary considerably, it is utterly impractical to adopt a mileage book, because such mileage book would have to be sold at a rate per mile lower than the lowest regular rate of any company party to the agreement. The very simple and satisfactory way out of this difficulty adopted in Ohio was to issue, instead of mileage books, coupon books containing a certain number of 5-cent coupons, these coupons being accepted in place of money in payment of fare on the various roads. The books in Ohio are sold at a rate which gives the traveler a reduction of 16⅔ per cent from his regular fare. These books are proving very popular with the traveling men, and we understand that over 1000 are already in use, although they have been out but a short time.

Now comes the Indiana Association with an equal appreciation of the importance of an interchangeable ticket and a committee to investigate the matter, as noted in the report of the Lebanon meeting of that association. Although no conclusions have been reached, it is evident at this stage of the game that any ticket adopted by the Indiana roads must be of the same general character as the Ohio ticket, because the Indiana roads also vary greatly as to the rate charged for regular fare per mile. The Indiana rates are some of them so low that it is not thought the companies with the lower rates would enter an agreement which would cause a 16⅔ per cent reduction from the regular fare on coupon tickets. The sentiment in Indiana seems to be in favor of a reduction of not over 10 per cent. Now, it is highly desirable that the same form of ticket be adopted by both States. The Ohio Association realizes this so much that the officers of the Ohio Association are following the proceedings of the Indiana men with a great deal of interest. They make no secret of the fact that they think that the adoption of a different ticket in the two States would be a mistake. These tickets are intended for the regular traveler more than for anyone else, and, as a general thing, those who travel in Ohio also travel in Indiana. It will be to the benefit of the roads of both States if a ticket good in both States be adopted. There is at the present time apparently a difference of exactly 6⅔ per cent in the ideas of the associations of the two States, although the Indiana Association has been careful not to go on record as yet. In Ohio, when this ticket matter was first brought up, the conditions as to rates of fare were much the same as in Indiana—that is, there were some roads having rates as low as 1¼ cents a mile, and a reduction of 16⅔ per cent was more than these roads could stand. The difficulty has been got over in Ohio by the raising of the rates by such companies as had this low rate.

It may be necessary for the Ohio men to agree to a smaller discount on coupon tickets than is now in force if there is to be a ticket good in both States. At any rate, the Indiana Association will do well to go very slow before adopting a separate ticket from the Ohio roads. The two States have everything to gain and nothing to lose by uniting on a form of ticket acceptable to both. The matter will have to be compromised, but by giving a little here and a little there, the companies ought to get together to the advantage of all.

Free Interline Baggage in Ohio

The broad-minded spirit of the men in charge of the Ohio interurban railway properties has been well illustrated by the decision recently reached in the Ohio Interurban Railway Association to check baggage free on interline business where a passenger has a ticket over two or more connecting lines. Although many of the companies do not really desire this, the decision was unanimously in favor of checking free on interline business, because of a belief that it was for the good of all interurban traffic in general to do this and that no one company should stand in the way of what some other companies feel strongly to be necessary. As a consequence of this rule, some rather queer situations can be found among the Southern Ohio roads, where a passenger holding an interline ticket gets his baggage carried free, while next to him may be a passenger with a local ticket who is charged 25 cents for his trunk. Of course, there is more justice than at first appears in such a state of affairs, because the company, to handle the local passenger's trunk, may be put to considerable more trouble in proportion to the revenue received than in the case of the through passenger. It is probable, however, that this rule is an entering wedge which will in time result in the free checking of local baggage on all the Ohio roads.

Considerable fear has been expressed lest checking baggage free result in the abuse of the privilege so that merchandise and express matter will be carried by local passengers as baggage, where before it would go as express or freight at express or freight rates. We are inclined to think that an abuse of this kind could be prevented to a large extent by a strict interpretation of the rules regarding personal baggage. Miscellaneous merchandise cannot be checked on steam railroads as personal baggage, nor should it be so checked on electric roads. Of course, it is possible that some regular local passengers might find it worth while to pack merchandise in trunks for the sake of getting free transportation for it, but everything considered, it is not likely that these abuses would amount to much in the aggregate. One of the greatest fears seems to be that free baggage privileges will be taken advantage of by farmers who make a regular trip to town with farm products, but it ought not to be difficult to stop such abuses.

Lighting Offices from Car Houses

When the general offices of a street railway company chance to be located near a car house it is often worth while to ascertain if they cannot be lighted at less expense than by the purchase of current from the local electric light company. The matter is a simple one if an alternating-current sub-station is installed at the car house for the power supply of the local cars, and unless the local central station is in a position to quote exceedingly low rates it generally is cheaper for the street railway company to install its own transformers and supply the office and car house lights from its own circuits.

With direct-current 600-volt supply in the car house and no alternating circuits available at the offices, a frequent method of obtaining lighting current independently of the central station is to install a motor-generator set in the car house, as the insurance rules forbid the installation of either lighting or power circuits in ordinary buildings when one side of the line is the trolley wire and the other side the ground return. The motor-generator set is, of course, open to the objection of any moving mechanism in comparison with a stationary system like that furnished by a small lighting transformer and its connections; it may also occupy floor space which can ill be spared; it introduces the never-ceasing charges of interest, insurance, taxes and depreciation, requires some attendance, and at loads below its normal rating sags considerably in efficiency of transformation.

These objections, however, are often far from serious in connection with car house operation. The motor-generator bears an enviable reputation for maintaining continuous service. It can easily be installed on an overhead platform if floor space is not available, particularly in the small sizes necessary for lighting service, and as for attendance, the cost of looking after the outfit by the regular car house force is insignificant. The success which has attended the motor-generator in the exacting requirements of telephone exchange operation is a good thing to remember.

Each specific case, however, must be figured on its own merits, the treatment being somewhat as follows, assuming a concrete example: Given a suite of general offices adjoining a car house, with a total installation of 120 incandescent lamps of the usual 16-cp type, and local lighting rates 15 cents per kw-hour, it is interesting to compare the cost of home production with the central station bill for a year's service. Assuming that the average lighting load occurs with 60 lamps burning 1½ hours per day and 300 days per year, with a Sunday and holiday average of 10 lamps burning 1 hour each, we have an annual consumption of 2760 lamp-hours. Allowing 15 lamps per kilowatt, the bill comes to $276, or $23 per month. With a 10 per cent discount, the cost of office lighting falls to approximately $250 per annum, the energy consumption at the meter being 1,843,000 watt-hours. Assuming a flat rate of 10 cents per kw-hour, the bill amounts to about $185.

A motor-generator set rated at 6.5 kw, and consisting of a 125-volt direct-current generator, direct driven by a 600-volt motor, would be amply large for the work in hand and allow liberal provision for future extension of the lighting service. Such a machine should not cost over $500 installed, and allowing 6 per cent interest, 8 per cent depreciation and 1 per cent insurance and taxes, the fixed charges come to $75. The cost of attendance and maintenance ought not to exceed $25 per year. As for the cost of power, it should be possible in most cases to supply 600-volt direct current at a city car house trolley wire at not over 2.5 cents per kw-hour. With 1893 kw-hours demanded by the lighting circuits and an allowance of 75 per cent as the efficiency of the motor-generator set, we have a power cost of $61.50. The total cost of the lighting service, exclusive of lamp renewals, which we may assume to fall upon the street railway company in each case, amounts to about $162 per year, or a little over $13 per month.

It will be seen from these figures that unless the central station rate for commercial incandescent lamps is well down toward what is, in many localities, a low price for even power service, it is decidedly worth taking a little time and trouble to find out just what the possibilities are. In case the trolley voltage fluctuates widely at the car house, it will probably be necessary to install a differentially wound generator instead of the ordinary compound machine. When the car house sub-station includes a storage battery, however, there need be little anxiety in regard to the regulation of the lamp voltage. With alternating current at the power house and no sub-station at the car house, it is important to figure the cost of running an a. c. line for both car house and office lighting before deciding either to patronize the local central station or to install a motor-generator set. A hundred dollars a year is the equivalent of 2000 5-cent fares, and is worth saving in any event.

The Rapid Transit Problem

One of the most interesting features of opening new rapid transit lines for service in the densely populated districts of large cities is the effect of these additional facilities upon the volume and distribution of traffic within the tributary region. It has long been recognized that a permanent solution of the rapid transit problem in a growing city cannot be secured by the development of any single route of high-speed service. New facilities not only open up additional avenues of travel and thereby tend to—and often do—relieve the congestion existing upon other lines; they apparently create traffic, which sooner or later grows to a volume that requires additional means of transportation to be furnished. In other words, the new routes laid out from time to time produce a temporary alleviation, but ultimately become inadequate to handle the traffic which seeks outlets through them.

This absence of a permanent cure of congestion by any specific remedial line of transit has led to the belief in some quarters that there is little hope of solving the problem of urban transportation by increasing the internal railway facilities of great cities through the addition of subways, tunnels, elevated structures and even surface routes to the existing means of handling traffic. This contention is ably supported in a recent number of the "Forum" by Henry Harrison Suplee in his review of recent progress in applied science. Mr. Suplee's argument, in brief, is that the provision of greater facilities cannot be expected to relieve a congestion which they really aid in creating; that they actually attract more people to the business districts, increasing the number of persons daily carried between the business and the residence sections; that the strongest hope of relief at present lies in a wider dispersion of the residence sections from the business districts; that every effort should be made to discourage the provision of additional facilities reaching such portions of the city as are already well filled, while making it exceedingly convenient to reach fairly remote and partially developed suburbs; that numerous trains should be run from the heart of the business districts at maximum speed to suburbs where there is room to spread, giving no opportunity for alighting in the sections already well filled; and that a large part of the traffic could thus be directed over a far greater area, leading ultimately to the use of the entire area of the original city for business purposes, with a tributary suburban residence area outside, having reasonable population density.

In looking into problems of this character it is important to take the broadest possible view of the factors and conditions involved. Pedestrian and vehicular traffic contribute to the congestion of cities no less than does railway traffic. It is open to grave doubt whether the sum total of traffic in a large city is increased to such an extent by new rapid transit lines that the congestion of the city as a whole is made worse than before the new lines were opened for service. Rather it appears that the regular growth of great cities, increase of population, addition of new industrial establishments, extension of office building facilities and the like—phenomena set in motion by deeper economic causes than the mere creation of new internal rapid transit routes—are the true causes of urban congestion. Concentration is the great tendency of twentieth century business. The modern office building would certainly appear to be a far greater cause of congestion than the rapid transit line, which is constantly at work in the effort to relieve the condition in the territory which it serves. It must not be forgotten that every person who travels by a rapid transit line means one less pedestrian or vehicle passenger on the street itself; that the movement of large numbers of people upon railways is a far more speedy and efficient method of relieving congested streets than any other known.

It is reasonably certain that the growth of great cities continues and will continue even where new rapid transit routes are not opened. Whether we like it or not, the business of these cities gravitates to the central region every time, and there is little prospect that the trend of affairs in the future will be outward until the saturation point of the congested district is well in sight. Certain manufacturing plants, educational institutions and special organizations like music halls, art museums, etc., swing away from the heart of a metropolitan business district long before the region overflows into the less populous sections; but the vast majority of a city's workers, housed during business hours within office buildings and mercantile establishments, or else occupied in or about the streets themselves, can only be relieved from the throttling conditions of slow travel by internal rapid transit routes. It is only necessary to see the colossal inconvenience suffered by congested districts which remain unprovided with rapid transit facilities to appreciate the great usefulness of such facilities in making travel easier and quicker. If a modern large city should stop growing, the rapid transit problem could readily be solved, and solved permanently; as it is, the best that can be done is to develop such routes as nearly as possible along the consistent lines of an efficient and inter-related system. Comprehensive schemes of this character are being worked out at the present time in New York on north and south lines, not to mention the great railroad developments running from west to east.

Enough has been said, we believe, to show that internal rapid transit routes relieve congestion as a whole instead of increase it; that they do not of themselves notably increase the population of our great cities, since by their inception they enable urban workers to travel more speedily and easily within the congested districts, and also to live further away from their places of business; and finally, that the office building—specifically the high-speed passenger elevator—is one of the prime causes of urban congestion, and is likely to remain so. Hence the unwisdom of trying to stem the tide of city travel by overburdening the existing facilities for its handling, and the far-sighted sagacity of providing new routes in a comprehensive transportation scheme within the city limits.

As for the suburban problem, the electrical equipment of steam railway local service offers the best solution at the present time. The running of numerous express trains without stops from the business district to sparsely settled suburbs is an operating scheme of doubtful financial expediency. Frequent and limited service of this character can seldom be profitably given without an adequate volume of supporting traffic. The rapid acceleration of the electric motor in comparison with the steam locomotive means a great deal to the distant suburbanite in the way of shortened time of transit. The elimination of stops is a serious question outside the city proper, and particularly is this true within the zone of 5-cent fares on the trolley lines. It is safe to say that suburban development must be from within the city outward, and that artificial restrictions of suburban population density based upon reduced service are bound to be of doubtful value from the standpoint of both the traveling public and the transportation companies.

POWER HOUSE OF THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY

A description was published in the STREET RAILWAY JOURNAL for Feb. 18 of the single-phase system of the Indianapolis & Cincinnati Traction Company. Single-phase operation is, however, not the only interesting feature of the installation, the general engineering involved, and especially the equipment of the power house, being worthy of careful attention. The selection of

STANDARD CAR, RUSHVILLE LINE

Sargent & Lundy as the consulting engineers made it certain that the whole work of equipment and installation would be along the most skilful lines of modern practice. Their latest work fully sustains the high reputation of this firm. Some particulars of the power station were published in the previous issue referred to, but in view of the interest which attaches to this line, further information, which was not available at the time of the previous description, is now published.

Current for the operation of 120 miles of railway is supplied from a single power station. This is located in Rushville, Ind., about 40 miles from Indianapolis and about 80 miles from the other end of the completed line. The site is adjacent to the Cincinnati, Hamilton & Dayton Railway, with a connecting track from that road to the company's side track alongside the power station, which track in turn is connected to the main track of the operating company. This arrangement is convenient for ordinary business, and will be especially useful whenever it becomes necessary to burn coal under the boilers. Natural gas is now being used. The side track along the power station is built at a proper level for the dumping and crushing of coal, so that it can be handled by carrier and elevator and fed under the boilers on chain grates without manual handling of any kind. A mill race from the stream known as "Flat Rock" runs along the east side of the power station. The company has a perpetual contract for the use of this water for condensing and other purposes.

BUILDING

The station building is 113 ft. x 128 ft. 10 ins., and is of very heavy and substantial construction. The foundations are of concrete and the upper walls are of brick laid with cement mortar. The floors and other frame work and roof structure are of steel. Floors are of concrete, and a gravel asphalt roof is laid upon a concrete base with expanded metal, leaving nothing about the building that can burn except the doors and windows. The building is designed and constructed with a view to the installation of coal-crushing and automatic coal-handling machinery, with overhead bunkers feeding direct to the boiler grates. As natural gas is being used as fuel at the present time, the coal bunkers and carriers have not yet been put in, but everything is prepared for their installation, even to the punching of holes in the steel structure from which the coal bunkers will be suspended.

Foundations for the engines, boilers, pumps and other machinery are all of solid concrete. Stairways are made of either steel or concrete. The cellars and chambers for electric wires, cables, switches, transformers, protective apparatus, etc., are built according to the most modern practice and in the most substantial manner. The structural and architectural features of the building were designed by Sargent & Lundy, the consulting engineers, and constructed under their supervision. The John A. Schumacker Company, of Indianapolis, was the general contractor, and the American Bridge Company furnished the larger part of the steel work.

WATER TUNNELS

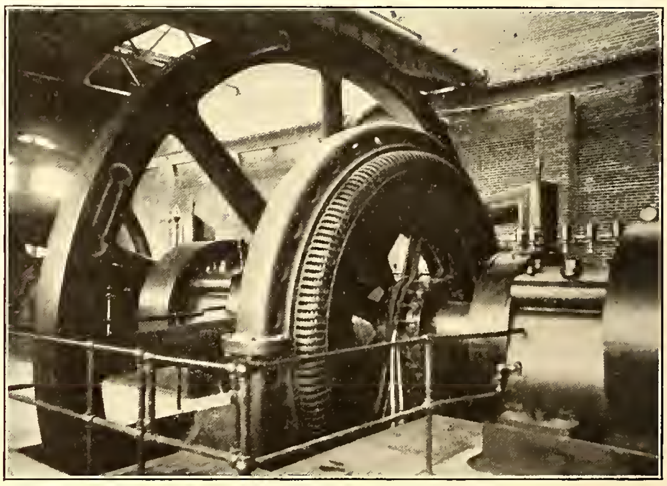
A concrete tunnel or pipe 3 ft. 6 ins. in diameter, running under the basement floor, conveys the water from the mill race to the condensers, and a similarly constructed tunnel is provided to carry the water back again to the mill race, connecting at a point some 300 ft. below the intake. The supply tunnel is provided with an intake crib which is equipped with an iron grill and removable screens.

SMOKESTACK

At the east end of the power station erected upon a heavy concrete base is a well proportioned, self-supporting steel stack 180 ft. high, lined its entire length with fire brick. The inside measurement of the stack is 11 ft. It is of sufficient size to take care of eight 350-hp boilers, space for which is provided in the present building. The stack was constructed by the S. Freeman & Sons Manufacturing Company, of Racine, Wis.

FUTURE EXTENSIONS

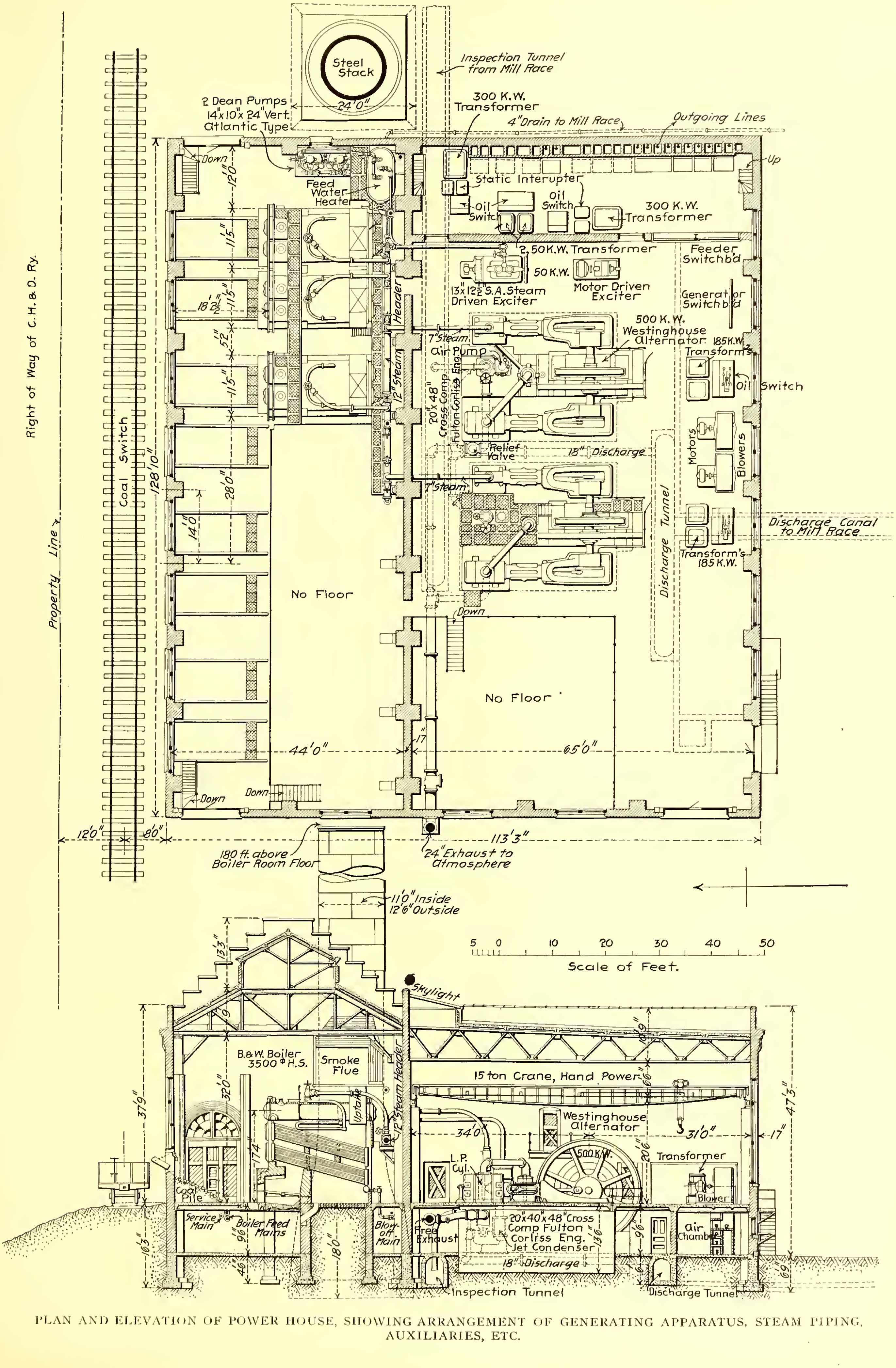
The power house is so framed and constructed that the west wall can be taken out without disturbing the other walls or the present steel frame work, and the building extended to the west. For this purpose a space of over 200 ft. has been reserved for extensions to accommodate the future needs of the company.



VIEW OF ONE OF THE GENERATING UNITS

EQUIPMENT

The present equipment includes three Babcock & Wilcox water-tube boilers of 350-hp nominal capacity each. Each boiler contains in the setting a Babcock & Wilcox superheater proportioned for about 100 degs. of superheat. Space is provided in the building for five additional boilers of the same capacity, which will be installed as rapidly as additional power is required. Natural gas is being burned under the boilers,

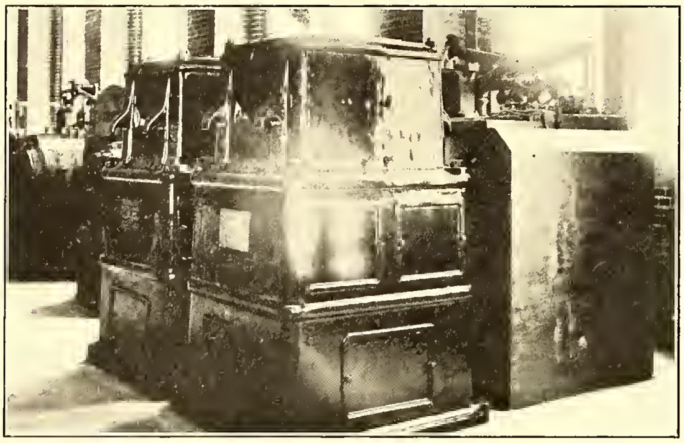


PLAN AND ELEVATION OF POWER HOUSE, SHOWING ARRANGEMENT OF GENERATING APPARATUS, STEAM PIPING, AUXILIARIES, ETC.

but, as has already been said, provision is made for the use of coal if at any time the supply of natural gas becomes exhausted. The boilers are now equipped with flat grates set in an extension furnace, but the setting is arranged so that chain grate stokers can be easily installed when the coal-handling apparatus is put in.

The boiler room is equipped with a large open exhaust feed-water heater of the Stillwell-Bierce make, and with two vertical "Atlantic type" feed-pumps, built by the Dean Brothers Steam Pump Works, of Indianapolis.

The engine room is provided with a traveling crane, built by the Northern Engineering Works, of Milwaukee, of sufficient



250-KW AIR-BLAST TRANSFORMERS AND OIL SWITCHES

capacity to handle all the machinery, and which greatly simplifies the work of installation. The present generating equipment, as stated in the previous issue, includes two 700-hp Corliss type, cross-compound, condensing engines, built by the Fulton Iron Works, of St. Louis, Mo. Each engine is equipped with an independent steam drive jet condenser, made by the Dean Brothers Steam Pump Works. The condensers are set in the basement, but are arranged for operation from the main floor level.

Each engine is direct connected to a 500-kw, 2300-volt, three-phase, 25-cycle, Westinghouse revolving-field, alternating-current generator running at a speed of 94 r. p. m. The engines are operated at a steam pressure of 140 lbs. per square inch, and are guaranteed to deliver the maximum capacity necessary to drive the generators.

The generators are of standard Westinghouse construction. The frames of the stationary armatures are of cast iron and surround inner cores of laminated steel, which are built up with overlapping joints so as to form a circular ring, slotted to receive the coils. The slots are of the partially closed type, and the coils are connected to give the three-phase relation. The field core is formed of laminated punchings, dove-tailed to a cast-iron spider. It has thirty-two poles, each of which is wound on a machine-formed coil. The field is separately excited. The generators will develop full load continuously under normal conditions with a temperature rise not exceeding 35 degs. C. above the surrounding air, and immediately following such a full load run will carry 50 per cent overload for a limited period with a temperature rise not exceeding 55 degs. C. The generators have a close inherent regulation, but arrangement has been made further to control the voltage by means of Tirrill regulators mounted on the switchboard. The present engine room provides sufficient space for the installation of two additional generating units.

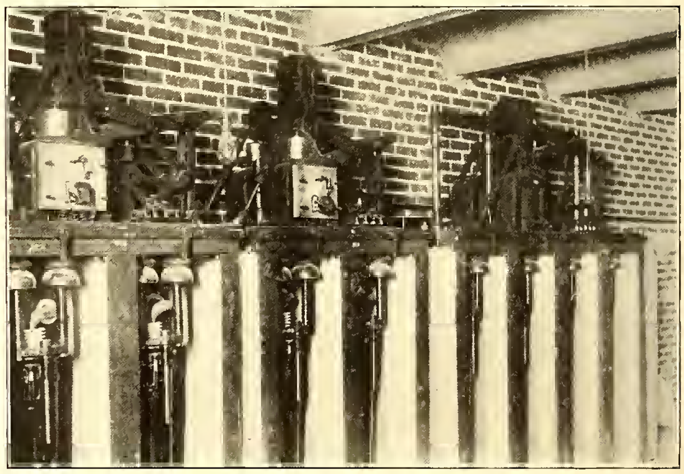
Two exciter sets have been installed, one of which is driven by a Westinghouse compound steam engine, the other by a type C induction motor, which in turn is driven from the main generators through transformers.

The generators are connected directly to two pairs of 250-kw air-blast transformers, which are connected according to the Scott three-phase, two-phase system, to transform the current from 2300 volts three-phase to 33,000 volts two-phase, at which higher potential it is delivered to the transformer stations along the line of the railway, and to the lowering transformers in the power house which supply the portions of the trolley located in and near the city of Rushville. Air to cool these step-up transformers is furnished by a pair of 90-in. fans made by the Sturtevant Company, and driven by Westinghouse type C induction motors.

The air-blast transformers are connected in pairs, and each pair is connected in turn with its own generating unit. The high-tension coils of the transformers are divided so that they may be connected for either 16,500 volts or 33,000 volts. The low-tension winding is designed for 2300 volts, the potential of the generators. The insulation between the high-tension coils and core was submitted to a test of 66,000 volts alternating current for one minute, and for the same length of time a potential of 4600 volts was applied between the low-tension coils and core. These transformers are designed to carry full load for twenty-four hours with a temperature rise of 25 degs. C. above the temperature of the surrounding air, and after a full load run under these conditions each will carry an overload of 40 per cent for two hours with a final temperature rise not exceeding 55 degs. C. Their efficiencies are approximately as follows:

	Per Cent		Per Cent
Full load	97.4	Half load	96.1
Three-quarter load	97	One-quarter load	92.8

Between the high-tension coils of the step-up transformers and the main bus-bars, 33,000-volt, oil-insulated, electrically-operated, two-phase, non-automatic switches have been installed. On each outgoing feeder leading to the transformer stations a double-pole automatic switch of similar type has been inserted, and each outgoing feeder is also protected by disconnecting switches, which were made by the Westinghouse

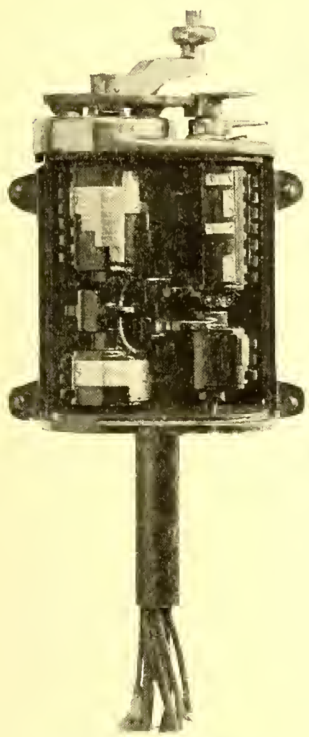


ARRANGEMENT OF ELECTRICALLY OPERATED OIL CIRCUIT BREAKERS

Company in accordance with designs specially prepared by Sargent & Lundy, the consulting engineers.

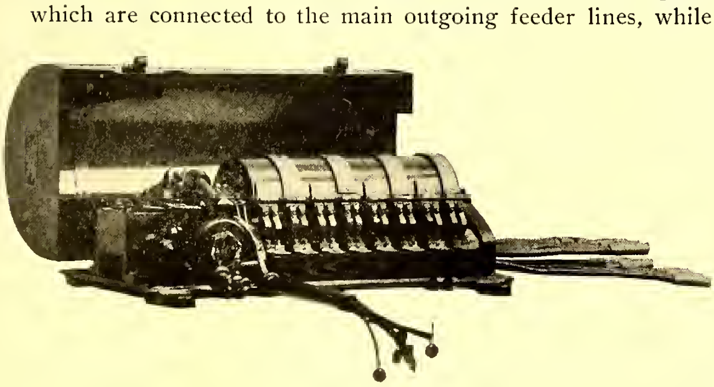
SWITCHBOARD

The generators are connected in parallel. The operating panels are located in the main engine room, forming two switchboards of blue Vermont marble. The first board is composed of five panels and provided with apparatus for the control of the two exciter sets, the motors which drive the ventilating fans for the step-up transformers, and the ammeters, voltmeters, wattmeters, Tirrill regulators, synchroscopes and switch control mechanism for the two 500-kw main generators. As has been stated, all the switches are electrically operated, current for this purpose being supplied by the exciter set. As, however, the generators are governed by Tirrill regulators, it has been thought wise to install a specially designed booster set in the switch operating circuit, in order that the electromotive force of the exciters may not be so reduced by the action of the Tirrill regulators that the switch mechanism may fail to act, and in this way all possibility of failure has been overcome. The second switchboard is composed of twelve blue Vermont marble panels, designed to control the outgoing feeder circuits. Five of these panels are now blank, but will be equipped with the necessary apparatus when the operations of the road are more extended. The main bus-bars occupy a portion of the basement. They are mounted upon heavy insulators, which are supported upon a masonry structure which is very heavy and substantial. Provision has been made so that the air from the transformer fans is carried through the bus-bar chamber. The bus-bars are arranged in a double set, each of which is protected by a disconnecting switch.


MASTER CONTROLLER

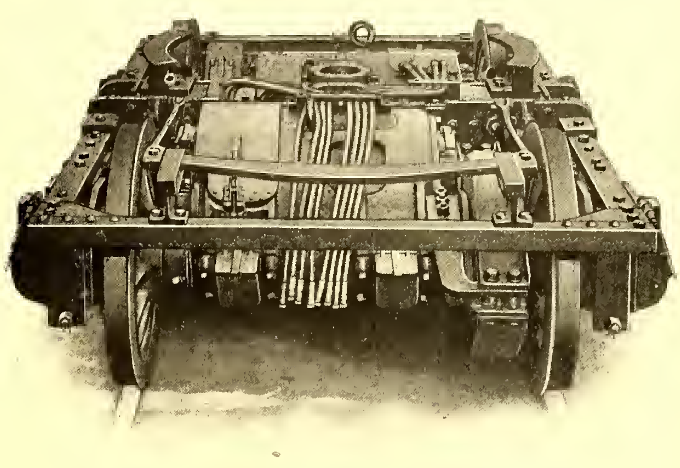
The east end of the building constitutes what is called the high-tension chamber, and is divided into four floors. The basement contains the bus-bars, which are mounted similarly to those leading from the generators, together with the instrument transformers. On the main floor are installed the oil-insulated, electrically-operated, high-potential switches which are controlled from the panels in the engine room, the lowering transformers from which the 550-volt alternating-current trolley line in the city of Rushville is operated, the lowering transformers —33,000 volts to 3300 volts— which feed the sections of the trolley immediately next to Rushville on either side, the lowering transformers for the operation of the motors which drive one exciter and the ventilating fans in the engine room, and the static interrupters for the protection of the lowering transformers.

On the third floor have been installed the static interrupters which are connected to the main outgoing feeder lines, while


REVERSER

the low-equivalent lightning arresters are mounted upon the fourth floor of the high-tension chamber. It will be noted that all switching is done on the high-tension side.

The general plan of operation is the transmission of alternating current over single-phase circuits at 33,000 volts to transformer stations, which are located every 10 miles or 12 miles along the road, where the potential is reduced to 3300 volts and connected direct to the trolley. The transformer stations require no attention, as the feeder lines are all controlled from the main power house and no moving apparatus is installed in the transformer houses. Because of the high potential at which the current is transmitted and fed to the trolley, no auxiliary feeders are necessary, and the total expenditure in copper is exceedingly low. The possibility of this saving


MOTORS AND TRUCK

constitutes one of the most important advantages of the alternating-current single-phase railway system.

ROLLING STOCK

The cars of the Indianapolis & Cincinnati Traction Company were described in the Street Railway Journal for Jan. 28 and Feb. 18, but some further particulars of the electrical equipments which were not available at the time of publishing the previous articles may be of interest.

As the cars must be operated over the tracks of the local railway companies in the city of Indianapolis, which are all supplied with direct current, it was necessary in their equipment to make provision for operation on either direct or alternating current. Furthermore, as it was not considered advisable to use a high potential trolley within the limits of the town of Rushville, it became necessary to provide for the use of two alternating-current trolley voltages. The main portion of the trolley circuit will be fed with 3300-volt, single-phase, alternating current. The total arrangement therefore includes operation at 550 volts direct current within the city limits of Indianapolis and 550 volts alternating current in Rushville, and 3300-volt alternating current on the other sections of the line. Because of this complicated service, it seemed advisable to pass by the attractive and economical features of control by induction regulators and to adopt the rheostatic system on account of its simplicity and adaptability to both alternating and direct-current operation.

The car equipment includes four No. 106-A alternating-current, commutator type, series-wound railway motors, rated at 75-hp each; one main auto-transformer wound for a primary potential of 550 volts, 1650 volts and 3300 volts, and for a secondary potential of approximately 250 volts; reversing switch; motor cut-out switch; commutator or change-over switch, to throw the equipment from alternating current to direct current, and vice versa; a complete unit switch system of multiple control, with two operating controllers arranged for the operation of the cars either singly or in trains; rheostats for use on either alternating or direct-current circuits; air compressors direct connected to both an alternating-current and direct-current series-wound motor; air reservoirs; two sets of storage batteries, consisting of seven cells each; complete Westinghouse air-brake equipment, with control valve on either platform; complete hand-brake equipment, with controlling lever on one platform; one wheel trolley for low-potential service, and one bow type trolley for high-potential service.

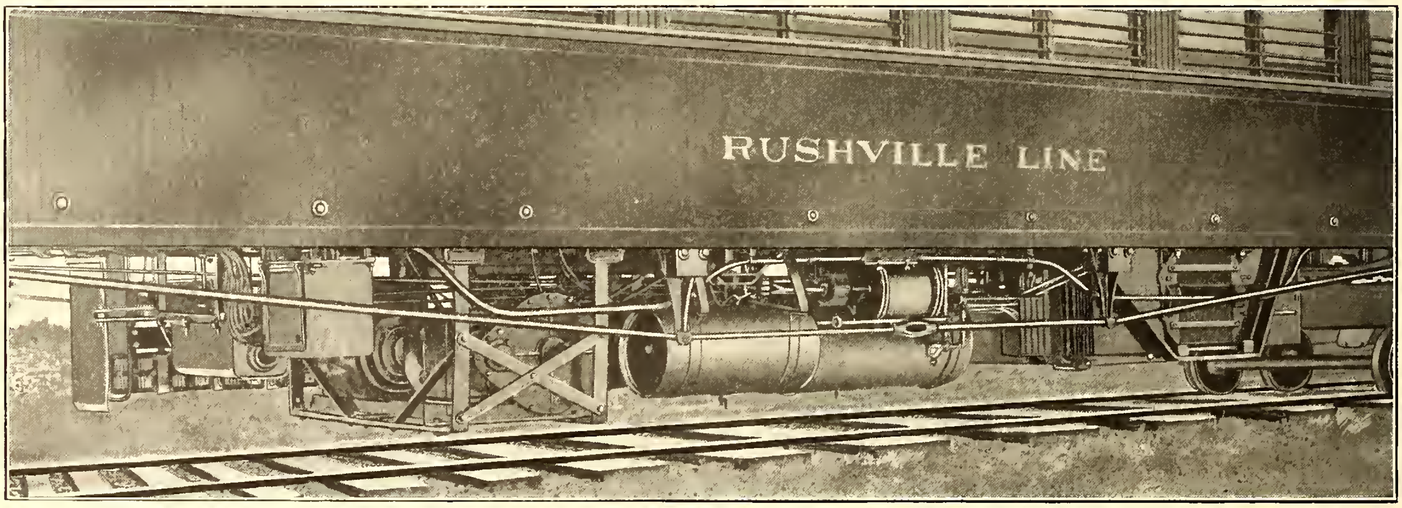
MULTIPLE CONTROL

The unit-switch system of multiple control as adopted is the standard Westinghouse equipment modified to suit the double operation by alternating and direct current. The unit switches are arranged in groups, one of 8 units and one of 4 units, which are mounted under the floor of the car. They are operated by compressed air, which, in turn, is controlled by magnet valves actuated by current from the storage batteries. The operating controllers are mounted one upon each platform, and are very small and compact, as may be seen from the accompanying illustration. The reverser, which is also illustrated, is of the reciprocating type, generally used with the Westinghouse system of multiple control.

The circuits of the controlling equipment and the four driving motors of a single car are shown in diagram on page 507. The controlling is done entirely by the unit-switch system, for which purpose there is used a cable containing eleven conductors running the full length of the train. The main operating circuits may receive power from any one of three sources, entirely distinct as to voltage or character of current. Thus the supply may be at 3000 volts alternating, 500 volts alternating or at 500 volts direct current. For direct-current operation, the four propelling motors are connected in series and subjected to a plain rheostatic control for acceleration. For alternating-current work there is installed a main auto-transformer having two primary feeding taps, at points corresponding to 3000 volts or 500 volts for normal magnetization of the core. When the supply voltage is 3000, the former of these is used, while for 500-volt supply the latter is employed.

Two distinct taps from the auto-transformer are used for current for the motors. The voltage impressed upon the motors is given one or the other of a lower or higher value, according to the speed desired. Thus without series-paralleling

BOW TROLLEY CONNECTED TO BASE MOUNTED ON INSULATORS



VIEW OF PART OF CAR, SHOWING DETAILS OF THE APPARATUS MOUNTED UNDERNEATH

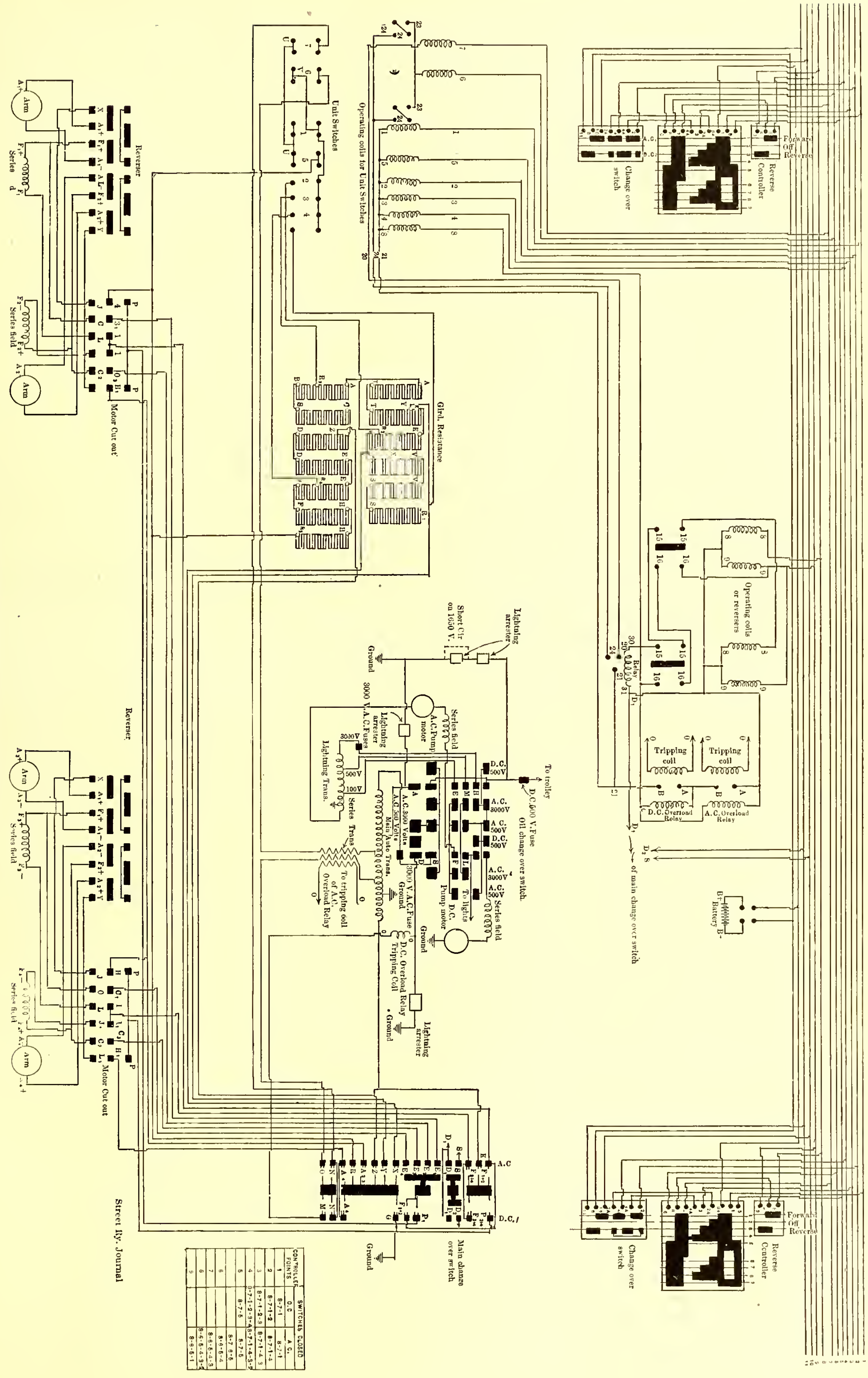
the motors, the same effect is produced by merely varying the active electromotive force at the motor terminals. Under all conditions of alternating-current operation, all of the motors of each car are connected in parallel, and for each of the two values of voltage impressed thereon, simple rheostatic control is used.

For both direct and alternating-current operation, the lighting circuit is supplied with current at 500 volts, either directly from the continuous-current circuits or through a special auto-transformer from the alternating-current circuits. As is the case with the main power transformer, the lighting transformer has taps at 3000 volts and 500 volts, respectively. The lamps are supplied from the 500-volt tap. At the 100-volt point there is placed an additional tap for supplying current to a compensated alternating-current series motor for operating the air pumps. It will be observed that the grounding point of the lighting transformer is at the neutral electromotive force point of the alternating-current motor. An entirely distinct pumping equipment is operated by a small series-wound, 500-volt direct-current motor which is controlled automatically by the air pressure. The diagram on page 508 shows the connections in simple form.

The motors, which are of the standard Westinghouse single-phase type, are rated at 75-hp each, and are geared for a maximum speed of 45 m.p.h. for local service.

AUTO-TRANSFORMER

The main auto-transformer is of the shell form, air-cooled type. Before shipment it was subjected to a test of 10,000 volts between winding and iron, and was operated at double potential for ten minutes. It is designed for operation at 25 cycles, a frequency which has been adopted as standard for single-phase railway service.

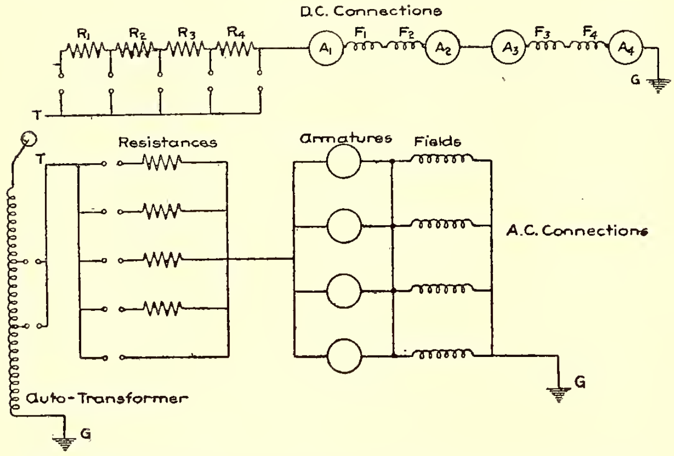


GENERAL DIAGRAM OF CONNECTIONS

TROLLEYS

The illustration of the bow trolley given on page 506 shows the standard form of collector designed for high-potential alternating-current circuits. The trolley is mounted upon a thoroughly insulated platform, and is raised, lowered and controlled by the motorman by means of compressed air. There is therefore no danger at any time of contact with live parts of the trolley. The bow carries a large, flat aluminum shoe, which makes contact with the under side of the trolley wire. For low-potential service, whether alternating or direct current, a modification of the Union Standard trolley is provided, as the bow type could not be used in the city of Indianapolis.

A novel feature of the equipment of these cars was installed



SIMPLE DIAGRAM OF A. C. AND D. C. MOTOR CONNECTIONS

at the suggestion of A. A. Anderson, general superintendent of the road. It consists of a speaking tube connecting the motorman's position with the rear platform, so that the conductor and motorman may talk with each other at any time. The entire electrical equipment of these cars was furnished by the Westinghouse Electric & Manufacturing Company, and installed under the supervision of Sargent & Lundy, of Chicago, the consulting engineers.

There is a plan on foot for the building of an automobile race course in the vicinity of Pennington, N. J., extending around a circle of 20 miles. Part of the course will be located close to the tracks of the Trenton Street Railway, which will be largely benefited by the resultant traffic. Superintendent Beach, of the Philadelphia & Reading Railway, is quoted as saying that his company will run half-hourly trains from Philadelphia and New York on days when there is a meet. Pennington is located 54 miles from New York and 37 miles from Philadelphia, on the New York branch of the Reading system. It is 7 miles north of Trenton.

Work on the Trenton (N. J.), Newhope & Lambertville Street Railway is progressing more rapidly as the weather improves, and cars will doubtless be running late in May or early in June, if the power house is completed by that time. With the exception of the streets in Yardley and Newhope, it is laid with 80-lb. T-rail. The grades are all light, while the curves, outside of the two municipalities, are limited to 4 degs. In Newhope Borough a number of houses had to be torn down to make room for the road following a private right of way, and between Yardley and Taylorsville 80,000 cu. yds. of rock were taken from the side of the hill to make room. Inasmuch as this had to be cut out, it was used for ballasting the line, although, aside from the excavating, other stone was convenient.

KEEPING CAR RECORDS

For keeping records of repairs to cars the Virginia Passenger & Power Company, of Richmond, Va., uses a filing system in which, instead of having a card for each car, an envelope is used. Blank forms for reporting changes in armatures or wheels, painting, or any other items that it is desired to record, are filled out by the man who does the work, and when turned into the office are placed in the envelope belonging to the respective car on which the work is done. This obviates any necessity for copying records, and forms a flexible system by which the history of each car can be accurately kept. Any

Car No.............................. FORM A 12. 8-10-'02.

Virginia Passenger & Power Co.,

RAILWAY DEPARTMENT.

Old No:..............................

Open. Closed. Convertible.

Builder..............................

Length of Body..............................

No. Benches..............................

Length over Bumpers..............................

FACE OF ENVELOPE FOR KEEPING CAR RECORDS

special data, such as reports of tests, can be easily recorded by simply dropping a memorandum in the envelope belonging to the car on which the test is made.

The envelopes are made of heavy manila paper, and measure 6½ ins. long x 3⅝ ins. wide, with the flap on the long side. On the face of the envelope are spaces for writing in a general description of the car. The blanks for recording the various kinds of work done on the car are 5½ ins. long x 3⅛ ins. wide, and will slip into the envelopes easily. Reproductions of the printed matter on the envelope and on blanks are presented herewith.

FORM A. 11. 8-24-'04. 3000.

Virginia Passenger & Power Co.,

RAILWAY DEPARTMENT.

______________Report.

No.________ ______________190___

Taken out / Put in } Car No.________

Foreman.

BLANK FOR REPORTING NECESSARY CAR REPAIRS

The company at one time started an individual armature record, but this was not found to be of any particular value and it was discarded. The mileage of cars is recorded each day in a book provided for that purpose, and the life of wheels, bearings, etc., is determined by comparison with the envelope file and the mileage book.

S. W. Huff, general manager of the Virginia Passenger & Power Company, states that the envelope system of filing records has proven very satisfactory, as it involves very much less clerical work and there is less liability to error than with other systems previously used. It is much less trouble to slip wheel or motor records into the envelopes than it is to make the entries in a book.

THE EFFECT OF THE PAST TWO WINTERS

In the last annual report of the Massachusetts Electric Companies, published in abstract in the issue of this paper for Dec. 20, 1904, President Gordon Abbott referred to the exceptionally low temperature and heavy snow storms which prevailed during the winter of 1903-04, and their effect upon both the traffic and expenses of operation. This statement attracted wide attention in Massachusetts, and the effect of the severe winters was discussed at some length by the Railroad Commissioners of the State in their last annual report, but little attention has been given to the subject elsewhere, either by the investing or general public.

There is no doubt that both the winter of 1903-04 and that of 1904-05, which is just passing, have been exceptionally severe in the Eastern States. Either one alone would have been remarkable, but coming together as they have, they have been phenomenal. Thus the average temperature in New York for December, 1903, and January and February, 1904, was 26.4 degs. F., the lowest on record—that is, in thirty-four years, while the average temperature for the corresponding three months which have just past has been only 0.4 degs. higher—that is, 26.8 degs. Table I. is taken from the records of the United States Weather Bureau in New York, and shows the mean temperature by months during the past five years:

TABLE I.—TEMPERATURE IN NEW YORK DURING WINTER MONTHS FOR LAST FIVE YEARS

	1900–01.	1901–02.	1902–03.	1903–04.	1904–5.
December	35.2	34.4	32.2	30.1	28.2
January	35.1	29.2	30.6	24.1	27.5
February	25.6	28.5	34.4	25.0	26.4
Mean	30.8	30.7	32.4	26.4	26.8

But it is not alone in temperature that the winters in the Eastern States during the last two years have been exceptional. The snowfall has also been remarkably large, and while the amount has varied greatly even in neighboring cities, the aggregate, as shown by Table II., greatly exceeds the average for the preceding six years. In this table eleven cities have been taken, the first eight to represent important sections in the Eastern States, the latter three representative localities in the Middle West, where the falls have not been either actually or proportionately so great. In this table the figures for the last two years are given by months as well as years, so that the amounts in each month of 1904-05 can be compared with those of 1903-04. As will be seen, the New York City figures are especially large, the fall having already aggregated 53.8 ins., or nearly twice as much as the average for the last seven years.

TABLE II.—SNOW FALL IN DIFFERENT CITIES DURING LAST EIGHT YEARS

Cities.	Average of Six Years Ending June 30, 1903.	1903–04.							1904–05.				
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total.	Nov.	Dec.	Jan.	Feb.	Total to Mar. 1
Boston	42.5	2.4	10.6	35.7	16.5	8.9	1.4	75.0	...	12.0	21.3	8.0	41.3
Worcester	[1]48.2	0.5	14.8	35.8	8.9	11.2	...	71.2	...	12.2	25.8	10.2	38.2
New York	34.0	...	7.7	15.2	5.6	4.4	0.1	33.0	0.5	26.8	19.3	7.2	53.8
Philadelphia	25.2	...	5.2	14.2	5.8	4.2	...	29.4	0.9	18.9	11.6	7.9	39.3
Albany	54.2	...	12.5	20.8	8.2	11.1	5.0	57.6	6.2	23.1	18.2	7.8	55.3
Syracuse	[2]	7.3	24.0	39.0	15.6	13.2	11.2	110.3	2.0	7.8	16.7	15.1	41.6
Buffalo	82.2	1.1	25.4	39.2	18.2	10.5	13.9	107.3	2.3	18.0	37.4	18.6	76.3
Pittsburg	36.4	1.0	8.5	6.6	4.5	0.4	1.3	26.3	0.1	8.4	17.2	5.2	30.9
Cleveland	44.7	7.8	14.3	21.6	7.8	7.5	1.0	53.0	0.3	11.8	14.8	13.3	38.9
Chicago	30.8	2.2	18.6	11.0	13.4	14.3	...	59.5	...	6.8	8.5	13.7	29.2
St. Louis	18.0	1.5	2.8	14.3	2.5	...	5.5	24.6	3.3	5.4	6.8	9.6	21.8

[1] Average of four years, report for November, 1900, missing. [2] No station during these years.

The effect on operating expenses of removing this snow has, of course, been enhanced by the exceptionally cold weather which accompanied it, and where the street railway company is obliged to remove snow from the street, which is plowed to one side from its tracks, the cost increases rapidly. The expense from this item is not readily obtainable from all the cities mentioned in the previous table, and that for 1904-05 from comparatively few cities as yet. Nevertheless, a study of the reports of the railway companies given in the table shows that this cost item has increased greatly, and in some cases been more than double the average during the preceding six years. Table III. shows the amounts charged to "Removal of ice and snow" on the lines mentioned:

TABLE III.—COST OF REMOVAL OF ICE AND SNOW PER MILE OF TRACK

	Average of Six Years Ending June 30, 1903.	1903–04.	1904–05 to Mar. 1
Boston Elevated	374	633	....
Worcester Consolidated	77	94	....
Springfield Street	96	173	140
State of Massachusetts[1]	112	212	....
New York City[2]	211	452	720
New York & Queens County	94	69	108
United Traction, Albany	100	138	80
Syracuse	58	113	55
Buffalo	[3]77	[4]127	....

[1] This includes all the lines in the State.

[2] Average of lines operated directly by Metropolitan Street Railway Company and New York City Railway Company.

[3] Average of International Railway, Buffalo Railway and Crosstown Railway.

[4] Average of International Railway and Crosstown Railway.

Unfortunately the effect of the snowfall is not confined to the direct expense of removing it, but is reflected in other ways. In fact, the actual cost is but a small fraction of the total expense. The other principal results are:

(1) Increase in repair cost.

(2) Decrease in gross receipts, owing to interruption of schedules.

(3) Increase in power required.

It is impossible to determine the exact extent to which these three items are influenced by severe winter weather, but the records on several railways in the list quoted show that the repair account during the first quarter of 1904 was 50 per cent larger than during the corresponding quarter of the previous year, and that the effect of the cold weather, so far as repairs were concerned, extended over even into the second quarter. In view of the continuance of the same weather conditions this year it is not too much to expect a similar increase in the repair account during the coming three months. The loss in receipts owing to the interruption of schedules and the increased power required are also very large, but owing to other conditions which affect them, the total cannot be accurately measured.

If the winters should continue to be as severe as they have been during the last two years there would have to be a modification of all of our ideas of the cost of operation of electric roads. It is too much to expect, however, that for a long time to come there should be such a combination in any one or two years of such conditions. If investors and the public generally should recognize these conditions as exceptional and not general, there need be no unnecessary alarm at some of the reports which may appear during the next three months.

CREATING TRAFFIC—II. RELATIONS WITH THE NEWSPAPERS

BY E. P. HULSE

Maintaining friendly relations with the newspapers will take up quite a little of the traffic agent's time, for it is through the news columns of the daily and weekly papers in the territory that your road serves that the public gets the information by which it forms its own opinions; and public opinion begets the most potential form of advertising—the "by-word-of-mouth" advertising or what one friend says to another.

Many managements think that when they have inserted an ad. they have "bought the support" of the paper on all occasions and that it will see to the matter of looking out for the road's interests at all points. The business management of a newspaper nowadays exercises a sort of control over the news end, so far as seeing that no great amount of advertising is given free to any project that should, but does not advertise; but it seldom does the other thing, and sees that an advertiser improves all his chances of legitimate publicity. There exists in the forces of a newspaper a constant arrayal of the "staff" against the business management; a small rebellion at the dictum of the money-producing necessities; a feeling that the business manager is absorbing the prerogatives, and incidentally the perquisites, of the editorial and news end. So when you send in an ad. and perhaps a book of tickets, a theater pass or an invitation to dinner, and congratulate yourself on your ineffable finesse, you have done only a part of what is necessary or may have overdone it entirely. The business office opens the mail, perhaps although addressed to "the editor," and flaunts the passes in the faces of the actual writers on the paper, and you have defeated the object you sought to attain. Although you advertise, your road and its attractions are covertly and sometimes openly "roasted." And, parenthetically, it does not pay to advertise extensive time-tables in the newspapers, not even in summer. Run a short ad. regularly where those who are looking for it can find it, covering especially the attractions, and telling also where detailed time-tables can always be secured, and giving the office or despatcher's or starter's telephone number. Of course, notice of change of schedules, opening of new routes, special features, etc., should be given through the advertising columns. In newspapers your "suggestion" is confusedly surrounded by many others, and your ad. is valuable chiefly to those who already have the desire to go somewhere and are looking through the paper for the best promise of amusement. The "direct suggestion," by means later to be described, I have found more valuable. Of course, you should place an ad. in the newspapers in your territory during the amusement months, and use the trade or class journals for certain purposes and the amusement and theatrical periodicals for others. Insert a season ad. in the newspapers, kept in as small space as possible, in a regular specified position, and changed every week; but you well know that an inch in the news columns voluntarily mentioning your road is worth a column in the advertising part, and I will show you how to get it.

Do not start in by giving a pass-card or a book of free tickets renewable as often as the covers are sent back. The possession of one pass in an office creates a demand for two, then three, then a dozen, until the latest "cub" reporter and the pressmen and the stereotypers feel aggrieved because they have not got one also, and you have made more enemies than friends. Also, when you give a pass-card or book outright you cancel at once the possibility of renewing the obligation. Keep them coming to you. Cultivate their personal acquaintance. Friendship will repay you with items that you could not buy. Give out no books. I am sorry to say that I have had to take up many complimentary books that were issued at the first of the year in times past to newspaper business offices that the conductors reported were being used by barbers, paper-hangers, cloak salesmen and others connected in no way with the newspapers. Nor do I favor the custom of steam roads in this particular, of keeping an account of transportation issued to a newspaper as a credit on the advertising account. But let the actual writers on the paper, the city editor, the reporters, feel that you are anxious for them to take an outing over your road or be entertained at your resort, and that you would appreciate their making their desires along these lines known personally to you. Do not force tickets or passes on them; newspaper men are as independent as any profession and more contemptuous of apparent bribery. But you will strike an unfailing response if you will give them to understand that at all times they can get facts out of you in regard to accidents, projected lines, new methods of operation, etc. If they have scented a news item, and come to you for the facts, they will appreciate your denial if accompanied by the explanation that the interests of the road would suffer by premature announcement and the promise that they shall have the story as soon as it is possible to turn it loose. Then follow this up by doing so.

DISTINGUISHED SPEAKERS AT BOARDS OF TRADE OUTING

Many Interesting and Enjoyable Features at the Gathering at Canobie Lake Park Yesterday

"I did not know there was a place in New Hampshire where such a dinner as we have had could be served. Now that I've found out, I shall make frequent pilgrimages from Lowell to Canobie Lake."

So spoke United States Sub Treasurer George A. Marden at the outing of the Merrimack Valley Boards of T... yesterday...

...tary C. H. Littlefield of Lawrence from Gov. John L. Bates and Lieut. Gov Curtis Guild of Massachusetts. Col. William A Gaston of Boston and Congressman Currier of New Hampshire.

C E. Adams of Lowell, president of

CANOBIE LAKE BECOMING RESORT FOR FOUR CITIES

More and more is Canoble lake becoming the popular inland resort for Lowell, Nashua, Haverhill and Lawrence. Picnic parties from cities and towns further distant seek the many diversions afforded at the park conducted by the New Hampshire Traction company. This company three years ago opened ...

supply. Its only outlet is at the Flume from ... beautiful brook flows along betw... ...ed banks, finally to find ...

CANOBIE LAKE AN IDEAL SUMMER RESORT

Many Local People Seek Rest and Recreation on its Wooded Shores

A beautiful jewel of matchless setting, the clear waters of Canobie lake sparkle forth from surrounding verdant, forest clad hills to greet the eye of the tired cityite on his vacation. Situated in the extreme southern part ...

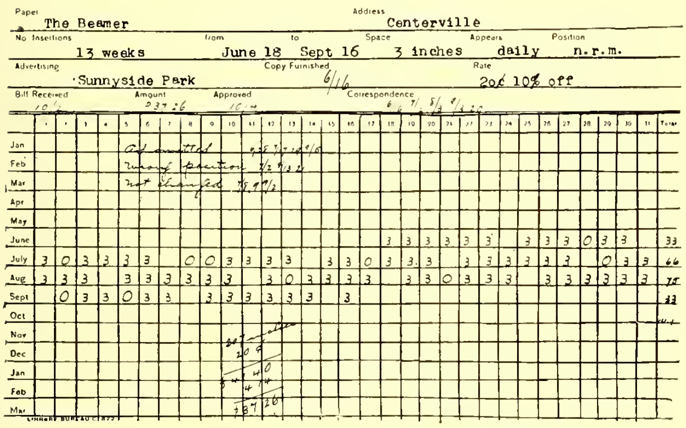
family. The Malden cottage, newly erected, stands across the track from the above and ... Trail of M...

Enter... time ...

A GROUP OF NEWS ITEMS, WHICH PROVE MORE EFFECTIVE IN CREATING TRAFFIC THAN PAID ADVERTISEMENTS

You will gain their astonished respect if you occasionally manifold the announcement of a matter that is real news and send it to all without their first nosing it out.

A good press agent should give the papers at least one item of real news each day, and keep his road's name in the reading columns. Then when your line has an accident, or the high-tension wires are down and the return of a Sunday school picnic is delayed until long after dark and anxious mothers are demanding impossible things over the telephone, or a merry-go-round has run away and rained young ones over an acre of ground, it is not the great impersonal "Interstate Corporation" that must suffer publicity; it is John's road, and his road gets the advantage of having all extenuating features mentioned along with the inevitable facts. Then also, when you send in an announcement that is advertising disguised as news, it does not return to you with a note from the advertising solicitor, nor is it thrown into the waste basket, but it is "something that Smith has sent in, and it goes." Do not underrate the amount of good or harm that any newspaper can do your road; the manager that professes to despise the whole newspaper fraternity has to haul down his colors sooner or later. It is simple: forestall any possibility of unpleasant news items being published without your side being represented, and save yourself apoplexy. This close personal relation with the writers on



CARD FOR CHECKING NEWSPAPER ADVERTISEMENTS

all the newspapers in the district you serve may be maintained by the traffic agent without allowing the dignity of the road management to suffer.

I believe every road manager has attempted at some time or other to give a dinner to "the press," and has gone through the "never-again" stage of regret therefor when he found that the mechanical departments were the only ones present. There is no class that is so hard to get together as the newspaper makers. No time can be set when the actual writers on both the morning and afternoon papers can be present. Nor can a dinner be given to the men even in one city. The best plan is to take as small a number as possible from each paper and have them out to your park or resort for a little personal dinner or entertainment. It does not take many days to cover the entire circuit, and it certainly pays as compared with the customary general banquet.

In placing your newspaper advertising, make your contracts direct. You can usually do so at a lower rate than you can get through the agencies. The commissions paid by newspapers to the advertising agencies that send them business average from 15 per cent to 25 per cent. Customs of individual papers differ, some of them sticking to their card rate and others making concessions to secure the business where competition is strong. Specify a regular position, with an understanding that extra space for big occasions is to go at the same rate as the regular ad. Have it understood with the business management that a free advance notice of coming attractions is to be inserted each week in the news columns with the change of advertisement copy. Have someone on the local force give a general write-up on Monday covering Sunday at the various resorts, the crowds out, the weather, how they enjoyed themselves. That is the day when many take their only weekly outing, and they like to see some mention in the paper. Have Tuesday's papers give a criticism of the theatrical attraction for the week, granting that you have some sort of performance. Get someone on each paper to do this, as a general story by the traffic man necessarily bears the press agent earmarks. Design an attractive cut heading for all your advertising, which shall be the trade mark of the road, and also coin some apt phrase or nickname. Hardly a steam road but is called by some name other than its incorporated one. If you do not put some nickname in the public mouth it will start one for you.

As to keeping track of the ads. for the purpose of checking the bills, the best method is a card system, each card containing space at the top for the items of: Name of paper; City or town; Number of insertions contracted for; Space; Appears; Position; What advertised; Copy furnished; Rate; Bill received; Amount; Approved; Correspondence. Space is left at the bottom for the daily checking of the ad. The accompanying blank shows a card of this kind which I designed to serve the purpose of a daily checking record. The newspapers will furnish you an advertiser's free copy for the purpose of checking.

Go through the news columns also of all the newspapers, and where the road is mentioned and used well, drop a note thanking the writer or voice a protest if injustice is done. Clipping bureaus seldom send in half the matter of interest that appears, and when the newspapers learn that you are watching their columns they are apt to be more particular with what goes in concerning your road. Although the newspaper may not be the best medium for your purpose in putting travel suggestions into the mind of the public, it does a great deal in forming public opinion, and relations with the public may be vastly improved through its judicious handling.

THE USE OF TAIL RODS ON ENGINES

The practice of employing tail rods to support the piston of a steam engine is quite common on the Continent of Europe, but there are very few builders of American engines who have adopted this form of construction. An interesting experience on the practical value of the tail rod, however, has been conducted during the past two years in the power station of the Camden & Suburban Railway Company, now a part of the South Jersey Division of the Public Service Corporation of New Jersey. In this station the equipment includes two cross-compound condensing Corliss engines, manufactured by the Pennsylvania Iron Works Company, and with cylinder dimensions 30.5 ins., and 52-in. x 42-in. stroke, each direct connected to an 800-kw Westinghouse generator. The engines are duplicates of each other, except that one which was installed three years ago had no tail rods, while the other, which was installed in the station two years ago, employs these rods on both high and low-pressure pistons.

The experience in this station indicates that there has been a great saving both in steam consumption and maintenance by the use of these rods. The second engine has cost nothing for maintenance during the two years in which it has been in service, even the bull rings have not been changed, and the tool cuts are still visible on the bottom of the cylinder. The other engine has worn out two sets of bull rings during its three years of service, and the low-pressure cylinder has worn down 1-16 ins.; moreover, it is possible to work the second engine at about 10 per cent greater capacity than the other. The general results have been so satisfactory that in a new engine of similar capacity which the company is about to install, and which is to be of the Westinghouse cross-compound horizontal Corliss type, tail rods have been insisted upon.

The engineers of the company attribute the better results secured with tail rods in Camden than in other similar installations to the fact that very substantial rods have been used, in connection with a proper support. The success of the tail rod, in their opinion, depends upon having a through rod from cross head to tail bearing of sufficient strength and properly bowed upward, so that when the weight of the piston is added the deflection due to this weight simply gives a fair bearing to the piston on the lower part of the cylinder.

Before adopting the tail rod in the present engine the deflection due to the weight of the piston was very carefully calculated and the tail rod was given a bent to compensate for the deflection, so that the movement of the piston is perfectly horizontal. The cross heads were also made extra large and with adjustable wedges, and were so arranged that the piston rod can be sighted with the adjustable tail rod and brought in perfect parallelism.

MARCH MEETING OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION

The Indiana Electric Railway Association held its March meeting at Lebanon, Ind., with Vice-President J. W. Chipman in the chair. The work of the meeting was the discussion of the question of interchangeable coupon ticket books. A committee had been appointed at the February meeting at Anderson to consider the matter and report at this meeting, with the end that some form of ticket book good on the various Indiana roads be adopted. This committee, of which Charles A. Baldwin, of the Indiana Union Traction Company, was chairman, was not ready to report formally. W. H. Norviel, in the absence of Chairman Baldwin, explained that the committee had held several meetings and secured information from the various roads as to their rates of fare. The committee did not feel as if it was ready to make a final report or recommendations as to such an important matter without more time. W. R. McKown, of the committee, however, had prepared a statement which told of some of the ideas of the committee and the work that had been done. This unsigned statement was not to be considered as a report.

Mr. McKown then read the statement. The committee had secured figures on the regular rates of fare of all the interurban roads in Indiana. It was found that these rates varied all the way from 1¼ cents to 2½ cents per mile. This difference in regular rates of fare on different roads would make any scheme for interchangeable mileage books impracticable, because no rate per mile for such books could be made that would satisfy all companies and their customers. It was therefore thought that a book of 5-cent coupons which would be accepted at their face value, in place of the regular cash fare on any road signing the agreement, and sold at a discount from the face value of the contained coupons, would be most satisfactory. In Ohio such a book had been adopted, this book containing 240 5-cent coupons for $10, and thus affording a discount of 16⅔ per cent from the regular fare. In Indiana regular rates of fare were in many cases lower than in Ohio, and a discount of 16⅔ per cent would bring the rate of fare down to where several Indiana companies would not come into the agreement. It was thought a book containing $10 worth of 5-cent coupons, selling for $9, equal to 10 per cent discount, would be more acceptable to Indiana roads. A permanent transportation committee would be necessary if a coupon book were adopted. A proposed form of contract was then read.

W. G. Irwin, general manager of the Indianapolis, Columbus & Southern, thought it unfortunate that such low rates of fare had been put in force on the early interurban roads in Indiana. The builders of these roads frequently did not realize that they were building anything more than an extended street car line. As distances became longer there was necessity for heavier equipments and higher speeds, which increased the operating expenses so as to call for higher rates of fare. It might be that some of these interurban roads would not earn as much if they increased the rate of fare, but in any event he was certain that there should be more uniformity about the practice of the various roads in both the regular rates of fare and in the charges for special service. Such a lack of uniformity frequently caused hard feeling on the part of the public. For example, his road might not give as favorable a rate on a certain class of business as some other interurban road, and his customers would complain about it. Likewise, the customers of other interurban roads might hold up his road as an example where his road was lower than the other roads. It would undoubtedly be conducive to better feeling if rates of all kinds were uniform. Nevertheless, under conditions as they are now, he thought a 5-cent coupon book as proposed was probably the best thing.

The chairman then called upon E. C. Spring, president of the Ohio Interurban Railway Association, who was a visitor at this convention. Mr. Spring took the floor and gave a very interesting talk on the situation in Ohio and Indiana. He told how the Ohio Interurban Railway Association had appointed a committee to devise an interchangeable mileage or coupon ticket and how this association had thrashed the matter over for some five months. The committee reported a plan which was at first rejected by the association, and the matter was gone over again month after month, until finally the original coupon book proposed was adopted. The sale of this book had been remarkable, considering the short time it had been offered to the public. He advised the Indiana Association to get figures on the traffic and rates of fare from every road in the State, and then, in considering the matter, to ask the committee of the Ohio Association to confer with them. He wished very much that a book could be devised which would be good for both States. Because of the interchange of business between the roads in the two States, it was very desirable that this be done. Most of the traveling men covering Ohio also covered Indiana, and the same book ought to be good in both States. He offered his congratulations to the Indiana Electric Railway Association for the fine start it had made and the interest shown in the association. He told a little of the work of the Ohio Association and what a great benefit it was proving to its members. He invited the Indiana men to any of the meetings of the Ohio Association. The next meeting would be at Cincinnati, and the subject would be roadbed and repairs required in springs. He favored the standardizing of interurban practice in all respects as far as possible, and such associations would bring this about. Mr. Irwin, who preceded him, was right when he spoke of the importance of uniform practice in the dealings of the interurban roads with the public of the entire State. In response to a question as to how many roads had adopted the Ohio interchangeable coupon book, he replied that about twenty-seven roads in Ohio signed the contract, this being practically every interurban road in the State, with the exception of the Appleyard properties, and it was probable that they would soon enter the agreement.

F. D. Norviel, of the Indianapolis & Northwestern Traction Company, asked Mr. Spring whether, when the Ohio interchangeable coupon book was adopted (which in effect gives a reduction of 16⅔ per cent from the regular fare), there was any objection to this on the part of roads where the regular fare charged was only 1¼ cents per mile. Mr. Spring replied that all such roads had raised their rates. Answering a further question as to what the effect of raising rates was and how it was taken by the public, Mr. Spring cited the case of the Dayton & Northern, where, during the last year, the number of passengers had been less after the rates were raised, but the gross receipts had increased. Answering a further question as to the feeling of Ohio companies about the free carrying of baggage, he said that those in the northern part of the State in direct competition with steam roads on long runs favored free baggage. In Southern Ohio, where the roads catered more to the local business and to cross-roads farmer, the companies favored charging for baggage, in order to avoid a lot of farm produce being thrown upon them for free transportation. He cited a case of this kind in his own experience, where a farmer, having secured special permission to carry a few baskets of produce, such as he could handle himself, to town without extra charge, appeared one morning soon after the permission was granted with 1200 lbs. of stuff for which he expected free transportation.

Mr. Irwin raised the question whether interurban roads would not be swamped with free baggage if no charge were made, with the result that special baggage cars would have to be run. Mr. Spring pointed out that it was important that the baggage go with the traveling man, otherwise he will take the steam road, where his baggage will go with him. It is no advantage to the traveling man to be able to go himself if his baggage cannot go at the same time. Mr. Norviel pointed out that a very small percentage of interurban passengers carry trunks, and even if one in ten took a trunk there would be plenty of room in the baggage compartment of an interurban car.

The discussion was concluded by carrying a motion made by C. C. Reynolds, general manager of the Indianapolis & Northwestern, to the effect that the ticket committee be continued and instructed to investigate rates and to confer with a similar committee of the Ohio Association. The ticket committee was added to by the appointment of Charles G. Lohman, superintendent of transportation of the Indiana Railway Company, South Bend, who had been acting on the committee at its recent meetings in place of General Manager Smith, of the same company.

A committee was appointed to confer with H. J. McGowan, president of the Indianapolis Traction & Terminal Company, regarding the maintenance of a joint ticket agent and information bureau at the Indianapolis Terminal Station. This committee consisted of C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Company; W. G. Irwin, general manager of the Indianapolis, Columbus & Southern Traction Company, and A. W. Brady, president of the Indiana Union Traction Company.

The resignation of A. L. Drum from the executive committee was received and accepted, Mr. Drum having moved to Chicago.

THE AURORA, ELGIN & CHICAGO CARS ENTER CHICAGO

The Aurora, Elgin & Chicago Railway, the high-speed third-rail line running west from Chicago, on March 11 began operating into Chicago over the tracks of the Metropolitan West Side Elevated Railway Company to the latter company's stub terminal on Fifth Avenue, near Jackson Boulevard, in the heart of the city, in accordance with an ordinance recently passed by the Chicago Council. Under the old arrangement the Aurora, Elgin & Chicago cars entered the city as far as Fifty-Second Avenue, at which place was an elaborate terminal depot where passengers changed to the Metropolitan Elevated trains. Under the new arrangement it is not necessary to change cars. In operating over the elevated tracks, Aurora, Elgin & Chicago cars, after leaving the downtown terminal at Fifth Avenue, will make only one station stop within the city limits. This will be at Fifty-Second Avenue, for the accommodation of local passengers living along the line of the elevated road who can transfer at that point. The next stop after Fifty-Second Avenue, which is 6.5 miles out, is Des Plaines Avenue, which is 9.7 miles out. Under the new arrangement the Metropolitan West Side Elevated Railway Company is to maintain the local service on the Aurora, Elgin & Chicago tracks between Des Plaines Avenue and the city, leaving the through business to the Aurora, Elgin & Chicago. The new time-table of the Aurora, Elgin & Chicago calls for trains every half hour. The trains on the even hour go to Batavia and Aurora, and those on the half hour to Elgin. The regular running time to Elgin, which is 41.5 miles distant, as well as to the other two terminals, which are not quite as far, is one hour and twenty-five minutes, of which time twenty-one minutes is consumed on the elevated structure between the city and Fifty-Second Avenue. This one hour and twenty-five minutes is the running time for trains making all stops west of Fifty-Second Avenue. Four limited trains are run each way daily to accommodate regular suburban travel, thus putting this road in a position to compete directly with the steam railroad suburban service for the regular commuter travel for the first time. These limited cars are scheduled to make the run of 41.5 miles between Chicago and Elgin in one hour and ten minutes, including three station stops and slow speed on the elevated road on account of the local trains. This will necessitate a steady maximum speed of more than 60 m.p.h. for at least three-fourths of the distance. These new terminal facilities of the Aurora, Elgin & Chicago make possible one of the most interesting competitions for the suburban business going out of a great city that is to be found anywhere in the United States at the present time. The road has heretofore been handicapped by necessity of transferring passengers at Fifty-Second Avenue to and from the elevated road.

NEW HAVEN ABANDONS THIRD RAIL BETWEEN HARTFORD AND BRISTOL

The New York, New Haven & Hartford Railroad is to abandon the third rail on its line between Hartford and Bristol. All reports to the contrary notwithstanding, there is nothing mysterious about this move by the company. The line was laid some time ago for experimental purposes. A feature of the equipment was the placing of the third rail midway between the service rails. Ever since the installation of the system there has been a disposition on the part of the public to magnify the danger of the exposed rail and to impose upon the company unnecessary expense in protecting the rail against trespassers on the track. This tendency to burden the company, and the fact that the improvements were necessary, have caused the company to decide to abandon the running of electric cars on the line.

The Pacific Electric Railway Company, of Los Angeles, is operating a freight and express service between Los Angeles and Wilmington daily except Sunday. The schedule of rates is interesting, as follows: Minimum charge, both freight and express, 25 cents; freight rates per 100 lbs., first-class, 14 cents; second-class, 13 cents; third-class, 11 cents; fourth-class, 10 cents; express rates per 100 lbs., merchandise rate, 40 cents; special rate, 25 cents.

The Pacific Electric Railway Company and the Los Angeles Interurban Railway Company have undertaken the novelty of delivering coupon tickets to any part of Los Angeles when purchased in lots of $1 or upward.

THE QUESTION BOX

In this issue of the Question Box are continued questions and answers relating to the handling of freight and express, and the track department. Under the subject of freight and express are given opinions in regard to joint traffic agreements, and data on the cost of handling freight and express are also presented. The chief topics discussed in the track department are best ways of securing good drainage and the advantages and disadvantages of concrete foundations under rails and roadbed.

D 8.—An interurban electric railway wishes to make an agreement with a city road for the joint handling and exchange of express and freight matter. What is a fair basis upon which to form such an agreement? What are the essential features of your agreement covering this matter?

I think it should be arranged on the tonnage basis if the terminal line is required to do the warehouse work, if not, on the mileage basis. A. Eastman.

An interurban road should pay the terminal company a reasonable trackage toll, should either man or pay for the manning of its cars, pay any special taxes levied and share its just proportion of the terminal depot costs, based on tonnage handled.

Geo. W. Parker, G. E. & P. A., Detroit United Ry.

About 5 per cent of ingoing and outgoing business.

J. R. Harrigan, Gen. Mgr., Columbus, Buckeye Lake & Newark Tract. Co.

This company has no agreements with any city road for the joint handling and exchange of express and freight matter. In my opinion an interurban line desiring to enter a city over the tracks of another company should make an agreement for the operation of such cars on a car mileage basis. If it is desirable to jointly handle the express and freight matter at the terminal station the proper way of handling this is to pro rate all the expenses based on the gross earnings of each company.

E. J. Ryon, Supt. Schenectady Ry. Co.

The interurban company should pay to the city company a sum per car mile for use of tracks and power, so that the net profit to the city company will equal the net profit earned by one of its regular cars.

H. J. Clark, Interurban Elec. Exp. Co., Auburn & Syracuse.

I believe the express car mileage is the proper basis for an agreement between a city company and an interurban company for bringing the interurban express cars into the city. The car mileage is always a definite figure, and is easy to determine. The interurban express cars make so many miles over the city tracks and the interurban company should pay a fair amount per car mile for the privilege. I believe, however, the amount to be paid per car mile should be redetermined at the beginning of each year, and should be somewhat in relation to the gross receipts from express and freight during the preceding year; as the receipts increase the compensation per car mile paid by the interurban company should increase, as it is usually demonstrable that the increase in business is due largely to the fact that the interurban company is able to reach the heart of the city. The interurban company should furnish its own express cars, the car crews, and men to handle its stuff at the express terminal. It should also, of course, assume all responsibility for accidents caused by its cars or crews while within the city limits. The city company should furnish power and the tracks. A percentage of the gross receipts from express and freight is not so good a basis as car mileage on which to make agreement between the two companies, inasmuch as it is often difficult to decide just what portion of the stuff carried by the interurban company should be considered when determining the amount due the city company.

I am of the opinion, however, that the ideal way of handling the express and freight question, where one or more interurban companies desire to handle express and freight in conjunction with a city company, as, for instance, as at Albany, is to organize a separate company to carry on this business over all the systems. This company should operate itself and pay the different railway companies in proportion to the stock of the express company held by each. Under these conditions the express and freight should be handled entirely at night, when the lines are clear. This would do away with interference with passenger traffic, and would relieve the demand on the power station during the day when power is needed for moving passenger cars.

Edgar S. Fassett, Supt. United Tract. Co., Albany.

D 9.—Does it pay to handle express matter by electric cars? Does it pay to handle freight by electric cars?

Perhaps, I am unqualified to answer this question, but from the best information that I am able to obtain, the express and package business on electric roads has not been, in every instance, an overwhelming financial success, because of the large expense incident in developing and handling the business, and it occurred to me that perhaps in some cases it would be more profitable to contract with one of the large express companies which operate over the steam railroads in the particular locality, to take charge of the express and package business upon similar terms as it is handled over steam roads. The large express companies have agencies in nearly all of the cities and villages, and are prepared to handle the business with the least possible expense, and they could take on the business of the electric lines in these cities and villages, where they operate, with very little additional expense, and could, therefore, pay liberally for the business, and perhaps a great deal more than the net profits amount to, where the business is handled by the electric roads.

E. G. Connette, Gen. Mgr. Syracuse Rapid Transit Ry. Co.

Questions for each individual road, considering its particular circumstances, to solve for itself.

Geo. W. Parker, G. E. & P. A., Detroit United Ry.

The handling of express matter by the electric cars on the lines of this road is profitable. Except in a general way, I am unable to answer this question, but am of the opinion that it can be made profitable under the right conditions and the proper management.

E. J. Ryon, Supt. Schenectady Ry. Co.

It pays to handle both freight and express matter by electric cars.

George Dunford, Gen. Ex. Agt., Utica & Mohawk Valley Ry. Co.

This company accepts freight and express packages (at a compensation) only for the convenience of its patrons. This class of business is considered unprofitable here and the front platform of the regular passenger car is the only facility we care to offer to shippers. We give 20 per cent of the carry charges to the conductor and motorman who handle the goods.

A. H. Rogers, President Southwest Missouri Elec. Ry. Co., Webb City, Mo.

We have found it profitable to handle freight and express by electric cars.

H. J. Clark, Interurban Elec. Exp. Co., Auburn & Syracuse.

The United Traction Company for some time has given a combined express and freight-carrying service over its entire system, and this business has been handled at a fair profit. In my opinion, neither an exclusive express business nor an exclusive freight business can be handled profitably, but the two combined can be made to give a fair return on the investment.

J. W. Gibney, Supt. Ex. Dept., United Tract. Co., Albany.

If a company has proper facilities and can secure sufficient tonnage per train at fair rates, there is profit in freight. We carry express matter on passenger trains without extra help for handling, and therefore with good profit. If we did not handle express, passengers would insist on carrying numerous large packages in cars without revenue to the company, and if rules were enforced prohibiting packages, patrons would resent it and go to steam competitor, or drive into town to buy or sell supplies, resulting in loss of passenger earnings. Southern Superintendent.

D 10.—As a broad proposition, can express or freight matter be hauled as cheaply per ton mile by electricity as by steam?

I think not.

A. Eastman.

No.

Geo. W. Parker, G. E. & P. A., Detroit United Ry.

Under the conditions that electric roads are handling freight and express matter at the present time, I do not believe that freight can be handled as cheaply per ton mile as by steam.

E. J. Ryon, Supt. Schenectady Ry. Co.

D 11.—What does it cost per ton mile to haul express or freight matter by electricity—including all items of expense properly chargeable to this department?

Our information is to the effect that there is such a wide range in the method of accounting pursued by different companies that I would not care to answer this question.

Geo. W. Parker, G. E. & P. A., Detroit United Ry.

D 12.—Will you please give the following information concerning your express business:

Gross receipts,
Operating expenses,
Cost of power,
Interest on investment,
Total expenses,
Net income,
Total tonnage
Average rate per 100 lbs.,
Gross earnings per express car mile per day,
Earnings per car hour?

In connection with above statistics, please give statement as to general character of express or freight business transacted.

The following is the report of the Electric Express Company, of Schenectady, for the year ending June 30, 1904:

Gross receipts	$36,237.94
Operating expenses	32,089.03
Net income	4,148.91
Total tonnage, pounds	10,371,000
Average rate per 100 pounds, cents	34.9
Gross earnings per express car mile per day, cents	78.9
Earnings per car hour	$5,686

The above figures do not give the cost of power or interest on investment, for the reason that the Electric Express Company is a corporation owned by the Schenectady Railway Company, but not operated as a branch of the railway. The cost of power is included in the car mileage paid by the Electric Express Company to the Schenectady Railway Company.

E. J. Ryon, Supt. Schenectady Ry. Co.

The following is a report of the express and freight department of the Utica & Mohawk Valley Railway Company for the year ending June 30, 1904:

Gross receipts	$36,187.96
Operating expenses	22,177.24
Cost of power and interest on investment	4,557.91
Net income	9,452.81
Total tonnage, pounds	17,208,715
Average rate per 100 pounds, cents	21.03
Gross earnings per express car miles per day, cents	41
Earnings per car hour	$4.27

George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

The following is a statement of the express and freight department of the United Traction Company for the year ending June 30, 1904:

Gross receipts	$38,000
Operating expenses	28,000
Net income	10,000
Total tonnage, tons	22,092
Cost of power, cents per car mile	1.84
Express car miles, own cars	36,645
Express car miles, foreign cars	12,739

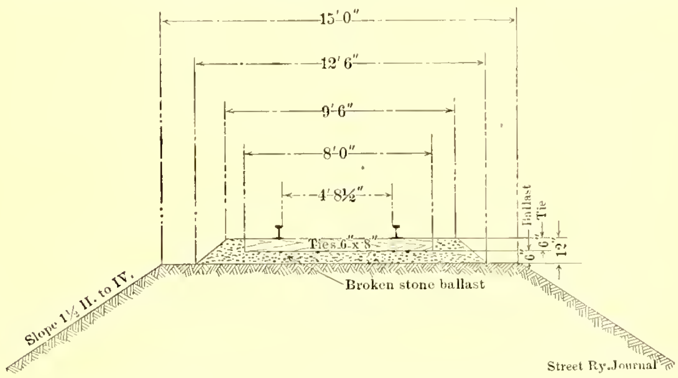
United Tract. Co., Albany.

I 10.—How can good drainage be secured on suburban and interurban electric roads? Please answer this question in detail.

The ideal road is one built entirely upon a fill. The sub-grade should crown at the center with a slope of about 2 per cent, and a free draining ballast, coarsest at bottom, should be used. Drainage ditches of ample capacity bottomed to a depth of at least 12 ins. below sub-grade, and plenty of carefully located culverts, are requisite. It is a better investment to have twice the capacity in ditches and culverts, than insufficient drainage. As an old railroad man once said, "the most important thing in railroad construction is good drainage, the next is more drainage." The ballast should slope from top of tie at center of track to 2 ins. below top of tie at its end. On double track, covered box drains should be placed 500 ft. apart.

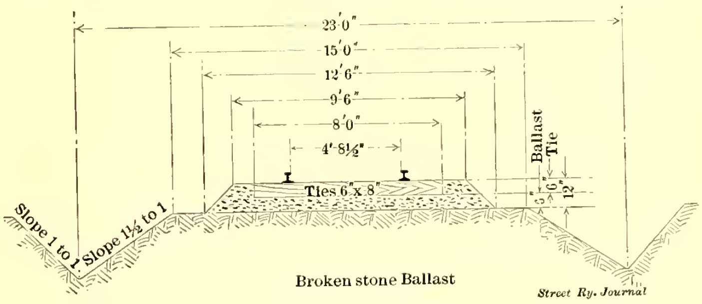
M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

It is very easy to secure good drainage on suburban roads if the ditches be made wide enough and deep enough, and the trans-



STANDARD SECTION ON EMBANKMENTS, ATLANTA

verse drains of tile be large enough. This is a question where the individual cases must be decided by the engineer in charge, and no general laws can be made to cover all cases. I send, however,



STANDARD SECTION IN EXCAVATIONS AND ON LEVEL, ATLANTA

blue prints of our standard roadbed on which we have little trouble from lack of drainage, so long as we keep our ditches clear.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Locate the road with due consideration for drainage. Do not let ascending and descending grades meet in cuts, except at summits.

Asst. Eng. Ry. Dept

Best drainage is secured by laying drain tile graded to discharge into ditches at side of track.

H. A. Tiemann, New York City.

I 11.—How can good drainage be secured on city tracks? Please answer this question in detail.

If the tracks are laid on paved streets, and the streets are sufficiently crowned, and the paving is in good shape, there should be no trouble from drainage except perhaps where two descending grades meet. In this case it is well to make a depression in the center of the track with a cover plate and ample drainage to the nearest sewer.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

I would construct a catch-basin with man-hole every 500 ft., just outside the tie line on double or single track, and would place track basins reaching from rail to rail of each track, emptying on a good grade, directly into the catch-basin. The drain discharge should be located so as to be readily reached by a man on the man-hole ladder, so that if hose flushing fails to clean the drain, it can be easily reached through its outlet. The catch-basin should be trapped to the surface water sewer and have ample capacity at the bottom for collection of sediment. A sectional concrete catch-basin can be made at comparatively slight expense by unskilled labor.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Put catch basin, connected to sewer, at all points where water is likely to collect.

H. A. TIEMANN, New York City.

I 12.—What is the best form of cover plate and design of openings for track drains, especially with reference to the prevention of horses' shoes getting caught in openings?

Iron grating is probably the best form of cover for drains, but it is objectionable on account of the horses' shoes getting caught in the parallel openings. To obviate this, a cover slightly concave with round holes 1½ ins. in diameter, and 1½ ins. edge to edge drilled in it, has been found to be very satisfactory. The plate should be so designed that the area of the openings in the plate shall equal the area of the drain pipe below, provided this drain pipe has been figured to carry only such water as comes in through this one cover.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

The track drain should be of cast iron, about 12 ins. wide, extending from rail to rail, and be set with cover ½ in. below tram or groove of rail, the groove being cut out at the drain. The cover should be removable and have a double row of 1 in. x 3½-in. oblong holes, flaring out underneath for self-cleaning. The bottom of drain should be semi-circular in cross-section, 8 ins. in diameter in the clear, and have a slope of 3 ins. to the 8-in. circular nose outlet on the end.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Make the openings small enough to prevent the trouble mentioned, or provide bosses or projections near enough together to prevent the shoes reaching the openings.

Asst. Eng. Ry. Dept.

I 13.—What is the best way of keeping tracks to gage in unimproved streets? Give details.

Use tie rods not smaller than 2 ins. x ⅜ in. With this practice the ties in the track may become so decayed that the spikes will loosen up, but still the tie rods will preserve the gage. If rail braces are used they frequently become loose and worthless as soon as the tie begins to decay. It often happens, too, that one end of a tie will decay while the other may be sound. In this instance, the weight of the car will push away the brace on the decayed end, thus destroying the gage. With tie rods it is very evident that this cannot happen.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Insert a row of heavy deep paving headers on both sides of rails and heavy tie rods with lock nuts on both sides of rails. Double spike on inside of rails.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

By using brace tie plates or tie rods. Prefer brace tie plates for the reason that should improvements be made on the streets the teams would not be able to break them down so easily.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Tie plates and tie rods with girder rail or tie plates alone with T-rails.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

On T-rail, 6 ins. and under, use braces at curves; on girder rail use tie-road 6 ft. apart.

Asst. Eng. Ry. Dept.

Use tie plates with low rails, brace tie-plates or tie rods with high rails.

J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Light Co.

I 14.—Have you had any experience with "creeping" rails, and how have you remedied this difficulty?

We have had very little trouble with creeping rails, probably because we slot-spike all our joint plates to the ties. Some time ago a short section of track began creeping a little, and we bolted an anchor plate on the center of each rail and slot-spiked it to the tie. The ballast around these ties was piled up heavily and the trouble was remedied.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

At double-track steam road crossings, use timbers extending under all four steam rails, with Portland cement concrete from bottom of timbers to paving or planking. Also use anti-creeping clamps on rails for 20 ties outside of crossing, placed to brace against direction of travel. On T-rail use anti-creepers, two pairs to a 30-ft. rail, and joints slotted for spikes.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Yes. The best remedy we have found is "anti-creepers."

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 15.—Have you had any experience with "waves" developing in the top surface of rails? What is the cause of this phenomenon and how can it be remedied?

We have had no trouble with "waves" developing in the top of rails.

W. T. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Yes. It is caused by the use of insufficient and poor ballast and want of care in maintaining track.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

Have had some little trouble from this source, caused by bad lot of ties, not properly adzed.

J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Light Co.

I 16.—Do you know of any electric road that has used crude oil on the roadbed to lay dust and kill weeds? What have been the results obtained?

At one time we intended to sprinkle our roadbed with oil, but found it unnecessary to do so.

Boston & Worcester St. Ry. Co.

No. But steam roads have found the practice economical and satisfactory.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

We have never tried this and do not know of any roads in this vicinity that have.

E. J. WILCOXEN, Supt.,
Rochester & Sodus Bay Ry.

Do not know of any such road.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

I 17.—Is crude oil a satisfactory substitute for salt for preventing obstruction of switches and special work by ice and snow?

We have never attempted to find a substitute for salt. In this section we have very little trouble from snow and ice, but have always found salt a satisfactory remedy.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

We do not think it is.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

No.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 18.—Do you know of any satisfactory device to be attached to each car for cleaning the groove of girder rails? Please give description, with sketch or photograph.

We do not.

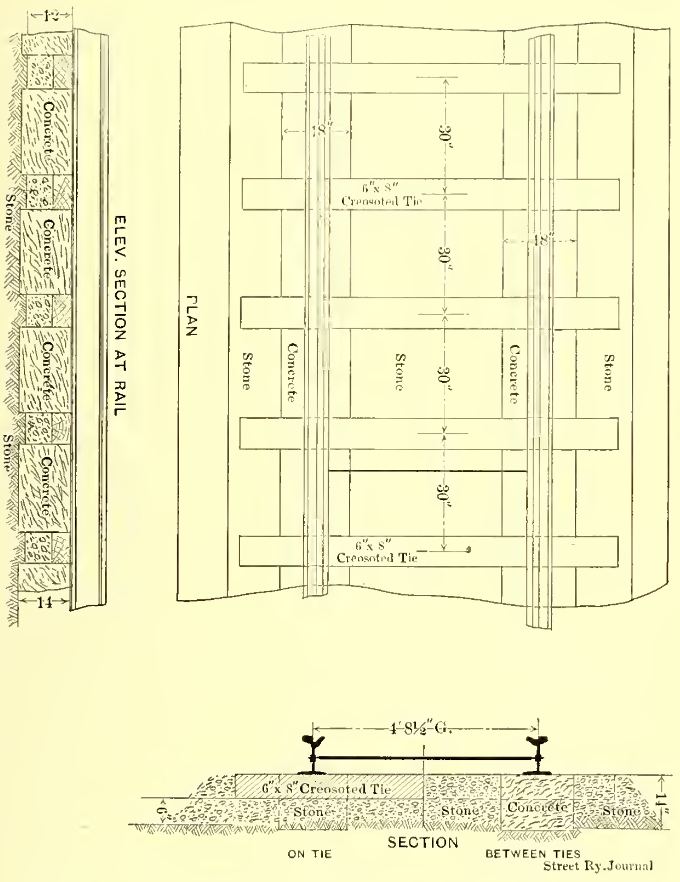
W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

We do not.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 22.—What has been the experience with concrete foundations under rails or roadbed? Please give details as to how concrete was laid, cost of construction and results secured.

I have never been an ardent advocate of concrete stringer construction. It is almost impossible to get a good line and surface unless the concrete be brought up two or three inches above the base of the rail, which cannot always be done on account of the paving used. When the rail is laid on a stringer, the concrete in setting, contracts and leaves small spaces between the stringer and rail, which gives rise to a vertical motion in the rail when the car passes over it. Some have attempted to fill these small spaces with cement grout, but this soon powders away. In the case of sheet asphalt paving, the rails can be laid on stringers of concrete and this same concrete brought up within 3 ins. of the top of the rail. This makes a very rigid and noisy construction. We have adopted a compromise which admits of some slight elasticity in the track, and at the same time makes a very durable construction. The rails are first spiked down on 6-in. x 8-in. x 8-ft. creosoted pine ties spaced to 30-in. centers. Tie rods 2 ins. x 3/8 in. are then



STANDARD CONSTRUCTION IN PAVED STREETS, ATLANTA

put in every 7⅛ ft. The track is then surfaced and lined on 6 ins. of broken stone, and the cars are run over it for a short while. It is then gone over again and any settling places raised. Between the ties an excavation is then made immediately under the base of the rail 14 ins. deep and 18 ins. wide, and this is filled with concrete, bringing it ½ in. above the base of rail. The remainder of the track is filled to the top of ties with broken stone. (This construction can be more easily understood from the accompanying drawing).

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

We have found that 9-in. girder rail, with concrete laid from bottom of tie to within 5 ins. of rail-head, thoroughly tamped under and around base of rail, has given good results. Materials should be distributed along the track in right proportions; stone on one side and sand and cement on the other. The mixing board or machine should be drawn along on the rails ahead of the work. If on double-track work, the mixing board should be on track nearest stone piles. Concrete be mixed 1 part of Portland cement to 3 parts of sand, thoroughly mixed in a dry state, wetted to the consistency of good mortar, and then 7 parts of thoroughly wet broken stone placed upon it and thoroughly mixed. Thorough mixing is essential to good results. Concrete should be carried ahead for tamping under the base of rails, but only so far as will insure its becoming thoroughly bonded with the main body before setting. The spaces between ties should be first filled and thoroughly tamped, and the top layer brought directly over the ties and tamped until it flushes on the surface. The spaces under head and flange of rail should be packed full of a soft mixture consisting of 1 part cement to 3 parts of sand, the headers and stretchers being set in the same mixture. If gravel is used the proportion 1 to 10 gives good results. With broken stone, delivered at $1.25 per cubic yard, and Portland cement at $1.20 per bbl., the cost would be about $2.75 per cubic yard. With gravel at 60 cents, the cost would be about $2.10 per cubic yard.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Concrete foundation is necessary under tracks in paved streets if proper grade is to be maintained. Several types of concrete construction are employed. One that has proven the cheapest and fully as durable as any employed by the writer, has the following features: A beam of concrete in the form of a flat top pyramid, 12 ins. at the base, 6 ins. at the top, and 7 ins. high is laid under each rail from tie to tie; and under every second tie is laid a similar beam, 12 ins. at base, 10 ins. at top, and 6 ins. high. With 7-in. rails ties should be placed 4 ft. center to center, and with 9-in. rail, 5 ft. center to center. This construction requires 420 yds. of concrete per mile of single track, and at $5 per yard laid, the cost will be $2,100 per mile of track for concrete. The total cost with 9-in. girder rails at 93 cents per ft., laid with brick pavement, costing $1.25 per sq. yd., will be $16,508 per mile of single track. Itemized, this cost is as follows: Pavement per mile, $5,866; material per mile, exclusive of pavement, $7,702, and labor per mile, exclusive of pavement, $2,939; total, $16,508. If granite blocks, special brick or Medina sand stone are used, the cost of pavement per mile will be practically doubled.

H. A. TIEMANN, New York City.

There is probably no city in the country of equal size, that has more track on concrete foundation than can be found in Richmond. This concrete is laid 6 ins. deep under the ties between the rails, and 2 ft. on each side of rails, and is also placed in the cribs level with the top of the ties. It is made from a rich mixture, subject to city inspection. The webs of the girder rails, which are 8 ins. and 9 ins. in depth, are filled with a rich mixture composed of sand, fine stone and Portland cement. The actual cost of this concreting is $1.50 per running foot of single track road. No contractors' profits are included in this, as the work is done entirely by the company. A city ordinance requires all tracks to be concreted in paved streets. When the work was first done, although the cost was high, I considered the concreting of tracks a good thing, and something that would last forever, but finding after a time that the tracks at places were getting out of surface, and on investigation discovering that same was caused by this slab of concrete (as it might be called) settling at points, I have radically changed my mind. If we were building any sort of a structure on a concrete foundation, we would not stop at 6 ins. regardless of foundation, but would naturally go down to bed-rocks or to some firm material, which would safely hold the structure. Of course it would be folly for street railways to hunt such foundations, for a mile of track might cost more than a squadron of first-class battle-ships. Another difficulty we find is that when the ties in this concrete have rotted, the question is how to renew them, it being almost impossible to take them out, and when one is finally gotten out, it is a difficult matter to find one to fit exactly in its place. On a short stretch of paved street in the heart of the city, and over which passes our heaviest traffic, there is no concrete under the ties, this particular piece of track having been laid before the ordinance went into effect. It is, however, ballasted with broken stone, and I consider it to be the finest piece of track, and the least costly to maintain, on the system. Whenever any part of it appears to be getting out of surface, all that is necessary to do is to pull up a few paving stones, tamp the ties, and surface same, as one would do on a steam road. This, as is well known, is impossible to do with a concrete foundation. On one of our divisions, instead of placing the 6-in. broad slab of concrete under the whole roadbed, permission was obtained from the authorities to dig a trench and construct a stringer of concrete, 15 ins. wide and 18 ins. deep, under each rail, connecting the rails with tie-rods and steel channel cross-ties every 5 ft. Experience has shown that this is not even as good as the original method, on account of lack of footings. The concrete beam at points broke entirely in two where the foundation was not of the proper material to support it, and I am strongly of the opinion that the same would have happened even had this concrete beam been constructed with reinforced metal.

Ch. Engr. Ry. Dept.

REPORT UPON INCREASING THE CAPACITY AND REDUCING THE NOISE OF THE UNION ELEVATED RAILROAD OF CHICAGO

The report on these two subjects, submitted to the committee on local transportation of the Chicago City Council by Bion J. Arnold, was made public this week, so that it is possible to present a brief extract of it in this issue. In his letter of transmittal, Mr. Arnold acknowledges the assistance rendered him in the preparation of this report by J. B. Strauss, C. E., and George Weston, C. E.

In discussing the elevated loop, Mr. Arnold refers to a previous report which he submitted to the local transportation committee of the Chicago City Council, November, 1902, relating to the Union Elevated loop. In that report he pointed platform. Mr. Arnold also recommended the establishment of auxiliary stub terminals and, if feasible, the through routing of trains.

Fig. 1 represents the loop as it is now constructed and operated. The point on the loop which now limits its apacity is at *a*, where the Metropolitan tracks cross the outer loop track to enter and leave the inner loop at Fifth Avenue and Van Buren Street, where, under present conditions of maximum operation, forty in-bound and forty out-bound Metropolitan trains meet sixty-seven Oak Park and Northwestern trains in one hour. The next most congested point is at *b*, Van Buren Street and Wabash Avenue, where thirty-one in-bound and thirty-one out-bound trains of the South Side Road meet sixty-seven Oak Park and Northwestern trains in one hour.

Assuming that it is practicable to pass a train through these

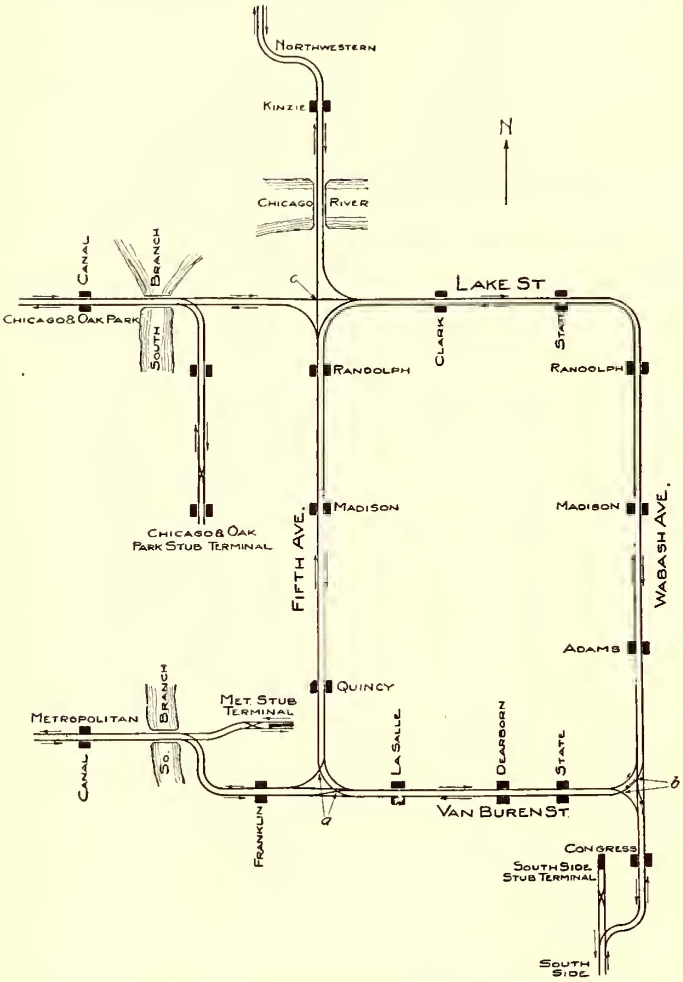


FIG. 1.—PRESENT ARRANGEMENT OF THE UNION LOOP

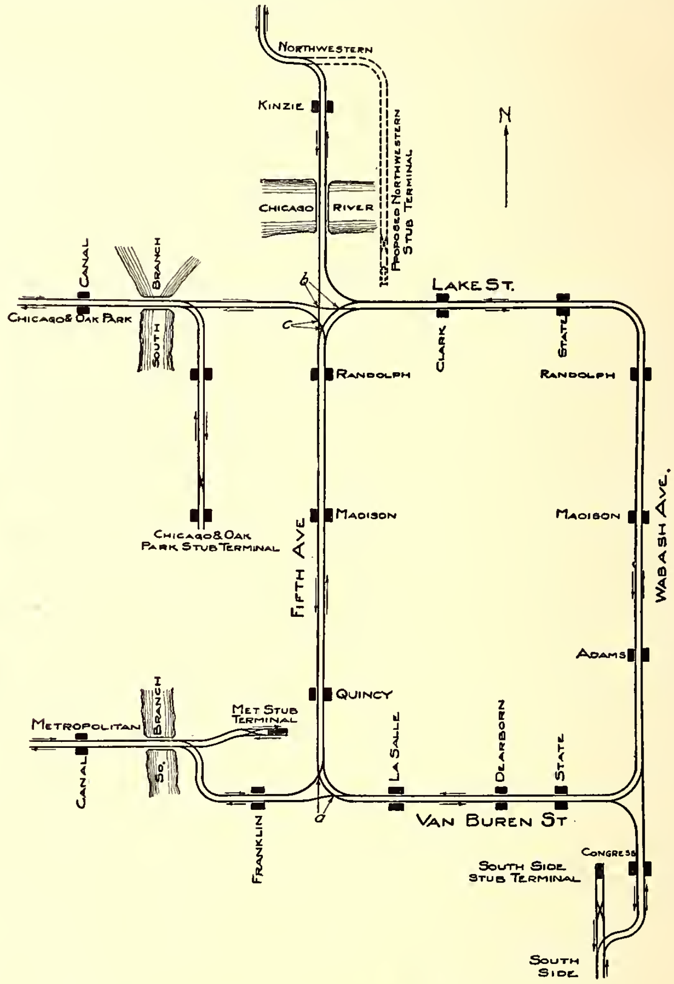


FIG. 2.—PROPOSED REARRANGEMENT OF UNION LOOP

out that at that time 1600 trains, ranging from two to five cars in length, are delivered to the loop railroad daily. The total number of cars operated on the loop per day was 5000. The traffic of the elevated railroads, like that of the surface lines which terminate in the business district, is principally handled during ninety minutes in the morning and ninety minutes in the evening. The period of maximum congestion on the loop tracks extends over approximately thirty minutes during the morning and thirty minutes during the evening rush hour. At these times the average headway between trains on the outer loop is 19.8 seconds and on the inner loop 19.5 seconds. The ultimate capacity of the loop tracks is fixed by the number of in-bound and out-bound trains which it is possible to pass through the junctions at Lake Street and Fifth Avenue, Wabash Avenue and Van Buren Streets, and Van Buren and Fifth Avenue. The present capacity, however, might be somewhat increased by lengthening the station platforms so that two trains of five or six cars could simultaneously occupy a

points and clear for another train in forty-five seconds, the maximum number of trains that could enter the loop in one hour from either of these points would be forty-five, provided the interlocking plant had to be worked for each train; but since it is possible for a train to pass off from the loop at each of these points at the same time that a train is also passing on to it, the interlocking device needs to be worked but twice to allow the passage of three trains—one entering the loop, another leaving the loop and the third crossing the tracks of the other two—and it is this feature that gives the present junction points their efficiency over any other that can be devised for the present method of loop operation, for it permits three trains to be handled through them in one and a half minutes, provided the trains chance to come, or are arranged, in such manner as to utilize this advantage.

The perfection during the past few years of power mechanism for operating switches and signals at junction points has been such as to warrant its adoption on the loop, and if used the capacity of the junctions could be somewhat increased, owing to the quicker action of the mechanism. When the advantages of this improvement and of the use of "the multiple-unit system" on the cars are utilized, there is no way that the capacity of the loop, as now built, can be increased under the present method of individual ownership operation except by extending the platforms, and when this is done relief to the present loop district must come from the development and operation of stub-end or other terminals for each road, unless unification or some method of joint operation can be effected whereby through routing can be adopted.

Mr. Arnold then discusses several methods of through routing, giving the advantages of each. Of these, he recommends either that shown in Fig. 2 or Fig. 3.

In Fig. 2 provision is made for routing through trains from the South Side Road to the Northwestern Road and back, and from the Metropolitan Road over the Union Loop to the Chicago & Oak Park Road and back, and at the same time it makes provision for the operation of loop trains for all the roads. It places the trains of the South Side and Northwestern roads on the outside loop track, and the trains of the Metropolitan and Chicago & Oak Park roads on the inside loop track. It also reverses the running of the trains of the Northwestern Road to right-hand running, and those of the Metropolitan Road to left-hand running. The routing of the through trains under this system would be as follows:

A train originating on the South Side Road would run north on the east track of the Wabash Avenue section of the loop, thence west on the north track of the Lake Street section of the loop, thence north on the east track of the Northwestern Road. Returning it would run south on the west track of the Fifth Avenue section of the loop; thence east on the south track on Van Buren Street and south on the west track of the South Side Road, thus intersecting traffic on the Metropolitan Road at point *a*, and the Oak Park Road at points *b* and *c*, as at present.

A train originating on the Metropolitan Road would enter the loop on Van Buren Street from the north track of the Metropolitan Road, thence north on the east track of the Fifth Avenue section of the loop, thence west on the south track of the Chicago & Oak Park Road. Returning it would run east on the north track of the Chicago & Oak Park Road, thence east on Lake Street on the south track of the loop, thence south on the west track of the loop on Wabash Avenue, thence west on the north track of the loop on Van Buren Street, and out to the south track of the Metropolitan.

Suitable curves are provided at Van Buren Street and Wabash Avenue and Fifth Avenue and Lake Street on the outside loop track to allow the operation of loop trains for both the South Side and Northwestern systems, while similar curves are provided at Fifth Avenue and Lake Street and Fifth Avenue and Van Buren Street on the inner loop track to allow the operation of loop trains of both the Metropolitan and Chicago & Oak Park Roads.

This plan gives all the advantages of the present system of operation and all necessary advantages of through routing, and at the same time reduces the congestion on the loop, or increases the capacity of the entire elevated railway systems up to the full capacity of the junction points, an increase of not less than 25 per cent over its present capacity, and if power operated junction point mechanism is employed a further increase will be effected. It would necessitate the changing of cars for passengers desiring to go from either the south or the north divisions of the city to the west side, and vice versa, but inasmuch as all roads could operate a certain portion of their trains around the loop, all stations could be made transfer stations, thus avoiding congesting the people at a few transfer points, and with a suitable transfer system would give to the citizens the best elevated service possible with the present elevated loop structure when using grade crossings.

Still a better plan is shown in Fig. 3, which is submitted as the best possible solution of the entire problem. It is the same as the plan shown in Fig. 2, except that the crossings are eliminated by elevating the tracks of the inner loop over those of the outer loop at Fifth Avenue and Lake Street, and the outside track of the loop over the Metropolitan tracks at Fifth Avenue and Van Buren Street. The routing of the cars would be the same as in the case shown in Fig. 2, but the capacity of the systems would be limited only by the facilities for loading and unloading on the loop structure. Assuming that all trains operated were through trains, the capacity of the present loop and of the roads connected therewith would be increased 100 per cent, and by extending the platforms, thereby permitting increased facilities for loading and unloading, the capacity would be still further increased, and thus the advantages of the entire elevated and loop systems utilized to their possible maximum capacity. If then each road should be allowed a stub-end terminal, its rush-hour capacity could be still further increased, so that the only limit to the capacity of the elevated roads of the city would be determined by the number of main line tracks leading away from the terminals.

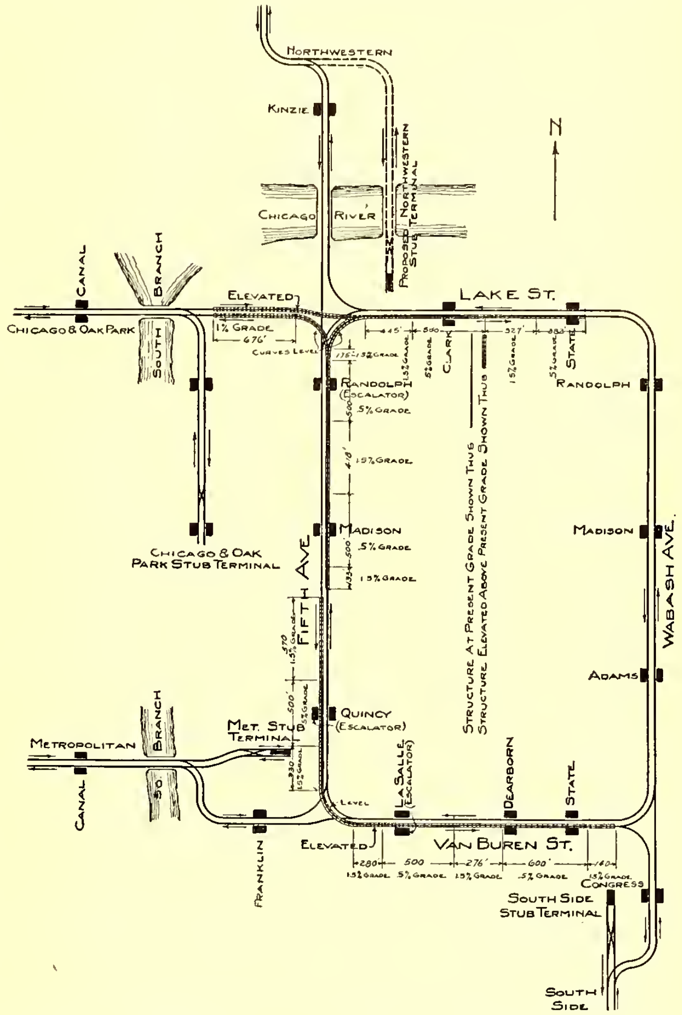


FIG. 3.—PROPOSED REARRANGEMENT OF UNION LOOP TO GIVE MAXIMUM CAPACITY

Modifications of the plan shown in Fig. 3 were suggested in case it should prove practicable to enlarge the loop by extending it in various ways. In all the plans calling for the tracks of the loop to be elevated, the grades have been kept well within the limit for safe operation, as the maximum grades are $1\frac{1}{2}$ per cent, while in front of stations all grades have been reduced to one-half of 1 per cent for a distance of 500 ft., thus giving ample room for two trains in case the platform should be extended. Universal through routing of trains can be accomplished, if necessary, with either of the plans proposed.

The cost of changing the loop to conform to the above described systems would be about as follows: For the plan shown in Fig. 2, including necessary changes in special work, new interlocking power mechanism and the extension of platforms, but not including any alteration of present track or structure to reduce noise, $97,000.

For the plan shown in Fig. 3, including elevation of structure, removing and replacing track on elevated portions, modification of stations and platforms due to elevation, new power mechanism for interlocking plants, necessary changes in special work and the installation of escalators at Clark, Randolph, Quincy and La Salle Streets, but not including any alterations of present track or structure to reduce noise, $500,000.

Summarized then, Mr. Arnold's recommendations for increasing the capacity of the loop are as follows, arranged in the order of their merits in general and in sub-classification:

First—(a) Reconstruct, elevate and through route in accordance with plan shown on Fig. 3; (b) extend the platforms; (c) develop the stub-end or auxiliary terminals.

If it is found impracticable to elevate, then:

Second—(a) Reconstruct and through route in accordance with plan shown on Fig. 2; (b) extend the platforms; (c) develop the stub-end or auxiliary terminals.

If on account of the diversified ownership of the roads, or for any other reason, it is found impracticable to secure through routing, then:

Third—(a) Leave the loop as it is now and install power mechanism for operating the switches and signals at the junctions; (b) extend the platforms; (c) develop the stub-end or auxiliary terminals.

PART II.—SUGGESTIONS FOR REDUCING THE NOISE UPON THE UNION ELEVATED LOOP

The question of deadening or reducing the sound on metallic elevated railway structures has been a serious one ever since such structures have been put in operation, and though public remonstrance has been great at times, and some experiments for reducing the noise have been made, but little has been accomplished which can be accepted as definitely pointing toward a satisfactory solution of this trying problem, although recent methods of using concrete have made the solution more likely.

The first elevated railroad company to meet criticism of this nature was the Manhattan Elevated, of New York, and a number of experiments were made by this company between the years 1871 and 1878 in an endeavor to find some method of reducing the noise caused by the operation of trains on its elevated metal structure. Many schemes were proposed by various individuals whose theoretical considerations had led them to believe that a practical demonstration of their ideas would solve the problem.

Most of the schemes proposed were methods for supporting the rail upon some cushioning material, such as lead, felt or asphalt, while others proposed to not only support the rail in this manner, but also to surround it with some substance, such as sand, asphalt mixed with sand, crushed stone, felt, lead, etc. Almost all those who offered solutions seemed to think that some method of shrouding the rail and providing a cushion between it and the structure would prevent the difficulty.

Figs. 1, 2 and 3 show some of the most meritorious schemes proposed. These were tried, with others, but it was found that the deadening effect on the noise was not sufficient to warrant the expenditure necessary to put the plans into execution over the system and experiments were abandoned.

When the New York Central & Hudson River Railroad Company completed its steel viaduct, extending from the Harlem River to 110th Street, in 1897, where its trains enter the city of New York through one of the most densely populated districts of the city, it was soon confronted with damage suits on the part of the people, due to the excessive noise made by trains running over its track on this steel viaduct. The company's engineers went into the subject thoroughly at the time, and, after experimenting to a considerable extent with various substances, such as sawdust mixed with asphalt and other mastic material, came to the conclusion that no such material placed around the rails and under the ties would effectually

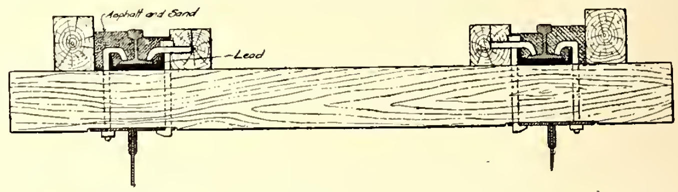


FIG. 1.—MANHATTAN EXPERIMENT, SHOWING RAILS SURROUNDED WITH ASPHALT AND RESTING UPON LEAD STRIPS CARRIED IN STEEL CHANNELS

overcome the difficulty, for while they deadened the noise somewhat, they were not strong enough to hold the track. Fig. 4 represents a longitudinal section of this structure as built at the time it was first put in operation. It will be noticed that the rails were clamped rigidly to the steel deck plates of the structure, thus providing the best possible means for the transmission to the structure of whatever blows or shocks the rails

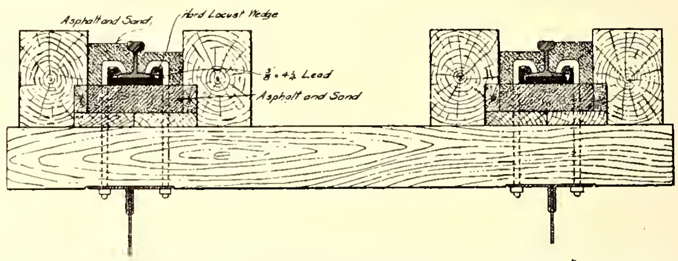


FIG. 2.—MANHATTAN RAILWAY EXPERIMENT, SHOWING SAME AS FIG. 1, EXCEPT THAT STEEL CHANNELS REST UPON ASPHALT

received from the rolling stock. Fig. 5 represents a longitudinal section of the same structure after the rails had been raised and provided with sawed ties underlaid with crushed stone ballast, thus making the track similar to the later type of ballasted steel railway bridges and street crossings. The ill effects produced by the operation of the trains were so reduced as to cause the citizens living along the right of way to cease their

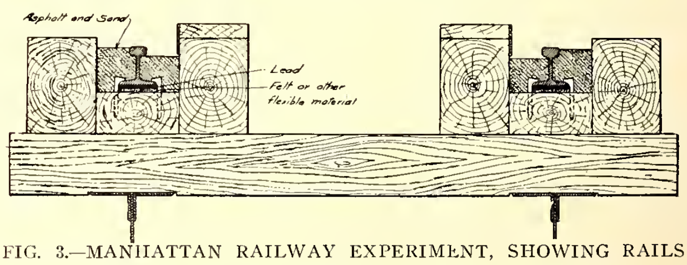


FIG. 3.—MANHATTAN RAILWAY EXPERIMENT, SHOWING RAILS SURROUNDED WITH ASPHALT AND RESTING UPON LEAD STRIPS UNDERLAID WITH FELT

objections, which resulted in the withdrawal of the damage suits previously brought, thus showing that the remedy applied in this case was somewhat effective, although the noise was only partially eliminated. The structure occupies one of the principal street in Harlem, and is lined on each side with high apartment buildings. The tracks on leaving the steel structure extend for a considerable distance over a stone viaduct, thence into a tunnel underneath Park Avenue. This case, therefore, offers about the best example of the relative sound deadening effects of four classes of construction that I have been able to find during my investigation, as the trains coming from the north operate first over a steel drawbridge, where the rails rest directly upon the plates of the bridge, then over a rock-ballasted steel viaduct, then over a rock-ballasted stone viaduct, and thence into a tunnel, where they are completely surrounded for certain distances and open to the streets at other places. It will be found by one who investigates this case that the noise is greatest on the bridge, less on the steel-ballasted structure, considerably less upon the stone viaduct, and if the observer is on the surface of the street over the tunnel where the trains are completely enclosed, the perceptible noise is very slight. It will thus be seen that in this case the only place where the objectionable noise is eliminated entirely is where the trains are completely surrounded by a mass of non-metallic and non-vibrating material.

One of the earliest European attempts to deaden the noise on an elevated structure was made on the Liverpool Overhead Railway at Liverpool, England, in 1893. This road was built with a ballasted floor with asphalt and ballast supported on circular steel arches bent from flat plates, in accordance with the type of construction known as Hobson's arch plate system. The rails were supported upon longitudinal wooden sleepers, which rested directly upon the arch plates, and the space be-

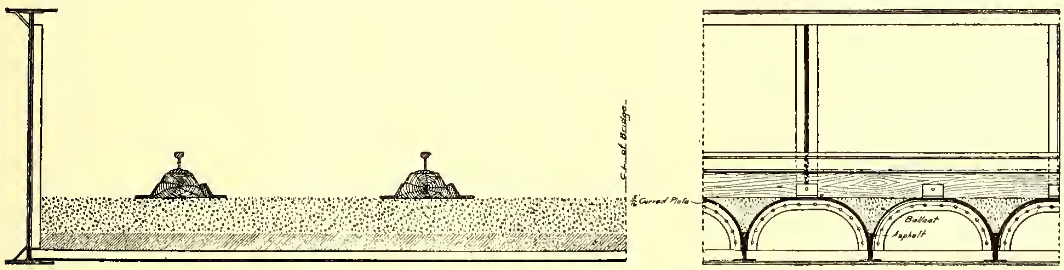
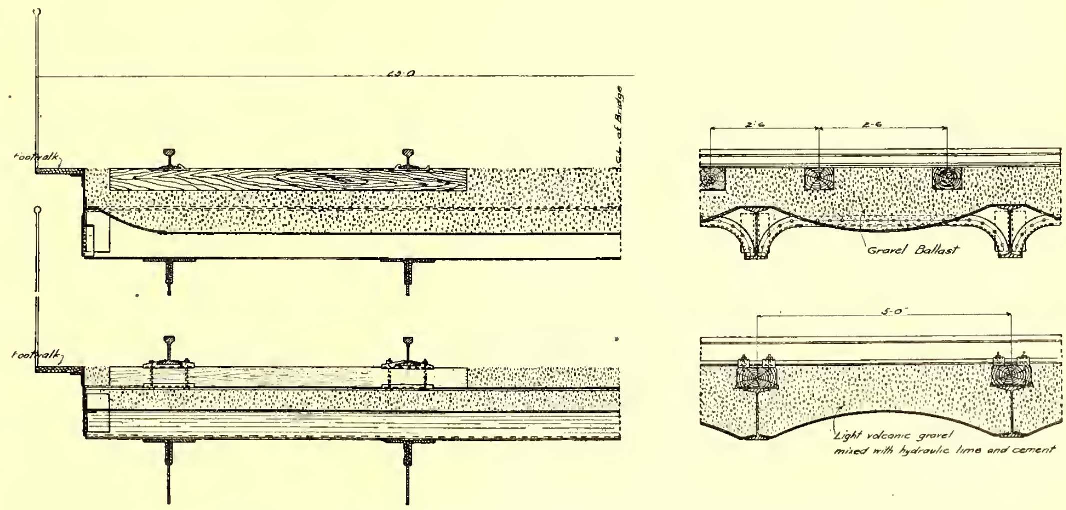


FIG. 6.—ROADBED OF LIVERPOOL OVERHEAD RAILWAY

tween these plates was filled with asphalt and ballast. Fig. 6 shows this type of construction.

The latest European attempt made in this direction was made in connection with the Elevated Electric Railroad of Berlin, Germany, completed in 1901. This is a rapid transit line, about 6 miles long, and in both the business and residential sections the construction was intended to reduce the noise, the general design for this purpose embracing a solid floor of buckled plates, filled with special ballast of volcanic gravel secured from the Rhine Valley. This construction is shown in Figs. 7 and 8, and it will be noticed that in Fig. 7, which represents the road as constructed in the western or residential portion of the city, the ties are embedded in ballast, while in Fig. 8, which represents the type of construction used in the eastern part of the city, the ties are further apart and rest directly upon the I-beams of the structure, the rails here being of extra depth and weighing 86 lbs. per yard, to allow for the increased distance between the ties. While these methods

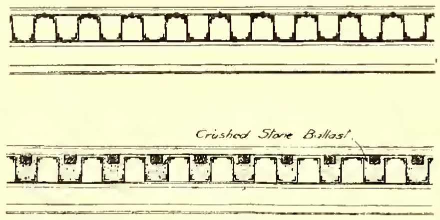


FIGS. 7 AND 8.—ROADBED OF BERLIN ELEVATED RAILWAY

of construction have accomplished to a considerable degree the object sought, they have not eliminated the noise as thoroughly as is desirable upon the Union Loop.

PRESENT LOOP STRUCTURE

The present steel structure of the Union Elevated Railway in Chicago, while well designed from a structural standpoint, shows that little consideration was given to the problem of noise, which makes it very difficult to reconstruct it in such a manner as to apply what is now known regarding sound deadening without costing a great deal more than it would have cost had the subject been given careful consideration at the time of construction.



FIGS. 4 AND 5.—NEW YORK CENTRAL VIADUCT AS ORIGINALLY CONSTRUCTED, AND AFTER TIES IN BALLAST WERE USED

Fig. 9 is a side elevation and plan of a typical loop span, comprising latticed deck, longitudinal trusses, semi-latticed girders and riveted posts; and Fig. 10 shows an enlarged transverse section with detail of floor. It will be seen that the rails rest immediately upon ties which, in turn, are rigidly secured to the upper chords of latticed steel trusses, thus giving the best condition for imparting the hammer blows, caused by the wheels upon the rails, directly to the structure that could have been devised, unless the rails had been placed immediately upon the upper chords or upon a metallic support between the rails and the chords. While this construction is not questioned from a railroad engineering standpoint, for it is well designed, attention is called to it to show some of the difficulties that will be encountered in attempting to modify it so as to deaden the sound to such an extent as may be found practicable. Were the present structure not in place, I am firmly of the opinion that a concrete structure could be designed and built which would prevent to a large degree the noise now emanating from the present steel structure, for a cost which would not be greatly in excess of the cost of the present structure, and such a design is shown in Figs. 11 and 12; but to change the present structure into one resembling such a form is a difficult and expensive task.

In analyzing the relative merits of different classes of construction, the fact should not be lost sight of that the noise comes primarily from the trains, and a large part of this noise cannot be eliminated entirely, no matter how good the design of the structure, and the best, therefore, that can be expected is to minimize the noise caused by the operation of the trains, to

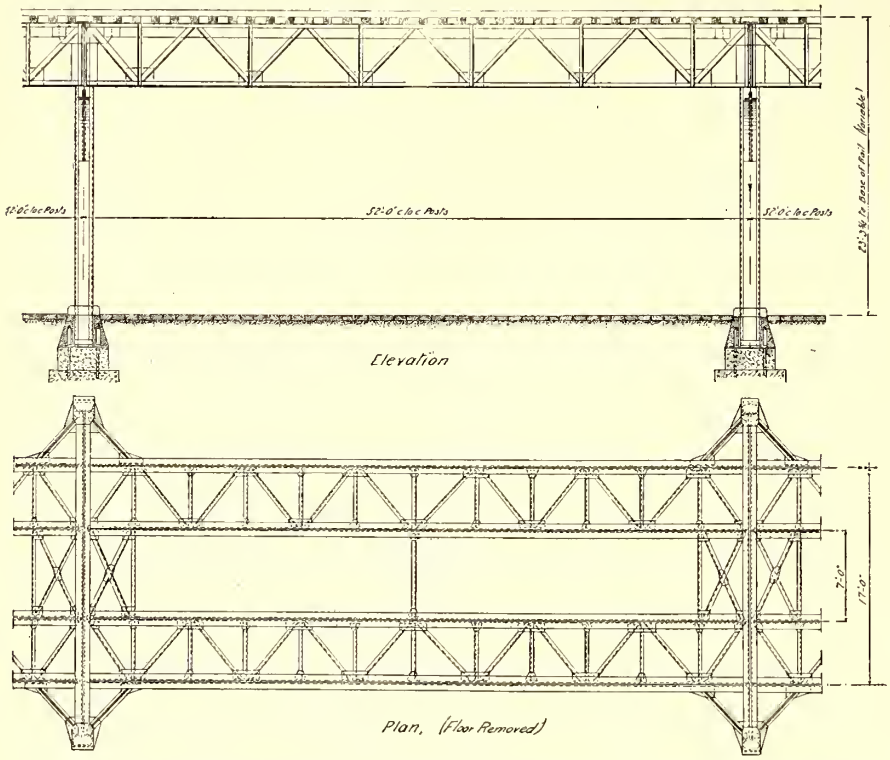


FIG. 9.—SIDE ELEVATION AND PLAN OF PRESENT TYPICAL LOOP SPAN

the greatest possible extent, and prevent it being intensified by the supplemental action of a vibrating or ringing structure.

The structure shown in Figs. 11 and 12 would be built of stone or concrete reinforced with steel parts embedded in the concrete, similar to the methods now becoming so generally utilized in the construction of railway bridges, buildings and other structures.

The use of concrete would eliminate almost all of the difficulty encountered with the present structure due to vibration, and if, in addition, the structure were carried up solid on each side of each track to a point slightly above the bottoms of the

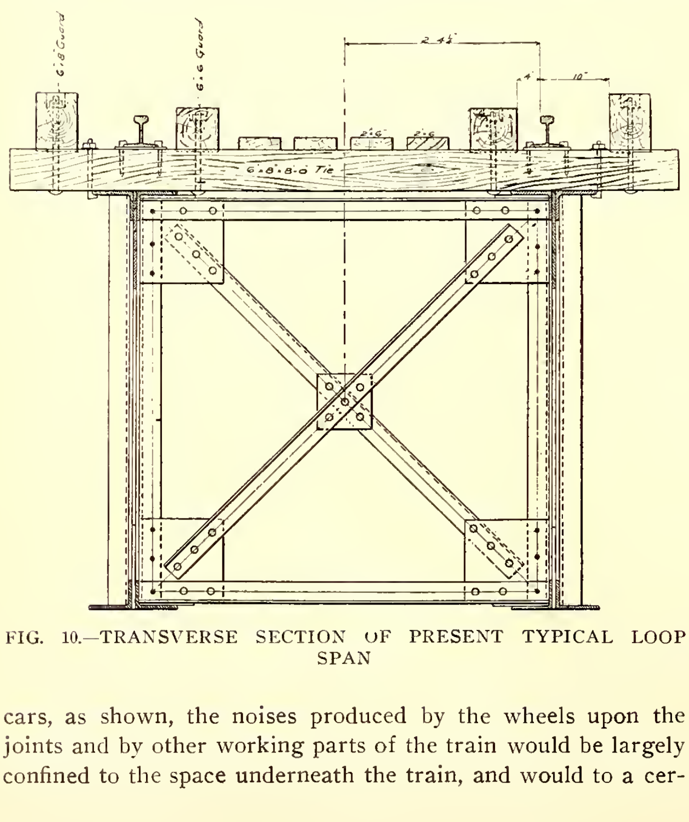


FIG. 10.—TRANSVERSE SECTION OF PRESENT TYPICAL LOOP SPAN

cars, as shown, the noises produced by the wheels upon the joints and by other working parts of the train would be largely confined to the space underneath the train, and would to a certain extent dissipate themselves and be prevented from being immediately transmitted in a horizontal plane to the sides of the tall buildings on each side of the structure, thence upward, to the annoyance of the occupants of the upper stories, as at present. This class of construction would be objected to by the operators of the road, owing to the fact that it would introduce difficulties in removing ties; but in answer to this it may be said that the underground railroad of New York (the latest to be constructed), as well as the Berlin Elevated Road and others, have at the present time this objection in a greater or less degree, so that it should not be considered prohibitive if, by its adoption, other advantages could be gained.

Furthermore, the ties on an elevated structure should last many years, and the use of concrete steel ties, similar to those now beginning to be used in steam railway service, would almost entirely eliminate this objection, as they would seldom, if ever, have to be renewed.

Since it would be manifestly unjust to ask that the present loop structure be removed, and thus permit the erection of a design of this character, the problem then is how best to modify the present design so as to reduce the noise to the greatest possible extent without making the cost prohibitive.

There are four primary causes of the noises of the loop, which are as follows:

1. Imperfect track construction.
2. Imperfect rolling stock.
3. Imperfect roadbed.
4. Defects in structure. (a) Elasticity of the steel; (b) lack of rigidity.

IMPERFECT TRACK CONSTRUCTION

The track when built in 1895 was laid with 80-lb. steel rails upon light tie plates, and provided with all necessary special work for operating the trains in and out of the loop, and so long as the joints of the track remained new and in good condition the noise was not excessive, after the inequalities incident to the opening of a new line of track had worn off, except at the junction points and on cross-overs, where many frogs and switches were necessarily placed. As the track became worn and the joints hammered, the noise began to increase, and

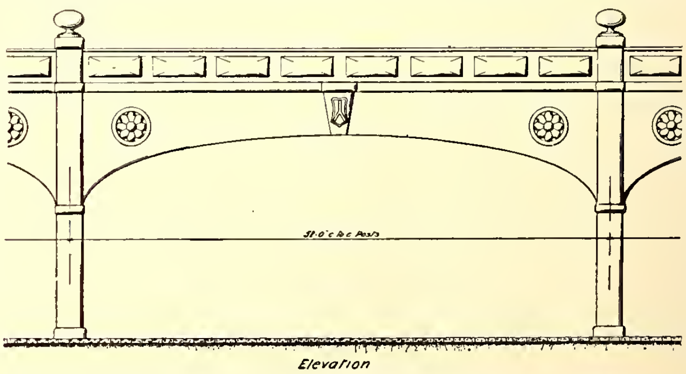
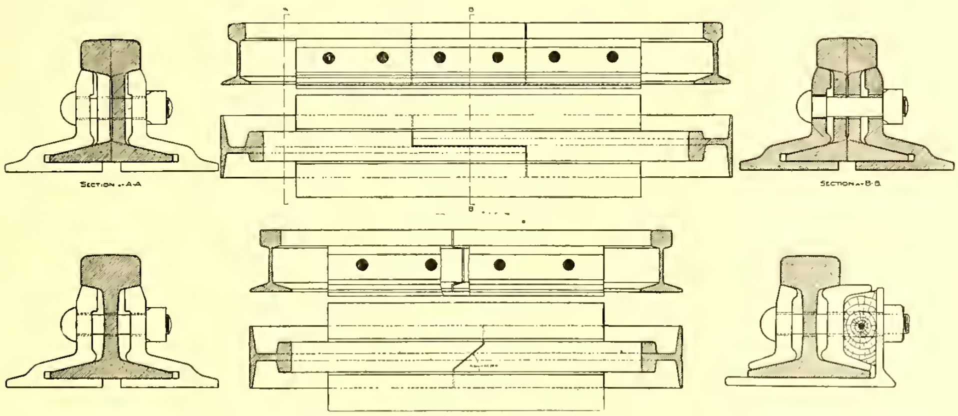


FIG. 11.—ELEVATION OF SUGGESTED CONCRETE STRUCTURE

it has continued to increase until the present time, when it is almost unbearable in certain places, and especially at the junction points. The present condition of the track is largely due to the failure of the tie plates, which proved to be too light for the duty imposed upon them.

As the hammering of the wheels over the joints is the chief source from which noise is imparted to the structure, it is of vital importance that these joints and the entire track be built in as thoroughly first-class manner as possible, and maintained in this condition. It seems almost impossible to procure a type of joint over which a heavily loaded wheel will pass without imparting to the rail a blow sufficient to produce sound of considerable magnitude, and in time cause a hollow place in the rail upon which the wheel strikes after leaving the joint.

I have given careful attention to the rail and joint question, and believe that the most practical thing to do under the circumstances, in view of the fact that the present rail is badly worn and would have to be renewed before experiments with any new type of rail could be conducted, during a sufficient length of time to determine its practicability, is to use the American Society of Civil Engineers' standard section, rerolled steel T-rail, weighing not less than 80 lbs. to the yard, having its ends cut at an angle of about 40 degs., and provided with some first-class joint of the bridge type, such as the continuous, the Weber, or other equally as good joint. A bridge type of joint is one which allows the ends of the rails to be jointed midway between two ties and the joint itself extends from tie to tie, thus bridging the space between the ties and forming a support for the open rail ends. Fig. 14 represents such a joint as seems best to adopt under the circumstances. This joint is not new and has been used in different forms by various railroads, and especially by the Lehigh Valley Railroad, where it was known as the Sayre joint, for a period of about twelve years, and to a certain extent by the Buffalo, Rochester & Pittsburg Road. While it has been abandoned by the former road, due probably to the fact that the advantages gained in steam railway service were not considered by the management sufficient to pay for its increased cost, I believe it to be the most practical thing to adopt in this case at present, for, by its use, it will be possible for the Union Loop Company to equip its road during the coming summer with new rail, and thus at once eliminate a large part of the present noise. If this type of joint is used, the rails should not be over 45 ft. in length, on account of expansion difficulties. It is important that the joint be made with shoulders on the rails, as shown, thereby removing the sharp points.



FIGS. 13 AND 14.—SECTIONS AND PLAN OF MITERED JOINTS AND SCARF JOINT

If there were sufficient time to secure special rails, there is one other type of joint which I believe would do good service. This is known as the scarf joint, shown in Fig. 13, and is the standard joint used by the Prussian State Railways for a number of years, and at present used on the Berlin Elevated Road. In its best form, however, it necessitates a specially rolled rail, as it will be noticed that the web is eccentric or off-center of the rail, this construction permitting the rails to be alternated and allowing the webs to lap at the joints, thereby making a stiff, substantial joint, and, at the same time, providing a practically continuous rail for the wheel when passing the joint. It is this form that is used on the Berlin Road, and is there known as the Haarmann-Vietor rail, after the patentees.

All "special work" not absolutely necessary for the proper operation of the trains should be removed, and worn special work now in place (and ultimately all the present special work) replaced with the best and most improved type of manganese steel special work, which, although very expensive, lasts so much longer than ordinary special work that, under the conditions existing on the loop, it is advisable to use it. All frogs should be of the movable point type where conditions will permit, or of a type which will offer as nearly a continuous rail as practicable for the rails over which the wheels are passing. In order to make the rail and its support a unit, all rails should rest on large and heavy tie plates and be secured to the ties by means of screw spikes or otherwise in such a manner as to prevent the rattling of the rail and plates, and be maintained in this condition.

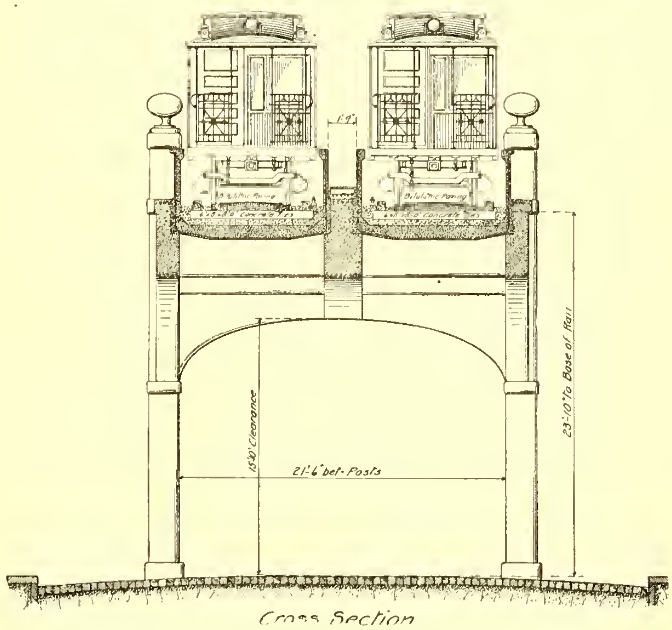
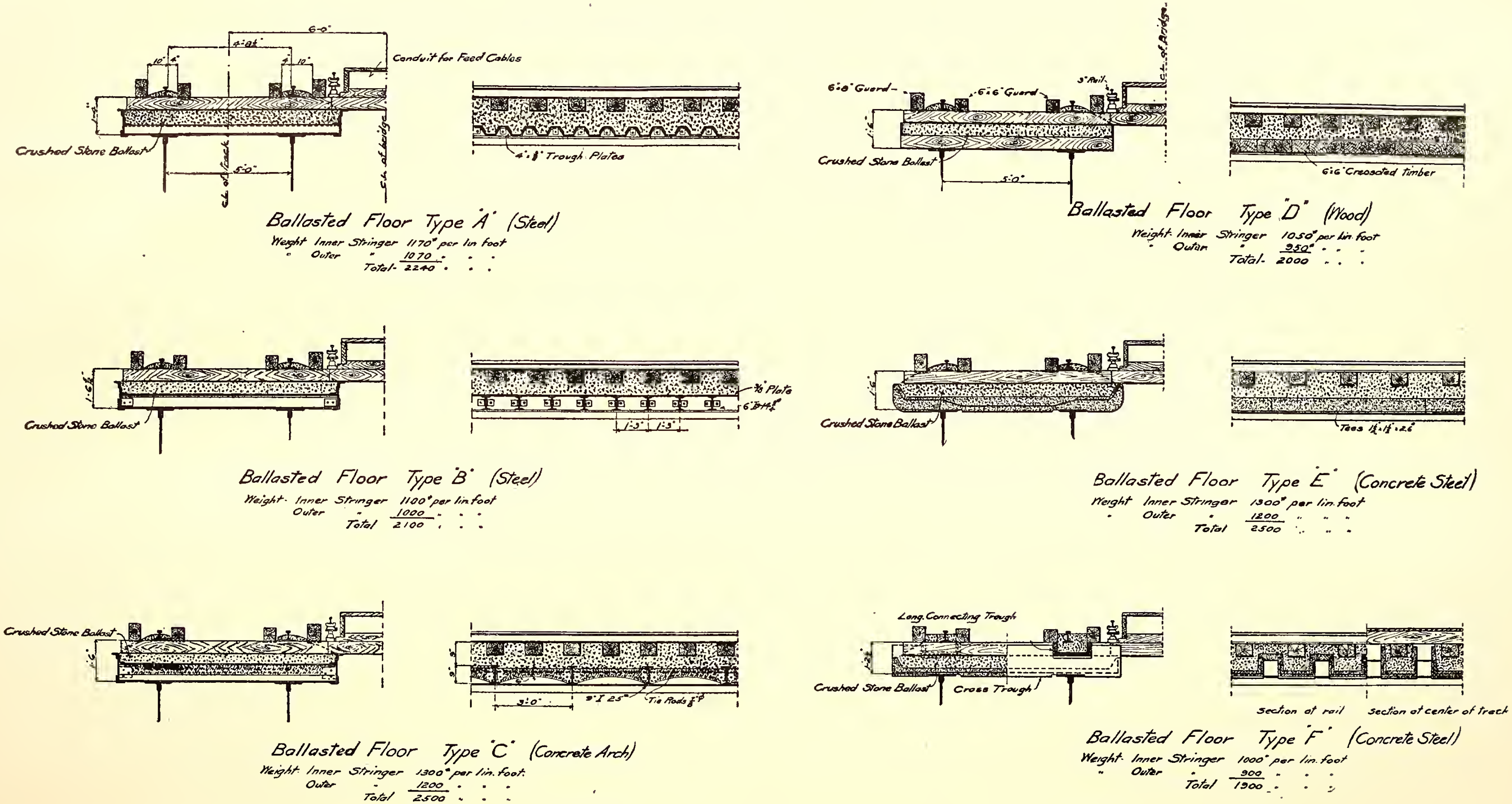


FIG. 12.—TRANSVERSE SECTION OF SUGGESTED CONCRETE STRUCTURE

IMPERFECT ROLLING STOCK

The rolling stock in use in the Union Loop consists mainly of rather light cars with open running gear. Since a large part of the noise proceeds from this running gear, it is important to apply some corrective for this either on the cars or on the structure. Unless the railroad companies will maintain this apparatus in good condition and thereby prevent much of the present noise from this source, some method of enclosing the entire truck, including the wheels, with a light casing of sound deadening, non-combustible material, such as asbestos sheeting, should be tried. This casing should come as close to the guard rails as practicable and clear the third rail, so as to intercept as much of the noise from the wheels as possible. It should have a bottom, and the sides should be hinged to permit inspection.

A truck casing of this type should, to a considerable degree, smother the noise due to brake beams and shoes, defective gears, rattling of bolts and rivets on trucks, etc., which is particularly annoying at times, and in a large part that resulting from the impact of the wheels on the rails. From a railroad standpoint this is a very objectionable thing to do, for the reason that inspection of the truck and motor parts would be made more difficult and the capacity of the electric motors



Note.
Ballast Broken Stone 6" deep under ties
Ties 6"x8"-8'-0" spaced 2'-0" c. to c.
Every 4th tie extended to carry cable conduit

FIG. 15.—SHOWING TYPES OF FLOORS APPLICABLE TO THE UNION LOOP

would be reduced owing to their enclosure. Careful inspection and the prompt renewal of all defective and badly worn parts would largely remove this source of noise and, by adopting side walls on the structure as hereinafter described, the noise from the same would be rendered less objectionable.

The Northwestern and Chicago & Oak Park roads use single motor cars on their trains, which method of operation imposes upon four sets of motor gears the entire duty of accelerating any train, no matter how heavy. This results in excessive gear noise on heavy trains, which could and should be eliminated by the adoption of the multiple-unit system, which provides each car with its own motors and thereby imposes less duty upon individual gears. Furthermore, the average speed of the trains could be increased by its adoption.

The latest types of cars used for intramural transportation, such as those recently put into service in the subway by the Interborough Company, of New York, are provided with sound deadening material in the hollow spaces of the floors and sides. There are several fireproof substances that can be used for this purpose, and all new equipment purchased by the elevated roads of Chicago should have all hollow places filled with some such material. Such of the present cars as have no sound deadening material in them should have the hollow spaces filled with mineral wool, asbestos or some other light, non-combustible material.

The present cars and trucks should be put in first-class condition and kept so, and all future cars should be equipped with trucks having as few parts as practicable.

The relief opening of the triple valves of the air brakes should be provided with some device for muffling the noise of the escaping air when the brakes are released, and thus prevent the sharp whistle now common to some of the cars. This can often be accomplished by changing the size of the orifice.

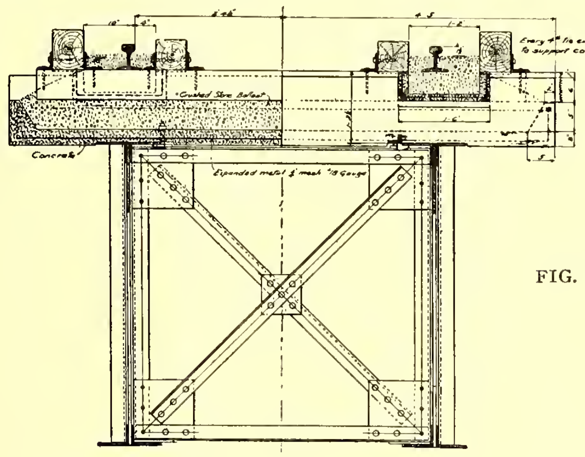
IMPERFECT ROADBED

As has been previously pointed out, the roadbed of the present structure, though satisfactory for railroad operation, is defective from the standpoint of sound deadening, and in order to remedy this defect as far as practicable some type of ballasted floor must be used. This might involve the reinforcement of the loop structure to provide for the added weight, and this reinforcement governs the selection of the type of floor to be adopted. Considerations of cost, maintenance, interruption of traffic and cutting off the light in the streets below, as well as the difficulties attending the alteration of the existing structure, enter into the problem.

Ballasted floors have been used in this country, and especially in the vicinity of Chicago, by different steam railroads in crossing streets on viaducts, the ballast generally being supported on steel trough plates or I-beams with steel plate decking. In some instances creosoted plank has been substituted for the steel decking, and in some types the ballast has been omitted altogether, as in the case of the first track on the New York Central viaduct.

In order to compare the various types of floor construction, six such ballasted floors applicable to the loop are shown on Fig. 15, designated as types A, B, C, D, E and F. These types have all been designed to support a single track only, leaving an open space between tracks for the feeder conduit and third rails, except at crossings, turn-outs and junction points, where the floor would extend across this space. All floors have been figured for 12 ins. of broken stone ballast, weighing 140 lbs. per cubic foot, and providing for 6 ins. of ballast under the ties. Types A and B are what may be termed ballasted steel floors. Type C is a ballasted concrete arch floor, and type E a ballasted concrete steel floor resembling the latest type adopted by steam railroad companies for bridges. All of these are "solid" floors—that is, they form a continuous decking under the track. Type F is a type of open ballasted concrete steel floor.

The effect of the ballast as used in these various types would



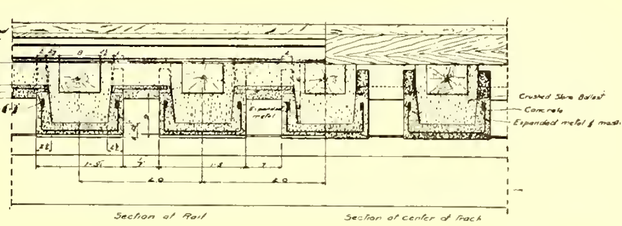


FIG. 16.—REINFORCED SOLID CONCRETE STEEL FLOOR, TYPE E

be a cushioning of the rails, and a reduction of the impact due to the cars, improving the riding qualities of the track, reducing the noise and increasing the durability of the structure. By carrying the ballast up and around the rails the noise due to the singing or humming of the rail would be greatly reduced.

In respect to cost, types A and B involve drilling of many holes and much field riveting; type C likewise involves such work, but to a less extent, the gain, however, being offset by the cost of the forms required for the concrete arches; type D has but little field work, but in order to insure durability the timber must be treated, which increases the cost and removes the main argument for its adoption; types E and F are the cheapest floors both in first cost and maintenance.

Experience in the application of ballasted floors to railroad bridges has shown that the track maintenance has been reduced to such an extent that the saving is more than sufficient to pay the interest on the increased investment, made necessary by its adoption.

Where the weight of a floor is not excessive, as with types D and F, it is probable that the reduction of impact, due to its distribution by the ballast of the floor, would so far reduce the overstress in the members of the present structure as to make its reinforcement unnecessary, although this would somewhat reduce the present factor of safety.

The wooden ballasted floor, similar to type D, is now in experimental use on a section of the Boston Elevated Railway, with marked effect toward deadening the sound. The ballasted steel floors are objectionable because they add to the amount of metal in the structure. This not only increases the noise due to the steel in the structure itself, as will be explained hereafter, but it likewise adds to the cost of painting and maintenance. Steel thus used in a ballasted floor is exposed to deterioration from the water, oils and greases which find their way to the bottom of the ballast.

The concrete floor, on the other hand, is free from these objections, being, in the first place, practically inelastic, and therefore almost noiseless in itself, and, secondly, being proof against deterioration from any of the agencies herein referred to. Type E would probably be made in 6-ft. sections, weighing about 4000 lbs. each, and is adapted to be constructed in any convenient shop near the site, allowed to set and erected in place as required. This would avoid all work in the field except placing and setting, and thus greatly expedite the work and reduce the cost.

Type F, shown in detail in Fig. 16, is in some respects an improvement on type E. While the amount of concrete is about the same, the individual cross troughs weigh only 1000 lbs. each, which facilitates handling and setting. The field work embraces the bolting of the connecting longitudinal troughs to the cross troughs, and the placing of this floor in position would require the least time and therefore involve the minimum delay to traffic. An important advantage of this floor is that there is a 7-in. opening between each cross trough, which would admit light to the street below and allow snow falling on the structure to be handled as at present. In types E and F hook bolts would be provided for securing the concrete to the structure.

The principal objection, aside from its cost, that is usually brought against the use of a solid floor in a city street is the difficulty of removing snow from the track. While it is admitted that this difficulty is more serious with a solid floor than when an open type of floor is used, it is not insurmountable, since the Berlin and Liverpool roads, a portion of the Boston Elevated, and the portion of the New York Central previously referred to, have been successfully operated, and this objection should not be allowed to prevent the adoption of some type of solid floor if it proves efficient in reducing the sound. I am of the opinion that a type of snow-plow or snow-collecting device could be perfected which would effectually remove the snow by collecting it and carrying it away in case it became necessary to operate the loop with a solid floor.

The most important characteristic of these floors is their increased weight, as compared with present floor, the greatest increment being 1680 lbs. per lineal foot of track for type E, and the least 1080 lbs. per lineal foot for type F. This additional weight increases the stresses in the structure throughout and necessitates its reinforcement to secure a corresponding increase of its strength to a greater or less degree, depending upon the reduction of impact due to the use of ballast.

DEFECTS IN STRUCTURE

The volume of sound given forth by a medium is due to its elasticity, and metals, being the most highly elastic solids, are the best sounding bodies. For the same reason, the duration of sound is greater in metals than in other solids. It is likewise true that an enclosed air space, set in vibration by a sounding body, magnifies the volume of sound according to the laws of resonance.

The present supporting structure of the Union Loop is constructed entirely of steel, which is set in elastic vibration by the passing loads. The various component parts of the structure enclose air spaces more or less confined, which are in turn set in vibration by the molecular motion of the adjacent steel, while the structure as a whole is free to vibrate under influence of the live loads. It will be apparent, therefore, that the Union Loop as built realizes every essential condition for the production of noise.

The concrete steel reinforcement, hereinbefore referred to, does the exact opposite. As a sounding medium it is very low, having about one-tenth the sound wave velocity of steel. In encasing the steel it places an inelastic medium between it and the confined air spaces, and thus destroys their resonance. It also largely increases the rigidity of the structure and the bulk of material in it, thus destroying all noise due to vibration. For these reasons the concrete steel reinforcement should completely eliminate the noise created by the structure itself, leaving only such noises as are inherent in the trains themselves, as hereinbefore discussed.

From the foregoing and from observations made during my investigation of this subject, I am of the opinion that the objectionable noises now caused by the operation of cars over the Union Loop can be greatly reduced. Since the loop occupies the most congested section of the municipality and therefore causes annoyance to the greatest number, and is at the same time the best paying piece of elevated road in the city, its owners ought to be willing to spend sufficient money on its improvement to reduce the noise to as great an extent as it seems reasonable to expect from the adoption of modern engineering methods, even though the accomplishments of the results should prove too expensive for application to lines less favorably located.

While the methods suggested in this report would, in my judgment, prove effective, some of them are to a certain extent experimental, and it would therefore be unjust to demand that they be adopted and applied by the railroad company to the entire loop without their relative efficiencies having first been determined by experiments on short sections of structure, thereby keeping the experimental expense as low as practicable until the best type of construction could be determined by actual demonstration.

My recommendations for reducing the sound upon the loop and suggested methods of procedure are then as follows:

First—If practicable adopt the plan of increasing the capacity of the loop shown on Fig. 3 of Part I. of this report. This would eliminate the maximum amount of special work and thus reduce the noise, due to the hammering of wheels on frogs and switches, to the greatest possible degree, and at the same time increase the capacity of the loop to the greatest extent possible by track modification, and leave it in the best condition for through routing or loop operation, or both.

Second—If the arrangement shown on Fig. 3 is not adopted, reconstruct in accordance with the plan shown on Fig. 2, which leaves all tracks at the present grades. Reinforce the structure at all junctions and provide each junction with a solid floor ballasted with crushed stone or slag.

Third—If neither of the above plans are adopted reinforce the present structure at all junctions and provide each junction with a solid floor ballasted with crushed stone or slag.

Fourth—Equip sections of about 300 ft. each of the Market Street stub terminal of the Chicago & Oak Park Road over which trains do not now operate regularly with different floors, as shown by types D, E and F, using stone, slag or gravel ballast in different sections, and reinforce the structure supporting these sections with the concrete steel reinforcement. Operate trains over this stub terminal when so equipped until the relative merits of the different types can be determined. The equipment of this terminal is suggested to prevent interfering with present traffic, but should the railroad company prefer to conduct the trials upon the loop or elsewhere it should be allowed to do so.

Fifth—After the type of floor and kind of reinforcement which most effectually accomplishes the elimination of noise is determined, the loop structure between junctions should be reinforced and the type of floor selected applied.

Sixth—In any event reconstruct the track and special work in accordance with the suggestions contained in this report, and maintain the rolling stock, track and special work in first-class condition under rigid city inspection.

Seventh—All changes in the structure should be made in accordance with plans approved by the city and prepared with the special object of sound deadening in view, and the experimental and permanent work done in a manner satisfactory to the city.

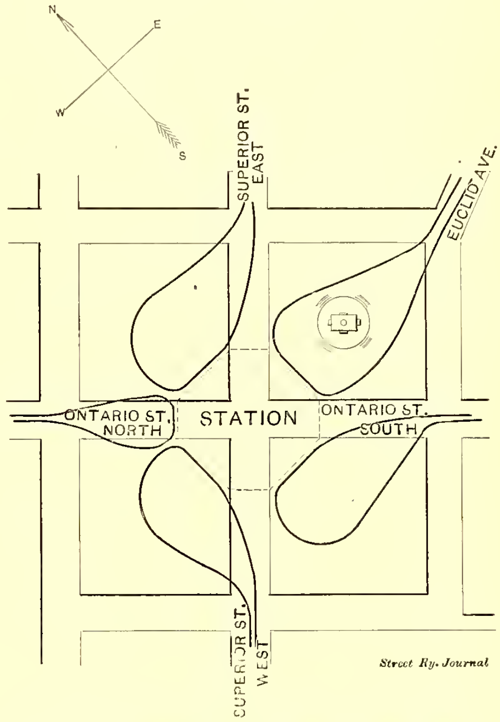
SUBWAYS IN CLEVELAND

As outlined in a recent issue of the Street Railway Journal, the city officials of Cleveland and the officials of the Cleveland Electric Railway are considering plans for relieving the congestion of surface traffic in the downtown section of that city by means of subways. The peculiar layout of Cleveland, a fan-shaped city, with principal streets radiating from the Public Square, brings all car lines to a central point, and although attempts have been made to deviate some of the routes away from this center, there have always been strenuous objections to this plan. The point of greatest congestion is the center of the Public Square, where Superior Street crosses Ontario Street. On Superior Street, west of the center of the Square, the street railway company has four parallel tracks, and while this improves the situation considerably on that street, it aggravates rather than improves the situation at the crossing point mentioned. The accompanying illustration shows the downtown section of the city within a radius of less than ½ mile of the Square. It represents the location of cars under existing schedules at 5:40 in the evening, and it shows about 150 cars within the radius mentioned. Practically no interurban cars are included, as they arrive and leave on the hour.

DIAGRAM SHOWING DISTRIBUTION OF CARS DURING RUSH-HOUR SERVICE

When the subject of a subway was first given consideration it was proposed simply to remove the crossing in the center of the Square by depressing one or the other of the main streets, but later plans propose improvements which it is believed would take care of the trouble for a long time to come. The plan most favorably considered provides for five subway loops in the downtown section; one to be north of the Public Square and extending to the proposed Union passenger station and group of public buildings, the other four to be under the four corners of the Square, with approaches on Ontario Street, Euclid Avenue and Superior Street, as indicated in the plan presented. The subway entrances would be at Erie Street on Euclid Avenue, at Erie Street on Superior Street, at Lake Street on Ontario Street north, at the viaduct on Superior Street west, and at Broadway on Ontario Street south, thus leaving the heart of the city without surface cars. The present plan of operating cars across the city would, of course, have to be abandoned if the loops were adopted and all lines would terminate in the center of the Square. The plans also provide for a large transfer station and waiting room in the center of the Square. The transfer scheme would be simple, as a passenger could step from one car into another. The tracks would be depressed slightly below the platforms, making only one step into a car. It is proposed to have the subway system a shallow one, with light and air shafts placed at frequent intervals. The soil in this district is sandy, making close shorings necessary.

The Cleveland Electric Railway Company has retained the services of William Barclay Parsons, the well-known authority on subway construction, to consider the advisability of establishing the subway. Mr. Parsons spent two days in Cleveland last week, and with President Andrews and the company's engineers went over the congested territory. He was given data and maps covering the downtown section, the Public Square, Cuyahoga River and the viaducts.



PLAN SUGGESTED FOR PUBLIC SQUARE SUBWAY

The plans for financing the project are at this time entirely hypothetical, and President Andrews, of the street railway company, declines to be interviewed on this point. A plan which is said to have found more or less favor with the street railway company may be outlined somewhat as follows: The city to build the subway on a bond issue, the company paying the interest and retiring bonds as they fall due. At the end of a certain period the company would surrender the property to the city. The company is said to favor fifty years, while the city officials are said to favor a shorter term. But, of course, as intimated, the plans are wholly in the air as yet.

It is generally believed, however, that the company will soon have some definite proposition to make on the franchise matter and that its proposition will embody something about the subway.

One point which might render it impossible for the company to build and own the subway is the fact that the Public Square was deeded to the city for park purposes, and it was only recently that the street railway company was prevented from building an interurban passenger station there, on the ground that such action might forfeit the city's right to the Square.

During the present week President Andrews and a party of his own engineers, city officials, newspaper men and representatives of the Chamber of Commerce, have visited Boston and New York to study the subways in these centers.

THE AUTOMOTONEER IN ITS NEW FORM

The automotoneer for preventing too rapid advancement of the controller handle, or, in the language of the shop, "fast feeding," was originally made to go inside the controller and thus be a part of the controller itself. The Garton-Daniels Company, of Keokuk, Iowa, which has been developing this apparatus for the past six years, has now worked out a new type of apparatus intended to go on top of the controller. One of the new automotoneers, which is shown in Fig. 1, is a simple and compact piece of apparatus which is applied by simply slipping it over the controller and fastening it by screws to the controller top. It is not necessary to alter the controller in any way except to remove the pointer collar on top of the controller. There are two principal parts to this apparatus; the stationary part shown in Fig. 2 is bolted to the top of the controller. Inside of this either one of the parts shown in Figs. 3 and 4 revolves with the controller handle, and may be considered as forming a part of the controller handle. In the stationary portion, Fig. 2, which is in the form of a cylinder, a zigzag channel is cast, as seen. The revolving part of the automotoneer, which moves with the controller handle, has a dog on it, which follows this zigzag groove or channel. The notches in this zigzag channel correspond to the controller notches. In advancing the controller, the dog which travels in the channel is raised in passing from one notch to another.

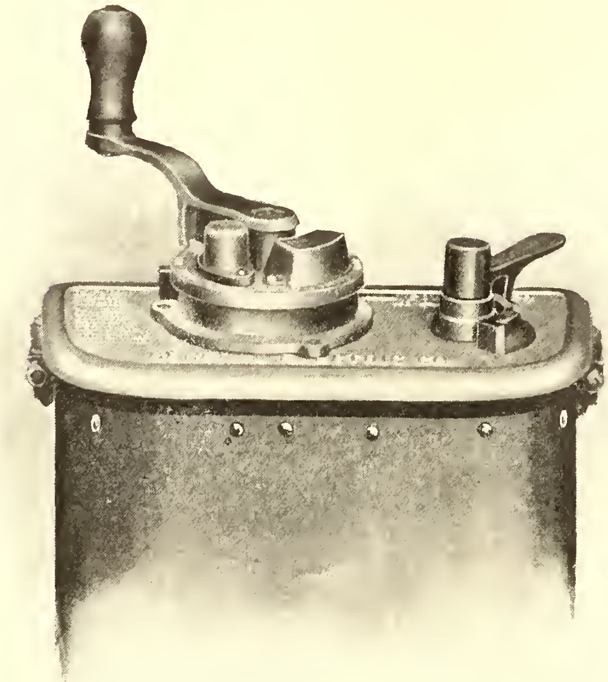


FIG. 1.—IMPROVED FORM OF AUTOMOTONEER

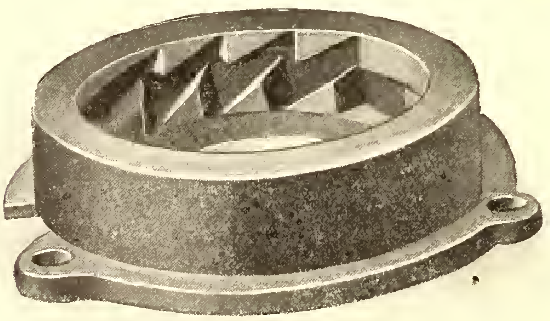


FIG. 2.—STATIONARY PORTION BOLTED TO CONTROLLER CASE

After each notch, time must be given for the dog to fall before the controller can be advanced to the next point. In one form of this device, Fig. 4, the movement of this dog is regulated by an adjustable dash pot. As the dog is raised in following the zigzag channel from one notch to the next it compresses the dash pot. As the dash pot releases the dog and allows it to fall in the predetermined time for which the dash pot is set, the controller handle is released so that it can be advanced to the next position.

In Fig. 3 is another form in which the rapidity of this disengagement is fixed so that it cannot be altered after it leaves the shop. The one with the adjustable dash pot can be adjusted at any time after the device leaves the shop. Both types are very simple, but the one with the fixed time ratio has fewer working parts, owing to the omission of the dash pot and its accompanying lever. In the operation of this automotoneer, the handle is simply moved from point to point, just as if the device were not present. No backward movement of the handle is necessary to allow the dog to fall and release it before going to the next point if the device is properly adjusted so that the points of the automotoneer match with the points of the star wheel inside the controller. The former types of automotoneer placed inside the controller took the place of the star wheel. On the present type, the star wheel, and in fact everything inside the controller, is left intact, with the result that the star wheel performs its usual function, and if the device is properly adjusted does not place on the automotoneer the work of stopping the controller handle at each point. In case the motorman tries to go beyond a point before the automotoneer releases, it immediately checks the handle. These two new styles have proved entirely satisfactory in actual service during the past nine months, giving no indications of undue wear. All parts are made interchangeable.

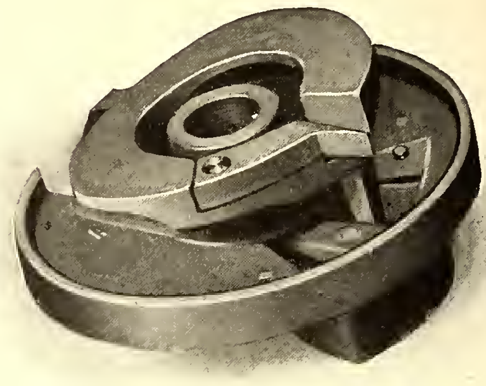


FIG. 3.—ONE FORM OF MOVABLE PORTION

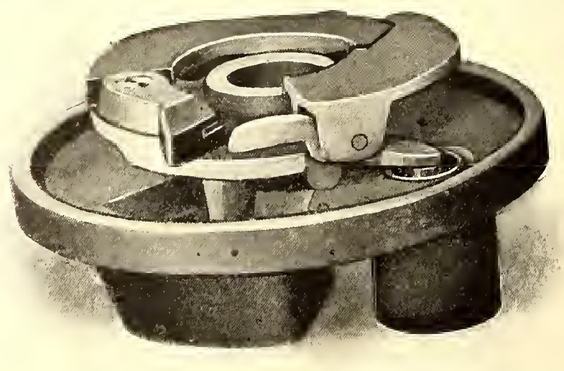
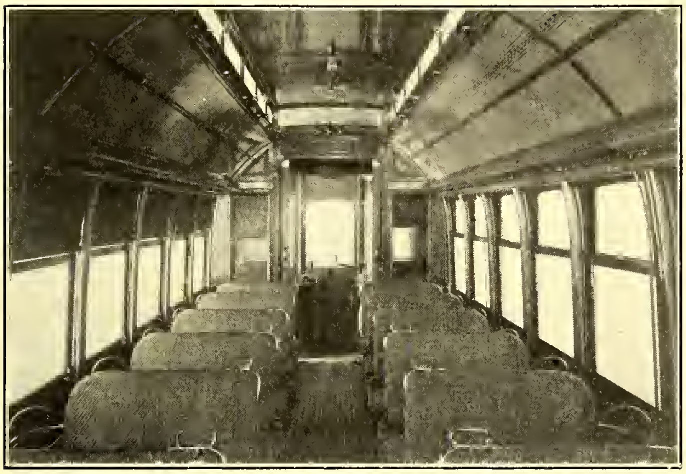


FIG. 4.—MOVABLE PORTION WITH ADJUSTABLE DASH-POT

CONVERTIBLE CARS FOR INDIAN TERRITORY

The American Car Company has recently delivered to the Muskogee Electric Traction Company, Indian Territory, three convertible cars built under the Brill patents. The convertible type of car is well adapted to service in that part of the country, where the climate is mild and the summers are long and have a large rainfall, while the winters are short and have little snow. The cars are for use in Muskogee, which, though



INTERIOR OF MUSKOGEE CAR

having a small population, is one of the two most important trading centers in Indian Territory. It is centrally located, and is on the line of the Missouri, Kansas & Texas Railway. There are 5½ miles of track in the town and about twelve cars are operated. The lines of the railway company reach an attractive amusement park which the company owns.

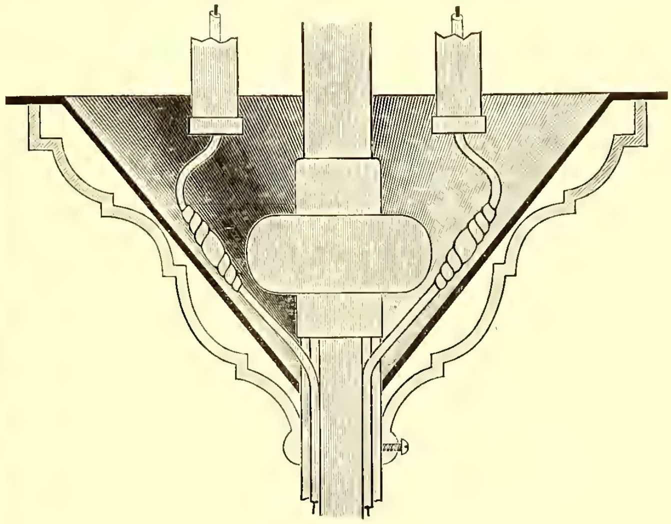
The new cars are finished in ash, with bronze trimmings, and have ceilings of decorated birch. They are mounted on Brill No. 21-E trucks. The general dimensions are: Length over the end panels, 20 ft. 7 ins., and over the crown pieces, 30 ft.; from the panel over the crown, 4 ft. 8½ ins.; width over the sills, including the facing, 6 ft. 11¼ ins., and over the posts at the belt, 7 ft. 9 ins.; sweep of the posts, 5 ins.; centers of posts, 2 ft. 7 ins.; side sill size, 5¼ ins. x 6 ins.; end sill size,

MUSKOGEE CAR, OPEN

4¼ ins. x 6 ins.; sill plates, ⅝ in. x 8 ins.; thickness of the corner posts, 3¾ ins., and of the side posts, 3⅜ ins.; length of the seats, 33½ ins., and width of the aisles, 18 ins.; height of the steps, 14 ins., and of the risers, 12 ins. The No. 21-E trucks used have a wheel base of 7 ft., and 33-in. wheels. The furnishings include Brill sand boxes, "Dedenda" platform gongs, angle-iron bumpers and reversible seats, with corner grab handles.

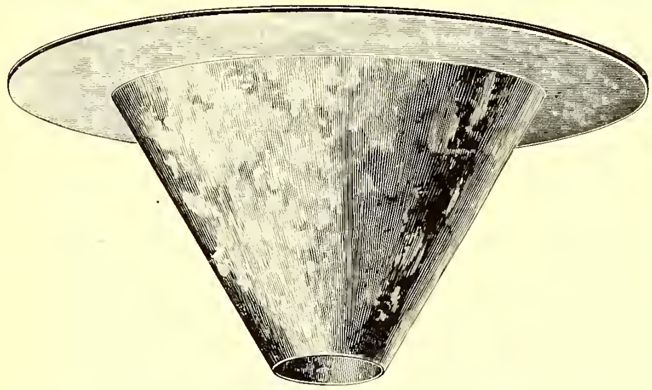
A NEW CANOPY INSULATOR

To obviate the many ceiling fires, due to defective insulation on the joint where the wires project through the floor or wall



SECTION OF CANOPY INSULATOR

and make connection with the wires of the electrolier, the Mica Insulator Company, of New York, has placed on the market a



EXTERIOR OF CANOPY INSULATOR

new insulator known as the "Young" canopy insulator. It is claimed by the manufacturer that this is an improvement over the present ring form of canopy insulator which does not give protection at the most vital point. The flange of the "Young" insulator also gives perfect protection to the brass canopy from the surface of the ceiling or wall, thereby removing any possibility of a short-circuit between the two conducting wires, between either of the conducting wires and the canopy, or between the wires through the canopy to the ceiling.

The new insulator is made from the well-known material micanite, made up from large laminations of mica, and molded with both flange and taper into one solid whole.

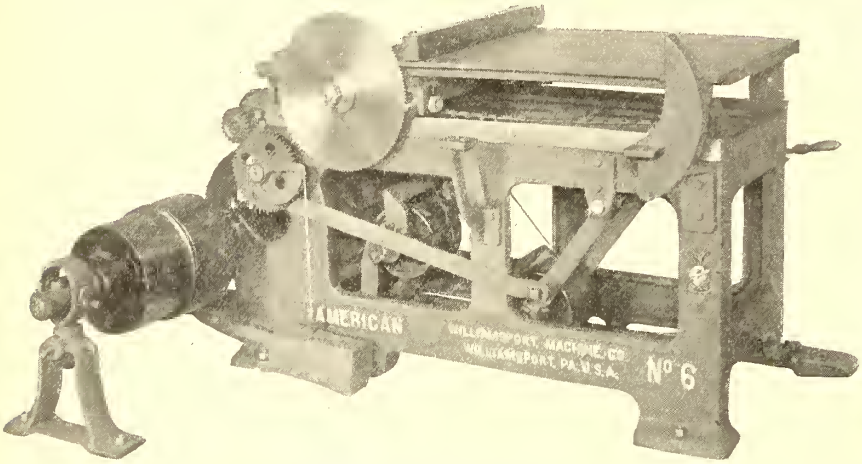
It is stated to be the only canopy insulator which is absolutely fireproof, and also the only one which insulates the canopy from the ceiling and from the service wires as well. It has been approved by the National Board of Fire Underwriters.

W. L. Stehlau, general manager of the Springfield & Xenia Traction Company, has arranged with the Dayton & Xenia Traction Company to operate through service from Springfield to Dayton by way of Xenia, Ohio.

RAILWAY CUT-OFF SAW

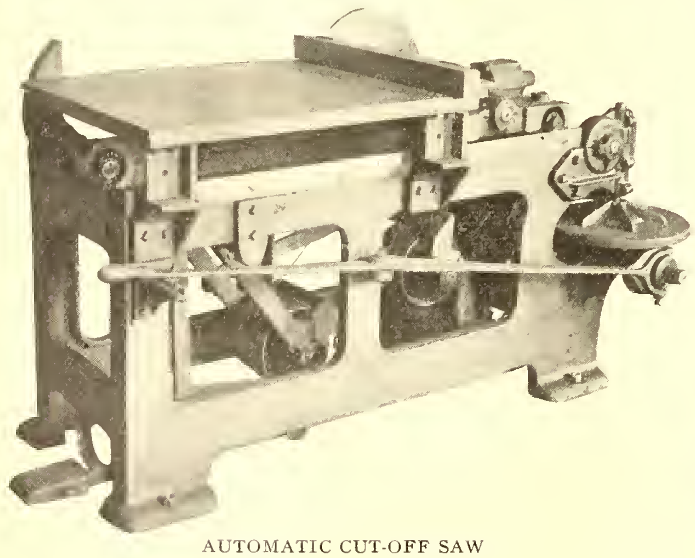
The improved automatic cutting-off saw (No. 6), shown in the accompanying illustration, has been designed by the American Woodworking Machinery Company, of New York, for cutting off lumber square in all kinds of woodworking factories. The ease with which the saw is operated should recommend it to all parties wanting a machine of this kind.

The main frame is very compact and is cast in one solid casting with internal ribs, and the guide rails that the rolls in carriage revolve on are steel, securely bolted to the main frame. The saw arbor is made of steel and journaled in long self-oiling boxes cast solid to the sliding carriage, which is moved to do its work by friction drive operated by the foot treadle at front of the main frame.



AUTOMATIC CUT-OFF SAW

There are four changes of feed for the saw to travel, 13 ft., 20 ft., 28 ft. and 35 ft. per minute. These changes are controlled by the hand lever at the right of operator. The foot treadle controls the length of travel of saw from 2 ins. to 26 ins. As soon as the foot treadle is released the saw carriage is returned by the weight of the tightener on the belt. By this arrangement the operator, having the use of both hands, can more readily handle the stock. In this way double the amount of stock can be cut as compared to the old style machines, where the saw is drawn forward by hand, or the old style foot treadle, where the movement of same is about the same as the saw carriage travels.

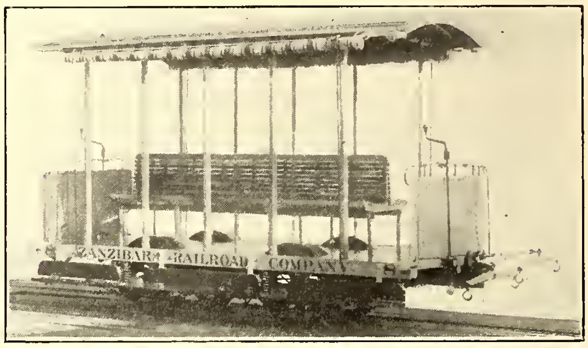

AUTOMATIC CUT-OFF SAW

The table is of iron, provided with a cut-off gage, which can be used either in the front or the back of the table, as shown. An endless belt 5½ ins. wide is furnished with each machine. There are sub-brackets attached to the main frame with holes drilled in them for attaching wooden extensions.

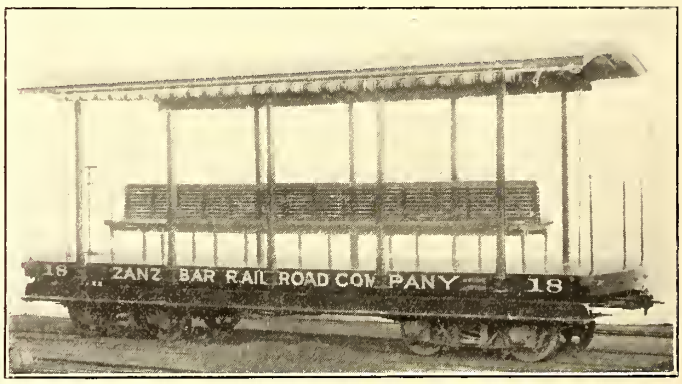
The builder furnishes one 16-in. diameter saw and necessary wrenches, and tight and loose pulleys, self-oiling, 12 ins. x 6 ins., running at 490 r. p. m. The size of the table is 33½ ins. x 25¾ ins. Its capacity covers 2-in. stock up to 26 ins. wide, and a 16-in. saw will cut through 5 ins. in thickness.

AMERICAN CARS FOR ZANZIBAR, SOUTH AFRICA

Ten of the larger and eight of the smaller cars illustrated have lately been shipped to the Zanzibar Railroad Company, of Zanzibar, Africa, by the J. G. Brill Company. Zanzibar is a city on the island of the same name near the western coast of South Africa, about 200 miles north of Cape Town. This city has a population of about 100,000, and does considerable export business in ivory, rubber, skins, cloves, etc. The island is an English protectorate, with an area of 625 sq. miles.


OPEN HORSE CAR

The ten double-truck cars are for use with steam dummies, and the eight cars on gear trucks will be drawn by horses. There were also two closed horse cars especially fitted up for private use. The double-truck cars measure 22 ft. over the crown pieces and are 5 ft. wide over the sills. The roofs are simply constructed and arranged to be readily removed, and the seats are also removable. The cars are mounted on freight trucks of the builder's manufacture. The weight of the car and the trucks is 8770 lbs. The length of the short cars is 13 ft. 8 ins. over the crown pieces, and width over the posts, 5 ft. The curtains of both styles of open cars are arranged to be raised or lowered from one end by means of ropes with pulleys. These cars are mounted on Brill gear trucks with 6-ft. wheel base. The "private" closed cars are 14 ft. over the end panels, 21 ft. over the crown pieces and 5 ft. wide over posts at belt. There are five windows to each side, arranged to drop into wall pockets. The interiors are finished in cherry and ash of natural color, and the ceilings have carline finish. The cars are furnished with wicker chairs and the floors are covered with carpet rugs. They are also mounted on Brill gear trucks with 6-ft. wheel base.



OPEN STEAM CAR

INDESTRUCTIBLE PACKING

Porter & Berg, of Chicago, have recently been appointed sales agents for the Rogers journal packing throughout the United States and Canada. This packing is composed of equal quantities of very fine, long, hair-like steel shavings and the best grade of cotton waste mixed together by special machinery. When once mixed, the steel shavings cannot become separated from the cotton waste, as the character of the materials and the method of mixing prevent this. The steel shavings are very elastic and give the necessary spring to the waste to sustain its weight when saturated with oil, and hold it firmly up against the journals without packing the journal tightly, as is the case when wool or cotton waste is used.

This packing will not become covered with the metallic incrustation, where in contact with the journal, which soon forms on other packings, and is so fatal to proper lubrication and the cause of a majority of all hot boxes.

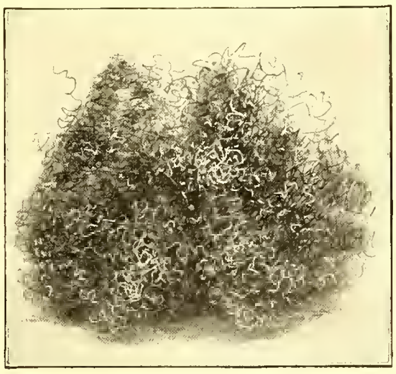
To those who are not acquainted with the results obtained from the use of this packing, there may at first be some doubt about the wisdom of using a mixture containing steel shavings in journals. It is claimed, however, that this doubt has in every instance been dispelled after such parties have a more intimate knowledge of and experience with this packing, and that it will not injure the bearings or cause any wear on them.

Both cotton and steel are conductors of heat and convey the heat away from the journal into the oil and keep the oil limpid in cold weather. The steel shavings act as a filter, thus cleansing the oil, and by their elasticity keep the waste from falling away from the journal. The cotton waste has a strong capillary attraction and draws the oil from the box up to the journal and insures a constant and even lubrication. On the contrary, woolen waste is a non-conductor of heat, has not as strong a capillary action as cotton, and when saturated with oil becomes soggy and will not stay up against the journal, thus necessitating constant attention and frequent renewals.

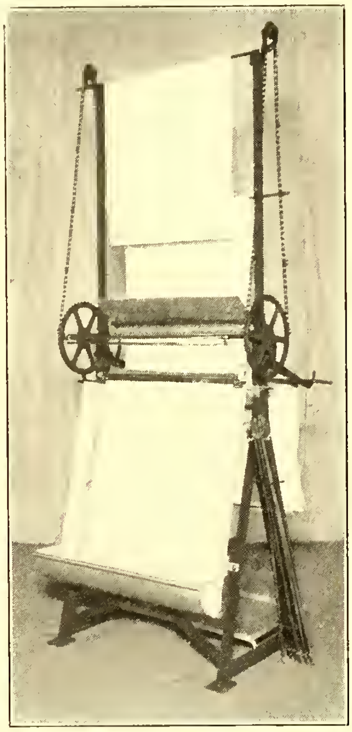
This journal packing is said to keep in good condition in the journals for from fifteen months to two years, or longer, according to conditions. This makes a great saving in labor, oil and waste, as ordinary wool waste packing has to be renewed many times a year and requires frequent attention, and for every pound of wool waste thrown away about 2 pints of oil is lost. In order to keep the wool waste up against the journals it is necessary also to crowd at least twice as much of it into the journal box as is required when Rogers' packing is used.

As a positive evidence of the durability of this packing, the following is cited: Engine No. 969 on the Illinois Central Railway was packed with this journal packing for an endurance test, and made 210,000 miles, going through the repair shop twice during duration of test, and used the same packing for entire mileage. This road has used the packing for over seven years and has had no trouble with hot boxes caused by defective packing.

INDESTRUCTIBLE PACKING



STEEL SHAVINGS



BLUE PRINTING MACHINE

BLUE PRINT WASHING AND DRYING MACHINE

C. F. Pease, of Columbus, Ohio, has designed a machine for reducing the cost and labor of producing large quantities of blue prints, and to do away with the large washing tanks and drying paraphernalia usually occupying a great deal of space in a blue print department. The construction effects great economy in floor space, avoids wet, sloppy floors, and thoroughly dried prints are secured in much less time than by the old process.

The washing of the prints is accomplished by a spray of running water flowing over the treated side of the paper only, removing the surplus ferroprussiate in the quickest time possible. Prints are not soaked through as in the old process, as the water coming in contact with one side of the paper only, and for but a very short time, leaves it in a condition to dry in about one-third of the time usually required. Therefore the delivery is greatly expedited.

The print is placed on the drying rod before washing and remains there during the entire process of washing, wiping and drying, making it unnecessary for the operator to wet his hands. He can therefore work to and from the printer and washer without difficulty, washing sheets as fast as printed, as the time required at the machine is but a fraction of a minute. As it hangs in the washing tray on the drying rod the water flows down both sides of the doubled print, half of it on the side toward the operator and the balance between the print and the back of the tray. When the front portion of the print in view of the operator is completely washed the balance is always in the same condition.

The surplus water is removed by a device which wipes the print as it is moved upward out of the way on the drying chains. As the next print is pulled through the wiping device the previous one is carried still higher and over the top, and finally downward until it is automatically stripped from the chains of the machine, falling into a drying rack, from which the dry prints may be removed as required. The construction of the machine is of a very rigid, light, cast-iron frame work, thoroughly braced and supporting the washing, dripping and drying devices, making a completely self-contained and portable machine, and occupying but small floor space.

The washing tray, guard and pan are made of extra heavy galvanized iron, reinforced and supported by galvanized malleable iron fittings, especially designed for the purpose. The upper frame carrying the small sprockets and chains is of iron tubing, well braced and secured to the main frame of the machine, and provided with screws for adjusting the chain. The spray is through brass tubing properly guarded by a copper shield to direct the spray where required. The drying rods, of which a sufficient number are supplied to meet all requirements, are of the best air and kiln-dried maple, are varnished, polished, metal tipped and provided with rubber separators.

FINANCIAL INTELLIGENCE

WALL STREET, March 15, 1905.

The Money Market

There were no important changes in the local money market this week. The tone continued easy, and, if anything, the tendency of rates was toward a lower level, despite the preparations making for the payment of $13,500,000 of government funds by the depository banks, and the demand for funds in connection with the flotation of various railway bond issues, chief of which were the $6,000,000 Long Island Railroad refunding 4 per cent bonds, guaranteed by the Pennsylvania Railroad Company, and the $5,000,000 4 per cent gold bonds of the St. Paul, Minneapolis & Manitoba Railroad, which are guaranteed by the Great Northern Railway Company. As in the previous week, the inquiry for accommodations was confined largely to the call money market, borrowers generally continuing to draw their requirements from the open market rather than to pay the prevailing rates for time contracts. As a result, the rates for demand money held relatively firm, practically all the business being transacted at from 2½ to 4 per cent, the ruling rate for the week being 2¾ per cent. In the time loan department business was practically at a standstill. The banks continued to hold rates for all fixed periods at last week's level, but there was no disposition on the part of borrowers to enter the market at the present time. In some instances maturing loans were renewed at the old rates, while in others they were promptly liquidated. At the close the market was extremely dull and easy at 3 to 3¼ per cent for sixty and ninety days, and 3¼ to 3½ per cent for four to six months. Loans for over the year were negotiated at 3½ per cent on first-class collateral. The weekly statement of averages issued by the banks on last Saturday was favorably received. The changes in the principal items were insignificant. Loans decreased $1,505,000, presumably due to the shifting of loans, or to liquidation of bond holdings. Instead of an expected decrease in cash, the banks gained the small sum of $312,400. Deposits were $2,304,200 smaller than in the preceding week. Reserve required decreased $576,050, which, added to the gain in cash, brought about an increase in the surplus reserve of $888,450. The surplus is now $9,278,150, against $29,937,075 in 1904, $1,024,000 in 1903, $3,112,900 in 1902, $10,002,600 in 1901, and $2,686,425 in 1900. Apart from the reduction in the Bank of England's discount rate to 2½ per cent, there were no important changes in the foreign money markets. The action of the Bank of England directors was taken as an indication that an easy monetary situation abroad is expected for some time to come. At the close sentiment in the local market was rather mixed. In some quarters it was said that the stiffening of rates at all the interior cities, as a result of the increased activity in spring trade, would soon be reflected in firmer rates here, but on the other hand it was believed that the market would not advance much above the present level of rates. This latter belief was based upon the attitude of foreign bankers, who are ready to take advantage of any appreciable increase in rates, to place large amounts of foreign funds in the local market, against exchange transactions.

The Stock Market

There was a decided improvement in the local securities market this week. Trading was considerably more animated, and prices, with few exceptions, ruled substantially above those prevailing at the close of last week. Early in the week trading was only moderately active, and prices displayed more or less irregularity as a result of profit-taking sales. Later on, however, sentiment became more cheerful, and prices advanced sharply on the announcement of the reduction in the Bank of England discount rate to 2½ per cent, which was taken to mean that the managers of that institution were of the opinion that a period of cheap money abroad was at hand. The local money market also continued easy, and there was nothing in the statement of the New York banks to indicate any appreciable change in rates. This, together with the improved railroad earnings for the first week of March, and the gratifying reports from the Western traffic managers, imparted pronounced strength to the entire market, which was continued up to the close on Saturday. There were no unfavorable developments over Sunday, and at the beginning of the present week the upward movement was continued, many issues making new high records. Noteworthy strong features were Reading, the Vanderbilt issues, Louisville, Baltimore & Ohio, Norfolk & Western, Lackawanna, Union and Southern Pacific. On Tuesday the advancing tendency was checked. The announcement that Paris bankers had ordered the adjournment of the negotiations for a new Russian loan, was followed by heavy realizing for foreign account, which carried prices off sharply. In several instances, however, decided strength was shown, especially in Delaware & Lackawanna, which touched 400, a gain of 23 points since Monday, and in American Smelters, which crossed par.

The stockholders of the Pennsylvania Railroad have authorized the directors to issue $50,000,000 bonds, making the total amount to be put on the market, $100,000,000. They will probably bear interest at the rate of 3½ per cent, and will be convertible into stock at 150. The bond market was fairly active and firm.

The local traction issues were neglected, but prices generally held firm.

Philadelphia

There was a material falling off in the dealings in the local market for traction stocks this week. Trading included a larger number of issues, but in most instances the individual totals were considerably smaller than in the preceding week. At the opening the market developed weakness, especially in the speculative stocks, but toward the close prices responded to the improvement in other quarters of the market, and in many issues the early losses were fully recovered. United Gas & Improvement was the principal feature of the trading, both as regards activity and price fluctuations. At the opening the stock was under pressure, the price declining a point to 115½ on moderate dealings, but later there was a sharp rally to 117¾, on the declaration of the quarterly dividend of 2 per cent and on buying by the pool. In the subsequent dealings there was selling by the speculative element, which caused another reaction to 115¼, but at the close an active buying movement developed, which lifted the price to 116¼, or within ⅛ of last week's closing figure. About 25,000 shares of the stock were dealt in. Pressure was also brought to bear in Philadelphia Company common and Philadelphia Electric, the first named declining to 43½ and the latter to 10½. In the last half of the week, however, both issues displayed strength, Philadelphia common advancing to 45, or nearly a point above last week's closing, while Philadelphia Electric rose to 10¼. Philadelphia Traction was quiet but strong, about 1000 shares selling at 99⅞ to 100, an advance of ¼. Philadelphia Rapid Transit was fairly active and irregular. From 29¾ at the opening, the price ran off to 29⅛, but toward the close there was a recovery to 30, the final transaction taking place at 29⅜. Upwards of 9000 shares changed hands. Other transactions included Fairmount Park Transportation at 22½, Union Traction at prices ranging from 58½ to 58¾, Consolidated Traction of New Jersey at 82¼ to 82¾, United Traction of Pittsburg preferred at 49⅞, American Railways at 53⅛ to 52⅞, Reading Traction at 30, and United Railways & Improvement of San Francisco at 80⅛.

Chicago

A meeting of the directors of the Metropolitan Elevated Railroad Company has been called for next Monday, when the reports of the committee appointed to recommend a successor to Mr. McAllister, as president of the company, will be received, and it is possible that a new president will be chosen before the annual meeting of the stockholders on April 4. Several names are under consideration, including that of Vice-President Higginson, but no decision will be reached until after the return of F. A. Delano.

Although the contest for control of the company continues, it is said that an agreement between the contending interests is not improbable. Nothing official is obtainable at this time, but leading interests on both sides are said to have intimated that the matters in dispute will be adjusted before the annual meeting.

The feature of the market for street railway issues this week has been the strength displayed by the various elevated railroad stocks on the reports of a renewal of the negotiations for the merging of the various properties. The leading feature was the activity and strength in Metropolitan issues, the common advancing to 24 and the preferred to 66. The advances in these issues were partly due to the operation of the cars of the Aurora, Elgin & Chicago over the Metropolitan tracks into the new terminal at Fifth Avenue. Chicago & Oak Park Elevated was strong, sales taking place at 6½ to 6⅝. Earnings of the company are very gratifying, and it is expected that the operations of the road for the present six months will be sufficient to wipe out the deficit of the last six months, and that the earnings for the fiscal year will show a small surplus. Northwestern Elevated common held firm around 24½, while several hundred shares of the preferred brought 62 to 61¾. South Side Elevated was strong and a point higher, sales being made at 96 and 97. Very little interest was manifest in the stocks of the surface roads, but prices ruled firm. Chicago Union rose from 12 to 12¾, in sympathy with the strength of the stock in the New York market, and small lots of the preferred sold at 50. West Chicago broke from 63 to 60. In the bond department transactions included $4,000 North Chicago 5s of 1909 98¾, 3000 North Chicago 4½s at 95, and $10,000 Northwestern Elevated 4s at 95¼.

Other Traction Securities

Trading in the Baltimore market was upon a much smaller scale, but prices generally held firm at near last week's closing figures. The United Railway issues, although considerably less animated, continued to furnish the prominent feature of the trading, both as regards activity and price movements. Early in the week heaviness was displayed in all three issues, due, in part, to the cessation of aggressive buying of the income bonds on reports of an amicable settlement of the questions at issue between the management of the company and the income bondholders committee. No confirmation of the report was obtainable. The stock opened ⅜ lower at 16½, and declined further to 16¼ on fairly active trading. Later on there was an advance to 17, but at the close profit-taking carried the price off to 16½, or ⅜ below the previous week's close. The income bonds also opened fractionally lower at 67⅝, and gradually eased off and closed at 67, a loss of ⅞. The 4 per cent bonds, however, displayed decided strength and ended the week with a small net gain at 94¾. Total transactions in the stock aggregated 15,000 shares, while upwards of $525,000 of the incomes, and $80,000 of the 4 per cent were traded in. Other transactions included $11,000 Charleston Railway & Electric 5s at 94¼ to 94, $5,000 Augusta Street Railway 5s at 104½, $130,000 Norfolk Railway & Light 5s at 94¾, Atlanta Street Railway 5s at 106½, Charleston Street Railway 5s at 106⅜, Washington City & Suburban 5s at 120⅝, City & Suburban 5s at 114¼, North Baltimore Passenger Railway 5s at 121, and Central Passenger 5s at 117. In the Boston market interest centered almost exclusively in the Massachusetts Electric issues, both of which displayed decided activity and strength. The common, on purchases of nearly 4000 shares, advanced from 16⅞ to 19¼, while the preferred rose from 62½ to 65 on the exchange of nearly 3000 shares. There was no news to account for the sharp advances in these issues. Boston Elevated was also strong, the price rising from 155 to 156 on limited dealings. West End common was unchanged, with sales between 97 and 98, but the preferred rose to and closed at 116, a small gain over last week's final price. On the New York "curb" the principal feature was the activity and wild fluctuations in Interborough Rapid Transit. Opening at 210, the price ran off to 203¼, but later on, the strike being declared off, the price advanced sharply to 221, an extreme gain for the week of 11 points. In the final dealings, however, there was renewed selling, which resulted in a reaction to 214, from which it rallied only a point. About 20,000 shares were dealt in. Other transactions included 700 Washington Railway & Electric common at 34 to 34⅜, $100,000 Washington & Electric Railway 4s at 89½ to 89¾, $20,000 North Jersey Street Railway 4s at 81¾ flat, $35,000 Jersey City, Hoboken & Paterson 4s at 79⅞ flat, 900 shares Public Service Corporation stock at 128, $40,000 certificates at 77¾, and $50,000 5 per cent notes at 98 and interest.

Aurora, Elgin & Chicago securities attracted a great deal of attention in Cleveland last week on account of the opening of the road into the heart of Chicago. The bonds are held in a pool in Cleveland, but within the past two weeks several hundred thousand dollars worth have been sold at a range of from 80 to 86½. A considerable amount of the common stock has sold in small lots at 10, while the preferred had one small sale at 65; holders are now asking 90. Detroit United advanced from 79¾ to 83 on the prediction that the dividend will be increased next quarter. Toledo Railways & Light advanced to 26, also on dividend rumors. Northern Texas Traction advanced to 51¾; another dividend increase predicted. Several lots of Western Ohio 5s sold at 78, an advance from 76⅞. At Cincinnati, Cincinnati Street Railway advanced to 149 on several sales. Cincinnati, Newport & Covington preferred advanced to 93¾, while common sold at around 32½.

Security Quotations

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

	March 8	March 15
American Railways	52½	52½
Boston Elevated	155	155
Brooklyn Rapid Transit	66	66¾
Chicago City	198	a199
Chicago Union Traction (common)	11¾	12¼
Chicago Union Traction (preferred)	48¼	47¾
Cleveland Electric	82½	82½
Consolidated Traction of New Jersey	81	81
Consolidated Traction of New Jersey 5s	110¼	110¼
Detroit United	80	81½
Interborough Rapid Transit	209	214
International Traction of Buffalo	—	29
International Traction of Buffalo (preferred)	—	64½
International Traction of Buffalo 4s	81	81
Manhattan Railway	171½	171
Massachusetts Electric Cos. (common)	17⅛	a18½
Massachusetts Electric Cos. (preferred)	62	a64½
Metropolitan Elevated, Chicago (common)	22½	23
Metropolitan Elevated, Chicago (preferred)	64½	65
Metropolitan Street	122¾	122½
Metropolitan Securities	84⅝	84¾
New Orleans Railways (common)	3½	3½
New Orleans Railways (preferred)	14	14
New Orleans Railways, 4½s	81	81
North American	102	103
North Jersey Street Railway	23	23
Philadelphia Company (common)	43½	46¾
Philadelphia Rapid Transit	29⅛	29¾
Philadelphia Traction	100	100
Public Service Corporation 5 per cent notes	97¾	97¾
Public Service Corporation certificates	72½	72
South Side Elevated (Chicago)	94	a95
Third Avenue	131½	130
Twin City, Minneapolis (common)	109	109
Union Traction (Philadelphia)	58½	58¾
West End (common)	97½	98
West End (preferred)	115¼	115¼

a Asked.

Iron and Steel

The "Iron Age" says the outlook continues very cheerful in all directions. Considering the very heavy tonnage placed earlier in the year in pig iron, the buying has been very good in such widely distant points as New England and Chicago, Philadelphia and Cincinnati, and the market is firmer. This is particularly true of New England, where the announcement of an advance of fifty cents in the prices of Buffalo irons is to be especially noted since that producing point has been relatively low in that particular territory.

STRIKERS SEEK OLD PLACES IN NEW YORK

Discredited by their national bodies, the local leaders in New York of the Brotherhood of Locomotive Engineers, the Brotherhood of Locomotive Firemen and the Amalgamated Association of Street Railway Employees of America, under which the employees of the Interborough Rapid Transit Company of New York were organized, became conciliatory. Friday morning saw a rush of ex-employees to the company's officers for reinstatement. All of them have to fill out formal application blanks, as though they had never had any connection with the company. On these blanks they must put down where they were last employed. Those who are taken back lose their seniority.

Grand Chief Warren S. Stone, of the Brotherhood of Locomotive Engineers, in discussing the situation, said that the action of the strikers was in direct violation of the laws of the order, and that they had repudiated their agreement with the general body.

"This action was taken," said Mr. Stone, "to show the public that we will not countenance any man violating his agreement and allowing him to remain in the organization. We have 172 bodies in the Brotherhood throughout the country, and we cannot afford to allow our well-established reputation for integrity to be besmirched by any unwarranted action of a particular subdivision. All the employees of the company, from the officers down, who remained faithful have been voted two weeks' additional pay by the directors in recognition of their loyalty.

ANNUAL REPORT OF THE UNITED RAILWAYS COMPANY OF ST. LOUIS

The fifth annual report of the United Railways Company, of St. Louis, has just been published. President Murray Carleton, in reviewing the events of the year ending Dec. 31, 1904, refers to the termination of the lease of the road on Oct. 29, 1904, by the St. Louis Transit Company, and the reassumption of the property by the United Railways Company. During the year the company purchased 450 new cars. The improvements recommended by Mr. Carleton are the erection of a new wood-working ship at a cost not to exceed $40,000, and of a new car house on Kossuth Avenue at the same expense. Generally speaking, the condition of the company is good, and it is the expectation of the managers that its present condition and degree of efficiency can be maintained and improved out of earnings. With this end in view it is proposed to renew some 10 miles of track this year, and pay for the cost of renewal out of earnings. The following is a summary of the business of the company during the last four years:

	1904	1903	1902	1901
Earnings from operation and other income	$9,977,564.17	$7,295,847.38	$6,452,218.90	$5,783,912.72
Operating expenses and taxes	5,751,066.65	4,513,514.57	3,967,721.32	3,692,400.58
Gross income, less operating expenses and taxes	$4,226,497.52	$2,782,332.81	$2,484,497.58	$2,091,512.14
Deductions:				
Interst on funded debt, miscellaneous interest and organization expenses	2,446,292.36	2,257,273.22	2,165,720.44	2,040,932.14
Net income	$1,780,205.16	$525,059.59	$318,777.14	$50,580.00
Dividends	598,022.50	587,846.25	586,860.63	576,210.00
Surplus	$1,182,182.66	....	....	....
Deficit		$62,786.66	$268,083.49	$525,630.00

VOLUME OF BUSINESS

	1904	1903	1902	1901
Revenue passengers	201,316,532	147,141,429	130,830,722	117,546,811
Transfers and passes	83,974,502	63,096,679	54,247,218	46,449,131
Total passengers	285,291,034	210,238,108	185,077,940	163,995,942
Car mileage	37,910,484	32,535,626	31,074,581	29,340,361
Percentage of passengers using transfers	39.64	40.25	38.68	36.76

ASSETS

Property and Plant:		
Railroads, properties and securities purchased	$75,732,073.10	
Pacific Railroad Company	46,713.95	
C. B. Holmes	7,542.16	
Construction and equipment (Exhibit "D")	13,547,745.77	
Total property and plant		$89,334,074.98
Preferred capital stock of United Railways Company of St. Louis (70,000 shares), held by the National Bank of Commerce in St. Louis, trustee, for the use and benefit of this company		7,000,000.00
Capital stock of the Louisiana Purchase Exposition Company, par value, $210,000		2,100.00
Material and supplies		278,955.26
Current Assets:		
Cash	$386,528.08	
Cash on deposit to pay bond coupons	406,525.00	
Brown Brothers & Company, syndicate managers	1,224,000.00	
Bills receivable	76,559.17	
Bills collectible	45,561.02	
United States Government—postoffice department	8,283.54	
City of St. Louis	4,407.33	
Sundry debtors	6,962.50	
Fidelity & Casualty Company of New York	75,000.00	
Fidelity Trust Company of Louisville, Ky., deposit for redemption of Southern Railway Company first mortgage bonds of 1884	2,000.00	
Interest accrued on bills receivable	1,388.65	
Total current assets	$2,237,215.29	
Deferred Assets:		
Insurance paid in advance	$31,552.02	
Water tax paid in advance	17,769.50	
Prospecting for oil—Central Power Station	25.60	
Total deferred assets	$49,347.12	
Total current and deferred assets		2,286,562.41
Total assets		$98,901,692.65

LIABILITIES

Capital Stock:			
Preferred shares	$20,000,000		
Less—Reserved for acquisition of capital stock of constituent companies not purchased	16,800	$19,983,200.00	
Common shares	$25,000,000		
Less—Reserved for acquisition of capital stock of constituent companies not purchased	86,200	24,913,800.00	
Total capital stock issued			$44,897,000.00
Funded Debt:			
General first mortgage 4 per cent gold bonds	$42,000,000		
Less—Reserved for underlying liens	13,708,000	$28,292,000.00	
Underlying Liens—Bonds outstanding, schedule No. 1		13,688,000.00	
St. Louis Transit Company improvement 20-year 5 per cent gold bonds, dated Oct. 1, 1904, guaranteed by this company		10,000,000.00	
Total funded debt outstanding			51,980,000.00
Current Liabilities:			
Bills payable—St. Louis Transit Company		$367,331.00	
Audited vouchers and accounts payable		277,205.03	
Unclaimed wages		3,554.30	
Trust Fund Certificates—Employees' savings deposit		5,720.00	
Employees' Badge Deposit—St. Louis Transit Company		285.65	
Outstanding Tickets—St. Louis Transit Company		9,405.83	
Matured interest coupons unpaid (paid after Dec. 31, 1904)		746,525.00	
Dividend on preferred capital stock outstanding (1¼ per cent)		162,290.00	
Southern Railway Company first mortgage bonds of 1884, due and unpaid		2,000.00	
Total current liabilities		$1,574,316.81	
Deferred Liabilities:			
Interest accrued on funded debt		$213,124.99	
Interest accrued on bills payable		5,021.07	
Outstanding tickets		11,832.26	
Reserved for damages and removal of World's Fair terminals		55,498.98	
Miscellaneous accounts accrued, or accounts awaiting distribution		26,278.50	
Total deferred liabilities		$311,755.80	
Total current and deferred liabilities			1,886,072.61
Profit and Loss:			
Surplus, Dec. 31, 1903	$229,941.25		
Less—Dividend paid on preferred stock, Jan. 10, 1904	229,941.25		
Rental from St. Louis Transit Company for ten months ended Oct. 31, 1904		$790,261.66	
Net income from operations for November and December, 1904		246,813.38	
Total net income for the year ended Dec. 31, 1904		$1,037,075.04	
Less—Dividends on preferred stock		898,455.00	
Surplus			138,620.04
Total liabilities			$98,901,692.65

In addition to the above tables, the report contains a list of the underlying liens, a summary of income for the years ending Dec. 31, 1904 and 1903 (ten months by St. Louis Transit Company and two months by United Railways Company of St. Louis); a table of traffic statistics, showing the revenue passengers, passes and transfers; construction and equipment expenses from the organization of the company up to and including Dec. 31, 1904, and cost of additions, acquisitions, betterments and improvements to the properties and lines of railway of the United Railways Company of St. Louis made by the St. Louis Transit Company and United Railways Company of St. Louis for the year.

The one hundred and ninety-fifth meeting of the American Institute of Electrical Engineers will be held at the chapter room, Carnegie Hall, 154 West Fifty-Seventh Street, New York, on Friday, March 24, 1905, at 8:15 p. m. The following papers will be presented and discussed:

1. "Line Construction for High-Pressure Electric Railraods," by George A. Damon.
2. "High-Pressure Line Construction for Alternating-Current Railways," by Theodore Varney.
3. "Application of High Pressure to Electric Railroads," by Ernest Gonzenbach.

HIGH-SPEED LINE FROM NEW YORK TO NEWARK

Every year reports are circulated about the probable use for electric railway purposes of the bed of the Morris Canal, in New Jersey, should the Legislature of that State decide to abandon the waterway. In order fully to acquaint the public of its attitude toward this matter, the Public Service Corporation of New Jersey, through its president, Thomas N. McCarter, has issued a statement concerning the use to which the property would be put if it were acquired by that company. According to Mr. McCarter, if a bill is passed by the Legislature authorizing the abandonment of navigation upon the canal, and permitting the sale of the property of the canal company, and its diversion to other public uses, the Public Service Corporation will endeavor to acquire so much of the roadbed or right of way of the canal as lies within the city of Newark, and northwesterly thereof, at least as far as Bloomfield. If the company is successful in this it will proceed also to acquire by purchase or condemnation whatever private or reversionary rights there may be in the canal bed, and devote the property to subway purposes, free from grade crossing, operating therein high-speed trains as used in the New York subway. Mr. McCarter is of the opinion that this undertaking would furnish adequate rapid transit to the sections of the city reached by it, and would greatly reduce the time now consumed in a trip from Broad Street, Newark, to East Orange, Orange, Bloomfield, Glen Ridge and Montclair.

This right of way the company would also connect with a private right of way across the meadows, which it has already acquired, and build a high-speed line to and through Jersey City over a route already surveyed, to a point where it would connect with the new tunnels now being constructed to New York City, thus giving a new route and direct connection to different parts of New York City from Newark, as well as furnishing rapid transit between Newark and Jersey City, and between the entire Hudson Hill and New York City. Mr. McCarter says frankly that negotiations to this end between the companies controlling the tunnels and the Public Service Corporation Company are now awaiting the result of legislation for the abandonment of the canal, for it does not seem feasible to carry out the schemes in any other way, because there is no other practicable entrance into Newark.

CLEVELAND INSPECTS THE NEW YORK SUBWAY

In connection with the plans now under discussion for a subway at Cleveland to relieve surface congestion in the downtown section of that city, a party of prominent financial, technical and newspaper men from Cleveland visited New York on March 14, as the guests of Horace E. Andrews and J. J. Stanley, of the Cleveland Electric Railway Company, for the purpose of studying the latest achievements in subway building. The party was brought to New York in a special car attached to the Cleveland & New York express over the New York Central Railroad. The gentlemen made a tour of investigation through the New York subway lines, and left in the evening for Boston, where an inspection of the Boston subway was made. Included in the party were the following: A. B. McNairy, president, Cleveland Chamber of Commerce; F. A. Scott, secretary, Cleveland Chamber of Commerce; J. G. W. Cowles, member, Chamber of Commerce; William J. Carter, city engineer, Cleveland; Chas. E. Kennedy, editor, "Cleveland Plain Dealer;" B. F. Bower, editor, "Cleveland Daily World;" Edward B. Lilley, managing editor, "Cleveland Plain Dealer;" Henry J. Wendenthal, editor, "Cleveland Press;" E. R. Johnstone, editor, "Cleveland Leader;" Chas. A. Otis, Jr., of Otis & Hough, bankers and brokers, proprietor of the "Cleveland World;" Mr. Andrews, Mr. Stanley, H. J. Davis, secretary, and C. H. Clark, engineer maintenance of way, Cleveland Electric Railway Company.

NEW HAVEN BUYS THE HARTFORD SYSTEM—NEGOTIATING FOR SPRINGFIELD PROPERTY

The New York, New Haven & Hartford Railroad Company, through its electric railway holding company, the Consolidated Railway Company, has negotiated the purchase of the Hartford Street Railway Company, of Hartford, Conn., at a compromise figure understood to have been $285 cash per share for this stock, and 285 per cent for the East Hartford & Glastonbury Horse Railway Company's debentures. Negotiations for the purchase of the system have been in progress for some time, and were delayed somewhat by the demand of the owners of the Hartford Company for $300 per share.

The Hartford Company has an authorized capital of $2,000,000, of which $1,000,000 is issued, and on this it pays 6 per cent dividends. It has also $2,500,000 4 per cent bonds outstanding, with power to issue $500,000 more. The company has guaranteed $200,000 5 per cent debentures of the East Hartford & Glastonbury line, which it has a right to convert into its own stock, dollar for dollar. This rests with the board of directors. The company owns lines to West Hartford, to Newington, to Burnside, to East Windsor Hill, to Windsor and Rainbow and to Wethersfield, leases the line to Glastonbury, and has an intimate connection with the Farmington line to Unionville. At Windsor the line for Windsor Locks, Suffield and Springfield comes in; at East Windsor Hill the line for Enfield and Springfield on the east side of the river comes in; at Newington is the line to New Britain and beyond; at Burnside is the connection for Manchester and Rockville, and connections south are contemplated from Wethersfield on this side of the river and from Glastonbury on the east side.

In connection with this sale the rumor is revived that the New Haven Company is still conducting negotiations for the lines in the vicinity of Springfield, Mass., and that a deal for these properties is likely to be closed soon. A slight variation from the plan of this purchase as set down in the Street Railway Journal of Jan. 28, 1905, is proposed, however. Mentioned to be included in the deal now are the Springfield Street Railway, the Springfield & Eastern and the Woronoco Street Railway. It is said that the majority interest in the Springfield Company demand $250 a share for their holdings.

ANNUAL BALL OF B. R. T. EMPLOYEES

The second annual ball of Brooklyn Rapid Transit Employees Association, and the closing exercises of the educational classes of the association for the season of 1904-05, were held in the New Labor Lyceum, at Willoughby and Myrtle Avenues, Brooklyn, on Tuesday evening, March 14. An excellent entertainment was given, after which the floor was cleared for dancing.

Geo. F. Wolfram, trainmaster of the Brooklyn Bridge division, opened the exercises with a short address. He referred briefly to the excellent service rendered by employees in all branches of the system, and graciously acknowledged the debt of the company to the trainmen for their untiring efforts during the very severe winter weather. Then he read a report of the association, contrasting conditions on March 1, 1905, with those of April 30, 1904, which reflects great credit upon the committee on management of the association and especially upon Geo. W. Edwards, the secretary.

This report showed that on March 1, 1905, there were 4021 members enrolled and a credit to the association of $11,912.94, as against 2742 members on April 30, 1904, and a credit of $674.64, a surprising gain. Donations from the company were acknowledged to the sum of $5,044.99. Since May 1, 1904, a total of $7460 has been paid for sick benefits. For school purposes and in providing entertainments for the members of the association and their friends $2,365.91 has been expended since Oct. 1, 1904. Figures of attendance at the educational classes show 100 men in the electrical class under Edward Taylor, engineer of tests of the company; 30 under a professional physical culture teacher; 10 enrolled in civil engineering; 30 in the band under the leadership of the bandmaster of the Thirteenth Regiment, N. G., of New York, and 40 in the English branches.

Mr. Wolfram brought his remarks to a close by referring to the plans of the association for the future. Several selections were next rendered by the B. R. T. band, one of the few of its kind. Dr. Cardoza, of the Fourteenth Regiment, of Brooklyn, then gave an exhibition with the foils and with broadswords. The instructor of the physical culture class then exhibited the members of his class in classic poses. An exhibition of feats of weight lifting brought this part of the entertainment to a close. Preceding the clearing of the floor for dancing, several selections were rendered by the band of the St. John's Orphan Home drawn up in the center of the hall. Among the officers of the company present were: Dow S. Smith, general superintendent; W. B. Graham, superintendent of the surface division; Geo. R. Folds, assistant to Vice-President and General Manager Calderwood; W. O. Wood, superintendent of the elevated division; F. D. Valentine, superintendent of employment; Edward Taylor, engineer of test and instructor of the class of the association in electricity; Henry Pistor, superintendent of the Bergen Street division; Frank Bush, superintendent of crosstown division; William Seibert, superintendent of Ridgewood division; M. J. Kennedy, superintendent of Flatbush and Ninth Avenue division; George Stone, superintendent of East New York division; W. W. Atwood, trainmaster eastern division of the elevated; E. F. Reeves, superintendent Brooklyn Bridge division; A. K. Stone, trainmaster southern division of the elevated; J. R. Williams, general foreman of southern division, and Geo. W. Edwards, the secretary of the Employees' Association. The entertainment committee in charge of the affairs was Geo. W. Wolfram, Henry Pistor and G. W. Edwards.

NEW CARS TO BE ORDERED FOR CHICAGO

The Chicago City Railway Company will probably let contracts for 200 new cars the latter part of March. The Chicago Union Traction Company is drawing up specifications for 60 new cars.

THE SALE OF THE MEMPHIS SYSTEM—EIGHTEEN MILES OF LINE TO BE BUILT

The sale of the Memphis Street Railway, of Memphis, Tenn., to Ford, Bacon & Davis, of New York, has been effected, as noted in the STREET RAILWAY JOURNAL last week. New officers were elected immediately after the transfer was made. Geo. H. Davis has been made president of the company to succeed C. K. G. Billings, of Chicago, and Thomas H. Tutwiler, one of the engineers in charge of Ford, Bacon & Davis' Nashville office, has been elected vice-president and general manager to succeed Frank G. Jones. Other changes in the management are the appointment by Mr. Tutwiler of E. W. Ford as superintendent, and the election of W. H. Burroughs, for a number of years with the St. Louis Transit Company, as secretary and treasurer. The purchaser proposes to carry out the new work provided for in franchises recently granted the company. This will involve the building of 18 miles of new line.

NEW PUBLICATIONS

Cement and Concrete. By Louis Carlton Sabin, B. S. C. E., New York: The McGraw Publishing Company; 496 pages. Price, $5.00

This is a treatise designed especially for American engineers, covering the manufacture, properties and testing of cement and the preperation and use of cement mortars and concretes; effect of variations in manipulation of cement tests: characteristics of materials and methods of preparing mortar and concrete; strength of mortars in cohesion, adhesion, bending, etc., and the effect of variations in treatment; the use of concrete with and without reinforcement. There are one hundred and sixty-one tables, more than two-thirds of which are from original tests by the author, who is assistant engineer of the engineering department of the United States Army.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MARCH 7, 1905

784,037. Switch for Overhead Trolley Tracks; Robert N. Cundall, Hopedale, Mass. App. filed Jan. 4, 1905. The switch-plate is mounted in a transversely slidable manner between fixed sections of main and branch tracks, and provided with depending track sections to complete the gap between the ends of one or the other of the fixed tracks, and means for locking the plate in position.

784,038. Automatic Self-Dropping Trolley Pole; John Deland, Terre Haute, Ind. App. filed Sept. 5, 1903. Details of construction of a trolley wheel adapted to automatically lower upon becoming disengaged from the wire.

784,237. Electrical Rail Guard; Lewis B. Stillwell, Lakewood, N. J., and Frederick R. Slater, Yonkers, N. Y. App. filed Sept. 16, 1904. Relates to the construction of a bracket for supporting a horizontal board above the third-rail.

784,238. Electrical Rail Guard; Lewis B. Stillwell, Lakewood, N. J., and Frederick R. Slater, Yonkers, N. Y. The insulator and base for the guard is formed of a single casting, the guard consisting of a board horizontally supported above the third-rail.

784,298. Construction of Railway Cars; George M. Brill, Philadelphia, Pa. App. filed Nov. 24, 1903. The object of this invention is to construct a car generally of wood, so that it can be readily made practically fire-proof during the course of its construction.

784,303. Third-Rail Electric Railway System; Thomas J. Casey and Fred H. Pickles, New York, N. Y. App. filed Aug. 11, 1904. The third-rail has a vertical contact surface facing the car; the guard consisting of a hinged board projecting over the rail and connected to but insulated from the same by blocks of insulating material.

784,357. Circuit Controller for Electric Railway Signals; Harry B. Snell, Jackson, Mich. App. filed April 15, 1904. Two contact plates are connected to but insulated from the trolley wire and used in connection with a switching apparatus of such character that either one of two devices will be actuated, depending upon the direction of movement of the vehicle.

784,389. Railway Rail; Franz Bertgen, St. Louis, Mo. App. filed April 30, 1904. The base of the rail is slotted to receive a tongue on the tread of the rail.

784,386. Car Street; Samuel M. Curwen, Philadelphia, Pa. App. filed Oct. 29, 1903. A "walk-over" seat providing co-operating mechanism, so that a plurality of links at one end of a seat actuate a single link at the other.

784,426. Walk-Over Car Seat; Charles K. Pickles, Philadelphia, Pa. App. filed Sept. 9, 1903. This construction utilizes only one link at each end of the seat, and mechanism which co-operates with said links to shift the seat cushion in unison with the back.

784,428. Car Seat and Guard; Charles K. Pickles, Philadelphia, Pa. App. filed Feb. 10, 1904. An improvement upon patent 784,-386, above.

784,429. Car Seat; Charles K. Pickles, Philadelphia, Pa. App. filed July 22, 1904. Provides a "walk-over" seat in which the back may be inclined at certain definite and predetermined angles to the seat cushion to suit the convenience of the occupant of the seat.

784,448. Trolley; John H. Thompson, Charleston, W. Va. App. filed Aug. 4, 1904. Details.

784,518. Grab Handle for Railway Cars; Samuel M. Curwin, Haverford, Pa. App. filed Dec. 17, 1904. A handle for open cars, consisting of two vertical rods arranged parallel on each side of the stanchion and so connected with the seat that the handle will always be operative at the back thereof, and prevent passengers leaving the car from facing in the wrong direction.

784,519. Grab Handle for Railway Cars; Samuel M. Curwen, Haverford, Pa. App. filed Dec. 17, 1904. A handle attached to the car seat and reversible with the seat to either side of the stanchion.

784,520. Grab Handle for Railway Cars; Samuel M. Curwen, Haverford, Pa. App. filed Dec. 17, 1904. See preceding patent.

PERSONAL MENTION

MR. AUGUSTUS WOLFF has resigned as chief engineer of motive power of the United Railroads of San Francisco. Before becoming connected with the San Francisco system, Mr. Wolff was with the Brooklyn Rapid Transit Company.

MR. WILLIAM B. GRIMSHAW, formerly freight agent of the Trenton, Lawrenceville & Princeton Railroad and the Trenton-Newtown Street Railway, both controlled by the New Jersey & Pennsylvania Traction Company, has been appointed freight agent of the Philadelphia & Easton Railway, with headquarters at the Raubsville (Pa.) power house. The line traverses a country practically without freight facilities, excepting at the terminals and the town of Riegelsville.

MR. GARDINER C. SIMS has become the general manager of the Marine Engine & Machine Company, of Harrison, N. J., and New York. The company will build Armington & Sims engines in addition to its other products, to meet the requirements of the market. The original and constituent characteristics of the Armington & Sims design are still the fundamental features of the engine, which has been steadily improved in detail as necessitated by modern steam practice, since the introduction of the engine in 1872. The present patterns are all new, having been reproduced and perfected by Mr. Sims since the cessation of his services during the Spanish-American war. Mr. Sims is well known in the electrical field, where his pioneer work did so much to ensure the success of incandescent lighting 25 years ago.

MR. H. A. NICHOLL, general manager of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio, has been elected general manager of the Indiana Union Traction Company, of Anderson, Ind., to succeed Mr. A. L. Drum, who, on March 1, became general manager of the Chicago & Milwaukee Electric Railway Company. Mr. Nicholl is a man versed in steam and electric railway work. At one time he was superintendent of the Rochester Railway Company, of Rochester, N. Y. After leaving this company he became assistant manager and treasurer of the Ithaca Street Railway Company, the Brush-Swan Electric Light Company and the Cayuga Lake Railway Company, all of which are under one management. Among the companies with which he has been connected are the Chicago & Northwestern; Natchez, Jackson & Columbus; Yazoo & Mississippi Valley; Illinois Central; North Side Electric, of Chattanooga, and the Rochester & Sodus Bay Electric Railway, the construction of which he superintended. In the Indiana Union Traction system are embraced more than 250 miles of line.

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1905, to date, 98,950 copies—an average of 8246 copies per week.

Competition with Suburban Steam Service

Although electric traction has had things its own way as regards local transportation in the majority of cities of this country, there are a few of the largest centers where, on account of the great distances to be covered between the city limits and the downtown district, steam suburban service has retained nearly all of the regular suburban travel. The principal reason for this has been that in our greatest cities none but the steam railway companies have any facilities for reaching the heart of the city from the suburbs quickly. The surface and elevated lines are too much taken up with business inside the city to make way for through suburban traffic. In Chicago, however, it begins to look as if serious competition for the steam railroads is in sight. As noted in our last issue, the Aurora, Elgin & Chicago Railway, which has attracted considerable attention the country over as a high-speed road, has now completed arrangements whereby its trains are running over the Metropolitan Elevated tracks into the very heart of Chicago, delivering passengers some blocks nearer than the competing steam railroads, and in spite of the handicap imposed by the presence of local elevated train service on the same tracks, is to make fast enough schedule so as to leave the balance, if anything, in favor of the electric service. Running north from Chicago, arrangements are likely to be made soon whereby cars from the northern suburbs along the lake shore can come in over the Northwestern Elevated Railroad tracks, which will mean active electric competition for the excellent steam suburban service in that direction. Is it any wonder that rumor has it that the Chicago & Northwestern Railway Company, whose suburban service is directly affected by both these developments, is inquiring earnestly into the feasibility of electrifying its suburban service?

Breaks on Interurban Trolley Wire

One of the most exasperating sources of delay on an interurban electric road is the breaking of a trolley wire. The breaking of an interurban trolley wire on a modern high-speed interurban road may be an interruption of minor importance which can be patched up so that the road can be put in operation in a few minutes, or it may mean the paralyzing of that section of the road for some hours. Thanks to trolley catchers and retrievers, it seldom happens that the trolley pole, in leaving the wire, does damage to the overhead work, but if a trolley pole ever does get a good chance at the overhead line in running 40 m.p.h. or 50 m.p.h. something happens. Several hundred feet of trolley wire are likely to get down before the trouble is stopped. So much goes down that it cannot be got clear of the track by the crew of the offending car except by a long continued effort. In the meantime all that section of the road is shut down, and no overhead line repair car, except one furnished with independent motor power, can reach the scene of accident. Of course, breaks occur which are not as serious as this and can be got clear by the train crew in a short time, so that the car can drift past the break and proceed, but the most aggravated cases are almost certain to cause a long delay on the average interurban road. We recently heard the chief despatcher of a large interurban road relating how he had boasted to his general manager one day over the fact that the road had operated 321 consecutive trains into terminals on time, during which period forty-eight freight trains had also been operated. Within a few minutes of his reference to this record word came in of ½ mile of trolley down, with a resulting delay of traffic on that end of the road for hours.

While the tools carried on the ordinary interurban car may serve to cope with ordinary breaks of trolley wire where the overhead line is damaged but little, both the tools and train crew are inadequate to cope with such wrecks of the overhead line as sometimes occur. The use of the double trolley wire, which is very common, adds much to the stability of the line in case one trolley breaks. If the catenary construction is to become common it should improve the strength of line construction very much. As conditions are now, however, about the only safe way for the interurban road is to maintain some kind of a trouble car not dependent on electricity for its supply of current. It may also be practicable to teach interurban train crews enough about line work so that they can clear up dead grounds more promptly than the average crew does at present. Of course, with the ground once removed, the ordinary repair car can usually get to the scene of action or very near to it.

Free Baggage

One of the liveliest topics among interurban railway traffic men at present is the checking of baggage. Some roads follow the steam road precedent and check baggage free, while others make a charge for each trunk, the charge being usually 25 cents. Some roads are equipped with cars which permit the carrying of baggage on all passenger cars, and others are not. Those who advocate the free checking of baggage believe that considerable traffic, especially that of commercial travelers, goes to steam railroads which would patronize the interurban cars if baggage were checked free on them. While the interurban rates between two points may be lower than the steam railroad rate, the interurban rate plus the charge for baggage may be more than the steam railroad rate. It is argued that an interurban road can better afford to carry baggage free for the few passengers that have it than to lose the traffic which would go to the steam roads if the interurban does not carry baggage free. On the other hand, it can be argued that interurban roads are now carrying considerable baggage from which they receive an income which would have to be carried free if free checking of baggage was enforced. As a matter of fact, the number of interurban passengers carrying other than hand baggage is very small. It might be larger if baggage were carried free, but even then it would be a small proportion of the total business. But it must be recognized that commercial travelers with trunks and sample cases afford a steady source of revenue to any transportation line prepared to handle them. Such regular commercial travel is the backbone of the transportation business, as it is steady, month in and month out, and is practically independent of the weather and other local conditions which influence the balance of the traffic. That this class of traffic should be catered to goes without saying. If any considerable portion of it is going to the steam railroads it is time to investigate.

We do not think the mere matter of a few cents difference in rates between two points makes much difference with commercial travelers. Frequency of service does make a great difference, and because of the frequency of the interurban service, the interurban road has a great advantage over the steam road at the outset. If this advantage is not counterbalanced by too great a charge for baggage or too much inconvenience about baggage, the interurban road will have the best of the game, and here again it is a matter of convenience and time rather than price. It is evident in this connection that if an interurban road is not in a position to take trunks on the same car with the traveling man, the business is likely to be lost. Furthermore, if there is much inconvenience about checking baggage on the interurban, the interurban will be avoided. Interurban lines not having worked out the system of receiving and checking baggage as thoroughly as the steam railroads, are at a disadvantage, and it is well to give full recognition to this at the outset and remedy it rather than shut the eyes to it.

This whole matter of the checking of baggage and through connections is sure to work itself out, or rather to be worked out, but it will take the co-operation of interurban roads to do it. It is just such a co-operation that is being especially fostered by the associations of Ohio and Indiana, which are holding such frequent meetings these days. Conditions differ decidedly on different interurban roads, and this is probably responsible for many of the differences in practice. In Ohio and Indiana, for example, interurban lines, connecting as they do all the important manufacturing centers, are naturally in a position to get a large amount of commercial traveler business calling for the transportation of trunks on each passenger car. Where lines are more of a suburban character, connecting numerous small towns with some large city, there is no such demand for the carrying of baggage, and on such roads we rarely find such provision for carrying baggage. It is undoubtedly true that the carrying of any large amount of baggage on each passenger car is a source of delay and annoyance, and many managers, having found this to be true, have been inclined to abandon the idea of carrying baggage on each passenger car altogether, allowing it only to be carried on express cars. As soon as cars which have no provision for carrying baggage have been adopted, the road at once shuts off any possibility of doing much with the class of commercial travel spoken of until a point is reached where very frequent service is given by the baggage and express car.

It seems as if there might be a golden mean between no baggage whatever on passenger cars and so much baggage as to delay the passenger traffic. We are inclined to think that a compromise of this kind is the best thing that can be adopted where any considerable travel is to be secured from commercial men who must always have their baggage accompany them on the same train.

Overalls for the Motormen

The question of the kind of clothes that motormen on interurban cars shall wear is one often difficult of solution and can rightly be solved only by considering many local conditions. The men themselves when compelled to furnish and care for their own clothes naturally favor a standard of dress lower than is desired by the company. They argue that this work is akin to that of the locomotive engineer, and therefore they should be allowed to wear overalls. In reality the motorman's position is quite different from that of an engineer. He is more or less before the eyes of the passenger, while very few of the patrons of a steam road ever see the engineer. So long as no trouble occurs, the motorman is not any more in contact with dirt than are the passengers. Occasionally, however, it may be desirable for him to get into the dirt somewhat, and he may even be compelled to get down underneath the car and loosen the brakes, repair an open circuit in the headlight resistance or do some similar task that ruins a decent suit of clothes. The duties of an interurban motorman in this respect may differ considerably from that of a city motorman, because, in the city, there is not the necessity for making such repairs on the road that there is on long interurban runs with cars on one-hour headway. The motorman usually pays for the clothes, and often the margin between his living expenses and earnings is so small that he hardly feels justified in ruining his apparel for the good of the company. The result is that he is often very reluctant about doing any dirty work, and if it is possible to do so, he will operate the car the remainder of the day, or at least until a new one is given him, with things out of order rather than get down and fix them.

The only alternative is to permit him to wear overalls. When clean, it must be admitted that these look much more businesslike in a motorman's cab than do the conventional blue uniforms. The motorman feels and moves much more freely in them, and so long as they are kept clean they are preferable from every standpoint. But they will become dirty. One trip under the car usually suffices. When in overalls the wearer is not as careful of avoiding grease as when in a more expensive uniform, and he usually emerges with dirt and grease very much in evidence. If compelled to care for his own garments, the dirty ones are likely to be worn until the end of the week. If the company bears the laundry expenses a change will be made at first opportunity. The reduced expenses, brought about through better care of the equipment, will usually warrant it doing so; or, if not this, at least in insisting on reasonably clean suits when men go on duty. To the interurban manager it is simply a question of whether or not the company shall adopt overalls and jumper as motorman's uniform and have the car equipment better cared for, or whether the motorman shall be compelled to wear the conventional uniform and the several expenses connected with the maintenance of cars and delays on the road be permitted to creep up to a much greater figure than is necessary.

Light and Fresh Air

We take especial pleasure in bringing to our readers' notice Mr. Fox's description of some of the methods employed on foreign roads for lighting and ventilating cars. They make our own American practice seem very crude in these particulars. Properly shaded lamps and good ventilation would go far toward increasing the comfort of passengers in those longer runs that are now becoming common. For the raw lighting methods now commonly followed there is really small excuse, for the change to good practice is easy, cheap and, in the end, as we have before now shown, highly economical.

It is not necessary to use costly globes or elaborate ceiling structures. Lamps of moderate candle-power, well distributed and worked with frosted bulbs, greatly improve the illumination. If thus shaded, two rows, one at each edge of the monitor roof, can be used without inconveniencing standing passengers, or with the addition of downward reflectors a single liberal row in the roof does good work. Such a row should, however, be staggered to give the best distribution, as the light from a central row is much interfered with by the standing passengers, always an important part of the load in our American cars. Each year electric cars grow more and more comfortable and commodious in their design, and some of these little refinements in lighting should certainly be introduced, particularly since they tend toward reduction of the energy required for proper illumination.

The ventilation problem is far more difficult and serious. It is a subject now forcibly before the public, and of late there have been some efforts at general or municipal regulations touching it. From a hygienic standpoint, ventilation is far more important than lighting. We fancy that if samples of air were taken from many of our street or steam cars at the close of the rush hours, or from a large proportion of our popular theaters or churches, for that matter, and were subjected to chemical and bacteriological examination, they would disclose some startling conditions. It is fortunate, indeed, that the human eye cannot, unaided, detect the ubiquitous microbe. Unhappy indeed would be our lot if we could see them as we see flies and mosquitoes. Respirators would be at a premium, and nervous prostration, superinduced by trying to side-step dangerous bacilli, would become epidemic.

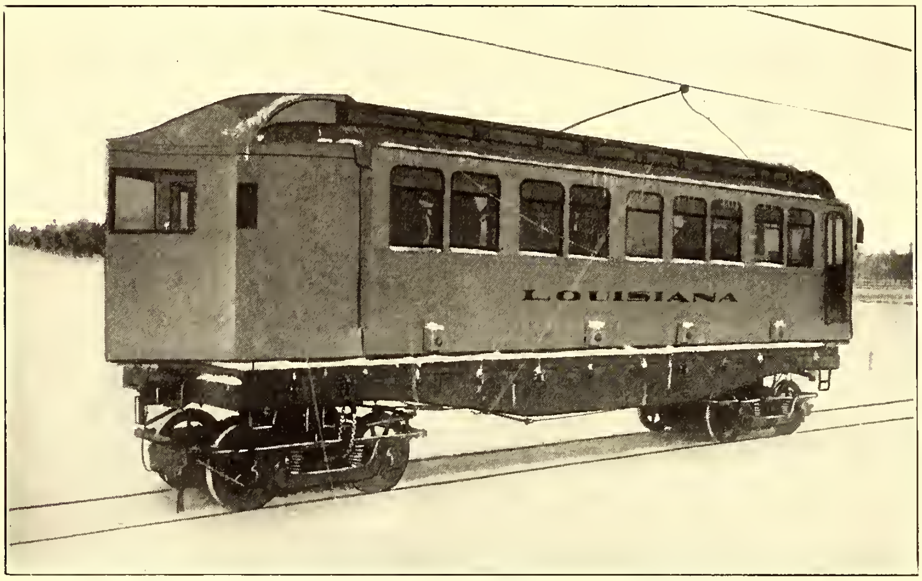
Seriously, car ventilation is a very troublesome matter indeed, and there is more excuse for defects in the case of cars than in that of a public edifice. We do not wish to discourage invention or to pose as alarmists, but we are strongly of the opinion that to ventilate adequately a closed street car without grave danger from drafts is impossible during the rush hours. The condition of affairs is this: In a car less than 8 ft. high and containing, say, 1500 cu. ft. of space when empty are from fifty to eighty human beings with breathing apparatus in full action. The only chance for ventilation is through apertures in or near the roof within 2 ft. of the heads of the standing passengers, or else to take the air in through the heaters. With the latter method the amount of air that can be introduced when the car is full is very limited, and at best it comes from near the surface of the street. The correct principle is perhaps thus to draw in air over the heaters and to discharge it from the top of the car, but as a matter of practice we do not believe it can be made really effective when the car is full, as it is at certain hours of the day. It can do something, but not very much, in view of the very limited air space in the car and the obstruction to air flow offered by the passengers. Pure air gets in through the doors when they are opened, and that is about all. Roof ventilators take in air rather than let it out, and thus impede circulation over the heaters.

Doubtless something could be done by forced ventilation from fans, preferably driving out air at the top of the car, but only by using blowers of considerable power, and ventilation by their aid would be effective principally at the time when it is least needed—that is, when only a moderate number of passengers is aboard.

Some time since we suggested the use of forced draft to blow out cars at the end of the trip. This would not, of course, furnish fresh air in transit, but it would at least enable the cars to start in thoroughly ventilated and would relieve some of the very unpleasant features of overcrowding. Two or three minutes vigorous use of a 2-ft. hose would freshen up a car and clear it of bad air and dust in a wonderfully effective manner, and even though the process could not be repeated at every trip, it would be of real service to apply it as often as opportunity offered. The fact is that when cars are as crowded as they usually are at the rush hours, the most that can be done is to help the ventilation a little, to apply remedial measures, and to look forward hopefully to weather when the windows can be opened. One has only to ride in a crowded, closed car, even with the windows put down, to realize the difficulties of effective ventilation. There is no panacea at all available. We should like to see the use of ventilating fans to keep the air moving tried, but we are not over sanguine as to the practical results. If the air is changed fast enough to be of much use, half the passengers will kick over the drafts about their necks, and the other half will complain of air about their feet. The space is too small and the people are too many for thoroughly effective ventilation.

RECENT WORK OF THE ELECTRIC RAILWAY TEST COMMISSION

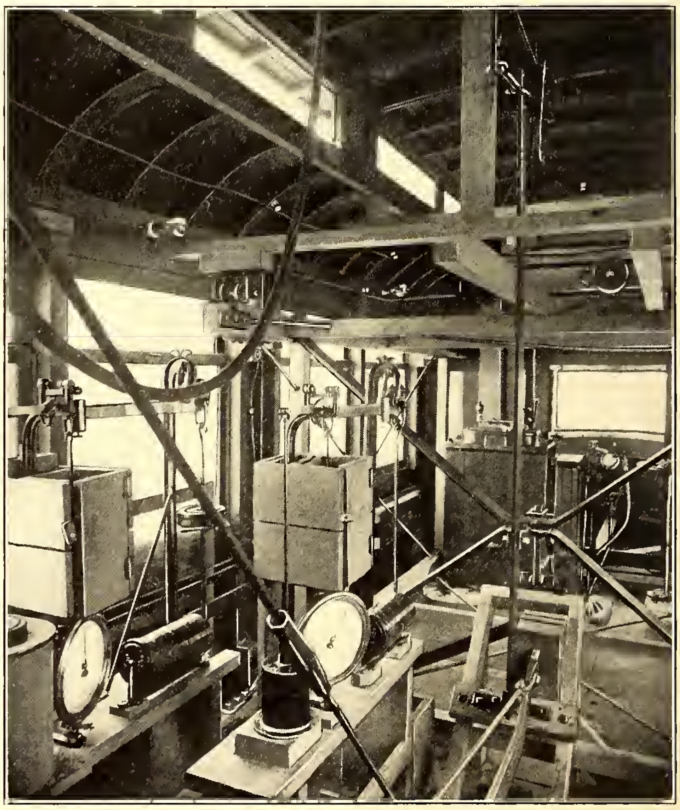
The field work of the commission approaches completion, the test corps now being at work upon the lines of the Indiana Union Traction Company investigating the problem of air resistance in the motion of car bodies. As will be remembered, the commission, consisting of J. G. White, H. H. Vreeland, J. H. McGraw, W. J. Wilgus and G. F. McCulloch, was appointed over a year ago by President Francis, of the Louisiana Purchase Exposition, in consultation with Prof. W. E. Goldsborough, chief of the Department of Electricity. The commission immediately began preparation for tests at St. Louis and elsewhere, and early in the summer actual testing was begun. A test corps of ample size, selected from various technical schools, has been at work making such tests as were recommended by a number of engineering committees appointed by the commission to act in an advisory capacity. The tests have comprised studies of the alternating-current losses in rails; of the efficiency of various methods of braking and accelerating, both for city and interurban cars; of the energy consumption in cars with different kinds of service, and of the resistance offered by the air to the motion of cars at high speeds.



WIND TEST CAR WITH WEDGE-SHAPED VESTIBULE

While the earlier part of the work has been described in some detail in the technical press, but little has been said regarding the special dynamometer car designed and constructed for the purpose of measuring directly the head and rear pressures and the side and roof resistances of car bodies. This car was recently completed at the shops of the Indiana Traction Company at Anderson, Ind., this company having co-operated heartily in the rather tedious work incident to an experiment of this sort. The equipment for the car was secured partly by loan and partly by purchase of supplies through funds donated to the work by various electric and steam railway companies and by engineers interested in the investigation of important railway problems. The Indiana Union Traction Company, in addition to the facilities offered in its shops and offices, placed at the disposal of the commission a pair of high-speed Baldwin trucks and a set of four Westinghouse No. 85 motors, rated at 75-hp each. The Baldwin Locomotive Works made the changes in the center plates and side bearings of the trucks necessary to enable them to turn freely under the frame of a steel flat car loaned by the Pressed Steel Car Company. A motor-compressor of ample size, with governor and brake cylinder, was furnished by the National Electric Company, and the test corps designed and constructed the special brake rigging necessary to adapt these to the steel car frame. A powerful hand-brake rigging was also constructed, with the Peacock brake drums supplied by the National Brake Company. Special bumpers were constructed to prevent damage to other cars in coupling, and heavy chains were used to prevent excessive motion of the car frame with respect to the trucks. As the frame was raised considerably above its usual height by the changes mentioned, this was considered desirable.

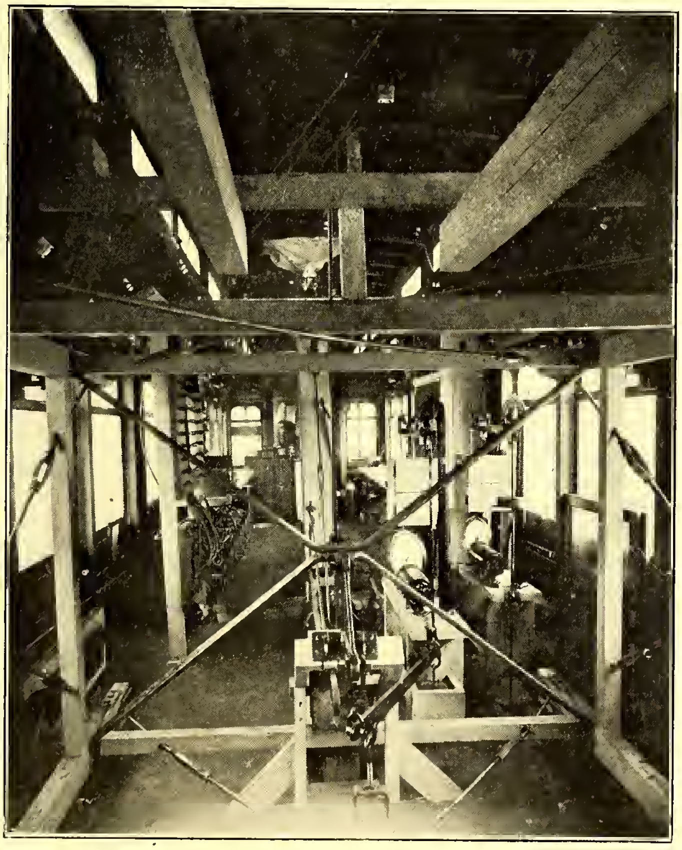
The dynamometer equipment, consisting of an interurban car body, 32 ft. long, without vestibules, rolls freely upon rails screwed to the flat car floor. This body, with a special steel vestibule and a standard vestibule, was supplied by the J. G. Brill Company. Under the side sills of the dynamometer body are mounted eight Chapman double-ball bearings, and these carry four axles of 3 7-16 ins. diameter, 9 ft. long. Upon the axles are specially chilled wheels, 12 ins. in diameter, with ground treads. The rails are also ground where they come into contact with the wheels. By this method of mounting there is, for practical purposes, no friction between the body and the flat car floor. The body is restrained from excessive motion by various effective safety devices. The pressure of the air upon the body is measured by means of scale beams, constructed for the tests by Fairbanks, Morse & Company and loaned by them. The beams are supplied with dash pots, and the weighing mechanism consists of the regular beam with weights and poise, and, in addition, a spring balance with dial is employed to render easier the manipulation of the machine.


INTERIOR OF WIND TEST CAR LOOKING FORWARD FROM THE MIDDLE

A successful plan has been carried out on this car for the purpose of separating the head and rear resistances from the total. The vestibule is independent of the body, but is carried therefrom by means of a link suspension. In order to guide the vestibule and to transmit the pressure to the weighing device, a steel-trussed oak frame, attached to the vestibule, projects into the car a distance of 8 ft., and it is guided on all sides by small Chapman bearings. This method of suspension has proven very satisfactory. In order to secure stability of the vestibule and body, each of these is held against the scales by counterweights, the forces of which are transmitted through bell cranks and levers, all equipped with knife-edge contacts.

In order to eliminate from the measurements all forces but those due to the air, the controllers are mounted upon iron stands carried upon the flat car floor and projecting into the car body, thus removing the effect of stiffness in the controller cables, a serious matter in a car of this size. Similarly, the trolley base is inside the car, carried upon the top of an oak post which projects upward from the flat car. No error is possible, therefore, from the resistance between trolley wheel and line wire. While the forces mentioned are small in amount, the sensitiveness of the apparatus is such that the precautions taken are necessary.

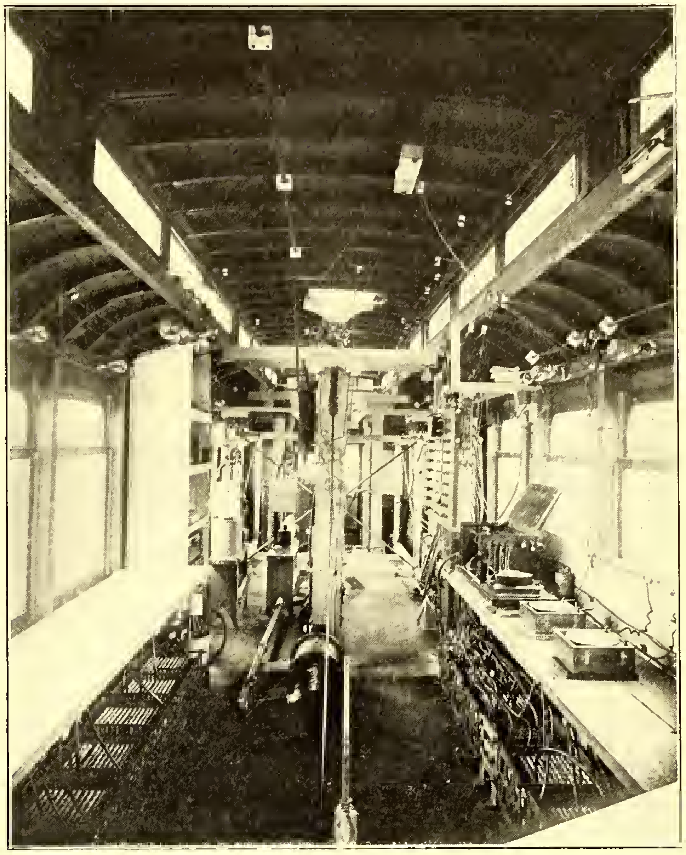
The construction of the air resistance car was carried out by the test corps, which put in about three months in the actual detail work. This included the assembling of the equipment, the construction of the special brake rigging and other equipment, with the exception of the heavy steel and woodwork,



VIEW OF INTERIOR OF WIND TEST CAR FROM THE FRONT PLATFORM

which was done by outside parties from the funds of the commission. The corps also wired the car for a double-end controller arrangement, one controller of the Westinghouse "L-4" type being loaned by the traction company, the other by the Westinghouse Company, the latter also supplying a pair of circuit breakers and a large number of resistance grids for controlling the running speed of the cars.

The commission has realized the necessity of making exact measurements of all of the quantities involved in these tests, especially in regard to the matter of speed. For this purpose two independent plans are employed. The test track, somewhat over 25,000 ft. in length, is divided in sections of 1000 ft. each. The sections are marked by large signs plainly numbered. The instant of passing each sign is indicated on the graphical record of a General Electric recording ammeter, which is also used for the current record. This ammeter records upon a strip of paper regular intervals of five seconds each. Upon this record is superimposed the time of passing each of the



VIEW OF INTERIOR OF WIND TEST CAR FROM THE REAR PLATFORM

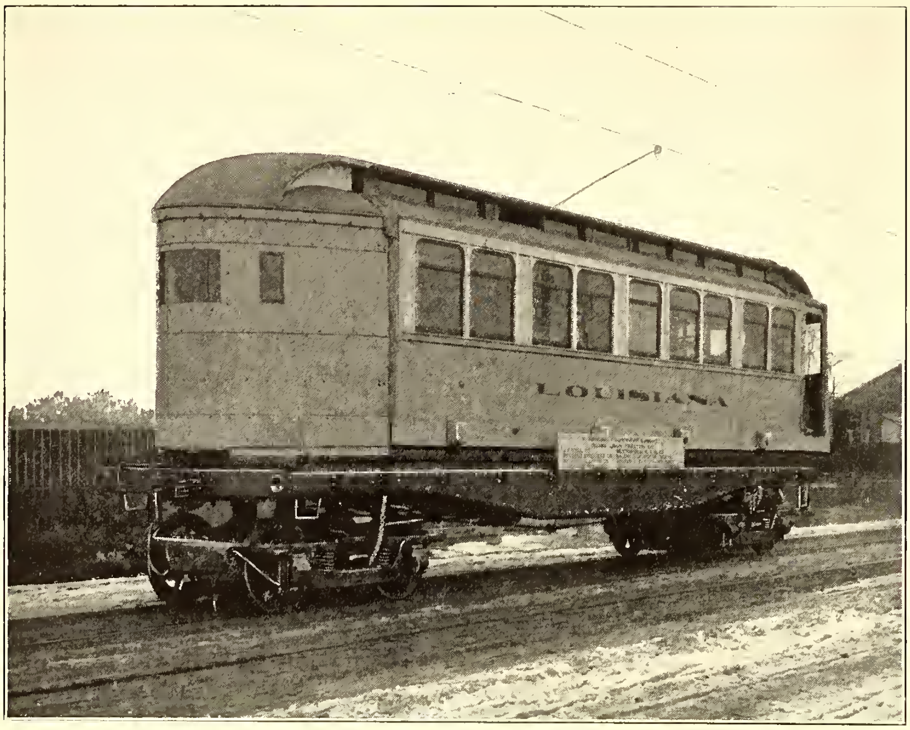
section signs, this being accomplished by closing a switch for an instant as each of these signs are passed. Thus the time of passing through a section of 1000 ft. is accurately recorded.

The second speed device consists of a small dynamo carried upon the truck frame and geared to the car axle by sprocket wheels and chain. This dynamo is an Apple igniter of the Dayton Electrical Manufacturing Company. It has permanently magnetized field poles, but these also carry exciting coils through which the field current of the recording ammeter is also passed. As this current must be maintained accurately at a value of 1 amp. for current measuring purposes, it is admirably adapted for the purpose mentioned. The electromotive force generated by the dynamo is read upon a Weston voltmeter specially arranged for this purpose. The electromotive force at 60 m.p.h. is about 7 volts. The readings are directly proportional to the speed. This apparatus has now been in operation for some weeks, and has demonstrated its accuracy and convenience.

In addition to the speed measurements, accurate readings at five-second intervals of motor electromotive force are recorded, and the current record is continuously checked by means of a direct-reading ammeter in the same circuit. The direction and velocity of the wind are also taken at frequent intervals, accurate anemometers having been supplied by Queen & Company for the purpose.

The tests on the "Louisiana," as the air-resistance car has been named, will continue until sufficient data are at hand to determine the resistance to the motion of different shapes of car front at all speeds reached by modern interurban cars up to 70 m.p.h., this limit being set by the line and motor capacities. A speed of 72 m.p.h. has been reached for a short period.

During the past few days another important investigation has been completed by the use of a car exhibited by the Cincinnati



WIND TEST CAR WITH PARABOLIC VESTIBULE

Car Company at the Exposition. This car is supplied with the same motor equipment as the "Louisiana," but it has, in addition, the latest type of Westinghouse electro-pneumatic control. The tests made upon this car were designed to supplement those previously made, and to supply important data, not only in regard to the control system, but having reference in general to heavy interurban car operation problems. An interesting feature of these tests was that all records were taken autographically, a special recording table having been constructed along the line of the experience gained at St. Louis. A wide strip of paper is carried by motor power across a glass table, on opposite sides of which the observers are stationed with their instruments. Opposite each is a guide and pencil carriage, the latter of which is operated by a cord carried over a drum attached to a pointer over the instrument needle. The observer simply follows the motion of the needle with his pointer and the result is recorded. The base line for each record is traced by a separate pencil carried by an electromagnet through which passes the current from a time-marker recording five-second intervals, thus synchronizing all of the records. While somewhat similar to other recording apparatus in use, this equipment was designed independently and has some features of its own.

The results of all the work of the commission will be published in full in a report to be issued as soon as practicable after the completion of the work.

The Fort Wayne & Wabash Valley Traction Company, in connection with the Indianapolis Northern Traction line, has begun through service between Fort Wayne and Indianapolis, with Peru the connecting point. The company will run three limited cars between Fort Wayne and Peru daily, and these are to connect with the limited service now in force between Peru and Indianapolis. The distance of 130 miles is being covered in five hours. The fare for the trip is $2.20.

TICKETS AS A PRIZE IN A GUESSING CONTEST

The West Pennsylvania Railways Company, of Connellsville, Pa., has inaugurated a novel guessing contest. To the first passenger guessing nearest the number of miles run by the passenger cars of the company during the month of March, 1905, will be given a book of tickets good for 100 rides on any line of the system. Guesses must be made on coupons cut from "Trolley Talk," properly filled out and in the company's hands on or before April 1. Employees of the company are not to compete. Announcement of the winner will be made in "Trolley Talk" for April.

DRAMATIC CROSSING FIGHT

There was a struggle at Santa Rosa, Cal., on March 1 over a railroad crossing that lasted several hours and was dramatic in the extreme. An injunction had been obtained by the California Northwestern Railroad to prevent the Petaluma & Santa Rosa Electric Railway from crossing its tracks on Sebastapol Avenue, Santa Rosa. In deference to this order, the electric railway company postponed building the crossing until the case had been disposed of in the courts. On March 1 an order was handed down doing away with the

LOCOMOTIVES AND FLAT CARS OF THE CALIFORNIA NORTHWESTERN RAILROAD BLOCKING THE CROSSING

embargo. The electric railway company proceeded to carry out the work, but met with opposition from the Northwestern, which drew up locomotives on either side of the crossing and so harassed the laborers of the electric railway that they had to desist many times. Hand to hand encounters between the contesting interests were not infrequent. The view herewith shows how effectually all operations were blocked by the steam locomotives, and gives an idea of the intensity of the interest shown by the public. Finally, President Foster, of the Northwestern, informed of the action of the court, ordered the locomotives and the flat cars to be withdrawn.

CAR LIGHTING AND VENTILATION

BY JOHN P. FOX

The recent editorials in the Street Railway Journal on car lighting and car ventilation are very timely, and improvements along the lines suggested would seem well worth trying as added inducements to make people ride. It seems curious that the naked incandescent lamp is still the rule. But it is one of those survivals that go with an early developed industry, which the newly sprung up English roads have avoided. Economy often limits the English interior lighting in the number of lamps, but the colored shades, pear-shaped globes and prism or cut-glass globes tend to increase the efficiency of the light, as the editorial points out. Fig. 1 shows the interior of a Manchester car; Fig. 2 of a Leicester car. Recent City & South London cars present very attractive lighting, as seen in Fig. 3, colored photographs of railway scenery being the only advertisements used. Fig. 4 illustrates the interior of a prism globe with two lamps; Fig. 5 shows the exterior. The lowness of English ceilings, as required in double-deck cars, has led to a common use of white millboard or lincrusta. This has the effect of lightening up the interior very much and adding to the effective illumination.

On the Continent bare electric lights are the rule, as in the Berlin surface car, Fig. 6, which has a white ceiling. The cars of the Berlin Elevated and Underground Railway have admirably placed lights over the longitudinal seats, with cut-glass globes, as already illustrated in the Journal, June 4, 1904, pages 845-846. Berlin surface cars have an ingenious arrangement for detecting burned out lamps, consisting of a test lamp with two projecting rods, which can be quickly slipped into holes in the base of each lamp, making all unscrewing unnecessary till the broken filament is discovered.

FIG. 1.—INTERIOR OF CAR IN MANCHESTER, SHOWING PRISMATIC CEILING GLOBES

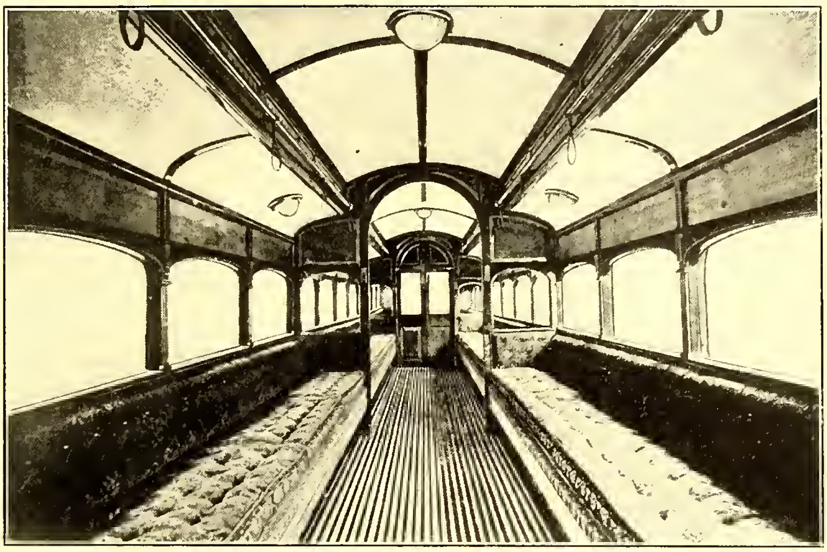


FIG. 3.—INTERIOR OF CITY & SOUTH LONDON TUBE CAR, WITH PRISMATIC CEILING AND DECK GLOBES

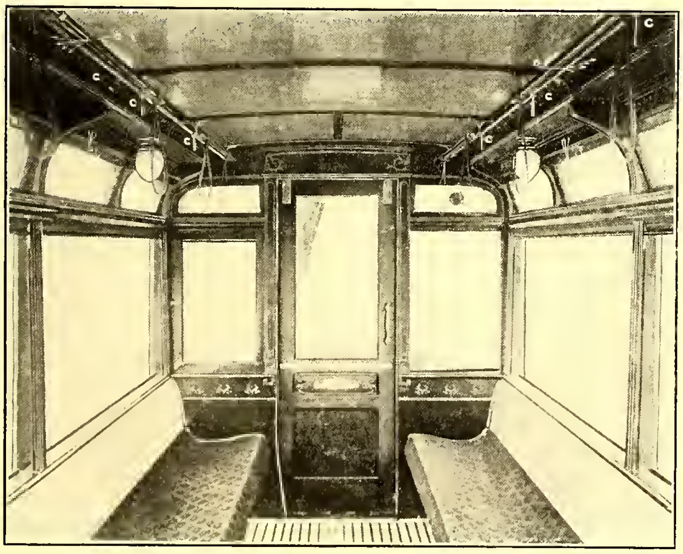


FIG. 2.—INTERIOR OF CAR IN LEICESTER, SHOWING PEAR-SHAPED GLOBES AND VENTILATION DUCTS

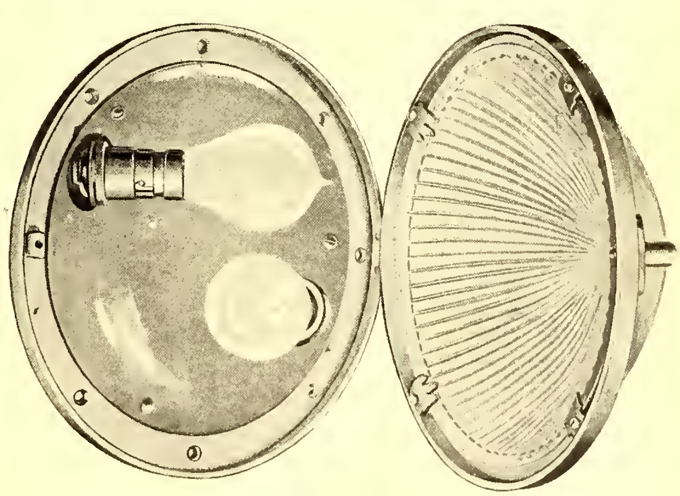


FIG. 4.—PRISM GLOBE, OPEN, WITH TWO LAMPS

For an example of lamps with frosted globes, a very effective treatment is shown in Fig. 7, representing the interiors of the King's and Queen's compartments of a London & South Western royal saloon car. The elliptical ceiling, in spite of certain advantages and attractions, has never gained a foothold in this country on steam or electric roads, perhaps because it has not been thought consistent with sufficient ventilation. But the Pennsylvania Railroad has permanently closed its deck sashes to keep the rain out effectively, using globe ventilators in the ceiling for air outlets. It would be a great improvement if something as effective as the Pennsylvania ventilating system, illustrated in Fig. 8, were applied to electric cars. In this well-known system, the motion of the train forces air down a duct in two corners of a car, then horizontally in ducts along the floor, where the air is heated by steam pipes, passing out under every seat toward the aisle and avoiding drafts. There are no exposed steam pipes, all being enclosed in the ducts, and the system is always effective, except with a standing train in summer, when the spring balanced windows can be easily opened. Moisture entering would drip out at *A*. It may be doubted whether this system would furnish enough air with electric cars, except where the latter are run at high speeds with few stops. Car air is usually the worst at rush hours, when the speeds are the lowest and when the direction of the wind might prevent all ventilation if it was the same as the car. Electric fans seem the only sure device, especially if downward ventilation is desired, and the addition of one or two fans would hardly seem to add much to the necessary complication of a modern car. According to a test made by a street railway company several years ago, it took 35 per cent less current to heat a car if some of the current were diverted to a fan blowing outside air through the heaters; and further experiments along this line would be very interesting. Even with present arrangements, the most crowded city cars can be kept satisfactory to most passengers if a little trouble is taken, as is the case in Boston, where various deck ventilators have been tried in the elevated trains, and tests for carbon dioxide in both surface and elevated cars have shown good and improving conditions, due to the care of the management.

As to foreign ventilating methods, the latest English practice was described in the JOURNAL for June 4, 1904, page 838, and for Aug. 29, 1903, page 388. The ventilator sashes, as shown at *A*, Fig. 2, are usually hinged at the bottom so as to prevent downward drafts from the incoming air and to exclude rain. The fresh air then passes into the car through the inlets marked *BB*. The outlet for the foul air is provided by a recess made in the roof of the car marked *CC*, which is just above the hinged window referred to. The circulation of the foul hot air through this recess to the outside is shown by the arrows marked *DD*. Some double-deck cars, as in Manchester (Fig. 1), and also on the Continent, have monitor roofs under the upper floor. The forward sashes of the Liverpool cars are pivoted vertically in the middle, so as to open out and force air in, the rear ones drawing air out, besides which there is a sliding panel in the top of the doors. Many of the Berlin cars have ventilators in the ends of the monitor roofs, as in Fig. 6, controlled by a long handle to allow easy adjustment. The surface cars of the Berlin elevated road, besides the end ventilators in the roof, have the side sashes hinged vertically and open out, so as to force air in at the front end and out at the rear, just as with the elevated cars.

FIG. 5.—PRISM GLOBE, CLOSED

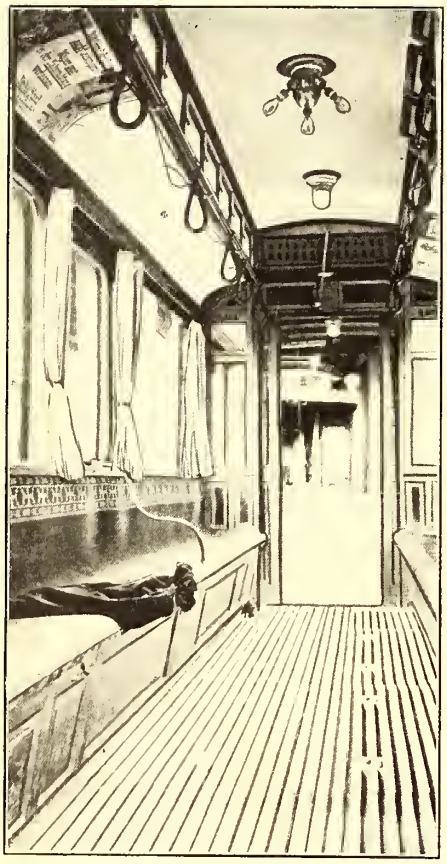


FIG. 6.—INTERIOR OF BERLIN ELEVATED AND UNDERGROUND CAR, WITH VENTILATING DUCTS IN END MONITOR PANEL

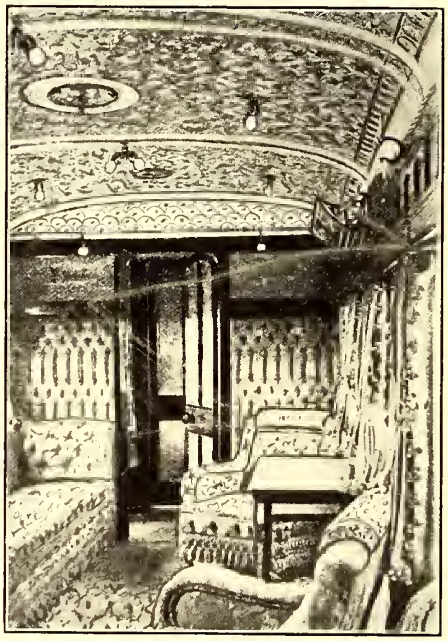


FIG. 7.—COMPARTMENT IN ROYAL PRIVATE CAR, LONDON & SOUTH-WESTERN RAILWAY, SHOWING EFFECT OF ELLIPTICAL CEILING AND FROSTED GLOBES

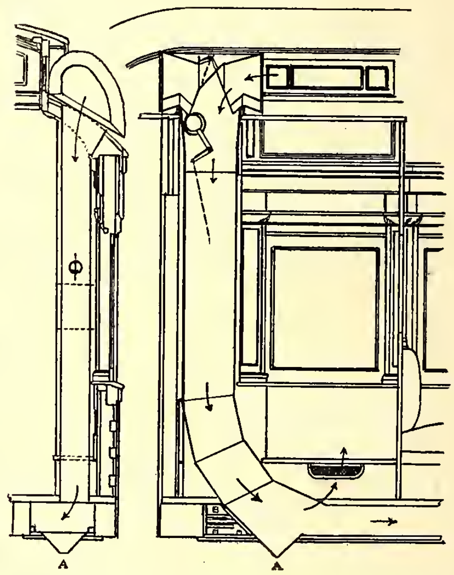
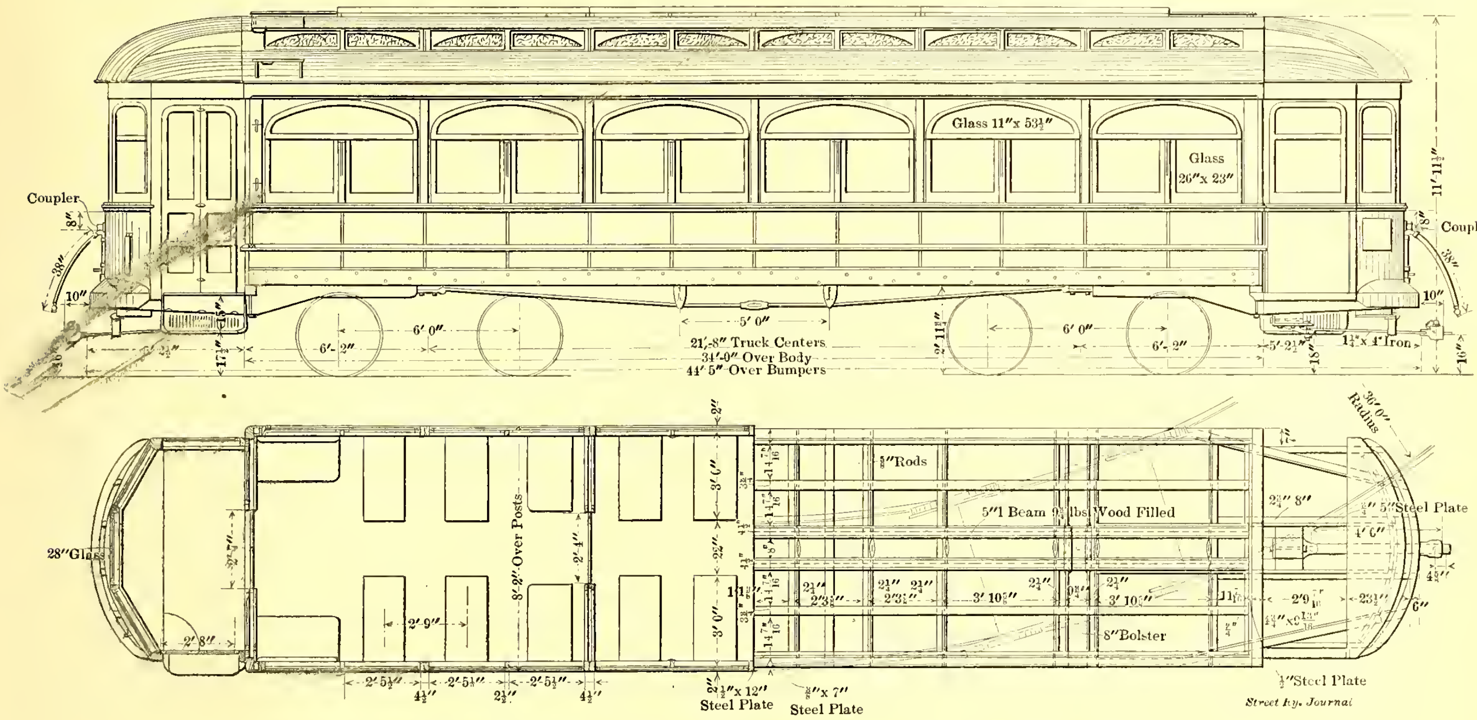


FIG. 8.—SECTIONS SHOWING METHOD OF VENTILATION ON PENNSYLVANIA RAILROAD CARS

New mileage books have just been issued by the Indiana Northern Traction Company, the line between Wabash and Marion, which are interchangeable with those of the Fort Wayne & Wabash Valley Traction Company. The new books, like those on the east and west interurban roads, retail at $8 for each 200 5-cent rides, making a reduction of 20 per cent. So far there has been no further move in making interchangeable mileage on all Indiana interurbans. This has been discussed, and at a recent meeting was recommended, but has not yet been done. The movement of the two roads means that they are ready to be the pioneers in the interchangeable mileage plans.

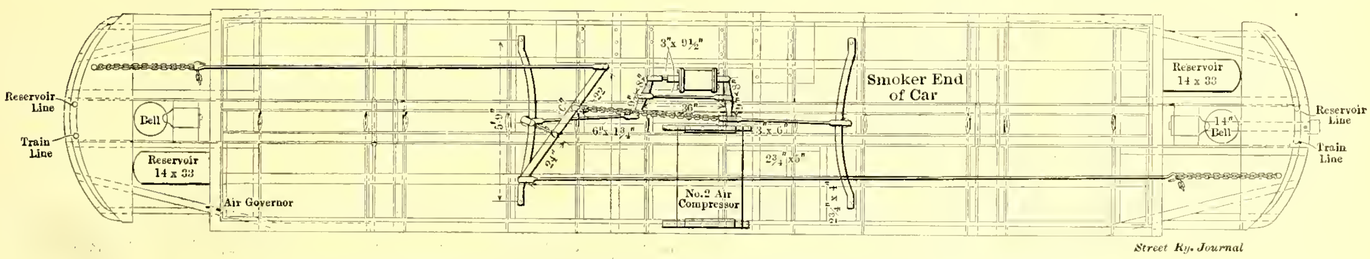
NEW 4000-TYPE CAR FOR BUFFALO

The International Railway Company, of Buffalo, has recently placed in service between Buffalo, Niagara Falls and Lockport a new type of car, known as the "4000-series," embodying a number of new ideas in car construction. The cars were built at the shops of the J. G. Brill Company, the order as placed calling for twenty-three motor cars and twelve trail cars, the details of design for the motors and trailers being similar, with the exception of the electrical equipment.



SIDE ELEVATION AND PLAN OF NEW 4000-TYPE CAR FOR BUFFALO

The following are the general dimensions for this type of rolling stock: Length over body, 34 ft.; length over vestibules, 43 ft. 5 ins.; length over bumpers, 44 ft. 5 ins.; width over posts, 8 ft. 2 ins.; width over sill plates, 7 ft. 11 ins.; height from bottom of sill to top of roof, 8 ft. 11½ ins.; height from rail to top of roof, 11 ft. 11½ ins.; width over guard rails, 8 ft. 5¼ ins.



ARRANGEMENT OF BRAKE RIGGING FOR HAND AND AIR BRAKES

The conspicuous features of the design include the following: The body has six sets of windows on each side, the two lower sash and one stationary transom sash extending the full length of two lower sash in each set, giving a wide window similar in general appearance to that known as the Pullman type of window. The bottom sash of each window is designed to be raised into the upper part of the side of the car, there being 4 ft. 3 ins. clear from top of floor to lower edge of bottom rail of sash when window is raised. The space below the sash rail is paneled with 7-16-in. whitewood, the upper panel being convex and the lower panel concave. There is an enclosed vestibule at each end of the car, with double folding doors at diagonal corners of car, the vestibule having four windows, three of the sash being designed to drop. The roof of the car is of the monitor type, with steam coach hoods, the hoods being detachable and covered with No. 18 steel plates. There are twelve ventilator sash on each side. The glass in each pair of sash forms a half-ellipse to correspond in appearance with the transom sash in side of body.

BOTTOM FRAMING

The outside sills are of long leaf yellow pine, 3¾ ins. x 7¾ ins., running full length of car body. The sills are plated on the outside with a ⅜-in. x 6-in. plate of steel, full length of body, kept flush with bottom of sill, and on the inside with a ⅜-in. x 10-in. plate of steel running full length, but kept up 1 in. from bottom of sill. There is also an inner or sub-sill of yellow pine, 1¼ ins. x 5 ins., to receive tenons in cross framing, all securely bolted together with ½-in. button-head bolts. Both plates and wood were painted with one heavy coat of mineral paint before they were bolted together. There are two stringers of yellow pine, 2½ ins. x 3¾ ins., gained into the cross framing.

END SILLS

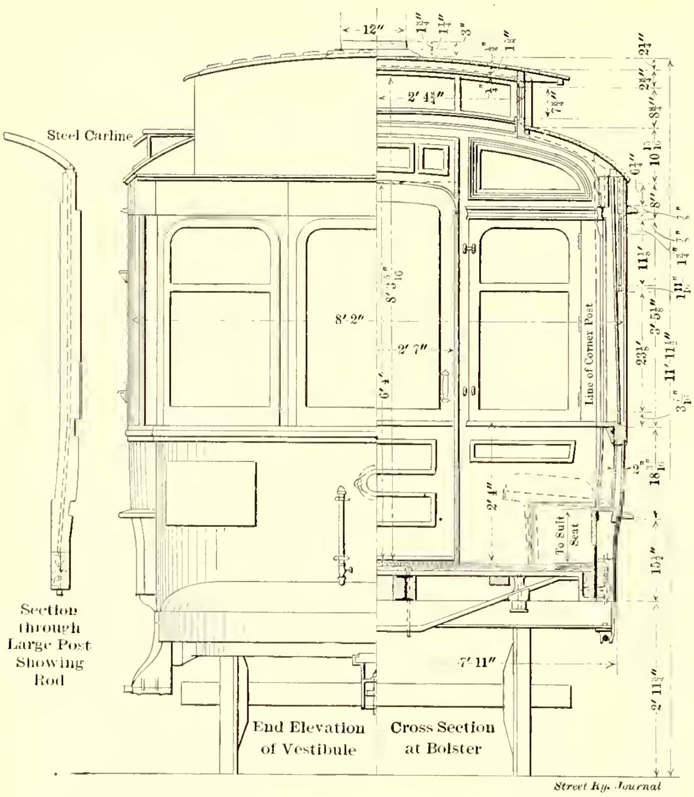
The end sills are of white oak, 4¾ ins. x 8 ins., with sub-sill, 4¾ ins. x 2 5-16 ins., extending full width of bottom frame and double mortised at ends to receive ends of side sills. There is a ½-in. x 5-in. steel plate extending to each side sill and turned 8 ins. at ends, and securely bolted with four ½-in. bolts at each corner to inside longitudinal plate, the two bolts nearest angle passing through the steel plate only, the other two bolts passing through side sill and longitudinal plates, with head on outside. There are short sub-sills, 1¾ ins. x 5 ins., bolted inside, to receive ends of stringers and flooring.

CROSS FRAMING

The cross framing is 2¼-in. x 5-in. oak timber, double tenoned into the sills. A space ½ in. deep and just wide enough to allow brake rod to work over needle beams is cut in part of cross framing.

CENTER SILLS

The center sills consists of 9¾-lb. I-beams, filled on each side



CROSS SECTIONS, BUFFALO CAR

with yellow pine or oak to make up a total width of 4½ ins. Each end of each I-beam is fastened to end plates with two angle plates, ⅜ in. x 4 ins. x 6 ins. x 6 ins., riveted to I-beams and bolted through the end plates and sills, there being a ⅝-in. cross tie-rod passing through bottom frame at each cross bar with button-head on outside and turnbuckle in center. The center sills were kept down ⅝ in. and have a ⅝-in. nailing strip on top. The I-beams and filling space were given a good coat of mineral paint before being put together.

BODY BOLSTERS

The upper plate of the bolsters is ⅝-in. x 8-in. steel. The lower plate is I-in. x 8-in. steel. The depth of truss was governed by height of truck center plate so as to give a clearance of 36 ins. from top of rail to under side of sill, with weight of car body on trucks.

NEEDLE BEAMS

The needle beams are of 5-in. I-beams, weighing about 12 lbs. to the foot, with suitable malleable cast struts on ends to receive truss rods. The needle beams are placed 5 ft. center to center.

UNDER TRUSS RODS

There are two under truss rods, consisting of 1⅛-in. round rods placed under side sills, extending from bolster to bolster, with 1¼-in. turnbuckle centered between needle beams, the distance from under side of sill to top of the truss rod at its lowest point being 7½ ins. The ends of truss rods are connected with a ⅞-in. pin to a ¾-in. x 3-in. wrought-iron strap, which is securely fastened to the bolster and side sill.

INSIDE TRUSS ROD

There is also a ⅜-in. x 2-in. inside iron truss rod with ⅞-in. round ends, supported at the bolsters by suitable wrought-iron straps fastened to post by gaining and screwing. The ⅞-in. round ends pass through side sills near the end sills and through a suitable malleable cast-iron washer, with bearing for nut at right angles to rod, this rod being kept up as high as possible on inside of car.

BODY FRAMING

The corner posts are 3¾-in. x 6-in. white ash, tenoned into end sill and fastened thereto with a strap bolt. The door posts each have a vertical ⅜-in. round rod grooved into it and passing through end plate and end sill.

A unique feature is the method of strengthening the side posts. The large side posts, which, as will be seen from the drawing, occur between each set of windows, are of white ash and consist of two halves, each half 2¼ ins. thick, the halves being grooved on the inside to take a ½-in. square rod which passes vertically through the center of the posts and is bent at a slight angle, as shown on one of the detail drawings. This rod is to prevent side of car becoming bulged out after being in service for a time. These vertical rods have round ends and pass through the side sill at the bottom and through the steel carlines at the top. There is a nut at the bottom of each rod, so that if the side of the car gives evidence of getting out of line the nuts can be screwed up. It will be evident that the slight angle of these vertical rods gives them the effect of a truss rod, and by tightening the nut at the bottom the sides of the car can be drawn inwardly. The two halves of these large side posts are glued and screwed together, with the square rod between them. The small or intermediate side posts are of white ash, 2¼ ins. thick, tenoned and fastened to sill with strap bolts.

BOTTOM FRAMING OF VESTIBULES

The vestibule platforms are carried on platform knees made

NEW 4000-TYPE BUFFALO CAR

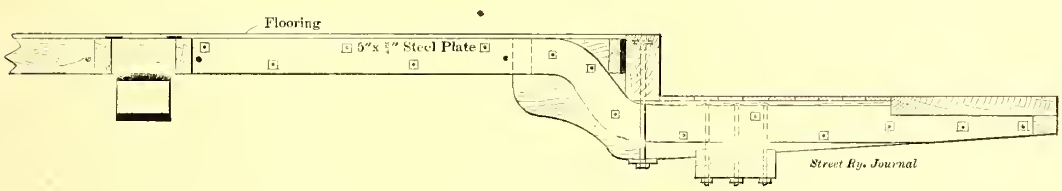
of white oak, 2¾ ins. x 8 ins. The outside knees are reinforced by 3-in. x 4-in. x ½-in. angle iron, extending, as shown in one of the drawings, and bent to the shape of under side of knees. The two inner knees are of white oak, 2¾ ins. x 8 ins., each knee reinforced by a steel plate, ¾ in. x 5 ins., bent, as shown on detail drawing, and securely bolted to center sills of car and knees. Each knee is hung with two ¾-in. bolts passing through end sill and through a plate of iron placed transversely on under side of platform knees, of sufficient strength to carry weight of vestibule without bending. A ⅜-in. x 2½-in. plate is sunk into the upper edge of end sill under heads of bolts, and of sufficient length to form a bearing for both bolt rods at the same time. Across the under side of both center knees is fastened a piece of white oak, 4½ ins. x 11 ins., to which is fastened the company's standard draw-bar pocket of wrought iron, especial care being taken to make this strong enough to stand the strain of pulling a loaded car weighing 25 tons without breaking.

The end platform sill is white oak, 2¾ ins. thick. The buffer is ⅜-in. x 3½-in. x 6-in. angle iron, bent to shape of vestibule. The round side of the vestibules below the sash rail are covered with No. 14 steel plate. Each vestibule has one folding door arranged to fold back against the front of vestibule.

The end doors to the interior of the car are single sliding doors with drop sash. In each case the door is arranged to slide away from the open side of the vestibule, so that the door when open does not interfere with a clear vision of the step from the inside of the car.

The car has a smoking compartment divided from the main compartment by a double partition having a single sliding door.

The windows are fitted with the O. M. Edwards sash fixtures. All side and end windows have curtains of pantasote, mounted on Hartshorn spring rollers and fitted with the Curtain Supply Company's fixtures. The seats are the Hale & Kilburn 3-ft. cross seats, with high roll-back and finished in dark green, giving a 22-in. aisle down the center of the car. At each of the four corners there is a short longitudinal seat. It will be noticed from the drawing that advantage is taken of the slight bend in the side posts to gain all the advantages of a



MANNER OF APPLYING REINFORCING PLATE ON PLATFORM KNEES

wider car, inasmuch as the cross seats fit into the angle of the posts, thus permitting a full-sized seat without encroaching upon the aisle space. The car is fitted with electric heaters of the Consolidated Car Heater Company's manufacture. The heaters are of the truss plank type, extending full length of car on each side, with the exception of under the end seats, where panel heaters were used.

The car is equipped with General Electric type M multiple-unit control, with four GE 74 motors to each car, giving an aggregate of 260 hp in motor capacity. The body is mounted on Brill 27 double trucks of the M. C. B. type, with 6-ft. wheel base. The axles are forged iron, 5½ ins. in diameter in the body and 6-in. wheel and gear fit. The journals are 4¼ ins. x 8 ins., with M. C. B. boxes, using oil and waste for lubricating the bearings. The cars are geared to 60 m.p.h. The truck is fitted with steel-tired wheels, 33 ins. in diameter, supplied by the Railway Steel Spring Company.

Each car is equipped with brake rigging for both hand and air brakes. The air-brake equipment consists of the Christensen straight-air system with motor-driven compressors.

Another unique feature is in the arrangement to prevent persons from securing a foothold on the buffers. There is a piece of No. 14 sheet steel fastened to the buffer and dasher, as shown in the half-tone engraving, this sheet steel forming an angle of 45 degs. with the dasher. It is fastened to the buffer and to the dasher with ¼-in. stove bolts about 3½ ins. apart. It will be seen that it is practically impossible for a mischievous boy or other person to stand or sit upon this incline. The plans and specifications for this new type of car were prepared at the company's shops.

GERMAN IMPRESSIONS OF AMERICAN RAILWAY PRACTICE

During May and June last year, General Manager Koehler and Chief Engineer Peiser, of the Grosse Berliner Strassenbahn, visited the United States to see the St. Louis Exposition and inspect the railway systems of the large cities of the Eastern and Central States. The following are some of the comments on American street railway systems which they make in the February number of the "Zeitschrift für Kleinbahnen."

After referring to the principal railway exhibits at the Exposition, the writers praise in the highest terms the arrangements made by the two St. Louis companies for handling the World's Fair traffic. The writers, in describing the working of the American method of cash fares and registers, express the opinion that the American public would not submit to the annoyance of the European method of fare receipts, although they consider the American system open to numerous possibilities of fraud. The visitors were also greatly impressed by the elaborate transfer system.

In St. Louis a careful inspection was made of the shops of the St. Louis Transit Company. Messrs. Koehler and Peiser found many excellent devices in use, but criticise the arrangement of the buildings. As the woodworking shop is entirely separate from the main shop, which contains twenty-eight tracks, cars under repair must frequently be transferred from one building to another, causing inconvenience and delay. So far as the writers could judge, there was nothing in the shape of the property to make the present layout necessary. The paint shop is also badly located with reference to the other buildings. The car painting, which seems to have been of a superficial character, impressed them very unfavorably.

In Chicago nothing of special interest was found, but the travelers note that, despite the great size of its generating station, the Chicago City Railway Company's power costs 1¼ cents per kw-hour, not including interest and depreciation, a large amount compared with other American cities. They were greatly impressed with the general features and management of the Boston Elevated Railway Company's system. Comparing the latter with the Grosse Berliner Strassenbahn, they find that the operating expenses of the Boston company are nearly double that of the Berlin corporation, although the Boston mileage is only 9 per cent greater. The larger income per passenger, however, which the American company receives (4.99 cents, as against 2.31 cents) makes the payment of dividends possible.

The writers consider the conduit system used in New York to be very satisfactory, ascribing its success to the central position of the slot and the fact that the current collectors are always in the conduit.

The receipts of the Sheffield (England) tramways in 1904 were $1,148,197, an increase of over $34,065 over 1903; 62,579,866 passengers were carried and 5,658,926 car-miles were run during the year. The total number of cars is 247, an increase of 29 in the year. The average number of ordinary cars running daily is 139 and 58 special cars. There are over 64 miles of single track (excluding depots), and the total number of employees is 1386. The question of running motor omnibuses from some of the present outside termini to outlying districts has been considered, but as the corporation has not the power to run such vehicles under the existing acts it has been decided to apply for the necessary authority in the next Parliamentary bill.

FUSES VERSUS CIRCUIT BREAKERS FOR PROTECTION OF RAILWAY APPARATUS

BY EDWARD TAYLOR

There is probably no ordinary piece of electric railway equipment so commonly misunderstood as the fuse. It is doubtful if even one out of ten railroad men, except among the engineering staff of the company, really knows what is meant by a 200-amp. fuse. It is the popular opinion among the more intelligent classes of street railway employees that a 200-amp. fuse is one which will carry but 200 amps., and that when the current of the circuit in which it is placed exceeds that amount the fuse will immediately "go out," or "blow," thereby opening the circuit. As a matter of fact, all standard fuses should carry a current 5 per cent higher than their rating indefinitely, without excessive heating or "blowing out" taking place. This very important time element of a fuse is not usually understood to be a function in the calculation of the size of fuse that would be best adapted to a given circuit.

The general confusion among railway men upon this point probably arises from the greater familiarity of the average street railway man with circuit breakers and their action. A circuit breaker being set at any given amperage should, upon the current reaching that point, blow out instantaneously. The fact that the circuit breakers on street railway cars are set at a certain definite point, and that when the current of the car, for any reason, reaches this figure, the circuit breakers go out at once, is well known by practically all men connected with the operating or mechanical departments of street railways. The comparatively recent use of enclosed fuses, and the similarity of their purpose to that of circuit breakers, therefore naturally leads one not familiar with the subject to assume that the action is the same—that a fuse has merely, as a circuit breaker, a maximum current capacity and that any excess will open the circuit.

As a matter of fact, however, the action of the two protective devices is radically different. Not only does the blowing of a fuse depend upon the length of time a given current is carried, while the circuit breaker depends only upon the amount of current, but their performance in opening a circuit shows a marked difference. The circuit breaker in dropping out breaks the arc caused by opening the circuit almost instantaneously, causing often a severe inductive kick on motor circuits, while the fuse, in opening, allows the current to fall off gradually, owing to the fact that the arc which is formed burns itself out, with a constantly increasing resistance.

THE CIRCUIT BREAKER

To properly understand the action of both devices a knowledge of their construction is necessary. All circuit breakers used in equipping present railway cars are of the magnetic blow-out type, and have, essentially, a switching mechanism for breaking the contact in a magnetic field. This magnetic field is supplied by an electromagnet which is in series with the arc which it must break; consequently when a heavy arc is to be broken, there is a strong current and correspondingly powerful magnetic flux to disrupt it. When the arc is dissipated, the current, of course, ceases. The electromagnet used for blowing out the arc is also made use of to attract the moving armature attached to the trigger which holds the breaker in, or, in other words, which normally keeps the contacts of the switch together.

The operation of the breaker is therefore practically as follows: When the current passing through the breaker rises above a predetermined point, sufficient magnetism is set up to attract the armature, which carries with it the trigger, releasing the switch covering the contacts, which tend to fly apart, owing to the action of a spring. The point of opening is determined by the tension of a spring attached to the moving armature and acting against the pull of the electromagnet. Upon the switch opening, arcing ensues, but, as an arc cannot, as is well known, be maintained in a comparatively strong magnetic field, it is dissipated by the current passing over it and energizing the blow-out coil, whereupon current ceases to flow and the circuit is open. The quickness with which this takes place is best understood when it is remembered that in closing a circuit of 800 amps., where the circuit breaker is set at 600 amps., the needle of a deadbeat ammeter would have scarcely time to reach a point between 75 amps. and 100 amps. before the breaker blows and the needle drops back to zero. Consequently it is reasonable to assume that the action of the circuit breaker is instantaneous, as only a fraction of a second is lost in the operation.

FUSES

The inductive effect of this sudden opening of the circuit may be quite injurious to insulation or, on a motor circuit, cause trouble at the controller, especially if the motors are not designed to obviate or dampen this inductive kick. It is in this respect that a fuse has a great advantage over the circuit breaker. Upon the fuse going out the current tapers off gradually, reducing this inductive effect. This is true on either the enclosed or the open type of fuses, the essential difference between the two being that an enclosed fuse gives no outward manifestations of the action of blowing except on the indicator, while the open fuse in blowing displays various signs of disturbance, namely, violent discharge of vapor and volatilized metal, causing a pyrotechnic display, and in some cases letting go with a loud report. In street railway work it is of frequent occurrence for open fuses in going out to ignite adjacent woodwork, or for the arc to come in contact with the truck or iron frame work of a car, causing a short-circuit, with resultant burning and damage. They are also subject to deterioration from weather conditions. Notwithstanding these disadvantages, and the fact that the National Board of Underwriters has decided against bare copper wire for fusing purposes, owing to its relatively high point of volatilization, it is being used to a considerable extent in railway equipment, and consequently deserves discussion as to its particular advantages or disadvantages.

The principal reason for the use of the copper-wire fuse is its convenience, copper wire of various sizes being always at hand in the shops and upon cars. Being soft, it readily conforms to various positions and is easily handled, and as it has a high conductivity a comparatively small diameter can be used. The objections to its use, however, are many. In addition to the faults of all open fuses mentioned above, the high fusing temperature of copper is apt to give considerable trouble when it is used as a fuse, as copper melts at 1090 degs. C., while zinc fuses at only 418 degs. C. and lead at 320 degs. C. The high temperature of the molten copper is almost certain to ignite any inflammable material with which it comes in contact, while it also causes a more severe flash and report when, as usually occurs, the metal is heated to the point of volatilization. Copper, moreover, while it does not oxidize under ordinary conditions in the atmosphere, when heated in the presence of moist air, a condition repeatedly met with when it is used as an open fuse, oxidizes readily, and rapidly deteriorates in reliability.

THE ENCLOSED FUSE

For all of these reasons enclosed fuses of the type I shall describe are rapidly supplanting the use of the open fuse in almost every line of street railway work. The enclosed fuse has the advantage of being noiseless in its action, in having no display of flame or vapor, of being more reliable than the open, of being protected from the effects of weather and the atmosphere, and finally of being much safer to replace upon a live circuit, after one has been blown.

The construction of all standard types of enclosed fuses is essentially the same. One or more strips of zinc, or other metal with a low temperature coefficient, are held by suitable brass or copper contacts, fastened to and enclosed by a fibre encasing tube. This tube (in fuses of recent construction) is lined with a thin sheet of asbestos paper to protect it from the heat and arcing that will occur on its interior; this sheet prevents the fibre from being burnt so that a great number of refillings can be made, which is an important factor, as there is a wide difference between the cost of refilling a fuse and its original selling price. Surrounding the fuse metal, and, in most cases, completely filling the tube, is a material composed of some insulating, heat-conducting substance, such as calcium sulphate, calcium carbonate, sand, etc. This filling is usually powdered or granular, and serves the threefold purpose of absorbing the heat generated within the metal, of retaining the molten particles, either by uniting chemically with them or by simply extracting the heat therefrom, and of destroying either the continuity of the line of molten metal, thus opening the circuit, or the conductivity of the same, which gives the same result.

Zinc is the most commonly used metal for the fuse strip, as it more completely volatilizes at a comparatively low temperature and its vapor is more easily absorbed by the filling material. These zinc strips are usually cut away or made weaker at the center, so as to centralize the arc, keep it away from the terminals, etc. The cutting away or notching of this strip is a considerable factor in the time element of the blowing out of the fuse, in the temperature of full load, etc. The end structure of the fuse is usually bored or sawed in such a manner as to permit free egress of the gases generated at the time of blowing.

These holes for ventilation, above mentioned, have until quite recently tended to produce a condition which has in a number of cases called down upon this type of fuse severe criticism of its deportment, inasmuch as these apertures have formed a passageway to the interior of the fuse for moisture, which is collected and held in mechanical suspension by the necessarily absorbent nature of the filling. Where the filling has been found to contain large amounts of moisture the performance of the fuse has been found to be unsatisfactory; in some cases it causes the emission of sparks and vapor at the terminals, and in others causes a burning of the tube, while, if the moisture is excessive, the fuse may be completely short-circuited and its usefulness destroyed. This difficulty will in the future be, in a measure, done away with, for the manufacturers have experimented with a view to lessening this trouble, and find it advisable to cover the holes for ventilation with a thin piece of glazed paper. This serves to exclude moisture from the fuse interior while still maintaining the ventilating features; when gas is generated on the interior of the fuse during blowing, its pressure easily ruptures the paper and blows it out laterally, leaving a ready path for the egress of gas or vapor.

The general construction and arrangement of all types of enclosed fuses is thus seen to be very similar, but until very recently there has been no effort made to secure uniformity of different makes as to styles of terminals, sizes, ratings, etc. Each manufacturer had his especial type of terminal, which fitted his own fuse block, and no others; each one had an arbitrary rating for the various sizes of fuse used. It can, of course, be understood that the latter point is one on which it is indeed difficult to secure uniformity, or even a definite standard for classification or rating. This is due to the aforementioned time element of a fuse, which is one of the main functions of the calculation—a fuse that will carry a certain maximum current indefinitely will carry from 150 per cent to 200 per cent of this current for varying lengths of time; for instance, a 200-amp. fuse of a certain standard make will carry 300 amps. for five minutes, 400 amps. for one minute, 550 amps. for fifteen seconds, etc., and would carry 210 amps. continuously. The characteristics of the enclosed fuse are illustrated in the diagram, Fig. 1, which traces the performance of a 200-amp. enclosed fuse under test. The size and shape of the zinc strip, the amount of surface it exposes, the amount of cutting away or notching at the center, the heat conductivity of the surrounding filling, have all an important part in the question of the shape of the fuse curve upon which all calculations must be based.

The uncertainty and indefiniteness on this point has mitigated against the use of enclosed fuses, as has also the lack of uniformity on other points between the various makes. But within the last year a move was made which will materially affect the future use of enclosed fuses for overload protection. This was the action on the part of the National Board of Fire Underwriters in standardizing the classification, rating and style of terminals of enclosed fuses. The rules and specifications along this line laid down by the board will have a far-reaching and much desired effect, inasmuch as the manufacturers will be required to furnish a fuse of a much finer quality than was heretofore likely. Under the old system a superior style or size of fuse block might lead to the adoption of a certain fuse. Then, once adopted, the purchaser would be almost compelled to continue its use, even though the quality of the fuse deteriorated, as each manufacturer had his own size and shape of fuse to correspond with his own fuse blocks, and hence any change of fuses involved the expense and trouble necessitated by a complete renewal of blocks.

When all fuses are standardized as to style of terminal, however, the make of fuse showing the highest efficiency, and which most closely conforms to specifications in actual service, can and will be used. The manufacturers, therefore, will then naturally exert greater effort to keep the quality of their product up to the highest state and strive to give better satisfaction to the consumer. As, moreover, the whole fuse must conform to the underwriters' specifications, the resulting effect is that all manufacturers are placed on the same basis—i. e., the advisability of purchasing any one of a number of fuses will depend entirely on the intrinsic merits of the several makes, and not on local conditions. Furthermore, as no manufacturer will think it advisable to have the Board of Underwriters condemn a line of his fuses, they will exert an especial effort to the end that their fuses may comply in every way with the board's specifications, which are at first sight rather stringent, but which err, if error there is, properly on the side of safety. The consumer is thus seen to be the gainer by the action of the board, but on the other hand, it will be easily seen that the manufacturers in the long run will also reap an important advantage by the action. With the increased efficiency of enclosed fuses, and the more definite assurance of their reliability, will come a greater demand for their use, directly benefiting the manufacturers.

RELATIVE ADVANTAGES

With a clear understanding of the construction and action of the circuit breaker and of the enclosed fuse, the question as to which will afford the better protection to apparatus in any electric circuit presents itself, keeping in mind always that the circuit breaker in good condition will open directly a certain fixed amount of current flow through it, while the fuse cannot be immediately open even under conditions amounting to short-circuit. It is obvious, therefore, that each has its especial advantages. A circuit breaker can be set at a point which represents the maximum amount of current that can safely pass the circuit—the exceeding of this danger point even for the merest fraction of time opens the circuit. On the other hand, it will not guard against any currents below this point, no matter how long continued they may be. Thus on a line of varying voltage, or on a circuit of varying resistance, the circuit breaker can efficiently guard against all brief and excessive overloads, but not against a low overload continued for a long time. The latter case is, however, exactly what the fuse will protect satisfactorily, while the momentary high overload or short-circuit might materially damage a fuse-protected circuit before the fuse would go out. Wherever there is a steady and fairly constant load upon the circuit which it is wished to protect, a fuse will answer all purposes, and, owing to its cheapness, will, of course, be given the preference. But where the load is intermittent and irregular, it would seem that only by the use of both devices can proper protection be secured, the fuse to guard against continued overloads, and the circuit breaker for short-circuits or high overloads of brief duration.

In street railway motor circuits two chief classes of trouble are found, and it is to obviate these that protective devices are placed in the motor circuits. The first is the burning out of apparatus by short-circuits, or "grounds," developing, and being continued long enough to do severe damage; the second is the baking or roasting of armatures and field by continued overloading. In the first case the matter of time, rating or composition of the fuses, or of the adjustment of the circuit breaker are not of importance, as any conductor which is weaker than the wiring of the circuit is sufficient. But in the latter case, where the most suitable way of protecting against overload is desired, the question presents a great many more functions. On the motor circuit of a railway car such peculiar conditions are met with that neither device by itself would seem to cover all the sources of danger. To bring out this idea more clearly two curves are here presented, one to illustrate the characteristics of the current taken by a railway motor during acceleration and running; the other showing the time that the same motor could carry various current loads without injury.

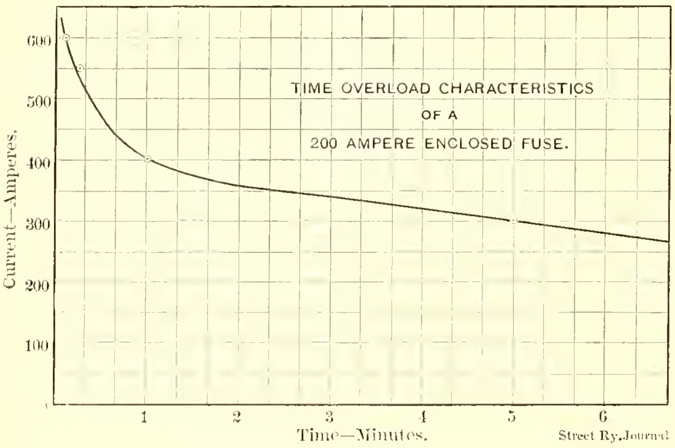


FIG. 1.

MOTOR CURRENT CONSUMPTION

Fig. 2 represents the average current input of a single motor (40 hp) on a 16-ton car in city service during the average run, the figures and data being obtained from the average of a great number of runs carried through many days and under varying conditions of grade, rail, etc. It was found that the motor received current for forty-two seconds on the average run, that the car coasted for an additional nineteen seconds and that the average stop was but six seconds. It will be noted on the curve that the current fluctuates widely, reaching at one instant 90 amps., and averaging during the first ten seconds 67 amps., while at full speed, just before dropping off power, only 22 amps. were taken. When it is remembered that this curve represents average conditions, it can be easily seen that the actual variation of current under adverse circumstances might be considerably larger. Assuming as a supposititious case, however, that the maximum current reached under normal conditions is 90 amps., as shown, the circuit breaker must be set above this point, and can offer no protection to overloads of whatever nature or duration that are beneath this point.

In order to guard against such cases which might be due to excessive journal friction, heavy up-grades, or other causes, a fuse would seem to be the only solution. A discussion of the heating effect on the motors of comparatively low currents through varying lengths of time would enable a better idea of the value of such fuse protection to be arrived at, and at the same time illustrate the difficulty of deciding upon the size of fuse most suitable in any given case. To facilitate the discussion a curve is shown in Fig. 3, of the heating effect of continuous currents, and the time that they can be carried by the particular motor in question before exceeding the danger point in temperature.

Integrating the current values shown in curve of Fig. 2, we find the root mean square current value of approximately 40 amps. Such a current as this if carried continuously on a 500-volt circuit would bring the motor temperature to the danger point, or give a 20-deg. rise above 75 degs. C. in 100 minutes after reaching 75 degs. C. But it must be remembered that the power is on only forty-two seconds, on each average individual run, while the car coasts for nineteen seconds, and makes a six-second stop. Thus, out of the sixty-seven seconds which is the average running time from the beginning of one acceleration till the beginning of the next, the power is on but forty-two seconds, or 63 per cent of the time. As this average holds true throughout an entire day's run, a secondary current value, averaged through the entire running time, must be secured.

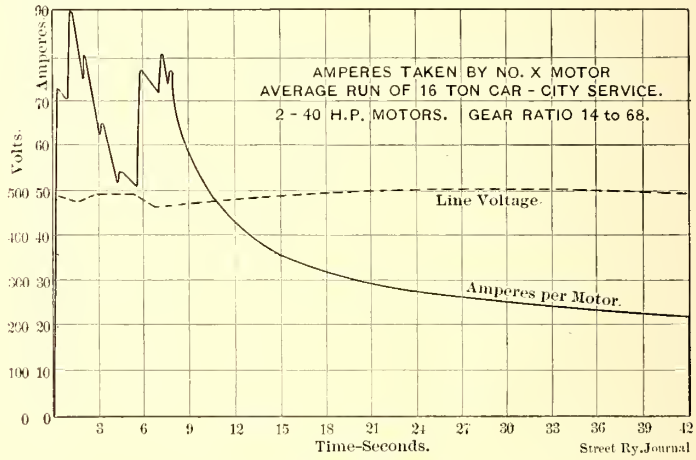


FIG. 2.

In the above case, averaging the current through the sixty-seven seconds gives 25 amps.

The 40 amps. first mentioned, however, is by no means the maximum current taken by the motor. It is the average of the currents taken on a great number of runs, under many widely differing conditions of grade, speed, voltage, etc. The curve itself, even in the portion representing acceleration, does not show the highest points reached by the currents under abnormal conditions. The maximum heating effect is thus seen to be very difficult of calculation, as the heating effect does not vary directly with the current, but with its square, in accordance with the $C^2 R$ formula.

Besides these points just mentioned, there is still another most important factor to be considered; this is the fact that in actual operation the power is [illegible] but 63 per cent of the time, and that the car is coasting o[illegible] anding during the remaining 37 per cent. It is obvious [illegible] ne motors are cooling during this period, and that the radiat[illegible] of heat will be more rapid during the coasting than while the c[illegible]r is at rest, due to the increased ventilation. The effect o[illegible] this intermittent heating, and of the varying rates of cool[illegible]g and the many indeterminate factors entering into any calculati[illegible]n of the motor heating, renders it impossible to exactly deter[illegible]ine the ultimate temperature of a motor after a predetermined length of run. But were the motor operating continuously, even with the current variations as great as in the curve, this value, 40 amps., would enable a very close approximation of the time the motor could run before overheating, to be made.

But it will be evident that under the conditions of actual operation, with the power on but 63 per cent of the running time and the motors heating during the same period, and cooling off during 37 per cent of the time, that the lower current value or 25 amps. will more closely represent the figure that must be used in calculating the heating effect. The motor in question will carry 25 amps. continuously for an indefinite period without overheating, and it could be therefore assumed that they will never overheat except under the most abnormal circumstances while in ordinary operation.

ADVANTAGES OF THE FUSE

Now, should this motor through some adverse condition be subjected to an overload that would bring its root mean square current from 40 amps. to 50 amps., for instance, it will be evident that the temperature will then increase very rapidly, for while the 40 amps. could be carried continuously for 100 minutes the 50 amps. could be carried but thirty minutes. In other words, an average increase of but 10 amps. would with this motor reduce the safe time of running by 70 per cent, and could only be guarded against by a fuse, which is selected to meet the same conditions as the motor.

The writer is of the opinion that, in view of the above considerations, where large cars are used much advantage will be gained by using both the fuse and the circuit breaker, and that by an intelligent review of the local case practically every circumstance that can be anticipated can be guarded against where this double protection is adopted.

FUSING INDIVIDUAL MOTOR CIRCUITS

The matter of not only fusing the main circuit of a car, but of also fusing the individual motor circuits independently, has been suggested and tried, with the idea that in case of trouble with any one motor, instead of the entire car circuit being opened, only the one containing the injured motor is cut out, leaving the remaining motors in, so the car can be transported on its own power to the end of its run. Another point is that the individual motor would be fused at a much lower point than if only a main fuse were installed. In case of a four-motor equipment, the total current of any one motor would have to rise to only one-quarter as much as it would if only a main fuse were used. It is obvious that a greater margin of protection is given and the danger of blocking the road with dead cars is less serious.

The disadvantages of this method, which are generally considered to outweigh the advantages, are the greater number of parts which would be necessitated, together with a considerable amount of additional wire. For it must be understood that the fuse could not be placed in either armature circuit, because were the fuse in the positive side of the circuit when going ahead it would necessarily be on the negative side when the direction of the car was reversed. Again, it could not be placed in the field, as this is usually on the negative side of the motor, and a fuse here could n[illegible] ect an armature from grounds. For this reason it is evic[illegible] on a two-motor car equipment the fuses would of nece[illegible] ve to be placed in the No. 15 and No. 19 wires leading [illegible] e main controller drum to the reverser, and that on a f[illegible] r equipment each armature lead would have to have a [illegible] ing it necessary to use two fuses per motor to give p[illegible] while car was moving in either direction.

Where the strictest econ[illegible] tor repair is necessitated, the foregoing method would [illegible] o be advantageous, but as above mentioned, the added [illegible] of parts, the additional first cost, etc., render the practicabi[illegible] f the scheme doubtful, except in special cases.

SELECTION [illegible] FUSES

In considering and deciding up[illegible] the particular class, kind or make of fuse that would be most suitable for protecting railway apparatus, there are two points of primary importance that should be considered in the comparison: 1. Which fuse is the least likely to short-circuit? 2. In which, after blowing, are the indications of burning the least? Or, in other words, which will allow the greatest number of refillings?

A simple but most severe test of these points, and one which the writer has found by experience to be reliable, is the placing of the fuse under test on a 50 per cent overload and allowing it to remain there until blowing. This will also develop the important and interesting fact of whether the fuse can be relied upon to open the circuit without any outward manifestations of the interior fusing action. The fuse should be tested on a circuit where the drop in potential on the short-circuiting of the fuse would be the minimum.

There is still another point that should be ascertained at the time of the test. It has been found by extensive use and exepriment that when the filling of an enclosed fuse becomes damp by absorbing moisture from the atmosphere through the vents it is much more liable to short-circuiting, the production of

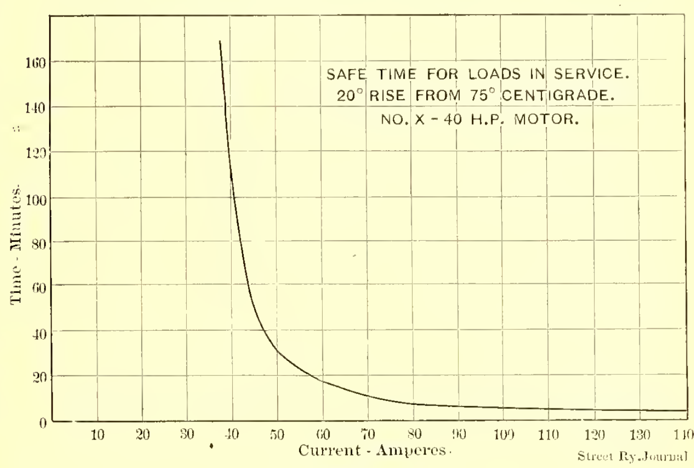


FIG. 3.

pyrotechnic effects in blowing, etc. For this reason it is important in testing, where there have been a number of fuses submitted, to make sure that the fuses are sufficiently old. Before being filled at the factory the filling is thoroughly dried out in high temperature ovens, and a certain amount of moisture will be gradually reabsorbed after the fuses are exposed to the atmosphere for any considerable length of time. And not only will the moisture held in mechanical suspension cause trouble, but should the filling compound contain sufficient water of crystallization, the short-circuiting effect on the fuse will be fully as severe.

Indeed, this water of crystallization in the filling compound may cause a very perplexing situation. Where the manufacturers have secured very favorable tests on fuses whose filling was immediately out of the high temperature ovens, the fuses on being tested ten days later gave most unsatisfactory results. This was laid to the absorption of moisture from the atmosphere, and the fuses were left for twenty-four hours in a temperature of 100 degs. C., in an attempt to drain off the moisture, but tests immediately following showed repeated short-circuiting. The theory in this case advanced and agreed upon as the true explanation was that the water of crystallization in this filling could be driven off only at a temperature of 120 degs. C., or higher, which was secured in the high temperature ovens at the factory, but was not reached in the second attempt to dry the fuse before testing.

These facts bring another important question to the front. It has heretofore been the common practice of the fuse manufacturing companies to throw out all enclosed fuses returned to them for refilling which have their outer coverings burnt, returning in their stead new fuses, and charging the full price for the same, rather than the refilling cost. In nine cases out of ten it is through no fault of the operating company that the fuse became burnt to such an extent that it was not refillable. In view of this fact the question arises: "Why should customers pay for defects in the manufacturers' equipment, even if said defects developed after the purchaser's tests?" It is undisputed by the manufacturers that if a fuse is in first-class condition no perceptible burning should take place in the tube, so it is only reasonable that they (the manufacturers) should be made to stand the loss of their defective fuses. By insisting on this form of guarantee from the fuse companies a nice per cent of the cost of fuses per year could be saved for the railway company.

When the points just discussed have been decided upon and the make of fuse selected, the question of the size of fuse presents itself. Should the load which the fuse is installed to carry be of a constant or steady character, the question can be easily answered, but where a railway motor circuit is under consideration, there are several rather complex considerations to be taken in account: The excessively high currents taken while accelerating; the non-uniform amount of current while running, owing to the character of the track, the grade, etc.; the relative time the car is coasting and standing; the various classes of service, and a number of local conditions. The effect of these points have been touched upon in an earlier paragraph, and it is easy to perceive that each must be properly considered in order to intelligently decide which fuse would be most economical from the double standpoint of protection to equipment and the purchasing cost of the fuses.

CONCLUSIONS

In conclusion, it must be apparent that only by the use of both protective devices, the fuse and the circuit breaker, conjointly, is it possible to protect a railway motor against short-circuits and sudden or continuous overloads. Furthermore, it will be evident that the protection afforded the motor also serves the same end in regard to the power house, checking line trouble before it can react dangerously upon the station equipment. It must be borne in mind, however, that only by exercising the greatest care in the selection of the fuse can efficient results be obtained. All the local conditions which can be a function of the calculation of the proper fuse must be taken into consideration. Economy in the initial cost of the fuse should not be allowed to affect the judgment on the other far more important points. A fuse will not blow out unless there be an abnormal condition occurring upon its circuit, and when this takes place it is far preferable to have a fuse let go than to take any chances with the more valuable equipment. The small cost of refilling a fuse cannot, obviously, be weighed against even the most insignificant motor repair, and the most economical fuse is the one that is most reliable, regardless of the purchase price.

The same reasoning applies to a circuit breaker, which should be thoroughly reliable. But the best of circuit breakers will give good results only when properly adjusted and maintained. It should be set at the minimum point at which it will stay in when carrying its normal load. It will be necessary to inspect and readjust it at least every two months, and there should be as stringent rules against holding it in, when in service, as there are against tying down a safety valve on a boiler, as the purposes of the two devices are almost identical.

The practice of installing complete protective devices is a measure of the truest economy, and one wherein the cost of maintenance cannot be considered a prime function. The benefits to be derived from them far exceed this item, and while the economy of their use may not be readily apparent to one not familiar with all the details of railway maintenance, it nevertheless is true that innumerable armature and controllers are saved from damage and many accident suits averted by the installation of efficient protective apparatus. The writer, from many years experience in testing, handling and experimenting upon electric railway equipment, can recommend unreservedly the application of both fuses and circuit breakers jointly upon the motor circuits of the heavier equipments.

CREATING TRAFFIC—III. ADVERTISING OTHER THAN IN NEWSPAPERS

BY E. P. HULSE

I have always found that the best form of publicity is through the use of pictures; they tell a story at a glance that would take columns of descriptive reading matter to equal. They stick in the mind better. A person going along a hot sidewalk on a summer day and catching sight of a picture of some cool grove or breeze-swept beach is quite likely to act on the suggestion. Bromide or solar enlargements of small photos of pretty scenes along the lines or at the resorts, say 16 ins. x 20 ins., mounted on cardboard, are quite inexpensive in quantities, and they may be placed in store windows all over the cities on your lines. Wall cases to contain posters the same size as the dasher signs may be cheaply constructed of little more than the glass front and the wood or sheet-iron back, both of which, with the poster between, slip into a grooved metal frame, by which the case is fastened in a conspicuous place along the sidewalk on a building front. Dozens of positions on the busiest thoroughfares may be secured for these cases, where the commercial bill-poster would not dare to tread. Their locations and the space taken in store windows by the enlarged photos previously referred to may be paid for by a season ticket to the amusement resort, admitting two people once each week—similar to the customary "lithograph" pass of the city theaters. As you will get riding, engendered by the possession of this theater pass, that you might not otherwise get, this form of advertising is really a source of income.

The dasher signboards on the cars should be large enough to allow the use of wood type, and should also be of such a size that paper can be displayed on them which will cut without waste or trim from the regulation stock size of 29 ins. x 42 ins., the dimensions of a theatrical one-sheet. A dasher signboard to carry a quarter-sheet—14½ ins. x 21 ins.—is a size frequently seen. These quarter-sheet dasher signs can also be used in the wall cases, and the type matter that goes on them can also be printed on a cardboard 14 ins. x 22 ins. (one-half of the regulation stock size of cheap board) and displayed in such store windows as you have made the season ticket arrangement with. By planning your signboards and wall cases so that the printer will not have to trim down the stock sizes of paper to get the size you demand, you will save materially on the cost of your printing. Wall time-tables, containing a condensed schedule and a map in two colors, with a row of half-tone views at top and bottom, will be given space in restaurants, hotels and other public places. This wall time [illegible] must be handsomely designed, as a plainly printed on [illegible] d be torn down after a few days. They can [illegible] brass tacks and long inch-wide strips of phot [illegible] d, making a very attractive panel.

Fliers are all right for s[illegible] d distribution, but when hung in bunches in t[illegible] ot of much value as an advertising medium. [illegible] f probabilities, they present a blank back to [illegible] ngers, unless printed on both sides; on the o[illegible] whirls them around or tears them out and s[illegible] y of them where they do no good. A printe[illegible] s of the car, designed to fit a certain space, [illegible] l notice in better form and can be changed [illegible] l. Your contract with the concern that han[illegible] advertising in the cars usually permits you [illegible] hing in your cars that tends to build up tr[illegible] sually called 8's or 16's, the former measur[illegible] s. and the latter 6 ins. x 9½ ins., they being [illegible] eet about 25 ins. x 38 ins.

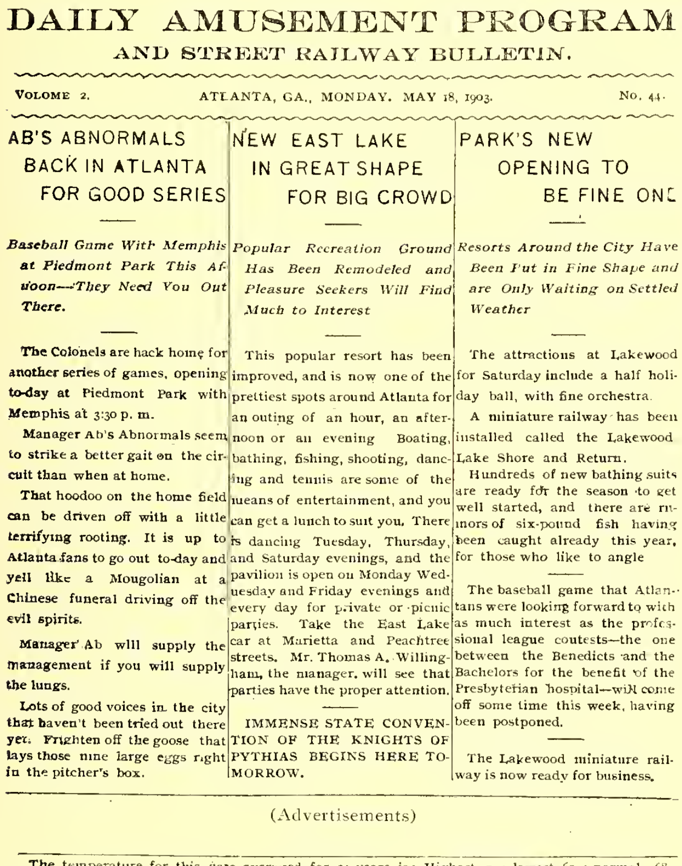
Banners across [illegible] inal points, where legally admissible, and sign[illegible] -tables and other information, are effective in supp[illegible] the starter, and a bulletin board like a blackboard serves a frequent advertising opportunity for events of interest where printed posters cannot be brought out in time. The regular billboard service in each city, usually controlled by the theatrical or circuit owners, is a good form of publicity when not overdone. The customary charge is 4 cents a sheet. The bill-poster in each city should be required to send you a list of the locations he is using, as often as the wallpaper is changed, and an occasional checking up of this list is a wise precaution. A lithographed poster, a half-sheet, 21 ins. or 22 ins. x 28 ins. or 29 ins., half the quantity ordered being printed on paper and half on cardboard, containing a fancy design in colors suggesting the various amusements and entertainments at the resort, is a good stock method of advertising. Other fancy lithograph pictures—for instance, a series on the order of the familiar Fencing Girl—might also be used. Steam railroads, particularly the Alton, and even soap and lard concerns, have used this idea very effectively. Those you adopt might be entitled the Blank Park Picnic Girl, matinee girl, canoeing girl, front seat girl, bowling girl, dancing girl, bathing girl, golf girl, etc. This style of advertising has one great point of value—permanency. They are seldom thrown away.

These window cards, posters, enlarged photos, wall time-tables, wall cases and bulletin boards can be attended to by a corps of distributors, boys from the high schools or college preparatories, who welcome the chance to do effective work at a very low figure during the summer. Such a corps, preferably uniformed in inexpensive khaki, forms the best medium of planting the "suggestion" in the public mind. The greater part of their time is taken up with tours of the offices and residential sections, leaving advertising matter, such as small circulars or cards or blotters. If an excursion is to be run from some point along the lines or a special day pulled off at some resort, their work in billing a city goes further for the money expended than any other form of publicity.

Almost all the advertising matter for an electric road should carry a map of one size or another. The extensive dissemination of an inexpensive map shows on the car register. There is nothing the public needs more when the traveling impulse is working. You know where your road runs and what are the through-car routes and connections, but the "man on the street" does not, and the chances are you have never brought to his attention any places where he can get this information in a way to make him remember it. This matter is often overdone, though; a lithographed map in several colors is a good thing to hang up in public places, but it is usually too expensive to give away in large quantities to nickel passengers. Vest-pocket folders, containing a condensed time-table, a map, a list of through-car routes, and a schedule of distances, fare and running time, perhaps even with time of arrival and departure of steam road trains at certain connecting points, can be placed in boxes in the cars and racks in public places.

Pamphlets and portfolios of views, too expensive to hand out indiscriminately to individual patrons, are of immense value in securing the patronage of organizations of various kinds that have outings during the summer and that can be handled by the carload. A list should be secured early in the spring of all churches, Sunday schools, lodges, unions, posts, clubs, women's organizations and societies of all kinds, and this form of advertising, accompanied by a printed letter, will result in quite a boom to the special car business, especially if followed up by letter, telephone or personal solicitation. This pamphlet should give a description of the interesting points along the line and at the resorts, illustrated with half-tone views, or the pictures may be printed separately on cards and grouped into a portfolio. There is then more possibility of their being retained and some of them being displayed or mounted. Outwitting the waste basket, which swallows so much good printing, is the point to aim at.

Quite the most effective means of bringing about a better feeling between the public and the corporation is by getting out a daily or semi-weekly bulletin, printed in the form of a diminutive newspaper, placed in the cars and distributed in all public places. This bulletin should call attention to all the attractions and interesting features along the system, the amusements and entertainments and public events in the cities that it reaches, and keep patrons and the public informed of changes



DAILY AMUSEMENT PROGRAM
AND STREET RAILWAY BULLETIN.

VOLUME 2. ATLANTA, GA., MONDAY. MAY 18, 1903. NO. 44.

AB'S ABNORMALS BACK IN ATLANTA FOR GOOD SERIES

Baseball Game With Memphis at Piedmont Park This Afternoon—They Need You Out There.

The Colonels are hack home for another series of games, opening to-day at Piedmont Park with Memphis at 3:30 p. m.

Manager Ab's Abnormals seem to strike a better gait on the circuit than when at home.

That hoodoo on the home field can be driven off with a little terrifying rooting. It is up to Atlanta fans to go out to-day and yell like a Mongolian at a Chinese funeral driving off the evil spirits.

Manager Ab will supply the management if you will supply the lungs.

Lots of good voices in the city that haven't been tried out there yet. Frighten off the goose that lays those nine large eggs right in the pitcher's box.

NEW EAST LAKE IN GREAT SHAPE FOR BIG CROWD

Popular Recreation Ground Has Been Remodeled and Pleasure Seekers Will Find Much to Interest

This popular resort has been improved, and is now one of the prettiest spots around Atlanta for an outing of an hour, an afternoon or an evening. Boating, bathing, fishing, shooting, dancing and tennis are some of the means of entertainment, and you can get a lunch to suit you. There is dancing Tuesday, Thursday, and Saturday evenings, and the pavilion is open on Monday Wednesday and Friday evenings and every day for private or picnic parties. Take the East Lake car at Marietta and Peachtree streets. Mr. Thomas A. Willingham, the manager, will see that parties have the proper attention.

IMMENSE STATE CONVENTION OF THE KNIGHTS OF PYTHIAS BEGINS HERE TOMORROW.

PARK'S NEW OPENING TO BE FINE ONE

Resorts Around the City Have Been Put in Fine Shape and are Only Waiting on Settled Weather

The attractions at Lakewood for Saturday include a half holiday ball, with fine orchestra.

A miniature railway has been installed called the Lakewood Lake Shore and Return.

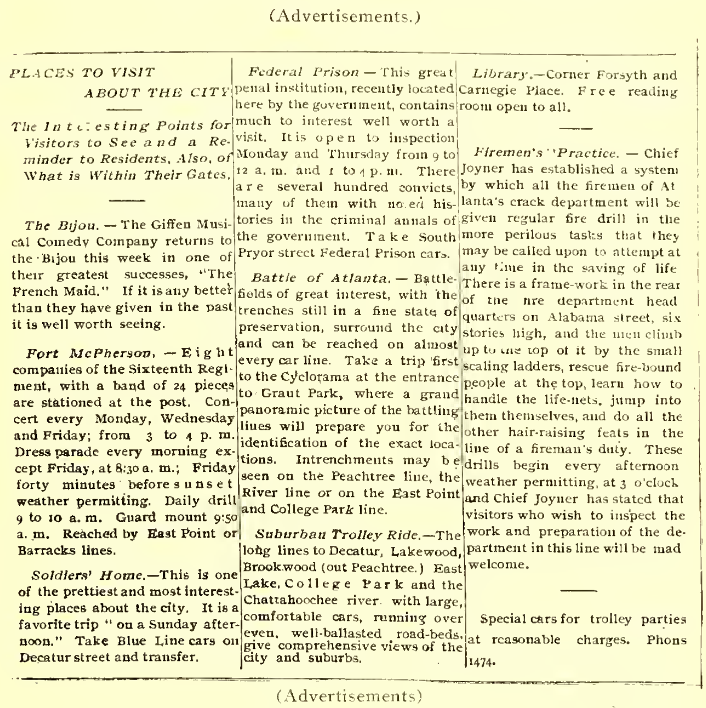
Hundreds of new bathing suits are ready for the season to get well started, and there are rumors of six-pound fish having been caught already this year, for those who like to angle.

The baseball game that Atlantans were looking forward to with as much interest as the professional league contests—the one between the Benedicts and the Bachelors for the benefit of the Presbyterian hospital—will come off some time this week, having been postponed.

The Lakewood miniature railway is now ready for business.

(Advertisements)

The temperature for this date averaged for 24 years is: Highest, 79; lowest, 60; normal, 68. Director Marbury says Fair and warmer to-day



(Advertisements.)

PLACES TO VISIT ABOUT THE CITY

The Interesting Points for Visitors to See and a Reminder to Residents, Also, of What is Within Their Gates.

The Bijou.—The Giffen Musical Comedy Company returns to the Bijou this week in one of their greatest successes, "The French Maid." If it is any better than they have given in the past it is well worth seeing.

Fort McPherson.—Eight companies of the Sixteenth Regiment, with a band of 24 pieces are stationed at the post. Concert every Monday, Wednesday and Friday; from 3 to 4 p. m. Dress parade every morning except Friday, at 8:30 a. m.; Friday forty minutes before sunset weather permitting. Daily drill 9 to 10 a. m. Guard mount 9:50 a. m. Reached by East Point or Barracks lines.

Soldiers' Home.—This is one of the prettiest and most interesting places about the city. It is a favorite trip "on a Sunday afternoon." Take Blue Line cars on Decatur street and transfer.

Federal Prison—This great penal institution, recently located here by the government, contains much to interest well worth a visit. It is open to inspection Monday and Thursday from 9 to 12 a. m. and 1 to 4 p. m. There are several hundred convicts, many of them with noted histories in the criminal annals of the government. Take South Pryor street Federal Prison cars.

Battle of Atlanta.—Battlefields of great interest, with the trenches still in a fine state of preservation, surround the city and can be reached on almost every car line. Take a trip first to the Cyclorama at the entrance to Grant Park, where a grand panoramic picture of the battling lines will prepare you for the identification of the exact locations. Intrenchments may be seen on the Peachtree line, the River line or on the East Point and College Park line.

Suburban Trolley Ride.—The long lines to Decatur, Lakewood, Brookwood (out Peachtree.) East Lake, College Park and the Chattahoochee river with large, comfortable cars, running over even, well-ballasted road-beds, give comprehensive views of the city and suburbs.

Library.—Corner Forsyth and Carnegie Place. Free reading room open to all.

Firemen's Practice.—Chief Joyner has established a system by which all the firemen of Atlanta's crack department will be given regular fire drill in the more perilous tasks that they may be called upon to attempt at any time in the saving of life. There is a frame-work in the rear of the fire department headquarters on Alabama street, six stories high, and the men climb up to the top of it by the small scaling ladders, rescue fire-bound people at the top, learn how to handle the life-nets, jump into them themselves, and do all the other hair-raising feats in the line of a fireman's duty. These drills begin every afternoon weather permitting, at 3 o'clock and Chief Joyner has stated that visitors who wish to inspect the work and preparation of the department in this line will be mad welcome.

Special cars for trolley parties at reasonable charges. Phone 1474.

(Advertisements)

FIRST AND FOURTH PAGES OF A TYPICAL BULLETIN. THE SECOND PAGE CONTAINS HUMOROUS MATTER AND THE THIRD CHANGES IN SCHEDULES AND IN RESORT ATTRACTIONS in schedule and improvements in the service. If interspersed with humorous stories of street car life or interlarded with clipped humor, it attracts more attention. Some sample sheets of such a typical bulletin are presented on the preceding page.

Many lines have adopted this little newspaper of their own, some daily and some weekly, and I have never found one that gave it up willingly. As a "sop to Cerberus" it certainly brings about a friendlier feeling between the public and the corporation. The spirit in which it is brought out usually marks it as popular at once. The cost can be saved out of the newspaper appropriation or it can be supported independently by carrying a few small ads. at high prices. I have seen an instance where these bulletins became so popular that a printing plant was installed in one of the car houses, similar to those maintained by many insurance and traffic associations, where the small printing of the company was also done. The feasibility of this is doubtful; it all depends on the man secured to run it.

These bulletins are distributed in the cars by means of boxes or hooks. Small metal boxes placed on the post by each bench, at a sufficient height so that there can be no danger of a passenger's head striking them, are best. They cost all the way from 3 cents and 4 cents apiece for dipped and japanned tin boxes to 50 cents and 75 cents for brass receptacles, in quanti-

THEATER TICKET GIVEN IN RETURN FOR DISPLAY SPACE IN STORE FRONTS

ties. I have found plain brass hooks, at about 80 cents a gross, almost as good. They should be placed high up on the post so that millinery cannot become entangled therein. The printer punches a hole of corresponding size in the thousands of bulletins, at a sufficient distance from the edge to prevent the breeze stripping them out, and the night men in the car houses hang them on the hooks.

There are many other mediums of publicity through judicious printing. The souvenir programmes at the resorts usually more than maintain themselves, so far as the cost is concerned, by the advertising space sold; and if they are made so attractive that patrons carry them away, there is no addition to the expense of cleaning up the place. Tags such as race-track patrons loop over a button on the coat are sometimes given out to good advantage. Free theater tickets, admitting to Monday and Friday matinee, distributed from dry goods stores, pharmacies and soda water fountains, etc., in the cities, keep the travel up on the bad days of the week. A phonograph at terminal points, calling out some clever "spiel," if a road management is not too conservative to adopt such a method, will direct more travel to its cars than the best of starters.

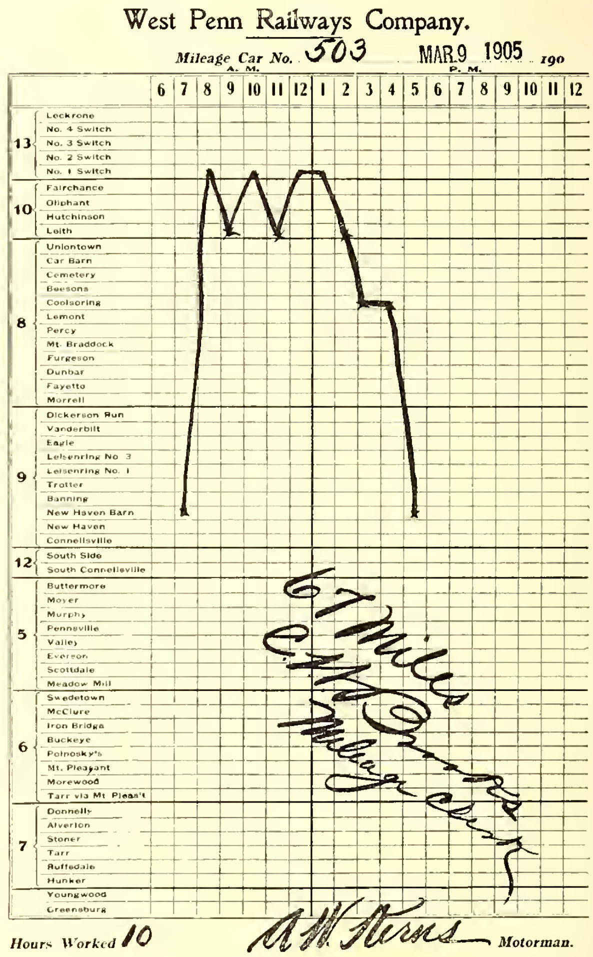
In the next issue there will be a discussion on what to advertise.

At the trial in Washington, D. C., recently, of a conductor charged with "knocking down" fares, a witness who attended without subpœna glibly and without the slightest consciousness of wrong-doing admitted that he never paid a car fare if he could avoid it. Unless he was asked for his fare he never offered it; never put himself out of the way to help the conductor whose car was crowded; never failed to cheat the street railway company if he was not asked to be honest.

KEEPING MILEAGE OF WORK CARS

In many electric railway offices doubt frequently arises as to the reliability of the figures turned in on the mileage of work, line and construction cars, owing to the fact that these cars operate back and forth between so many different switches, giving rise to lack of exactness in reporting the car-miles run, as the crews on the work cars are often not familiar with the fractions of a mile between the various sidings or points to which they have to run to do work, or to clear regular cars.

J. W. Brown, superintendent of transportation for the Pittsburg, McKeesport & Connellsville Railway Company, of Connellsville, Pa., has devised a simple method of obtaining this mileage correctly. A sheet $7\frac{1}{2}$ ins. x 12 ins., like the sample reproduced here, is used, and all the work car crews have to do



MILEAGE CARD FOR WORK CAR

is to report the points to which they went, and the car mileage is worked out by the mileage clerk in the office. For instance, this particular diagram shows that work car No. 503 left New Haven car house at about 7:30 a. m.; ran to switch No. 1, then back to Leith, then to switch No. 1 again, and back to Leith, and again to switch No. 1. It lay over at this point an hour and then ran to New Haven car house, stopping at Coolspring for an hour on the way. The mileage clerk, knowing the exact distance between all points, can readily determine the car-miles run from the diagram.

The road is divided into sections for the convenience of the maintenance of way department, and these sections are indicated by heavy lines on the sheet. It is therefore readily seen in what sections non-revenue cars were at work.

W. L. Stehlau, general manager of the Springfield & Xenia Traction Company, has arranged with the Dayton & Xenia Traction Company to operate through service from Springfield to Dayton by way of Xenia, Ohio.

THE QUESTION BOX

Questions and answers relating to freight and express and the track department are continued in this issue. Next week the publication of interesting answers pertaining to other departments will be recommenced.

D.—THE EXPRESS AND FREIGHT QUESTION

D 13.—What has been your experience with handling heavy commodities or rough carload freight, such as ice, coal, wood, stone, etc.?

Very unsuccessful, unless the haul is very short and a high rate can be charged. A. Eastman.

We are satisfied with our experience.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Not satisfactory. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We have had very little experience in handling rough carload freight. We have handled, all told, not over 40 carloads of ice, but this business was not particularly profitable. We have handled no coal or wood. Last year we entered into a contract for the hauling of some 5000 yards of crushed stone, which we handled successfully and profitably. E. J. Ryon, Supt.,
Schenectady Ry. Co.

We have had no experience in handling heavy commodities such as ice, coal, wood, etc. George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

D 14.—What has been your experience with handling milk on electric cars? Please give details.

Milk is a desirable commodity to handle on electric cars if enough of it can be obtained so as to allow the use of a regular double-deck milk car, hauling from 300 to 400 cans
A. Eastman.

Milk is one of the articles that we are especially prepared to handle. Our milk cars run on convenient schedules. Shippers are sold tickets at a fair cost, which entitle them to forward the can filled, and secure its return empty.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Revenue from milk is a large item in gross freight receipts on our lines. Charges are from 1 cent to 1½ cents per gallon. Use milk tags which are sold direct to shippers, usually 5, 8, 10-gallon tags. Use regular shipping tag perforated for two coupons, one for auditor, one for loaded can, remaining part of tag for return of empty. Stations "from and to" stamped on tag as case requires. Auditor's stub is detached before tickets leave the office. Shipper attaches tag to can. Conductor lifts going coupon. "Return free" tags remain on can. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Our experience in handling milk has proven entirely satisfactory. Up to the present time we have run no special cars for the handling of milk, the milk cans being handled on our regular runs. The milk is handled by a system of milk tickets which are attached to the cans, and provide for the return of the empties.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Our milk business has been comparatively light, and we have handled same on our regular express cars and on regular trips.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

We handle milk on both passenger and freight cars, using a milk ticket with coupon covering return of empty can. We find this a profitable branch of our business.
C. C. Collins, Gen. Supt. Exp.,
The Appleyard Lines in Ohio.

D 15.—Under what conditions can an electric road do a profitable business in hauling milk?

If it can secure enough milk business to be handled at reasonable rates to justify the service rendered.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Do not stop at every farm house or "Local Stop" to take on milk. Have regular milk stops established along line at places most suitable. A platform built the height of freight car floor is desirable. J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

I do not know of any particular conditions that are essential to the profitable handling of the milk business. If the milk is there and can be handled, the business will pay a higher rate per hundred pounds than ordinary freight. E. J. Ryon, Supt.,
Schenectady Ry. Co.

The milk business would be a profitable one if sufficient business could be obtained to warrant the running of a special car and the milk was delivered to platforms along the road and was accepted by consignee at express platform at the end of the route so that there would be no delivery expense at either end.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

D 16.—What has been your experience with handling light packages? Please give details.

We have been successful in handling light packages at rates that satisfy our customers. We would like to increase the traffic.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Light packages are a part of our business.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

This company handles light packages in exactly the same manner as they are handled by the large express companies.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Our experience in handling small packages has been highly satisfactory. We get a minimum charge of 15 cents to all points. Our drivers call at the department stores the same as is done by the old line express companies. If small packages are picked up at 3 o'clock in the afternoon, we can deliver them the same day at any point on our system. J. W. Gibney, Supt. Ex. Dept.,
United Tract. Co., Albany.

D 17.—What has been your experience with carrying baggage? What rates do you charge, and how is the baggage carried?

Our passenger rates being approximately one-third and one-half of the steam railroad rates, we make a charge of 25 cents per package for baggage. The public appreciate the reason and are satisfied. In consequence, our baggage business is considerable.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Considerable. Rates 25 cents for each division, no excess. We carry baggage on all passenger cars. Our patrons require this. Freight service of four trips a day not frequent enough.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Passengers' baggage going over the lines of the Schenectady Railway Company is handled by the Electric Express Company. We make a flat charge of 40 cents for a trunk, including cartage on both ends of the line. This arrangement is carried out more to secure travelers over the lines of the road rather than as a profitable investment to the express company. We have no combination cars handling both passengers and baggage.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

We handle baggage on our regular express cars and on their regular trips. The rate is 35 cents per piece under 150 lbs. For anything over 150 lbs. we charge our regular express rate.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Baggage is carried only on the regular freight and express cars, a charge of 15 cents per piece being made with a limit of 150 lbs.
H. J. Clark, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

We carry baggage as regular matter and make an arbitrary rate of 25 cents for ordinary baggage and 50 cents for commercial men's trunks. This is a profitable business. The charge of 50 cents for commercial men's trunks is less than the "excessive weight" charges made by the steam roads.
J. W. Gibney, Supt. Ex. Dept.,
United Tract. Co., Albany.

We carry baggage upon same basis as do the steam lines, but not on all trains. We have baggage and express compartments on some cars for the purpose. Southern Superintendent.

We carry baggage on all passenger and freight cars, using checks similar to those used by the steam lines, and charge 25 cents per piece any distance. On account of our low rates of fare this charge does not operate against us in competition with the steam lines.
C. C. Collins, Gen. Supt. Ex.,
The Appleyard Lines in Ohio.

D 18.—Under what circumstances is it advisable to give wagon collections and deliveries?

Unless the city be very large I would not recommend wagon collections and delivery unless absolutely necessary to compete with other companies. A. Eastman.

Collections and deliveries had better be entrusted to some reliable company having suitable facilities and a reliable staff to conduct the business. It is not and ought not to be a part of the railway company undertaking any more than would be the business of transporting the individual from his landing place to his home.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

When conducting a regular express business.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

It is not advisable to give wagon service except where the volume of business is sufficiently large to warrant such extra expense, and where such business cannot be secured without this service.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

It is advisable to give wagon collection and delivery where there is competition, and where such service has been established by the old line express companies.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

The success of our business is due to the wagon service. We give a wagon collection and delivery in Albany, Troy, Watervliet, Cohoes and Waterford. This wagon service puts us on even a better footing than the old line express companies. We do not, of course, attempt to do a local wagon express business in any of the cities. We maintain six wagons in Albany (population, 100,000); four in Troy (population, 80,000); two in Watervliet (population, 12,000); three in Cohoes (population, 25,000). The Cohoes wagons also serve Waterford (population, 5000).
J. W. Gibney, Supt Ex. Dep.,
United Tract. Co., Albany.

D 19.—What methods do you employ for soliciting express and freight business?

Good service is the best solicitor. A. Eastman.

Judicious advertising.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Personal interviews. We also distribute blanks to be signed by merchants requesting shippers to forward all shipments via electric express.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

The soliciting of business by our company is in the hands of its general manager who personally calls upon our patrons and shows them the advantage of handling their business over our lines, both from a financial and time standpoint.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Advertising. We also call on shippers and explain our service and rates.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

D 20.—What arrangements do you make for local agents at different points on your line? Is it better to pay local agents a commission or salary?

Commission when arrangements can be made. A. Eastman.

Where it is warranted agents are paid a salary commensurate with the service rendered. At other points, commissioners are paid on the gross outbound business. Salaried agents are preferable.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Our agents at way stations are storekeepers. They receive an annual pass. They consider that the agency brings them business. Agents at terminals are on straight salaries.
J. R. Harrington, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

At the large offices our agents are exclusively employed by our company. At small places where the traffic is not heavy we pay our agents on a commission basis. The question of a salary or commissioned agency depends entirely upon the circumstances and the volume of business to be handled. From a financial standpoint it is cheaper to pay salaries where business is large, and commissions where it is small.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

We employ as local agent, where possible, a man who has lived in the town for some time and is personally acquainted with the shippers. Pay agents a salary
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Ticket agents at all local stations take care of the express business. Pay regular salary.
H. J. Clark, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

We have local agents at each of our four principal terminals. We pay express agents a weekly salary, and it takes up all their time to handle the express and freight.
J. W. Gibney, Supt. Ex. Dept.,
United Tract. Co., Albany.

D 21.—Do you handle shipments destined to points at which you have no agents? If so, how?

Yes. Delivery is at the risk of the owner.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Way-billed to collect at station beyond. Destination is shown on way bill as the prepaid station.
J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We do not handle shipments destined to points at which we have no agents, unless by previous arrangement the consignee meets our cars and takes care of his property, giving us a receipt for the same.
E. J. Ryon, Supt.,
Schenectady Ry. Co.

Yes. The shipper prepays all charges and signs receipt, and goods are put off at points where there are no agents, entirely at the owner's risk.
George Dunford, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Shipments must be prepaid, and are delivered alongside track at owner's risk as covered by shipping receipt.
H. J. Clark, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

D 23.—How often and how should local agents remit express receipts?

Depends entirely on the amount of business handled. I think agents should remit daily if the amount of receipts are over five dollars per day. A. Eastman.

Daily or weekly, as circumstances may dictate.
Geo. W. Parker, G. E. & P. A.,
Detroit United Ry.

Settlements once each week. Remittance by passenger car conductor.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We require local agents to make remittances weekly. This should all be regulated by the volume of business, but should not extend beyond a period of 30 days.
E. J. RYON, Supt.,
Schenectady Ry. Co.

Express receipts should be forwarded to cashier by express car daily, express messenger signing receipt for having received same from agent.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Agents remit express receipts daily, and these receipts are held until the third day after receipt of goods, so that three days is given all agents for the collection of their accounts. The daily report shows the express and freight received and shipped, together with the value of the same, but the money remitted does not necessarily correspond to the amount charged against any agent as he is given additional leeway of a day or two, but all moneys must be turned in to cover the calendar month, credit of course being given the agent for goods on hand and uncalled for.
H. J. CLARK, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

Our local agents remit every morning the cash received the previous day. The money is kept over night in small safes at each of the terminal stations.
J. W. GIBNEY, Supt. Ex. Dept.,
United Tract. Co., Albany.

D 24.—Do you not find it advisable to make the accounting reports as simple as possible, combining as many as possible in one form? How do you accomplish this? The editor will appreciate receiving copies of blanks devised to simplify and concentrate express accounts and reports. Please add comments and explanations.

I would advise the adoption of a plan of auditing as simple as possible. Experience has demonstrated the fact that it is advisable to simplify everything connected with the express service, as the revenue derived from an express service is so small that it will not allow the adoption of a too complicated set of accounts.
A. EASTMAN.

Express agents' report is covered on one blank which he uses for the daily and monthly reports. This blank, as will be seen

..................................STATION. ....19.......

DAILY REPORT—EXPRESS RECEIVED AND SHIPPED.

	RECEIVED FROM			SHIPPED TO		
	POUNDS	COLLECT	PREPAID	POUNDS	COLLECT	PREPAID
SYRACUSE						
SPLIT ROCK						
MARCELLUS						
SKANEATELES						
AUBURN						
TOTAL						

ENCLOSED FIND $ WITH WHICH PLEASE CREDIT MY ACCOUNT.

..................................AGENT.

EXPRESS AGENTS' REPORT—AUBURN & SYRACUSE

from the accompanying reproduction, is very simple. The form is but 3 ins. x 5 ins. in size, nevertheless it gives all the data desired.
H. J. CLARK, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

Unnecessary reports, complicated reports, or superfluous reports are to be avoided. So simplify matters as to render the report a concise, understandable and correct exhibit of the business.
GEO. W. PARKER, G. E. & P. A.,
Detroit United Ry.

Make accounting as simple as possible, of course, but do not form too many combinations. Each transaction should be distinct, and each entry to check another. Our freight accounting is similar to steam railroad practice.
J. H. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

I advise that the reports be made as simple as possible. This company is working on practically the same lines as the large express companies.
E. J. RYON, Supt.,
Schenectady Ry. Co.

The accounting reports should be made as simple as conditions will permit.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

D 25.—How often should abstract reports be made of express matter received and forwarded?

I think abstracts should be made on the 7th, 14th, 21st and last day of each month.
A. EASTMAN.

Daily, weekly or monthly, depending upon the volume of the business and the necessity for checking and revising rates or other circumstances peculiar to each situation.
GEO. W. PARKER, G. E. & P. A.,
Detroit United Ry.

Once each week.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Abstracts of express matter received and forwarded are in reality all there is of the accounting to be made by a local office, and these abstract reports should be made as often as the business warrants.
E. J. RYON, Supt.,
Schenectady Ry. Co.

Abstracts of express received and forwarded should be reported every week, or not less than four times each month.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Daily.
H. J. CLARK, Interurban Elec. Ex. Co.,
Auburn & Syracuse.

D 26.—Who should audit the express accounts?

The general auditor.
A. EASTMAN.

The general auditor, until the business warrants the employment of an auditor of freight receipts and disbursements.
GEO. W. PARKER, G. E. & P. A.,
Detroit United Ry.

Some one who is familiar with freight business and freight auditing.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

The answer to this question depends entirely upon the conditions. If the express business is handled as a department of the railroad company, the auditing properly comes under the railroad department.
E. J. RYON, Supt.,
Schenectady Ry. Co.

A regular express auditor.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

Our express department has a cashier who is practically the auditor for this department.
J. W. GIBNEY, Supt. Ex. Dept.,
United Tract Co., Albany.

D 27.—What is the best form of shipper's receipt? The editor will appreciate receiving two copies of the receipt you use, with any comments or explanations you may care to make.

Same form and conditions as used by steam roads.
J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

In my opinion the best form of shipper's receipt is a duplicate shipping order, inasmuch as a carbon copy may then be retained for future reference.
E. J. RYON, Supt.,
Schenectady Ry. Co.

A duplicate receipt made out by the shipper, one copy of which accompanies the shipment and enables the warehouseman to check up the shipment and ascertain whether the goods have been received in accordance with the receipt signed by the driver.
GEORGE DUNFORD, Gen. Ex. Agt.,
Utica & Mohawk Valley Ry. Co.

I.—THE TRACK DEPARTMENT

I 19.—Is there any advantage in greasing curves?

The advantages are two. First, it prevents the curves from wearing so rapidly; second, it prevents the car from leaving the track. This can be readily observed if one will notice carefully a curve immediately after a train when the weather turns off cold and dry. The rails are very rusty, and the first few cars passing over them grind off small portions of steel, and in some cases the cars leave the tracks.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Grease applied to the guard of a curve reduces wear of both guard and wheel flanges and deadens noise of wheel vibration. Black oil applied with a swab, after thoroughly cleaning the rail, is as efficient, is applied more readily, and costs less than grease, and there is less liability of claims for damage to clothing of pedestrians. Grease is scraped from the guards by the wheels and dropped in large lumps on the pavements and crossings. If curves are oiled or greased at all, they should be gone over thoroughly at least once a day.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Many advantages if greased properly.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Yes. The results are, saving of flanges, of wheels and of power.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

Yes. Have ours always greased. J. CHAS. ROSS, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

There certainly is an advantage in greasing curves, for if they are not greased there is a very noticeable difference in the operation of the rolling stock and wear of rail.

Asst. Eng. Ry. Dept.

The writer is of the opinion that there is considerable advantage in greasing curves, on account of the decreased friction and absence of "squealing" due to wheels grinding against the guard. On ungreased curves there is also the danger of derailment of cars, owing to the tendency of the cars to climb over the guard, and this danger also applies to plain curves in a more marked degree. It is generally accepted as true that the squealing due to dry curves is very objectionable to the patrons and to the general public, aside from the question of rough riding. It has been mentioned, however, as a disadvantage, that the wheels pick up the grease and carry it along the straight track, where it is sometimes responsible for "skidding." This, in our experience, has not been a serious matter, and has never been the cause of anything in the nature of an accident that would warrant our allowing our curves to be dry.

P. NEY WILSON, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

I 20.—What are the relative costs of various kinds of woods available for ties? What are their relative length of life?

We use only three kinds of ties. Creosoted pine, long leaf yellow pine, and post oak or white oak. The sap pine tie (6 ins. x 8 ins. x 8 ft.) including creosoting costs 20 cents laid down at our yards; the long leaf yellow pine, 32 cents, and the oak, 38 cents.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

White oak ties are without doubt the best, but it is now almost impossible to get ties of that material. The life of a white oak tie is about 25 per cent longer than that of Southern pine, and the cost is at least 25 per cent greater. First quality hewed Southern pine ties, costing 60 cents delivered, and 35 cents to 40 cents for creosoting, are without doubt the best obtainable for use in the Northern States. The additional life, resistance to rail wear, and spike-holding qualities obtained by creosoting, make such treatment an economical practice. Treated ties are especially to be recommended in concrete paving foundations.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Sawed pine ties 6 ins. x 8 ins. x 8 ft., 45 cents f. o. b. Birmingham. Will last 2 to 5 years. Hewn pine ties 7 ins. x 9 ins. x 8 ft., 55 cents. Will last 2 to 5 years. Hewn oak ties, 6 ins. x 8 ins. x 8 ft., 53 cents. Will last 3 to 5 years. Creosoted pine ties, 8 ins. x 8 ins. x 8 ft., 85 cents. Will last indefinitely.

GEO. H. HARRIS, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

The price of ties vary so much in the different sections of the country that satisfactory comparisons cannot be made.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 21.—Has any satisfactory substitute been found for wooden ties? What has been the experience with iron, steel, glass, concrete or other materials for ties?

I have never been able to find a substitute for wooden ties. In fact, I have never attempted to do so, but have been satisfied with the experience of others.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

None that we know of.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

Steel ties, channel section on concrete foundation, have been used on this system in the paved streets for about three years, and thus far have given great satisfaction. The cost of laying the road on steel ties, which are put 5 ft. apart, is practically the same as a road laid on wooden ties 2 ft. apart.

Asst. Eng. Ry. Dept.

The steel tie has been used experimentally by several steam roads. Additional answers to this question are especially requested. EDITORS.

I 23.—What methods are available for welding joints? Please give your experience with any of the methods of welding track, including detailed cost of doing the work, and the results secured.

We have been cast welding our joints for the past seven or eight years and have had remarkable success with them. We have not lost one joint in a hundred. Our device is rather primitive, but most effective. We secured a boiler shell 4 ft. in diameter and 8 ft. long, lined it with fire brick and mounted it on a track, using this for the cupola. On this same truck was a blower operated by a discarded street car motor. Also on the truck we built up platforms for carrying the coke and iron. This outfit was hauled on its own wheels to the location of the welding, where we would pour from one hundred to two hundred joints at a run; the number depending on the size of the rail welded. The cost of these joints depended of course on the iron market. Sometimes we were paying $8.50 a ton for iron, and again $18.00. A mixture of 50 per cent new iron and 50 per cent old scrap cast iron was used, and with the market at $12.00, the joints on 9-in. rail cost about $2.90 each. We have some sections of 9-in. track which have been cast welded since 1897, and it is almost impossible to find the joints.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

I 24.—In sanding track, is it better to sand one rail or both? Why?

A sufficient amount of sand can be placed on one rail to do the work, and it is superfluous to sand both rails if one is sanded properly. Sand on both rails is an additional precaution, however, as it presents more friction, and it might be advisable to sand both rails on very steep grades. In sanding only one rail it wears the wheels and brake shoes on that side of the car, and it is well to alternate from one rail to the other in sanding.

W. H. GLENN, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

With one rail clean a better return is insured. Sanding should alternate from one rail to the other on succeeding hills, to maintain wheel wear as even as possible.

M. J. FRENCH, JR., Roadmaster,
Syracuse Rapid Transit Ry. Co.

Depends on grade and approaches to crossings. On city streets we prefer to sand both rails, as we believe we get a better contact between rails and wheels when bringing car to a stop.

Geo. H. Harris, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Lt. & Power Co.

Sand inside rail only. If too much sand is put on rails the electrical contact will be lost altogether. Too much sand is as bad as none.

Trackman.

We believe in sanding both rails.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

It has been our experience that it is more economical to sand one rail instead of both rails. We find from practical experience that sanding one rail answers the purpose, as it is not so difficult to do and requires less sand. I might mention in connection with this that we have no grades on our system over 2 per cent. On any grade over 2 per cent both rails should be sanded.

P. Ney Wilson, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

Both, because more effective.

J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

I 25.—When sanding track, is it better to sand from a special sand-car or to have sand on each car? Why?

It is best to have the track sanded from a special car, and also to have sand on each car. It often happens that the track becomes very slippery in places before the special sand cars can get to them, and in such cases sand on each car comes in very handy.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

It is safer to carry sand on each car, but on steep hills a man should be stationed to sand by hand.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

We consider that there are a great many advantages in sanding from a sand car. We find that it is expensive both in the first cost and maintenance to keep sand box in good condition on the cars, and the sand box is liable to fail at a dangerous moment, as the sand becomes lumpy, or in cold weather it may become damp and freeze hard. Sand buckets on front end of car present an unsightly appearance and they are undesirable. We have known cases where cars have been derailed by too much sand.

P. Ney Wilson, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

On a hilly road sand should be on each car. Barring the possibility of accident, greater economy of operation should be secured on comparatively level roads by sanding with a special sand car.

J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

Owing to the many and heavy grades on our system, the groove girder rail is sanded by hand by trackmen, as well as from sand boxes on the cars, and at times a sand car is used.

Asst. Eng. Ry. Dept.

Believe it is better to sand from each car, as conditions of weather change so suddenly, and the motorman should have means for applying sand quickly at dangerous places.

Geo. H. Harris, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Light & Power Co.

We not only keep the rails sanded on grades in cities, but also provide all cars with sand.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

I 26.—Is it a good idea to mix salt with the sand? Why?

It is not necessary to mix salt with sand in warm weather. When the conditions are such that there is a considerable amount of moisture or snow near, or on the rails that is likely to freeze, then it is well to mix in some salt.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

Salt acts like grease on the rail.

M. J. French, Jr., Roadmaster,
Syracuse Rapid Transit Ry. Co.

It is not, because during damp weather the salt will melt. Prefer to have straight sand dried in a kiln.

Geo. H. Harris, Supt. Ry. Dept.,
Birmingham (Ala.) Ry. Light & Power Co.

No. Each is often used where the other is not required.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

During freezing weather the mixing of sand and salt is desirable, but otherwise no mixing is required.

Asst. Eng. Ry. Dept.

We would not mix salt with sand under any condition. The moisture drawn by the salt makes the sand lumpy and it will not run.

P. Ney Wilson, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

No, not here. We only use salt in switches and special work, and on steep grades occasionally.

J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

I 27.—What can be done to overcome slippery rails, due to dead leaves on the track?

The only way in which we have ever treated this is to sweep the rails with a steel broom, and then sand them.

W. H. Glenn, Supt. Roadways,
Georgia (Atlanta) Ry. & Elec. Co.

If rails cannot be cleared of leaves wet the rail and use sand freely.

Columbus, Buckeye Lake & Newark Tract. Co., and
Columbus, Newark & Zanesville Elec. Ry. Co.

There are two ways of overcoming this difficulty. One is to send out a sprinkler and thoroughly sprinkle the roadbed and tracks. It will be found that water running down the track will wash a great deal of the gummy substance produced by crushed leaves from the rail. This trouble can also be overcome by placing a man on the front end of the car with a wire broom to clean the rails.

P. Ney Wilson, Supervisor, So. Jersey Div.,
Public Service Cor., Camden, N. J.

Sand liberally.

J. Chas. Ross, Gen. Mgr.,
Steubenville (Ohio) Tract. & Lt. Co.

When our rails get very gummy and slippery from this and other causes, we have found that the use of the sprinkling car with spray nozzle removed, and pipe arranged to wash the head of the rail, gives good results.

Asst. Eng. Ry. Dept.

ADDITIONAL QUESTIONS ON TRACK DEPARTMENT

The following questions relating to track work have been received from correspondents. Suggestions and opinions in answer to any or all of these from any of the readers of the Street Railway Journal will be appreciated:

I 28.—What is a good method of testing rail-bonds?

I 29.—What is the best method of keeping records of individual rail-bond tests?

I 30.—What has been the experience with soldered bonds?

I 31.—In using bond tester on special work in which each joint is bonded in addition to long bonding, what is the method of procedure in case the tie-rods span two or more joints?

I 32.—What is the best form of portable rheostat to use in connection with bond-testing instrument?

I 33.—Has the conductivity of the zinc joint held up?

I 34.—What is the best method of preventing switches from "kicking"?

I 35.—How many renewals of hard centers can be made on modern special work before the abutting rails are worn out?

THE CENSUS REPORT ON STREET RAILWAYS—I.

The complete report on the subject of street and electric railways issued by the United States Census Bureau has just been published. As readers of this paper will remember, an advance bulletin on this subject, known as Bulletin No. 3, was dated June 5, 1903, and was published in abstract in the STREET RAILWAY JOURNAL for July 11, 1903. The present report is a volume of 439 pages with 104 tables, as well as maps and half-tone illustrations. It is divided into two parts. The first, prepared by Prof. Edward Dana Durand, discusses the following subjects: Chapter I., scope and method of investigation; Chapter II., comparison with census of 1890; Chapter III., traffic; Chapter IV., capitalization; Chapter V., financial operations; Chapter VI., employees, salaries and wages; Chapter VII., interurban railways, economic, financial and social features; Chapter VIII., consolidation of street railways; Chapter IX., franchises, public regulation and public ownership; Chapter X., street railways in European countries. Part II. has been prepared by Thomas Commerford Martin, and is divided into five chapters, as follows: Chapter I., history and development of electric traction; Chapter II., roadbed, track and electric construction; Chapter III., cars and miscellaneous equipment; Chapter IV., interurban railway construction and equipment; Chapter V., power houses, equipment and output. The entire report has been prepared under the supervision and immediate direction of W. M. Steuart, chief statistician for manufactures.

CLASSIFICATION OF RAILWAYS

An interesting feature of the traffic figures is the fact that a classification has been adopted according to the population served—that is, the roads are divided into six divisions, as follows:

1. Railways in urban centers of 500,000 population and over.
2. Railways in urban centers of 100,000, but under 500,000 population.
3. Railways in urban centers of 25,000, but under 100,000 population.
4. Railways in urban centers of less than 25,000 population.
5. Fast, long interurban railways.
6. Miscellaneous interurban railways.

This classification of companies according to population, the authors acknowledge, involves no little difficulty. In the first place the more important street railways are not confined, as they were formerly, to a single municipality. They extend into the suburbs and adjacent rural districts, and often to cities and towns at a considerable distance. In determining the area to be credited to a given urban center, the rule followed has been to include all the municipalities reached by the lines of the company, or companies, which serve the city that constitutes the leading component in that center. The statistics of minor railways serving any part of the area thus defined have been added to those of the more central systems, and the population of any additional localities reached by these minor companies. The population of strictly rural areas, through which primarily urban street railway systems pass, has necessarily been disregarded in discussing urban centers, since there is no way of ascertaining what proportion of the inhabitants of such areas are actually within reach of street railway facilities.

Pittsburg and the neighboring cities and towns are cited as a striking illustration of the difficulty of ascertaining the population served by a railway company. Of the 469.47 miles of track reported by the eight Pittsburg companies, 188.19 miles lie entirely outside of the limits of any municipality. Nevertheless, the traffic is so largely carried on within city limits that these companies have been classed as urban rather than interurban. A somewhat similar condition exists in Buffalo, N. Y., and its vicinity, while the railways serving Detroit, Mich.; Fall River, Mass.; Canton and Akron, Ohio; New Haven, Conn., and several other important cities are so largely interurban that their statistics have been excluded from the urban groups.

HIGH SPEED AND INTERURBAN RAILWAYS

For the purpose of showing the operating results of the more typical modern interurban railways, fifty-five companies have been selected, which may be fairly described by the term fast, long interurban lines. No company was included in this group which reported less than 15 miles of single track, or which had more than one-third of its trackage within municipal limits, or which operated cars at a maximum speed of less than 20 m.p.h. The distinction between such interurban railways and those in the miscellaneous group was necessarily more or less arbitrary. Several of the companies in the miscellaneous group operated at least part of their trackage in such a way as to conform to the criteria indicated for fast, long interurban lines. This is notably the case with the Detroit United Railway Company, which yet carries the greater proportion of its passengers wholly within the limits of the city of Detroit, thus rendering the statistics of its total business quite incomparable with those of more strictly interurban lines. Group 6, the miscellaneous interurban class, includes on the one hand such cases as the Detroit United Railway Company and the Boston & Northern Street Railway Company, and, on the other hand, many small railways connecting mere villages, or operated in connection with summer resorts.

COMPARATIVE FIGURES WITH 1890

In Chapter II. are presented some statistics on geographical distribution of the railways and aggregate figures, as compared with 1890, which are largely the same as those presented in Bulletin No. 3.

TRAFFIC

Chapter III. on traffic will prove to the student of street railway values one of the most interesting in the book. The total number of fare passengers was 4,774,211,904; of transfer passengers, 1,062,403,392; the average fare passengers per mile of track, 212,217; the total car-miles, 1,144,430,466.

PASSENGERS PER MILE OF TRACK AND PER CAR-MILE

The number of passengers per mile of track for the country as a whole is 212,217. If only companies operating the entire year be considered, the number of passengers carried per mile of track is 218,616. The average density for all full-time electric surface railways combined is 205,478 passengers per mile of track. Elevated roads perhaps have a somewhat greater possible carrying capacity than surface roads, because of their large cars, long trains and high speed. It may be noted, however, that the number of passengers per mile of track on the Manhattan Elevated Railway in New York City, 1,837,625, only slightly exceeds that on the Third Avenue and New York City surface systems in that city, which are 1,612,630 and 1,434,088, respectively.

The average passengers per car-mile throughout the country were 4.26. The average on the Manhattan Elevated was 4.78, as compared with 6.51 on the New York City and 6.59 on the Third Avenue, on account of the shorter rides on the latter roads. Unfortunately, less than half the street railways of the country keep records of car-hours. The total number of car-hours reported in 1902 by the 390 companies which gave this information was 65,869,342. These companies carried 2,176,886,559 fare passengers; therefore, each car carried an average of 33.28 passengers per hour of operation. Most of the companies reporting car-hours are operated by electricity. The four elevated railways in Chicago have from 43.21 to 56.93 passengers per car-hour; these figures, as might be expected from the high speed of elevated trains, being considerably larger than for most surface railways in great cities.

Owing to the difficulties of separating interurban from city service in a number of cases, the report gives the following table of totals, and then two tables of selected cities in which the interurban traffic does not interfere with the city traffic:

TABLE SHOWING RELATION OF TRACKAGE AND TRAFFIC TO POPULATION IN GROUPS OF URBAN CENTERS, 1902

	All centers over 500,000 population.	All centers of 100,000 but under 500,000 population.	Twenty-nine selected centers of 25,000 but under 100,000 population.	Forty-six selected centers of less than 25,000 population.
Total population served	10,274,470	5,380,647	1,258,615	718 254
Number mites of track.	4,998.89	3,559.82	951.93	485.95
Miles of track per 1000 of population	.49	.66	.76	.68
Number of passengers.	2,456,542,270	994,327,853	135,842,312	49,179,495
Number of rides per inhabitant	239.1	184.7	107.9	68.5

TABLE SHOWING RELATION OF TRACKAGE AND TRAFFIC TO POPULATION IN SELECTED URBAN CENTERS WITH POPULATION OF LESS THAN 25,000: 1902

Name of Center.	Population of Center.	Number of Passengers.		Number of Miles of Track.	
		Total.	Per Unit of Population.	Total.	Per 1,000 of Population.
Fort Smith, Ark...............	11,587	731,553	63.1	8.93	0.77
Riverside, Cal.	7,973	547,051	68.6	9.52	1.19
San Diego, Cal.	17,700	2,220,000	125.4	16.60	0.94
Santa Barbara, Cal............	6,587	814,405	123.6	8.50	1.29
New London, Conn...........	17,548	1,320,791	75.3	8.51	0.48
Stamford, Greenwich, Conn..	18,417	1,327,617	72.1	12.69	0.69
Pensacola, Fla.	17,747	998,290	56.2	9.00	0.51
Athens, Ga.	10,245	356,969	34.8	6.53	0.64
Alton, North Alton, Upper Alton, Ill.	17,487	1,497,130	85.6	12.25	0.70
Cairo, Ill.	12,566	870,838	69.3	9.67	0.77
Kankakee, Bradley, Bourbonnais, Ill.	15,708	714,769	45.5	12.78	0.81
Vincennes, Ind.	10,249	450,000	43.9	8.00	0.78
Burlington, Ia.	23,201	1,600,000	69.0	14.50	0.62
Muscatine, Ia.	14,073	865,120	61.5	8.60	0.61
Ottumwa, Ia..................	18,197	1,211,028	66.6	10.00	0.55
Atchison, Kan................	15,722	533,867	34.0	9.00	0.57
Wichita, Kan.................	24,671	1,460,000	59.2	18.50	0.75
Shreveport, La................	16,013	1,450,000	90.6	8.80	0.55
Biddeford, Saco, Maine.......	22,267	728,909	32.7	8.15	0.37
Benton Harbor, St. Joseph, Mich.	11,717	1,198,826	102.3	10.50	0.90
Marquette, Mich.	10,058	373,672	37.2	7.00	0.70
Menominee, Mich.	12,818	529,764	41.3	6.71	0.52
Vicksburg, Miss..............	14,834	1,188,289	80.1	8.75	0.59
Springfield, Mo...............	23,267	1,700,715	73.1	19.10	0.82
Great Falls, Mont............	14,930	939,436	62.9	11.90	0.80
Concord, N. H................	19,632	1,510,856	77.0	12.71	0.65
Laconia, N. H................	8,042	436,171	54.2	8.87	1.10
Long Branch, Deal, Allenhurst, Asbury Park, Bradley Beach, Neptune City, Belmar, N. J......................	16,148	3,737,541	231.4	23.68	1.47
Perth Amboy, Metuchen, N.J.	19,485	880,128	45.2	9.06	0.46
Dunkirk, Fredonia, N. Y.....	15,743	681,770	43.3	7.00	0.44
Kingston, N. Y..............	24,535	2,217,334	90.4	9.16	0.37
Ogdensburg, N. Y...........	12,633	478,283	37.9	10.00	0.79
Ashtabula, Ohio..............	12,949	999,857	77.2	5.75	0.44
Lima, Ohio	21,723	1,375,979	63.3	18.55	0.85
Tiffin, Ohio	10,989	482,000	43.9	7.33	0.67
Zanesville, Ohio..............	23,538	1,800,000	76.5	10.00	0.42
Sayre, Athens, Pa.; Waverly, N. Y.	9,481	1,059,507	111.8	9.11	0.96
Tarentum, New Kensington, Pa.	10,137	622,447	61.4	6.61	0.65
Greenville, S. C..............	11,860	537,603	45.3	7.00	0.59
Austin, Tex.	22,258	1,213,703	54.5	13.38	0.60
Waco, Tex.	20,686	1,605,525	77.6	16.29	0.79
Ogden, Utah	16,313	861,910	52.8	11.00	0.67
Burlington, Winooski, Vt....	22,423	1,270,136	56.6	11.22	0.50
Everett, Wash.	7,838	971,650	124.0	9.65	1.23
Ashland, Wis.................	13,074	503,658	38.5	7.68	0.59
Janesville, Wis...............	13,185	304,398	23.1	7.41	0.56
Totals....................	718,254	49,179,495	68.5	485.95	0.68

Averages for density of traffic might be vitiated by the undue influence of a few companies having extremely high or extremely low density of traffic. To guard against such errors the accompanying table was prepared, which shows the number of full-time street railways which did not supply commercial lighting and which was within each population group reporting traffic of different degrees of density.

This table shows that the arithmetrical average of the groups is not greatly affected by high maxima and minima.

TRAFFIC IN URBAN DISTRICTS

A table (see page 562) is then given showing the trackage and traffic in urban centers of over 100,000.

TABLE SHOWING RELATION OF TRACKAGE AND TRAFFIC TO POPULATION IN SELECTED URBAN CENTERS WITH POPULATION OF FROM 25,000 to 100,000: 1902

Name of Center.	Population of Center.	Number of Passengers.		Number of Miles of Track.	
		Total.	Per Unit of Population.	Total.	Per 1,000 of Population.
Montgomery, Ala............	30,346	1,849,395	60.9	20.00	0.66
Little Rock, Ark.............	38,307	3,841,415	100.3	20.70	0.54
Sacramento, Cal.	29,282	3,948,791	134.9	23.50	0.80
Pueblo, Col...................	28,157	4,065,162	144.4	36.25	1.29
Meriden, Wallingford, Conn..	31,033	2,589,737	83.5	19.50	0.63
Augusta, Summerville, Ga....	42,686	2,360,674	55.3	31.02	0.73
Peoria, Averyville, North Peoria, Peoria Heights, Ill.....	60,340	6,750,000	111.9	41.25	0.68
Quincy, Ill....................	36,252	2,127,623	58.7	17.38	0.48
Rockford, Ill..................	31,051	1,989,080	64.1	23.00	0.74
Springfield, Ridgely, Ill......	35,328	3,532,013	100.0	23.83	0.67
Evansville, Howell, Ind.......	60,428	3,629,534	60.1	30.50	0.50
Dubuque, Ia.	36,297	2,391,355	65.9	20.85	0.57
Sioux City, Ia.; South Sioux City, Neb.	34,000	4,138,944	121.7	43.00	1.26
Topeka, Kan.	33,608	2,730,287	81.2	28.63	0.85
Lexington, Ky.	26,369	2,350,682	89.1	15.13	0.57
Bay City, West Bay City, Essexville, Mich.	42,386	1,986,982	46.9	23.30	0.55
Duluth, Minn.; Superior, Wis.	84,060	9,418,517	112.0	73.84	0.88
Dayton, Ohio	85,333	14,667,094	171.9	52.88	0.62
Springfield, Ohio	38,253	3,784,338	98.9	28.13	0.74
Altoona, Gaysport, Juniata, Bellwood, Pa.	46,034	4,759,279	103.4	27.50	0.60
Williamsport, South Williamsport, Pa.	32,085	2,582,297	80.5	16.41	0.51
Dallas, Tex.	42,638	6,574,773	154.2	46.30	1.09
Galveston, Tex.	37,789	2,851,603	75.5	35.86	0.95
San Antonio, Tex.	53,321	5,268,627	98.8	45.51	0.85
Salt Lake City, Murray, Utah.	56,833	10,631,591	187.1	78.04	1.37
Richmond, Va.	85,050	16,313,560	191.8	43.96	0.52
Spokane, Wash.	36,848	5,028,388	136.5	36.55	0.99
La Crosse, Onalaska, Wis....	30,263	1,706,728	56.4	17.11	0.57
Oshkosh, Neenah, Wis.......	34,238	1,973,843	57.7	32.00	0.93
Totals....................	1,258,615	135,842,312	107.9	951.93	0.76

TABLE SHOWING DISTRIBUTION OF COMPANIES, IN THE VARIOUS POPULATION GROUPS, ACCORDING TO NUMBER OF FARE PASSENGERS CARRIED PER MILE OF TRACK OPERATED: 1902

Passengers per Mile of Track.	Total.	Number of Companies.					
		Urban Centers, Population.				Interurban Railways.	
		500,000 and over.	100,000 to 500,000.	25,000 to 100,000.	Under 25,000.	Fast Long.	Other.
Under 25,000............	72	4	..	2	8	17	41
25,000, but under 50,000..	86	1	1	3	23	14	44
50,000, but under 10,000.	191	10	3	13	75	10	80
100,000, but under 200,000	150	13	1	40	54	1	35
200,000, but under 300,000	36	3	15	8	6	..	4
300,000, but under 400,000	16	4	8	2	2	..	..
400,000 and over........	17	13	4	..	..	..	..
Totals.............	568	48	38	68	168	42	204

In comparing the different urban centers at the present time it may be observed that length of track is a less accurate measure of street railway development than the number of passengers carried or the car-mileage operated. The amount of track required to serve adequately the needs of the people depends largely on the density of population and the topographical conditions of the city. Thus, largely because of the dense population in New York City, the proportion of trackage to population there is lower than in any other urban area except Albany and Troy, N. Y., and St. Joseph, Mo. Philadelphia and Boston also show considerably less track per 1000 inhabitants than most of the smaller cities. The population of Chicago is more scattered than that of the large cities just named, and it has, therefore, a larger proportion of trackage to population. The greatest length of street railway track per 1000 of population is found in the Western cities, Denver, Col., and Oakland and Los Angeles, Cal. This is explained by their scattered population and also by the fact that the companies operating there have a considerable suburban and interurban trackage.

Other conditions being equal, the extent to which the people of a city will patronize its street railways will depend largely on the size of the city. This is borne out by the figures in the table on page 562. The rank of the cities in 1902, as regards the ratio of passengers to inhabitants, bears a rough parallelism to their rank in population. Other factors, however, also influence the relative amount of street railway traffic, among which are the shape and general topographical features of the city, especially the presence or absence of hills; the density of population per unit of area, and the situation of the business sections with reference to the residence sections. The average wealth of the masses of the people and their habits and customs of life also affect their patronage of the street railways.

San Francisco, though falling into the second group of urban centers, has by far the largest ratio of rides to inhabitants, owing to its steep hills and the fact that its manufacturing and commercial interests are mostly centralized within a small area, while the residence section is extensive and comparatively thinly populated.

Among the centers of less than 500,000 population, Los Angeles, Cal.; Kansas City, Mo., and Washington, D. C., follow San Francisco in the ratio of passengers to inhabitants. The patronage of street railways is least per inhabitant in the Scranton, Pa., center. The low ratio is probably due to the fact that the patronage comes largely from a mining population with a low average of per capita wealth and with residences near the place of work. St. Joseph, Mo.; Rochester and Albany-Troy, N. Y., are also conspicuous for the small degree of street railway patronage.

A comparison of these statistics for individual cities in 1902 bears out in a general way the opinion that the larger the city the greater tends to be the number of passengers who will be carried per unit of track, but many other influences also enter in and often counteract that of population.

TABLE SHOWING TRACKAGE AND TRAFFIC IN URBAN CENTERS OF 100,000 POPULATION AND OVER IN 1902:

URBAN CENTER.	Population*	Miles of Track.	Miles of Track Per 1,000 Population.	Fare Passengers Carried.	Passengers Per Inhabitant.	Passengers Per Mile of Track.	Passenger-Car Miles.	Passengers Per Car Mile.
Albany, Troy, Rensselaer, N. Y.	216,530	75.83	0.35	26,417,076	122	348,372	7,449,410	3.5
Baltimore, Ellicott City, Md.	510,288	365.12	.72	96,763,878	190	265,019	23,330,292	4.1
Boston, Cambridge, Chelsea, Everett, Malden, Newton, Somerville, Brookline, Waltham, Mass.	927,994	451.68	.49	228,179,308	246	505,179	47,524,724	4.8
Buffalo, Niagara Falls, Lockport, North Tonawanda, N. Y.	421,694	320.48	.76	74,136,881	176	231,331	17,290,756	4.3
Chicago, Ill.; Hammond, Ind.	1,769,951	1,036.24	.58	410,284,094	232	395,935	102,366,407	4.0
Cincinnati, Ohio; Newport, Covington, Ky.	429,137	263.57	.61	86,208,384	201	327,080	23,940,175	3.6
Cleveland, Ohio, and vicinity	405,359	237.04	.58	81,370,202	201	343,276	18,768,515	4.3
Columbus, Ohio, and vicinity	127,022	106.43	.84	26,489,927	208	248,895	5,619,476	4.7
Denver, Col.	133,859	149.77	1.12	31,085,443	232	207,554	6,458,908	4.8
Indianapolis, Ind.	169,164	109.86	.65	30,005,026	177	273,120	6,921,490	4.3
Jersey City, Elizabeth, Hoboken, Paterson, Passaic, Newark, Bayonne, Orange, N. J.	969,736	463.54	.48	148,094,623	153	314,639	24,589,773	6.0
Kansas City, Independence, Mo.; Kansas City, Argentine, Rosedale, Kan.	237,042	181.24	.76	57,148,083	241	315,317	15,979,864	3.6
Los Angeles, Pasadena, Santa Ana, Orange, Cal.	118,746	164.16	1.38	30,803,086	259	187,641	9,533,269	3.2
Louisville, Ky.	204,731	147.13	.72	34,503,388	168	234,510	9,566,844	3.6
Memphis, Tenn.	102,981	71.88	.70	16,598,823	161	230,924	3,653,631	4.5
Milwaukee, Whitefish Bay, Wauwatosa, Wis.	301,701	145.50	.48	46,974,373	156	322,848	9,143,023	5.1
Minneapolis, St. Paul, Stillwater, Minn.	378,923	251.02	.66	63,009,957	166	251,016	12,895,343	4.9
New Orleans, La.	287,104	180.31	.63	53,184,273	185	294,960	17,810,169	3.0
New York, Yonkers, White Plains, Mt. Vernon, New Rochelle, Pelham, N. Y.	3,548,096	1,299.10	.37	943,687,316	266	726,416	180,499,539	5.2
Oakland, Alameda, Berkeley, Hayward, Emeryville, Cal.	101,872	122.80	1.20	17,247,022	169	140,448	5,449,713	3.2
Omaha, South Omaha, Dundee, Neb.; Council Bluffs, Ia.	155,268	105.95	.68	21,418,791	138	202,159	6,373,697	3.4
Philadelphia, Pa.	1,293,697	517.53	.40	331,304,685	256	640,165	61,175,495	5.4
Pittsburg, Allegheny, McKeesport, Bellevue, Sharpsburg, McKees Rocks, Carnegie, Wilkinsburg, Braddock, Homestead, Connellsville, Uniontown, Pa.	640,380	469.47	.73	168,632,339	263	359,197	34,311,111	4.9
Providence, Pawtucket, R. I.	268,946	137.05	.51	45,163,704	168	329,542	8,016,662	5.6
Rochester, Irondequoit, N. Y.	178,333	95.86	.54	20,171,260	113	210,424	5,196,819	3.9
St. Joseph, Mo.	102,979	35.15	.34	8,534,278	83	242,796	2,198,630	3.9
St. Louis, Mo.; East St. Louis, Granite, Ill.	614,328	396.21	.64	129,596,027	211	327,089	31,014,097	4.2
San Francisco, San Mateo, Cal.	344,614	276.50	.80	117,357,877	340	424,441	20,553,252	5.7
Scranton, Dunmore, Olyphant, Jermyn, Carbondale, Pa.	155,655	76.68	.49	8,331,663	54	108,655	2,322,162	3.6
Syracuse, Onondaga, Geddes, DeWitt, N. Y.	123,776	68.16	.55	14,234,508	115	208,840	3,704,195	3.8
Toledo, Ohio	135,271	97.78	.72	20,104,076	149	205,605	5,517,484	3.6
Washington, D. C.	279,940	139.67	.50	63,829,752	228	457,004	15,577,212	4.1

* Population shown for 1902 is that reported at the census of 1900.

PASSENGERS PER CAR-MILE

Because of differences in the size of cars and in the average length of rides a bare comparison of the number of car-miles operated in the different individual cities and of the number of passengers per car-mile is much less instructive than the other comparisons thus far presented. It is impossible, from the statistics, to trace any connection between the size of the city and the number of passengers carried per car-mile. The highest ratio of passengers to car-mileage is reported from the great urban center in Northern New Jersey, of which Jersey City, Newark and Paterson are the most important constituents; yet this center was the only one of the eight centers having a population severally of 500,000 and over that showed a ratio of passengers per inhabitant below 190. Other cities showing more than five passengers per car-mile are, in the order named, San Francisco, Providence, Philadelphia, New York and Milwaukee. The lowest ratio of passengers per car-mile, that of New Orleans, was 3, while that of both Los Angeles and Oakland was 3.2.

FARES

As regards fares, the report states that while 5 cents as a cash fare is practically universal, more than 200 companies offer tickets at a price of approximately 4 cents each. The most common practice among such railways is to sell six tickets for 25 cents. Sometimes a further reduction is made if a larger number of tickets is bought, twenty-five tickets being frequently sold for $1, and sometimes twenty-six or even more. On some railways the reduced fare is granted only to those who buy tickets to the value of $1. It is quite common for such companies to sell twenty-four or twenty-five tickets for $1. This is the custom, for instance, on the lines of the Connecticut Railway & Lighting Company, and on the systems at Springfield, Ill.; Des Moines, Iowa; Muskegon, Mich.; Syracuse, N. Y.; Chattanooga, Tenn.; Seattle, Wash., and a considerable number of smaller places. Occasionally, the purchase of a still larger number of tickets is required in order that the reduced fare may be obtained. Thus the Torrington & Winchester Railway in Connecticut sells seventy-five tickets for $3, and the companies at Atchison, Kan., and Cumberland, Md., with one or two others, sell 100 for $4. Two railways, in Olean, N. Y., and Bradford, Pa., require the passenger to buy 200 tickets in order to get a 4-cent fare, while the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., offers 500 tickets for $20. It is evident that a great majority of passengers will not take advantage of reduced fares if they are required to buy more than a dollar's worth of tickets at a time.

The approximately 4-cent fare in the various forms mentioned is found for the most part in cities and towns of medium or small size. In no urban center of more than 500,000 inhabitants are tickets sold to all classes of passengers at reduced rates. The largest cities in which, at the time of the census, six tickets were sold for 25 cents were Washington, D. C.; Detroit, Mich.; Milwaukee, Wis.; Dayton, Ohio; Indianapolis, Ind.; Reading, Pa.; Worcester, Mass.; Utica, N. Y.; Wilmington, Del., and Richmond, Va. In Detroit, however, these tickets are good only during the "rush hours" of morning and evening and the same may be true in some of the other cities named. Subsequent to the date of the census, the two railway companies in Cleveland, Ohio, reduced fares to the same basis, but they later restored the straight 5-cent fare.

The sale of tickets to patrons generally at reduced rates is quite rare among the street railways of New England, although a few of them grant lower rates to passengers who buy a dollar's worth of tickets. In the smaller cities and towns of New York a considerable number of railways sell six tickets for 25 cents. This is the practice, for example, in Binghamton, Oswego, Rome and Schenectady. On several railways in this State twenty-four or twenty-five tickets are offered for $1. Pennsylvania has even more railways which sell six tickets for 25 cents than New York. Among the more important Pennsylvania railways offering this rate are the Chester Traction Company, of Chester and vicinity; the Conestoga Traction Company, of Lancaster and vicinity; the Lebanon Valley Traction Company, of Lebanon and vicinity; the Schuylkill Valley Traction Company, of Norristown and vicinity; the Wilkesbarre & Wyoming Valley Traction Company; the Warren Street Railway Company, and the United Traction Company, of Reading. Altogether there are more than forty street railways in this State which have approximately a 4-cent fare.

In the Middle Western States of Ohio, Michigan, Indiana, Illinois and Wisconsin, the reduced fare, usually in the form of six tickets for 25 cents, is more common than elsewhere, and may almost be said to be the prevailing rate, except in two or three of the largest cities and on interurban railways. Practically all urban street railways in Indiana and Wisconsin sell six tickets for 25 cents, and the same is true of more than twenty-five of the street railways of Ohio. A fare at least as low as 4 1-6 cents is available for all passengers in every city of more than 25,000 inhabitants in Ohio, except Youngstown, Toledo and Cincinnati. A fare of approximately 4 cents appears also in about a dozen places.

Fares even lower than 4 cents exist in a few cities and towns. The most familiar instance is Detroit, Mich., where, on part of the system now operated by the Detroit United Railway Company, eight tickets for 25 cents are sold, in accordance with the terms of the franchise under which these lines were constructed. The new Central Market Street Railway in Columbus, Ohio, sells eight tickets for 25 cents, while the older street railways in this city offer seven tickets for 25 cents. The rate of seven tickets for 25 cents also prevails in Salem and Delaware, Ohio, while in two or three other towns of the State where six tickets are sold for 25 cents, twenty-seven may be bought for $1. A rate of seven tickets for 25 cents is also made on the Pittsburg, McKeesport & Greensburg Railway of Pennsylvania, while in Kansas one of the minor companies offers twenty-eight tickets for $1, and another thirty.

In addition to railways which thus practically fix their fares at 4 cents or less, there are a number which grant slight reductions from the 5-cent fare. The rate of eleven tickets for 50 cents exists in Pueblo, Col., on two interurban railways of Maine and in several other places. In Mobile, Ala.; Santa Barbara, Cal.; Colorado Springs, Col.; Auburn, N. Y.; Lincoln, Neb.; Toledo, Ohio; Spokane and Tacoma, Wash., and a number of other places the railways sell twenty-two tickets for $1. The leading companies of Northern New Jersey offer twenty-one tickets for $1, while on a number of railways of minor importance in various parts of the country, from 105 to 110 tickets are sold for $5.

REDUCED FARES FOR PARTICULAR CLASSES OF PASSENGERS

Sometimes street railway companies carry young children in company with their parents for half fare. In Baltimore, Md., for example, the fare for children is 3 cents. It is probably more common, however, to charge full fare for children above a certain age and carry others free. A more important practice is that of granting reduced fares to school children. In such cases the most common rate is 2½ cents, though sometimes 3 cents or 4 cents is charged. In New England it is almost universal for street railways to carry school children at reduced rates. Outside of New England the practice is frequently found in smaller cities and towns, and in a few instances in large cities also. Among the important cities which offer a fare of 2½ cents to school children are Boston, St. Louis, San Francisco and Denver. Street railway companies presumably act on the theory that, by thus reducing the fares of school children, they will secure a considerable amount of traffic from those who would otherwise walk.

The practice of granting special rates to working people is comparatively rare in the United States. The returns to the Bureau of the Census do not indicate, in some cases, whether such special rates reported are limited in any way, and in other cases they do not show precisely the restrictions imposed; but usually there is no restriction except as to the time of day at which the journey is taken. In general, it may be said that the reduced fare for workingmen is confined to the hours from about 6 to 8 in the morning and from about 5 to 7 in the evening. Naturally any person who rides at that time may usually avail himself of the reduced fare. The special rate is sometimes confined to particular routes or distances. The practice is more common in New England than elsewhere. About sixteen of the street railway companies of Massachusetts reported reduced fares for workingmen, the most common rate being 2½ cents, although several railways reported 3 cents or 4 cents. The most important company which makes special rates for workingmen is the Boston & Northern Railway Company, which serves many cities and towns in Eastern Massachusetts.

Among other instances of reduced fares for working people may be mentioned the practice of certain railways in the mining districts of Pennsylvania. For example, two companies centering at Shamokin, and several others elsewhere, sell thirty workingmen's tickets for $1. The Detroit & Port Huron Shore Line and the Saginaw Valley Traction Company sell eight tickets for 25 cents to workingmen, while the railways of Zanesville, Ohio, and Clinton and Dubuque, Iowa, make a 2½-cent rate. When the elevated railways were first opened in New York they charged a 10-cent fare, but were required by law to carry passengers for 5 cents during the rush hours morning and evening.

It is rarely if ever true that workingmen taking advantage of such special rates are confined to particular cars.

At the solicitation of the local postmaster at Des Moines, acting for Postmaster-General Wynne, the Des Moines City Railway Company has equipped one of its cars with a new mail box, known as the "McAllister," which promises to afford the advantage of mailing letters while the car is in motion. A car in Washington, D. C., is similarly equipped so as to thoroughly test the device. Unlike the boxes now in use in Des Moines, the new device is placed on the side of the car instead of on the rear dasher. It is open at the top, and is so designed as to receive letters while the car is in motion without obliging the depositer to manipulate a lid of any kind in mailing the letter. Neither rain nor snow can injure the mail after deposit.

ANOTHER ELECTRIC TRACTION NIGHT AT THE NEW YORK RAILROAD CLUB

Recognizing the general interest developed at the January meeting of the New York Railroad Club by the paper of W. B. Potter, of the General Electric Company, on "Developments in Electric Traction," and lack of time having prevented a general expression of opinion from members at that meeting, the executive committee of the club decided to continue this important topic for the meeting held at Carnegie Hall on March 17. This meeting was well attended and many prominent electrical engineers as well as steam railroad motive power men were present.

In the absence of President Vreeland, George W. West, superintendent of motive power for the New York, Ontario & Western Railroad, presided. No regular paper was presented and the entire evening was devoted to a further discussion of Mr. Potter's paper, which was printed in full, together with the discussion at the January meeting, in the Street Railway Journal for Jan. 28, 1905. Mr. Potter was called upon to open the discussion, but confined himself to a few general remarks, stating that he preferred to listen to the opinions of some of the steam railroad motive power men relative to the possibilities of the electrification of steam lines.

The chairman then called upon N. W. Storer, of the Westinghouse Company. Mr. Storer said that two points seemed to have been brought out conspicuously by the paper and the previous discussion; one of these was that electricity was to have a prominent place in railroad work in the future, and the other was that the third rail for conveying the current to the car or train, however successful it may have been in the past, does not fill all of the requirements for heavy and high-speed work. The speaker thought the third rail has many very desirable features, but lacks certain requisites for meeting steam railroad conditions. It is an obstruction, and no matter how well it may be protected it will always introduce a dangerous element, particularly to the section gangs engaged in track maintenance work. The various questions involved in the subject of electric traction on steam roads should be approached by everyone interested with an open mind and in a spirit of conservatism. The speaker agreed with the opinion expressed by Mr. Sprague at the previous meeting, that conservatism must be the rule. Whatever the limitations of the present steam locomotive, it is doing its work and doing it well, and any proposed change looking to the retirement of the steam locomotive must receive most careful consideration from every point of view. If electricity is to be given the attention it deserves from steam railroad men, the electrical engineer must be able to show economies in operation, particularly in the handling of suburban traffic. The choice of electrical systems is of the greatest importance. It seems to be well established that for suburban and terminal situations, where the traffic is very dense, as found on the New York Central lines out of New York, the direct-current motor is the thing. But continuous current will not do on trunk lines where traffic is not dense, owing to the cost of transforming and converting, thus making necessary economies impossible. For this long-distance high-speed work high-tension current must be used and alternating-current motors must be provided on the cars or trains. In the present stage of the art it is impossible to deliver direct current at sufficiently high voltage to give the advantages desired; it is also impossible to use the third rail for high voltages. It is therefore necessary to use high-tension currents, either single-phase or three-phase. Polyphase current is not suitable for railway work, because it requires complicated overhead conductors, and because the characteristics of the three-phase motor are not such as to meet best the conditions, particularly in the matter of variations in speeds. If the polyphase motor is out of it, single-phase distribution must be adopted.

There are several ways of utilizing single-phase currents. One method is to have motor-generator sets on the cars. This system is not desirable because of the great additional weight on the individual car units. The future railroad system will consist of a main line with many branches. These branches will be operated with single cars which will be delivered to the main line and made up into trains, so that every unit must be complete, and they must be capable of multiple control. This cannot be accomplished with motor-generator sets on each car, principally on account of the great excessive weight. This method might do for slow-moving freight traffic, but not for high speeds; and it will scarcely be the final system. About the only system available therefore for trunk and branch line work is single-phase distribution with series-wound motors on the cars. Something better may be developed some time, but at present this seems to be the only suitable method that will fill all the conditions of long and high-speed service.

A. H. Armstrong, of the General Electric Company, frankly admitted that the goal of the electrical engineer is to equip existing steam lines with electricity. It was the speaker's opinion that this whole question was one of finance more than of engineering. The large manufacturing companies have been able for some time to furnish electric locomotives that will do the work required, but heretofore they have not been able to offer economies over the steam locomotive. The art has now developed to a stage that will justify the electrical engineer in going before the steam railroad directorate and asking them to consider a complete proposition for equipping their lines electrically, in part or in whole. In making the decision as to the choice of generating and distributing methods, each section of a large system should be considered by itself as well as in relation to the whole problem, for a section comprising a long heavy grade may introduce entirely new factors. In this regard the electrical engineer, in attempting to make comparisons with steam operation, has been at a disadvantage, because it has been very difficult to segregate the accounts of the steam roads so as to obtain the results with reference to each particular section. Any road having a variable profile should have a motor that will give flexibility in varying speeds. Another road having a regular profile, whether it be comparatively level or a continuous grade, so long as the profile is reasonably regular, will find a three-phase system feasible. Continuous-current distribution in and around cities is so firmly fixed that for these conditions it will undoubtedly stay. All three single-phase roads now in operation in this country are using catenary construction.

I. C. Hubbell drew attention to the fact that although rapid strides are being made in the development of the electric motor, it must not be forgotten that improvements will also be made in the present steam locomotive, and in any comparisons between the two systems this must be taken into consideration. The speaker ventured to predict that within five years steam locomotives would be in use capable of producing a horse-power on 18 lbs. of water per hp-hour, as against 22 lbs. of water, the present measure of efficiency. Mr. Hubbell asked Mr. Potter if he would state the indicated horse-power developed by the stationary engine which supplied the power for the electric locomotive in the recent New York Central tests. He understood the electric locomotive developed 3000 hp, and wanted to know what was the output of the stationary engine in the power house at the time of the test. Later in the evening, Mr. Potter answered this by stating that the efficiency as shown by the indicated horse-power of the stationary engine in relation to the horse-power developed at the rim of the driver was about 65 per cent—that is, in order to obtain 3000 hp at the locomotive the engine would have to deliver about 4500 hp. These figures were obtained by taking the efficiency of the generator as 94, of the transmission lines as 95, of the sub-station apparatus as 90, of the third rail 90, and of the locomotive 90.

A. M. Waitt was of the opinion that electricity would make itself manifest in the steam railroad problem of the near future, not only on the score of economy, but also because of many other advantages. The incandescent light has supplanted gas in many instances, not because it is a cheaper form of illumination, but because it possesses many conveniences. Electricity on trunk and suburban roads will come because it offers many advantages that can be obtained in no other way. He was also convinced that the third rail will be the approved medium for conveying current because there is no room, especially in freight yards, for overhead wires with the complicated crossings, switches, etc.

Frank J. Sprague spoke at some length touching upon the arguments brought out at the previous discussion. He believes that we have not yet reached the limit of continuous-current distribution, and it is possible to use continuous current at higher voltages than are now customary.

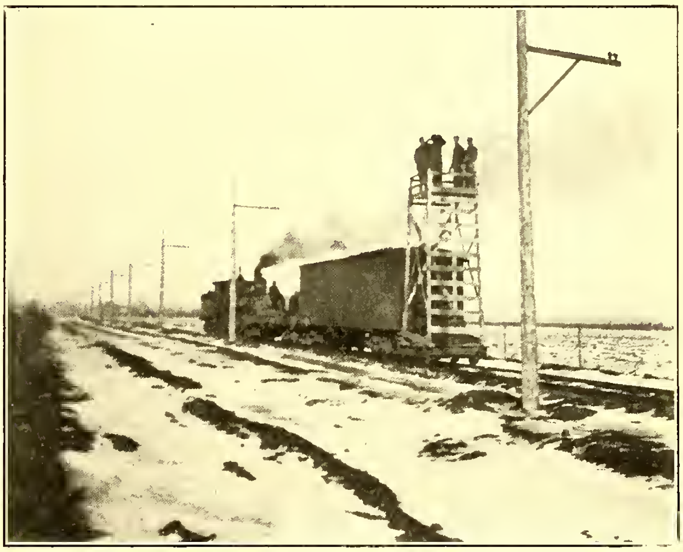
Additional remarks were made by Messrs. Rice, vice-president of the General Electric Company; Mitchell, Hibbard, Sprague and others, and Mr. Potter then closed the discussion, referring briefly to some of the points already brought out in the paper and the discussions.

THE OPENING OF THE BLOOMINGTON, PONTIAC & JOLIET SINGLE-PHASE RAILWAY

The Bloomington, Pontiac & Joliet Railway Company last week opened for traffic that part of its line between Pontiac and Odell, a distance of 10.4 miles. This road is equipped with single-phase, alternating-current motors of General Electric Company manufacture. That portion of the road now under construction is to extend from Pontiac to Dwight, a distance of 20 miles. It was considered by the Arnold Company, of Chicago, which has done the engineering of this road, that the situation was one calling for a low investment, and that a single-phase alternating-current trolley line was the best thing to install. The generator is located in the power station of the Pontiac Light & Water Company, which is owned by the same interests that control the railway company.

By using single-phase alternating current on the trolley at 3300 volts, it is intended to operate the whole line as far as Dwight without any feeders by simply connecting the power station at one end of the two No. 00 trolley wires with which the road is equipped. The overhead construction is very simple on the interurban portion. The trolley wires are hung from 3/8-in. steel stranded catenary cables. The trolley wires are grooved No. 00, and are to be supported from the catenary every 10 ft., though at present the supports are placed only every 100 ft. midway between the poles. The poles are placed 7 ft. from the center of the track. Instead of iron brackets a wooden cross-arm 3 ins. x 5 ins. in cross section and 7 ft. 9 ins. long extends out from the pole over the track, and is supported by a 3-in. x 3-in. wood brace. The cross-arm and brace are fastened to the pole as well as to each other by malleable iron fittings. The poles are 35 ft. long, set 7 ft. in the ground. The trolley wires are supported 19 ft. 6 ins. from the track. The catenaries are insulated by Thomas brown porcelain center bearing insulators placed 10 ins. apart. These insulators are mounted on malleable iron pins, on to which they are cemented with Portland cement. The trolley wire is supported by mechanical clips on which are bronze hooks, which slip over the catenary cable, and are hammered down so as to prevent them from coming loose.

Inside the city of Pontiac side pole instead of bracket construction was adopted. Both the trolley wires and the catenary cables are supported from span wires, the catenary spans being just above the trolley spans. The catenaries are used for safety. The insulation of trolley and catenary conductors is obtained entirely by strain insulators of impregnated wood 24 ins. long, similar to those used on the Schenectady-Ballston line, upon which the first General Electric experiments were tried. Additional insulation is secured by porcelain insulators located at the pole to which the span wire is attached. The ordinary form of trolley pole and wheel are to be used, exceptional precautions, however, being taken to insulate the trolley base. Drawings of the line construction are given in the paper which George A. Damon, managing engineer of the Arnold Company, presented to the American Institute of Electrical Engineers, March 24, and will be published in the next issue of this paper. The description of the cars purchased from the American Car Company for this road appeared in the Street Railway Journal of Feb. 18, 1905. They are equipped with four 75-hp G. E. A-605 25-cycle series compensated motors. Unlike the cars on the Schenectady-Ballston line, which had to operate on both direct and alternating current, these cars are equipped with a



METHOD OF STRINGING OVERHEAD WIRES ON THE PONTIAC SINGLE-PHASE LINE, USING A CONSTRUCTION LOCOMOTIVE

method of control which varies the speed of varying potential through the medium of a transformer, being designed for use on an alternating-current supply only. The cars have 25-cycle are headlights, the operation of which will be watched with considerable interest. No sub-stations are used on this portion of the line.

The Bloomington, Pontiac & Joliet Electric Railway is to form one of the important links in the chain of interurban roads which will probably be soon completed between Chicago and St. Louis.

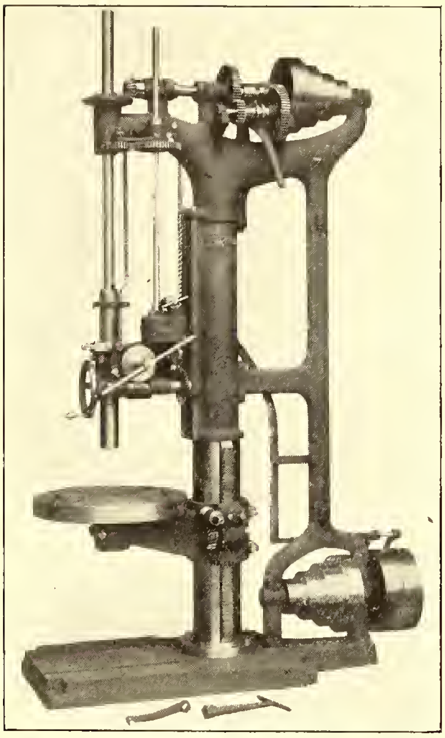
The officers are J. A. Carothers, president; W. F. Van Buskirk, treasurer, and F. L. Lucas, general manager.

Springfield, Ohio, has obtained membership in the Central League of Baseball Clubs, and the quarters of the home club will be at Hill Top Park, which is owned by the Springfield, Troy & Piqua Traction Company. The company will give a 5-cent fare and local service to the park, and will probably arrange to haul cars in trains to baseball games. The company will enlarge the grand stand and make other improvements to the park.

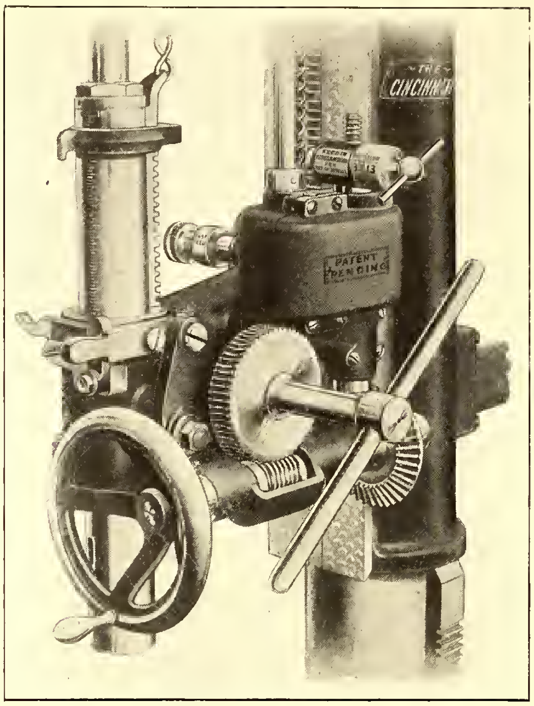
The annual report of the Union Depot Company, which operates the union passenger station (steam) in Columbus, Ohio, indicates that the local business on all the lines using the station had decreased considerably, owing to the competition of electric roads. Only the World's Fair business saved the station from a large decrease in gross earnings as compared with the year previous.

NEW HEAVY DESIGN OF UPRIGHT DRILL

One of the most important of the machine tools required in electric railway repair shops is the drilling machine. From the very nature of the work usually encountered, which tends naturally toward truck and underrigging detail repairs, the use of a drill is a prime necessity. Furthermore, the day is past when the ordinary simple design of drill, or makeshift second-hand device, will meet the requirements of repair shop work; the modern railway shop operating under the stress of present-day service must be equipped with the most rapid and efficient tools that can be had, in order to turn out the maximum quantity of work.



THE NEW DESIGN OF UPRIGHT DRILL, WITH GEARED FEEDS



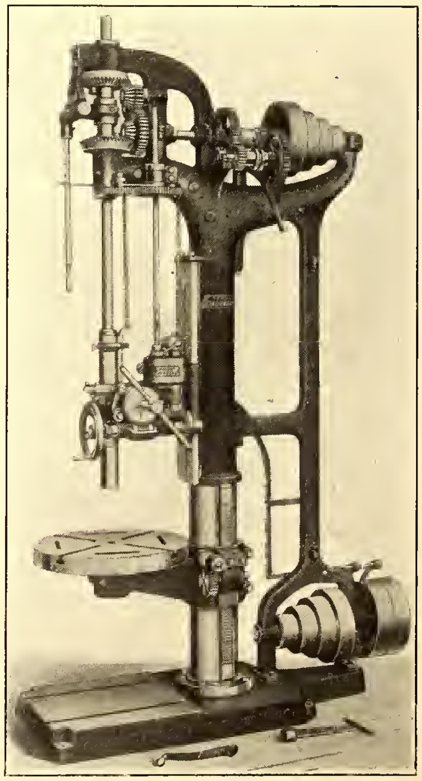
DETAIL VIEW OF THE POSITIVE GEARED FEED MECHANISM USED

In anticipation of the increasing requirements in this direction, the Cincinnati Machine Tool Company, Cincinnati, Ohio, specialists in the manufacture of drilling machinery, have recently added still further improvements to their extensive line of upright drills, which make them of particular interest to repair shop men. Their latest designs of heavy pattern upright drills are illustrated herewith, both the standard drill and the same with their new geared tapping attachment being presented. An additional view illustrates the improved positive geared feed mechanism which forms one of the most interesting features of the new drill.

It will be noticed that the feed cones formerly placed on the top of the drill have now been entirely eliminated and that the feed is now obtained entirely through gears. In this respect the drill differs from many others on the market which have a series of gears attached to the feed rod at the top of the machine, and is the only machine which has the feed changes placed directly on the head. It is now equipped with an entirely gear-driven feed, which has a quick-change feed box attached to the sliding head of the machine, so as to be most convenient for the operator. Through this mechanism six feeds in thousandths per revolution of the spindle are instantly obtained through the movement of a conveniently placed handle, as follows: 6-, 9-, 13-, 18-, 27- and 39-thousandths. An excellent idea of its mode of operation may be obtained from the detail view of the mechanism; as it is shown, the feed is set for 13- or 39-thousandths per revolution of the spindle, according as the slow or fast feed is used. This change from fast to slow is very conveniently made from a little button at the left of the gear box, and not at the point where the spindle drives the feed rod at the top of the machine, as is usual in other styles of drills.

The detail view shows also incidentally the arrangement of feed drive to the spindle and the automatic depth gage for throwing out the feed when the spindle has descended a predetermined distance. For this latter purpose the spindle is graduated in inches and provided with an adjustable throw-out pointer which, after descending close to the arm, presses downward the feed-release lever shown above the hand wheel. This results in dropping the worm out of mesh with the large work gear. The feed drive from the mechanism to the spindle takes place through the horizontal shaft carrying the worm and hand wheel; the worm meshes with the large worm wheel on the shaft above, which passes at a right angle through the arm to drive the spindle rack. This latter shaft when released from the worm is used for quick adjustment of the drill to or from the work.

It will be further noticed from the standard drill that the main drive from the upper belt cone to the spindle is through a conveniently arranged back gear, which may be shifted by the mere throwing of a lever conveniently placed at the right of the frame. This lever operates by throwing a jaw clutch so as to clutch in either the fast or the slow drive. The belt shifter is operated by a handle at the left of the frame, which comes close to the table and is convenient to the operator. While this machine is shown as arranged for belt driving, the design is such as to easily permit the application of the motor for direct driving. The company has designed a special type of bracket which is easily bolted over the back-stay of the drill frame so as to bring the motor directly above the outside belt - driving pulley. This makes a very convenient and easily applied support for the motor; one of its most convenient features lies in the fact that it can be applied to the Cincinnati drill at any time,



THE NEW CINCINNATI DRILL, WITH GEARED TAPPING ATTACHMENT whether the drill is a new or old one. The gear-tapping attachment which this company has designed for application to its upright drill has many features of advantage. It is, in fact, the only attachment of its kind which may be placed directly upon the standard design drill so as to form a part of it, and which has a ratio of return to advancing speed of 2 : 1. By its use the operator is enabled to start, stop or reverse the machine at will through the lever shown at the front of the spindle. It will be seen at a glance that this arrangement will greatly facilitate the operation of tapping of holes. By merely pulling the handle outward, the tapping drive is started at the slowest speed, while pulling the handle to its neutral position, the drive is instantly stopped; by pushing the handle inward, the return or backing-out drive at the double speed is thrown in.

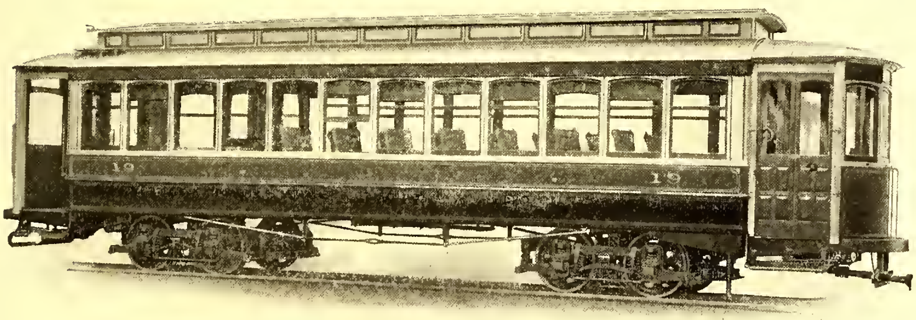
The Cincinnati Machine Tool Company manufactures these drills as a specialty, devoting its entire time to this class of work. Drills are built either plain or with the tapping attachment, as desired, and in sizes from 21 ins. to 42 ins.

SPECIFICATIONS OF THE 24-IN. CINCINNATI DRILL

Height of drill	8	ft.
Drills to the center of	25	ins.
Distance between base and spindle	48	"
Distance between table and spindle	36½	"
Traverse of table on column	19¾	"
Traverse of head on column	21¼	"
Diameter of table	22	"
Diameter of spindle in sleeve	1 11-16	"
Diameter of spindle above sleeve	1 9-16	"
Traverse of spindle	9	"
Revolutions of countershaft per minute		250
Floor space required	21½ ins. x 58 ins.	
Weight of drill, pounds		2,000

ROLLING STOCK FOR NEWPORT NEWS

Nine semi-convertible cars built by the J. G. Brill Company have recently been placed in operation on the lines of the Newport News & Old Point Railway & Electric Company, Virginia. The cars are intended for use in the city of Newport News and for suburban service between Newport News and Old Point. The railway company has seventy-five cars in commission and about 30 miles of track.



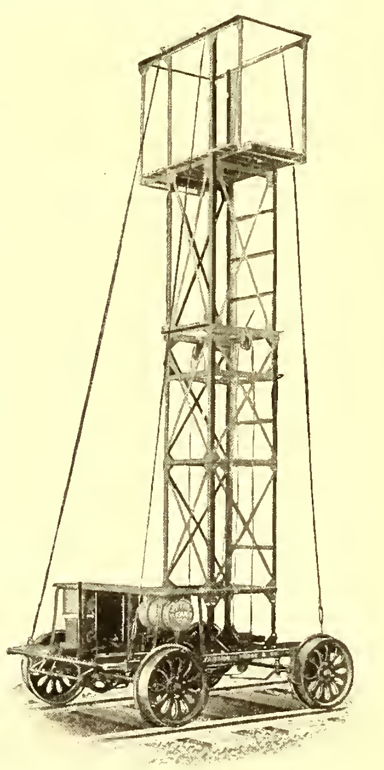
DOUBLE-VESTIBULE SEMI-CONVERTIBLE CAR FOR NEWPORT NEWS, VA.

The cars measure 33 ft. 4 ins. over the end panels and are 8 ft. ½ in. wide over the sills. They are seated for forty-four passengers and have a smoking compartment 8 ft. 9 ins. long at one end. The cane-covered seats, 24 ins. high, are of the double-roll back type and have grab handles attached. The interiors are handsomely finished in cherry, with ceilings of decorated birch. The semi-convertible window system particularly adapts the cars to the mild climate of Hampton Roads, as the sashes may be changed at will and held at any height, or raised entirely into pockets in the side roofs, thus admitting any amount of air desired. The advantages claimed for the roof pockets are that there is a gain of several inches in the interior width of the car, and that there is no danger of fingers being pinched, nor glass broken, as is so often the case where wall pockets are used.

The builder's specialties used include angle-iron bumpers, radial draw-bars, "Dedenda" gongs, "Retriever' bells, vestibule door controlling devices and sand boxes. The general dimensions of the cars are: Length over the crown pieces and vestibules, 43 ft. 4 ins., and panel over the crown pieces and vestibules, 5 ft.; width over the posts at the belt, 8 ft. 4 ins.; sweep of the posts, 1¾ ins.; centers of posts, 2 ft. 8 ins.; side sill size, 4 ins. x 7¾ ins., plated with ⅜-in. x 12-in. steel; end sill size, 5¼ ins. x 6⅞ ins.; thickness of the corner posts, 3¾ ins., and of the side posts, 3¼ ins. The No. 27-G trucks on which the cars are mounted have a wheel base of 4 ft., and 33-in. wheels.

A GASOLINE EMERGENCY AND INSPECTION CAR

On an interurban road where it is difficult to reach the scene of an overhead line break-down with a trouble wagon within any reasonable time, and where the breaking down of an overhead line may result in cutting off the current supply so as to prevent an electric motor car from reaching the scene of the accident, a gasoline emergency car may be a very desirable addition to the rolling stock of a company. Such a car is now being offered by Fairbanks, Morse & Company, of Chicago. This car is equipped with either a wood or steel tower for overhead line work. The gasoline engine, which is of the automobile type, is capable of running the car up to a speed of about 30 m.p.h., or it can be operated at very slow speed if necessary for repair work. It can be reversed at a speed of about 10 m.p.h. The gasoline engine, being always ready without a constant expense in keeping up fires, is certainly preferable to a steam locomotive as an emergency wrecking car. The car embodies principles well tried in gasoline automobiles and railroad speeders, so that there is really nothing experimental about the outfit. On the whole, it is rather remarkable that more emergency cars of this kind are not in use.



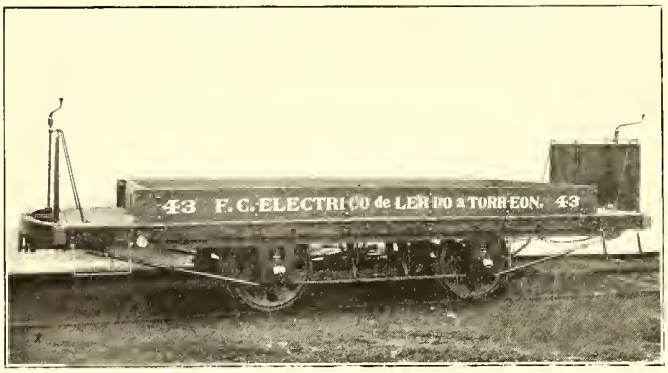
GASOLINE EMERGENCY AND INSPECTION CAR

INSTRUCTION CAR FOR SCHENECTADY

The Schenectady Railway Company has secured from the General Electric Company the skeleton car which it exhibited at the Louisiana Purchase Exposition to show the details of the equipment all exposed. The car will be used by the Schenectady Company as an instruction car for employees.

PLATFORM CARS FOR CENTRAL MEXICO

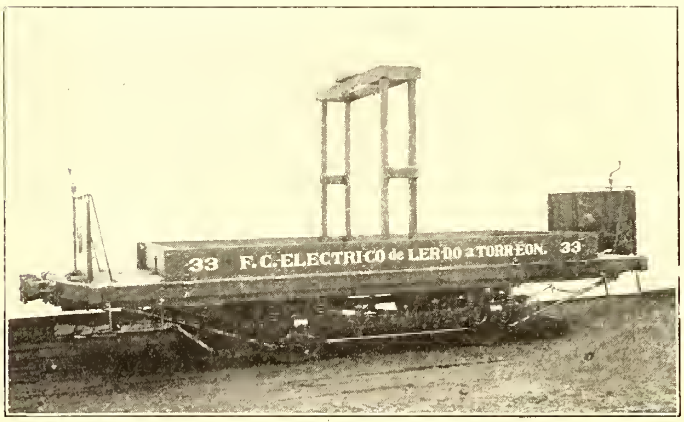
The platform cars shown in the accompanying cuts were recently shipped by the American Car Company to the Ferrocarril Electrico de Lerdo a Torreon, Mexico, where they will be placed on the 8-mile line between Lerdo and Torreon. The motor car with the trolley bridge is intended for use as a locomotive as well as for carrying loads, while the other cars are simply for use as trailers. This type is used for construction work and for carrying freight, and has proved quite profitable to the railway company. The cars are strongly built and will



TRAILER PLATFORM CAR FOR FERROCARRIL ELECTRICO DE LERDO A TOREON

stand plenty of hard work and can be put to a great variety of uses. The railway company operates a number of this type which have been built by the American Car Company.

The motor car is 21 ft. long over the end sills and 2 ft. 6 ins.



PLATFORM MOTOR CAR WITH TROLLEY BRIDGE

from the end of the body to the outside of the dasher. The width over the sills is 7 ft. It is mounted on Brill No. 7 trucks, with 7-ft. 6-in. wheel base and 33-in. wheels. The trailers have the same dimensions as the motor car, and are mounted on Brill equalizing running gear trucks. Brill brake rigging, "Dedenda" gongs and angle-iron bumpers are included in the equipment.

The Schoen Steel Wheel Company, of Pittsburg, has recently closed an order for 2700 of its solid rolled-steel wheels with the Brooklyn Rapid Transit Company. These wheels are for use on 200 passenger surface cars, 50 freight surface cars and 100 elevated cars. Particulars of the order for the cars on which these wheels are to be used was published in the Street Railway Journal for March 11. This order is probably the largest single order for steel wheels ever placed for surface electric railway use.

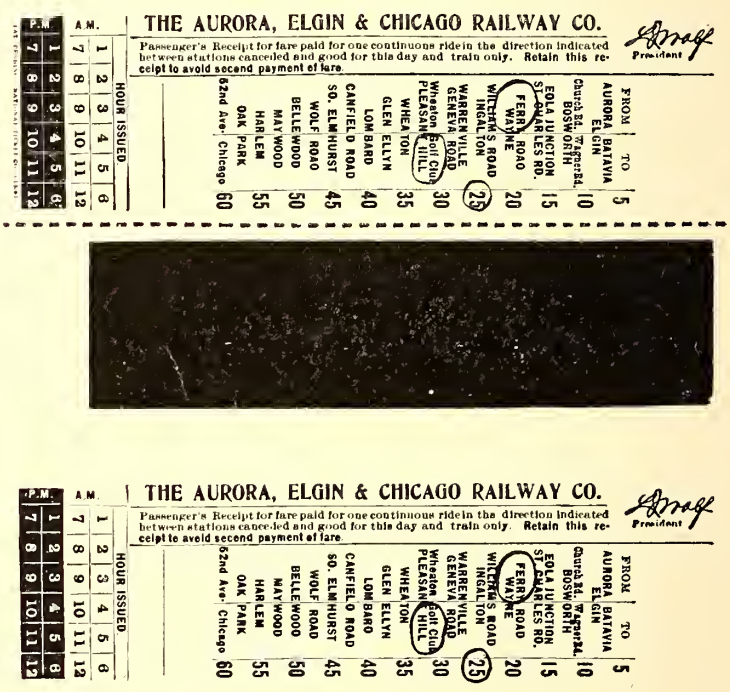
NEW INTERURBAN TICKET

The National Ticket Company, of Cleveland, is putting out a novel form of interurban ticket, which consists of a cash fare receipt in combination with a concealed duplicate.

The ticket comprises three sections, which are designed to be folded one upon the other. The first or upper section bears a list of the stations "from and to," a column of fares between stations and a time indication. The third or bottom section is a duplication of the first. Between these two is a blank section having a carbon coating, so that any marks made on the first will be reproduced upon the third. The second and third sections are sealed along the edges, and it is impossible to get at the third section without cutting along the edge.

To issue a receipt the conductor marks with an indelible pencil around or through the stations "from and to," and amount of fares paid, and any other data the road may require. The conductor then tears off the first section and gives it to the passenger as a cash fare receipt. After the receipt is issued the conductor cannot alter the marks on the concealed section without mutilating the ticket.

The auditor opens the concealed duplicate with a letter opener, or in cases where large numbers of tickets are used, several hundred may be stacked up and cut with a small paper



TELL-TALE INTERURBAN TICKET

cutter. The receipts are numbered in duplicate and bound in books of fifty. A metal case with hinged cover is furnished, which affords a smooth hard surface to support the paper while it is being marked.

COST OF SNOW REMOVAL IN BROOKLYN

Some figures as to the cost of snow removal on the lines of the Brooklyn Rapid Transit Company during the last four years have become available since the publication of the article last week on "The Effect of the Past Two Winters." They are as follows:

	Per mile of single track.
Average of two years ending June 30, 1903......	$113.61
Average of season of 1904....................	199.94
Average of season of 1905, up to March 1......	203.87

These figures, like those published last week, show a very large increase for this item during the last two years.

FINANCIAL INTELLIGENCE

Wall Street, March 22, 1905.

The Money Market

There was a decided improvement in the money market this week. The demand for funds was more active than in the preceding week, and rates responded to the heavy losses in cash sustained by the local institutions on the interior movement, and by the payment of $13,500,000 government funds by the depository banks. At the beginning of the week the rate for call money advanced to 4 per cent on the shifting and calling of loans preparatory to the payment of the Standard Oil dividend and other large disbursements, and although the rate later yielded to 2½ per cent on liberal offerings, the ruling rate for the week was about 3¼ per cent, as against 2½ per cent, the rate at which the bulk of the transactions were made in the previous week. The advance in call loans was followed by a general marking up in the rates for time contracts to 3½ per cent for all maturities. Local banks declined to offer with the customary liberality, and for the first time in many weeks borrowers were compelled to pay the full asking rates. A feature of the week was the heavy offerings, both on call and on time, by the international houses against exchanged transactions, and had it not been for this source of supply, it is probable that rates for all classes of accommodations would have attained a higher level. As a result of these operations by foreign houses, sterling exchange broke sharply to 4.8595 for prime demand bills, a loss of about 85 points for the week, and the lowest point attained thus far this year. The bank statement published last Saturday, although an extremely bad document, was, in some respects, better than was generally anticipated. The decrease in cash was $7,430,000, nearly $4,000,000 less than the preliminary estimates. The decrease in loans of $5,241,900 was probably due to the shifting of loans to other institutions. Deposits decreased $13,227,700. The reserve required decreased $3,306,925, which, subtracted from the loss in cash, left a decrease in the surplus of $4,123,928. The surplus is now $5,154,175, as against $27,310,575 in the corresponding week of 1904, $3,180,400 in 1903, $3,471,350 in 1902, $16,272,425 in 1901, and $5,817,300 in 1900. Mercantile paper was more active, owing to the preparation for the spring trade. Rates are firmly held at 4 per cent as the minimum for the best names. The market at the close, although a trifle easier in tone, was unchanged as to rates. It is expected that rates will rule at about the present level, at least for the present. The banks are already taking out new circulation against the bonds released by the payment of government money, which will increase the supply of lendable funds. It is also pointed out that so long as the present easy conditions prevail in the European money markets, international institutions will continue to offer funds liberally in the local market, which will operate against any appreciable advance in interest charges. Discount rates at the principal European centers remain practically unchanged from a week ago.

The Stock Market

Extreme irregularity in values characterized the dealings in the stock market this week. At the beginning the trading was upon a rising scale of activity, but the increase in activity was in most instances accompanied by a lower range of prices. The improvement in prices for American stocks in London, and the subsequent heavy purchases for foreign account, had absolutely no influence upon local sentiment. The expectation of dearer money, and reports of trouble at Paris, were used effectively by the advocates of lower values, and in many of the recently active issues prices were forced down from 1 to 2 per cent. New York Central and Union Pacific, and in the industrial, Colorado Fuel & Iron and American Smelter were especially weak, the weakness in the latter stock being attributed entirely to the death of one of the promoters of the company. Later, there were sharp recoveries from the low prices. The improvement, however, was only temporary. On Saturday, the Western element was decidedly bearish and sold stocks freely, which together with short sales by the local traders resulted in another sharp downward movement in values. Pressure against New York Central and St. Paul was pronounced, but just before the publication of the bank statement there was extensive covering by shorts which brought about a sharp rally on comparatively light purchases, but after the receipt of the statement there was renewed selling, and the market again displayed a reactionary tendency. At the opening of the present week, renewed pressure was brought to bear in certain quarters of the market, but this attempt to lower prices was not entirely successful. The failure of money rates to harden appreciably, and the reports of heavy traffic from Western traffic managers of all the leading roads, together with the continued improvement in all of the leading industries, imparted a decidedly firm tone to the market, and prices recovered sharply. Conspicuously strong features of the week were New York, Ontario & Western, American Locomotive, and some of the Southern Iron & Steel stocks, the strength in the latter group being due to the renewed talk of progress in the merger negotiations. Republic Iron & Steel issues were strong on prediction of an early resumption of dividends on the preferred stock. Tennessee Coal & Iron was also strong, but later declined about a point on the declaration of a 1 per cent dividend on the common stock, being the first since 1900. Toward the close the market became considerably less active, and on renewed attacks by the bears prices ran off sharply. The closing was weak. The bond market was fairly active and in the main prices held firm. That a good demand still exists for high-grade issues is evidenced by the fact that the $25,000,000 American Telephone & Telegraph 4 per cent gold bonds were largely over-subscribed before the opening of the books. Of the total amount, nearly $10,000,000 were taken abroad. Another feature of the bond market this week was the successful flotation of the £1,000,000 sterling St. Paul, Minneapolis & Manitoba Railway Company, Pacific Extension, 4 per cent bonds.

The local traction issues were irregular, but prices generally ruled comparatively firm.

Philadelphia

The local market for traction issues was fairly active this week, and although prices displayed more or less irregularity, the undertone was generally strong. In the early dealings all of the active issues sustained fractional losses, as a result of sales to realize profits, but toward the close the market grew firmer, and many of the leading issues more than recovered the early declines. One of the principal features of the trading was the activity and strength in Philadelphia Rapid Transit. From 30¼, at the opening, the price ran off to 29½, but later a fairly heavy buying movement developed which advanced the stock to 31¼, the close being at 31⅛, a net gain for the week of ⅛. About 20,000 shares of the stock changed hands. Philadelphia Company common was conspicuously strong. The initial transactions were made at an advance of 2⅜ over the previous close on the report of a deal by which the United Gas & Improvement would absorb the company. Later the price ran off about a point, but toward the close there was a recovery to within a small fraction of the highest. Upward of 35,000 shares were traded in. No confirmation of the rumor of a deal was obtainable. United Gas & Improvement, on the other hand, displayed pronounced weakness, the price declining from 116¼ to 114¾, but in the late dealings there was a recovery to 116⅜, which price represents a loss of ⅞, as compared with last week's closing figure. About 9000 shares changed hands. Philadelphia Traction ruled strong, several hundred shares selling at 100⅛ and 100. Other transactions included 10,000 shares Philadelphia Electric at prices ranging from 10½ to 10⅞, Railways General at 3⅞ to 3¾, Union Traction at 59 to 58¾, United Traction, of Pittsburg, preferred at 49⅞, United Companies of New Jersey at 273½, and Consolidated Traction of New Jersey at 82½ to 83.

Chicago

Trading in the street railway stocks was upon an extremely small scale this week, there being little disposition on the part of traders to deal actively, in view of the uncertainty regarding the franchise situation. Early in the week, officials of several of the local lines announced their intention of going ahead with the contemplated improvements, such as ordering new cars, and otherwise improving the service regardless of the municipal election. These plans, however, may be altered in view of the action of the Mayor and City Council in rescinding the ordinance granting an extension of the franchise rights to the City Railway Company. The Council also ordered the Corporation Counsel to file suit at once against the company to test the validity of the ninety-nine-year act, which the company contends extends its rights. The ordinance, however, contains a provision that the company shall be allowed to operate its lines preceding the result of the suit.

The Elevated Railway stocks were extremely quiet, but strong. Metropolitan common advanced from 23⅜ to 24, while the preferred rose from 65½ to 65⅞. South Side "L" jumped from 96 to 97¼ and closed at 97. Chicago & Oak Park common sold at 6⅝ to 6⅞, while the preferred brought from 20⅞ to 21½. Chicago Union Traction sold to the extent of 400 shares at 12¼ to 12⅛, and North Chicago brought 88½. West Chicago sold at 60.

Other Traction Securities

Interest in the Baltimore market centered largely in the United Railway issues, all of which were active and reactionary. The stock opened at 16½, and under moderate pressure the price ran off to 14½. Subsequently, there was a partial recovery, the closing being at 15¼, or 1¼ points below last week's closing. Announcement was made that the pool in charge of Alexander Brown and George C. Jenkins, as trustees for the common stock, was closed on March 15, and it is understood that considerably over a majority of the stock was deposited. The agreement runs for three years, and provides that the trustees may sell the stock on terms approved by 75 per cent of the stock deposited. The income bonds were extremely active at declining prices. From 66, at the opening, the price declined to 64½, with a subsequent rally to 65½. Nearly $400,000 of the bonds were traded in. The 4 per cent bonds were relatively firm, about $40,000 of them selling at from 94½ to 93⅝, and back to 94. Other strong features were the Indiana Northern Traction 5s, $30,000 of which sold at 97⅛, and Lexington Street Railway 5s at 103¾ to 104¼. Other transactions included Augusta Railway 5s at 104½, North Baltimore 5s at 121, City & Suburban 5s at 114⅜ to 114¾, and Macon Railway & Light 5s at 98¾. In the Boston market trading in the street railway issues was practically at a standstill. About the only issue to display activity was Boston & Worcester common, about 3000 of which sold at prices ranging from 29½ to 32, while the preferred brought 76 and 76½. The strength in these shares was attributed to the preparations making for the installation of a freight and express service upon its lines, which it is expected will increase the gross earnings of the company by $125,000 a year. Massachusetts Electric common and preferred were also strong, the first named advancing to 19⅛, and the preferred to 65, with a subsequent reaction to 64. Boston Elevated sold at 156 and 155½. Other transactions included West End common at 98½ to 98, and the preferred at 116. On the New York "curb" the dealings in Interborough Rapid Transit were somewhat smaller than in the preceding week, but the price fluctuations continued erratic. From 219⅜ the price dropped to 212 ex the dividend of 1¾ per cent, but at the close there was a rally to 215. Upward of 12,000 shares were dealt in. New Orleans Railway new stock displayed decided strength, about 2000 shares changing hands at from 25⅜ to 26⅜, an advance of about 1½ points. Bid prices for the old common and preferred stock advanced 1 and 1¾, respectively. United Railways of St. Louis preferred was strong, 400 shares selling at 79½ to 80. Washington Railway 4s were fractionally higher, at 89¾.

Security Quotations

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

	March 15	March 22
American Railways	52½	52
Boston Elevated	155	155
Brooklyn Rapid Transit	66¾	66¼
Chicago City	a199	199
Chicago Union Traction (common)	12¼	11
Chicago Union Traction (preferred)	47¾	45
Cleveland Electric	82½	82½
Consolidated Traction of New Jersey	81	81
Consolidated Traction of New Jersey 5s	110¼	110¼
Detroit United	81½	80¾
Interborough Rapid Transit	214	*214
International Traction of Buffalo	29	27
International Traction of Buffalo (preferred)	64½	62
International Traction of Buffalo 4s	81	82½
Manhattan Railway	171	169
Massachusetts Electric Cos. (common)	a18½	18¼
Massachusetts Electric Cos. (preferred)	a64½	63
Metropolitan Elevated, Chicago (common)	23	23¼
Metropolitan Elevated, Chicago (preferred)	65	65
Metropolitan Street	122½	123⅝
Metropolitan Securities	84¾	87
New Orleans Railways (common)	3½	4½
New Orleans Railways (preferred)	14	16
New Orleans Railways, 4½s	81	81½
North American	103	100⅝
North Jersey Street Railway	23	23
Philadelphia Company (common)	46¾	47
Philadelphia Rapid Transit	29¾	30¾
Philadelphia Traction	100	100
Public Service Corporation 5 per cent notes	97¾	97¾
Public Service Corporation certificates	72	72
South Side Elevated (Chicago)	a95	—
Third Avenue	130	129
Twin City, Minneapolis (common)	109	109¼
Union Traction (Philadelphia)	58¾	58⅞
West End (common)	98	98
West End (preferred)	115¼	116

a Asked. * Ex-div.

Iron and Steel

The "Iron Age" says the most interesting event of the week has been the sale of 200,000 tons of steel billets, the largest transaction of its kind for a long period. The purchaser was the Pittsburg Steel Company, owning a large wire mill at Monessen, and a barhoop mill at Glassport, Pa. The company does not make steel, and using, as it does, about 200,000 tons of billets per annum, is the largest single consumer in the country. It is understood that the sale is on a flat price, somewhat above the market, on 1½ inch billets for the hoop mill, but that no difference has been made in the price of Bessemer and of open-hearth steel. The sale of this large quantity of semi-material for delivery during the year, beginning July, 1905, is significant as showing confidence of buyers and sellers in the market. The United States Steel Corporation has prepared to bring down 19,000,000 tons of lake ores, while outside interests are arranging to ship 14,000,000 tons, a total of 33,000,000 tons, against the record of 27,570,000 tons in the banner year of 1902.

A PROJECT IN THE BLUE GRASS REGION

An important project for building interurban lines in the Blue Grass region is backed by Louis des Cognets, president of the Lexington Railway Company, of Lexington, Ky.; D. F. Frazee and J. W. Rodes, of the Phœnix National Bank, of Lexington, and others. The enterprise will be officially known as the Central Kentucky Traction Company, a company of that name having been incorporated with a capital stock of $200,000. This company will succeed to all the rights of the Fayette Interurban and the Blue Grass Consolidated Traction Companies, and will carry out in their entirety, so it is said, the plans of these companies. Unofficially it is said that the first line to be built will be the one between Lexington and Versailles.

ST. PAUL FRANCHISE CONTROVERSY SETTLED

A compromise has been agreed to between the city of St. Paul and the Twin City Rapid Transit Company regarding the rights of the latter in the city of St. Paul. The contention of the city was that the company's franchise was void, and it was proposed to bring suit against the company on this ground to oust it from the streets. What the result would have been of this litigation if carried to the courts is a matter for speculation. At any rate, it has been decided peaceably to settle the question. As a result, the company has agreed, among other things, to a 6 per cent tax upon its earnings, less what is paid in city, county and State taxes, and to make certain improvements to its system which are mostly of purely local interest.

AN INTERURBAN LINE BETWEEN HOUSTON AND GALVESTON

Johnston & Read, of Houston, Texas, have secured a charter from the State of Texas for the Houston-Galveston Electric Railway Company, with a capital stock of $1,350,000. The company is formed for the purpose of building and operating an electric railway, to run between Houston and Galveston, a distance of approximately 52 miles.

Johnston & Read are now located in Houston, and it is their purpose to build the proposed line at a very early date. An engineer corps is now in the field locating the line. This firm constructed, and now owns and operates, the Trinidad Electric Railway and the Trinidad Light & Power Company at Trinidad, Col. Mr. Read, of the firm, organized and constructed the Coal Belt Electric Railway at Marion, Ill. The first board of directors of the Galveston & Houston Company is as follows: Frank P. Read, W. M. Johnston, R. M. Johnston, George L. Horton and A. D. Trotter.

THE BOSTON-PROVIDENCE HEARINGS

Several important hearings on the proposed interurban line to be built between Boston and Providence were held in Boston last week before the legislative committee on street railways. The first proposition to be presented was that of the Shaw and Gaston group of capitalists, represented by Congressman Samuel L. Powers. Attorney William H. Coolidge, of the Boston & Maine Railroad appeared in opposition.

Congressman Powers stated that it was hardly necessary to argue the need of a high-speed electric railway between Boston and Providence. The two cities have a joint population, including suburbs, of nearly 2,000,000, are only about 40 miles apart, and the territory between is capable of great development. Massachusetts has been slow in building interurban roads, but its one notable example, the Boston & Worcester Electric Railway, has been a success. This road last year carried 8,000,000 5-cent fare passengers, of which 5,000,000 were through passengers. In 1890 the proportion of trolley to steam railway mileage was as 1 to 27, while in 1904 it was as 1 to 8. The speaker then described the interurban railway development of the Middle West, and discussed at length the advantages of a private right of way.

The Shaw-Gaston project is to build a double-track road from Forest Hill to the Rhode Island line, making arrangements with the Boston Elevated Railway Company and the Rhode Island Company to run cars through from Park Square, Boston, to Haymarket Square, Providence. It is hoped to make a schedule time of 1 hour and 55 minutes; line to be as much as possible on private right of way. It is not intended to sell power, except to other connecting street railway companies. The right of eminent domain is an absolute necessity if the line is to be built.

M. A. Cavanaugh, a street railway surveyor and contractor, then testified that the proposed route was 41.5 miles in length, and that it would pass through Boston, Hyde Park, Dedham, Norwood, Westwood, Canton, Sharon, Foxboro, Mansfield, North Attleboro, Attleboro and South Attleboro to the Pawtucket line. In Hyde Park and in Rhode Island it would be necessary to operate in the streets. The right of way would be about 50 feet wide. The heaviest grade after leaving Readville would be 3 per cent, and some heavy cuts and fills would be necessary. Between Readville and the Rhode Island line 24 highways would be crossed, but none of these would be grade crossings. Five trolley lines would also be crossed, serving as feeders. In round numbers the cost of the road would be $3,000,000, or $72,000 per mile of route, using the most modern equipment. Possibly the cars would be equipped for third rail operation on the Boston Elevated.

James L. Shaw testified that the Boston & Worcester Street Railway, of which he is president, carried 500,000 people last year between Boston and Worcester, and that 25 or 30 per cent of this was pleasure traffic. Summing up the history of his efforts to build a line between Boston and Providence, Mr. Shaw stated that the original intention was to run into Boston over the Boston & Worcester tracks, but this project, assumed a year and a half ago, was given up, as other interests were found to be planning a shorter line with faster running time, and a connection with the Boston Elevated.

Charles H. Blood, an attorney representing W. O. Chapman and others, then spoke in favor of a charter being granted to the Boston & Rhode Island Electric Company, capital stock, $1,000,000. His route would be from Forest Hills through Hyde Park, Milton, Canton, Sharon, Foxboro, Mansfield, North Attleboro, Attleboro and Seekonk to Providence. His company does not propose to carry freight, and could make the run in 1 hour and 42 minutes, with a fare of 55 cents. He estimates the total cost of construction as $2,000,000. This project is backed largely by residents of the territory to be covered.

Continued hearings on the Boston and Providence interurban electric railway bills have been held during the past few days. Additional information was brought out by Charles H. Blood, attorney for the Boston & Rhode Island interests. The proposed fare by the backers of this road would be 55 cents, of which 5 cents would be paid to the Boston Elevated Railway Company, and 10 cents to the Rhode Island Company, operating in Providence. W. O. Chapman, of Canton, one of the petitioners, testified that the proposed electric line fills a place which the steam railroads cannot, and that his route is the shortest, easiest in grades, cheapest to build, least expensive to operate and would accommodate the largest number of people. In Mr. Chapman's opinion, this line could be built for $1,000,000 less than any other proposed line. The cars each would be equipped with four 125-hp motors, and would be capable of a maximum speed of 60 m.p.h. A 66 ft. right of way, large enough for 4 tracks, had been figured. The total estimated cost is $2,000,000. The through business constitutes the main reason for building such a line.

The next bill heard was that of W. F. Garcelon and others for the incorporation of the Massachusetts & Rhode Island Electric Railway, an enterprise backed by Stone & Webster, of Boston. The capital stock is $1,500,000, and the proposed route connects with the Boston Elevated at Mattapan, running through the towns of Milton, Canton, Stoughton, Sharon, Easton, Foxboro, Mansfield, Norton, Attleboro, Rehobath and Seekonk, where it connects with the Providence system. Attorney H. H. Newton stated that in view of the present connection of the Blue Hill Street Railway with the Boston Elevated it would be necessary for the company to build for only 22 miles, and that solely a passenger business was wanted. Nor was the right of eminent domain desired. The road would accommodate a very large number of people not now served by steam roads or electric lines. The estimated running time is about 2 hours, and the fare, 50 or 60 cents. Geo. M. Thompson, consulting engineer, was then called and stated that in his opinion a double-tracked road of this character could be built for $66,000 per mile, including equipment.

Frederick S. Pratt of the executive committee of Stone & Webster then discussed the subject of interurban roads at length. He stated that Stone & Webster's experience had been that high-speed roads, with their expensive roadbed and equipment, could not be operated at a profit without correspondingly high rates of fare. Thus, the Puget Sound line, between Seattle and Tacoma, was operated at a loss until it began to carry freight. This road is 37 miles long; the fare charged is 60 cents, and the cars attain a speed of 60 m.p.h. This in Mr. Pratt's estimation constitutes a very high-speed road, while a moderately high-speed line, like the proposed route between Boston and Providence, calls for rolling stock capable of making 35 to 45 m.p.h. maximum speed, and a location at the side of the highway in part, and also on private right of way in certain portions. Mr. Pratt closed by stating that his company had no intention or desire to operate through cars from Providence to Boston over the elevated structure in the latter city.

RECENT WESTINGHOUSE RAILWAY ORDERS

A few of the important contracts recently entered into by the Westinghouse Electric & Manufacturing Company are given below. The orders include all sizes of apparatus from the smallest to the largest, and indicate the scope of this company's output. Additions to the equipment of electric railways and the installation of new roads, however, make up a greater total output in horsepower than any other branch of electrical engineering.

As an extension to its system the Louisville Railway Company will install two 750-kw, three-phase rotary converters, six 300-kw, air-blast transformers, with blower outfits and two switchboards. The United Railways and Electric Company, of Baltimore, has contracted for three 1000-kw rotaries, and nine 350-kw air-blast transformers. These will operate on a 13,000-volt line, transforming to 330 volts. Eighteen rotary converters with a total capacity of 27,000 kw, in 1000 and 1500-kw units, will be placed in substations of the New York Central & Hudson River Railroad Company Two 1500-kw direct current generators will be built for the Carnegie Steel Company to furnish power for two 1500-hp 250-volt motors. For the protection of this apparatus 10,000 amp circuit-breakers will be mounted on the switchboard. These motors will be the largest ever built for this voltage.

UTICA & MOHAWK VALLEY MAKES POWER CONTRACT

The Utica & Mohawk Valley Company has closed a contract with the Hudson River Electric Power Company for power for use on its lines and extensions thereof, and also for power for the operation of cars between Syracuse and Utica. The contract takes effect July 1, upon which date power is to be ready for delivery in Utica. The power company will build a large steam plant in Utica which will be added to from time to time as demands necessitate. Presumably, this plant will be built on a plot of ground of some 31 acres, recently purchased by the Utica & Mohawk Company. C. Loomis Allen, of the Utica & Mohawk Company, says, however, that the plans of his company as regards this land are not matured. The contract for power is for 3000 kw at present, with the right to take 15,000 kw. The term of the contract is twenty-five years. The steam plant in Utica will be used to fill the contract only until transmission lines can be run from a new plant to be built by the power company to utilize the waters of the Scoharie River.

HUNTINGTON'S SAN GABRIEL LOOP LINE

A direct electric railway from Los Angeles to Riverside and Redlands, completing a belt road which will touch nearly every point of interest in the great San Gabriel Valley, is the latest move of the Huntington interests, according to an authentic report. For a long time it has been known that the Pacific Electric Railway Company has had in mind the reconstruction of the old San Gabriel Rapid Transit Company's line, running from Los Angeles to Monrovia, cutting through Shorb and what is now known as Dolgeville. When reconstructed the old rapid transit will be the main line of a network now in operation, consisting of the two roads to Pasadena and San Gabriel. This, it is understood, will greatly facilitate traffic and insure a more rapid and satisfactory service. Mr. Huntington owns large tracts of land in and around Dolgeville, and a new road into that territory, making a complete circle around his possessions, will undoubtedly advance property in that neighborhood very materially. The town of Dolgeville is steadily growing, and within a few years it will be a large manufacturing center. The present scheme of increasing railway facilities there will, therefore, be of great advantage financially and commercially.

CANADIAN ASSOCIATION MEETS

The regularly quarterly meeting of the Canadian Street Railway Association was held in the Russell House, Ottawa, on March 7. The morning session was occupied in the reading of papers and discussion thereon. W. H. Moore, assistant to the president of the Toronto Street Railway, read a paper on "Problems of the Radial Road." "The Transportation of Mail" was treated by C. A. Carr, of London. At the afternoon session there were papers by W. G. Ross, of the Montreal Street Railway, on "Street Railway Benefit Associations," and by Dr. Ickes, of Brantford, on the "Sunday Observance Law in Ontario." Those present were: Allan Royce, Toronto Suburban Railway; Patrick Dube, Montreal Street Railway; T. Ahearn, W. Y. Soper, J. D. Fraser, J. E. Hutcheson and J. Murphy, Ottawa Electric Railway; E. A. Evans, Quebec Railway; Col. H. H. McLean, St. John Railway; Dr. Icks, A. J. Patterson, J. Turnbull, Grand Valley Railway; J. McArthur, Toronto & York Railway, and Acton Burrows, of the "Railway World."

INTERURBAN FREIGHT CARS ALONG CITY THOROUGHFARES—THE INDIANAPOLIS CASE

The suit brought in the Indiana Appellate Court by Lottie A. Kinsey, a property owner in College Avenue, Indianapolis, against the Union Traction Company and the Indianapolis Street Railway Company to determine the right of interurban railway companies to operate large passenger and freight cars upon the streets of the city, is likely to be terminated by the sale by her of the College Avenue property. The claim is made by attorneys that no action for injunction or damages will lie now that Mrs. Kinsey has sold. On the other hand, Gavin & Davis, attorneys for Mrs. Kinsey, say they do not believe that the sale of the property will terminate her right of action in the litigation now pending. They contend the statute provides that the transfer of an interest shall not abate a cause of action, so long as the cause continues.

In this case suit was brought for damages resulting from continued operation of the interurban cars, and that these injuries might not continue an injunction was asked. The trial court ruled adversely to Mrs. Kinsey's claim for damages, and she appealed. The Supreme Court in the Ft. Wayne case held that the construction and operation of an interurban electric road to carry passengers and light express matter and mail in trains made up of one or two cars of the best and most improved pattern, is not an additional servitude upon the street for which the abutting property owners are entitled to compensative damages.

On the basis of this decision the trial court ruled against Mrs. Kinsey's claim. Gavin & Davis say there is a difference between the two suits; that the pending suits shows more explicitly the difference between a local street car service and that of an interurban company, which is engaged in carrying freight and uses heavy cars. The latter case contains facts and abundant evidence of damages, such as was not brought out in the Ft. Wayne case, which they believe will prove sufficient to influence the court in rendering a decision favorable to their client. Although not in the record, it is pointed out that the property sold for at least $6,000 less than it would have brought had it not been for the incessant use of the street by interurban cars. In such case the attorneys say the new owner can be substituted if necessary, and they will insist that the case be not thrown out of court.

Many Indiana property owners have been anticipating a decision in this case for a year or more, and the Indianapolis Traction & Terminal Company has been waiting for a decision before entering upon the construction of interurban freight stations. If it is held that traction companies have no right to haul freight through the resident districts, freight houses will not be built. If the Kinsey suit is thrown out, a similar suit brought by John R. Allen, a property owner on the same street, and held to await the action of the Appellate Court in the Kinsey case will, it is said, be pushed to a conclusion. It is hoped, however, that this unfortunate delay in securing a decision may be avoided. The question is one of great importance to interurban companies, since their right to operate freight cars is challenged in many cities of the State.

SCIOTO VALLEY IMPROVEMENTS

The Scioto Valley Traction Company has completed grading on its extension from Circleville to Chillicothe and is now laying rails. The extension will be completed about July 1, giving the company 85 miles of road. Orders have been placed with the American Car & Foundry Company, of Wilmington, Delaware, for seven cars; two baggage and five 60 ft. passenger coaches, the same as those illustrated in the description of the road, which appeared in the STREET RAILWAY JOURNAL recently. The company is preparing for heavy traffic to Buckeye Park on the Lancaster division. This resort has been leased by Frank Mattox and J. W. Young, of Lancaster, who have arranged with the traction company for light and power. A number of attractions will be installed, the aim being to make the property one of the finest in Ohio.

A SURPRISE IN CHICAGO TRACTION MATTERS

The Chicago City Council took action at its meeting March 20, authorizing the corporation counsel to institute judicial proceedings to secure the adjudication of the rights of the city and the Chicago City Railway under the ninety-nine year act in the State courts. The action came as a complete surprise. Mayor Harrison read a message to the City Council urging that this action be taken at once so that a bill may be filed in the city courts. The street railway companies have always maintained that this is a matter for the Federal courts, and have carefully avoided letting it get into the State courts. It is a matter of common knowledge, as was plainly stated by the corporation counsel before the Chicago City Council, previous to the passage of the ordinance, that the United States courts have been much more favorable to the rights of capital where questions of the powers of legislative bodies are concerned than are the State courts. The ordinance authorizing the corporation counsel to take action was rushed through the Council and a bill was immediately filed by Corporation Council Tolman before Judge Mack, who was awaiting it in the county building, which adjoins the Chicago City Court. This gave the attorneys for the Chicago City Railway Company no time to take action of any kind.

IMPROVEMENTS FOR SPRINGFIELD—NEW POWER PLANT

H. J. Crowley, general manager of the American Railways Company, of Philadelphia, has announced that the company will spend $200,000 on improvements to the railway, lighting and park property of the Springfield Railway Company, of Springfield, Ohio. A number of attractions will be installed in Spring Grove Park. The West Pleasant Street city line will be extended. A lighting plant will be erected adjoining the present railway power station, and it is probable that two 500-hp units will be installed.

IMPORTANT WORK IN SPOKANE

Henry M. Richards, president of the Washington Water Power Company, has returned from a trip East and announces that his backers have provided $3,500,000 for the work of the company in Spokane the next three years.

The estimates of the work this year call for the expenditure of $1,100,000, and include three miles of extension to its street car system; an interurban line to Medical Lake, 16 miles; an office building in Spokane to cost $100,000; an $18,000 electric plant at Post Falls, Idaho, and a $100,000 interest in the Spokane Southern Traction Company. Mr. Richards announces that Charles Francis Adams, of Boston, has subscribed to $50,000 of the stock, and $50,000 of the bonds of the Spokane Southern, and that the General Electric Securities Company is a heavy subscriber to its bonds.

RAPID TRANSIT FOR CAMBRIDGE, MASS.

After many months of consideration it appears as though the Boston Elevated Railway Company and the citizens of Cambridge, Mass., have reached a possible basis of agreement in regard to a rapid transit scheme between the Hub and the University City. The situation has all along been a peculiar one in view of the legislative obligation laid upon the railway company to build an elevated road to Brattle Square, Cambridge, upon the completion of the new West Boston Bridge, and the subsequent opposition of the citizens of that particular suburb to that form of rapid transit.

The latest proposition is a combination of elevated and subway routes, the overhead system to be built from the West Boston Bridge to Dana Hill, Cambridge, and the subway from the latter point to Harvard Square, instead of Brattle Square. Harvard Square is the principal transfer point in Cambridge, and as such offers exceptional facilities for a rapid transit terminal. In case physical connection should be carried out between the present surface lines operating through or terminating in Harvard Square and the subway terminal, the conditions would be the exact reverse of those now obtaining at Dudley Street and Sullivan Square on the Boston Elevated system, as the surface cars would descend to the rapid transit platforms instead of ascending to the loops by open air inclines. The square would also be free from overcrowding with an underground terminal. Although the proposition in any event is to be passed upon by the legislature, it bears the mark of many excellent features. Conspicuous among these is a running time of seven or eight minutes to Scollay Square. A trip now requiring some 25 minutes by the Massachusetts Avenue and Roylston Street routes.

THE ARNOLD COMPANY—A CHANGE OF NAME

A Chicago company well known in the electric railway and construction field announces a change of name. The Arnold Electric Power Station Company is hereafter to be known as simply the Arnold Company, a name less descriptive but fully as significant to all in the electrical railway business, most of whom have called the company by its abbreviated name for some time past in familiar conversation. The Arnold Electric Power Station Company, which was formed by its president, Bion J. Arnold, in 1896, to carry on the class of construction work indicated by its title, a long time ago outgrew that title because of the constantly increasing scope of its business. The Arnold Company as it stands to-day not only carries on a consulting engineering business as regards electric power stations, interurban railways, electrical equipment of steam roads, shops and shop equipment, hydro-electric and transmission plants and modern industrial plants, but is prepared to undertake the construction on whatever work it does the designing and consulting. In order to handle this business, it is of course necessary for the company to maintain a full construction organization, and also a corps of electrical, civil and mechanical engineers capable of handling all branches of such an undertaking as electric railway construction or hydro-electric development with power transmission. One of the most important pieces of work in which the company is now engaged is a large water power plant at Lowell, Kansas, where a power station of 3000 kw capacity is to be put in operation with a 33,000-volt transmission line, carrying power to the lead and zinc mines in the vicinity of Joplin, Mo.

As to the position of Bion J. Arnold, the president of this company, in the electric railway field, nothing need be said here. His eminence makes it unnecessary. The Arnold Company, with its large organization, makes it possible to carry out on an extended scale many of the lines of work to which Mr. Arnold formerly gave his immediate personal attention and supervision. Mr. Arnold's services personally have been retained recently on some of the most important work in the country, notably the electrical equipment of the New York Central terminals at New York and a study of the Chicago local transportation problem. Most of the work coming to the Arnold office, however, is handled by the Arnold Company, of which he is president. Next to the president should certainly be mentioned George A. Damon, managing engineer, under whose supervision of the many engineering details the business of the Arnold Company has grown up, and who, although a young man, is undoubtedly one of the most popular, able and progressive engineers and business men in the Middle West.

Among the electric railway enterprises with which the Arnold Company has been prominently connected, are the building of the Chicago & Milwaukee Electric Railroad through the northern suburbs of Chicago in 1897, with rotary converter sub-stations and high tension transmission from a central plant; the power house and sub-stations of the Grand Rapids, Holland & Lake Michigan Rapid Railway; the Chicago Electric Traction Company's lines; the Lansing, St. Johns & St. Louis Electric Railway, on which the president, Bion J. Arnold, made the first single-phase railway motor experiments in the United States; the Kenosha Street Railway, and the Bloomington, Pontiac & Joliet Electric Railway, a road now under construction, using G. E. single-phase alternating current motors.

The company has a long list of clients among steam railroad companies for which the mechanical and electrical equipments for shops have been designed. The Arnold Company has had active charge of the electric power and light, compressed air and steam equipment of shops for the following railroads: Chicago & Eastern Illinois, Chicago & Great Western, Denver & Rio Grande, New York Central & Hudson River, Oregon Short Line, Pere Marquette, St. Louis, Iron Mountain & Southern, Union Pacific, and Wisconsin Central. Electric power stations have been constructed for the Chicago Board of Trade, Chicago & Alton Railway at Springfield, Ill.; Imperial Lighting Company at St. Louis; W. B. Conkey Company at Chicago; Land, Title & Trust Building, Philadelphia; Otis Elevator Company, Chicago, and Albert Dickinson Company, Chicago and Minneapolis.

The engineers of this company are very progressive, but not inclined to experiment with new apparatus at the expense of clients. The company publishes bulletins similar in make-up to those published by the large electrical manufacturing companies. These bulletins contain technical descriptions of work which the company has carried out, and are much in demand. Another advertising feature maintained by the company, which is of especial interest to electric railways, is the maintenance of a set of interurban maps of the Central States, which gives the roads in operation, under construction and projected, and the relative size of towns. Blue prints of such maps are furnished to electric railway officers upon request. The officers of the Arnold Company, in addition to the president and managing engineer already mentioned, are W. L. Arnold, vice-president, and Ralph G. Arnold, secretary and treasurer, who look after the business affairs of the company.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MARCH 14, 1905

784,639. Electrical Trolley; Seneca R. Stoddard, Glens Falls, N. Y. App. filed March 21, 1903. A contact shoe for third rails having a member mounted therein capable of lateral movement relatively thereto and acting by gravity to make and break connection with the conductor.

784,657. Means for Operating Railway Switches; Robert Crossley Bullough, Manchester, England. App. filed July 20, 1904. Details.

784,668. Car Brake; Lewis J. Evans, East Pittsburg, Pa. App. filed May 5, 1904. An emergency track brake consisting of a brake wheel adapted to be spring-pressed downwardly when released.

784,678. Trolley Catcher and Retriever; William W. Hoffman and Francis W. Powers, West Lafayette, Ind. App. filed Sept. 23, 1904. Details of a spring drum and ratchet arrangement.

781,681. Trolley Guide; John F. Jameson, Plimton, Ohio. App filed Dec. 21, 1904. The guide consists of a suitable framework for holding the trolley to the wire on curves, etc.

784,689. Holding Device for Switch Points or Tongues; Clarence C. Korns, Johnstown, Pa. App. filed Oct. 5, 1903. An arm connected to the switch tongue and pivoted to a pivoted weight eccentrically of the pivot of the latter, and means for always holding the weight in a position in which the pivotal connection of the arm therewith is above its own pivot, whereby the throw of the switch tongue will act to throw the weight.

784,696. Hand Strap; Uriah McClinchie, Brooklyn, N. Y. App. filed Sept. 10, 1904. A holder or frame for advertising matter is connected with the hand strap.

784,698. Brake Beam; John F. O'Connor, Chicago, Ill. App. filed Jan. 18, 1905. The brake beam is I-shaped in cross section, its web at the center being stretched so as to increase the depth of the beam at this point.

784,735. Railway Track Structure; George M. Ervin, Johnstown, Pa. App. filed Aug. 1, 1904. Relates to the construction of wear plates at switches, crossings, etc.

784,814. Railway Motor Control; Charles P. Steinmetz, Schenectady, N. Y. App. filed Aug. 20, 1904. Provides a control system by means of which electric motors may be operated on either alternating or direct current.

784,839. Brake Beam; Seth A. Crone, New York, N. Y. App. filed Oct. 1, 1904. A novel construction of fulcrum.

784,843. Trolley; Michael O. Day, Newcastle, Pa. App. filed Dec. 20, 1904. The harp is rotatably mounted in a hollow cylindrical casing, and springs are employed to return the harp to its normal position when the harp is out of alinement with the wire.

784,879. Sand Box for Street Railway Cars; Sidney W. Phelps, Globe Village, Mass. App. filed Aug. 29, 1904. A sand box mounted on the body of a car, a discharge pipe flexibly mounted on a truck-frame, and a flexible hose connecting the sand box and discharge pipe.

784,906. Car Brake; Ralph Vogel, Germantown, Pa. App. filed Nov. 24, 1903. An emergency brake consisting of track sections carried in advance of the truck adapted to be lowered upon the main rails and pass under the truck wheels between the latter and the track rails.

785,030. Switch; Abram E. Willey, Atlanta, Ga. App. filed Dec. 13, 1904. A switch-point, an oscillating disk eccentrically pivoted to the free end of the switch-point, operating bars pivoted to the disk on opposite sides of its pivot, switch-operating bars on the car, and means for independently projecting the switch-throwing bars to operate the switch-operating bars.

785,034. Car Wheel; John T. Duff, Pittsburg, Pa. App. filed Sept. 28, 1904. Provides a tread portion separate from the body of the wheel and so secured thereto that it can be easily removed or replaced in order that the tread portion can be renewed whenever damaged or worn.

12,324. Trolley Wheel Guard for Electric Wires; John L. Sullivan, Warren, R. I. App. filed Jan. 26, 1905. A pair of transversely disposed wheels mounted in the harp for engagement with the upper surface of the wire.

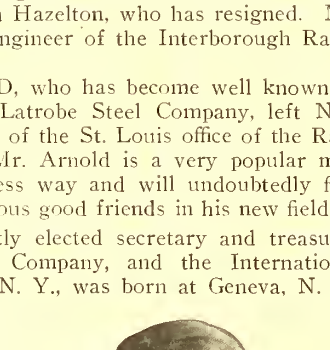
PERSONAL MENTION

MR. JOHN M. DIVEN has resigned as secretary-treasurer of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., and as superintendent of the waterworks system of that company, to become general manager of the Charleston Light & Water Company, of Charleston, S. C.

MR. H. N. LATEY, electrical engineer of the subway division of the Interborough Rapid Transit Company, of New York, has also been appointed electrical engineer of the Manhattan division of the company, vice Mr. Hugh Hazelton, who has resigned. Mr. Latey's new title is electrical engineer of the Interborough Rapid Transit Company.

MR. THOMAS B. ARNOLD, who has become well known as Eastern representative of the Latrobe Steel Company, left New York, March 18, to take charge of the St. Louis office of the Railway Steel Spring Company. Mr. Arnold is a very popular man in a social as well as a business way and will undoubtedly find little difficulty in making numerous good friends in his new field.

MR. J. F. SLOCUM, recently elected secretary and treasurer of the International Traction Company, and the International Railway Company, of Buffalo, N. Y., was born at Geneva, N. Y., March 25, 1876. About nine years ago he began his business career with the Power City Bank at Niagara Falls, N. Y. Four years later he accepted a position with the International Company as cashier, and a short time later was elected assistant secretary and treasurer under former secretary and treasurer, Mr. R. F. Rankine, who resigned March 2, 1905, to engage in other business.


J. F. SLOCUM

MR. CHARLES G. LOHMAN, who, as previously stated in the STREET RAILWAY JOURNAL, has been appointed superintendent of the Indiana Railway Company, of South Bend, Ind., began his street railway career in Indianapolis six years ago as an inspector. He advanced rapidly until finally he was made a division superintendent of the Indianapolis Traction & Terminal Company. Here he had charge not only of the division entrusted to him, but also of the traction terminal building, illustrated and described in the STREET RAILWAY JOURNAL. It was from the Indianapolis company that he resigned to become connected with the Indiana Railway. In his new position Mr. Lohman will have entire charge of the operation of a system of more than 50 miles, connecting South Bend, Mishawaka, Elkhart and Goshen and the city lines in these places. Mr. Lohman is a member of the ticket committee of the Indiana Electric Railway Association by special appointment last meeting.

MR. LEWIS B. STILLWELL has been appointed consulting electrical engineer of the Hudson Companies, whose incorporation on Jan. 9 was announced in the STREET RAILWAY JOURNAL for Jan. 14. This company will take up the work of the completion and equipment of the four tunnels under the Hudson River, frequently referred to as "the McAdoo tunnels." The company has opened offices at 21 Park Row, New York. The appointment of Mr. H. M. Sperry as consulting signal engineer of the company was announced in the issue of this paper for March 4.

MR. H. A. NICHOLL, general manager of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio., has, as previously noted in the STREET RAILWAY JOURNAL, been appointed general manager of the Indiana Union Traction Company. Under his direct supervision there will therefore come the largest interurban electric railway system in the world, comprising more than 250 miles of track, extending from Indianapolis as a center to such distant cities as Kokomo, Logansport, Marion, Muncie, Anderson, etc. It is a company controlled largely by Philadelphia interests, and is capitalized at $5,000,000, with $1,000,000 bonds outstanding. Mr. Nicholl is thoroughly fitted by previous training for the position, his experience having covered steam railroad, city railway and interurban work. Besides this, he had the experience in Ithaca of managing the public service utilities of the city, these being controlled by the Ithaca Railway Company, of which he was assistant manager and treasurer, the street railway and electric lighting interests of the city. As general manager of the Cleveland & Southwestern Company, Mr. Nicoll was responsible for the operation of 134 miles of standard gage interurban line.


H. A. NICHOLL

MR. WALTER H. WHITESIDE has been elected vice-president and general manager of the Allis-Chalmers Company, a position created for him. In no way will his work conflict with Vice-President Chalmers or President Warren. Mr. Whiteside formerly was manager of the sales department of the Allis-Chalmers Company. Previous to his connection with this company he was with the Westinghouse Electric Manufacturing Company.

MR. JAMES A. PIERCE, who, as previously noted in the STREET RAILWAY JOURNAL, has become superintendent of the Mexico City Electric Tramway Company, of Mexico City, Mex., under General Manager Wheatly, formerly was with the Brooklyn Rapid Transit Company, and later was Western representative at St. Louis, of Rossiter, McGovern & Company, from which company he resigned to accept the position in Mexico. It was in 1896 that Mr. Pierce entered the service of the Brooklyn Heights Railroad. His first work was in the office of the general superintendent of surface lines. After a few months he was transferred to the engineering department. Here his service in an official capacity was very successful. In April, 1900, he was appointed division superintendent of the Southern division (surface lines) with headquarters at Fifty-Eighth Street. In November, 1901, he resigned from the company to become the Western representative of Rossiter, McGovern & Company. Mr. Pierce is about 31 years of age.

MR. C. A. ALDERMAN, who for the past eight years has been identified with Mr. A. E. Appleyard as chief engineer of the Great Northern Construction Company, which built all of the Appleyard properties as well as a large number of other roads, has resigned to go with the Elkins-Widener syndicate, of Philadelphia. His resignation took effect March 20. Mr. Alderman has been in direct charge of the construction of perhaps more miles of high-speed interurban roads than any other engineer in the country. His first work for Mr. Appleyard was at Eau Clair, Wis., where he built the Chippewa Valley Electric Railway. Six years ago he located at Springfield, Ohio, and since then has planned and supervised the construction of the Dayton, Springfield & Urbana; Columbus, London & Springfield; Central Market Street Railway; Urbana, Bellefontaine & Northern Railway; Springfield & Western Railway; the Columbus, Buckeye Lake & Newark, and the Columbus, Newark & Zanesville. In his position he will act as constructing engineer for the Cincinnati Northern Traction Company for the reconstruction, including straightening of track, the erection of a new power house and otherwise improving the Cincinnati Dayton & Toledo Traction Company's line between Cincinnati and Dayton. As already outlined in these columns, the Cincinnati Northern Traction Company is to lease the line mentioned. For the present Mr. Alderman's headquarters will be in the Traction Building, Cincinnati. Mr. Alderman was given a farewell reception last week by officials and employees of the system, who presented him with a magnificent diamond pin as a mark of their good will.

NEWS OF THE WEEK

CONSTRUCTION NOTES

OAKLAND, CAL.—The directors of the Oakland Traction Consolidated have voted to increase the bonded indebtedness of the company to $7,000,000. The increase is $2,174,000. The former indebtedness was $6,500,000, but it was reduced to $4,826,000 by payments. It is stated that the new debt is to be partly applied in paying the old debt and partly to increase the facilities of the company.

SANTA CLARA, CAL.—The Santa Clara Interurban Railway Company has been incorporated by J. C. Campbell, W. H. Netson, J. E. Parkinson et al. The capital stock is $5,000,000. The plan of the company is to extend its line from the city of San Mateo to Alum Rock Park, in Santa Clara County, running through Redwood City, Menlo Park, Palo Alto, Mayfield, Mountain View, Sunnyvale, Santa Clara and San Jose.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has under construction and in contemplation numerous improvements to its system in this city. The company has recently secured a franchise from the city for the extension of its lines from Fifth and K Streets via K to Tenth to M and out M to Mt. Hope Cenetery. The track will be laid with 60-lb. rails of type section No. 6015, manufactured by the Carnegie Steel Company, and the continuous rail-joint will be used exclusively in its construction. The city has not as yet completed the grading of that portion of M Street to be used by the railway company, but as soon as this is finished the work of laying the tracks will be rushed to completion. The estimated cost is about $30,000. A franchise for the extension of the street railway lines from State and D Streets along State to Ivy, thence to India, and along India to the Old Town, a distance of about 4 miles, has been applied for recently, and if secured, construction work will commence immediately. The addition of an ostrich farm as a further attraction to the patrons of the company has recently been made. The farm is situated at the end of the Fifth Street line adjoining Mission Cliff Park, and consists of an enclosure about 400 ft. square, which will be stocked with about forty birds. A small fee will be charged for entrance to the farm, which will be leased to the owner of the birds. The latter improvements aggregate $3,000.

GRAND JUNCTION, COL.—A franchise has been granted George Smith, former Representative of Mesa County to the State Legislature, to construct an electric railway through Grand Junction, work to commence within ninety days after the passage of the ordinance. The road as projected by Mr. Smith is to run from Palisades to Grand Junction and probably to Fruita.

NAUGATUCK, CONN.—It is announced that work on the construction of the street railway which the Naugatuck Valley Electric Company proposes to build between Naugatuck and Seymour will be commenced next spring. The route runs through Beacon Falls. At both Naugatuck and Seymour the line will connect with the Connecticut Railway & Lighting Company's system. The Naugatuck Electric Company is closely affiliated with the Railway & Lighting Company. The line will form a connecting link by which Waterbury and Naugatuck will have electric railway communication with Ansonia, Bridgeport and New Haven. The preliminary surveys have already been completed.

WILLIMANTIC, CONN.—The next Legislature will be asked to grant a charter for an electric railway from Willimantic to Stafford, passing through the village of Eagleville Mansfield Depot, Merrow, etc., and quite closely paralleling the New London Northern steam road for a considerable part of the route.

TAMPA, FLA.—The City Council has granted a franchise for the construction of another street railway, which covers the main streets in the eastern portion of the town, and on to Ybor City and Sulphur Springs. The prospectors of the new road are: T. W. Smith and C. E. Ball, prominent real estate men; W. B. Gray, of the wholesale dry goods firm of Bentley, Gray & Company, and George C. Warren, of the real estate firm of Beckwith, Henderson & Company.

SWEETWATER, ILL.—Articles of incorporation have been filed with the County Recorder for the Springfield, Sweetwater & Peoria Electric Railway Company, with a capital stock of $2,500.

INDIANAPOLIS, IND.—The Consolidated Traction Company has increased its capital stock from $300,000 to $1,500,000, an amount sufficient to complete the construction of the road. The directors have decided to continue the road west to Covington and Danville. A spur will also be built to Almo and into the coal fields near by. The grade between this city and Crawfordsville is now ready for the ties and rails.

INDIANAPOLIS, IND.—The proposed electric railway which is to connect Indianapolis, French Lick and points along the Ohio River has filed articles of incorporation with the Secretary of State. The name of the new company is the Indianapolis & Ohio Valley Traction Company. It is capitalized at $50,000. The directors are: A. E. Fauve, M. E. Julliard Fauve, Butler Smith and Joseph H. Larimer, of Indianapolis, and Peter Backer, of Troy, Perry County. Mr. Larimer says: "The line will be from Indianapolis to Rockport, in Spencer County, and will connect Troy, Tell City, Cannellton, St. Meinrod's, Ferdinand, French Lick, West Baden, Bedford, Bloomington and Nashville. The survey for the line will be begun at once by Butler Smith, chief engineer of the company. Financial people in the East have been conferred with, and have made arrangements for financing the road when the preliminaries have been completed. The section of the road between Rockport and Cannellton will be the first to be built. Then connection will be made with Indianapolis. The company will aim to run limited cars to French Lick from Indianapolis."

INDIANAPOLIS, IND.—At a meeting held in the Claypool Block a few days ago for the purpose of organizing a company to construct an electric railway from Terre Haute to Vincennes, it was determined to capitalize for not less than $1,500,000; also that the line should be as near as possible an air line paralleling the E. & T. H. Railway. Dr. W. N. Heath was elected secretary, and was instructed to go over and locate the line with the company's engineer.

KOKOMO, IND.—The Kokomo Electric Construction Company has filed articles of incorporation with the Secretary of State. The capital stock is $20,000. The declared object is to promote, finance, construct, equip, rent and operate street and interurban railroads and plants for the creation and distribution of electric and other heat, light and power, etc. The principal office will be in Kokomo. G. W. Norwood, C. O. Scott and G. H. Martgolf are the incorporators.

ROCKPORT, IND.—J. H. Larimer, president of the new company incorporated to build an electric railway from this city to Indianapolis, is contracting for the right of way. The Commissioners will, it is said, grant the company a franchise through the county at their next meeting.

LOUISVILLE, KY.—The Louisville & Southern Indiana Traction Company has directed D. X. Murphy & Brother to draw plans and specifications for a terminal station on the west side of Third Street, between Market and Jefferson. The lot on which the building is to be erected fronts 55 ft. on Third Street, running back 105 ft. For the present the terminal building will be only one story, but the foundation will be so constructed that a three-story office building may be erected in the future. The architects will soon take out a permit, and work on the building will begin at once. The company expects to be running cars into the new station from New Albany and Jeffersonville via the Big Four Bridge early in the spring.

NEW ORLEANS, LA.—It is stated authoritatively that the National Surety Company, of New York, will make no more bonds in the State of Louisiana, because of the requirements of the State laws, and the New Orleans Railways Company has requested of the City Council of New Orleans that the bond of the National Surety Company required by a certain ordinance concerning some switch-track privileges, be substituted by a bond of the American Surety Company, of New York.

BIDDEFORD, MAINE.—The Biddeford Pool Electric Railway is said to have been financed. Charles E. Atwood is treasurer of the company.

PORTLAND, MAINE.—The Railroad Commissioners have approved the articles of incorporation of the Bridgton Street Railway Company, which is to operate a road 1½ miles long in Bridgton. The plan is to operate in the summer only.

ATTLEBORO, MASS.—The Selectmen of this town and of North Attleboro have received from the Attleboro Company petitions for the extension of the franchise granted to the company in January, 1902. The intention, it was stated when the franchise was granted, after considerable opposition, was to build a road which would connect Attleboro and Mansfield by way of West Mansfield, and also provide a connection between North Attleboro and Mansfield through that section known as New Boston. The people of North Attleboro were particularly pleased over the prospects of that line, for the reason that they felt it would give a new and more rapid connection with the Boston trains. The two boards have decided to withhold action on the petitions for some time.

BOSTON, MASS.—Petitions have been received from the Haverhill & Boxford and Maplewood & Danvers Street Railways, which are the connecting roads of the through line from Haverhill to Boston, for the Board's approval of locations granted by the Aldermen and Selectmen of cities and towns in which the roads are located. The Haverhill & Boxford asks for approval of certain grants in Haverhill and Boxford, with additional authority to construct on private land in said city and town, while the Maplewood & Danvers wants approval of location in the towns of Malden, Melrose, Saugus, Lynnfield, Peabody, Danvers, Middleton and Boxford. The company also asks for additional authority to construct on private land in Middleton and Boxford.

MARLBORO, MASS.—The Boston & Worcester Street Railway Company has completed its new sub-station at Marlboro, and is installing the machinery. A petition for authority to string a high-tension wire through the city to connect with this station has been held up by the Board of Aldermen, so that the station cannot be used for the present.

MIDDLEBORO, MASS.—The project for an automobile line from Falmouth, to connect with the Middleboro, Wareham & Buzzard's Bay Street Railway's southern terminus at Monument Beach, is taking a new form. The trackless trolley interests are said to have taken an interest in it. Their scheme is to run coaches that accommodate twenty passengers as a rule and can be operated on any good, hard road; like the trackless line that was in operation at Nantasket Beach last summer.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company has been granted a franchise by the Council to build a number of loops in the downtown section of the city.

ST. LOUIS, MO.—Another electric railway to St. Charles may be built next year if the project of the backers of the scheme to build a line from Kansas City to St. Louis is carried out. J. D. Housman, former manager of the St. Louis, St. Charles & Western Railway Company, it is said, has been asked to take charge of the work and extend his county cross-connecting line from University Heights on the Bonkomme Road to the Missouri River, and thence into St. Charles. Mr. Houseman would not commit himself when questioned, but it is stated from a source very reliable that the scheme will be perfected and the details announced within the next few days. Franchises for building electric railways out Bonhomme and the Olive Street roads have been obtained by different corporations which will be offered for the scheme, leaving but a few miles of private right of way to be secured. The road will probably tap Creve Coeur Lake. Entrance to St. Charles will be over the new highway toll bridge. The tracks of the St. Louis, St. Charles & Western Railway Company will be used. Mr. Houseman is also considering a plan to build about 4 miles of track from Jennings to the city limits at a point about a ½-mile from the northern terminus of the Grand Avenue line. He has made a proposition to several real estate owners in Jennings for the purpose of raising the required capital, and believes it will be favorably considered.

GLENDIVE, MONT.—A petition asking that a franchise be granted to the Glendive & Lower Valley Rapid Transit Company for the construction of an electric railway from Glendive to Buford, N. D., a distance of 80 miles, has been presented to the Board of County Commissioners. The following names were signed to the petition: E. S. Baer, J. R. Widmyer and H. J. Haskell, of Glendive, and B. S. Adams and John O'Brien, of Newlon.

NEW YORK, N. Y.—Commissioner Best has requested from the Board of Estimate and Apportionment $300,000 for a proposed temporary Brooklyn Bridge terminal in City Hall park. His purpose is to relieve immediately the congestion at the Bridge entrance. Plans have already progressed for a permanent structure on Center Street, after the completion of which, according to Mr. Best, the City Hall Park incumbrance will be removed. About a year ago Mr. Best made a similar proposal, which met with such general condemnation that it was quickly withdrawn.

RALEIGH, N. C.—The Raleigh & Durham Passenger & Power Company, which plans to build a line from Raleigh to Durham, has been granted a franchise by the City Council of Raleigh.

AKRON, OHIO.—To settle a long-standing controversy with the Northern Ohio Traction & Light Company relative to its share of the cost of eliminating grade crossings, the city has offered to grant the company a five and one-half-year extension of franchises if it will pay one-third the city's share of the cost of viaducts on Mill Street and Exchange Street and one-third the total cost of a viaduct over the Cuyahoga Valley at Main Street and North Hill; also to make certain track improvements. The last-mentioned viaduct would be built on private right of way, and the company would have a one-third interest in it. The viaduct would reduce two very heavy grades.

BOWLING GREEN, OHIO.—President E. H. McKnight, of the Lake Erie, Bowling Green & Napoleon Railway Company, states that the line from Pemberville to Woodville has been practically completed and it will be placed in operation within a short time. The company expects to build west from Bowling Green to Napoleon.

BOWLING GREEN, OHIO.—The Toledo, Bowling Green & Southern Traction Company has let contracts for the erection of a new passenger and freight station in Bowling Green.

BRYAN, OHIO.—The Toledo & Indiana Railway Company has practically completed track laying for its new extension to Bryan. A large steel bridge will be erected over Tiffin River, near Bryan.

CINCINNATI, OHIO.—The Cincinnati Interurban Railway Company has placed an order with the Cincinnati Car Company for twenty large double-truck cars to be used in the service between Cincinnati and Hamilton. Heretofore the company has used single-truck cars on a portion of this run. The road has recently been greatly improved to provide for better and faster service.

CINCINNATI, OHIO.—There is a report in circulation to the effect that the Cincinnati, Georgetown & Portsmouth Railway and the Ohio River & Columbus Railway are to be purchased by Eastern capitalists and consolidated. The first-mentioned road extends from Cincinnati to Georgetown, and operates electric passenger and steam freight trains. The Ohio River & Columbus is in operation from Ripley to Sardinia, and connects with the Cincinnati, Georgetown & Portsmouth Railway at Georgetown. It was laid out for an electric road, but at present is being operated as a steam line exclusively.

CLEVELAND, OHIO.—The Buckeye Street Railway Company has been incorporated, with $1,000 capital stock, by J. H. VanDervere, Edward H. Traccy, S. D. Reed, Davis Hawley and J. E. Chadwick. The officers of the company state that they expect to build a line from Canton to Akron. The Canton-Akron Railway already covers this territory.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company has placed a contract with the J. G. Brill Company for fifty cars to be built at the shops of the Kuhlman Car Company, Collinwood. They will be of the convertible type, very similar to the cars which the Cleveland Electric altered in its own shops, and which were illustrated in a recent issue of this paper. They will have Westinghouse No. 101 motors, Christensen air brakes and Eclipse fenders. Half of them will be fitted with Brill 27-F truck and half with a new M. C. B. short wheel-base truck built by the Baldwin Locomotive Works. This brings the company's rolling stock up to 900 cars suitable for both summer and winter use.

CLEVELAND, OHIO.—The Terminal Construction Company, of Cleveland, has been incorporated by F. W. Green, N. B. Wood, J. R. Zmunt, W. A. Bennett, D. Gindelsperger and others. The capital stock is $10,000. The object of the company is to build an entrance into Cleveland for a new interurban line to Akron, on which the promoters have been working for some time.

DAYTON, OHIO.—The plan of the Ohio Cold Storage Company for the erection of a power plant, cold storage plant and interurban freight and passenger station, which was proposed some time ago, is being revived. The company has an option on valuable property at Fourth and St. Clair Streets.

NORWALK, OHIO.—The Sandusky, Norwalk & Mansfield Railway Company has been enjoined temporarily from laying any more track along the Fairfield Pike in Huron County. The County Commissioners, who applied for the injunction, claim that the company never secured a franchise to use any of the roads in the county.

SPRINGFIELD, OHIO.—The line of the Springfield, South Charleston, Washington C. H. & Chillicothe Traction Company has been opened to South Charleston. Next spring the road will be extended to Washington C. H. and later to Chillicothe. Some remarkable work was done on the first section of this road, as 12 miles of track were laid and placed in eighty-five days. Cars will operate on a two-hour headway from Springfield to South Charleston this winter.

TOLEDO, OHIO.—The Arbuckle-Ryan Company has secured the contract for designing and supplying the steam equipment for the new plant of the Toledo & Indiana Railway at Stryker, Ohio. The company is at work on large power plants at St. Ignace, Allegan and Kalamazoo, Mich.

TOLEDO, OHIO.—The Toledo, Bowling Green & Southern Traction Company started Jan. 1 to operate its cars into Toledo over the tracks of the new Toledo Urban & Interurban Railway. The schedule to Findlay has been reduced to about 2 hours and 30 minutes, as against 3 hours and 15 minutes heretofore. About Jan. 15 the company will institute a still faster limited service with a special car.

TOLEDO, OHIO.—The "Toledo Blade" states that $5,000,000 of the $10,000,000 construction bonds of the Toledo, Columbus & Cincinnati Railway Company have been floated in New York. The company was originally organized about three years ago by Ellis Bartholomew, of Toledo, to build a line from Toledo to Columbus and Cincinnati. A short time ago the company was reorganized with E. C. Shinness as president. Wm. H. Luchtenberg, of Columbus, is also identified with the project.

WAPAKONETA, OHIO.—It is announced that the Sandusky Southwestern Railway Company has arranged with New York bankers for the financing of $5,000,000 worth of bonds. Considerable construction work has already been done on this property.

WILMINGTON, OHIO.—W. D. Riddell, chief promoter of the Wilmington & Hillsboro Traction Company, states that arrangements have been completed for financing the proposition and that the road will undoubtedly be built next spring. It will extend from Wilmington to Hillsboro, a distance of 20 miles, through a district where there are no steam roads. At Hillsboro connection will be made with a line to Cincinnati.

YOUNGSTOWN, OHIO.—The Pennsylvania & Mahoning Valley Railway Company has completed connection with its city tracks in New Castle, Pa., and is now operating its interurban cars directly into the city. In the near future, the Youngstown & Sharon Railway will build a connection with the city tracks and will also commence operating into the center of the city.

ZANESVILLE, OHIO.—Hon. C. B. Hart and Hon. A. C. Caldwell, representing the Security Trust Company, of Wheeling, W. Va., announce that that company has arranged for the financing of the Southeastern Ohio Railway, Light & Power Company, of Zanesville. Capital to the amount of $600,000 has been furnished. The company will build to Crooksville, Posey and Sayre. Valuable coal and oil fields will be opened up by the road. Construction work is to start in the spring.

TAZEWELL, VA.—The Tazewell Street Railway Company's system has been placed in operation.

GUTHRIE, O. T.—Ground has been broken for the construction of the street railway system which is being financed through the efforts of John Shartel, of Oklahoma City. The contract for the grading has been let to Mike Cassidy, of Guthrie.

CHAMBERSBURG, PA.—The Hagerstown Electric Railway Company has asked Myersville Council for certain privileges. The company will build a depot and warehouse in that town.

GALETON, PA.—A Buffalo company proposes to establish a trackless trolley belt line in this town, also a park a mile from the town.

HARRISBURG, PA.—The Kennerly Coal & Coke Company, chartered this week, with a capital stock of $1,000,000, to do business in Somerset County, with headquarters in Johnstown, proposes to build an electric railway to Bear's Creek, there to connect with the lines of the Johnstown Passenger Railway Company.

NEW CASTLE, PA.—The New York, Pittsburg and Cleveland capitalists who propose constructing an electric railway between this city and Meadville via Sharon have secured franchises from most of the towns through which the line will pass, and will begin construction work in the early spring.

SCRANTON, PA.—General Manager Silliman, of the Scranton Railway Company, denies that the company proposes to build a line from North Scranton to Clark's Summit.

WAYNESBORO, PA.—The City of Frederick has again extended the franchise of the Baltimore & Frederick Electric Railway Company; this time until Sept. 5, 1905, the company depositing a forfeiture of $2,000.

YORK, PA.—The York Traction Company has made a survey from its tracks on North Street, across Duke Street, to the Northern Central Railway freight warehouse. It is said that the company proposes to extend the tracks on North Street across Duke Street to the platform alongside the Northern Central warehouse. This will be done, it is said, in order to facilitate the loading and unloading of freight from the cars at the warehouse. The Traction Company carries considerable freight from Dover, Dallastown, Windsorville, Red Lion and other points, which is brought to York and shipped to distant points.

CHATTANOOGA, TENN.—Application will be made at once, under the laws of Georgia, for a charter for the Tennessee-Georgia Interurban Railroad Company, with a capital stock of $300,000, with privilege of increasing to $500,000. This company will be formed with the object of constructing and operating an electric railway between Chattanooga and Ducktown, Tenn., via Ringgold, Catoosa and other nearby Georgia points. The incorporators will be S. W. Divine, of Chattanooga; J. H. Walker, Jr., J. C. Bryan, J. R. Jones, W. E. Biggen, J. M. Robinson, W. E. Bryan and J. W. Clark, of Catoosa County, Georgia.

KNOXVILLE, TENN.—The grading for the new car sheds of the Knoxville Traction Company, which are to be constructed just east of the Park Avenue Bridge, has been begun, and the work of building the superstructure will begin in a few days. The general extensions to the system, including those being made to the power station, have already been referred to in detail in the STREET RAILWAY JOURNAL.

BRENHAM, TEX.—The proposed electric railway between Brenham and LaGrange is taking tangible shape. There was a meeting of the Commercial Club and citizens of Brenham the other day to hear from Gustav Hellig, of LaGrange, Tex., on the subject. He explained that a St. Louis corporation is ready to put up the money for the construction if the report of the engineer sent over the line is satisfactory.

SAN MARCOS, TEX.—Judge B. G. Neighbors, an attorney of Hays County, is said to have secured financial backing for building an electric railway from San Marcos along the river, touching Martindale, Fentress, Staples, Prairie Lea, and terminating at Luling, on the Southern Pacific Railway.

SALT LAKE CITY, UTAH.—The City Council, at the request of B. Mahler, of Cleveland, Ohio, has resumed consideration of the petition of the company of which he is the chief promotor, for a proposed interurban which, when completed, will extend from Payson to Logan.

SALT LAKE CITY, UTAH.—The franchise of the Utah Light & Railway Company to construct a line from Third and U Streets in a southerly direction to Fifth South Street has been extended one year by the committee on streets, provided that the company will extend its present line on Thirteenth Street East to Third South within three months.

SALT LAKE CITY, UTAH.—The extension of its electric railroad system to Bingham Junction and the town of Sandy, is among the projects planned for the early spring by the Utah Light & Railway Company.

SPOKANE, WASH.—Jay P. Graves has incorporated the Spokane & Interurban system to build an electric railway from Spokane across Moran Prairie, through Palouse County to Moscow, Ida, and eventually to the Snake River. The articles of incorporation have been filed and the capital of the company placed at $3,500,000. The incorporators are: Alfred Coolidge, president of the Traders' National Bank, of Spokane, and the Colfax National Bank, of Colfax; John Twohy, member of the firm of Twohy Brothers, large railroad contractors and heavy stockholders in the Old National Bank; F. Lewis Clark, one of the largest property owners in the city; F. A. Blackwell, president of the Cœur d'Alene & Spokane Railway, and Jay P. Graves, president of the Spokane Traction Company and an extensive stockholder in the Granby mines and smelter, of which he is also managing director. Mr. Graves says the road will be operated by electricity for its passenger and express service, but that it will move its carloads of freight at night by steam power. The new company will enter Spokane over the lines of the Spokane Traction Company. This company, together with the Cœur d'Alene & Spokane Company, controls a site 155 ft. x 175 ft., bounded by Washington, Sprague and First. A terminal company will be formed to construct a station and office building for passenger depot and office purposes by the three companies. It is thought that at first power may be secured from the Washington Water Power Company, but it will probably be necessary in the near future to acquire a plant of its own.

MILWAUKEE, WIS.—John I. Beggs, president of the Milwaukee Electric Railway & Light Company, is quoted as saying that it is the intention of the management of his company to build an electric line from Waukesha to Oconomowoc, but that it has not definitely decided when to build.

NEWS NOTES

ATLANTA, GA.—After Jan. 21, 1905, the cars of the Georgia Railway & Electric Company will stop on the near side of all streets to take on and let off passengers. Heretofore all cars have stopped on the far side of the streets. Several years ago the cars stopped on the near side of the street, but when D. A. Belden became general manager of the combined electric car companies he inaugurated the plan of stopping on the far side of the streets.

MARLBORO, MASS.—A new schedule of wages for motormen and conductors on the Marlboro & Framingham division of the Boston & Worcester Street Railway, a voluntary increase over the old schedule, has just gone into effect. Under its terms, employees will be given 21 cents an hour for the first year, 22 cents for the second and third, 23 cents for the fourth, fifth and sixth years, 24 cents for the years up to the tenth year, and 25 cents an hour after the tenth year. General Superintendent E. P. Shaw, Jr., makes this comment: "While our net earnings do not at the present time warrant us to increase the scale of wages, we hope that by your earnest co-operation, accident expenses will be reduced, and by your greater attention to the traveling public, our patronage will increase."

WORCESTER, MASS.—In the STREET RAILWAY JOURNAL of Nov. 5 reference was made to the methods employed by various citizens of Marlboro, Mass., to extort tribute from the Boston & Worcester Street Railway Company by refusing the road permission to bring 13,000-volt power to a new sub-station, which was to be placed in operation in that city, and the hope was expressed that the Board of Aldermen would be sufficiently far-sighted and public-spirited to permit the company to carry its plans to a logical conclusion without the payment of money to the calamity howlers who were stirring up the trouble. After several weeks of effort on the part of the company to meet the situation in a straightforward and honorable manner, the Aldermen have denied the road the completion of its plans to give better service to the community, and there the matter rests.

JERSEY CITY, N. J.—Justice Jonathan Dixon, at Jersey City, has handed down a decision refusing to set aside the award of $200,000 given to the Lackawanna Railroad Company in its suit against the Manhattan & Hoboken Railroad for a right of way under the Lackawanna property for a tunnel from the foot of Fifteenth Street, Jersey City, to Hoboken. The case will now be carried to the Court of Errors and Appeals on the ground that Justice Dixon erred in not allowing evidence concerning the ship canal which the Lackawanna proposes to build to go before the jury.

TOLEDO, OHIO.—The employees and most of the officers of the Toledo & Indiana Railway have organized a new association to be known as the Lavenberg Club, named after the genial general manager of the road, who has been instrumental in getting the new organization started. The object of the club is two-fold, that of creating a friendly and social feeling among the employees and their families and also of affording financial relief in case of sickness, accident or distress. The officers elected are: President, Arthur S. Webb; vice-president, James Dougelby; secretary, Perry O. Keister; treasurer, Addison B. Thompson. Already there are fifty members to the club, and it is expected to extend it to every employee of the road. The club meets twice each month.

YORK, PA.—The York Board of Health has deputized ten conductors in the employ of the York County Traction Company to act as its agents in enforcing that section of the anti-spitting ordinance which pertains to trolley cars of the city. These conductors are invested with full authority to make arrests for violation of the ordinance. The board, it is stated, is determined in its efforts to suppress the habit of spitting upon the floors of street cars.

KNOXVILLE, TENN.—The Christmas gift of the employees of the Knoxville Traction Company came in the form of a notice posted on the bulletin board in the Gay Street car house, increasing the salaries of all the motormen and conductors. The increase amounts to from 15 per cent to 22 per cent, an average of about 20 per cent for all of the men. The increase in salaries takes effect Jan. 1, and is on a graduated scale covering the length of the period of service of the different men. The new men now start in on as high a salary as the old men have been receiving, but the old men will receive a 20 per cent increase.

MILWAUKEE, WIS.—Four-cent fare tickets are now accepted by the Milwaukee Electric Railway & Light Company regardless of the time when presented. Heretofore they have been accepted between certain time limits only. This change in the rate of fare is in accordance with the terms of the company's franchise.

FINANCIAL NOTES

CHICAGO, ILL.—The Elgin, Aurora & Southern Traction Company reports earnings as follows:

November	1904	1903
Total gross receipts	$36,380	$34,615
Operating expenses	21,872	22,296
Net earnings	$14,507	$12,318
Deductions from income	9,333	9,172
Net income	$5,174	$3,146
Five months ending Nov. 30	1904	1903
Total gross receipts	$201,586	$206,678
Operating expenses	107,799	116,887
Net earnings	$93,786	$89,790
Deductions from income	46,505	45,862
Net income	$47,280	$43,928

Operating expenses include an accident appropriation equal to 2 per cent of gross receipts. Bonds of the company purchased and held in sinking fund, $57,000.

GOSHEN, IND.—A merger which consolidates the Indiana Railway Company, operating interurban lines between Goshen, Elkhart, Mishawaka and South Bend, and South Bend and Niles, Mich., with the Indiana Western Railway Company, which is constructing a line west from South Bend, touching Chain Lakes, New Carlisle, Laporte and Michigan City, has just been effected and has a most important bearing on electric railway interests in Northern Indiana. The Consolidated has also started the building of a line from Niles, Mich., to Buchanan, Mich., and thence on to Benton Harbor and St. Joseph, Mich. The consolidated companies have a capitalization of $3,000,000, and provision is made for issuing bonds to pay off indebtedness and add to the equipment, the bonds running fifty years. The directors are Arthur Kennedy, of New York City; J. McM. Smith, of South Bend; Wilber L. Stonex, of Goshen; James B. McCance, of South Bend, and Walter Lyon, of Pittsburg, Pa.

BOSTON, MASS.—The Taunton & Buzzards Bay and Taunton & Pawtucket Street Railway Companies, successors to the Middleboro, Wareham & Buzzards Bay and the Bristol County Street Railway Companies, have applied to the Railroad Commissioners for an approval of capital stock. The capital of the Taunton & Buzzards Bay Street Railway Company is fixed at $225,000, and of the Taunton & Pawtucket Street Railway Company at $200,000. The roads were recently sold by the receivers to Boston, Providence and Pawtucket men.

BOSTON, MASS.—The State Railroad Commissioners have authorized the consolidation of the Worcester & Southbridge, the Southbridge & Sturbridge, and Worcester, Rochdale & Charlton Depot Street Railway Companies, the controlling interest in all of which has been acquired by the New York, New Haven & Hartford Railroad Company. The new system, which will be known as the Worcester & Southbridge Street Railway Company, has permission to increase its capital stock by $100,000, to be used in purchasing the outstanding stock of the Southbridge and the Sturbridge & Charlton Depot roads on a share-for-share basis. The original Worcester & Southbridge Road and the Charlton Depot Company went into the hands of receivers about a year ago, but were subsequently reorganized.

CONCORD, MASS.—The sale of the Concord & Boston Street Railway Company's property will be held on Jan. 28. The postponement is made in order that the creditors may have further opportunity to arrange for a satisfactory disposal of the property.

LEOMINSTER, MASS.—The Railroad Commissioners have approved an issue of bonds by the Leominster, Shirley & Ayer Street Railway Company amounting to $100,000. These are payable Feb. 1, 1921, and are to bear interest at 5½ per cent. The proceeds are to be used in paying off floating indebtedness.

BALLSTON, N. Y.—The Eastern Railroad Company, whose incorporation has been noted in the STREET RAILWAY JOURNAL, is a reorganization of the Ballston Terminal Railway. It is capitalized at $100,000. Of the nine directors of the company, Thomas F. Barrett, Carlsbad Hotel, Saratoga Springs, holds 986 of the 1000 shares into which the capital stock is divided. The other directors are Frederick H. Beach, George T. Cunningham and Byron L. Cole, of Ballston; Thomas R. Hiller, of Somerton, Pa.; I. J. Eshelman, Harry M. Wall, Abraham A. Moyer and Emlyn Poynter, of Philadelphia.

MIDDLETOWN, N. Y.—A judgment of foreclosure and sale involving the Middletown-Goshen Electric Railway, has been obtained before Justice Dickey, in Brooklyn, by the trustee, the Farmers' Loan & Trust Company, of New York City.

NEW YORK, N.Y.—The New York Securities Company has obtained a receivership for the New Orleans Railways Company, E. C. Foster and Pearl White being the receivers. The action was taken to forestall unfriendly suits pending reorganization.

PEEKSKILL, N. Y.—The Peekskill Lighting & Railway Company reports as follows:

One month, October	1904
Gross earnings	$9,656
Operating expenses	5,368
Net earnings	$4,287
Four months ending Oct. 30	1904
Gross earnings	$42,771
Operating expenses	22,507
Net earnings	20,264
Deductions from income	9,583

CLEVELAND, OHIO.—George T. Bishop, president of the Northern Texas Traction Company, has returned from Texas, where he made an inspection of the property. He says that the best news of the company is the continuation of the enormous earnings which have been shown heretofore. The month of December continues the rate of increase which has been shown through the past few months. He says that the company will earn 4¾ per cent this year and will pay 3 per cent on the stock.

CLEVELAND, OHIO.—The November financial statement of the Cleveland & Southwestern Traction Company shows as follows:

November	1904	1903
Gross receipts	$41,047	$37,861
Operating expenses	22,891	22,908
Net earnings	$18,155	$14,952
Eleven months		
Gross receipts	$438,290	$411,750
Operating expenses	271,180	242,522
Net earnings	$167,110	$169,227

DAYTON, OHIO.—The Dayton & Northern Traction Company has increased its capital stock by an issue of $100,000 5 per cent preferred stock. The action was taken to pay off an indebtedness incurred at the time of the construction of the road.

DAYTON, OHIO.—The Oakwood Street Railway Company has increased its capital stock from $19,000 to $500,000. The increase has no significance other than a desire to have a capitalization in some way commensurate with its value. The old capital represents the amount paid for the property at Sheriff's sale twenty-five years ago. The road is owned outright by the Winters-Clegg families. It has 8 miles of track, earns at the rate of $130,000 a year, and has no bonded indebtedness.

SPRINGFIELD, OHIO.—The Springfield, Charleston, Washington C. H. & Chillicothe Traction Company has filed a mortgage for $1,500,000 in favor of the Ohio Trust Company, covering an issue of 5 per cent bonds. The claims of the Springfield, Troy & Piqua Traction Company for furnishing power to the road are made a prior lien to the bonds. The road has just been placed in operation to South Charleston.

YOUNGSTOWN, OHIO.—A new report is in circulation to the effect that the Youngstown & Southern Railway has been sold to the Lake Shore & Michigan Southern Railway (steam). Officials of the company repeat the former denial, that they have no intention of selling the property, and that it will be completed as an electric line as originally projected.

PITTSBURG, PA.—The United Traction Company has declared a dividend of 2½ per cent on the preferred stock, payable Jan. 20, as registered Jan. 10.

READING, PA.—The lease of the Adamstown & Mohnsville Electric Railway to the United Traction Company has been placed on record. The lease is for 999 years from Jan. 1, 1905, and provides that the lessee is to pay quarterly to the lessor 37½ per cent of the gross receipts until the annual gross earnings shall reach $25,000, all over that amount to be retained by the lessee.

When the lease expires the lessee shall have the option to purchase the road for $75,000, subject to the mortgage bonds then outstanding.

EL PASO, TEX.—A dividend of $3 yer share has been declared payable on the preferred stock of the El Paso Electric Company on Jan. 9, 1905, to stockholders of record at the close of business Dec. 29, 1904. The stock transfer books will close Dec. 29 at 2 p. m., and will reopen Jan. 10, 1905, at 10 a. m.

MILWAUKEE, WIS.—Taxes on gross receipts for the year ending Nov. 30, 1903, paid by the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company, total $136,802, an increase of $1,738 over the preceding year, on total receipts of $3,648,206, according to the statement filed with Controller Pawinski by President John I. Beggs, of the companies. The gross receipts of the Milwaukee Electric Railway & Light Company for the year are $3,191,909, making a tax of $127,676, while the receipts of the Milwaukee Light, Heat & Traction Company, total $456,297, giving a tax of $9,126. The taxes of the companies have more than doubled in seven years, as is shown by the following table of the taxes paid by the two companies since 1897:

Years	T. M. E. R. L. Co.	M. L. H. & T. Co.	Total
1898	$62,460	$1,509	$63,969
1899	79,088	4,650	83,738
1900	87,654	5,836	93,491
1901	95,541	6,427	101,968
1902	108,260	7,024	115,283
1903	120,657	8,407	125,064
1904	127,676	9,126	136,802

AMONG THE MANUFACTURERS

THE CHARLES N. WOOD ELECTRIC COMPANY, of Boston, Mass., has issued a bulletin of electrical machinery ready for immediate shipment, including mainly small, 110-volt, 220-volt and 500-volt d.c. motors, and several alternators and dynamos.

LIKE ITS OTHER PRODUCTS, the 1905 calendar of the McCullough-Dalzell Crucible Company, of Pittsburg, Pa., is distinguished for substantial simplicity and neatness in design. A novelty in the make-up of this wall calendar is the arrangement for folding it in the middle for desk use, thereby exposing only the dates themselves.

BOLTS, NUTS AND RIVETS are treated at length, with many comprehensive tables, in the new catalogue, No. 25, issued by the famous specialists in that line—the Hoopes & Townsend Company, Philadelphia, Pa. The publication is one which will certainly be found a good reference book in the engineering and shop departments of traction companies.

THE OHMER FARE REGISTER COMPANY, of Dayton, entertained its traveling salesmen at an elaborate banquet last week. John F. Ohmer, president of the company, was presented by the traveling men with a silver smoking set of three pieces, while E. B. Grimes, assistant general manager, was presented with a cut glass ink-well with sterling silver top.

THE MEMPHIS "TIMES" says that the officials of the Memphis Street Railway Company are contemplating some radical improvements throughout the system, and that should bonding be done, the bonds used probably will be of the soldered type made by the Lord Electric Company, of Boston, Mass., whose bonds were recently adopted for use in the electrification of the Long Island Railroad.

LEST THE RAILWAY BUILDER FORGET that the steam shovel is a prime necessity in construction work, the Vulcan Iron Works, of Toledo, Ohio, have gotten out for his benefit a finely colored calendar for the new year, the upper of the two illustrations showing one of their Vulcan steam shovels at work and the lower one a section of the Panama Canal construction, Culebra cut.

THE AMERICAN VENTILATOR COMPANY, with headquarters at 15 Cortlandt Street, New York, is now manufacturing under the Joseph Leather United States patents the ventilating car and building system, which has proved so successful on many of the prominent English steam and electric railways. The officials of this company, who are well-known in American railway circles, are: President, Anderson Fowler; secretary, Richard B. Kelly; treasurer, Henry M. Shaw.

THE ALLIS-CHALMERS COMPANY opened new sales offices in Philadelphia on Jan. 1 in the Land Title Building. The offices heretofore maintained by the electrical department of the company, the Bullock Electric Manufacturing Company, in the North American Building, have been removed also to the Land Title Building, where they have been consolidated with those of the parent company. The new offices are under the charge of W. A. Wood, who will look after each of the interests of the company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has just published in neat pamphlet form three of the papers presented at the August, 1904, meeting of the Ohio Electric Light Association, at Sandusky, Ohio. These are: Special publication No. 7024, Instrument Equipment of a Testing Department, by F. Conrad; special publication No. 7023, Points for Consideration when Purchasing Series A.C. Lamps, by G. Brewer Griffin, and special publication No. 7022, Notes on Incandescent Street Lighting, by K. C. Randall.

THE CALIFORNIA GAS & ELECTRIC CORPORATION, of San Francisco, has just ordered from the Stanley Electric Manufacturing Company two frequency-changing outfits of 5000-kw capacity each. These outfits are for use in connection with the contract which the California Gas & Electric Corporation has secured from the San Francisco Street Railway Company, and will change the 60-cycle current from the Bay County long-distance line to 25 cycles for further distribution among the sub-stations of the street railway company. The contract awarded the Stanley Company also includes transformers of 12,000 kw.

THE JOLIET (ILL.) "REPUBLICAN" announces that the Illinois Steel Company there is about to begin an extension of its works at a cost of $100,000, to accommodate the business of the Continuous Rail-Joint Company of America. The latter company is a New Jersey corporation with headquarters at Newark, N. J. It has extensive works at Troy, N. Y., but has found its Western business requires a plant nearer the center of trade, and for that reason has entered into the arrangements noted above with the Joliet company.

THE INGERSOLL-SERGEANT DRILL COMPANY compressor catalogue has just been issued. This catalogue, which is numbered Form 35, consists of advance sheets of the company's catalogue No. 36, and includes some additional information besides that appearing in the first edition of No. 35. There are new views of several important installations, including those of the Cleveland Stone Company and the Mare Island Navy Yard. Air receivers, inter and after-coolers are also given a place. The complete catalogue, No. 36, will appear later in the year.

THE WESTINGHOUSE COMPANIES' PUBLISHING DEPARTMENT has fittingly opened the new year by publishing a neatly bound combined pocket diary, atlas and engineers' encyclopedia. The engineering data embrace a great deal of new and interesting matter on lightning arresters, choke coils, operating hints, comparative tables showing heating values of various kinds of coals, data on boilers, power gases, turbine performance curves, application of motors to machine tools, etc. A prominent feature is the information given on railway work, such as train resistance, electric car heating and drop in lines and rails.

W. S. MONTGOMERY, who was for many years sales manager for the Conover Condenser Company, and for the past year New York manager for the Payne Engine Company, has severed his connection with the latter concern and formed a partnership with G. M. Rogers, under the firm name of Rogers & Montgomery, and with offices at No. 147 West Twenty-Third Street, New York City. The new firm will deal in a general line of small labor-saving tools and hardware specialties, and are the exclusive United States sales agents for the new line of patented hand and press punches lately brought out by the Gem Tool Works, of Brooklyn.

A BANQUET was tendered S. M. Keeble, of St. Louis, at the Missouri Athletic Club, by the electrical fraternity of the city, as a tribute of the high esteem in which he is held by his many friends, as he will shortly leave the Frank Adam Electric Company, with which he has been connected as chief of switchboard and electrical department, to become general sales manager of the Cutter Company, of Philadelphia, manufacturers of the I. T. E. circuit breakers. Mr. Keeble carries with him the best wishes of all with whom he has been connected in business, and a slight tribute was paid him by the Adam Company in the form of a gold watch and chain. A diamond-studded Masonic emblem, presented to him by his brother members, symbolizes their esteem.

C. V. FUNK, of the Ohmer Fare Register Company, at Dayton, Ohio, has installed the company's registers in the passenger cars of the Toledo & Indiana Railway. The new method accounts for all persons traveling, showing whether by cash fare, ticket or pass, and is a safeguard to the company and conductor as well. Each conductor is provided with a key, on which is his individual number, and the register cannot be operated unless this key is inserted in the machine, and every record made there will show by what conductor it is made. Every transaction is registered, printed on a roll of paper and shows the amount, date, trip and conductor. When the conductor has finished his day's run he simply inserts his key, takes a footing, and his report is ready for the auditor. The night inspector of cars takes out the day's records as the cars are turned in.

THE MAYER & ENGLUND COMPANY, of Philadelphia, wound up the year 1904 with what it believes to be undoubtedly the largest rail-bond order of the year. It has secured the contract to supply all the rail bonds required for the special section of contact rail for the Long Island Railroad, as well as a large number of bonds for use on the track rail. The order aggregates 48,000 of the company's well-known protected rail bonds, having a total weight of considerably over 100,000 lbs. The bonds for the contact rail are of the type L-3 pattern, applied to the base of the rail with hydraulic punches and compressors, in the same manner as the bonds furnished to the New York subway. Each joint will be bonded up to 1,500,000 cm, which is equivalent to the full carrying capacity of the rail. In addition to this very large order, the Mayer & Englund Company is carrying several other contracts over into 1905, so that its rail and bond factory will be running full time until the spring work opens up.

TURBO-GENERATOR CONTRACTS closed by the Westinghouse Electric & Manufacturing Company during the last week of 1904 included two 1000-kw outfits for the Haverhill (Mass.) Electric Company, to be used in lighting and power work in that city; two 1500-kw outfits for the Rochester, Syracuse & Eastern Railway Company, and one 1000-kw outfit with exciter for the Springfield Electric Light Company, Springfield, Mass.; also a 300-kw turbo-generator with exciter for the Northern Electric & Manufacturing Company, of Montreal. The Springfield Electric Light Company's contract also included two 500-kw rotary converters and four 300-kw transformers. The company also has closed a contract with the Ontario Power Company for an alternating-current generator with a rated output of 10,000 hp at 85 per cent power factor. This is in addition to three other machines of similar type which the Westinghouse Company is furnishing for this plant. The generators are of the revolving-field, two-bearing type, designed for direct connection to water-wheels; they generate three-phase current at 12,000 volts and

25 cycles, and run at a speed of 187½ r. p. m. Among other apparatus included in this contract are twelve 3000-kw, oil-insulated, water-cooled transformers, wound for 12,000 volts and 60,000 volts; two 375-kw exciters and complete switchboards. P. N. Nunn and L. L. Nunn are the engineers in charge of the Ontario Power Company's plant, and the plant is being built by the Niagara Construction Company, of which General Francis V. Greene is president.

E. S. LEA, who is widely known as an authority on the subjects of turbines and centrifugal pumps, has resigned his position as sales manager for the De Laval Steam Turbine Company and has opened an office at 42 Broadway, New York, as consulting engineer. Mr. Lea, prior to his four years' connection with the De Laval Company, had a wide experience in designing and constructing power plants and water works and in the manufacture of general machinery. The recent striking development in the uses of the steam turbine and the centrifugal pump, and the lack of exact knowledge among engineers regarding the capabilities and limitations of the various types now on the market, seem to assure a large measure of success to Mr. Lea, who is the first to enter this important field as an independent consulting expert. Mr. Lea is a member of the American Society of Mechanical Engineers and an associate member of the American Institute of Electrical Engineers and of the American Society of Naval Engineers.

THE ECCLESTON LUMBER COMPANY, of New York, has presented the following interesting report on the pole situation: "The largest consumers of poles have been experimenting considerably during the last two or three years, realizing that the supply of Northern cedar and chestnut poles is becoming scarcer and higher priced all the time, and the results of their experiments has been a frank acknowledgment that the Southern white cedar or juniper poles are in every way as desirable and more economical than the Northern cedar, principally from the fact that the butts of the Northern cedar poles are naturally more or less decayed, the common specifications allowing 20 per cent of butt rot, whereas the Southern cedar or juniper poles are perfectly sound, exceptionally straight, free from shakes, and hold a good taper, and the durability of the Southern poles is as good as the Northern poles and their strength as great. During the past year over 400,000 of these Southern cedar or juniper poles have been used, all it was possible to get out of the Southern swamps. At no time did the supply anywhere equal the demand. It is the opinion of those best posted that this year and the year to follow will see a tremendous quantity of Southern red cypress poles universally used, as the supply of cedar or juniper is very limited, and there is practically no limit to the amount of cypress that can and will be used for poles. Present indications point to an exceedingly heavy demand for poles this coming year, and it would be well for the largest users to place their contracts at an early date, as they will, we believe, effect a very considerable saving, as the prices generally are bound to advance."

DIRECTORY OF STREET RAILWAY ASSOCIATIONS

National Association of Railroad Commissioners.

President, IRA B. MILLS, of Minnesota.
First Vice-President, J. S. NEVILLE, of Illinois.
Second Vice-President, W. G. SMITH, of South Dakota
Secretary, E. A. MOSELY Washington, D. C.
Assistant Secretary, M. S. DEUTER, Washington, D. C.
Next convention at Deadwood, South Dakota, August 15, 1905.

American Street Railway Association.

President, W. CARYL ELY, President International Ry. Co., Ellicott Sq., Buffalo, N. Y.
First Vice-President, ELWIN C. FOSTER, President New Orleans Railways Company, 317 Barone St., New Orleans, La.
Second Vice-President, JOHN I. BEGGS. President and General Manager Milwaukee Elec. Ry. & Lt. Co., Milwaukee, Wis.
Third Vice-President, RICHARD McCULLOCH, Ass't Genl. Mgr. St. Louis Transit Co., 3869 Park Ave., St. Louis, Mo.
Executive Committee: Presidents and Vice-Presidents and JOHN J. STANLEY, General Manager Cleveland Electric Railway Co., Cleveland, O.; HOWARD F. GRANT, Manager Seattle Electric Co., Seattle, Wash.; C. G. GOODRICH, Vice-President Twin City Rapid Transit Co., Minneapolis, Minn.; FRANK G. JONES, Vice-President and General Manager Memphis Street Railway Co., Memphis, Tenn.; W. E. HARRINGTON, General Superintendent Public Service Corporation of New Jersey, Camden, N. J.

Street Railway Accountants' Association of America.

President, W. G. ROSS, Managing Director Montreal Street Railway Co., Montreal, Que.
First Vice-President, FRANK R. HENRY, Auditor St. Louis Transit Co., St. Louis, Mo.
Second Vice-President, ISAAC McQUILKIN, Comptroller Indiana Union Traction Co., Anderson, Ind.
Third Vice-President, J. W. LESTER, Treasurer Worcester Consolidated Street Railway Co., Worcester, Mass.
Acting Secretary and Treasurer, W. B. BROCKWAY, Auditor Nashville Railway and Light Co., 40 Morris Street, Yonkers, N. Y.
Executive Committee: F. E. SMITH, Auditor Chicago Union Traction Co., Chicago, Ill.; G. B. WILLICUTT, Secretary United Railroads of San Francisco, San Francisco, Cal.; ARTHUR L. LINN, Jr., Ass't Secretary and Treasurer Utica & Mohawk Valley Railway Co., Utica, N. Y.; P. S. YOUNG, Comptroller Public Service Corporation of New Jersey, Nerwak, N. J.

American Association of Street Railway Claim Agents.

President, W. A. DIBBS, New York, N. Y.
Vice-President, E. W. O'CONNOR, Savannah, Ga.
Secretary and Treasurer, B. B. DAVIS, Columbus, O.
Executive Committee and Officers: WM. RENAUD, New Orleans, La.; WM. WHITE, Chicago, Ill.; J. P. FEENY, Jersey City, N. J.

American Railway Mechanical and Electrical Association.

President, C. F. BAKER, Superintendent Motive Power Boston Elevated Railway Co., 101 Milk St., Boston, Mass.
First Vice-President, H. H. ADAMS, Master Mechanic United Railways & Electric Co., Carroll Park Shops, Baltimore, Md.
Second Vice-President, JOHN MILLAR, Master Mechanic International Railway Co., Cold Springs, Buffalo, N. Y.
Third Vice-President, F. G. SIMMONS, Superintendent of Way, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
Secretary and Treasurer, WALTER MOWER, Detroit United Railway Company, Detroit, Mich.
Executive Committee: D. F. CARVER, Chief Eng. Public Service Corporation of New Jersey, 29 Exchange Place, Jersey City, N. J.; J. S. DOYLE, Master Mechanic Electrical Department Interborough Rapid Transit Co., 98th St. & 3rd Ave., New York City; C. C. LEWIS, Chief Eng'r Schenectady Railway Co., Schenectady, N. Y.; W. H. McALONEY, Master Mechanic Denver City Tramway Co., Denver, Col.

American Street Railway Manufacturers' Association.

Executive Committee: DANIEL M. BRADY, Chairman, President Brady Brass Co., 95 Liberty St., New York; JOHN A. BRILL, Vice-President J. G. Brill Co., Philadelphia, Pa.; CALVERT TOWNLEY, General Agent, New York Westinghouse Electric and Manufacturing Co., New York, N. Y.; E. M. WILLIAMS, Director Sherwin Williams Co., Cleveland, O.; FRED S. KENFIELD, President Street Railway Review, Chicago, Ill.; GEO. J. KOBUSCH, President St. Louis Car Co., St. Louis, Mo.; J. R. LOVEJOY, Manager Railway Department General Electric Co., Schenectady, N. Y.; JAMES H. McGRAW, President McGraw Publishing Co., 114 Liberty St., New York, N. Y.; W. J. COOKE, Vice-President McGuire-Cummings Manufacturing Co., Chicago, Ill.; JOHN W. NUTE, President St. Louis Car Wheel Co., St. Louis, Mo.; WM. WHARTON, of Wm. Wharton, Jr. & Co., Philadelphia, Pa.; C. K. KING, Secretary Ohio Brass Co., Mansfield, O.; FRANK C. RANDALL, Vice-President National Electric Co., Milwaukee, Wis.; W. H. WHITESIDE, Allis-Chalmers Co., Chicago Ill.
Secretary, RICHARD W. MEADE, 621 Broadway, New York, N. Y.
E. H. BAKER, Chairman Finance Committee, Galena Signal Oil Co., 26 Broadway, New York, N. Y.
C. C. PIERCE, Chairman Entertainment Committee, General Electric Co., Boston, Mass.

Colorado Electric Light, Power and Railway Association.

President, JOHN A. BEELER, Vice-President and General Manager Denver City Tramway Co., Denver.
Vice-President, C. E. DOOLITTLE, Vice-President and Manager The Roaring Fork Electric Light and Power Co., Aspen.
Secretary and Treasurer, GEO. B. TRIPP, General Manager The Colorado Springs Electric Co., Colorado Springs.

Connecticut Street Railway Association.

President, J. B. CARRINGTON, New Haven.
Vice-President, A. M. YOUNG, Branford.
Secretary, E. W. POOLE, Bridgeport.
Treasurer, E. S. GOODRICH, Hartford.
Executive Committee: The above officers and J. E. SEWELL, Bridgeport, C. S. TREADWAY; Bristol; WALTER LEARNED, New London.

Iowa Street & Interurban Railway Association.

President, GEORGE B. HIPPEE, General Manager. Des Moines City Railway Co., Des Moines.
Vice-President, J. F. LARDNER, General Manager, Tri-City Railway Co., Davenport.
Secretary and Treasurer, L. D. MATHES, General Manager, Union Electric Co., Dubuque
Executive Committee, President, Vice-President, and the Secretary and Treasurer.
Next meeting at Dubuque, Spring of 1905.

The Maine Street Railway Association.

President, W. R. WOOD, Portland.
Secretary and Treasurer, E. A. NEWMAN, 471 Congress St., Portland.
Executive Committee: WILLIAM R. WOOD, Portland; AMOS F. GERALD, Waterville; J. MANCHESTER HAINES, Augusta; G. E. MACOMBER, Rockland.

Massachusetts Street Railway Association.

President, EDWARD P. SHAW, Newburyport.
First Vice-President, FRANCIS H. DEWEY, Worcester.
Second Vice-President, ROBT. S. GOFF, Fall River.
Secretary, CHARLES S. CLARK, 70 Kilby St., Boston.
Treasurer, FRED H. SMITH. Quincy.
Executive Committee: President, Vice-Presidents and P. F. SULLIVAN, Lowell; H. H. CRAPO, New Bedford; WILLIAM S. LOOMIS, Holyoke; R. T. LAFFIN, Worcester; and W. W. SARGENT, Fitchburg; WM. M. BUTLER, Boston.
Auditing Committee: GEO. W. COOK, Springfield, CHARLES F. GROSVENOR, Palmer; H. C. PAGE, Pittsfield.
Monthly meetings second Wednesday of each month excepting July and August.

Michigan Interurban and Street Railway Association.

President, J. D. HAWKS, Detroit.
Vice-President, W. L. JENKS, Port Huron.
Secretary and Treausrer, BENJAMIN S. HANCHETT, Grand Rapids.
Executive Committee: Officers of the Association and STRATHEARN HENDRIE and JOHN WINTER, Detroit.
Next meeting to be held at call of president.

New England Street Railway Association.

President, J. H. NEAL, Boston, Mass.
Vice-Presidents for States: I. L. MELOON, Sanford, Me.; H. A. ALBIN, Concord, N. H.; C. K. JONES, Brattleboro, Vt.; JOHN T. CONWAY, Brockton, Mass.; D. F. SHERMAN, Providence, R. I.; J. K. PUNDERFORD, New Haven, Conn.
Secretary, JOHN J. LANE, 12 Pearl Street, Boston Mass.
Treasurer, NATHAN L. WOOD, care of Frank Ridlon Co., Boston, Mass.
Executive Committee: H. E. FARRINGTON, Chelsea Mass.; C. F. BAKER, Boston, Mass.; W. D. WRIGHT, Providence, R. I.; E. A. STURGIS, Worcester, Mass.; LOUIS PFINGST, Boston, Mass. R. W. CONANT, Cambridge, Mass.; D. E. MANSON, Boston, Mass.
Finance Committee: J. H. NEAL, Boston, Mass.; JAMES F. WATTLES, Boston, Mass.; FRED F. STOCKWELL, Cambridgeport, Mass.
Meetings are held the fourth Thursday of every month at various points in New England.

New York State Street Railway Association.

President, C. LOOMIS ALLEN, Utica.
First Vice-President, J. H. PARDEE, Canandaigua.
Second Vice President, A. B. COLVIN, Glens Falls.
Executive Committee: E. G. CONNETTE, Syracuse; R. E. DANFORTH, Rochester; B. B. NOSTRAND, Jr., Peekskill; E. F. PECK, Schenectady.
Next meeting at Niagara Falls, September, 1905.

The Ohio Interurban Railway Association.

President, HARRIE P. CLEGG, Dayton.
Vice-President, E. C. SPRING, West Milton.
Secretary and Treasurer, J. H. MERRILL, Lima.
Executive Committee: E. B. GUNN, Springfield; R. E. DeWEESE, Dayton; F. J. J. SLOAT, American Association, Cincinnati; A. W. ANDERSON, Dayton; HOWARD FRAVEL, West Alexandria.

Southwestern Electrical & Gas Association.

(Consolidation of Southwestern Gas, Electric & Street Railway Association and the Southwestern Electrical Association.)
President, J. F. STRICKLAND, Waxahachie.
Secretary, F. E. SCOVILL, Austin, Texas.
Treasurer, A. E. JUDGE, Tyler, Texas.

Pennsylvania State Street Railway Association.

President, F. B. MUSSER, Harrisburg.
Secretary, CHARLES H. SMITH, Lebanon.
Treasurer, W. H. LANIUS, York.
Executive Committee: The President, Secretary, Treasurer and ERNEST H. DAVIS, Williamsport, JOHN A. RIGG, Philadelphia.
Next meeting will take place in September, 1905.

Toronto (Canada) Railway Roadmasters' Association.

President, E. WHITAKER, Toronto.
Vice-President, GEORGE A. GREENE, Toronto.
Secretary and Treasurer, JOHN F. ARGUE, Room — Janes Building, King and Yonge Sts., Toronto.
Executive Committee: F. M. BLIGHT, D. KEARNEY and LOUIS WHEELER.
Executive Committee meets the first of each month.

Virginia Street Railway and Electric Association.

President, R. D. APPERSON, Lynchburg.
Vice-President, E. R. WILLIAMS, Richmond.
Executive Committee: The above and R. L. WILLIAMS, Norfolk, and E. L. TRAFFORD, Richmond.

Union Internationale de Tramways et de Chemins de fer d'intérêt local.

President, LEON JANSSEN, Gen. Mgr. Société des Tramways Bruxellois, 6, Impasse du Parc, Brussels.
Vice-Presidents, GUSTAV KÖHLER, Berlin; E. A. ZIFFER Vienna.
Secretary, P. T'SERSTEVENS, 6, Impasse du Parc, Brussels.
Treasurer, F. NONNENBERG, Chief Engineer of the Compagnie des Chemins de fer Secondaires, Brussels.
Executive Committee: Officers and Messrs. BROCA, Paris; GERON, Cologne; KESSELS, Brussels; VON PIRCH, Barmen-Elberfeld; LAVALARD, Paris.
Next convention, 1906.

Index to Advertisers

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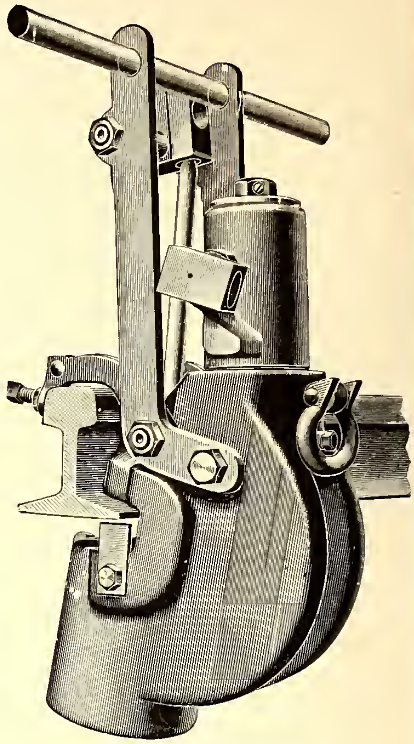
LONG ISLAND RAILROAD

Through Its Engineers,
Westinghouse, Church, Kerr & Co.,

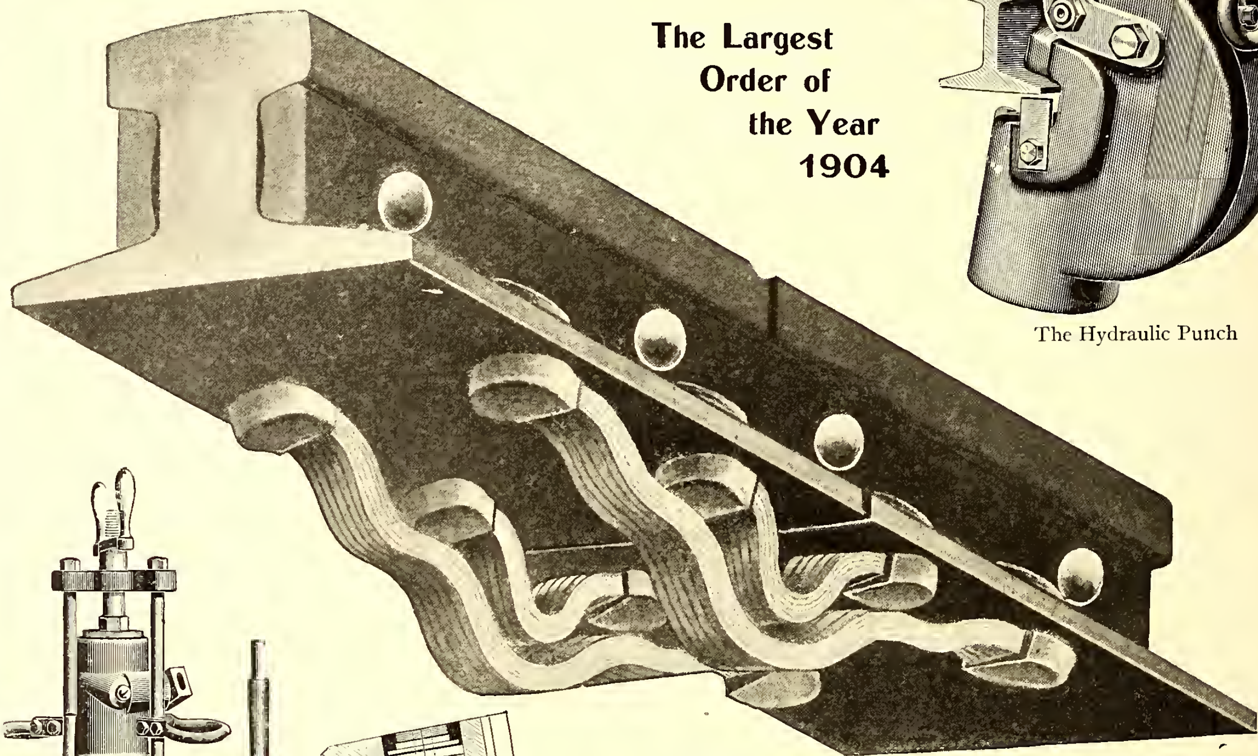
Has Placed an Order with Us for

48,000 Rail Bonds

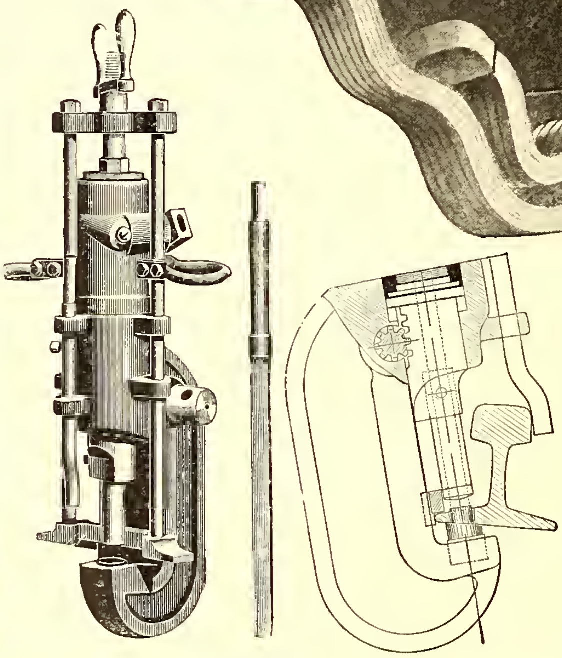


The Hydraulic Punch

The Largest Order of the Year 1904



Showing Method of Bonding Special Contact Rail with 1,500,000 C. M. of Copper



The Hydraulic Compressor

Also Hydraulic Machinery for Installing Them

WHY???

Did They Do It?

Ask Them or

THE MAYER & ENGLUND CO.

"The Protected Rail Bond People"

PHILADELPHIA, U. S. A.

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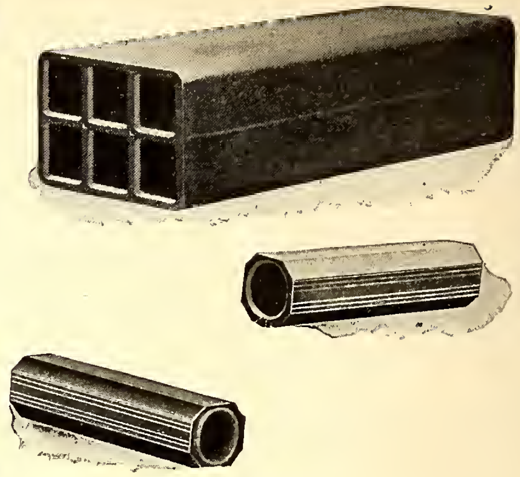

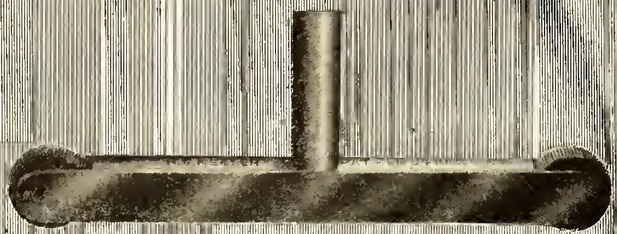

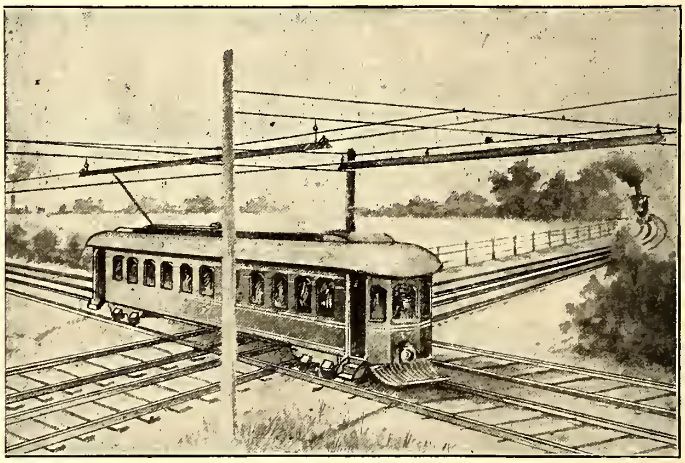

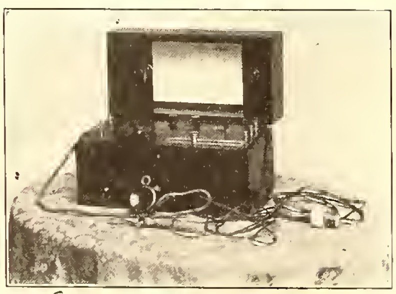

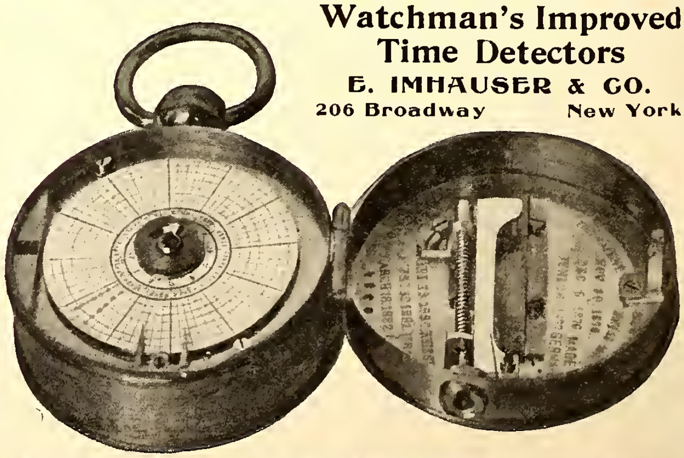

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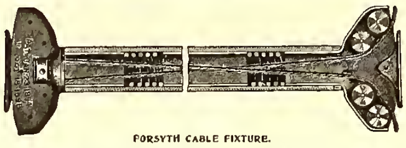

FORSYTH CABLE FIXTURE.

No breaking or fraying of cables. Spring-pressed shoes hold curtain. Adapted for convertible or open cars. Can't bind or stick in grooves.

THE CURTAIN SUPPLY CO.

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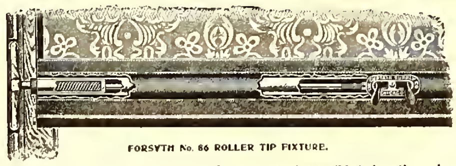


FORSYTH No. 86 ROLLER TIP FIXTURE.

New adjustment, simple and automatic. Fewer parts. Impossible to lose tips or handles. Won't creep up. Curtain securely held. Self-righting and remains in grooves.

OWNERS FOUNDATION CURTAIN FIXTURE PATENTS

Root Spring Scrapers

Are the highest priced Scrapers on the market. They are sold on a guarantee to give 3 to 1 better results than any Scraper made, and to be satisfactory in every way.

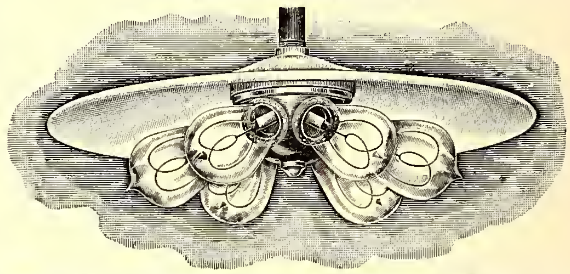
We can equip to ANY CAR

THE ROOT SCRAPER CO., KALAMAZOO, MICH.

Use Benjamin Wireless Clusters

For Car and Outdoor Lighting

Accept No Substitutes



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CHICAGO NEW YORK

...The...

Bellamy Vestlette

PATENTED APRIL 27, 1897.

For Street Railway Conductors

ABSOLUTELY SAFE

Money cannot be lost or stolen from these pockets.

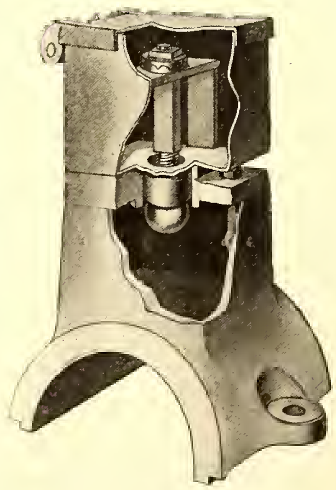
OVER 50,000 IN USE

Saves the price of a coat yearly. Conductor's uniform always presentable. Adopted as a part of the uniform by many Street Railway Companies. Agents wanted on every line.

The Bellamy Vestlette Mfg. Co., Cleveland, Ohio

DO NOT WORRY

Are you losing your Armatures and Bearings?



Bearings have run 225,000 miles.

IT CAN BE PREVENTED

Have you ever figured what this trouble costs you?

IT CAN BE SAVED

How many cars out of service on this account?

IT CAN BE AVOIDED BY USING OUR AUTOMATIC LUBRICATOR

We claim only that which we can prove.

Standard Automatic Lubricator Company

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We can supply any book on any branch of Engineering ✣✣✣✣✣✣ Send us your inquiries

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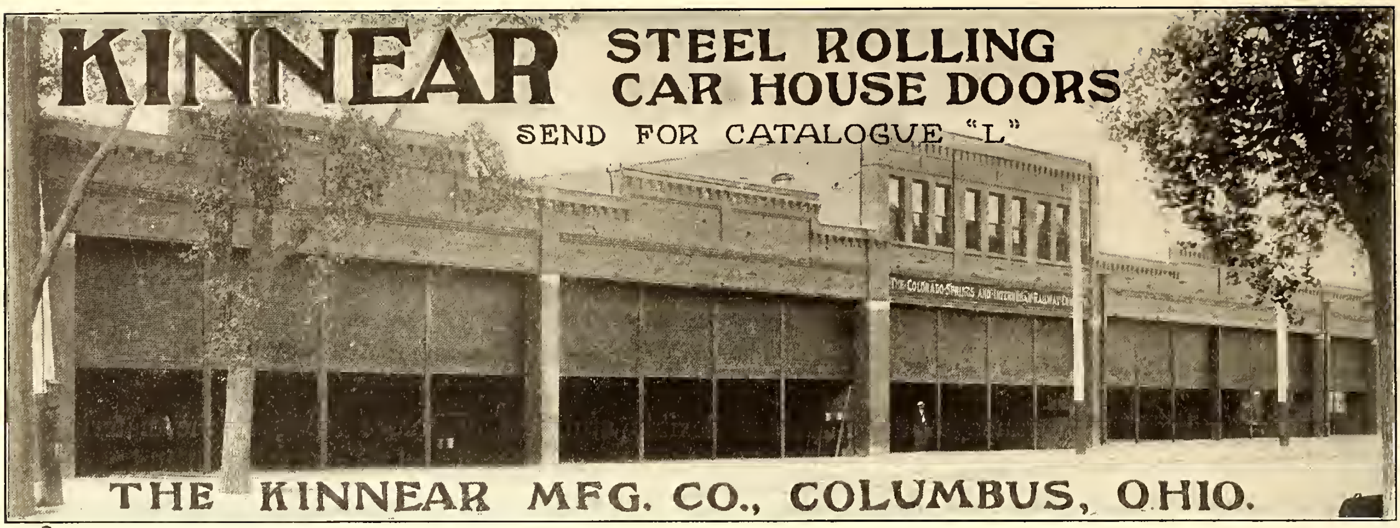

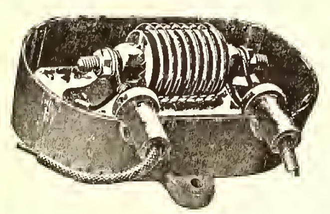

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SHAW'S NON-ARCING

Lightning Arresters and Static Dischargers

Will Not Fuse. Always Ready. No Moving Parts.

SHAW ENGINEERING & MANUFACTURING CO.

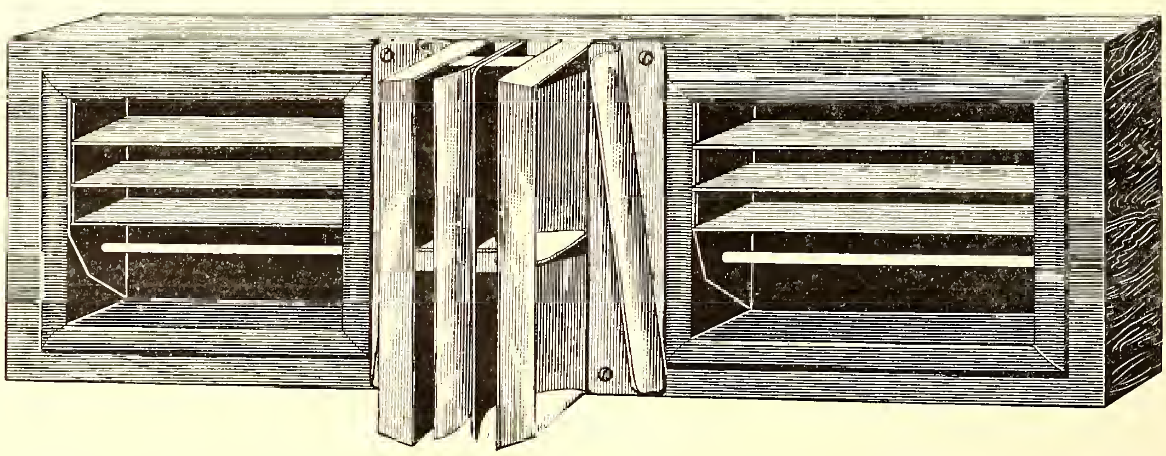
Sales Dept., 15 Cortlandt Street, New York Factory, Newark, N. J.

"Perfectly Annealed" might be stamped on every McCullough-Dalzell Crucible—and service would prove the marks correct. Uniformity in this, as in every other superior crucible quality. Write for prices.

McCULLOUGH-DALZELL CRUCIBLE CO., PITTSBURGH, PA.

Well-Ventilated Cars

contribute to both the comfort of passengers and the health of the community.



Our ventilators, which are adapted to all types of railway cars, are unequalled for the manner in which they supply pure air without subjecting passengers to draughts or chills. Used on both sides of the Atlantic with uniform success, as numerous letters testify. Send to us for information which will be of value to you.

American Ventilating Co. 15 Cortlandt St., New York

CLASSIFIED DIRECTORY

OF

Manufacturers, Manufacturers' Agents, Engineers, Contractors, Bankers, Brokers, Etc., Etc.

NOTE—For reference to the advertisements, see alphabetical index on pages 9-13
***Indicates adv~~~tisements appearing only in the International edition.**

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The Audit Co. of Illinois.

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Petry Company., Ambrose.

Air-Brakes
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National Electric Co.
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Westinghouse Air Brake Co.
Westinghouse Traction Brake Co.

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Amusement Attractions
Armitage-Herschell Co.
Ingersoll Construction Co.
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Anchors, Guy
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Armature and Field Coils
Chattanooga Armature Works.
Cleveland Armature Works.
Columbia Machine Works & Malleable Iron Co.
Elliott Bros. Electric Co.
Ford Electric & Mfg. Co.
Garton Co., The, W. R.
Peerless Electric Co.
Ridlon, Frank, Co.
Rossiter, MacGovern & Co.
Swazey & Smith.
Van Dorn Elliot Electric Co.
Waterbury & Co.

Armature Lifts
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Armature Winding
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"Automotoneer"
Garton-Daniels Co.

Babbitt Metal
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American Railway Supply Co.
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Waterbury Button Co.
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National Ticket Co.
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Bankers and Brokers
Equitable Trust Co.
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Jackson, C. L.
Lonas, Clendenin & McCord.
Municipal Bond & Securities Co.
Perry, Coffin & Burr.
Trask, Spencer, & Co.
U. S. Mortgage & Trust Co.

Batteries, Storage
Electric Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Tray Plate Battery Co.

Bearings
Brill, J. G., Co.
Buda Foundry & Mfg. Co.
Columbia Machine Works & Malleable Iron Co.
Elec. Ry. Equipment Co., Cin'ti.
Mayer & Englund Co.
Long, E. G.
McGuire-Cummings Mfg. Co.
New Era Mfg. Co.
Nuttall, R. D., Co.
Ohio Brass Co.
Peerless Electric Co.
Phosphor Bronze Smelting Co.
Pittsburgh White Metal Co.
Porter & Berg.
St. Louis Car Co.
Stuart-Howland Co.
Taylor Electric Truck Co.
Van Dorn & Dutton Co.
Wesco Supply Co.

Bells and Gongs
American Car Co.
Brill, J. G., Co.
Mayer & Englund Co.
Porter & Berg.
Ridlon, Frank, Co.
St. Louis Car Co.
Stuart-Howland Co.
Wesco Supply Co.

Belting, Leather and Rubber
Case Mfg. Co.
Robins Conveying Belt Co.

Blinds, Car
American Car Co.
Brill, J. G., Co.
Porter & Berg.
Sjoberg, J. P., & Co.

Blowers
American Blower Co.
Sturtevant, B. F., Co.

Boiler & Pipe Coverings
H. W. Johns-Manville Co.

Boiler Cleaners (Mechanical)
Lagonda Mfg. Co.

Boiler Cleaning Compounds
Dearborn Drug & Chemical Wks.
The Ironsides Co.

Boilers
Allis-Chalmers Co.
Babcock & Wilcox Co.
*Babcock & Wilcox, Ltd.
*Borsig, A.
Cooper, C. & G., Co.
Harrisburg Foundry & Machine Works.
Harrison Safety Boiler Works.
Heine Safety Boiler Co.
*Howden, James, & Co.
Phœnix Iron Works Co.
Stirling Co., The.
*Stirling Boiler Co., Ltd.
Westinghouse, Church, Kerr & Co.
Wetherill, Robert, & Co.

Bonds, Rail
Brown, Harold P.
Chase-Shawmut Company.
Elec. Ry. Equipment Co., Cin'ti.
Falk Co.
*Felten & Guilleaume.
*Forest City Electric Co.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
Lord Electric Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Protected Rail Bond Co.
Stuart-Howland Co.
Wesco Supply Co.

Bonnets, Car
Sjoberg, J. P., & Co.

Boring Machines
Niles-Bement-Pond Co.

Brackets and Cross Arms
Anderson, A. & J. M., Mfg. Co.
Creaghead Engineering Co.
Electric Railway Equipment Co., Cincinnati.
Lindsley Bros. Co.
Maus & Co., H. H.
Mayer & Englund Co.
Morse Cedar Co.
Moss, T. J., Tie Co.
Ohio Brass Co.
Phelan, D. W.

CLASSIFIED DIRECTORY—Continued.

Porter & Berg.
Ridlon, Frank, Co.
Smith Lumber Co.
Southern Exchange Co.
Standard Tie Co.
Stuart-Howland Co.
Swazey & Smith.
Western Electric Co.

Brake Chains
McGuire-Cummings Mfg. Co.
Sterling-Meaker Co.
St. Louis Car Co.
Taylor Electric Truck Co.

Brake Handles
Brill, J. G., Co.
Columbia Machine Works & Malleable Iron Co.
McGuire-Cummings Mfg. Co.
National Brake Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
St. Louis Car Co.
Stuart-Howland Co.
Wesco Supply Co.

Brake Shoes
American Car Co.
Barbour-Stockwell Co.
Brill, J. G., Co.
Buda Foundry & Mfg. Co.
Long, E. G.
McGuire-Cummings Mfg. Co.
Porter & Berg.
St. Louis Car Co.
Stuart-Howland Co.
Taylor Electric Truck Co.
Wesco Supply Co.
Wharton, Wm., Jr., & Co.
Wheel Truing Brake-Shoe Co.

Brakes, Car
American Car Co.
Brill, J. G., Co.
Christensen Engineering Co.
Emergency Car Brake Co.
General Electric Co.
McGuire-Cummings Mfg. Co.
National Brake Co.
National Electric Co.
Peckham Manufacturing Co.
Philadelphia Air Brake Co.
Sterling-Meaker Co.
St. Louis Car Co.
Taylor Electric Truck Co.
Van Dorn & Dutton Co.
Westinghouse Air Brake Co.
*Westinghouse Brake Co., Ltd.
Westinghouse Traction Brake Co.

Bridges and Buildings
American Bridge Co.
Hitner's, Henry A., Sons.
Indianapolis Switch & Frog Co.
Lindsay, W. W., & Co.
Owego Bridge Co.
Riverside Bridge Co.

Brillium Fuel
Brown, Harold P.

Brooms, Track
American Car Co.
Brill, J. G., Co.
Consolidated Car Fender Co.
General Railway Supply Co.
Mayer & Englund Co.
McGuire-Cummings Mfg. Co.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wesco Supply Co.

Brushes, Motor and Dynamo
Garton, W. R., Co.
General Electric Co.
Le Valley Vitæ Carbon Brush Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Speer Carbon Co.
Stuart-Howland Co.

Buttons
American Railway Supply Co.
Waterbury Button Co.
Woodman, R., Mfg. & Supply Co.

Cable and Rope Filler
The Ironsides Co.

Calculating Machine
Morschhauser, W. A.

Car Curtains and Shades
(See Curtains and Curtain Fixtures.)

Car House Doors
Columbia Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Cars
American Car Co.
Brill, J. G., Co.
Buda Foundry & Mfg. Co.
*Brush Electrical Engineering Co.
Buckley, T. H., Car Mfg. Co.
Convertible Car Co., Ltd.
*Electric Ry. & Tramway Carriage Works Ltd.
Hanna, J. A., Co.
Jewett Car Co.
Jones, J. M., Sons.
Kuhlman, G. C., Car Co.
Laconia Car Co. Works.
*Maschinenfabrik Oerlikon.
Niles Car & Mfg. Co.
Southern Car Co.
St. Louis Car Co.

Cars, Hand and Push
Buda Foundry & Mfg. Co.
Kalamazoo Railway Supply Co.

Cars, Velocipede
Buda Foundry & Mfg. Co.
Kalamazoo Railway Supply Co.

Car Ventilators
American Ventilating Co.

Car Shop Woodworking Machinery
American Wood Working Mach. Co.
Fay & Egan Co., J. A.

Car Steps
Railway Appliances Co.

Car Wheel Boring Machines
Niles-Bement-Pond Co.

Carts, Dump
Troy Public Works Co.

Cast Welded Joints
Falk Co.
Goldschmidt Thermit Co.
Heil Rail-Joint Welding Co.
Lorain Steel Co.
Pepper & Register.
Wharton, Wm., Jr., & Co.

Castings
Buda Foundry & Mfg. Co.
Case Mfg. Co.
Christensen Engineering Co.
Columbia Machine Works & Malleable Iron Co.
Elec. Ry. Equipment Co., Cin'ti.
Falk Co.
Laconia Car Co. Works.
Lorain Steel Co.
McGuire-Cummings Mfg. Co.
National Electric Co.
New York Switch & Crossing Co.
Ohio Brass Co.
Phosphor Bronze Smelting Co., Ltd.
Porter & Berg.
Star Brass Works.
St. Louis Car Co.
Taylor Electric Truck Co.
Wharton, Wm., Jr., & Co.

Cattle Guards
Buda Foundry & Mfg. Co.
Kalamazoo Railway Supply Co.
Merrill-Stevens Mfg. Co.

Chains (Standard and Special)
Aultman Co.
Case Mfg. Co.
Jeffrey Mfg. Co.

Change Carrier
Bellamy Vestlette Mfg. Co.

Chemists (Mfg. and Analytical)
Dearborn Drug & Chemical Wks.

Circuit Breakers
*British Thomson-Houston Co.
*British Westinghouse Electric & Mfg. Co.
Cutter Co.
Electric Ry. Equipment Co., Cincinnati.
Garton Co., The W. R.
Garton-Daniels Co.
General Electric Co.
H. W. Johns-Manville Co.
Mayer & Englund Co.
*Nalder Bros. & Thompson.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wesco Supply Co.
Westinghouse Electric & Mfg. Co.

Clocks, Electric
Imhauser, E., & Co.

Clusters
Benjamin Electric Mfg. Co.

Coal Handling Machinery
(See Conveyors.)

Coil Taping Machines
Griswold, Geo. M.

Commutators and Commutator Bars
Chattanooga Armature Works.
Cleveland Armature Works.
Columbia Machine Works & Malleable Iron Co.
Elliott Bros. Electric Co.
Ford Electric & Mfg. Co.

CLASSIFIED DIRECTORY—Continued.

*Forest City Electric Co.
Garton Co., The W. R.
General Electric Co.
General Railway Supply Co.
Homer Commutator Co.
Mayer & Englund Co.
Ohio Brass Co.
Peerless Electric Co.
Porter & Berg.
Ridlon, Frank, Co.
Rossiter, MacGovern & Co.
Stuart-Howland Co.
Swazey & Smith.
Van Dorn-Elliott Electric Co.
Waterbury & Co.
Wesco Supply Co.

Condensers
Alberger Condenser Co.
Allis-Chalmers Co.
Blake-Knowles Steam Pump Wks.
Bulkley, Henry W.
Conover Condenser Co.
Goubert Mfg. Co.
Power Specialty Co.
Watson Machine Co.
Westinghouse, Church, Kerr & Co.
Wheeler Condenser & Eng. Co.
*Worthington Pump Co., Ltd.

Conductor's Vestlette
Bellamy Vestlette Mfg. Co.

Conduits
American Conduit Co.
American Vitrified Conduit Co.
Camp, H. B., Co.
Gest, Guy M.
National Conduit & Cable Co.
Standard Sewer Pipe Co.

Contractors
Arnold Elec. Power Station Co.
Bates & Neilson.
*British Thomson-Houston Co.
Byllesby & Co., H. M.
Chicago Eng. & Constructing Co.
Columbia Construction Co.
Creaghead Engineering Co.
Cudworth, Axtell & Co.
Cullen, Wm. A.
*Dick, Kerr & Co., Ltd.
Electrical Installation Co.
Falk Co.
Gest, Guy M.
Gherky, Wm. D.
Knox Engineering Co.
Kohler Brothers.
Lindsay, W. W., & Co.
Lonas, Clendenin & McCord.
MacAfee, John Blair.
*Machinenfabrik Oerlikon.
Mitchell, W. K., & Co.
Pepper & Register.
Pratt, Mason D.
Rossiter, MacGovern & Co.
Sanderson & Porter.
Saxton, E.
Serrell, Lemuel W.
Sheaff & Jaastad.
Smethurst & Allen.
Standard Engineering Co.
Walworth Mfg. Co.
Western Electrical Supply Co.
Wharton, Wm., Jr., & Co.
White, J. G., & Co.
*White, J. G., & Co., Ltd.
Woods, Robert P.

Controllers
*British Thomson-Houston Co.
Case Mfg. Co.
General Electric Co.
*Maschinenfabrik Oerlikon.
Westinghouse Electric & Mfg. Co.
*Witting, Eborall & Co., Ltd.

Controller Parts
H. W. Johns-Manville Co.

Controller Regulators
Garton-Daniels Co.

Conveyors, Coal and Ashes
*Babcock & Wilcox, Ltd.
Brown Hoisting Machinery Co.
General Railway Supply Co.
Jeffrey Mfg. Co.
Mead, John A., & Co.
*New Conveyor Co.
Northern Engineering Works.
Robins Conveying Belt Co.
Steel Cable Engineering Co.

Cooling Towers
Alberger Condenser Co.
Wheeler Condenser & Engineering Co.
*Worthington Pump Co., Ltd.

Cord, Bell and Trolley
American Car Co.
Brill, J. G., Co.
International Register Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Recording Fare Register Co.
Samson Cordage Works.
Silver Lake Co.
Sterling-Meaker Co.
Stuart-Howland Co.

Cotton Duck
Boyle, John, & Co.

Couplers, Car
McGuire-Cummings Mfg. Co.
St. Louis Car Co.
Van Dorn, W. T., Co.
Westinghouse Air Brake Co.

Covers, Crucible
McCullough-Dalzell Crucible Co.

Cranes, Traveling
Brown Hoisting Machinery Co.
Case Mfg. Co.
Niles-Bement-Pond Co.
Northern Engineering Works.

Cross-Overs, Portable
Buda Foundry & Mfg. Co.
Wharton, Wm., Jr., & Co.

Crossings, Frogs & Switches (Track)
Alabama Frog & Switch Co.
*Allen, Edgar, & Co., Ltd.
American Frog & Switch Co.
*Askham Bros. & Wilson, Ltd.
Baldwin & Rowland Switch & Signal Co.
Barbour-Stockwell Co.
Buda Foundry & Mfg. Co.
Cleveland Frog & Crossing Co.
Elliot Frog & Switch Co.
Falk Co.
Indianapolis Switch & Frog Co.
Lorain Steel Co.
New York Switch & Crossing Co.
Paige Iron Works.
Weir Frog Co.
Wharton Wm., Jr., & Co.

Crucibles
McCullough-Dalzell Crucible Co.

Crushers, Coal
Mead, John A., & Co.

Curtains & Curtain Fixtures
American Car Co.
Brill, J. G., Co.
Curtain Supply Co.
Federal Mfg. Co.
Hale & Kilburn Mfg. Co.
Pantasote Co.
*Peters, G. D., & Co.
Ridlon, Frank, Co.
St. Louis Car Co.

Curtain Material
Boyle, John, & Co.
Pantasote Co.

Curtain Rollers
Hartshorn Co., Stewart.

Dating Stamps
National Ticket Co.
Stromberg, Allen & Co.

Derailing Devices
American Frog & Switch Co.
Buda Foundry & Mfg. Co.
Ohio Brass Co.
Wharton, Wm., Jr., & Co.

Detective Service
Drummond's Detective Agency.
Franklin's Detective Agency, Benj.

Doors, Car
Sjoberg, J. P., & Co.

Doors, Steel Rolling
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Drills, Track
Buda Foundry & Mfg. Co.
Kalamazoo Railway Supply Co.
Ludlow Supply Co.
Merrill-Stevens Mfg. Co.
Porter & Berg.
Railway Appliances Co.
Ridlon, Frank, Co.

Duplicating Systems
General Manifold Co.

Dynamos
(See Generators.)

Economizers
Broomell, Schmidt & Steacy Co.
Green Fuel Economizer Co.
Westinghouse Machine Co.

Electric Hoists
Thomas Elevator Co.

Elevating Machinery
(See Conveyors.)

Elevators, Passenger and Freight
Bates, F. A. & H. P.

Emergency Brakes
Emergency Car Brake Co.

Engineers (Consulting)
Baker, W. E., & Co.

CLASSIFIED DIRECTORY—Continued.

Bates & Neilson.
Blood & Hale.
Bonner, Wm. T., & Co.
*British Westinghouse Electric & Mfg. Co.
Burch, Edw. P.
Byllesby, H. M., & Co.
Chapman, C. A.
Chicago Eng. & Constructing Co.
Coleman, Jilson J.
Columbia Construction Co.
Cudworth, Axtell & Co.
Engstrom, Axel H.
Farnum, Loring N.
Ford, Bacon & Davis.
Gherky, Wm. D.
Kitfield, E. H.
Knox Engineering Co.
Mershon, Ralph D.
Pierce, Richardson & Neiler.
Pratt, Mason D.
Roberts & Abbott Co.
Sargent & Lundy.
Sheaff & Jaasted.
Standard Engineering Co.
Stearns, Chas. K.
Wagner, Herbert A.
Western Electrical Supply Co.
Westinghouse Electric & Mfg. Co.
White, J. G., & Co.
*White, J. G., & Co., Ltd.
Woods, Robert P.

Engines, Gas
*Borsig, A.
*British Westinghouse Elec. & Mfg. Co., Ltd.
De La Vergne Machine Co.
Loomis-Pettibone Gas Machinery Co.
Power & Mining Machinery Co.
Tod, Wm., Co.
Westinghouse Machine Co.

Engines, Gasoline
Prouty-Pierce Locomotive Mfg. Co.

Engines, Oil
American Diesel Engine Co.

Engines, Steam
Allis-Chalmers Co.
American Blower Co.
Ball & Wood Co.
*Borsig, A.
*British Westinghouse Elec. & Mfg. Co., Ltd.
Brown-Corliss Engine Co.
*Brush Electrical Engineering Co.
Buckeye Engine Co.
Bullock Electric Mfg. Co.
Cooper, C. & G., Co.
De La Vergne Machine Co.
Greenwald, I. & E., Co.
Harrisburg Foundry & Machine Co.
Hooven, Owens, Rentschler Co.
*Howden, James, & Co.
McIntosh, Seymour & Co.
*Maschinenfabrik Oerlikon.
Phœnix Iron Works Co.
Providence Engineering Works.
Russell Engine Co.
Shepherd Engineering Co.
*Stewart, D., & Co. (1902), Ltd.
Sturtevant, B. F., Co.
*Sulzer Bros.
Tod Co., The Wm.
*Tosi, Franco.
Westinghouse Machine Co.
Wetherill, Robert, & Co.

Engine Stops
Consolidated Engine Stop Co.

Engravers
National Ticket Co.

Exhaust Heads
Burt Mfg. Co.
Sturtevant, B. F., Co.

Fans, Steam and Electric
American Blower Co.
Sturtevant, B. F., Co.

Fence Posts
Beidler, Francis & Co.

Fenders and Guards
Baltimore Car Wheel Co.
Brill, J. G., Co.
Consolidated Car Fender Co.
Hipwood-Barrett Car & Vehicle Fender Co.
Mayer & Englund Co.
McGuire-Cummings Mfg. Co.
Parmenter Fender & Wheel Guard Co.
Peckham Mfg. Co.
Sterling-Meaker Co.
Swazey & Smith.
Wesco Supply Co.
Western Electric Co.

Fibre
American Vulcanized Fibre Co.
Wilmington Fibre Specialty Co.

Fields
(See Armature and Field Coils.)

Field Testing Instruments
Century Electrical Co.

Filters
Burt Mfg. Co.
Harrison Safety Boiler Works.
*Vacuum Oil Co.

Fireproof Doors and Shutters
Columbus Steel Rolling Shutter Co.
Kinnear Mfg. Co.

Fittings, Malleable, Cast Iron and Bronze
Crane Co.
Mitchell, W. K., & Co.

Forges
Sturtevant, B. F., Co.

Frogs
(See Crossings, Frogs & Switches.)

Frogs, Car Replacing
(See Replacers, Car.)

Fuses
Chase-Shawmut Company.
D. & W. Fuse Co.
H. W. Johns-Manville Co.
Mayer & Englund Co.

Gaskets
Peerless Rubber Mfg. Co.

Gates, Car
Brill, J. G., Co.
Pitt Car Gate Co.
St. Louis Car Co.

Gates, Railway Crossing
Buda Fdy. & Mfg. Co.

Gauges
Bonner, Wm. T., & Co.

Gears and Pinions
American Vulcanized Fibre Co.
Bliss, E. W., Co.
Case Mfg. Co.
Elliott Bros. Elec. Co.
Falk Co.
Fogarty, James H.
Ford Electric & Mfg. Co.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
Long, E. G.
Lorain Steel Co.
Mayer & Englund Co.
New Process Raw Hide Co.
Nuttall, R. D., Co.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Swazey & Smith.
U. S. Projectile Co., E. W. Bliss Co., successors.
Van Dorn & Dutton Co.
Waterbury & Co.
Wesco Supply Co.

Generators
Blackwell, Robt. W., & Co., Ltd.
*British Westinghouse Elec. & Mfg. Co., Ltd.
*British Thomson-Houston Co.
*Brush Electrical Engineering Co.
Bullock Electric Mfg. Co.
Case Mfg. Co.
Christensen Engineering Co.
Crocker-Wheeler Co.
*Dick, Kerr & Co., Ltd.
*Electric Construction Co., Ltd.
Ford Electric & Mfg. Co.
General Electric Co.
Jeffrey Mfg. Co.
National Electric Co.
*Peebles & Co., Bruce.
Sprague Electric Company.
Sturtevant, B. F., Co.
Westinghouse Electric & Mfg. Co.
*Witting, Eborall & Co., Ltd.

Generators, Gas
Loomis-Pettibone Gas Mach'y Co.
Power & Mining Machinery Co.

Glass Cutters
Sterling-Meaker Co.

Gongs, Car
(See Bells and Gongs.)

Graders and Rock Crushers
Allis-Chalmers Co.
Jeffrey Mfg. Co.

Graphite Paint
Detroit Graphite Mfg. Co.

Grease Cups
Crane Co.
McGuire-Cummings Mfg. Co.

CLASSIFIED DIRECTORY—Continued.

Grease and Oils
(See Lubricants.)

Handles, Register
(See Register Handles.)

Harps
(See Trolley Harps.)

Headlights
Brill, J. G., Co.
Globe Electric Mfg. Co.
Porter & Berg.
St. Louis Car Co.
Swazey & Smith.

Heaters, Car
Baker, Wm. C.
Brill, J. G., Co.
Consolidated Car Heating Co.
Franklin Railway Supply Co.
H. W. Johns-Manville Co.
McGuire-Cummings Mfg. Co.
Simplex Electric Heating Co.
Smith, Peter, Heater Co.
Swazey & Smith.

Heaters and Purifiers, Feedwater
Allis-Chalmers Co.
*Babcock & Wilcox, Ltd.
Broomell, Schmidt & Steacy Co.
Green Fuel Economizer Co.
Goubert Manufacturing Co., The.
Harrison Safety Boiler Works.
Power Specialty Co.
Webster & Co., Warren.
Western Heater, The.
Wheeler Condenser & Eng. Co.
Whitlock Coil Pipe Co.
*Worthington Pump Co.

Heating and Ventilating Apparatus
American Blower Co.
Sturtevant, B. F., Co.
Webster, Warren, & Co.

Hoists
Brown Hoisting Machinery Co.
Case Mfg. Co.
Northern Engineering Works.
Sturtevant, B. F., Co.

Hose Bridges
Ohio Brass Co.

Industrial Railways
General Railway Supply Co.
Wharton, Wm., Jr., & Co.

Inspection Cars
Buda Foundry & Mfg. Co.

Instruments, Measuring and Testing
Bristol Co.
Century Electrical Co.
Cutter Co.
Du Bois & West.
General Electric Co.
Keystone Electrical Instrument Co.
*Nalder Bros. & Thompson.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Insulating Compounds
Garton, W. R., Co.
Hydro-Carbon Mfg. Co.
Ironsides Co.
Johns-Manville Co.
Ohio Brass Co.
Pittsburgh Insulating Co.
Porter & Berg.
Sherwin-Williams Co.
Standard Varnish Works.
Sterling Varnish Co.

Insulating Paper and Cloths
Pittsburgh Insulating Co.

Insulating Tape
(See Tape, Insulating.)

Insulators, Third Rail
Reconstructed Granite Co.

Insulators, Pole
Locke Insulator Mfg. Co.
Thomas, R., & Sons' Co.

Inventions, Perfected and Developed
Peters, G. D., & Co.

Jacks, Car Replacing
Atlas Ry. Supply Co.
Buda Foundry & Mfg. Co.
Duff Manufacturing Co.
Kalamazoo Ry. Supply Co.
Mayer & Englund Co.
Merrill-Stevens Mfg. Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
Watson-Stillman Co.

Jacks, Hydraulic
Watson-Stillman Co.

Joints, Rail
Atlas Railway Supply Co.
Continuous Rail-Joint Co. of America.
Dossert & Co.
Falk Co.
Heil Rail-Joint Welding Co.
Railway Appliances Co.
Weber Railway Joint Mfg. Co.
Wharton, Wm., Jr., & Co.

Lamp Clusters
Benjamin Electric Mfg. Co.

Lamps, Arc and Incandescent
Anderson, A. & J. M., Mfg. Co.
Garton, W. R., Co.
General Electric Co.
Mayer & Englund Co.
Porter & Berg.
Sawyer-Man Electric Co.
St. Louis Car Co.
Stuart-Howland Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Lathes
McCabe, J. J.

Lathes, Axle
Niles-Bement-Pond Co.

Lathes, Engine
Niles-Bement-Pond Co.

Lathes, Steel Tired Car Wheel
Niles-Bement-Pond Co.

Lathes, Turret
Niles-Bement-Pond Co.

Lathes, Woodworking
American Wood Working Mach. Co.
Fay & Egan Co., J. A.

Lead Covered Wires and Cables
Waterbury & Co.

Lifts, Armature and Motor
Duff Mfg. Co.
Jeffrey Mfg. Co.
Ohio Brass Co.
Patten, Paul B.
Porter & Berg.
Ridlon, Frank, Co.
Van Dorn & Dutton Co.
Watson-Stillman Co.

Lighting, Car
Consolidated Car Heating Co.
St. Louis Car Co.

Lightning Arresters
*British Thomson-Houston Co.
Garton-Daniels Co.
General Electric Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Shaw Engineering & Manufacturing Company.
Stuart-Howland Co.
Wesco Supply Co.
Westinghouse Elec. & Mfg. Co.

Line Material
*Ambroin-Werke.
American Vulcanized Fibre Co.
Anderson, A. & J. M., Mfg. Co.
Billings & Spencer Co.
*British Thomson-Houston Co.
Central Union Brass Co.
Creaghead Engineering Co.
*Dick, Kerr & Co., Ltd.
Dixon, S., & Sons, Ltd.
Electric Ry. Equipment Co., Cincinnati.
*Felten & Guilleaume.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
H. W. Johns-Manville Co.
Macallen, W. T. C., Co.
*Maschinenfabrik Oerlikon.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
Stuart-Howland Co.
Swazey & Smith.
Thomas, R., & Sons, Co.
Wesco Supply Co.
Western Electric Co.
*Witting, Eborall & Co.

CLASSIFIED DIRECTORY—Continued.

Lock Nuts
Columbia Nut & Bolt Co.
Spiral Nut Lock Co.
Weber Railway Joint Mfg. Co.
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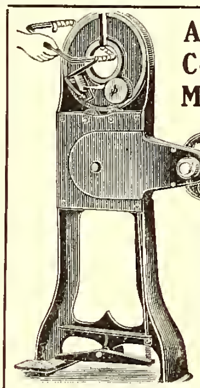

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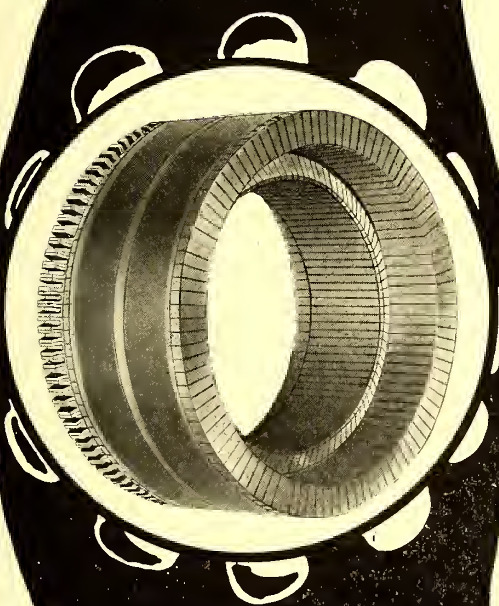


1928
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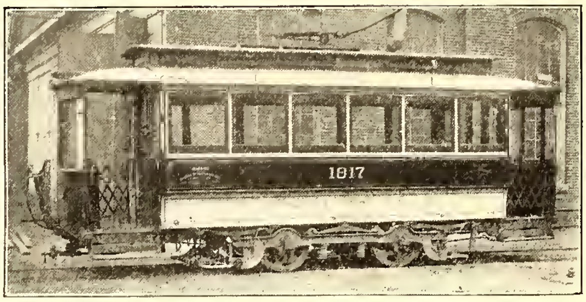
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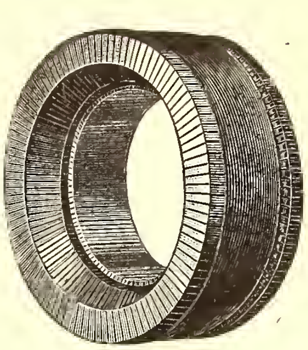
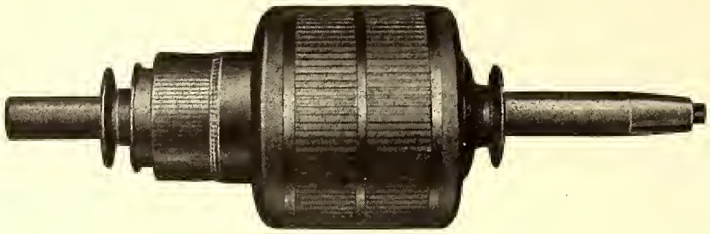
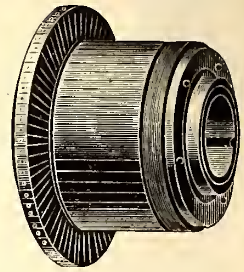

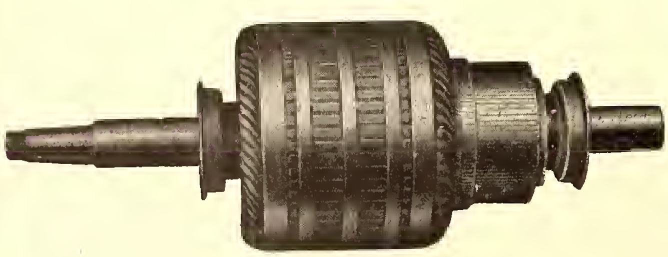
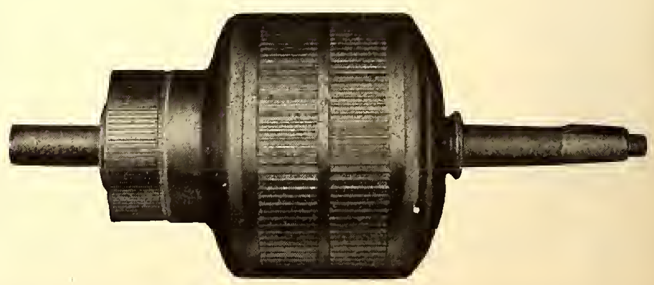

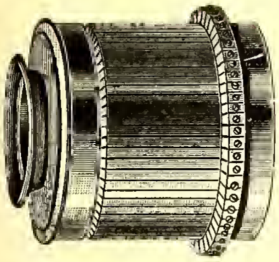

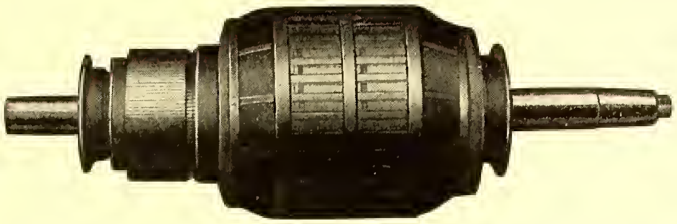

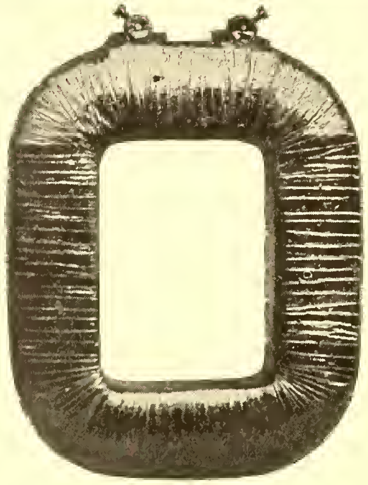

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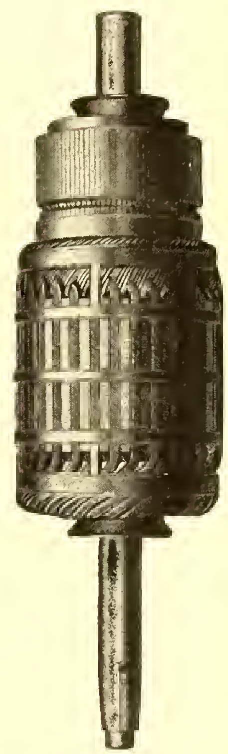

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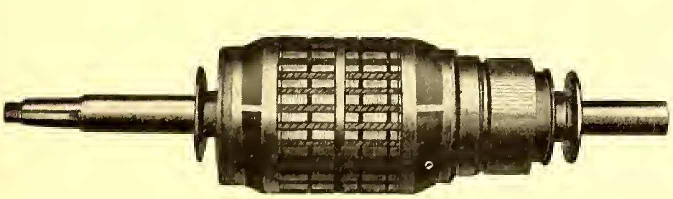

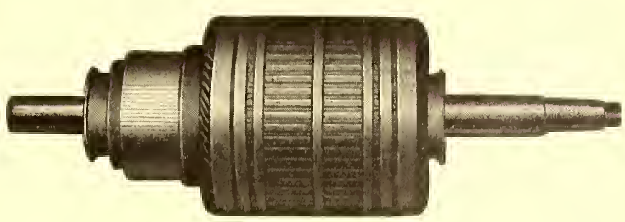

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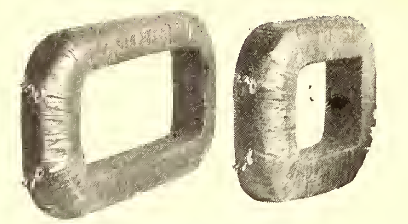

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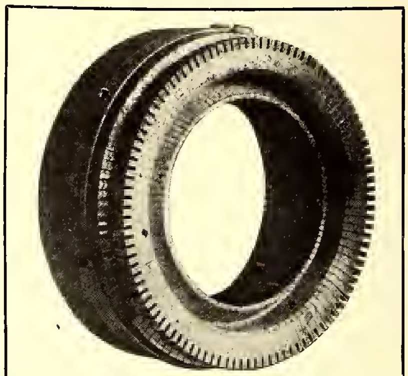

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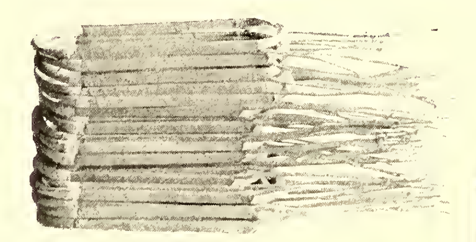

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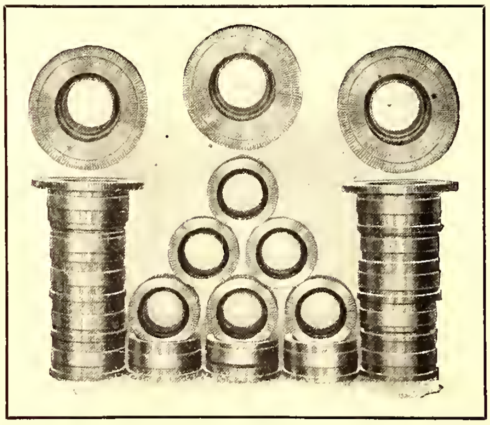

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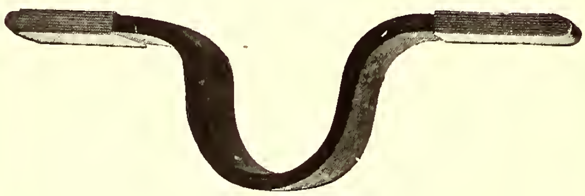

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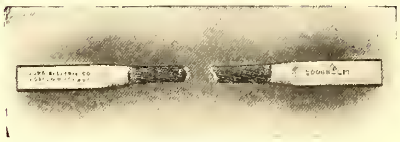

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Every phase of Track Construction and Track Work is treated. Special attention has been paid to Costs and other data of Track Work, and particularly to Labor-Saving Machinery in Track Service.

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Every railway official in charge of operation, whether he has direct supervision of track work or not, should be acquainted with at least the general features of this branch of railway engineering, and keep informed of the progress therein. Those who have direct charge of track must be competent to handle the details. Men trained in other departments may, through promotion, be placed in position where general, if not special, knowledge of track appliances and work is demanded of them. Superintendents, general superintendents and general managers must frequently take the responsibility for large purchases of track materials or make decisions on lines of improvement of the roadway or on the introduction of new appliances. Subordinate officials or employees looking for advancement will greatly further their interests by informing themselves on track and track work.

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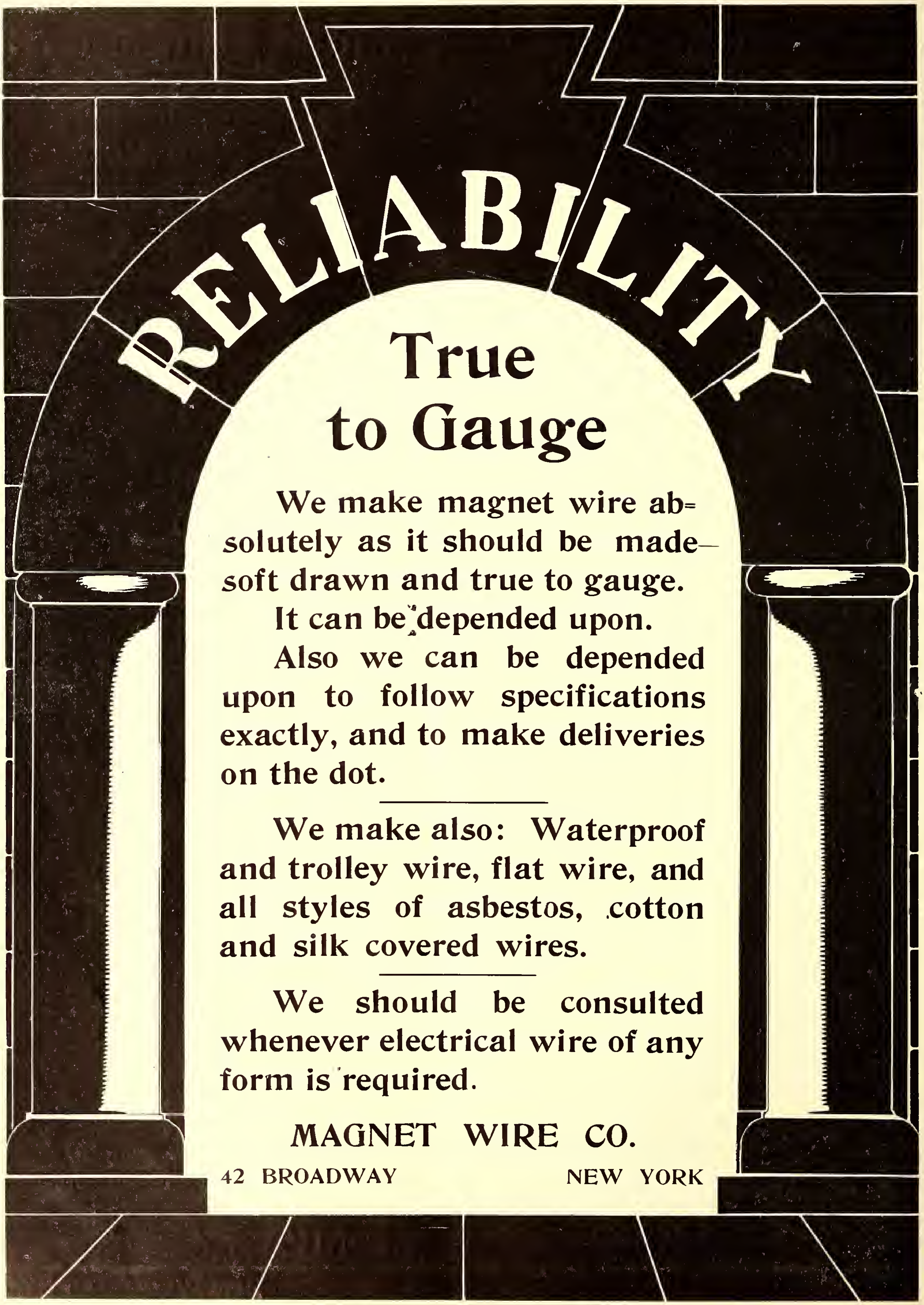
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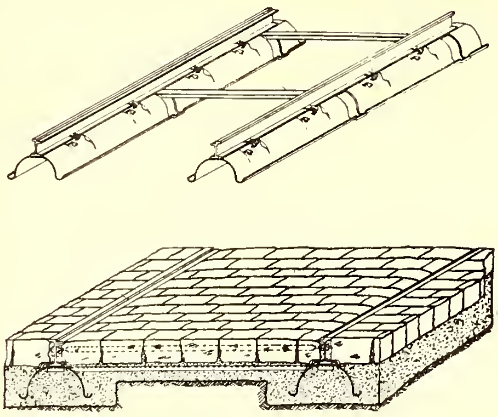

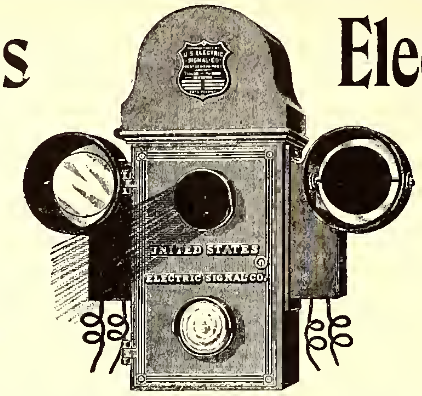

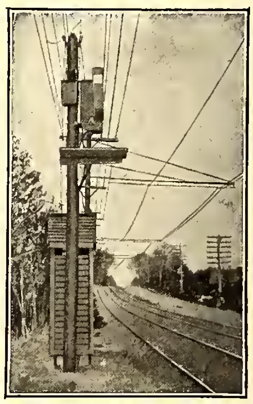

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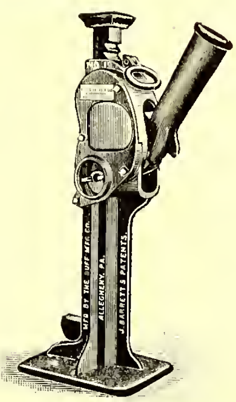

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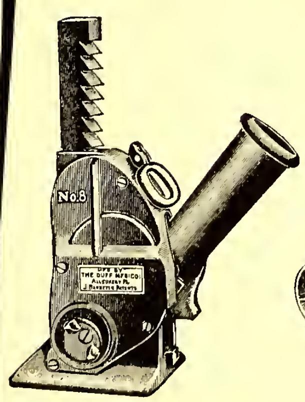

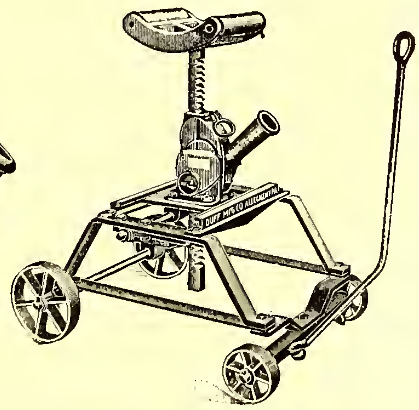

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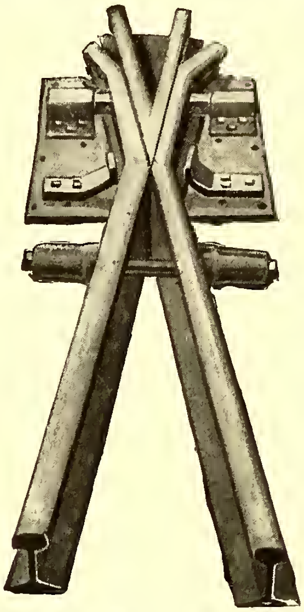

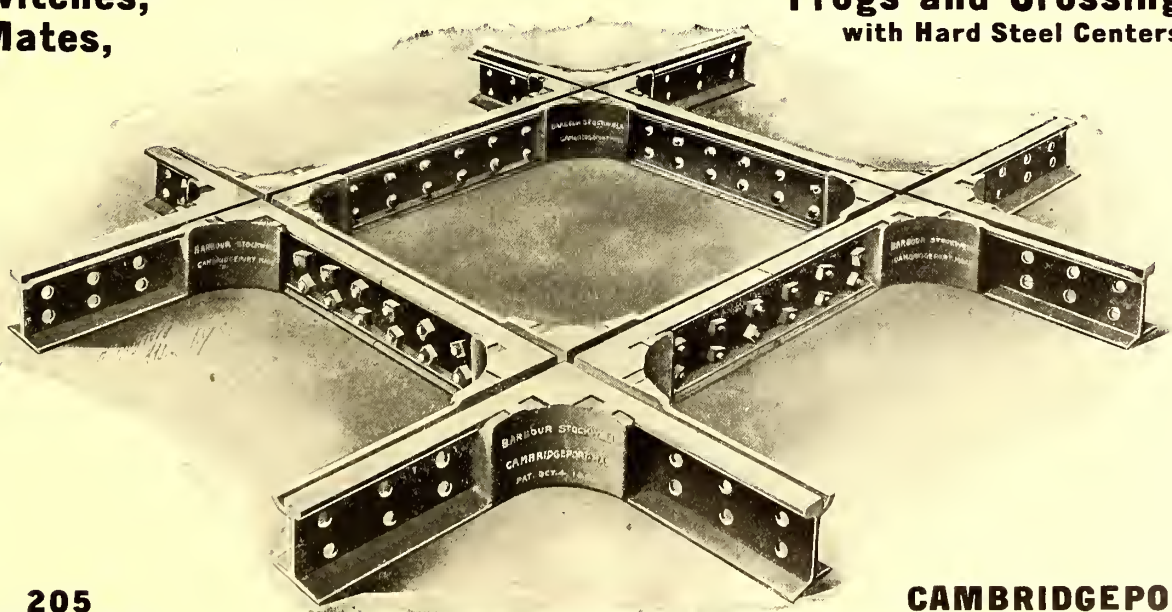

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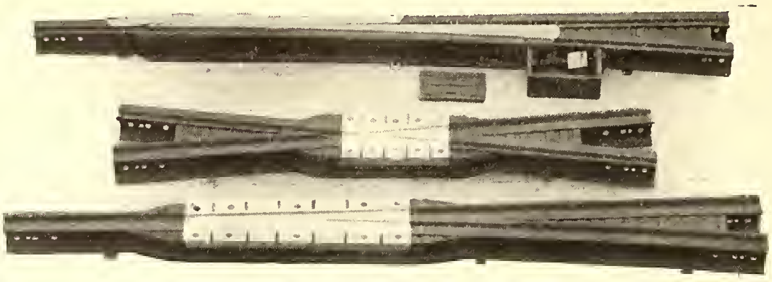

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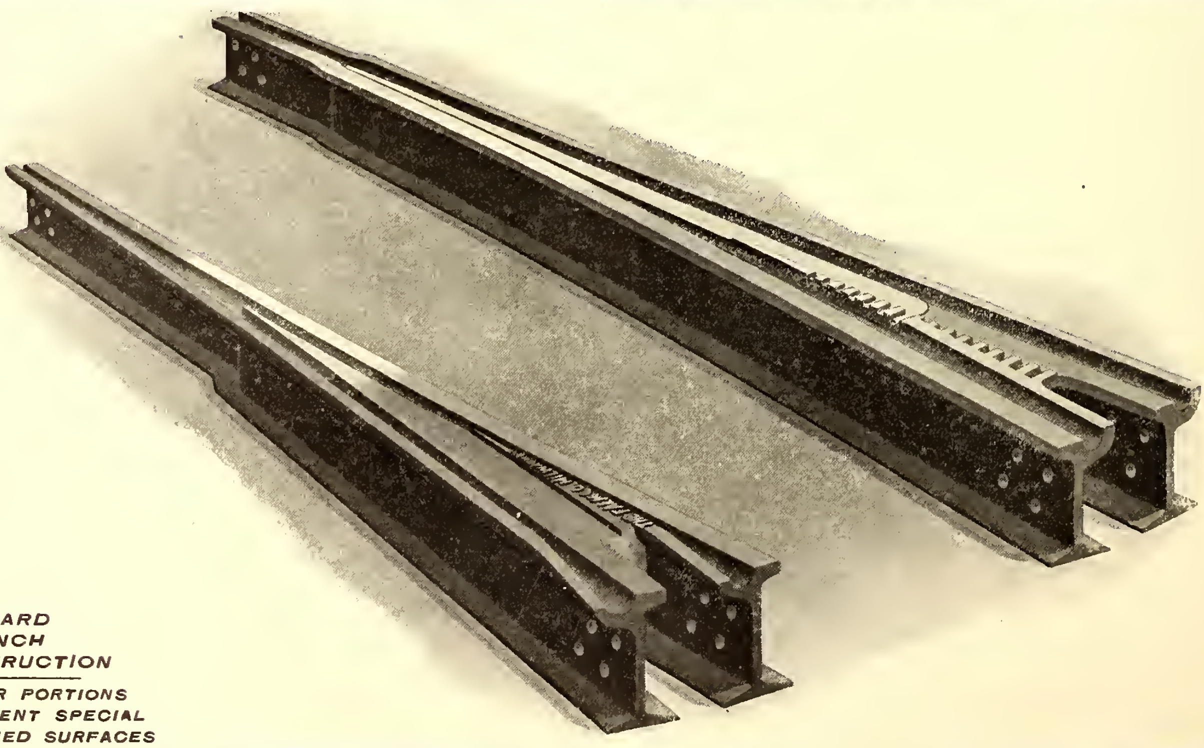

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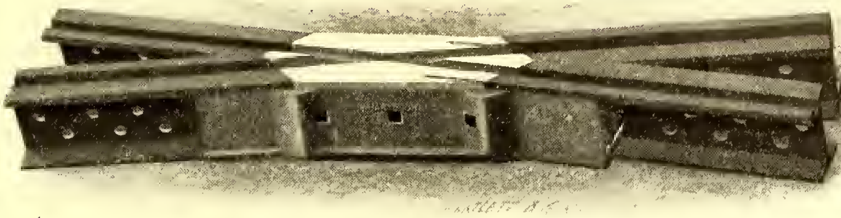

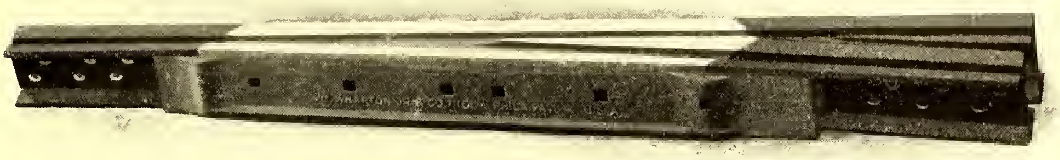

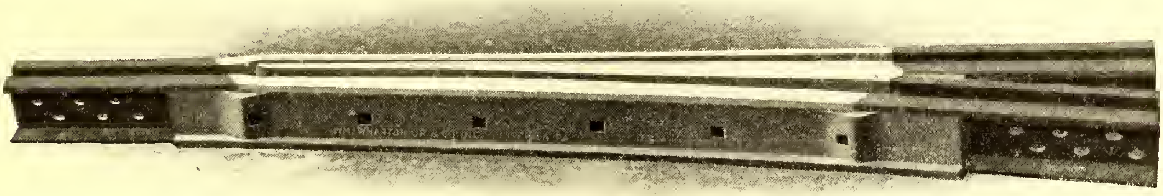

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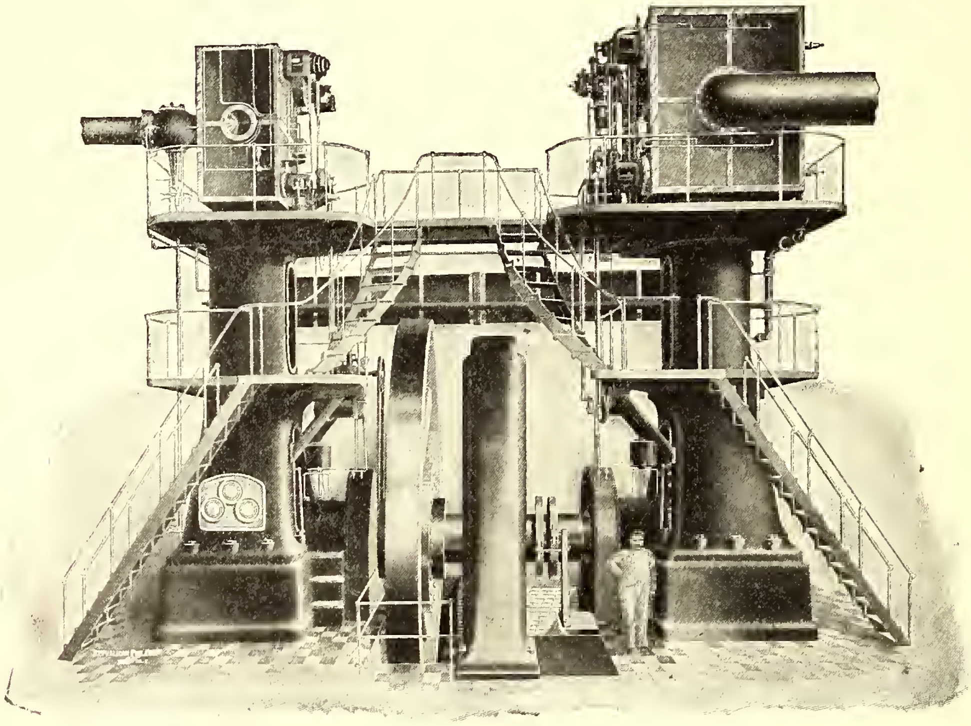

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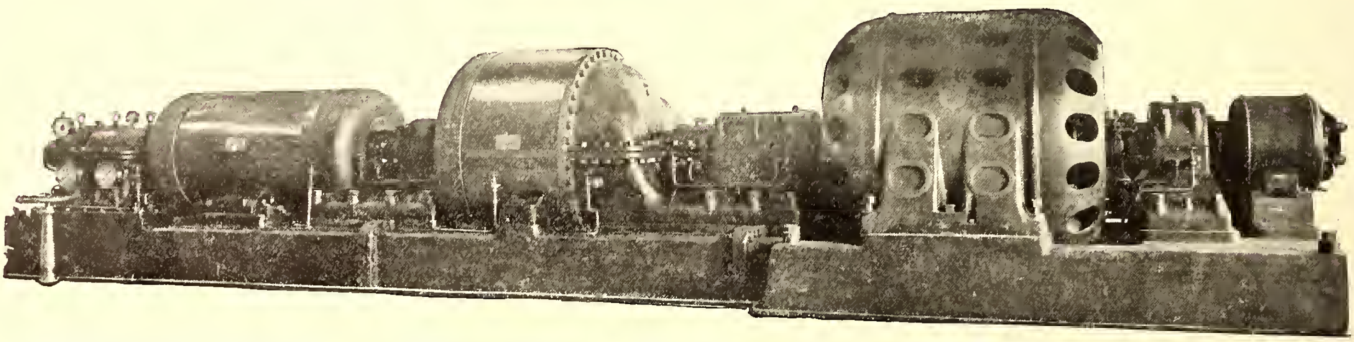

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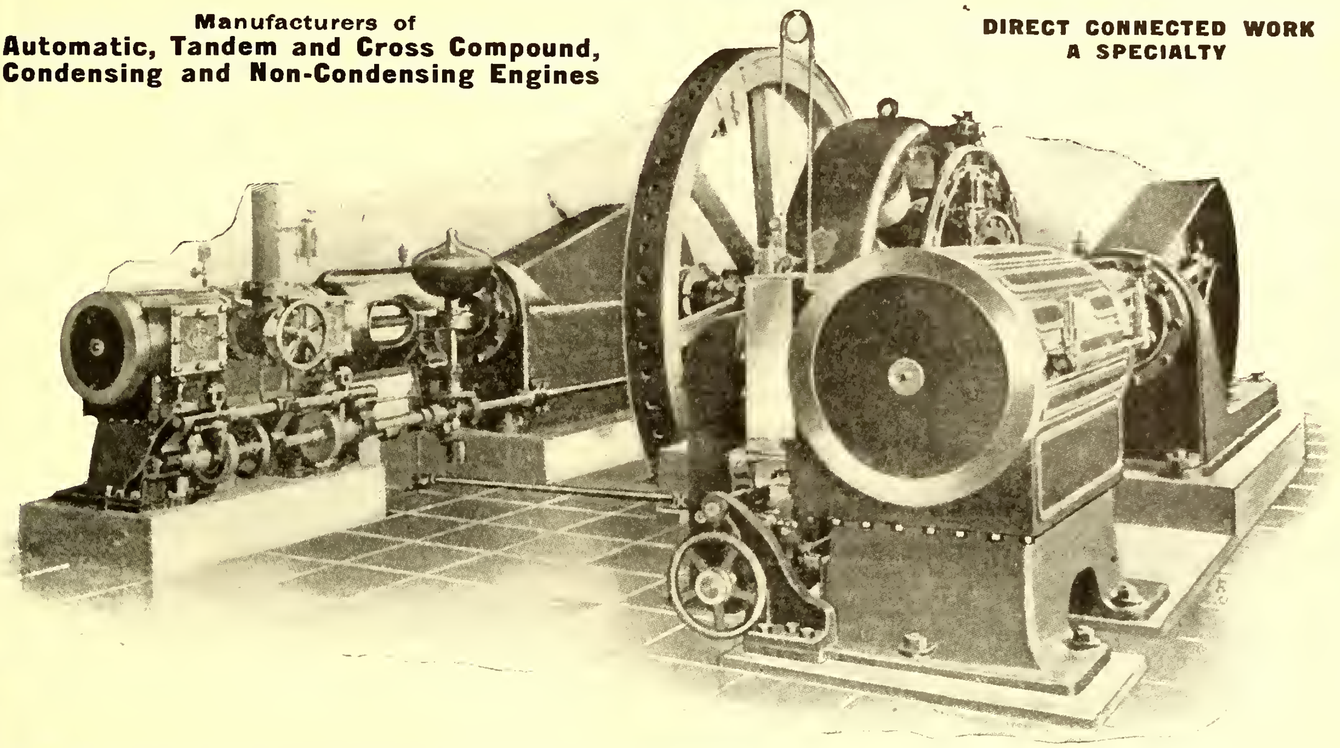

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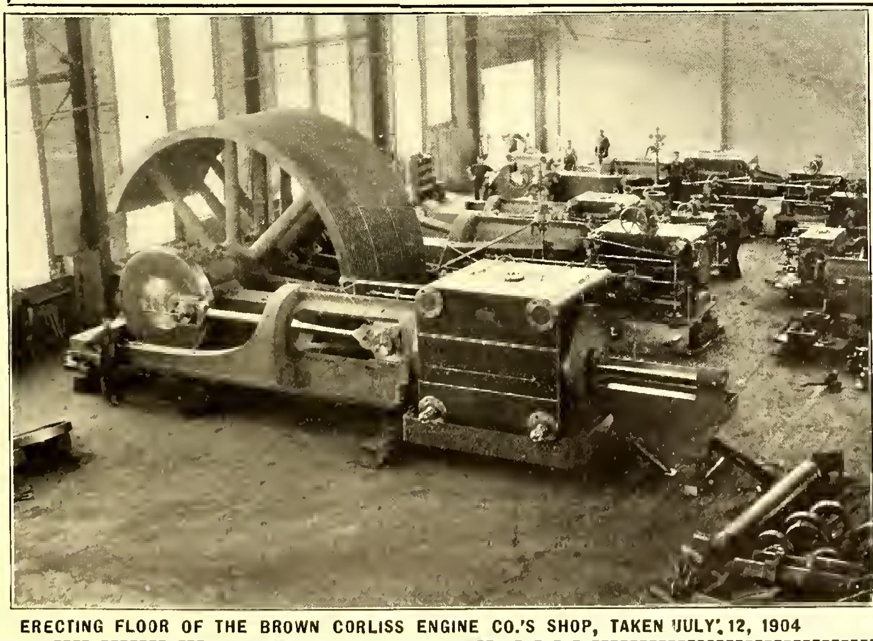

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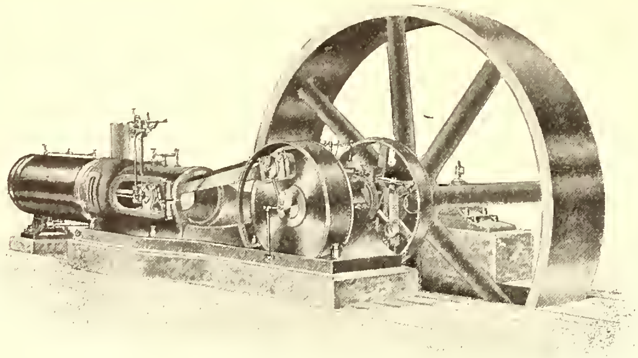

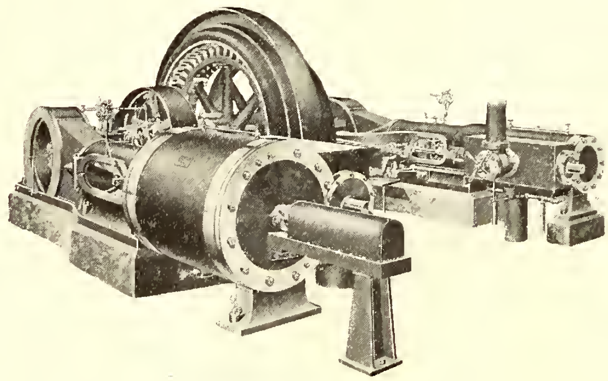

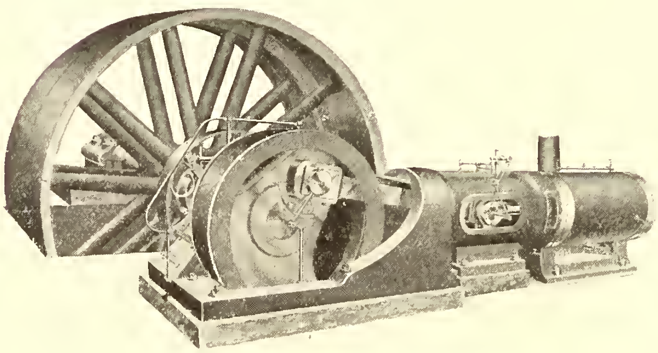

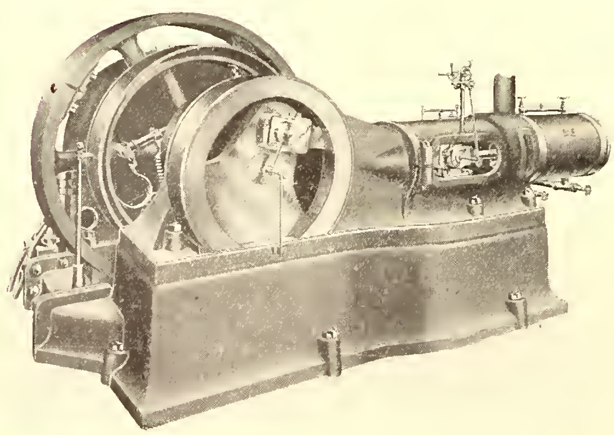

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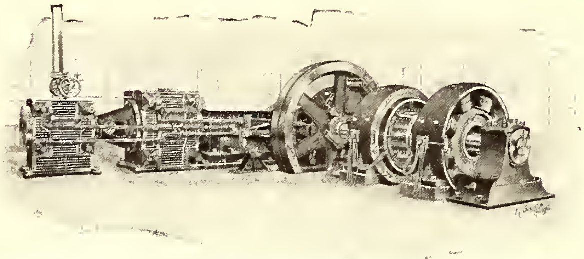

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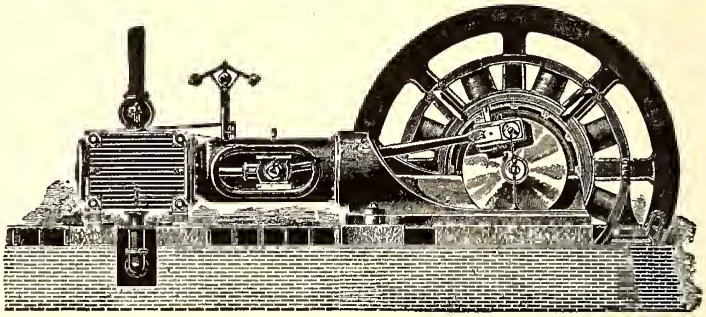

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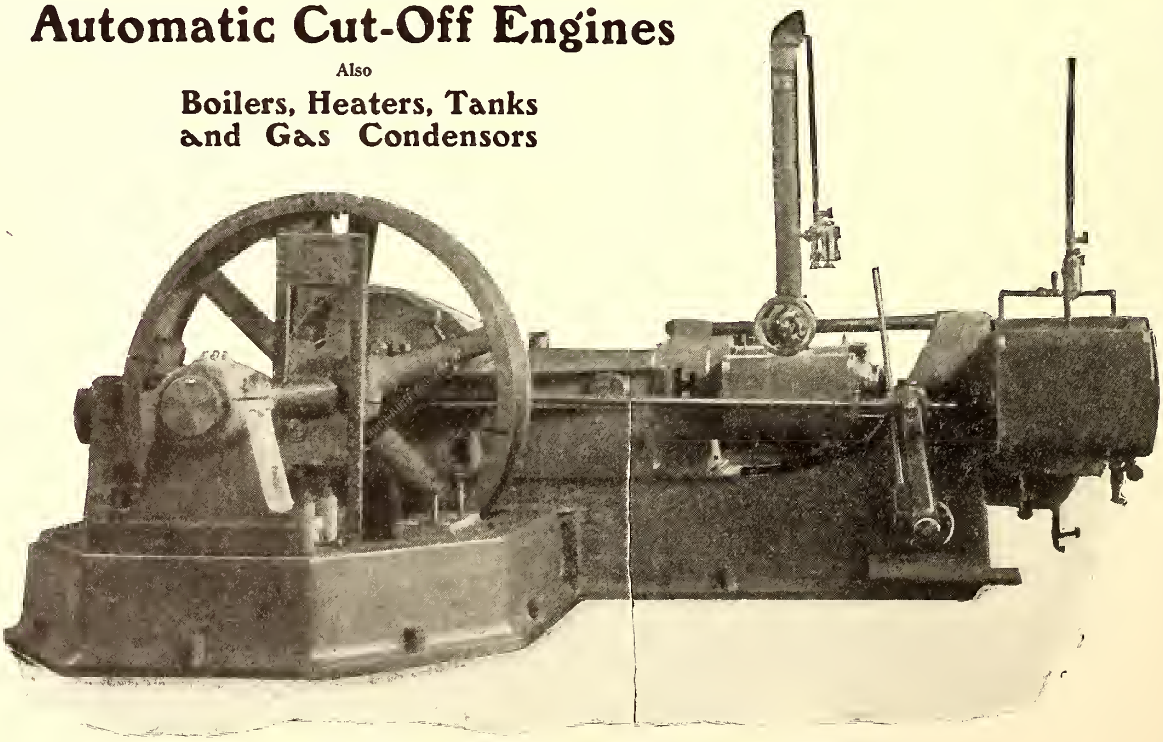

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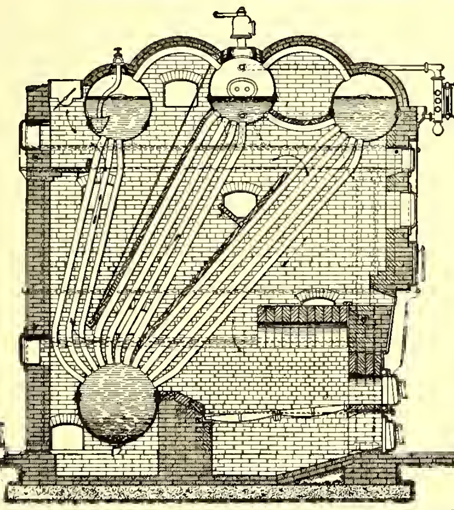

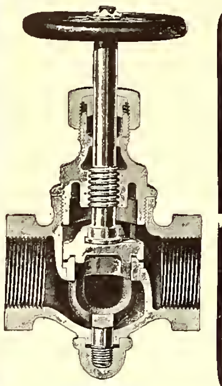
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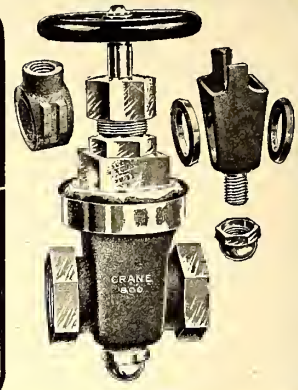

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Their Design and Construction

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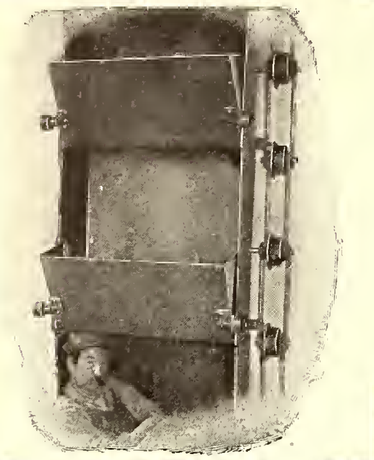

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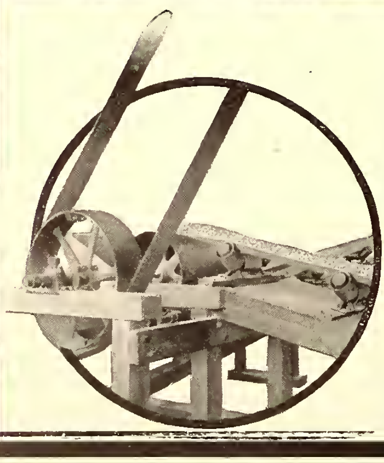

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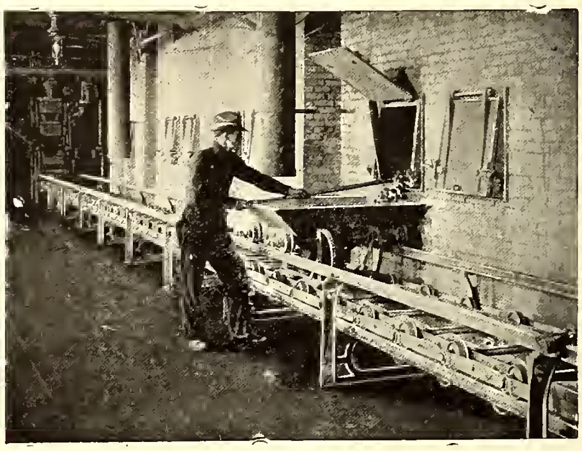

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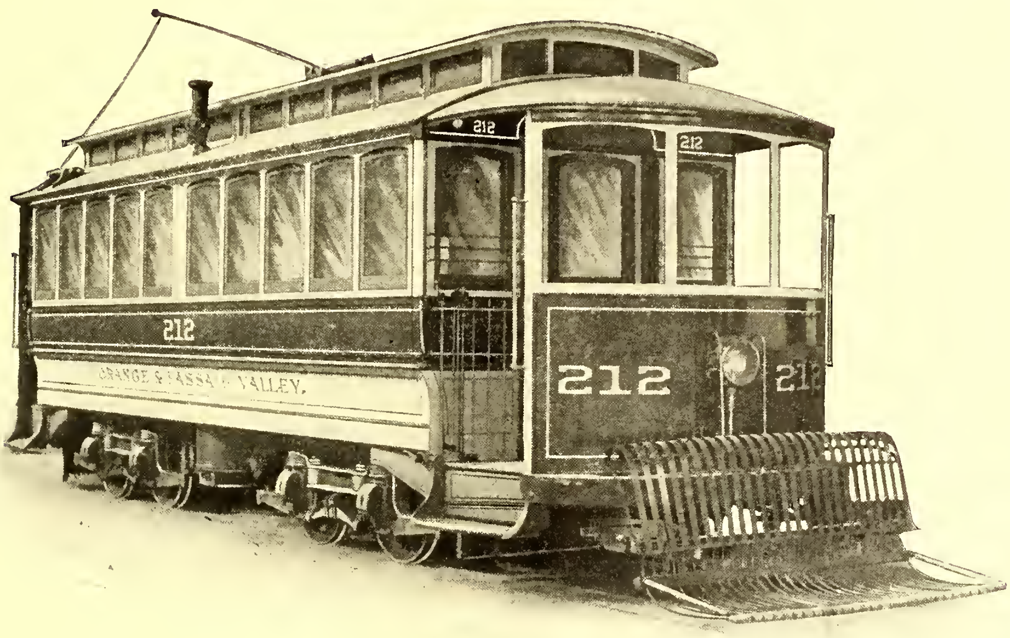

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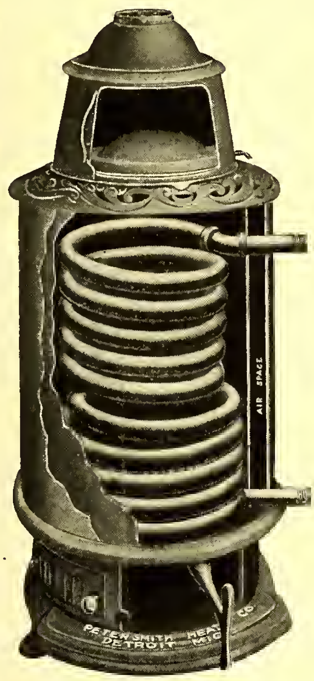

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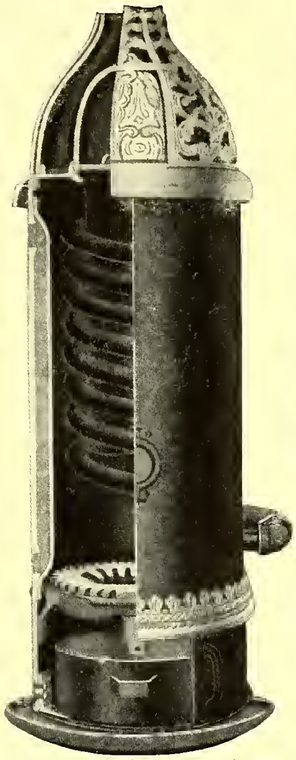
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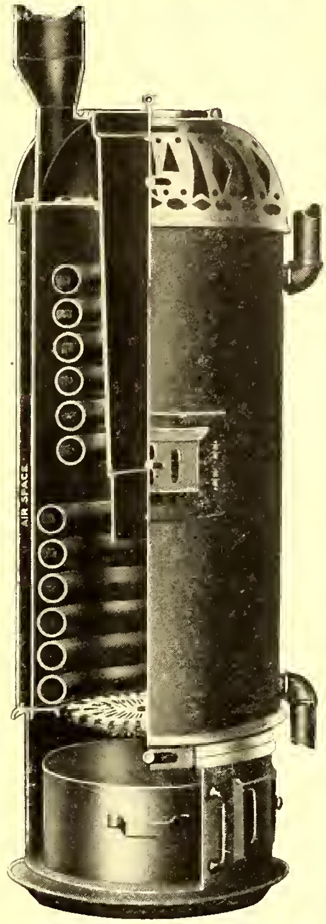

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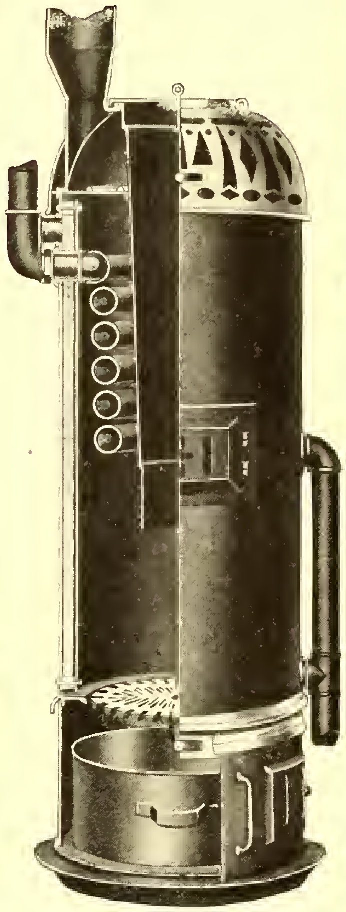
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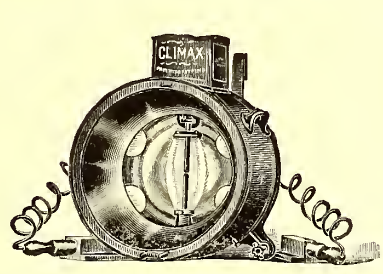

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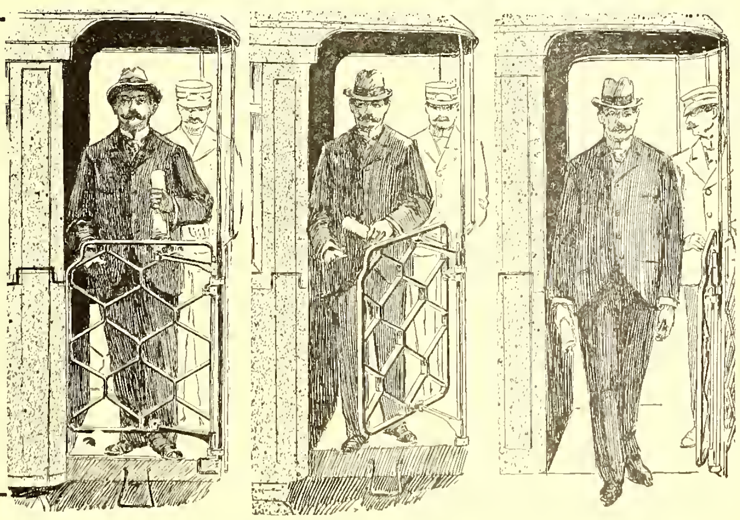

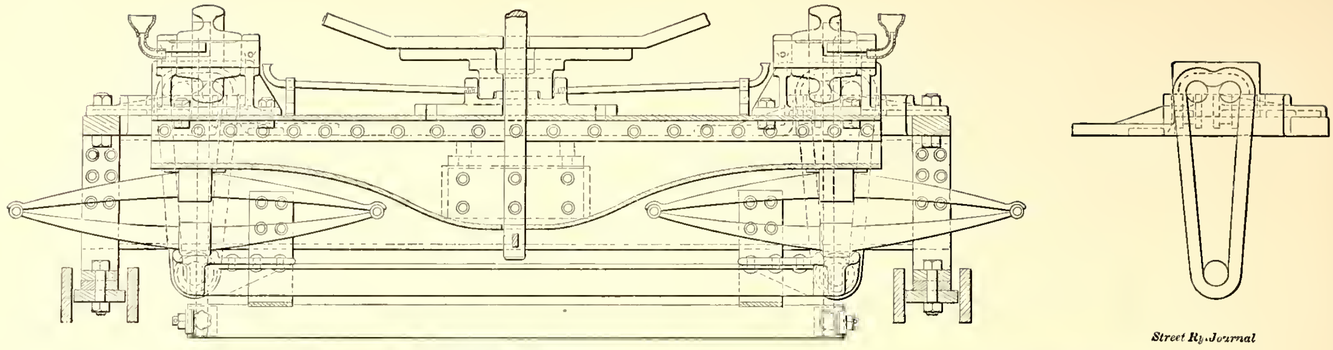
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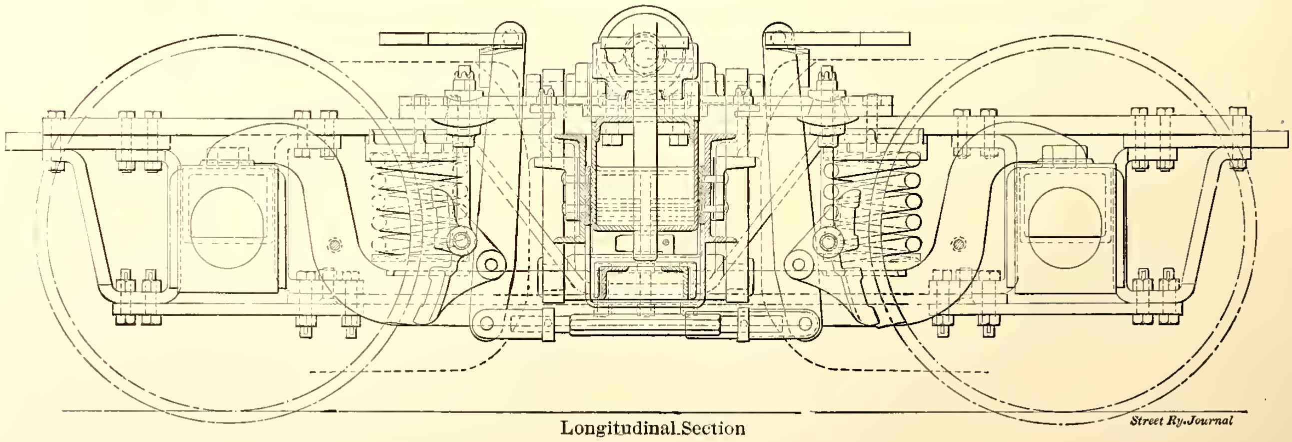
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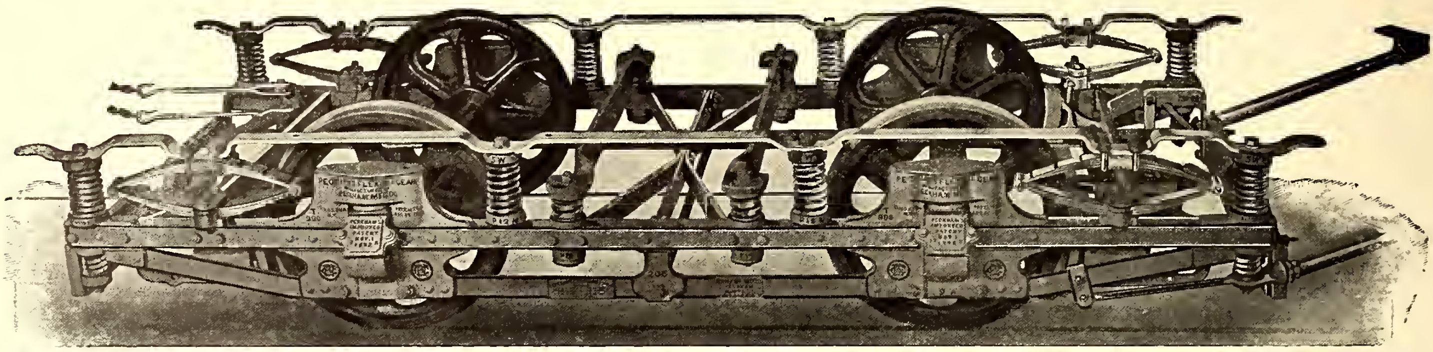

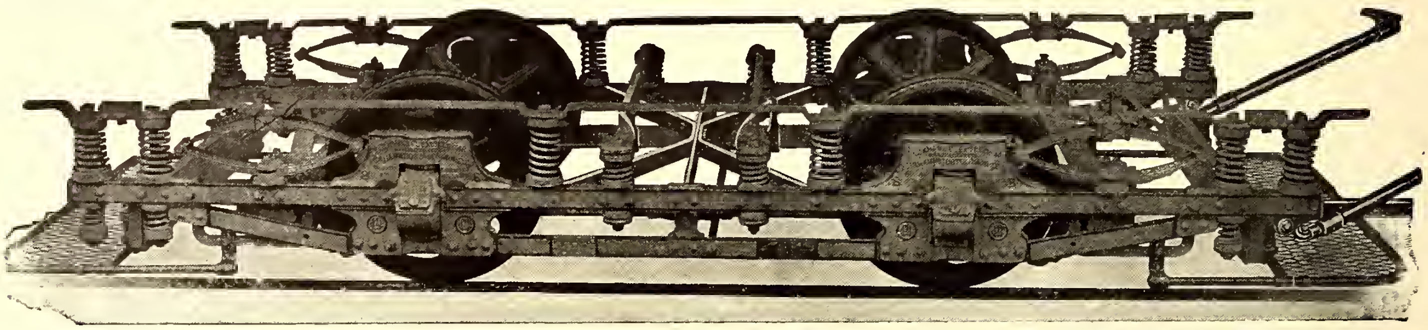

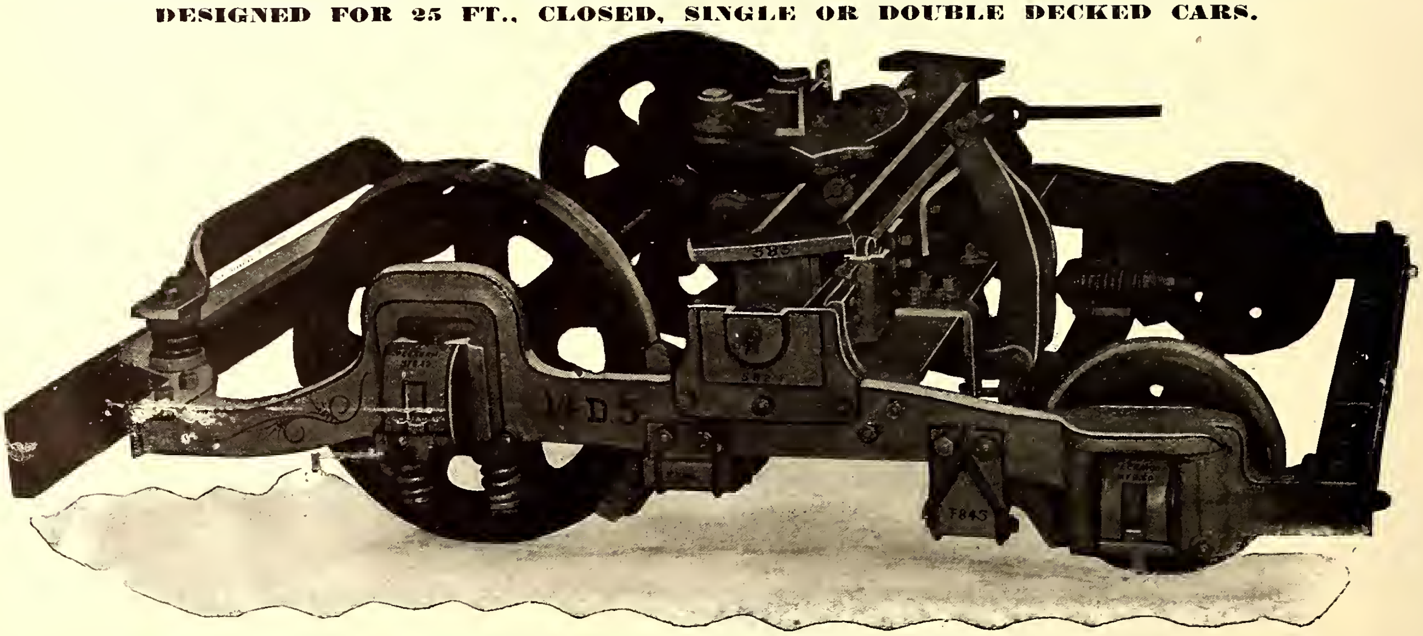

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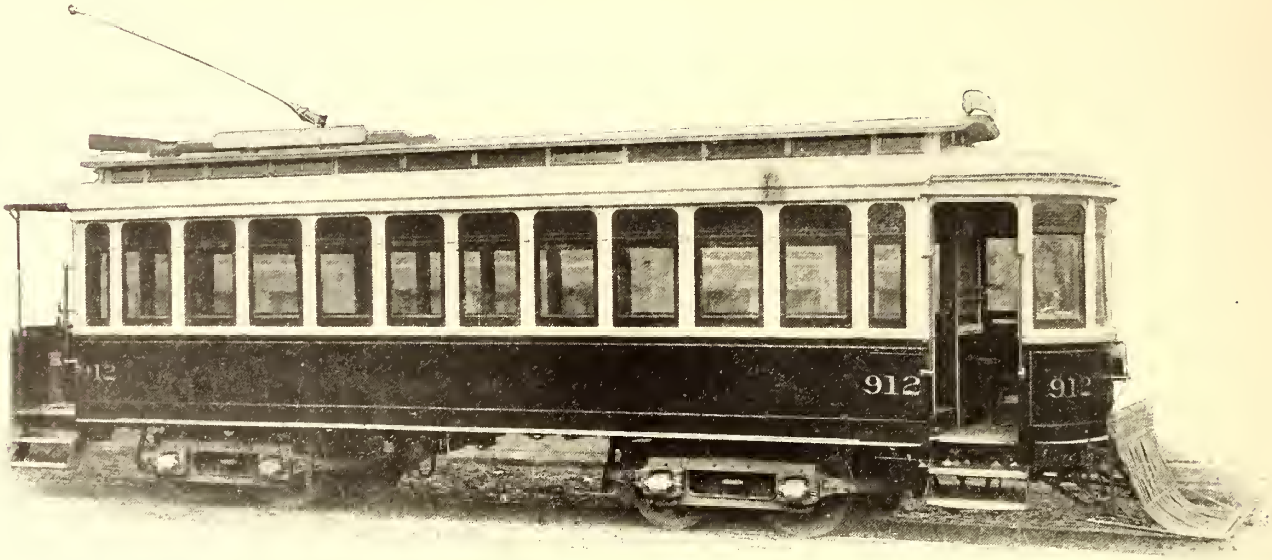

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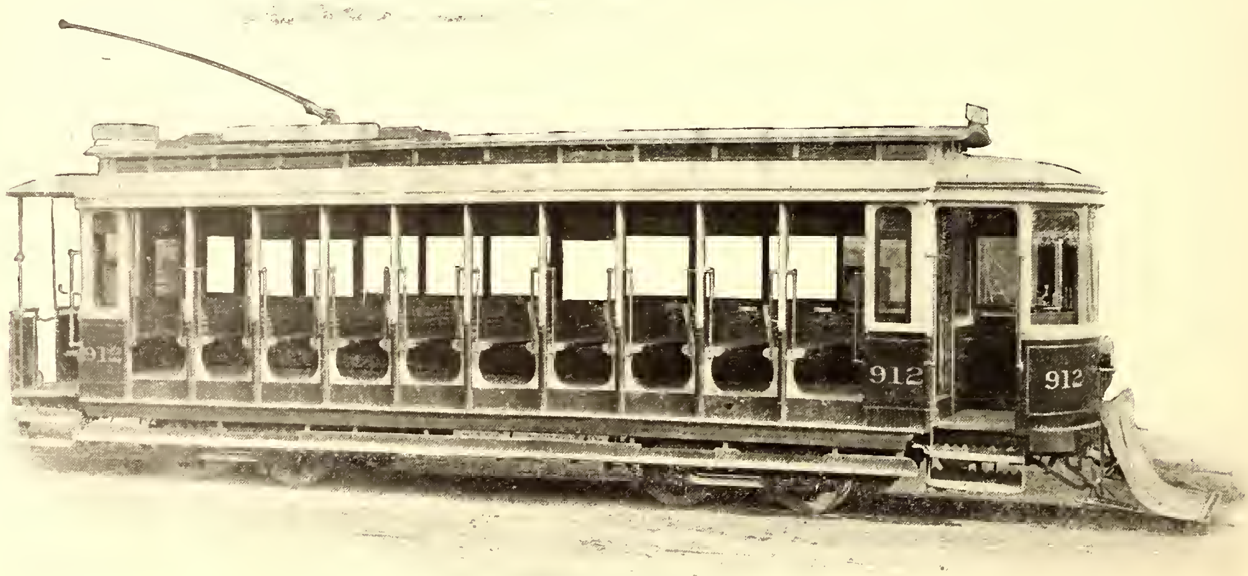

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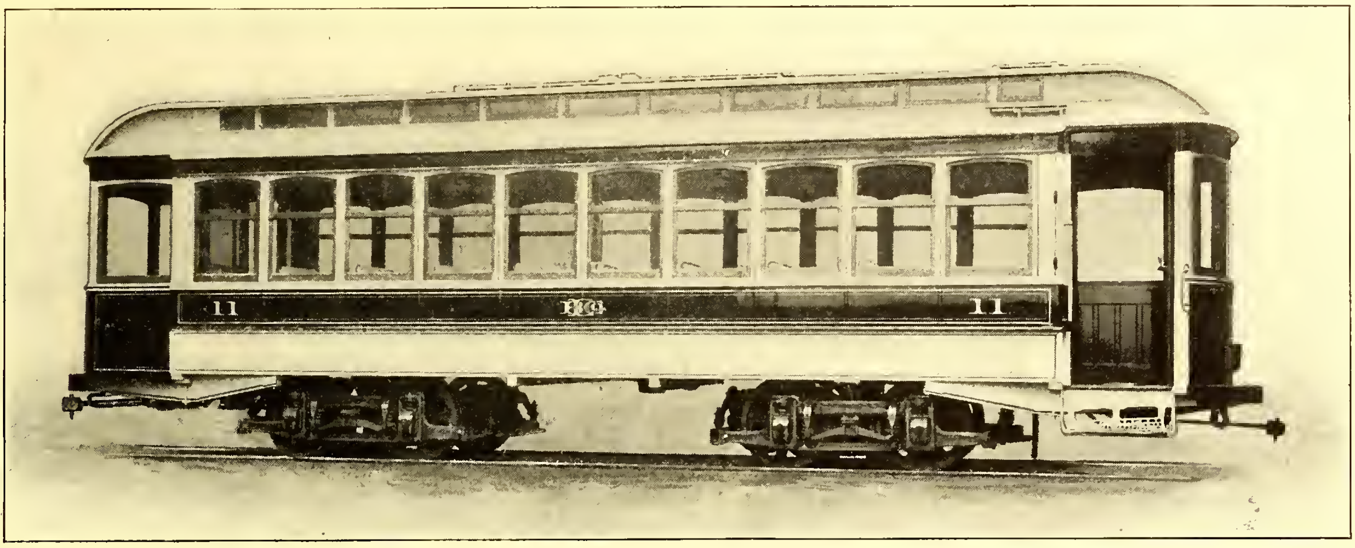

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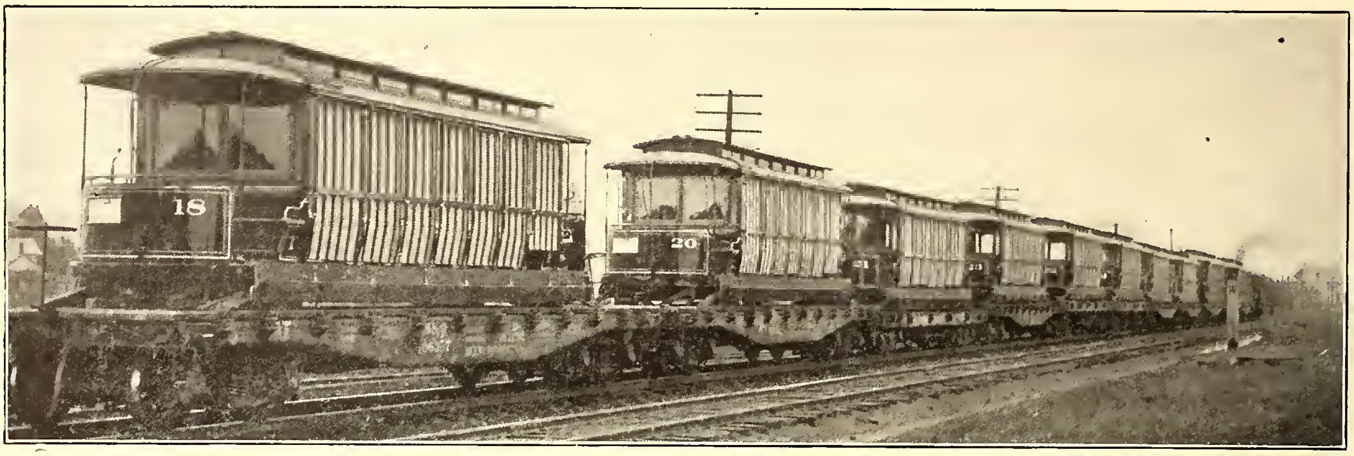

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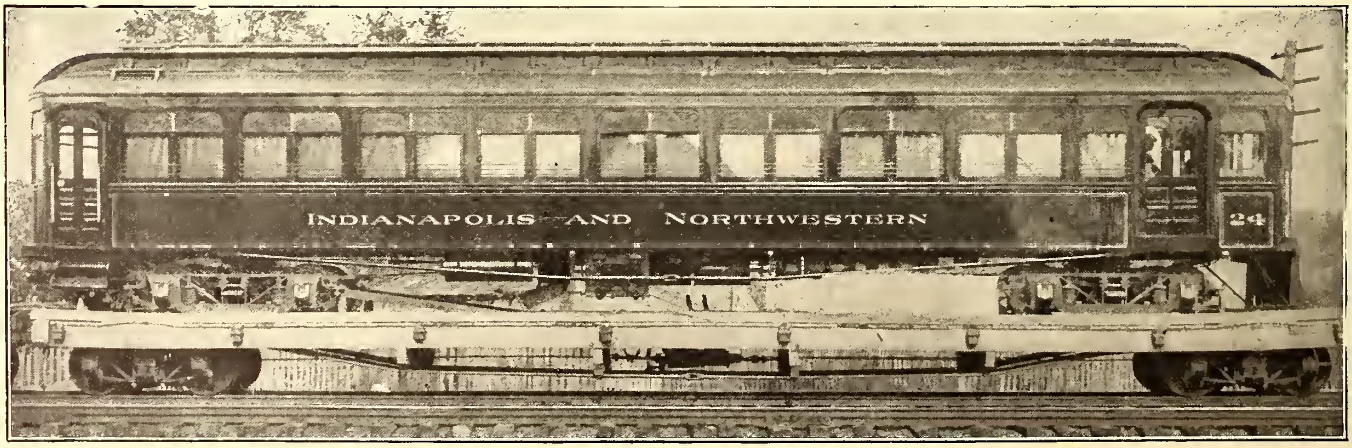

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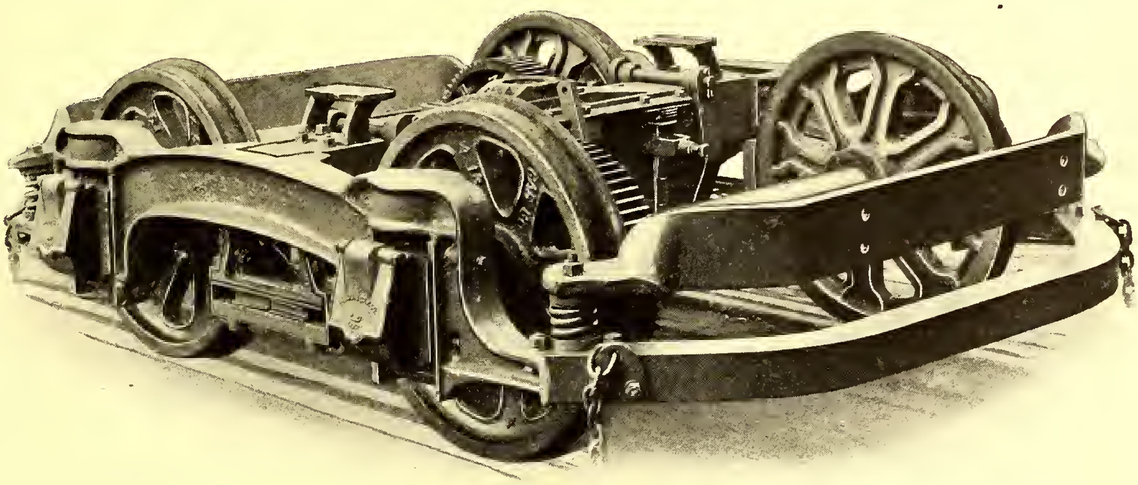

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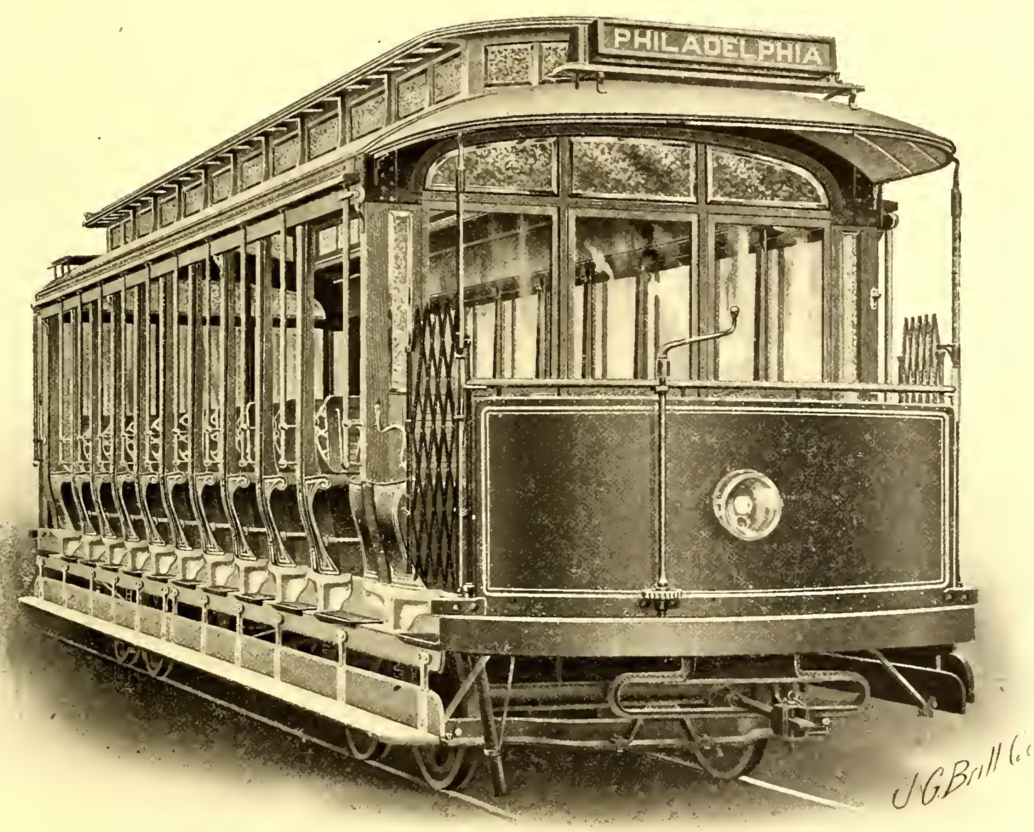


BRILL NARRAGANSETT CAR (**Patented.**)

panies say. Think of the difference in step heights—16 inches, 13 inches, 7½ inches are the Narragansett steps, while with the single step the heights are 19½ inches and 17 inches, and it is impossible to get the car floor lower than 36½ inches with double trucks. The Z-iron sills of the Narragansett with the upper step on the middle web provides double steps without exceeding the width of a standard single step open car and is one of the simplest and most useful inventions in car building. It makes an open car as safe to enter and leave as a closed car with dropped platforms, and it is the strongest open car ever built because of the Z-bar sills. The seats are full standard length. Each of the four years since the car was introduced has seen a large increase in orders, and we are already building Narragansetts for the coming season.

SPRINGS—The steel used is known as the P. R. R. Standard Analysis and Test.

Gould Storage Battery Co.

COMPLETE STORAGE BATTERY PLANTS
- Railway Line and Regulating
- Isolated and Train Lighting
- Central Lighting and Power
- Electric Vehicle

GOULD COUNTER E. M. F. BOOSTER SYSTEMS

SALES OFFICES: New York, 1 W. 34th Street. Chicago, Rookery Building. Boston, 89 State Street. San Francisco, Century Electric Company.

Works: Depew, N. Y.

BULLETINS FURNISHED ON APPLICATION

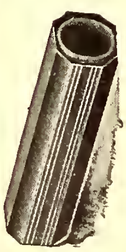
National Battery Company

General Offices, Laboratory and Works
BUFFALO, N.Y.

"Unit Accumulator"
PATENT ALLOWED JANUARY 11, 1905

Electric Storage Batteries

Sales Offices
NEW YORK
CHICAGO
BOSTON
PROVIDENCE



VITRIFIED CLAY CONDUIT

of unequalled quality Standard and Self-Centering Single Ducts, in all sizes, 2, 3, 4 and 6 Way Multiple Ducts.

Complete Subway Systems.

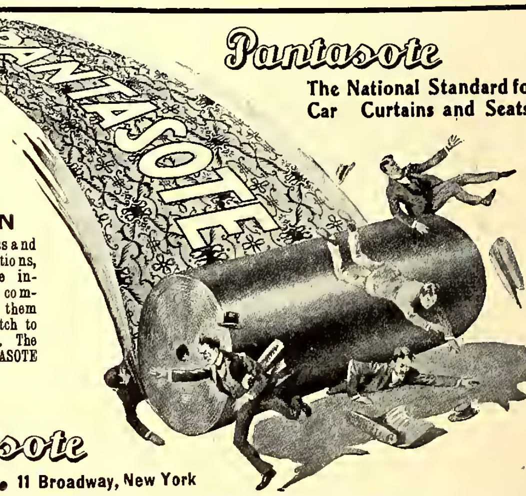
SEND FOR ESTIMATES

Standard Sewer Pipe Co.

ROCHESTER, N. Y.

Pantasote

The National Standard for Car Curtains and Seats



CAUTION
There are worthless and dangerous imitations, Most of them have inflammable surface compounds. Test them with a lighted match to find the genuine. The surface of PANTASOTE will not burn.

THE... Pantasote Co., 11 Broadway, New York

OWEGO BRIDGE COMPANY,

SHOPS AT OWEGO, N. Y.

A Specialty of Electric and Steam Railway Work.

WRITE US FOR ESTIMATES.

OWEGO BRIDGE COMPANY,

LAND TITLE BUILDING, PHILADELPHIA.

..NOW..

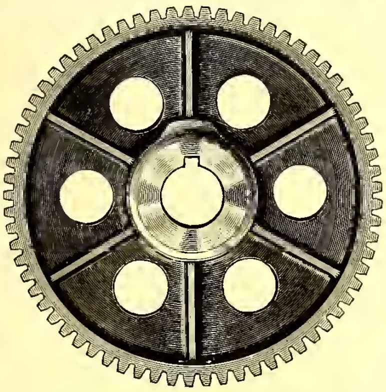
Is the time to get in a supply of paving brick and block for paving between tracks, in and around car barns, etc.—we have a large stock on hand just now and are willing to sell at most attractive prices. Prompt shipments assured. ∴ ∴ ∴
We also make the Arthur's Hump Rail Block and rail brick of all kinds. *Write Us* ∴ ∴

Mack Manufacturing Co.
LAND TITLE BUILDING ∴ PHILADELPHIA

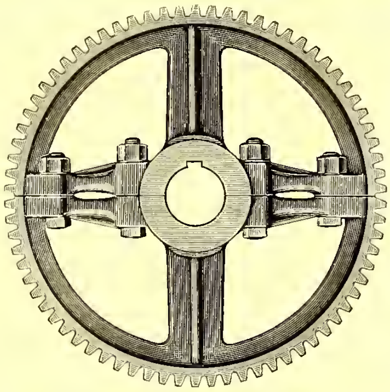
A Signal for Stopping Electric Cars at Night

¶ Almost every street railway manager will recognize the necessity of a signaling device for the use of patrons in the suburban and rural districts, to enable them to signal a car to stop *at night*. The HAYCOX ELECTRIC CAR SIGNAL was designed for this purpose. It enables the prospective passenger to signal a car without standing on the track, lighting matches, etc. Can be seen by the motorman a distance of *1,000 feet*, giving ample time to stop the car at the desired place. ¶ The Haycox Signal is *simple in construction*, *low in price*, *costs practically nothing for maintenance*, and quickly pays for itself by preventing accidents, as well as in other ways.
Write For Descriptive Circular.

THE OHIO BRASS COMPANY
Sole Manufacturers
MANSFIELD, : : : : : OHIO, U. S. A.



HIGHEST QUALITY



FOR ALL TYPES OF MOTORS

GOOD

Gears and Pinions

Design, Material, Workmanship—With these three features right, the product is right. We use the **very best** high carbon, open hearth steel for Gears; hammered steel for Pinions. Mechanically perfect. Prices and deliveries are right, too.

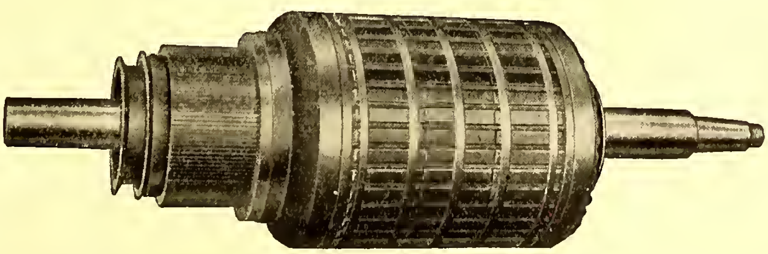
VAN DORN & DUTTON CO.
CLEVELAND, OHIO

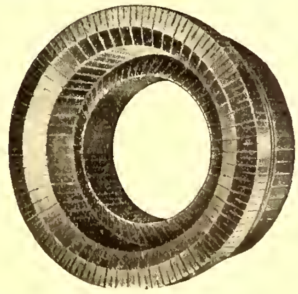
Eastern Office: 95-97 Liberty St., New York
E. G. LONG, Mgr.

In Armature Rewinding and Repairing

We Lead and Others Follow
All work quickly and satisfactorily done.

We also make a specialty of building **Armature Coils, Field Coils and Commutators**





Guaranteed equal to best factory work. Prices always the best. Write us.

THE VAN DORN-ELLIOTT ELECTRIC CO., CLEVELAND, OHIO

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA, PA.

MANUFACTURER OF THE

"Chloride Accumulator"

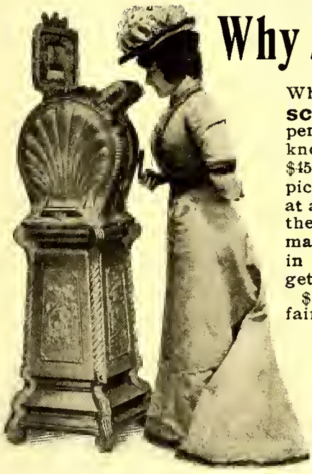
FOR ELECTRIC RAILWAY POWER HOUSES, FEEDER SUB-STATIONS, ROTARY SUB-STATIONS, ETC.

SEND FOR BULLETIN DESCRIBING RAILWAY INSTALLATIONS

SALES OFFICES

New York, 100 Broadway — Boston, 60 State Street — Chicago, Marquette Bldg. — San Francisco, Rialto Bldg. — Philadelphia, Allegheny Av., & 19th St. — St. Louis, Wainwright Bldg. — Cleveland, Citizens' Bldg.

HAVANA, CUBA, G. F. Greenwood, Mgr., 34 Empedrado Street. CANADA, The Canadian General Electric Co., Ltd., TORONTO



Why Share the Profits?

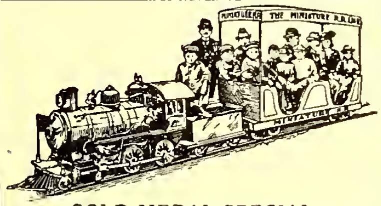
Why allow an outsider to place **Mutoscopes** in your park and give him 50 per cent. or more of the gross. Do you know that you can buy the machines for $45.00 each and have no investment in pictures. We rent the pictures to you at a nominal rental per day and change them as often as you require. The machines will easily pay for themselves in one season and after that you will get the GROSS.

$1.00 per day per machine is a very fair average for summer parks.

Write for full particulars and discounts.

American Mutoscope and Biograph Co.

Muto. Dept. 11 E. 14th St., New York



GOLD MEDAL SPECIAL

Miniature Railroad Co.

407 Broadway, New York City, N. Y.

For Parks, Summer Resorts, etc.

Hauling Capacity, 25 Tons

Earning $1,500 in six days

With proper care will last 25 yrs.

Gagney's Locomotive Works

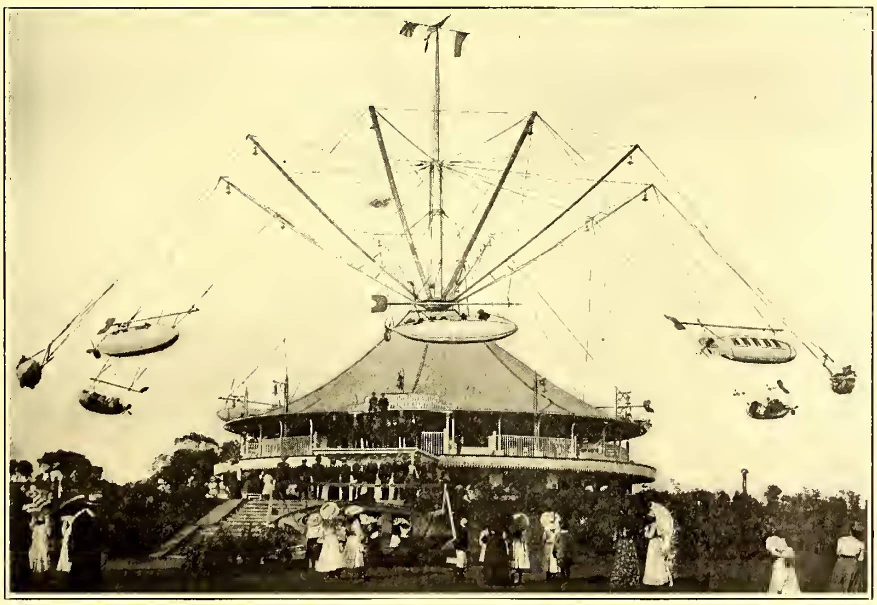
Grand Prize and Gold Medal received at World's Fair, St. Louis

The book you are looking for was described in our four-page advertisement of books adapted to the use of Street Railway Men in the JOURNAL of February 11, 1905.

McGraw Publishing Company

114 LIBERTY STREET NEW YORK, N. Y.

The Sir Hiram Maxim Captive Flying Machine



FULLY COVERED BY PATENTS

THOMAS J. RYAN offers to Summer Parks **the latest invention of Sir Hiram Maxim,** of London, England—the newest Summer Park Amusement.

The Sir Hiram Maxim Captive Flying Machine has been operated with extraordinary success at **Earl's Court** and the **Crystal Palace, London;** at **Blackpool, Eng.,** and in **Paris.**

Mr. Ryan will construct and sell a limited number of these machines for the coming season, under the American patents owned exclusively by him.

These machines can be constructed to suit any park, both as to size and price—from one with a main tower 35 feet high and a 20 foot mast surmounting it, to one with a main tower 65 feet high and a 35 foot mast.

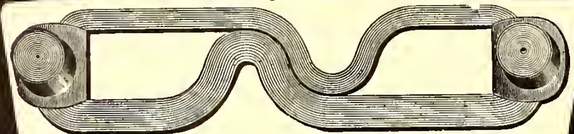
Passenger carrying capacity as follows: No. 1 machine, four boats for six persons each; No. 2, four boats for eight persons each; No. 3, six boats for eight persons each; No. 4, ten boats for ten passengers each. Machines of the No. 4. size are now being constructed for Dreamland, Coney Island, and Willow Grove Park, Pennsylvania.

All parts built under supervision of skillful mechanical engineers, insuring absolute safety.

BIGGEST MONEY MAKER THIS COUNTRY HAS EVER KNOWN. Persons who mean business may obtain detailed information by addressing

THOMAS J. RYAN, 1028 Land Title Building **PHILADELPHIA, PA.**

Being the shortest, the Protected Bond offers less resistance to the passage of current



than any other Bond. Being under the joint plate, it cannot be stolen, and is protected from the earth's gases. It is easy to install, and is made in sizes and shapes to meet all conditions. Cheapest because made better and lasts longer than any other.

CATALOGUE ON APPLICATION.

The Protected Rail Bond Company

The Mayer & Englund Company
General Sales Agents
PHILADELPHIA, PA.

NEW YORK, 85 Liberty Street
PITTSBURG, Park Building
CHICAGO, 135 Adams Street
ATLANTA, 52 S. Forsythe Street

The MAYER & ENGLUND CO.
PHILADELPHIA

H. F. SANVILLE & CO., Philadelphia, Pa., Correspondent
L. F. MAHLER CO., St. Louis, Mo., Correspondent

RAIL BONDS

FOR ALL CLASSES OF WORK

Send us Your Specifications

TYPE "G"

Shawmut Soldered Rail Bond

SOLD AND ATTACHED

BULLETIN No. 25

CHASE=SHAWMUT CO.

NEWBURYPORT, MASS.

SPRANLEY & REED, New Orleans, La., Correspondent
JOHN R. COLE CO., San Francisco, Cal., Correspondent

THE

Long Island Railroad

Through Its Engineers

Westinghouse Church Kerr & Co.

Ordered from Us in 1904

Over 100,000

THOMAS SOLDERED RAIL BONDS

Of Large Capacity

The type of bond used exclusively on the track rails of the Long Island Railroad

ASK THEM WHY THEY DID IT

We now have other equally large and important contracts for furnishing and installing

THOMAS SOLDERED RAIL BONDS

For some of the largest traction companies in America. Our bonds are soldered to the rail, insuring permanency of attachment and maximum conductivity.

LORD ELECTRIC COMPANY

Main Office and Factory, Boston, Mass.

CHICAGO	NEW YORK	SAN FRANCISCO
THE W. R. GARTON CO.	HENRY M. SHAW	F. A. LAWSON & CO.
118-32 W. Jackson Bvd.	1503 Fuller Bldg	519 Mission Street

Thermit Rail Welding Process

DR. H. GOLDSCHMIDT'S PATENTS

THERMIT RAIL WELDING, HOLYOKE, MASS.

CHEAPEST QUICKEST SIMPLEST BEST

No Distortion of Line
No Mutilation of Rail
Outfit Simple and Cheap
Operated by One or More Men
Perfect Alignment of Track
Absolute Amalgamation of Rail Ends

GOLDSCHMIDT THERMIT CO.

43 Exchange Place, New York City

Index to Advertisers.

Index to Advertisers.

(Continued from page 9.)

"DELTABESTON MAGNET WIRE"—Warning to all Infringers

We beg to notify the trade that suit has been commenced against the **TETER-HEANY DEVELOPING COMPANY,** of York, Pa., for infringement of L. W. Downes' U. S. letters patent No. 534,785 and No 709,001 for asbestos insulated wire and process of making the same, under which patents we are licensees ; and we desire to warn the trade against the purchase or use of the asbestos insulated wire put out by the said Teter-Heany Developing Company in violation of our rights as licensees under said patents.

DELTABESTON WIRE

D. & W. FUSE COMPANY

WIRE DEPARTMENT

PROVIDENCE, R. I.

DELTABESTON WIRE

For books on any subject connected with Electric Railway Engineering see our four-page advertisement on the colored pages of the issue of February Eleven, Nineteen Hundred and Five

McGraw Publishing Co.

114 Liberty Street, NEW YORK, N. Y.

BARRETT JACKS

Meet Every Lifting Requirement

THEY ARE . . . EASILY HANDLED, QUICK, DURABLE AND POWERFUL.

Send for Catalog and Prices

THE **DUFF MFG. CO.**

PITTSBURG, PA.

Works: Allegheny, Pa.

Bituminized Fibre Conduit

FOR UNDERGROUND CONSTRUCTION

COMBINES the **GOOD FEATURES** of other conduits.
ELIMINATES the **BAD FEATURES** existing in many kinds.
HAS VALUABLE FEATURES not found in any other duct,

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

AMERICAN CONDUIT COMPANY,

Main Offices,
1005-6 MANHATTAN BUILDING,
CHICAGO

Other Offices,
170 Broadway, New York
336 Macy Street, Los Angeles

Underground Conduit Installations

FOR ALL PURPOSES

CABLE INSTALLATIONS

WILLIAM D. GHERKY, Engineer and Contractor

CORRESPONDENCE SOLICITED -:- 334 NORTH BROAD ST., PHILADELPHIA

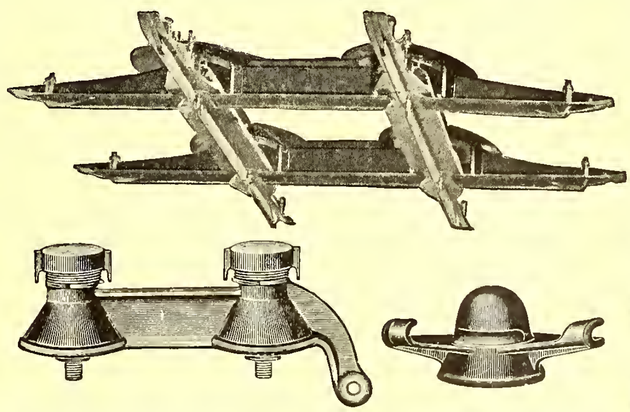
CEDAR

POLES POSTS TIES

LINDSLEY BROS. CO.

Tribune Building CHICAGO

Anderson Trolley Line Material for all Systems



STANDARD ALL OVER THE WORLD

SEND FOR CATALOGUES AND ESTIMATES.

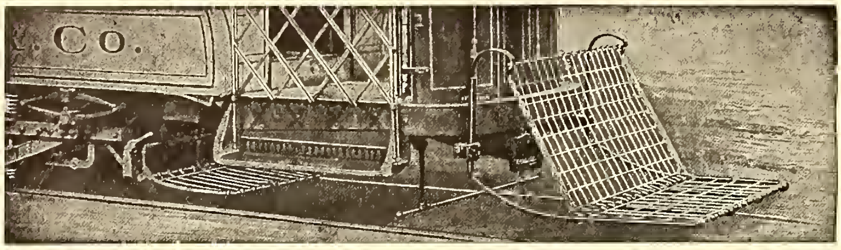
Albert & J. M. Anderson Manufacturing Co.

MAIN OFFICE AND FACTORY, BOSTON, MASS.

NEW YORK, 135 Broadway
PARIS, 20 Rue St. George
LONDON, 59 City Road

CHICAGO, 175 Dearborn Street
BRUSSELS, 20 Avenue Du Boulevard
MILAN, 12 Via Dante

PARMENTER FENDERS AND WHEEL GUARDS



Are life-saving devices which cannot fail. Fender can be be dropped at the will of motorman. Readily folded and transferred. Light, effective, durable. Wheel Guard is automatic and can be used in connection with fenders or independently. Easily adjusted.

. . . WE SOLICIT INVESTIGATION . . .

Parmenter Fender and Wheel Guard Co., 409 India Building, 84 State Street, BOSTON, MASS.

ECLIPSE LIFE GUARD

Saves both life and limb, and enough damage claims in six months to more than pay for the total cost of equipment.

See page advertisement February 11th issue.

Eclipse Railway Supply Company
Temple Block, KANSAS CITY, MO. Vulcan Bldg., CLEVELAND, OHIO

CHAS. N. WOOD ELECTRIC CO.

TROLLEY CATCHERS

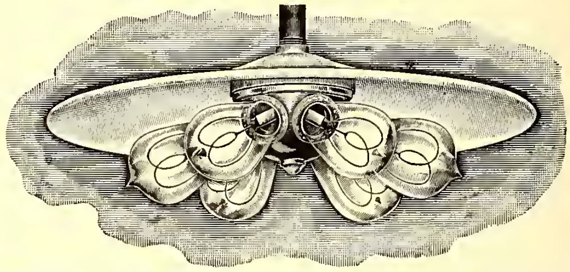
BOSTON, MASS.

CHAS. N. WOOD ELECTRIC CO.

Use Benjamin Wireless Clusters

For Car and Outdoor Lighting

Accept No Substitutes



BENJAMIN ELECTRIC MFG. COMPANY
CHICAGO NEW YORK

The Earll Trolley Retriever

May be re-set while the car is at high speed, conveniently and safely, and without hooking the pole down to the roof of car, and without touching anything but the rope. It cannot be left in an inoperative condition. It can be operated with one hand. It never fails to operate at the right time. It is the lightest, smallest, and strongest Retriever on the market, and yet it has the largest rope space.

CHAS. I. EARLL
BISHOP BUILDING, cor. William and Liberty Sts., NEW YORK

WE FURNISH REPAIR PARTS So that any good mechanic can overhaul INTERNATIONAL REGISTERS and make them as good as new at slight cost.

INTERNATIONAL REGISTERS

do not need any repairing until long after they have paid for themselves in actual service, but it is always a decided advantage to have interchangeable repair parts, easily and cheaply obtained and sure that they will always fit. Send for catalog of registers, badges, trolley rope, punches, buttons and other supplies.

THE INTERNATIONAL REGISTER CO.
124 WEST JACKSON BOULEVARD
CHICAGO, ILL.

CLASSIFIED DIRECTORY

OF

Manufacturers, Dealers, Engineers, Contractors, Etc., advertising in this issue of the Street Railway Journal

NOTE—For reference to the advertisements, see alphabetical Index on pages 9-11

Advertising (Street Car)
Petry Company, Ambrose.

Air-Brakes
Christensen Engineering Co.
National Electric Co.
Philadelphia Air Brake Co.
Westinghouse Air Brake Co.
Westinghouse Traction Brake Co.

Air Compressors
Allis-Chalmers Co.
Christensen Engineering Co.
General Electric Co.
Westinghouse Traction Brake Co.
National Electric Co.

Alternators
Christensen Engineering Co.
National Electric Co.

Amusement Attractions
American Mutoscope & Biograph Co.
Miniature Railroad Co.
Morris, E. Joy.
Ryan, Thos. J.

Anchors, Stombaugh Guy
Matthews, W. N., & Bro.

Armature Lifts
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Van Dorn & Dutton Co.

Armature Winding
(See Repair Work.)

Armature and Field Coils
Chattanooga Armature Works.
Columbia Machine Works & Malleable Iron Co.
Elliott Bros. Elec. Co.
Ford Elec. & Mfg. Co.
Garton Co., The W. R.
McLeer & Co.
Ohio Brass Co.
Porter & Berg.
Van Dorn-Elliott Elec. Co.
Waterbury & Co.
Wood, Chas. N., Electric Co.

"Automotoneer"
Garton-Daniels Co.

Asbestos Material
Johns-Manville Co., H. W.

Babbitt Metal
(See Bearings.)

Badges and Buttons
American Railway Supply Co.
International Register Co.
Mayer & Englund Co.
New Haven Car Register Co.
Porter & Berg.
Waterbury Button Co.
Woodman, R., Mfg. & Supply Co.

Bankers and Brokers
Jackson, C. L.
National Elec. Construction Co.

Battery Carbons
National Carbon Co.

Batteries, Storage
(See Storage Batteries.)

Bearings
American Car Co.
Brill, J. G., Co.
Central Union Brass Co.
Columbia Machine Works & Malleable Iron Co.
Electric Railway Equipment Co., Cincinnati.
Garton Co., The W. R.
Long, E. G.
Mayer & Englund Co.
New Era Mfg. Co.
Ohio Brass Co.
Phosphor Bronze Smelting Co.
Pittsburgh White Metal Co.
Porter & Berg.
St. Louis Car Co.
Van Dorn & Dutton Co.

Bell Cord
(See Cord, Bell and Trolley.)

Bells and Gongs
American Car Co.
Brill, J. G., Co.
Garton Co., The W. R.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
St. Louis Car Co.

Belts, Leather, Rubber and Canvas
Case Mfg. Co.
Porter & Berg.
Robins Conveying Belt Co.

Biographs
American Mutoscope & Biograph Co.

Blinds (Car)
American Car Co.
Brill, J. G., Co.
Porter & Berg

Blowers
Green Fuel Economizer Co.
Sturtevant, B. F., Co.

Boilers
Allis-Chalmers Co.
Harrison Safety Boiler Works.
Westinghouse, Church, Kerr & Co.

Boiler Cleaners
Lagonda Mfg. Co.

Boiler & Pipe Coverings
Johns-Manville Co., H. W.

Bonds (Rail)
Central Union Brass Co.
Chase-Shawmut Co.
Electric Railway Equipment Co., Cincinnati.
General Electric Co.
Lord Electric Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Roebling's, John A., Sons Co.

Boring Mills
Niles-Bement-Pond Co.
Pratt & Whitney Co.

Brackets and Cross Arms
Anderson, A. & J. M., Mfg. Co.
Creaghead Engineering Co.
Electric Railway Equipment Co., Cincinnati.
Garton Co., The W. R.
Lindsley Bros. Co.
Maus & Co., H. H.
Moss Tie Co., T. J.
Morse Cedar Co.
Ohio Brass Co.
Porter & Berg.
Southern Exchange Co.
Standard Tie Co.
Worcester, C. H., Co.

Brake Chains
Sterling-Meaker Co.
St. Louis Car Co.

Brake Handles
American Car Co.
Brill, J. G., Co.
Columbia Machine Works & Malleable Iron Co.
Garton Co., The W. R.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
St. Louis Car Co.

Brake Shoes
American Car Co.
Brill, J. G., Co.
Long, E. G.
Porter & Berg.
St. Louis Car Co.

Brakes (Car)
American Car Co.
Brill, J. G., Co.
Christensen Engineering Co.
Garton Co., The W. R.
General Electric Co.
National Brake Co.
National Electric Co.
Peckham Manufacturing Co.
Philadelphia Air Brake Co.
St. Louis Car Co.
Sterling-Meaker Co.
Van Dorn & Dutton Co.
Westinghouse Air Brake Co.
Westinghouse Traction Brake Co.

Bridges
Hitner's Sons, Henry A.
McGuire, M. C.
Owego Bridge Co.
Riverside Bridge Co.

Brooms (Track)
American Car Co.
Brill, J. G., Co.
Garton Co., The W. R.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.

Brushes (Motor and Dynamo)
General Electric Co.
Le Valley Vitae Carbon Brush Co.
National Carbon Co.
Ohio Brass Co.
Porter & Berg.
Speer Carbon Co.

CLASSIFIED DIRECTORY—Continued

Buttons
(See Badges and Buttons.)

Cables
(See Wires and Cables.)

Car Replacers
Duff Mfg. Co.
Van Dorn & Dutton Co.

Car Seats
Hale & Kilburn Mfg. Co.
Pantasote Co.
St. Louis Car Co.

Carbon Brushes
(See Brushes, Motor and Dynamo).

Cars
American Car Co.
Brill, J. G., Co.
Convertible Car Co., Ltd.
Hanna, J. A., Co.
Jewett Car Co.
Kuhlman, G. C., Car Co.
Niles Car & Mfg. Co.
St. Louis Car Co.

Car Wheel Boring Machines
Niles-Bement-Pond Co.

Castings
Case Mfg. Co.
Central Union Brass Co.
Christensen Engineering Co.
Columbia Machine Works & Malleable Iron Co.
Electric Railway Equipment Co., Cincinnati.
Garton Co., The W. R.
National Electric Co.
Ohio Brass Co.
Phosphor Bronze Smelting Co.
Porter & Berg.
Star Brass Works.
St. Louis Car Co.

Chains, Standard and Special
Case Mfg. Co.

Change Carrier
Bellamy-Vestlette Mfg. Co.

Circuit Breakers
Anderson, A. & J. M., Mfg. Co.
Garton Co., The W. R.
General Electric Co.
Hill, W. S., Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Porter & Berg.
Westinghouse Elec. & Mfg. Co

Cleaner, Floor and General
India Alkali Works.

Clusters
Benjamin Electric Mfg. Co.
Porter & Berg.

Coal Handling Machinery
Robins Conveying Belt Co.

Commutators and Commutator Bars
Billings & Spencer Co.
Central Union Brass Co.
Chattanooga Armature Works.
Columbia Machine Works & Malleable Iron Co.
Elliott Bros. Elec. Co.
Garton Co., The W. R.
General Electric Co.
Homer Commutator Co.
McLeer & Co.
Ohio Brass Co.
Porter & Berg.
Rossiter, MacGovern & Co.
Van Dorn-Elliott Electric Co.
Waterbury & Co.
Wood, Chas. N., Electric Co.

Condensers
Alberger Condenser.
Allis-Chalmers Co.
Blake-Knowles Steam Pump Works.
Conover Condenser.
Power Specialty Co.
Sturtevant, B. F., Co.
Taunton Locomotive Mfg. Co.
Watson Machine Co.
Westinghouse, Church, Kerr & Co.

Conductors' Vestlette
Bellamy-Vestlette Mfg. Co.

Conduits (Clay)
American Conduit Co.
Gherky, Wm. D.
National Conduit & Cable Co.
Standard Sewer Pipe Co.

Contractors
Arnold Elec. Power Station Co.
Bates & Neilson.
Byllesby & Co., H. M.
Creaghead Engineering Co.
Gherky, W. D.
Kohler Brothers.
MacAfee, John Blair.
Mitchell, W. K., & Co.
Myers, L. E., Co.
National Elec. Construction Co.
Rossiter, MacGovern & Co.
Sanderson & Porter.
Schott, W. H.
Seaboard Construction Co.
Stearns, Charles K.
Western Electrical Supply Co.
Westinghouse, Church, Kerr & Co.
White, J. G., & Co.

Controllers
Case Mfg. Co.
Garton Co., The W. R.
General Electric Co.
Westinghouse Elec. & Mfg. Co

Controller Parts
Johns-Manville Co., H. W

Conveyors (Coal and Ashes)
Case Mfg. Co.
Robins Conveying Belt Co.

Cord (Bell and Trolley)
American Car Co.
Brill, J. G., Co.
Garton Co., The W. R.
International Register Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Samson Cordage Works.
Sterling-Meaker Co.

Cotton Duck
Boyle, John, & Co.

Cotton Hose
Garton Co., The W. R.
Porter & Berg.

Couplers (Car)
St. Louis Car Co.
Westinghouse Air Brake Co.

Cranes, Traveling
Case Mfg. Co.
Niles-Bement-Pond Co.
Pratt & Whitney Co.

Crossings, Frogs and Switches (Track)
Alabama Frog & Switch Co.

Curtain Rollers
Hartshorn Co., Stewart.

Curtain Material
Boyle, John, & Co.
Pantasote Co.

Curtains and Curtain Fixtures
American Car Co.
Brill, J. G., Co.
Porter & Berg.
St. Louis Car Co.

Cutting-Off and Centering Machines
Niles-Bement-Pond Co.

Derail Devices
Ohio Brass Co.
Porter & Berg.

Detective Service
Drummond's Detective Agency.

Doors (Car)
American Car Co.
Brill, J. G., Co.

Doors and Shutters, Steel Rolling
Kinnear Mfg. Co.

Drills, Multiple Spindle Radial
Niles-Bement-Pond Co.

Drills, Track
Garton Co., The W. R.
Ludlow Supply Co.
Niles-Bement-Pond Co.
Porter & Berg.

Dynamos
(See Generators.)

Ears, Trolley
Garton-Daniels Co.
Garton Co., The W. R.
Porter & Berg.

Economizers
Green Fuel Economizer Co.
Sturtevant, B. F., Co.
Westinghouse Machine Co.

Electric Brakes
General Electric Co.
Westinghouse Traction Brake Co.

Electric Hoists
Thomas Elevator Co.

Electric Shovels
(See Shovels.)

Electrical Testing
Electrical Testing Laboratories.

Elevating Machinery
(See Conveyors.)

Engineers (Consulting)
Arnold Elec. Power Station Co.
Baker, W. E., & Co.
Bates & Neilson.
Byllesby & Co., H. M.
Gherky, W. D.
Mershon, Ralph D.
Myers, L. E., Co.
Sanderson & Porter.
Schott, W. H.
Stearns, Charles K.
Van Bibber, Charles Edwin.
Western Electrical Supply Co.
White, J. G., & Co.
Woods, R. P.

CLASSIFIED DIRECTORY—Continued

Engines (Gas)
Allis-Chalmers Co.
Loomis-Pettibone Gas Mach. Co.
Power & Mining Machinery Co.
Westinghouse Machine Co.

Engines (Steam)
Allis-Chalmers Co.
Buckeye Engine Co.
Bullock Electric Mfg. Co
Hooven, Owens, Rentschler Co.
Westinghouse Machine Co.
Wetherill, Robb & Co.

Fans
Green Fuel Economizer Co.
Sturtevant, B. F., Co.

Fare Registers
(See Registers, Fare.)

Feedwater Heaters
(See Heaters, Feed-Water.)

Fenders and Guards
Eclipse Railway Supply Co.
Mayer & Englund Co.
Parmenter Fender & Wheel Guard.
Peckham Mfg. Co.

Fence Posts
Lindsley Bros. Co.

Fibre
American Vulcanized Fibre Co.
Wilmington Fibre Specialty Co.

Filters
Oil & Waste Saving Machine Co.

Fittings
Mitchell. W. K., & Co.

Flying Machine (for amusement purposes)
Ryan, Thos. J.

Frogs (Car Replacing)
Ohio Brass Co.
Porter & Berg.

Fuses
Chase-Shawmut Co.
D. & W. Fuse Co.
Garton Co., The W. R.
Johns-Manville Co., H. W.
Mayer & Englund Co.
Porter & Berg.

Gates (Car)
Brill, J. G., Co.
St. Louis Car Co.

Gears and Pinions
Bliss, E. W., Co.
Case Mfg. Co.
Fogarty, James H.
Ford Elec. & Mfg. Co.
Garton Co., The W. R.
General Electric Co.
Long, E. G.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
U. S. Projectile Co.
Van Dorn & Dutton Co.
Waterbury & Co.
Wood, Chas. N., Electric Co.

Generators
Bullock Electric Mfg. Co.
Case Mfg. Co.
Christensen Engineering Co.
Crocker-Wheeler Co.
Ford Elec. & Mfg. Co.
General Electric Co.
Loomis-Pettibone Gas Mach. Co.
National Electric Co.
Power & Mining Machinery Co.
Westinghouse Elec. & Mfg. Co.

Generators (Gas)
Loomis-Pettibone Gas Mach. Co.
Power & Mining Machinery Co.

Gongs (Car)
(See Bells and Gongs.)

Graders and Rock Crushers
Allis-Chalmers Co.

Grease and Oils
(See Lubricants.)

Grease Cups
Crane Co.

Grinders, Drill
Niles-Bement-Pond Co.

Hammers, Steam
Niles-Bement-Pond Co.

Headlights
American Car Co.
Brill, J. G., Co.
Garton Co., The W. R.
Porter & Berg.
St. Louis Car Co.

Heaters (Car)
American Car Co.
Brill, J. G., Co.
Franklin Railway Supply Co.
Johns-Manville Co., H. W.
Porter & Berg.
Smith, Peter, Heater Co.

Heaters and Purifiers (Feed-water)
Allis-Chalmers Co.
Green Fuel Economizer Co.
Harrison Safety Boiler Works.
Power Specialty Co.
Taunton Locomotive Mfg. Co.

Hoists
Case Mfg. Co.
Niles-Bement-Pond Co.

Hoisting Towers
Robins Conveying Belt Co.

Horizontal Boring and Drilling Machines
Niles-Bement-Pond Co.

Hose Bridges
Ohio Brass Co.
Porter & Berg.

Insulating Compounds
American Vulcanized Fibre Co.
Central Union Brass Co.
Garton Co., The W. R.
Johns-Manville Co., H. W.
Ohio Brass Co.
Porter & Berg.
Sterling Varnish Co.

Insulated Paper and Cloths
Sterling Varnish Co.

Instruments (Measuring and Testing)
Century Electrical Co.
Du Bois & West.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulators (Trolley)
(See Line Material.)

Jacks (Car Replacing)
Duff Manufacturing Co.
Garton Co., The W. R.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.

Joints (Rail)
Continuous Rail Joint Co. of Am.

Lamps (Arc and Incandescent)
Anderson, A. & J. M., Mfg. Co.
General Electric Co.
Porter & Berg.
Sawyer-Man Electric Co.
St. Louis Car Co.
Westinghouse Electric & Mfg. Co.

Lamps, Clusters for
Benjamin Electric Mfg. Co.
Porter & Berg.

Lathes
McCabe, J. J.

Lathes, Axle
Niles-Bement-Pond Co.

Lathes, Engine
Niles-Bement-Pond Co.

Lathes, Steel Tired Car Wheel
Niles-Bement-Pond Co.

Lathes, Turret
Niles-Bement-Pond Co.

Lifts, Armature Motor
Duff Manufacturing Co.
Ohio Brass Co.
Porter & Berg.
Van Dorn & Dutton Co.

Lightning Arresters
Garton-Daniels Co.
Garton Co., The W. R.
General Electric Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg
Westinghouse Elec. & Mfg. Co.

Line Material
Anderson, A. & J. M., Mfg. Co.
Billings & Spencer Co.
Central Union Brass Co.
Columbia Machine Works & Malleable Iron Co.
Creaghead Engineering Co.
Electric Railway Equipment Co., Cincinnati.
Garton-Daniels Co.
Garton Co., The W. R.
General Electric Co.
Johns-Manville Co., H. W.
Long, E. G.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.

Locomotives (Electric)
American Car Co.
Brill, J. G., Co.
General Electric Co.
Robins Conveying Belt Co.
Taunton Locomotive Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Locomotives (Second Hand)
Males Co.

Lubricators, Journal
Railway Journal Lubricating Co.
Standard Automatic Lubricator Co.

Lubricators (Machinery)
Crane Co.

Lubricants
Galena Signal Oil Co.

CLASSIFIED DIRECTORY—Continued

Machine Tools
American Wood Working Machinery Co.
McCabe, J. J.
Niles-Bement-Pond Co.
Pratt & Whitney Co.

Magnet Wire
D. & W. Fuse Co.
Magnet Wire Co.

Mechanical Draft
Green Fuel Economizer Co.
Sturtevant, B. F., Co.

Merry-Go-Rounds
Morris, E. Joy.

Metal (Anti-Friction)
(See Bearings.)

Mica
Central Union Brass Co.
McLeer & Co.
Porter & Berg.

Milling Machines
Niles-Bement-Pond Co.

Miniature Railroads
Miniature Railroad Co.

Mining Machinery
Allis-Chalmers Co.
Ford Elec. & Mfg. Co.
Loomis-Pettibone Gas Machinery Co.
Power & Mining Machinery Co.

Motors (Electric)
Bullock Electric Mfg. Co.
Christensen Engineering Co.
Crocker-Wheeler Co.
Ford Elec. & Mfg. Co.
General Electric Co.
Loomis-Pettibone Gas Mach. Co.
National Electric Co.
Power & Mining Machinery Co.
Westinghouse Elec. & Mfg. Co.

Motor Lifts
Ohio Brass Co.
Porter & Berg.
Van Dorn & Dutton Co.

Multiple Unit Control
General Electric Co.
Westinghouse Elec. & Mfg. Co

Nickelumen
New Era Mfg. Co.

Oils
(See Lubricants.)

Oil Cups
Crane Co.

Oil Soap
India Alkali Works.

Overhead Trolley Equipments
(See Line Material.)

Paints and Varnishes
Garton Co., The W. R.
Hydro-Carbon Mfg. Co.
Porter & Berg.
Standard Varnish Works.
Sterling Varnish Co.

Panels
American Car Co.
Brill, J. G., Co.

Patent Attorneys
Rosenbaum & Stockbridge.

Paving Blocks
Mack Mfg. Co.

Phosphor Bronze
Case Mfg. Co.
Electric Railway Equipment Co., Cincinnati.
Garton Co., The W. R.
Phosphor Bronze Smelting Co.
Porter & Berg.

Phosphor Tin
New Era Mfg. Co.

Picture Machine
American Mutoscope & Biograph Co.

Pipe (Riveted Steel)
Porter & Berg.

Pipe (Wrought Iron and Steel)
Crane Co.
Mitchell, W. K., & Co.

Planing Machines
Niles-Bement-Pond Co.

Platforms (Car)
American Car Co.
Brill, J. G., Co.

Poles (Metal)
Columbia Machine Works & Malleable Iron Co.
Greaghead Engineering Co.
Electric Railway Equipment Co., Cincinnati.
Garton Co., The W. R.

Poles and Ties (Wooden)
Fowler-Jacobs Co.
Glenn-Kline Lumber Co.
Gray Tie Co.
Lindsley Bros. Co.
Maus, H. H., & Co.
Morse Cedar Co.
Moss Tie Co., T. J.
Phelan, D. W.
Southern Exchange Co.
Standard Tie Co.
Worcester, C. H., Co.

Poles (Trolley)
(See Trolley Poles.)

Power Transmission Machinery
Allis-Chalmers Co.
Case Mfg. Co.

Presses, Hydraulic Wheel
Niles-Bement-Pond Co.

Pulleys
Rockwood Mfg. Co.

Pumps
Blake-Knowles Steam Pump Works
Deming Co.

Punches (Ticket)
American Railway Supply Co.
International Register Co.
Woodman, R., Mfg. & Supply Co.

Rail Benders
Niles-Bement-Pond Co.

Rail Blocks
Mack Manufacturing Co.

Rail Joints
(See Joints, Rail.)

Rail Joint Testing Instruments
Mayer & Englund Co.

Rail Joint Welding
Goldschmidt Thermit Co.

Rails (Second-Hand)
(See pages 41-43.)

Rail Welding
Goldschmidt Thermit Co.

Rattan for Sweepers
American Car Co.
Brill, J. G., Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.

Registers and Register Fittings
International Register Co.
Mayer & Englund Co.
New Haven Car Register Co.
Porter & Berg.
Sterling-Meaker Co.

Repair Work
Dustin, Chas. E., Co.
Elliott Bros. Electric Co.
Ford Elec. & Mfg. Co.
Garton Co., The W. R.
Homer Commutator Co.
Porter & Berg.
Rossiter, MacGovern & Co.
Van Dorn-Elliott Electric Co.
Wood, Chas. N., Electric Co.

Rock Crushers
(See Graders & Rock Crushers.)

Roller Coasters
Morris, E. Joy.

Rope (Wire)
(See Cables.)

Sand Boxes
American Car Co.
Brill, J. G., Co.
Jewett Car Co.
Ohio Brass Co.
Peckham Manufacturing Co.
Porter & Berg.
Sterling-Meaker Co.
St. Louis Car Co.

Sashes (Car)
Brill, J. G., Co.

Seatings (Car)
St. Louis Car Co.

Second-Hand Apparatus
(See pages 41-43.)

Separators
Harrison Safety Boiler Works.
Power Specialty Co.
Westinghouse, Church, Kerr & Co.

Shades (Car)
(See Blinds, Car.)

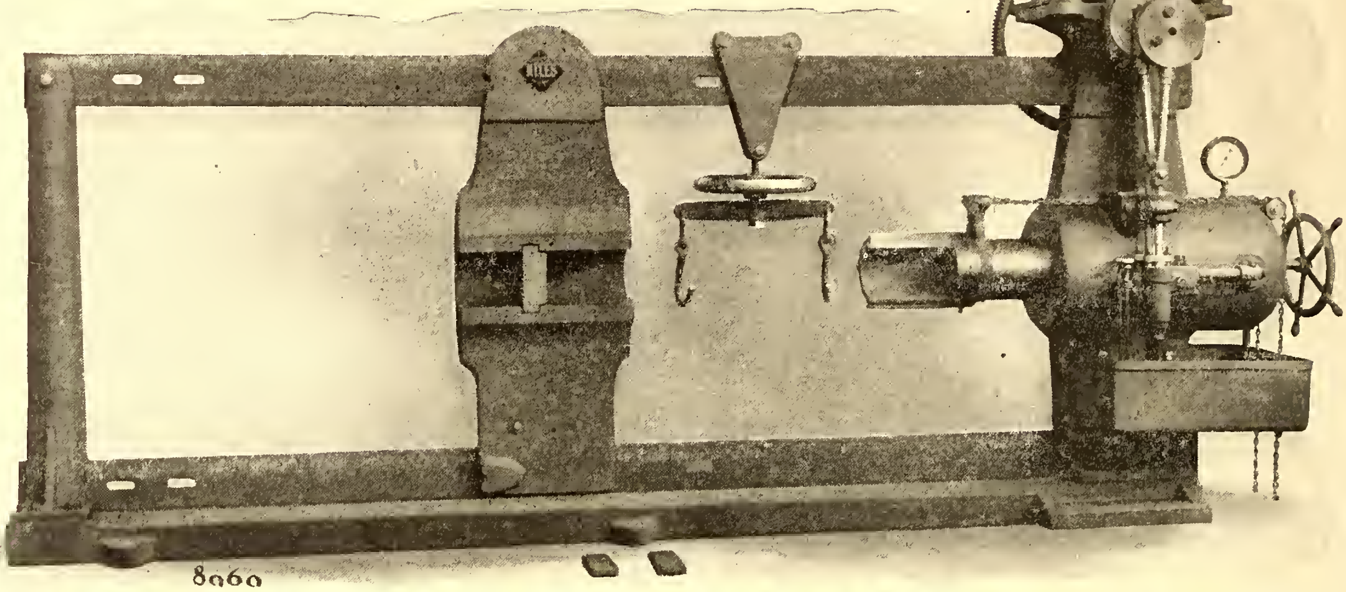
Shade Holders (Lamp)
Garton Co., The W. R.

Shade Rollers
Hartshorn Co., Stewart.
Porter & Berg.

Shovels
Males Co.
Vulcan Iron Works Co.

Signal Systems
Blake Signal & Mfg. Co.
Jordan Automatic Signal Co.
Eureka Automatic Electric Signal Co.

MACHINE TOOLS, CRANES and HOISTS FOR STREET RAILWAY SHOPS



NILES-BEMENT-POND CO., 136-138 Liberty St., New York, U. S. A.

OFFICES: BOSTON, 144 Pearl Street; CHICAGO, Western Union Bldg.; PITTSBURGH, Frick Building; ST. LOUIS, 516 North Third Street; PHILADELPHIA, 21st and Callowhill Streets; LONDON, 23-25 Victoria Street, S. W.

"First in the Hearts of Repair Shop Men"

McCABE'S "DOUBLE-SPINDLE" LATHE

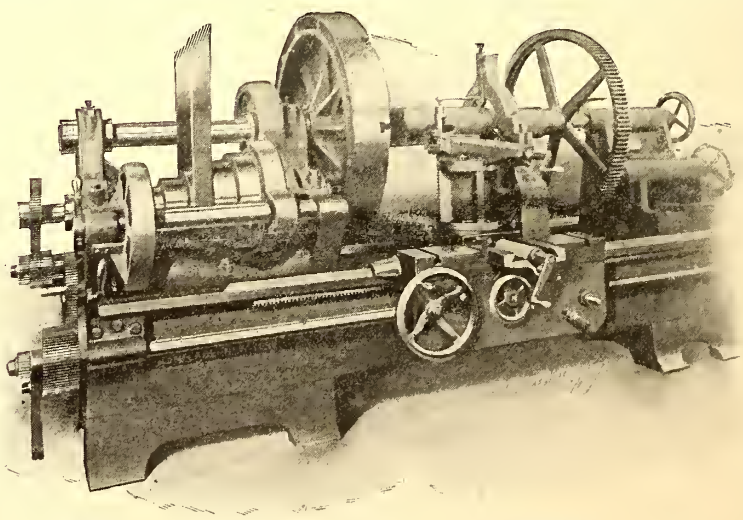
Ever since their initial introduction years ago, they've always been regarded as such—"First in the hearts of repair shop men."

True, they've been distributed in various manufacturing shops as well—500 now in use altogether—but with street railway shops, in particular, they do "stand in solid."

2 Lathes' worth of the best lathe-making in every ONE of these lathes. When a big job comes along, presto, you've a big 48 inch lathe, and so 'tis with anything small—chango, you've got a 26 inch lathe.

No period of lethargy—the "Double-Spindle" doesn't permit that—one's "on the job" while the other's "on the quiet."

Then there's the price, only half what you'd pay for a 48-inch Lathe.



McCabe's "New Style" 26-48 inch "Double-Spindle" Lathe

Any wonder repair shops want 'em? Let's show catalogue with testimonials from some railroad "fellers."

J. J. McCABE, 14 Dey Street, New York City

CLASSIFIED DIRECTORY—Continued

Signs (Street Car)
American Car Co.
Brill, J. G., Co.
Columbia Machine Works & Malleable Iron Co.
Porter & Berg.
St. Louis Car Co.

Slotting Machines
Niles-Bement-Pond Co.

Snow Plows and Sweepers
American Car Co.
Brill, J. G., Co.
General Electric Co.
Peckham Mfg. Co.
Van Dorn & Dutton Co.
Taunton Locomotive Mfg. Co.

Soap, Oil
India Alkali Works.

Soldering Coppers
Garton Co., The W. R.
Porter & Berg.

Special Work
(See Crossings, Frogs and Switches.)

Springs
American Car Co.
Brill, J. G., Co.
Long, E. G.
Peckham Mfg. Co.
Pittsburg Spring & Steel Co.
Railway Steel Spring Co.
Union Spring & Mfg. Co.
Van Dorn & Dutton Co.

Springs (Sash and Blind)
American Car Co.
Brill, J. G., Co.

Sprinklers (Track and Road)
American Car Co.
Brill, J. G., Co.

Steam Shovels
(See Shovels.)

Steam Traps
Crane Co.
Mitchell, W. K., & Co.

Steel Rolling Doors and Shutters
Kinnear Mfg. Co.

Steel Sub-structure
American Ry. Tie & Girder Co.

Steel Tired Wheels
Standard Steel Works.
Taylor Iron & Steel Co.

Stokers (Mechanical)
Westinghouse Machine Co.

Storage Batteries
Electric Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Tray Plate Battery Co.

Stoves (Car)
(See Heaters, Car.)

Superheaters (Steam)
Power Specialty Co.

Sweepers
(See Snow Plows and Sweepers.)

Switches and Switchboards
Creaghead Engineering Co.
General Electric Co.
Hill, W. S., Electric Co.
Porter & Berg.
Waterbury & Co.
Westinghouse Elec. & Mfg. Co.

Switches (Track)
(See Crossings, Frogs and Switches.)

Tape (Insulating)
American Vulcanized Fibre Co.
Garton Co., The W. R.
Johns-Manville Co., H. W.
Porter & Berg.

Telephones and Telephone Systems
Blake Signal & Mfg. Co.
Creaghead Engineering Co.
Porter & Berg.

Testing
Electrical Testing Laboratories.

Thermit Welding
Goldschmidt Thermit Co.

Third Rail Systems
General Electric Co.

Tickets and Transfers
Keller Printing Co.

Ties
(See Poles and Ties.)

Track Cleaners
American Car Co.
Brill, J. G., Co.
Garton Co., The W. R.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
St. Louis Car Co.
Van Dorn & Dutton Co.

Track Drills
Ludlow Supply Co.
Porter & Berg.

Track Equipment
(See Rails, Joints, Crossings, etc.)

Transfer and Turn-Tables
American Car Co.
Brill, J. G., Co.
Van Dorn & Dutton Co.

Transformers
Bullock Electric Mfg. Co.
Christensen Engineering Co.
National Electric Co.
Westinghouse Elec. & Mfg. Co

Trolley Base
Garton Co., The W. R.
Porter & Berg.

Trolley Harps
Porter & Berg.
Star Brass Works.

Trolley Hoists, Electric
Niles-Bement-Pond Co.

Trolley Pole Catchers
Earll, Chas. I.
International Register Co.
Mayer & Englund Co.
Trolley Supply Co.
Porter & Berg.
Wood, Chas. N., Electric Co.

Trolley Poles and Wheels
Columbia Machine Works & Malleable Iron Co.
Creaghead Engineering Co.
Electric Railway Equipment Co., Cincinnati.
General Electric Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Star Brass Works.

Trucks
American Locomotive Co.
American Car Co.
Baldwin Locomotive Works.
Brill, J. G. Co.,
Burnham, Williams & Co.
Kuhlman G. C., Car Co.
Long, E. G.
Peckham Manufacturing Co.
St. Louis Car Co.
Thompson-Bonney Co.

Turbines (Steam)
Allis-Chalmers Co.
General Electric Co.
Hooven, Owens, Rentschler Co.
Westinghouse Machine Co.

Turnbuckles
Long, E. G.

Varnish
(See Paints & Varnishes.)

Valves and Gates
Crane Co.
Mitchell, W. K., & Co.

Vestibules
American Car Co.
Brill, J. G., Co.

Vulcanized Fibre
American Vlucanized Fibre Co
Wilmington Fibre Specialty Co.

Wagons (Trolley)
(See Tower Wagons.)

Watch Inspection
Forsinger, J. W.

Water Softening and Purifying Systems
Harrison Safety Boiler Works.

Wheels and Axles
American Car Co.
Brill, J. G., Co.
Garton-Daniels Co.
Long, E. G.
Peckham Manufacturing Co.
Railway Steel Spring Co.
St. Louis Car Co
Standard Steel Works.
Taylor Iron & Steel Co.

Wheel Presses
Niles-Bement-Pond Co.

Wires and Cables
Creaghead Engineering Co.
D. & W. Fuse Co.
Garton Co., The W. R.
General Electric C.
Magnet Wire Co.
Mayer & Englund Co.
National Conduit & Cable Co.
Phosphor Bronze Smelting Co.
Porter & Berg.
Roebling's John A., Sons Co.
Waterbury & Co.

Woodwork (Car)
American Car Co.
Brill, J. G., Co.
Jewett Car Co.
St. Louis Car Co

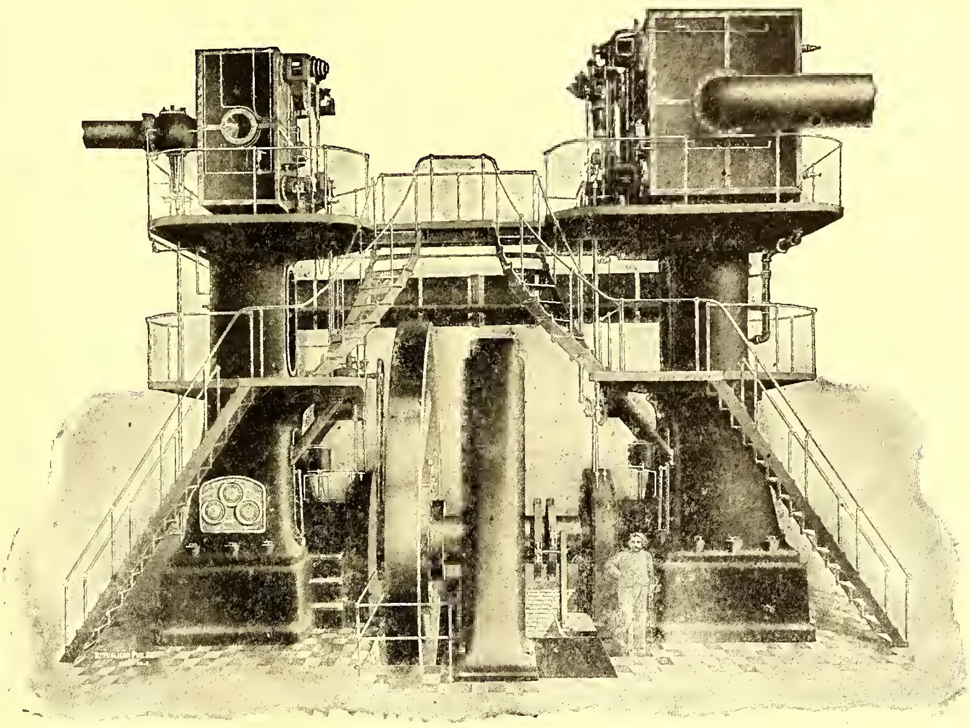
Wood Working Machinery
American Wood Working Machinery Co.

Hamilton-Corliss Engines

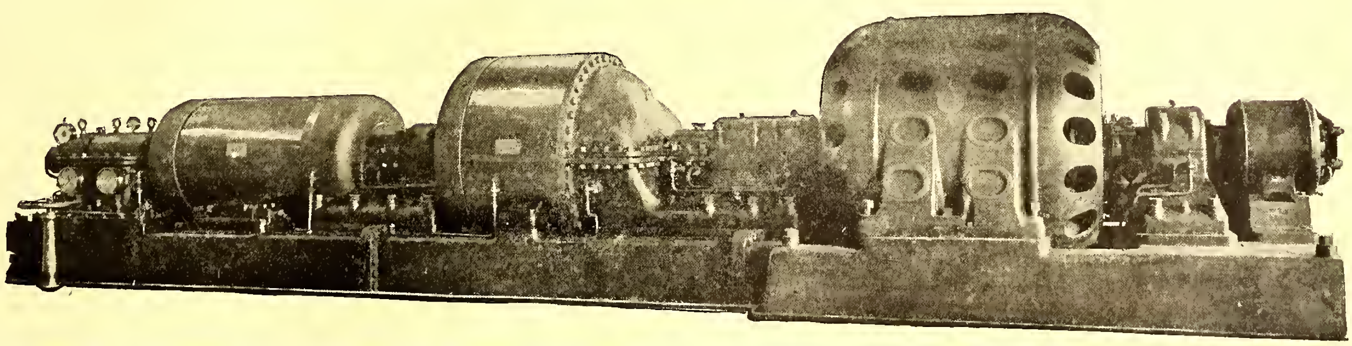
AND

Hamilton-Holzwarth Steam Turbines

MADE IN ALL SIZES



The New Hamilton-Corliss Vertical Cross Compound Engine



1000 K.W. Hamilton-Holzwarth Steam Turbine direct connected to 1000 K.W. alternating generator

Send for Catalogue T of Turbine and for Catalogue V of Vertical Engine

The Hooven, Owens, Rentschler Company

HAMILTON, OHIO, U. S. A.