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From 1893 to 1904

A visit to the Louisiana Purchase Exposition brings forcibly to mind the advance in the electric railway art since 1893 and the Columbian Exposition. Those of us that have been actively connected with electric railway development since 1893 have seldom stopped to think of the progress made since that time. In the matter of cars alone the difference between the exhibits of 1893 and 1904 is startling. By the latter we are reminded that the double-truck electric car has been almost entirely a development of the last ten years. The weight and carrying capacity of cars considered standard has been practically doubled in that time. The enclosed motor had but recently been introduced in 1893. Interurban lines were non-existent with one or two notable exceptions. The modern high-speed interurban was practically unknown. The first heavy electric elevated trains were being operated on the intramural railway. The multiple-unit system was so far from being considered seriously as a possible factor in the electric transportation problem that one or two prominent technical journals took occasion to editorialize about that time to the effect that the motive power would stay at the head of the train. Alternating-current high-tension transmission for railway work was thought of mainly as a means of utilizing distant water powers, rather than as a means of distributing power from a steam plant over a large area. What of the next eleven years? Will the single-phase alternating-current railway motor make possible the introduction of electricity for long-distance, high-speed service, now performed by limited steam passenger trains, or will the development be the building of small, cheap feeders to present trunk lines, or will development be in both directions?

The Interurban Right of Way

The importance of a private right of way in interurban electric railroading has been realized more and more in the past few years, until it is rare to hear of an entirely new line proposing to give high speed service between cities which omits to provide as far as possible an uninterrupted route for its cars. Many roads have gone to heavy expense in this direction, buying land at figures considerably above its intrinsic value through the belief that the superior service resulting would ultimately justify this investment. There is not sufficient realization of the influence of the new interurban railway upon the welfare of the community, in many cases; if this aspect of the situation were appreciated, there would be less extortion on the part of land owners and less need of resorting to the legal question of right of eminent domain.

Owners of interurban systems formed by the extension of suburban lines across country sometimes fail to appreciate the part played by a private right of way in competition with steam or other electric lines. Often the growth of such roads is a gradual, step-by-step process, the plan being to connect more and more outlying communities with each terminal city until finally a continuous line joins the great centers of population. An instance of this is found in the first through electric line placed in service between Boston and Worcester, Mass. When physical connection was first established between the two cities, it was not the result of a far seeing plan to provide continuous through service under a single management, and the system was in no sense an interurban line. Through tickets were unheard of; half a dozen changes of cars were necessary in the run of 50 miles and considerable time was lost in making connections, so that the running time rarely fell within five hours, against one hour on the competing steam road, 44 miles in length. All this has been changed by the establishment of the new trunk electric line between the two cities, which covers the 40-mile route in two hours, at half the steam railway fare. The old route possessed little, if any, private right of way, while the later line runs over its own ground to the exclusion of highways as far as physical conditions will permit—perhaps two-thirds of the way, to speak in the rough. The influence of the right of way is profoundly felt in the running time, and the double tracking of the entire route has followed as a matter of course. The traffic on the through line has been heavy enough to require half hourly cars all through the past winter, and there is no doubt that the loss of business is sorely felt by the competing Boston & Albany steam line.

One of the most striking points which has been illustrated

by the success of the electric "air line" route, is the necessity of meeting steam railway competition with steam railway methods of conducting transportation. Through cars, punctuality, comfortable rolling stock, through tickets, strict discipline, modern methods of despatching—these are essentials, coupled with high speed running. The private right of way is the condition of fast time; quite as important as its bearing on the schedule as a 200-hp motor equipment per car. Again, slow running in cities offers an obstacle not encountered to a serious degree on the steam road, whose private right of way runs entirely through the cities traversed. The electric line must make up for this drawback on the rural and suburban sections of its route. While it is possible to run at speeds of 35 miles and sometimes 40 miles per hour on clear straight highways, 60 m. p. h. is out of the question on anything except a protected right of way.

Protect Your Telephone Circuits

When the stringing of telephone lines on the same poles as high-tension transmission lines was first begun, there were some doubts expressed as to the safety of this procedure, on account of the possible danger to persons using the telephone. Practice has demonstrated, however, that on the majority of transmission lines, telephone circuits can be run on the same poles without bad results, either in the way of poor talking over the telephone line or danger to users of the telephone. The use of telephone circuits on high-tension transmission pole lines has now become so common that it is not out of place at this time to utter a word of warning lest familiarity with this practice should breed contempt and lead to the relaxing of some very important safeguards. All well constructed telephone exchanges and long-distance telephone lines operated by the regular telephone companies are equipped with protective devices, which will, to a large extent, eliminate possible danger to telephone users from crosses of high-voltage power lines with telephone lines. Where the telephone is used by an electric railway along its transmission lines, however, there is likely to be too little attention paid to protective devices, since the telephone is only one item in the operation of large property, and it is seldom that an electric railway company has a telephone expert in its employ. Only recently the daily press reported a fatality upon an interurban road, evidently due to some leak from a high-tension wire to a despatcher's telephone circuit. It must never be forgotten when a telephone line runs for many miles under a high-tension transmission line that there is a chance for a leak from or a cross with the high-tension transmission circuit and that the best precautions known to the telephonic art should be taken to prevent danger to employees who are constantly using the telephone in conducting the company's business, and who are sure to be victims if the telephone circuits are not supplied with devices which will render the telephone line harmless whenever they are crossed with transmission circuits. To be sure, there is pretty sure to be trouble when a high-tension line gets crossed with a telephone circuit, no matter what protective devices may be installed on the telephone circuit. However, this trouble can be confined mainly to damage to property without loss of life. Telephone protective devices are usually made to put automatically a dead ground on the telephone line whenever the potential exceeds a certain predetermined amount. While the automatic grounding of a telephone instrument on a line may cause considerable fireworks at various points when there is a cross with a transmission line, it makes the instrument practically safe, and thus human life is not endangered. A telephone instrument can only be dangerous when it is sufficiently insulated from the ground so that a dangerous potential can exist between the instrument and the ground.

Kicking Against the Inevitable

The struggles of the steam railroads against electric traction would be amusing if they were less pathetic. It has been thoroughly demonstrated that in competition with a free field and no favors a well-managed trolley line can starve out suburban steam service with hardly an effort. Yet the steam lines keep along at the same old pace with the same old cars, and set their faces rigidly against yielding to the march of progress. In two very special instances electricity is being adopted for steam on short terminal sections, but outside of these two examples the changes accomplished have been made grudgingly and with loud protests. The situation reminds us of the good old times when there was war to the knife between direct and alternating currents. A direct-current man would have gone to the stake before bowing down before the sacred transformer, and an alternating-current man used to stand about his station cursing the fates that compelled him to use a direct-current exciter. Just such a fanatical spirit seems to dominate the councils of the old line railway men. Only the other day a prominent railway manager, when interviewed on the cause of recent wholesale discharges of men, raised a cry that the trolley car was ruining his suburban business, and that the devil was to pay generally. The learned counsel of another road, in arguing before the Massachusetts Railroad Commissioners against the compulsory abolition of grade crossings, complained bitterly that electric cars could use grade crossings of the highway and that automobiles were allowed to run at large. And yet the roads that could adopt electric suburban service with the greatest ease still squirm and grumble and try to dodge the issue.

We are impelled to this comment by the fearfully and wonderfully made motor cars now being tried on several of the steam roads in England and on the Continent of Europe. Some of these roads apparently mean never, never to surrender to the malign trolley and the accursed third rail. One of these motors at present being tried on a prominent British line is a sort of cross between the Heilmann locomotive and the Patton motor car. It is a mighty combination car seating fifty-two passengers, and weighing some 35 tons. The forward quarter of the thing is devoted to the miscellaneous power station. This consists of an 80-hp petrol motor with all the varied chicken fixings that go with that sort of a machine, a 55-kw direct-connected multipolar generator, with both compound winding and separate excitation, a belted 72-volt exciter, thirty-eight cells of storage battery, a fan for cooling the water circulation of the engine, a surface cooler, an air brake motor, pump set, supplementary electric braking arrangements and a collection of rheostats and other bric-a-brac too numerous to catalogue here. Two good honest Westinghouse motors on the trucks do the rest. The petrol motor runs at constant speed, and by means of a controller and the generator field rheostat a certain amount of speed regulation is obtained. The fundamental scheme belongs to bygone years, but some new and weird complications seem to have been introduced in the present application that give it an unique place in the history of contraptions. We suppose the basic idea is to gain some advantage over the Heilmann scheme by using an internal combustion engine instead of a steam engine, but otherwise the general function of the car seems to be hardly different from

that of the rest of the futile motor cars that have adorned the scrap heaps of many a railroad.

The steam dummy as a substitute for an electric car is a favorite refuge of the harassed railway man when he is trying to solve the problem of trolley car competition. But the whole tribe of dummies fail to fill any long-felt want in suburban service. The demands of such work far exceed the possibilities of steam dummies or other makeshifts. The problem of suburban rapid transit is not how to find something which can be substituted for the electric car but how to get electric trains fast enough and capacious enough to meet the growing demand. All the resources of even the multiple-unit system are taxed to get acceleration swift enough and sustained speed great enough to fill the needs of the public. Why waste time in experimenting with petrol motor dummies while the real problem is to concentrate enough energy on a rapid transit system to make it do its work? If any one wants to work with petrol motors or the like let him do the work on an economical scale in a power station, and not attempt to mount a power station on wheels. There is to-day no material difficulty in supplying energy to any number of electric cars at a cost far below that attainable in any sort of a locomotive, and the real task of the engineer is to organize the service on a scale commensurate with the demand. Some of the steam roads are working their suburban services practically to the limit of the capacity of steam locomotives to do the work. They need the power for acceleration and fast running that only a central power station can supply, and the sooner they get down to business and adopt electric traction the better for themselves and for the public. Electric roads have lessons to learn from the steam railways, as we have many times remarked, but they can give lessons as well as receive them. It is time for the prejudice against electric traction to disappear, for if railway managers were less timorous about it they would soon fully realize its advantages. The locomotive is a remarkable machine, but it has its limitations like every other machine, and it finds them in dealing with modern rapid transit.

Convenience in Truck and Motor Repairs

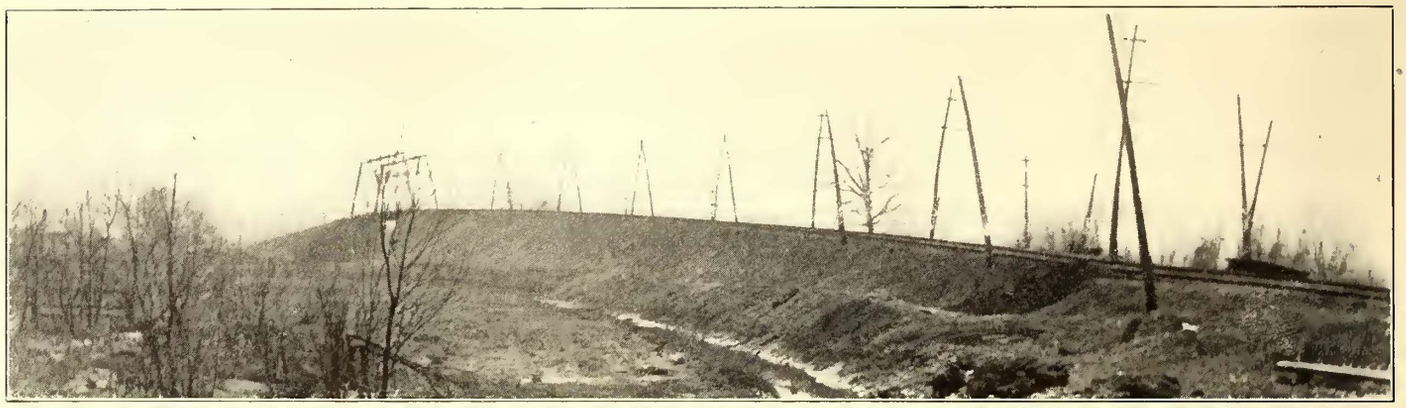
Considering the amount of money that is spent in the purchase of motor and truck equipments, it is strange how many companies, when ordering such equipments, fail to take into account the fact that after motors have been mounted upon the trucks and put in operation the time is sure to come when those motors must be taken off from the trucks for motor repairs and wheel renewals, and that this process must be repeated every few months as long as the trucks and motors are in service. From the way some trucks and motors are put together, one would be led to suppose that the purchasers never expected to take the motors out of the trucks oftener than once in several years. This remark applies more particularly to double-truck equipment. On a single-truck there is usually plenty of room for a motor, consequently there is no trouble about removing it from the truck. On double-truck cars, the equipment is likely to be crowded, and when buying trucks and motors, the purchasing company's officials should make sure that the combination is such that the motors can be taken out of the trucks without tearing the truck to pieces. Sometimes a half-inch difference in the dimensions of a truck will make all the difference between hoisting a motor out promptly and quickly and getting it out only by taking the truck to pieces or by a tedious process of worrying the motor out by tilting and squeezing. It has been said of some apparatus that when it is designed so as to facilitate easy repairs, it is likely to show strong inclination to give its owners the chance to make use of those characteristics. This remark was originally applied to static transformers. It certainly does not apply to the greater part of an electric car equipment. As a well-known master mechanic once put it to the writer, "we must design our equipment with the idea that at some time every piece in that equipment must be taken out for repairs." If this is true of repairs to parts which are not ordinarily considered likely to require repairs, how much more is it true of trucks and motors which must be taken apart regularly as the part of the routine in the operation of a road. Good shop facilities for hoisting are important, but it is equally important that the trucks and motors be so arranged that these hoisting facilities can be used to advantage. It is sometimes the case that neither the motor nor the truck in itself is of bad design, but the two are put together in a most unhappy combination. Manifestly, two such intimately related parts as trucks and motors must be considered together rather than as two entirely separate parts of the equipment.

Car Shop Pits

Electric railway companies now are using all varieties of pits, from pits 6 ft. deep to none at all. As we have noted a number of times recently, there is now a tendency on the part of some companies to abandon pit work as far as possible, but the repair shop pit will be with us for a number of years to come nevertheless. A certain amount of inspection must be made in pits, even if no repair work is done by lowering the motors into a pit. It is the intention expressly to call attention here to certain modifications of the usual practice in constructing pits, which should facilitate repairs. One of these modifications consists in raising the pit tracks about 2 ft. above the level of the car house floor, so as to bring trucks and journal boxes to a more convenient height for men in working on the trucks from the outside. This modification in no way detracts from the value of the pit, and in fact may sometimes lessen the amount of excavation necessary for a pit. Another modification in pit construction which accomplishes some of the same objects is that adopted at Kansas City, as illustrated in a recent issue of this paper. Here it was a case of applying pits to tracks already in a repair shop, and in order to bring the level of the repair track above the floor between the tracks it would have been necessary to either excavate between the tracks or to elevate the pit tracks above the remaining tracks in the repair shop, either of which would have been objectionable. The repair pit was, therefore, carried out beyond the track rails on each side of the track, and the track was supported on iron columns with lateral braces embedded in the masonry forming the sides of the pit. This makes it possible for a man to stand in the pit and work on the journal boxes and other parts, which can ordinarily be got at only by lying down on the car house floor alongside the trucks. This arrangement has some advantages and some disadvantages as compared to having the pit tracks above the level of the car floor between tracks. The Kansas City arrangement can manifestly be applied in old car shops without changing either floor levels or track levels. It enables a man when working in a pit to get at the outside as well as the center of a truck without crawling out of the pit. He can sit on the edge of the pit to do work from the outside of a truck, or he can stand in the pit. It is likely that under some conditions he might be able to work to better advantage if he were on a floor about 2 ft. lower than the track. Either of these two modifications of common pit construction seems to offer some decided advantages.

THE CANTON & AKRON RAILWAY

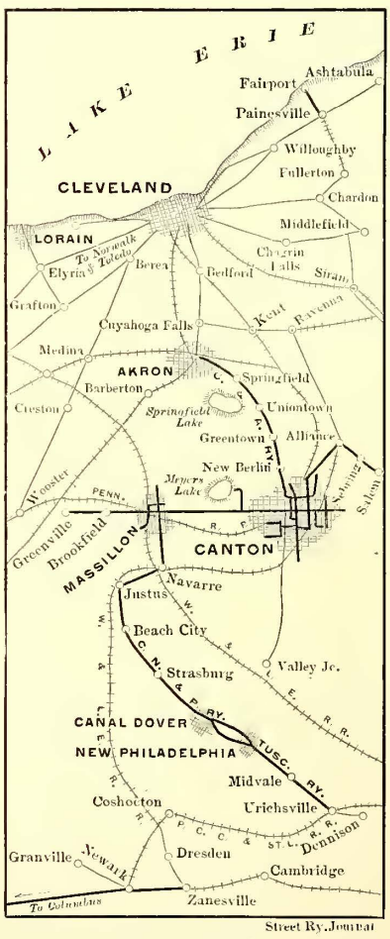
The plans of Tucker, Anthony & Company, and A. E. Appleyard & Company, of Boston, for operating through trunk lines across the State of Ohio, have been referred to a number of times in these columns, and the STREET RAILWAY JOURNAL of Aug. 1, 1903, contained an extended description of the Columbus, Newark & Zanesville Traction Company's system, a Tucker-Anthony property which forms the central link in this chain of lines. In the northern part of the State this syndicate now has in operation lines extending from Akron to Canton, Massillon, New Philadelphia, Canal Dover and Uhrichsville, which, with the completion of a proposed line from Uhrichsville to Newark or Zanesville, by way of Coshocton, will give the interests mentioned continuous trackage entirely across the State from Cincinnati to Cleveland by way of Columbus.



OVERGRADE CROSSING—CANTON-NEW PHILADELPHIA RAILWAY AND BALTIMORE & OHIO RAILWAY

The northern division of this system is at present owned by three distinct companies; the Canton-Akron Railway Company, operating an interurban line from Akron to Navarre by way of Canton and Massillon, and including city lines in these places; the Canton & New Philadelphia Railway Company, operating an interurban line from Navarre to Canal Dover, and the Tuscarawas Traction Company, operating an interurban line from New Philadelphia to Uhrichsville, and giving city service in and between New Philadelphia and Canal Dover. In all the system embraces 88.4 miles of city and interurban lines. From an operating standpoint the roads may be considered as one system, as the executive officers are practically identical and they are managed by the same general manager and general superintendent, although each road had its own superintendent and road officers.

The history of the system is an extended one. The Canton Street Railway Company built a narrow-gage city system in Canton in 1888, and in 1890 it consolidated with the Lakeside Street Railway Company, which operated a steam dummy line to Myers Lake. The Massillon Street Railway, operating a city line in Massillon, was extended to meet the steam dummy line, which had been electrified, and in 1892 the lines were consolidated by W. A. Lynch and others, as the Canton-Massillon Electric Railway Company, being one of the pioneer interurban roads of Ohio. The Canton-Akron Railway was completed between Akron and Canton in 1902. Originally it was projected by Thomas Childs, W. H. Hoover and other local people, but later it was taken up and financed by Tucker, Anthony & Company. Before it was completed the Everett-Moore syndicate, of Cleveland, obtained an option on the property together with the Canton-Massillon Railway, the plan being to consolidate them with the Northern Ohio Traction Company. Early in 1902 came the financial embarrassment of the Everett-Moore syndicate, and one of the first steps of the bankers' committee in charge of the affairs of that syndicate was to arrange with Tucker, Anthony & Company to take over the Canton-Akron and Canton-Massillon lines, and the properties were immediately consolidated under the name of the Canton-Akron Railway Company. Work was started on the extension from Navarre to New Philadelphia in 1903, and the line was recently completed. Between Canal Dover and New Philadelphia this line paralleled the Tuscarawas Traction Company. This company was formed in 1902 by the consolidation of the Tuscarawas Electric Company, which in 1890 built a line connecting Canal Dover and New Philadelphia, and the Tuscarawas Railway Company, which operated a line connecting New Philadelphia and Uhrichsville. These roads were controlled by the Pomeroy-Mandelbaum interests of Cleveland, and were sold to Tucker, Anthony & Company in 1903.



MAP OF SYSTEM CANTON & AKRON RAILWAY

The northern portion of this system traverses a rich farming district, while the southern portion passes through one of the most extensive and productive bituminous coal districts of Ohio. The cities touched are noted manufacturing centers. Akron is one of the leading centers of the world in the production of rubber goods, cereals and pottery, and it has numerous large manufacturing establishments in the iron and steel line. Canton, seat of Stark County, is one of the most beautiful and progressive cities of Ohio, and is noted as the home of the late President McKinley. It has many factories, including the Dueber-Hampden watch works, the largest in the country, employing over 3000 hands; the Canton Steel Works, Carnahan Iron & Steel Company, Canton Bridge Company, Berger Manufacturing Company, and Diebold Safe & Lock Company. The company operates about 16 miles of city track in Canton, including five city lines. Massillon is the home of the Massillon Bridge Company, the Massillon Steel & Iron Company, the Russell

Engine Company, and a large bottling works. South of the city is the Ohio State Insane Asylum, an enormous institution, having many hundreds of patients. Two city lines are operated in Massillon, one of them going direct to the asylum. Canal Dover and New Philadelphia are busy manufacturing cities and noted coal shipping points. The latter is seat of Tuscarawas County. The towns are 4 miles apart, and local service separate from the interurban line is given between them. Uhrichsville is a railroad and coal center.

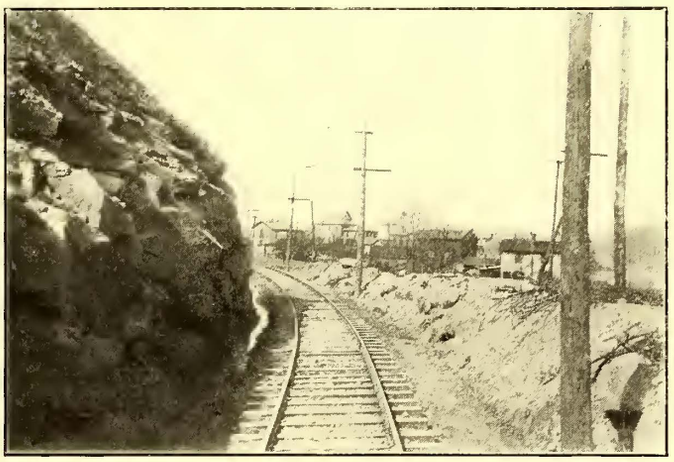
The population of the cities and towns touched by the system according to the latest census is shown in the accompanying table:

CANTON-AKRON RAILWAY	
Akron	42,728
Canton	30,667
Massillon	11,944
CANTON & NEW PHILADELPHIA RAILWAY	
Navarre	936
Beach City	364
Strasburg	461
Canal Dover	5,422
New Philadelphia	6,213
TUSCARAWAS TRACTION COMPANY	
Midvale	491
Tuscarawas	412
Uhrichsville	4,582
	104,247
Tributary population	35,000

The Canton-Akron Railway enters Akron over the tracks of the Northern Ohio Traction & Light Company from East Akron. Cars operate to the passenger station of the Northern Ohio Traction & Light Company, where they make direct connection with the cars of that company for Cleveland. Tickets are sold clear through over both roads, a coupon form of ticket being used, giving each road its regular fare. The traffic ar-

LINE VIEW—CANTON-NEW PHILADELPHIA RAILWAY

rangement with the Northern Ohio Traction & Light Company is on the Cleveland plan. The city crew takes the interurban car at the city limits and collects and keeps all the city fares, and the Northern Ohio Company pays the Canton-Akron Company at the rate of 2 cents per car mile for the use of the cars while on its tracks. The Canton-Akron Company gives hourly headway between Akron and Massillon; the Canton-New Philadelphia Company gives hourly headway between Massillon and New Philadelphia, and the Tuscarawas Traction Company hourly headway between Canal Dover and Uhrichsville. The cars connect so that a through trip is possible over all three lines without delays. Tickets are sold clear through, coupon tickets being used. In Canton the city cars operate on a 10-minute headway over five routes, all cars passing the interurban station, which, with the general offices of the companies, is located in the basement of the Court House Building, facing City Square. The company has five parallel tracks at this point, two tracks being used for the city cars, two for the interurbans, and the fifth by the cars of the Stark Electric Railway, which connects at this point, so that by this arrangement the interurban cars are permitted to lay over and do not interfere with regular traffic. Half-hourly cars are operated between Canton and Massillon, and there are half-hourly cars over the balance of the system on Saturdays, Sundays and holidays. During the summer months there is a 10-minute headway from



ROCK CUT—CANTON-NEW PHILADELPHIA RAILWAY

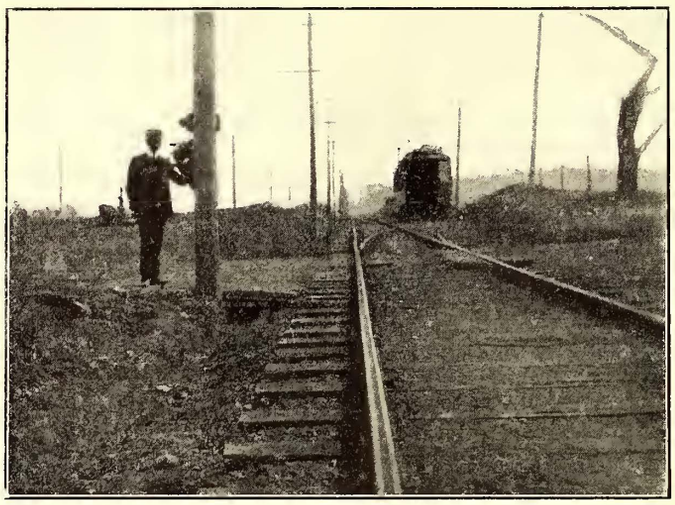
Canton to Meyers Lake, which is located on a spur line from Canton-Massillon division. The Massillon city cars give 15-minute headway over two routes. The Tuscarawas Traction Company gives 15-minute headway between Canal Dover and New Philadelphia in addition to the interurban cars. The rates of fare on the various lines are shown in the accompanying table:

Distance		Single Fare	Round Trip
	CANTON-AKRON RAILWAY		
	Akron	5 cent city fare	
	Elkhorn		
3	Springfield	5	10
4	Springfield Lake	10	18
8	Uniontown	15	28
11.5	Greentown	20	38
15	New Berlin	25	48
17.5	Edgefield	30	58
20.5	Canton	35	65
24.5	Rudurban	45	85
28.5	Massillon	50	90
34	Navarre	60	105
	CANTON-NEW PHILADELPHIA RAILWAY		
	Massillon	10 cents to Canton-Akron Co.	
	Navarre		
4	Justus	5	10
9	Beech City	10	18
12	Strasburg	20	38
16.5	Parral	25	48
18	Canal Dover	30	58
21.5	New Philadelphia	35	65
	TUSCARAWAS TRACTION COMPANY		
	Canal Dover		
3.5	New Philadelphia	5	10
8.5	Goshen	10	18
11	Midvale	15	28
14	Uhrichsville	20	38

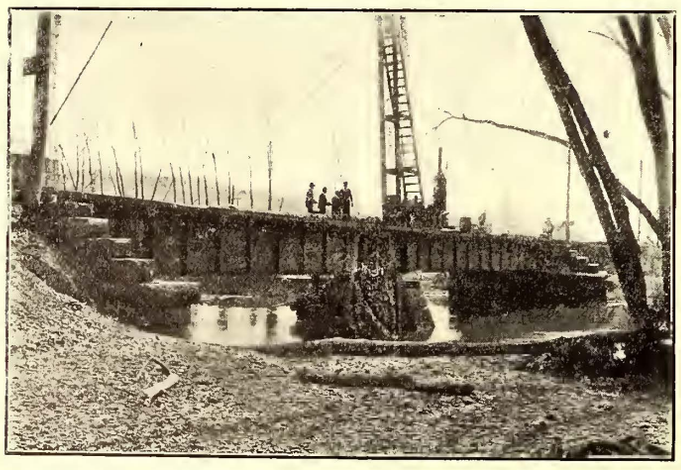
Five hundred-mile books, good on the three lines, are sold for $7.50. Commutation books, giving three-fifths of the regular fare, are sold between all points, good for bearer only within thirty days. One form of book is used for this service. It is made up of pages, each page containing five coupons, equivalent to a 25-cent ride. If the book is to be sold for a shorter distance, one, two or three strips of coupons are cut off with a paper shear. Six tickets for a quarter are sold on the city lines and transfers are given. All tickets, transfers and cash fare

receipts contain advertisements, and the company derives revenue enough from these to more than pay for the tickets.

General Manager George W. Rounds, of the system, has recently instituted a "get together" plan that has resulted in good feeling among the men. On the second Tuesday of each month all the employees of the system meet at the car house at Canton, and without any ceremony they discuss matters pertaining to the betterment of the service. Two sessions are held, so that all the men of the system are enabled to take part. The result of these meetings, it is stated, has been the betterment of the service in many ways, and Mr. Rounds states that he has been greatly assisted by the suggestions of some of the men. They are able to see matters close at hand, and are frequently able to make valuable suggestions at the meetings. Such things as new rules and regulations, or old ones, are frequently discussed, and their merits carefully gone over, so that the men working under these rules may know the cause which prompted their adoption, and the results to be gained by their enforcement. One of the moves recently adopted was the uniforming of all interurban motormen in overall uniforms, so that they are enabled to make necessary repairs to cars or handle baggage without damaging their clothes. Wages of city men start at 17½ cents and advance to 20 cents per hour. Interurban men start at 17½ cents and advance to 21 cents, although, as a general rule, the interurban men are taken from the ranks of the city men. At the car houses there are waiting rooms for the men, which are provided with individual lockers, reading tables and good sanitary toilet rooms.



PORTABLE TELEPHONE—CANTON-AKRON RAILWAY



7-FT. PLATE GIRDER BRIDGE ON STONE ABUTMENTS WASHED OUT BY FLOODS—CANTON-NEW PHILADELPHIA RAILWAY

Despatching of interurban cars is done by telephone. The despatcher's headquarters is at Canton, from which point he operates cars on both the Canton-Akron and Canton-New Philadelphia lines. A portable box telephone, made by the Garl Electric Company, of Akron, is carried on each car. This may be used at any point along the line by tapping the telephone wires by means of a long bamboo rod carried on the car. At regular passing points the conductor carries the telephone to a pole box, where he makes a connection by means of a short rod, provided with two metallic connections. The illustration shows a conductor using the portable telephone. The form of telephone order used is shown. The conductor calls the despatcher at regular meeting points and at other points designated by the despatcher. The conductor fills out the order blank and repeats the order back to the despatcher. If correctly received the despatcher says "complete," and the conductor signs his name. The conductor then reads the order to the motorman, who signs it, and hangs it on a hook in front of him. The motorman turns in the orders to the despatcher at the end of each trip.

C-A & C. N. P. RY. CO.

Train No. _____ Car No. _____

TELEPHONE ORDER.

Date.....Hour.....M

Received at.....

Car Going.....

Meet Car at.....

Meet Car at.....

Meet Car at.....

Meet Car at.....

Meet Car at.....

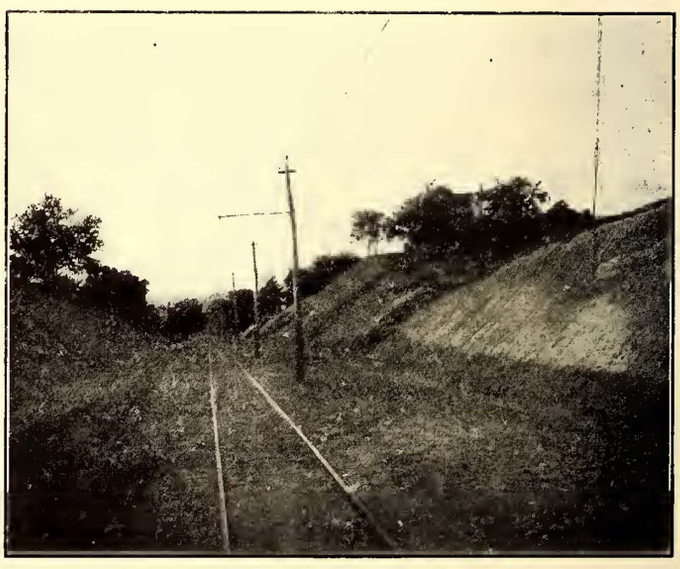
Call at.....

.....Conductor

.....Motorman

This order to be filled out by Conductor and then delivered to Motorman. Conductor must repeat orders back to Dispatcher and will wait until dispatcher uses the word "Complete," and repeat it after him. Motorman will turn in telephone orders every trip to Dispatcher

The express and freight business on these lines has not been developed to any great extent, but it appears to be quite promising. Goods are handled as express, and rates are a trifle lower than regular express rates. The company maintains an express office in Canton, and operates two teams, and in Massillon the company maintains an office. In other towns along the line the agency for the business is given to some store, usually an arrangement combining this business with the ticket office, and the agent receives 10 per cent on the business he originates. The Canton-Akron Company has an arrangement with the Electric Package Company, of Cleveland, whereby goods are shipped from Cleveland to all parts of the system. Goods are handled in the express cars of the Canton-Akron Company, transfer being made at Akron, and the Electric Package Company takes 60 per cent of the receipts and the Canton-Akron Company 40 per cent. This arrangement applies only as far as Massillon, and on goods coming from or goods beyond that point, the Canton-New Philadelphia Company receives its full

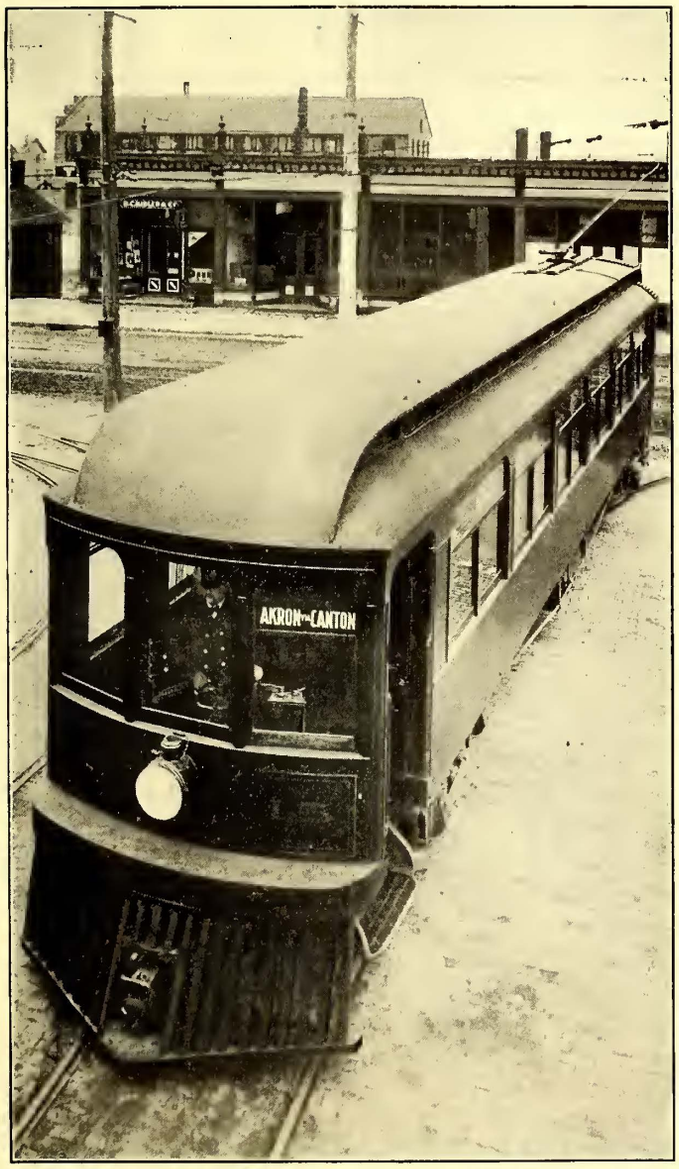


LONG CUT—CANTON-AKRON RAILWAY

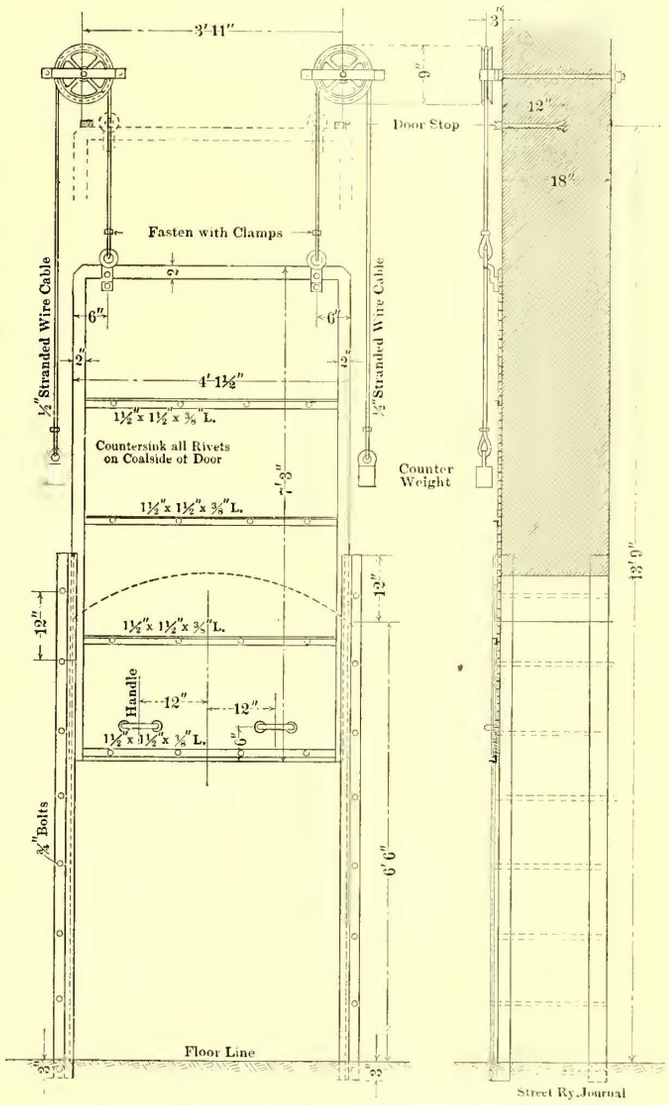
share. On goods originating in Akron, or going only as far as that city, the Northern Ohio Traction & Light Company receives 25 per cent for running over its road and for terminal facilities in Akron. There are two round trips over the system each day, and an extra run between Canton and Massillon, where the traffic is heaviest.

The territory traversed by this system is rolling country, and in some places rather rough, and the grades are unusally long. On the 20 miles between the city limits of Akron and Canton about half is on private right of way, 40 ft. wide, while the balance is at the side of the highway. On this portion of the road considerable heavy grading was done, as it was necessary to cut down the entire highway. At one point there is a 4 per cent grade of 1600 ft. with a 30-ft. cut at the top of the grade, and there are several other cuts almost as deep, and from 100 ft. to 300 ft. in length. The track is laid with standard white oak ties spaced 2 ft. apart, and the roadbed is graded to 14 ft. Sidings are 400 ft. long and laid out for half-hourly service. Rails are 70-lb. 30-ft. length, Pennsylvania section. The rails are bonded with 8-in. 0000 American Steel & Wire concealed bonds, having 7/8-in. terminals and cross bonded every 1000 ft. Climax stock guards are placed at all crossings on private right of way. The Canton-Massillon division, which was formerly a 4-ft. gage, was relaid with 60-lb. rails, while on the new Canton-New Philadelphia line the rail is practically all 80-lb., with the same track standards throughout, and practically all private right of way. The Canton city lines are laid with a 70-lb. girder rail, and these were also changed from 4-ft. gage. The Massillon city lines are laid with shanghai T, and in paving the inside course of brick is laid edgewise. The company has an extensive gravel bank south of Massillon and another near Canton, and tracks are ballasted 1 ft. under the ties and filled up even with the rail with course gravel. A steam shovel is used, with a number of side-dump cars. On the Canton-New Philadelphia line are several rather expensive bridges. At Sugar Creek, near Beach City, is a double-deck timber trestle, supported on piling and nearly 1000 ft. long; crossing the stream there is a 200-ft. steel span resting on stone abutments and crossing the Baltimore & Ohio Railroad overhead there is a 100-ft. steel span. Crossing the Baltimore & Ohio Railroad, near Canal Dover, there is a 100-ft. truss steel span resting on stone abutments, the approaches being filled, making long, easy grades; this is illustrated. There is also an 80-ft. girder bridge with 7-ft. girders near Canal Dover. During the severe floods a month ago the stone abutments and approaches of this bridge were washed out, and traffic over the bridge was interrupted for a time, transfers being made. It was necessary to drive piling to support the bridge and then rebuild the abutments. It is due the company, however, to state that the floods in this district were the worst ever experienced. Several times water was up almost to the floors of bridges, but this was the only one that was washed out, whereas the parallel steam road lost three bridges in this vicinity.

On the interurban lines, poles are 35 ft. tall, with 7-in. and

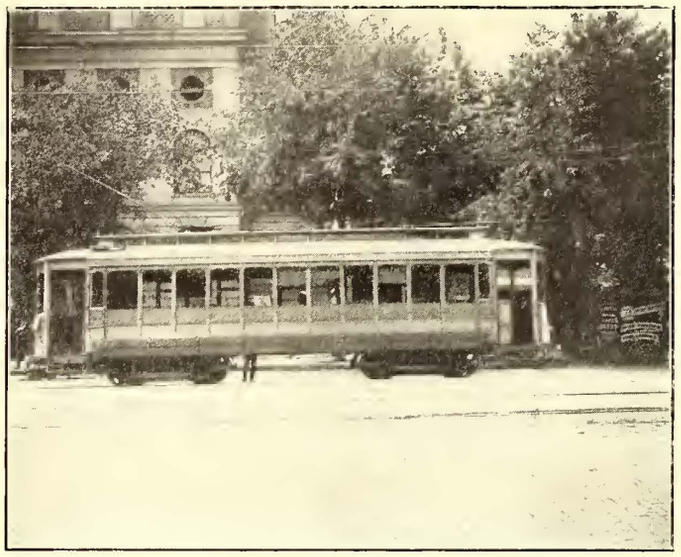


STANDARD INTERURBAN CAR, SHOWING MOTORMAN'S CAB AND CAB SIGNS—CANTON-AKRON RAILWAY



DETAILS OF SLIDING DOOR TO COAL STORAGE

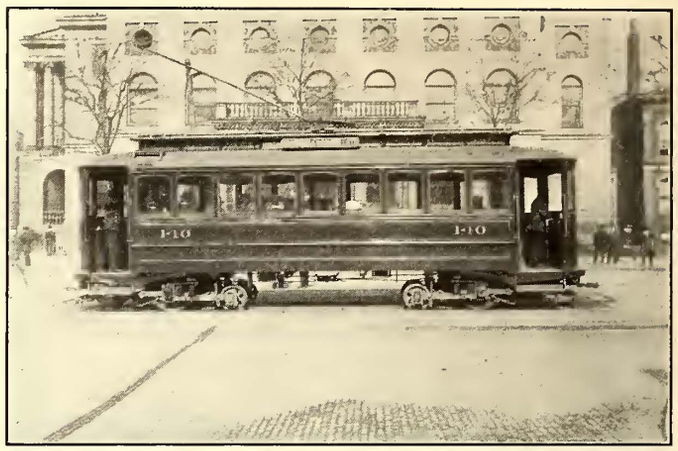
8-in. tops, and spaced 100 ft. apart. Fifteen inches from the top of the pole there is a cross-arm, 2 ins. x 3 ins. x 30 ins., carrying two three-phase high tension lines, the third being at the top of the pole. The pins are 2-in. locust, 15,000-volt, and the insulators are 7-in. triple petticoat Knowles glass, designed for



CONVERTIBLE CAR—CANTON-AKRON RAILWAY

15,000 volts. The high-tension wires are on an 18-in. equilateral triangle. On the Canton-Akron division they are No. 1 and No. 4 bare copper, and on the Canton-New Philadelphia they are 133,000-cm aluminum. Passing through Canton and Massillon the high-tension lines are No. 1 lead-covered, paper-insulated cables, which are strung with messenger cable hangers the same as telephone cables. Between Canton and Massillon there are two sets of high-tension lines supported on two cross arms, the same 18-in. triangle being maintained by

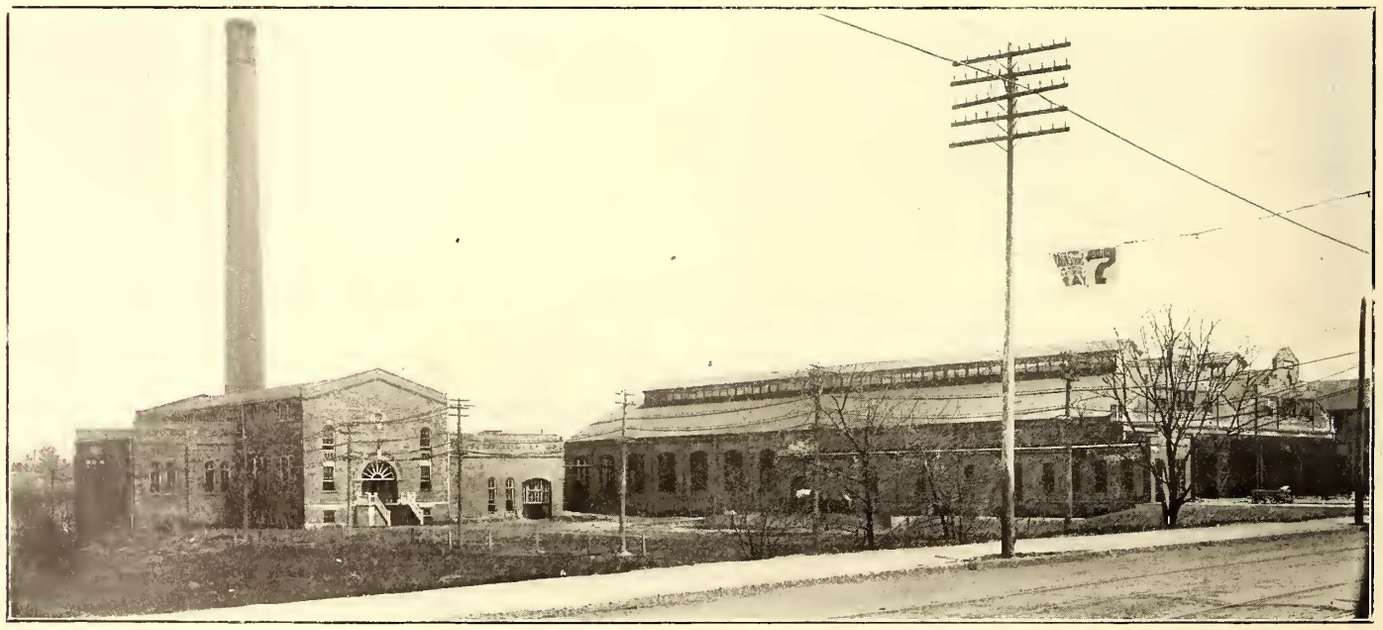
Company. A 500,000-cm aluminum feed wire extends the full length of the line, and is tapped to the trolley every 1100 ft. Trolley on the Canton-New Philadelphia is one 0000 grooved wire, held by 9-in. Garton mechanical ears. G. E., or Garton lightning arresters, are placed on every tenth pole and grounded



TYPE OF CITY CAR, CANTON-AKRON RAILWAY, IN FRONT OF WAITING ROOM, PUBLIC SQUARE

to the rail and to a copper plate. A 625,000-cm aluminum feeder extends the full length of this line on a separate cross arm. The telephone despatching system wires are No. 10 iron wire, and they are transposed every 600 ft. to do away with noise on the line. All stopping points have a cluster of lights on the pole and the poles are suitably marked. Approaching all crossings are whistle signals.

The rolling stock used on this system is of a very high order. For through interurban service there are ten cars built by the St. Louis Car Company. They are 58 ft. over all and 8 ft. 6 ins. wide. Three of the cars are straight passenger cars with no smoking compartments, and were designed especially for



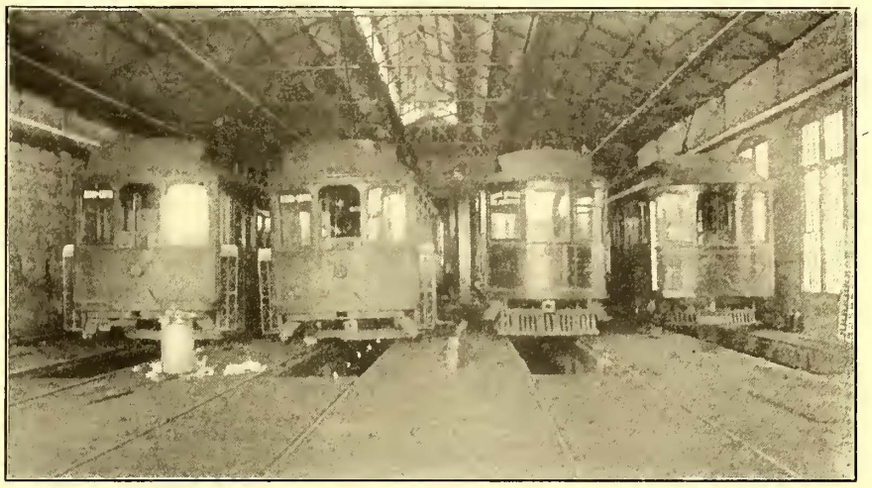
POWER HOUSE, CAR HOUSE AND SHOPS—CANTON-AKRON RAILWAY

placing one pin at each end of the upper cross arm and two pins on either side of the post on the larger cross arm, which is 15 ins. below. Side arms are 8 ft. long, of 1½-in. wrought-iron pipe, guyed to the post. On the Canton-Akron line the trolley wire is of peculiar section, known as the Meyers Special, and it was furnished by the Waelark Company. It is a modification of the figure 8 wire, having a flat surface on top. Hangers and ears were furnished by the Railway Equipment

trolley parties or inspection trips, although they are used in regular service. They have round front end with no front platform. The motorman's cab is built into the car and occupies half the front end. This gives one side seat at the front end, making an exceptionally fine place for observation of the road. These cars seat seventy-two passengers. Seats are of the walk-over type with high roll back and are plush covered. The interior finish is mahogany decorated with marquetry.

Originally the cars were lighted by six clusters of lights, covered by tinted globes, but these are being changed. There will be seven rows of incandescents across the car; three lamps in each row from the roof and two at the sides. The trolley lead will be carried the full length of the car on one side and ground on the other side, and one switch will control all the lights. The other cars of this lot have three compartments, a baggage room in front integral with the motorman's cab, a smoking compartment, seating twelve passengers, having leather covered seats, and the balance of the car being the same as the straight passenger coaches. These cars are very valuable in the through service, as they have ample seating capacity and at the same time are able to carry trunks and express matter. The floor framing of these cars is unusually heavy. There are six sills, all of them strengthened with channel iron. The two intermediates have not only a channel iron on one side but are plated on the outside as well. The side sills have a channel and bar on the inside and there is a filler of wood. All the sills are of yellow pine, extending in a single length from end sill to end sill. The corner posts are of oak and the intermediates of ash. These are spaced in such a way as to bring the windows in pairs, with a double post between them. The sides of the car are built with the inside sheathing laid horizontally, and this in turn is covered by narrow matched stuff put on vertically.

The cars are well trussed, the truss-rods being carried by deep saddles on the needle beams. The bodies are mounted on St. Louis No. 23-B high-speed trucks. They have 6-ft. wheel base, 6-in. axles and 33-in. and 34-in. steel-tired wheels, having 3½-in. tread, and 1¼-in. x ⅞-in. flange. The cars are equipped with four G. E. No. 73 (75 hp) motors and the G. E. multiple-unit train control system. Among other items of equipment are Christensen air brakes and whistles, Nichols-Lintern air sanders, four to the car; Knutson retrievers, Consolidated electric heaters and the Holland sliding trolley base. One of the most noticeable features is a pair of ornamental gates enclosing the rear platforms. These swing out from the lower step from a common center, and are operated by levers in the motorman's cab. A person cannot leave the car or board it until the motorman has fully stopped and pulled the lever opening the gates. On the side of every car is painted a warning against attempting to board when the gates are closed. The cars have controllers at both ends, but they are operated as single enders, and have pilots at one end only. Several additional cars of this type have been ordered.

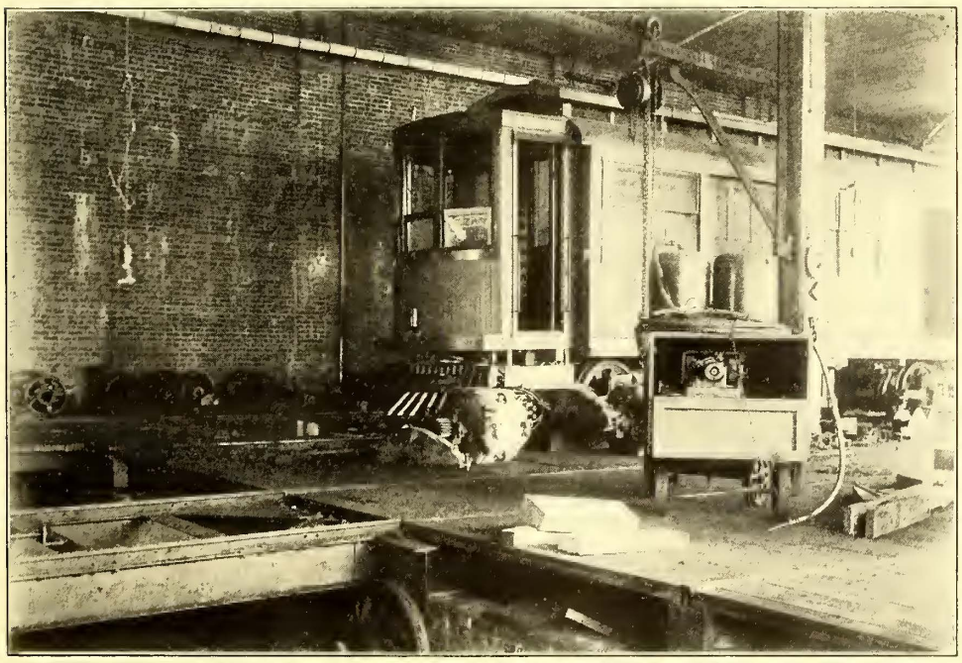


INTERIOR CANTON-AKRON SHOPS

The Canton-New Philadelphia line at present operates six 60-ft. cars, built by the Jewett Car Company, of a type which is largely used on roads owned by the Tucker-Anthony and Appleyard interests. They are of the semi-convertible type, the windows being very deep and removable, making them practically a summer car if desired. They have slat seats, and have a seating capacity of 108 passengers, being very valuable cars for excursions. They are mounted on Peckham M. C. B. trucks, equipped with G. E. No. 73 motors and type-M control.

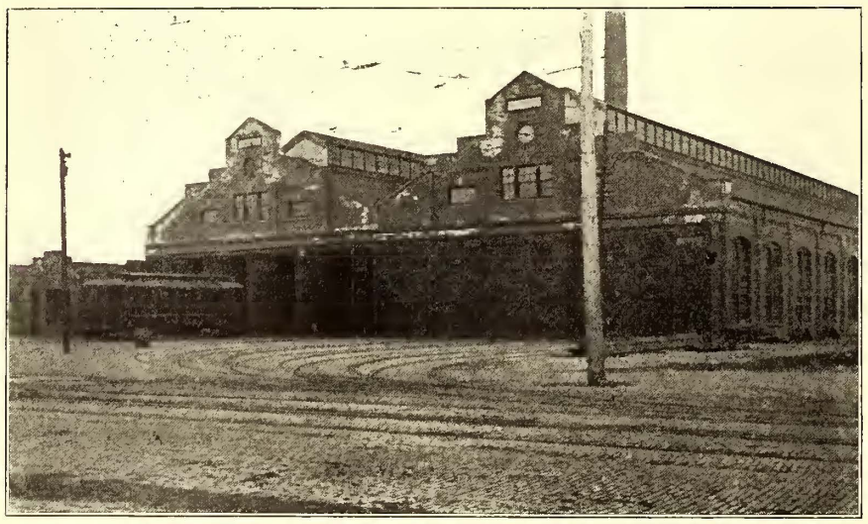
For city service in Canton the syndicate has recently installed eighteen 34-ft. double-truck cars, built by the Jewett Car Company, of Newark. They are fitted with Brill maximum traction trucks and G. E. No. 57 and No. 67 motors. For summer and park service in Canton there are six fifteen-bench 43-ft. open cars, operated with G. E. No. 57 motors and 14-B Peckham trucks. There are also several Brill convertible cars, used in extra service in Canton. For use in Massillon, Canal Dover and New Philadelphia there are a number of single-truck cars of various types.

All cars, city as well as interurban, are fitted with a cabinet sign, hung in the front of the car. The cabinets are neat oak affairs, made in the company's shop. They contain two rollers having spring curtain fixtures, and by means of a small wheel and ratchet they spring to any desired position. The signs are painted in black and white, and there are twelve routes on a roll, so that a car may be used for any route on the system. They are illuminated at night by two incandescents. Motormen on the interurban cars change the signs at each terminal and at Canton. Where the cars lay over at these points a large card is also hung at the side of the car, indicating the towns to which the car is going. Conductors announce the route of their car before it leaves a station and before the gates



TRANSFER TABLE, OVERHEAD MOTOR LIFT AND COMPRESSOR OUTFIT, NEW LINE CAR—CANTON-AKRON SHOPS

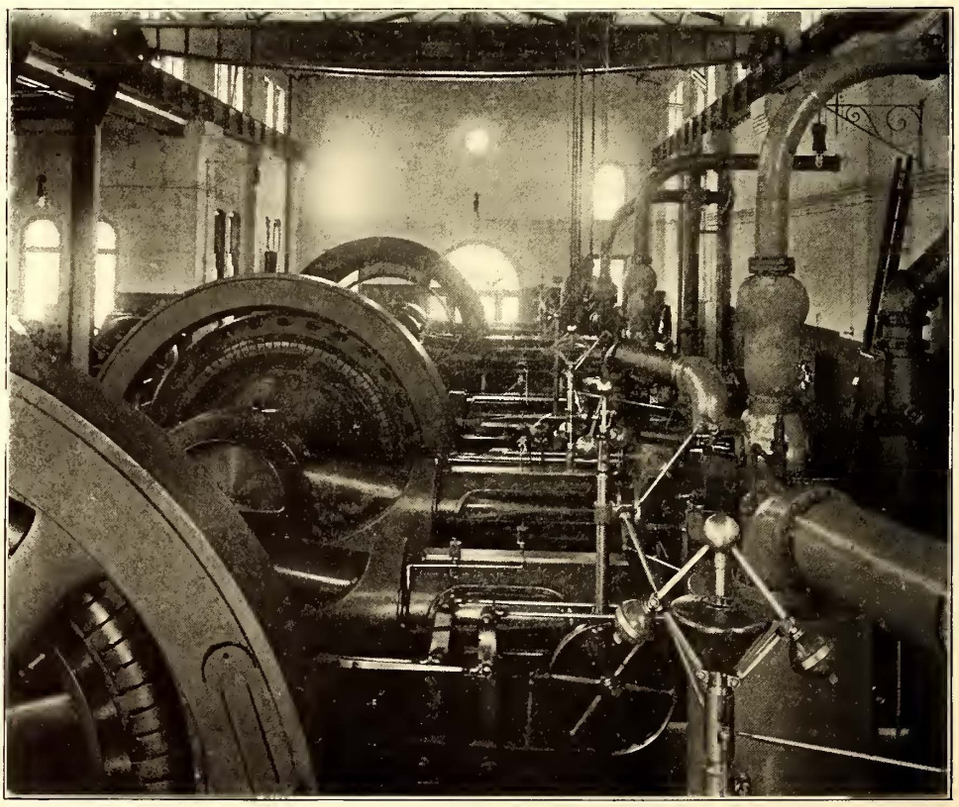
are closed. The main car house and shops are located at Canton, adjoining the main power station. The main buildings measure 122 ft. 6 ins. x 224 ft. 2 ins., being in reality two buildings with a fireproof wall between. The roofs consist of steel trusses covered with corrugated iron and purlines. An annex contains the superintendent's office, receiver's room, men's lounging room with built-in lockers, lavatory and stock room. The buildings are brick with ornamental stone trimmings. So far as dimensions and general make up, the buildings are a duplicate of the shops built by the Columbus, Newark & Zanesville Traction Company at Newark, having been designed by the same architect, E. H. Kitfield, of Boston. Each building has five tracks, the car storage section having concrete floor with tracks elevated on 8-in. x 12-in. oak track sticks, the other having tongued and grooved plank flooring. There are five track pits, each 30 ft. long, having concrete floors. The rear section of one house is divided off for the woodworking shop and the rear of the other for the machine shop. The carpenter shop has a transfer table covering three tracks with a pit under the center track. The shop contains several woodworking tools, and they have practically rebuilt a number of cars. At present they are building a line car by lengthening an old suburban car. It will be 40 ft. long, provided with two double doors on each side and a door at the end, so that poles may be carried. A trolley chain hoist for handling motors covers a portion of this shop. A valuable homemade device is a motor-driven compressor outfit mounted on a small truck with a long hose attached. This is used in blowing out motors, controllers, car seats, etc. Current is obtained by attaching a pole connection to the trolley wire. For pit work they use a heavy Barrett jack provided with a table and mounted on a steel-framed truck. Two women are employed in cleaning cars. They sweep and dust cars every day and thoroughly scrub out each car about every ten days.



CANTON-AKRON CAR HOUSE AND SHOPS, CANTON

SUBURBAN WAITING STATION

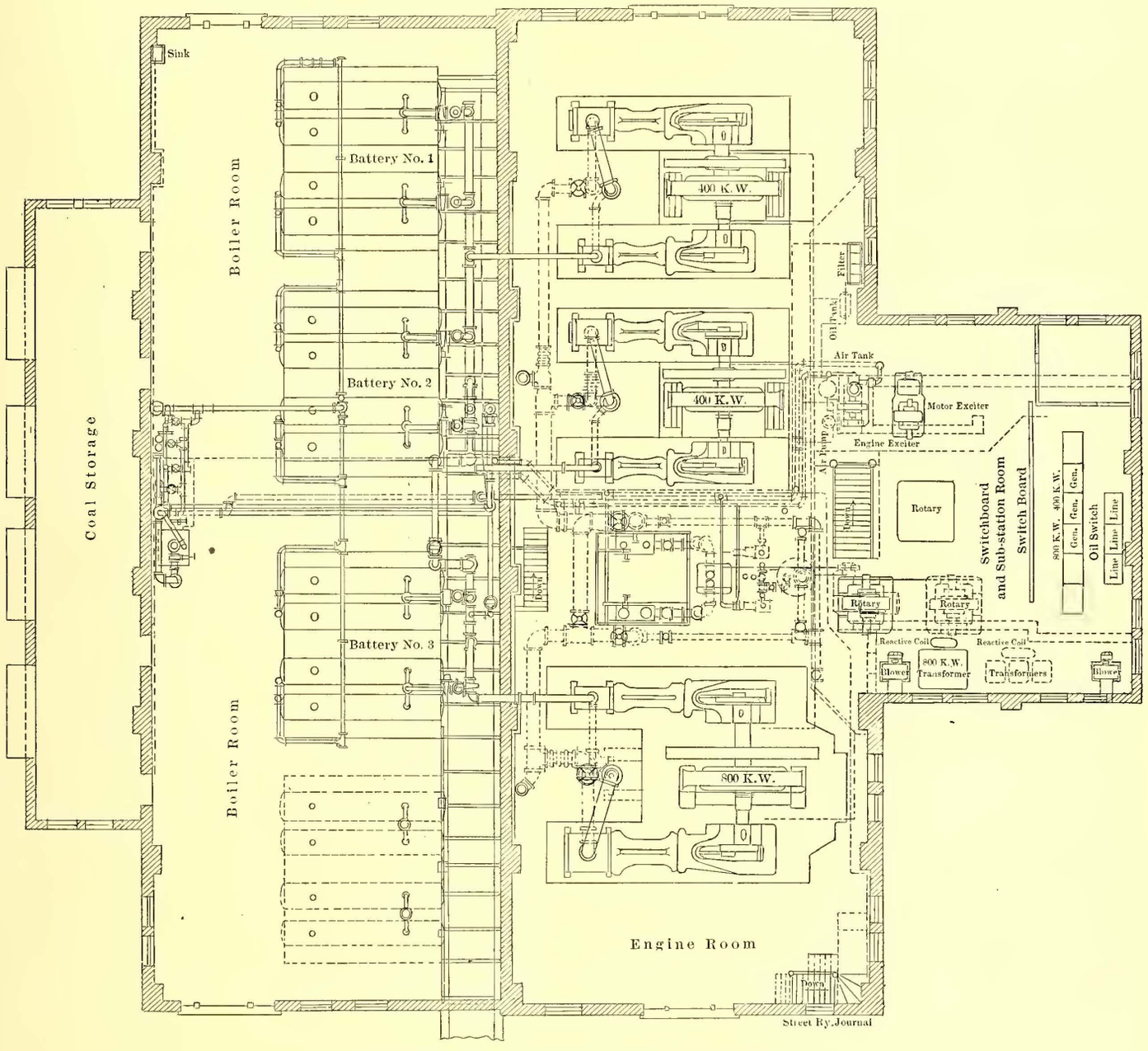
The repair shop equipment consists of a Putnam Machine Company's 42-in. No. 2 boring mill, a McCabe double spindle engine lathe, Hendy Machine Company's shaper, Strong, Carlisle & Hammond drill press, a Franklin portable hoist, a 200-ton wheel press, built by J. R. Schaffer & Company, Rochester, N. Y., and a wheel grinder built by the Springfield Manufacturing Company, Bridgeport, N. Y. This is in a separate dust-proof room. The emery wheels are belted to an independent motor hung outside the room, while the lathe is belted to the line shafting in the shop. Axles are turned on the McCabe lathe, and the wheels are bored to fit the axle on which they are to be used. In grinding the wheels, the wheels revolve, and both are ground at the same time. A blacksmith shop is located in a small building adjoining the shop. Babbitting is also done in this shop; a Weld babbitting device, furnished by Frank Ridlon Company, of Boston, is used. The company makes all its own coils and does its own armature winding and controller work, generator work, etc., two men doing the work for the entire system as well as work for other roads owned by the same interests. A taping machine is used in winding armature coils, and it is claimed one man can tape and finish 400 coils



GENERAL VIEW OF ENGINE ROOM—CANTON-AKRON RAILWAY

per day. Coils are first dipped in varnish, then taped and then dipped in varnish and hung up to dry; a large supply of finished coils is always kept on hand. In wheel fitting the company does work for a number of neighboring interurban roads, so that its tools are kept busy practically all the time. Solid gears and steel-tired wheels have recently been adopted for interurban service.

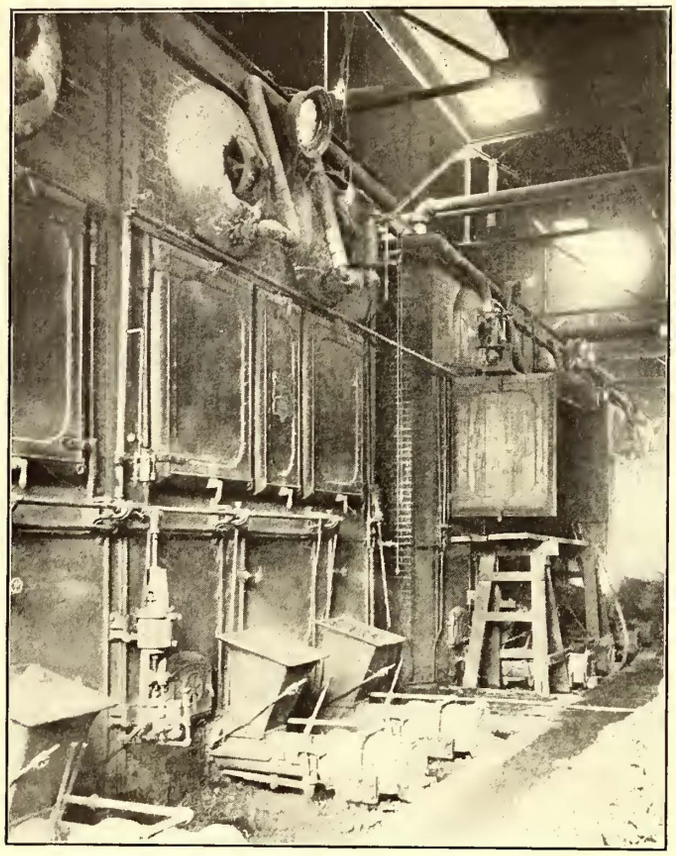
A car house capable of holding ten cars is located at New Berlin, on the Canton-Akron line, and the paint shop is located there. Practically all the company's cars were new last year, and little work has been done in this shop, but many of the cars will be refinished this summer.



PLAN OF POWER STATION—CANTON & AKRON RAILWAY

The main power station which supplies the Canton-Akron and Canton-New Philadelphia lines is located at Canton on a branch of the Tuscarawas River. The building is brick, the boiler room section measuring 46 ft. x 128 ft., the engine room being the same size and having a bay 36 ft. x 48 ft. for a sub-station equipment and switchboards. The engine room section has a peaked roof resting on a steel-trussed frame, and the roof is matched lumber with tarred paper and slate above. The engine room section is covered by a 30,000-lb. crane furnished by the Whiting Foundry & Machine Co. Adjoining the boiler room is a covered coal storage bin, 14 ft. x 78 ft., capable of holding twelve carloads of fuel. A switch, having an elevation of 6 ft. above the coal storage floor level, runs alongside, and the fuel is dumped into the storage from side-dump cars through chutes. There are sliding doors on the coal storage bins and these are provided with counter weights so that they are readily opened. The details of these doors are shown in the engraving on page 801. At present there are installed in the boiler room six 300-hp Aultman & Taylor boilers, set in pairs. Each has sixteen 4-in. tubes wide and nine tubes high, and two 42-in. drums. They are designed to run at 160 lbs. steam pressure and have a hydrostatic pressure of 225 lbs. The boilers are fired by Jones underfeed stokers, and they burn half slack and half run-of-mine. Owing to the close proximity of coal mines run-of-mine coal costs $1.70 per ton, and slack $1.20 per ton delivered. Smoke from all boilers passes through one 12-ft. smoke drum to a 200-ft. Custodis radial brick stack, which is supported on its own foundation outside the building. Draft is induced by a 6-ft. Buffalo forge fan, driven by a 8-in. x 10-in. Sturtevant engine, there being also an induction motor for reserve power. There is space in the boiler room for two additional boilers of the same size, and these are to be installed in the near future. They are to be equipped with Roney mechanical stokers. Adjoining the outside wall of the boiler

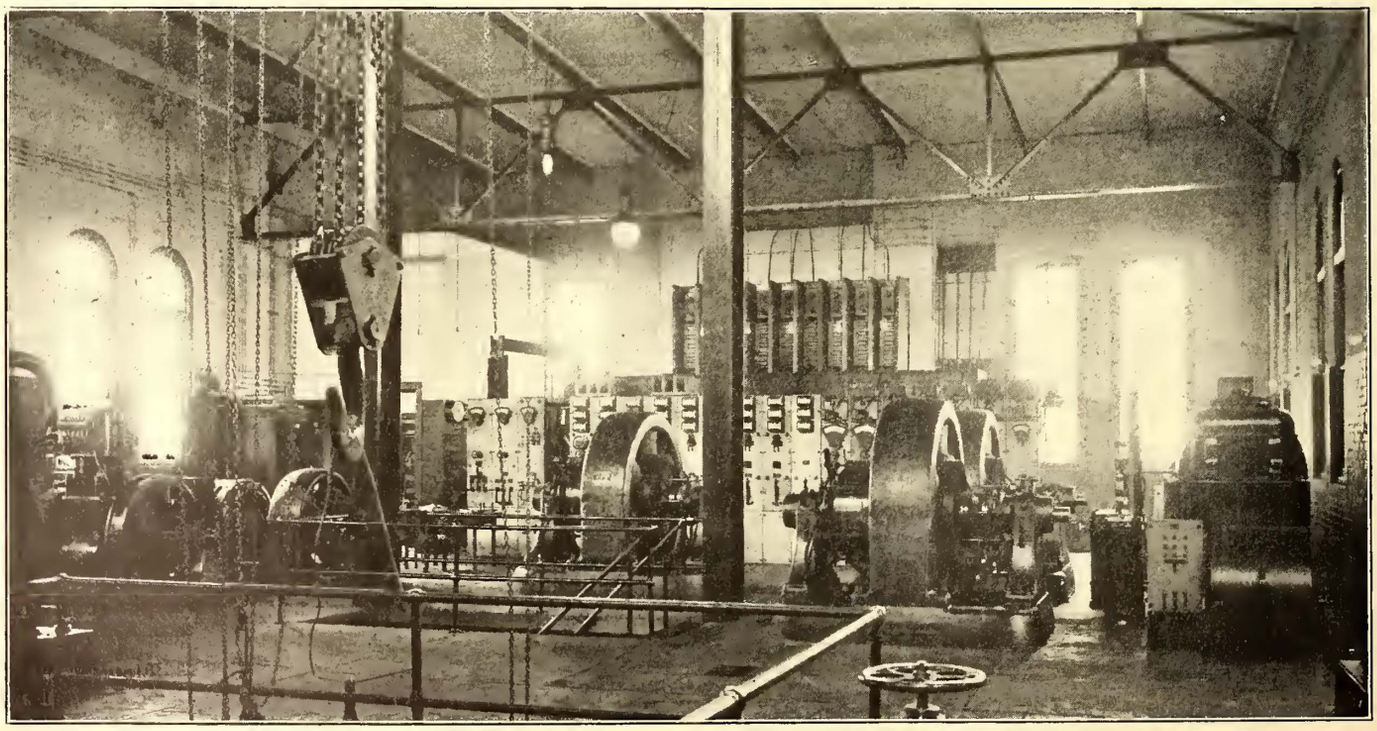
room is a No. 9 Cochrane feed-water heater and purifier. Adjoining the heater is a Smith-Vaile duplex admiralty pattern boiler feed pump, size 10 ins. x 6 ins. x 12 ins. Connected with



BOILER ROOM AND JONES UNDERFEED STOKERS—CANTON-AKRON RAILWAY

the feed-water pump is a Ross feed-water filter which removes oil from the water before it enters the pump. In an open pit below the center of the engine room are two Blake simplex twin vertical jet condensers and air pumps, 12 ins. x 28 ins. x 18 ins., with standard Blake jet condenser heads. Adjoining the condensers is a 6-ft. hot well. A ten-mesh wire screen strainer is arranged to slide between a pair of angle-bars in such a manner as to strain the water before it leaves the well. The cage formed by the strainer is packed with excelsior, and the strainer may be readily removed for cleaning and repairs. As originally designed the Blake condenser took water from the river and discharged into the hot well. It was designed to use the hot well water as boiler feed, and in the piping arrangement the pumps were arranged for delivering the hot well water to the feed-water heater with suction by-passed to the intake well so that either hot or cold water could be used, as the occasion required. Lately, however, changes have been made in both the circulating and feed-water systems. A deep well has been driven in the boiler room, and feed-water is delivered from this to the Cochrane heater, which is supplied by the auxiliaries. The water is heated to about 200 degs., and is then pumped to the boilers. For a time city water was used for feed-water, and this is still accessible, or, if necessary, feed-water may be taken from the hot well as originally intended. To provide condensing facilities for a large engine that had been installed after the house was completed, the company recently installed a 2100-hp parometric tube condenser, built by H. W. Bulkley, of New York. This takes water from a well, 10 ft. x 20 ft., just outside the house, water flowing from the creek by gravity. The condensing water is discharged into the hot well and passes from there to the overflow and back to the creek. At present the Blake condensers are not used except in case of emergency, as the new condenser has been found large enough to take care of the entire house.

All high-pressure piping is standard wrought-iron and all fittings and flanges are Crane's extra heavy. Separating each boiler from the main steam header are 8-in. Chapman valves, and separating each battery are Crane automatic globe valves. All the larger valves are by-passed. The exhausts from the engines are provided with 14-in. Chapman gate valves, and there are 22-in. Chapman gate valves at the condensers. The engine exhaust lines are provided with corrugated copper expansion joints. If desired the engines may exhaust into the atmosphere through 18-in. Lyman exhaust heads provided with drips to the hot well. These exhaust lines have 18-in. Blake automatic relief valves.



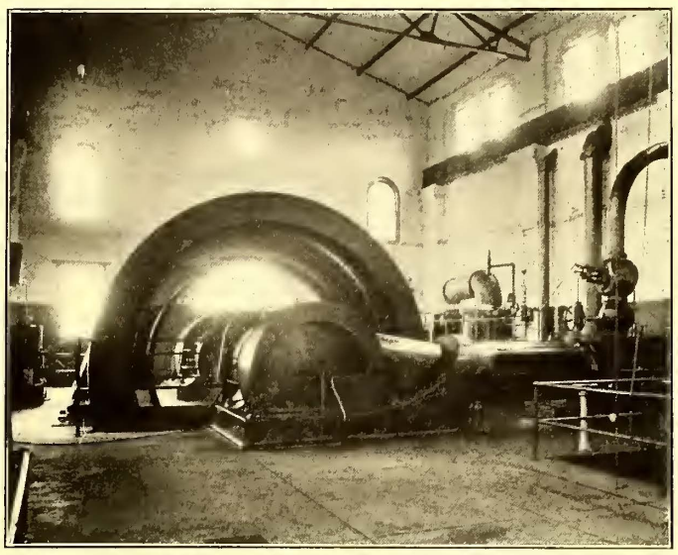
BAY IN HOUSE, SHOWING SUB-STATION EQUIPMENT AND SWITCHBOARD—CANTON-AKRON RAILWAY

The building and engine foundations were carried down to

solid rock and are of solid concrete. Three engines are now installed. Two of them are Allis-Reynolds Corliss cross-compound condensing engines, cylinders 20 ins. x 38 ins. x 42 ins., while the third engine is of the same type with cylinders, 26 ins. x 52 ins. x 48 ins. The smaller engines are rated at 700 lbs., although they have developed 1200 hp, while the larger engine is rated at 1500 hp, and has developed 2000 hp. The smaller engines revolve at 107 r. p. m., and the large machine at 94 r. p. m. The guaranteed steam consumption of both types is 15 lbs. They have Allis safety governors and stop valves. In the larger engine both steam and exhaust valves are double ported. On the smaller engines the speed regulating governors have G. E. series motors operating on the exciting current for synchronizing. The fly-wheel on the larger engine is 20 ft. in diameter and weighs 100,000 lbs.

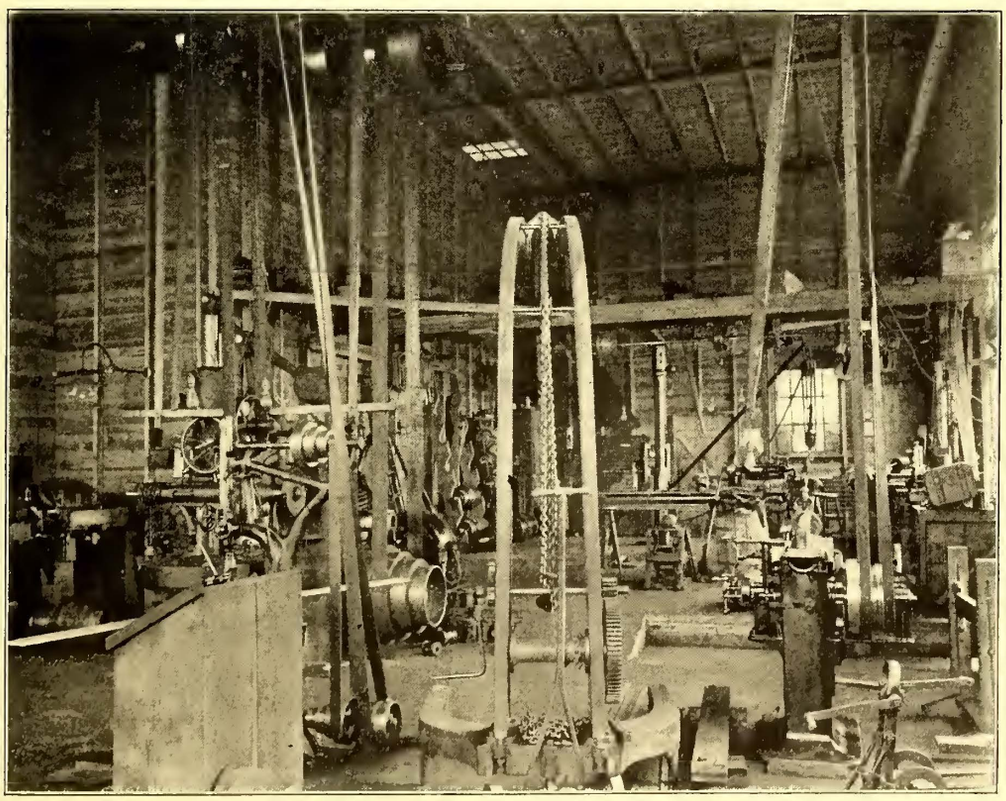
A very complete automatic oiling system has been worked out. In the basement are two 18-in. x 36-in. tanks, one above the other. The oil is fed from the upper tank and then forced by high pressure, supplied by a 10-in. x 10-in. Westinghouse air compressor to the engine oil cups, which are designed for either pressure or gravity feed. After passing through the bearings the oil is fed by gravity to receiving tanks in the basement, and is then forced by pressure to the two Turner oil filters on the engine room floor.

The large engine has direct connected to its shaft an 800-kw, three-phase, 25-cycle revolving field type General Electric generator, delivering current at 13,200 volts. The two smaller engines are direct connected to 450-kw generators of the same type. For exciting the fields of the generators there are installed in the bay a 35-kw, 125-volt, G. E. generator, driven by a 50-hp marine type engine, and a second generator of the same size driven by an induction motor. The first mentioned set is used for starting. The induction motor is supplied by current directly from the bus-bar through a separate 50-kw, three-phase transformer and through a separate switch, so that in case other transformers go out the exciting current would not be interrupted. The machines and the outgoing high-tension lines are protected by G. E. form-K hand-operated oil switches, which are arranged in soapstone barriers back of the switchboard. The sub-station equipment in the house takes care of the Canton city lines, feeds north on the Canton-Akron line half way to the first sub-station and west on the Canton-Massillon division to the Massillon city limits, besides furnishing the Meyers Lake spur line. This load recently necessitated



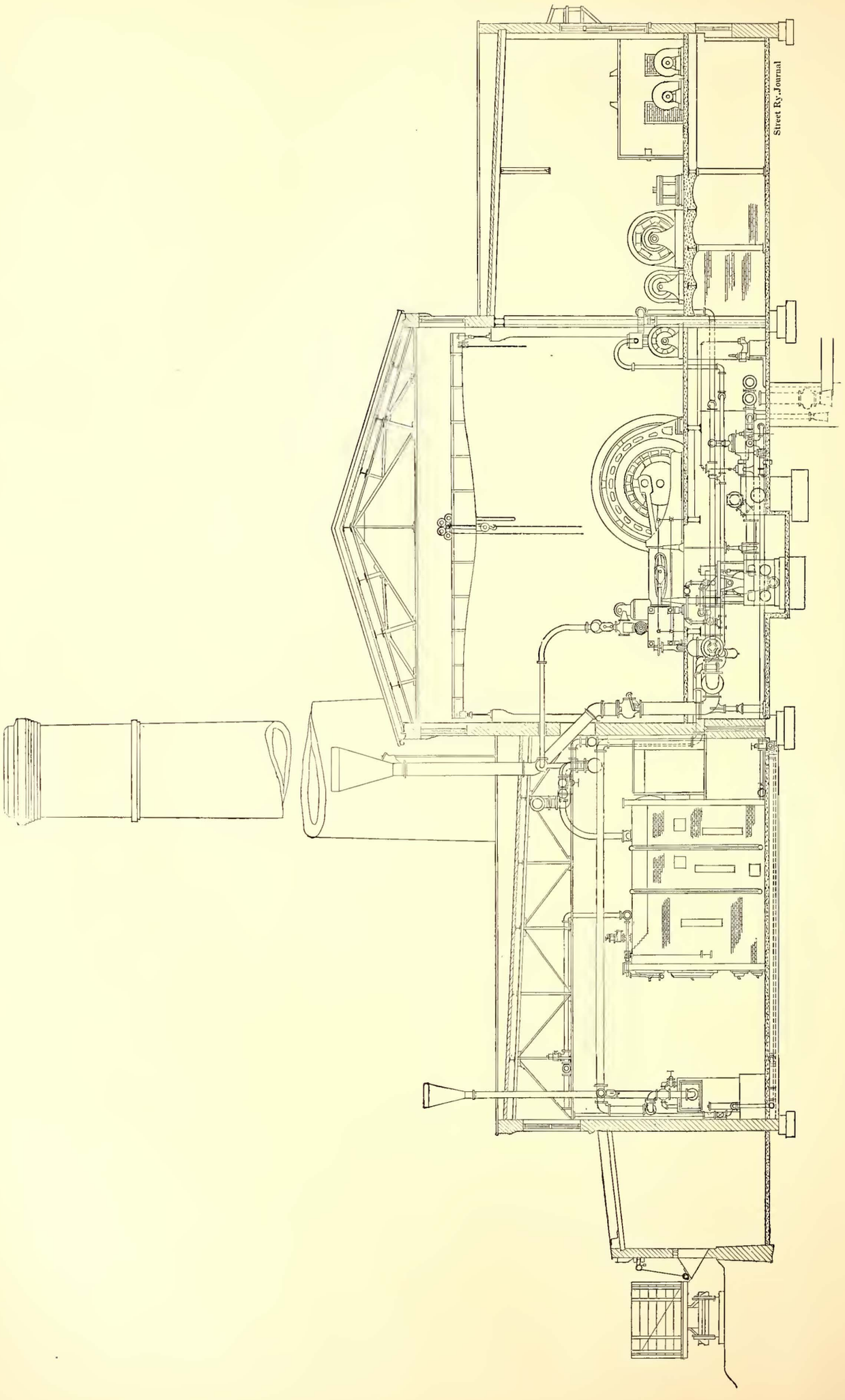
LARGE ALLIS-CORLISS ENGINE IN CANTON-AKRON POWER STATION

the installation of another rotary, so that there are now in the house three 300-kw G. E. rotaries operating at 500 r. p. m., and supplying 600-volt direct current. Supplying current to the rotaries are six 110-kw and one 300-kw transformers, supplying 370 volts through reactance coils. Transformers and reactance coils are cooled by two motor-driven blowers, and in common with modern practice there is an air blast chamber below the transformers, through which carried the wiring to the rotaries and switchboards. Where the cables pass through the flooring they are lead-covered triple conductors, laid in iron conduits.

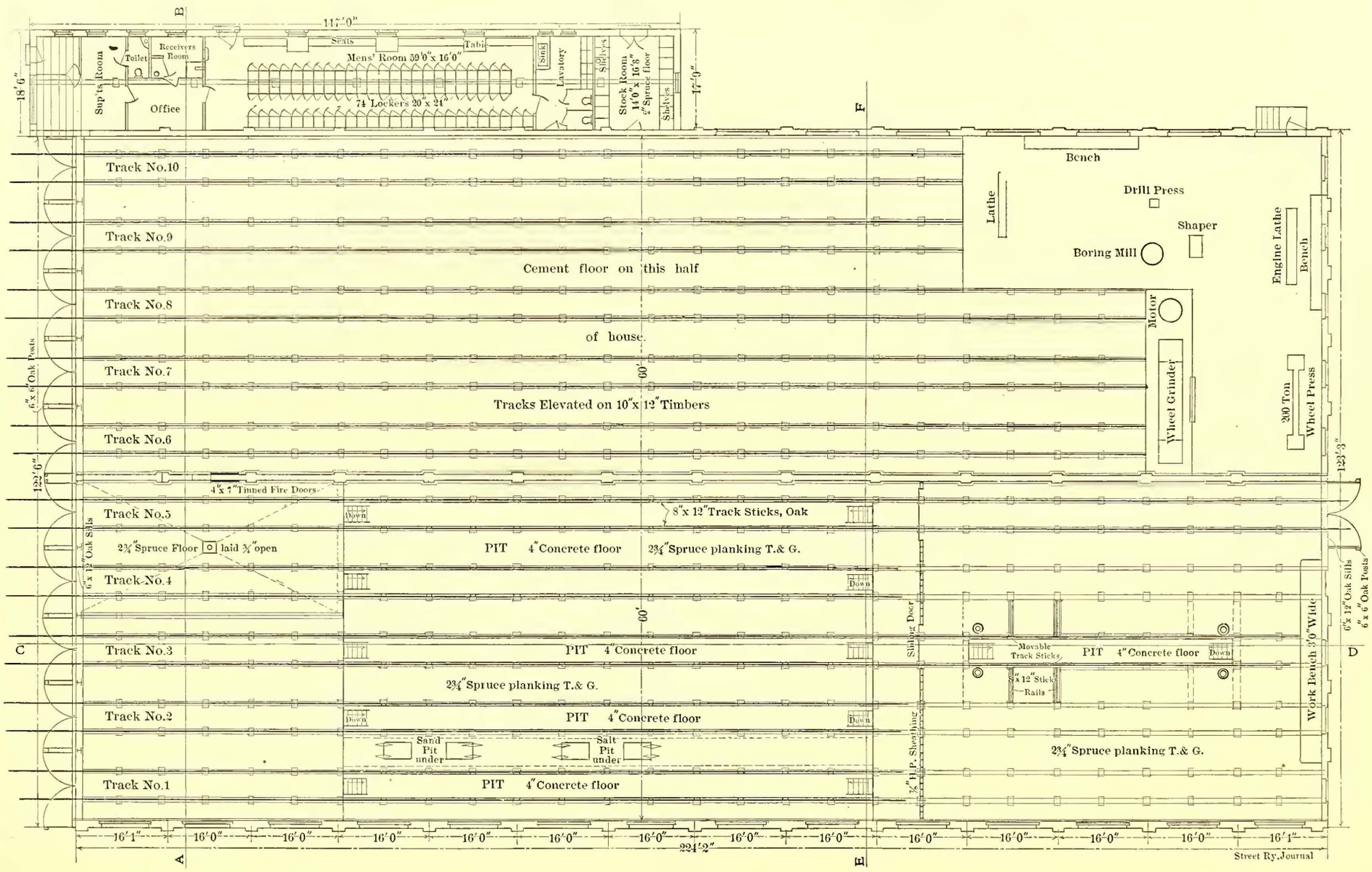


VIEW IN MACHINE SHOP—CANTON-AKRON RAILWAY

The station switchboard is placed across the center of the bay. It is made up of blue Vermont marble panels suspended from an iron frame. Beginning from left to right, the first two panels control the motor exciter and the engine exciter; they have voltmeters and ammeters. The third and fourth panels control the field circuits and have voltmeters and ammeters. Next, there are three main generator panels which have power factor indicators, ammeters, voltmeters, Thomson recording wattmeters and engine governor control switches. Three outgoing high-tension line panels have ammeters, automatic overload relays controlling the oil switches, and indicating lamps. Three panels controlling the a. c. sides of the rotaries have power factor indicators, voltmeters, ammeters and overload relays for the oil switches. Three d. c. rotary panels have M. K. circuit breakers, Thomson ammeters, field rheostats, Thomson recording wattmeters, five-point starting switches,



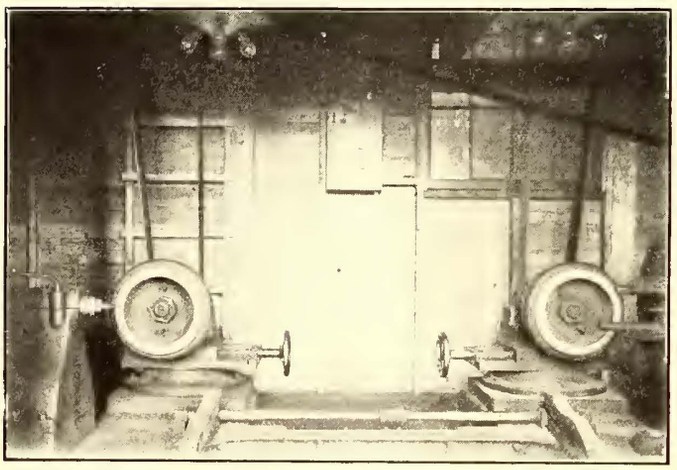
CROSS-SECTION OF POWER STATION—CANTON & AKRON RAILWAY



PLAN OF CAR HOUSE AND REPAIR SHOP—CANTON & AKRON RAILWAY

voltmeter plugs and 750-volt Western voltmeters. Four d. c. feeder panels have M. K. circuit breakers, Thomson ammeters and voltmeters. On a swinging arm at the side of the board are Weston static voltmeters for the d. c. sides of the rotaries. On panels in front of the transformers are switches for starting the rotaries at half tap. At this station they have discontinued the practice of starting rotaries from the d. c. side, although two of the boards are arranged for this method. In front of the motor-driven exciter is a panel for starting the exciter with direct current. A city lighting circuit has been brought into the house, and it may be used for lighting in case the house should shut down. Under ordinary conditions the lights in the house are supplied by the exciter sets. Owing to the use of the stokers and cheap coal, together with efficient condensing apparatus, the cost of current has been brought down as low as $.0054 per kilowatt-hour, and the average for

DESTINATION SIGN, CANTON-AKRON SYSTEM

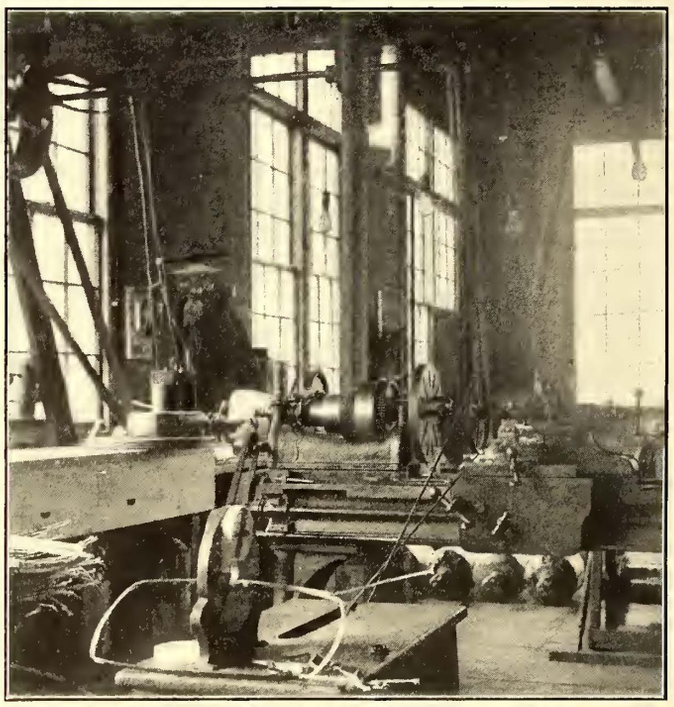


WHEEL-GRINDER IN SEPARATE ROOM

several months has been $.006, not including interest, taxes and depreciation. Pierce, Richardson & Neiler, of Boston, were the consulting and designing engineers for this plant, and the entire steam portion was designed by Samuel G. Neiler of that firm.

In addition to the sub-station in the main house there are five sub-stations on the two lines; at Springfield Lake, New Berlin and Massillon on the Canton-Akron division, and at Beach City and Canal Dover on the Canton-New Philadelphia. The stations at Massillon and Canal Dover are in connection with the old car houses. The building at Springfield Lake has a waiting room and large covered platform for the use of the patrons of the park at that place. The other stations are low, single story buildings, measuring 20 ft. x 35 ft., built of tile and having high-tension towers in the rear. They have air blast chambers below, and the equipment of each station includes one 300-kw rotary, one 300-kw single transformer, form-K oil switches in barriers and other necessary switching apparatus. Wiring in the stations is all carried below the floor in lead-covered paper insulated cables and iron conduits. The rotaries in the sub-stations are fitted with an automatic governor, which prevents them from racing and becoming d. c. motors when the high tension goes out. It consists of a fly-pole governor, belted to the rotary shaft and adjusted to run at the same speed as the rotary. If the rotary speeds up the governor makes a connection with a trip magnet and opens the d. c. circuit breaker. The trip magnet is also arranged for low-voltage release, the magnet being charged at all times from the 500-volt circuit. The magnet has 1000 ohms. resistance and is placed directly across the 500-volt circuit. It releases by short circuiting its current through a series resistance. The high-tension feeders are arranged so that all sub-stations may be cut together. There are breakers in the trolley at Navarre, and a record is kept of the current supplied to the Canton-New Philadelphia line. For this purpose the incoming feeders at Beach City have two recording wattmeters arranged in parallel, one checking the other.

The Tuscarawas Traction Company's line is supplied with current from a small direct-current station at New Philadelphia. It has two 160-hp Ball engines belted to four 80-kw G. E. generators and the most interesting feature of the station is that the company owns a good coal mine within a stone's



TAPING MACHINE, CANTON-AKRON SHOPS

throw of the house, and fuel is mined and dumped into the boiler room by its own men.

As is the practice with the other systems controlled by Tucker, Anthony & Company, the management makes a strong feature of promoting travel by park attractions. The Canton-Akron Company leases Meyers Lake, which for many years has been the most popular resort in that district. It is reached by the Canton city cars by a double-track spur line. Over 300 acres are enclosed, the lake itself covering 140 acres. It is 70 ft. deep, supplied by springs. The company has had it stocked with bass and pickerel, and it has become famous as a fishing resort. Fishing privileges are free and boats are rented at 25 cents an hour. The company has fifty steel row-boats and thirty-five flat-bottom fish boats. Two naphtha launches, one holding fifty and the other 100 passengers, are operated by the company. The north end of the lake is leased to the Country Club, which is the best family club in that portion of the State. The club has erected a handsome three-story building, situated on a high bluff overlooking the lake, and the company's boats make regular trips to the club house landing. A large theater, seating 2000 persons and having 800 opera chairs, has recently been erected, and regular vaudeville and light opera performances are given afternoons and evenings from May 15 to Oct. 1. There is a large hotel and restaurant, bathing beach, with bath houses, figure 8 roller coaster, and a

laughing gallery, both of which were supplied by the Ingersoll Company; "chute the chutes," bowling alley and numerous other attractions. There is a closed baseball park and Inter-State League, and on a number of occasions National League, games have been played there. There is a large dance pavilion, and regular concerts are given by the Canton Grand Army Republic Band, one of the most famous organizations of its kind in the country. Admission to the grounds is free, and picnic grounds are reserved for regular picnics free of charge. A cook house has been fitted up for picnickers. A portion of the grounds is set apart for campers, and a large number of people from the neighboring towns camp there the entire season. Campers are charged 50 cents per person for the first week and 25 cents a week thereafter. The majority of the privileges are let out on a fixed basis.

The Canton-Akron Company has leased Springfield Lake, a large body of water 5 miles south of Akron, and proposes to make it as attractive as Meyers Lake. A large pavilion and vaudeville theater have been erected and other attractions are being installed in preparation for the opening of the season.

The company employs a special excursion representative, who covers all the cities and towns within a wide district. He solicits excursion business from churches and societies, and arranges for dances, theater parties and private cars. The plan has proven a profitable investment.

Officers of the system are as follows: Canton-Akron Railway, W. H. Hoover, New Berlin, president; P. L. Saltonstall, Boston, vice-president; Chauncey Eldredge, Boston, secretary-treasurer. Canton-New Philadelphia Railway, P. L. Saltonstall, president; Chauncey Eldredge, secretary-treasurer. Tuscarawas Traction Company, P. L. Saltonstall, president; J. A. Rutherford, Cleveland, vice-president; Chauncey Eldredge, secretary-treasurer. George W. Rounds, Canton, is general manager of the three roads, and E. J. Rauch, general superintendent and purchasing agent. J. B. Anderson is chief engineer of the Canton-Akron and the Canton-New Philadelphia lines. L. E. Myers Company, Chicago, were contracting engineers for the two roads.

MAKING WRITTEN REPORTS

A street railway conductor writes that a way of killing two birds with one stone in disciplining street railway employees for minor offenses would be to require them, when found violating a rule, to make out a written report in explanation of the offense. Thus, suppose Motorman Johnson is caught by Inspector Brown, or Detective Smith, starting his car on one bell. Instead of the starter notifying him to see the manager he should be told to make out a written report as to why on Oriental Avenue, at 2:15 p. m., Aug. 14, he started his car before receiving two bells from the conductor. As a general thing a motorman or conductor hates to make a written report, and the fear of doing so would serve as an incentive to the non-violation of rules. The written report could also be copied by the office typewriter, and the statement therein could be considered by the depot master better than by personal interview.

The Boston & Worcester Street Railway Company, operating between Boston and Worcester, Mass., has just issued a striking circular advertising its line. The feature of the circular is a bird's-eye view in colors of the country between the terminals of the line, showing the line itself and its connections. The circular, when opened, is 24 ins. in length and bears on its reverse side small street railway maps of Boston and Worcester, time-tables, schedule of fares, data giving the history of the establishment of routes of travel between the cities, and a list of the interesting places along the route of the line.

STARTING ELEVATED TRAINS

Recently a number of letters, expressed in vigorous language, were published in the daily papers of a neighboring city criticising the delay in starting elevated trains. It was claimed that "trains are often held standing at stations with closed platform gates and doors after the gong has been rung for starting, making it necessary for many would-be passengers to wait for later trains when they might just as well be admitted to the train which is standing at the station waiting for a clear block signal to be given."

Doubtless it is unpleasant to thus be held at a station when a person is in a hurry, and the exact train which one desires is standing with closed gates beside the platform. One would be more than human if he did not appreciate the situation when the waiting for another train means the loss of a second train at one of the steam railroad stations farther up the line. But if the gates are opened for one they must be opened for all, and the result would be that the entire elevated service throughout the city would be delayed and far more people inconvenienced than could be affected at any one station.

In the system for starting and keeping trains on schedule time which is followed on the road in question, the stationmaster rings a gong that can be heard by all train men, announcing that it is time to close the gates. If all the gates are not promptly closed, not only that train but those following are delayed. The gates are, therefore, closed as quickly as possible, and as soon as all gates are closed the motorman is given the signal to start, which signal not only directs him to proceed, but notifies him that it is safe to do so. If the block signal indicates safety the train is instantly put in motion, but if the signal is at danger, owing to the preceding train being a little behind its schedule, then the train waits until the signal clears.

If the gates were held open waiting for the block signal to clear it would be necessary either to allow motormen to get under way without knowing that the gates were closed or to hold the train still further to permit the closing of the gates and the giving of signals that would occasion the loss of five or ten seconds more. An average loss of five or ten seconds at each station would cut down the number of trains per hour from 10 per cent to 20 per cent. This is the reason that trains stand still for several seconds after the gates are closed, and in the present knowledge of elevated railway practice there seems to be no way in which belated passengers can be admitted to trains which have received the starting gong from the platform without causing great inconvenience to all the other trains and traveling public throughout the rest of the system.

The operation of this system is constantly being studied by transportation experts from both America and Europe. Probably every foreign engineer who visits this country in the interests of urban rapid transit goes over the road if it is possible for him to include it in his itinerary. Not only does the company obtain in this way the benefit of suggestions, comments and criticisms from these outsiders, but its own operating forces are constantly analyzing the conditions of traffic, train movements, handling passengers, schedules, speeds, delays, etc., and their ingenuity is continually at work in the attempt to better the service. Nevertheless, irresponsible criticisms of this kind frequently come to the surface, as they do in other cities, from the general public, who seldom realize that their interests and the operating company's welfare are identical.

The minerals collected during the work of excavation for the New York subway are to be exhibited by the Rapid Transit Commission at the St. Louis Exposition. In addition to the minerals the exhibit contains the hub and spigot ends of the first wooden water pipe laid in New York City during the administration of Aaron Burr, 1799-1804. There is also among the curios a house connection for the first water pipe laid in New York, coins of all sorts, and Indian relics.

NEW SUB-STATION ON THE DENVER & NORTHWESTERN RAILWAY

A new sub-station has recently been placed in operation by the Denver & Northwestern Railway, at Clear Creek Junction, Col., for the purpose of supplying power to the Leyden and Golden branches of the road and to the line between Clear Creek Junction and Berkeley. Shortly before the sub-station was placed in service the new Golden branch commenced operation, the length of the extension from Clear Creek Junction being 9.65 miles. Through cars are now being run hourly between the central loop of the Denver City Tramway Company, on Fifteenth Street, Denver and Golden. The cars traverse the tramway tracks as far as Berkeley, where the private right of way of the Northwestern Company begins. The line to Arvoda and Leyden was described in the 1903 files of the Street Railway Journal, and the cars, roadbed and track of the new Golden line are similar to those previously operated on the other branch of the system. The running time between Denver and Golden, west-bound, is 1 hour, the total distance being about 16 miles. Fig. 1 shows the general layout of the Northwestern road.

The sub-station building is located on filled land just at the junction of the Leyden and Golden branches. It is a one-story brick structure, with concrete trimmings and foundations. A basement is located below the level of the tracks. The building is designed for waiting room and despatching purposes in addition to its power functions. The front elevation faces the south, and is 45 ft. 1 in. wide; the side elevations are each 50 ft. 1½ ins. in width, and the rear elevation is 38 ft. 2 ins. wide. The extreme height of the walls from the basement floor to the top of the roof is 34 ft. 6 ins. The southeast and southwest corners form octagonal projections, which will be utilized by the despatchers. At the present time the waiting room and despatching offices are uncompleted.

Entering the building at the track level the interior is divided into three parts, rotary and switchboard room, despatchers' towers and waiting room. There is a loft above the waiting room, and a basement beneath both rotary and waiting rooms.

Current is supplied to the sub-station at 2200 volts over a three-phase circuit of 500,000-circ. mil cables, running to the Platte Street power house of the Denver Tramway Power Company. The distance of transmission is approximately 5.3 miles. At Platte Street current is furnished for transmission also to the South Broadway sub-station of the Denver City Tramway Company. The generating machinery consists of a General Electric 1500-kw, three-phase revolving field alternator, having thirty-two poles and giving 25-cycle current at about 2300 volts, direct connected to an Allis-Chalmers 2000-hp horizontal cross-compound condensing engine, making 94 r. p. m. The South Broadway sub-station is similar in its complement of rotaries and transformers to the Clear Creek sub-station of the Northwestern Company.

The incoming 2200-volt line is carried from the pole outside the Clear Creek sub-station to a triangular wooden bracket mounted near the roof on the north wall. Both the bracket and the adjoining bricks of the wall, inside and outside of the building, are painted with black asphaltum to avoid the effects of moisture. The cables enter the building through porcelain bushings, inclined outwardly. They then pass across the loft above the waiting room to a brick chimney or wire duct, and thence to the switchboard and transformers. Inside the north wall the 2200-volt and 600-volt circuits are supported on porcelain blocks mounted upon a horizontal pair of slate bars, which are in turn attached to the wall by iron brackets. Each phase is tapped just inside the wall for a connection to ground through a G. E. 2000-volt carbon-pencil lightning arrester, with two 1-16-in. air gaps in series. The wire chimney separates the rotary and waiting rooms, although a wooden partition is partly built. The switchboard is mounted on angle-irons near the rotary starting switches. In the basement are the main transformers, blowers, current transformers, field rheostats and wire ducts.

From the switchboard the cables pass downward to the transformer primaries, thence the low-tension circuits lead to the reactance coils, starting switches and a. c. collecting rings of the rotaries. The d. c. rotary leads run beneath the floor to the switchboard and negative side of the line.

Two rotary converters are now installed in the sub-station. Each is a six-phase, 25-cycle, six-pole, 500-kw General Electric machine, with a normal speed of 500 r. p. m. and a full-load voltage of 600. The rotaries are compound wound, and are each started by opening the shunt-field circuit and then throwing three successive increasing a. c. voltages into the armature by means of two triple pole, double-throw knife switches, mounted on a panel between the rotary and the main switchboard. The field break switch is of the four-pole, 50-amp., 125-volt double-throw knife pattern, attached to the side of the rotary frame, while on the end of this frame are mounted the negative and equalizer switches. Each rotary is fitted with a spiral spring-end play device, having a ball bearing, and the shaft oscillation is about ⅛ in. Copper brushes are used on the

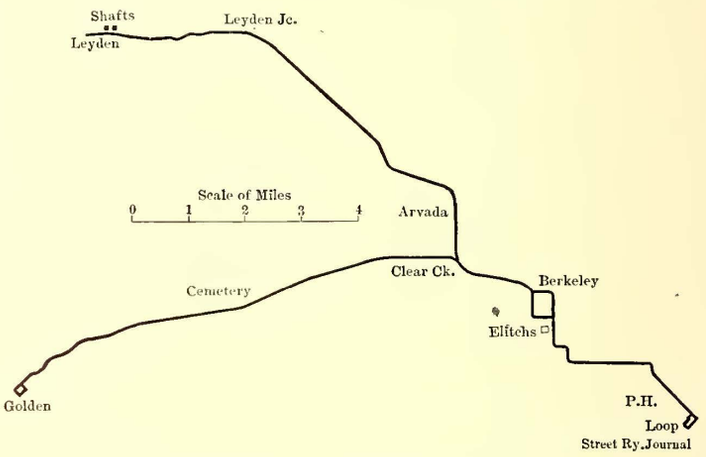


FIG. 1.—MAP OF DENVER & NORTHWESTERN RAILWAY SYSTEM

a. c. side, while the d. c. collection is made by twenty-four carbon brushes for each side of the line. Brush movement is effected by a hand-wheel shaft, operating a rack and pinion movement, and each bearing pedestal is provided with two glass oil gages and one brass drain cock. Each rotary is also fitted with a centrifugal governor at the end of the shaft, which closes an auxiliary circuit and trips the breaker in case of a runaway, due to direct-current reversal and failure of the a. c. power supply.

The switchboard is made up of eight black enameled slate panels, mounted about 6 ft. from the wall. At the end of the board are bracketed a Weston 600-voltmeter for d. c. readings, and a Thomson edgewise voltmeter, connected to a potential transformer for a. c. measurements. There are two a. c. lined panels, each being equipped with a Thomson alternating edgewise ammeter, a power factor indicator, oil switch handle and overload relay. The oil switches are of G. E. make, and are mounted on the back of these panels. At the rear are also three double-throw knife switches, designed to cut out the a. c. side of the sub-station in case it is necessary to send direct current through the three-phase line, as when the rotaries are shut down. A change in these switches connects the three-phase line directly to the positive feeder bus. The d. c. sides of the rotaries are cared for by two generator panels, each containing the usual circuit breaker, a 2000-amp. Thomson astatic ammeter, field rheostat handle, voltmeter plug, positive switch and recording wattmeter. The rheostats are hung in the basement,

and are operated by the usual rod and sprocket wheel connection. A stop with a rubber tip limits the travel of the positive switch so that it cannot strike the glass case of the wattmeter. There remain five feeder panels, manufactured by the Karas Electric Company, of Chicago, each containing a G. E. circuit breaker, Weston 2000-amp., three ground detector lamps and a quick-break, single-pole, single-throw feeder switch. A vibrating gong, mounted on the back of the switchboard, rings in case a circuit breaker opens.

The wire chimney inside is 5 ft. long by 18 ins. wide, divided into two equal parts, and it is open at each end so that an attendant can enter it when occasion arises. A striking feature of the rotary room is the daylight illumination, no less than sixteen windows being provided. The dimensions of this room are: Length, 35 ft. 4 ins.; width, 31 ft. 2 ins. The height varies from 18 ft. 3 ins. to 19 ft. 5¾ ins. Machinery is handled by a chain hoist hung from a longitudinal steel girder, which helps support the roof. No crane was provided.

The basement is 35 ft. 4 ins. wide by 43 ft. 10 ins. long, and has a depth of 11 ft. 6 ins. There is also a wire conduit, about 6 ft. deep, below the floor. The transformers are in two banks of three each, delta connected, General Electric make, each transformer being rated at 185 kw. They are of the air blast type, operating under a pressure of ½ ounce. The primary voltage being 2300, the secondary is wound for 430 volts. One General Electric reactance coil is placed between each bank and the rotary collecting rings. The current transformers and field rheostats are attached to the ceiling of the basement. Each bank of transformers is supplied with air by a Buffalo Forge Company's blower, direct connected to General Electric 25-cycle, 2-hp, three-phase induction motor, making 750 r. p. m. The induction motor is started by a small triple pole double-throw switch, which applies half voltage to its windings. The basement is also to be equipped with a pump, which will be driven by a G. E. 500-volt direct-current shunt motor, rated at 7½ hp with open frame, and 5½ hp closed frame, running at 1000 r. p. m.

The lighting arrangements are not yet installed, the incan-

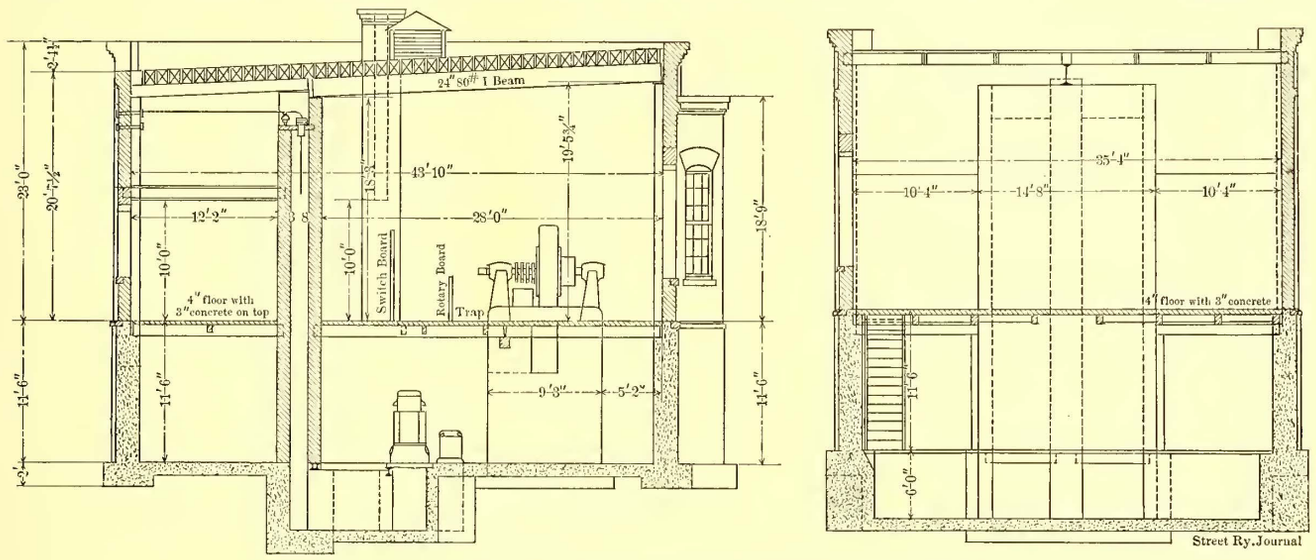


FIG. 2.—SECTIONS OF CLEAR CREEK JUNCTION SUB-STATION

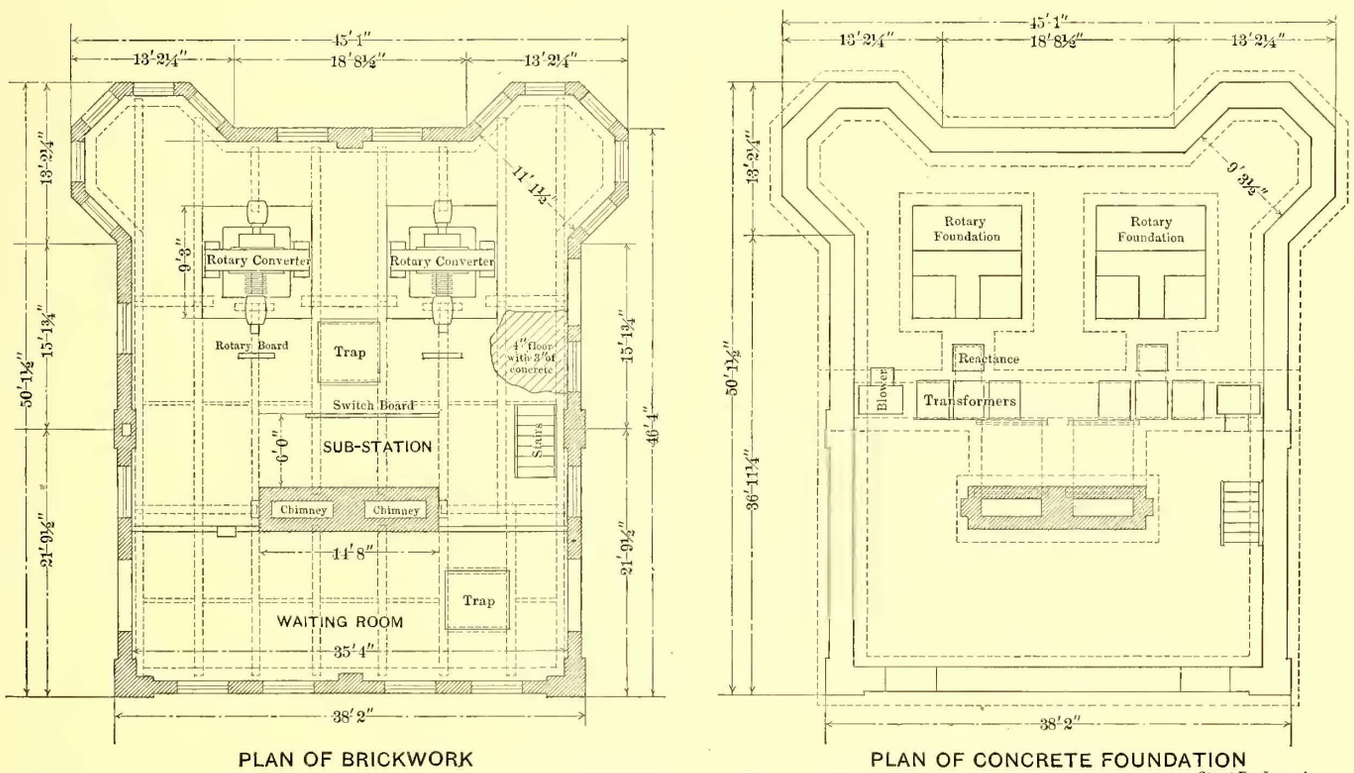


FIG. 3.—BRICKWORK AND FOUNDATION PLANS OF CLEAR CREEK JUNCTION SUB-STATION

descent work being temporary at present. The land around the sub-station is to be further filled in and platforms built to accommodate passengers who may wish to transfer at this point. A telephone system will also be added to the equipment.

A 41-ft. 6-in. trail car, closely resembling the motor cars of the Northwestern road is shortly to be placed in service for use during times of heavy traffic. The body weighs about 9000 lbs., the side entrance is 8 ft. wide, and the overall width 8 ft. 3 ins. This car is being built by the Woeber Carriage Company, of Denver, which manufactures practically all the cars of the Denver City Tramway Company and the Denver Northwestern road.

The Golden branch competes with the "Loop" line of the Colorado & Southern (steam) Railway between Denver and Golden. The regular fare on the steam road is 60 cents, and there are but two trains a day in each direction. The Denver Northwestern charges 30 cents, with the privilege of transfer to any point reached by the Denver City Tramway Company. The distance by the steam road is 16 miles, and although the Colorado & Southern has in force a commutation ticket of fifty rides for $8, the ticket expires in three months' time limit; the running time of trains between Golden and Denver is 45 minutes, against an hour by trolley, and the hours at which trains leave Golden for Denver and vice versa are not especially convenient. There is no doubt that the electric line is capturing some of the steam road's business, owing to the hourly interval and lower regular fare.

The design of the sub-station at Clear Creek Junction was made by L. L. Summers, of Chicago, consulting engineer of the Denver Tramway Power Company. The requirements of the near future were strongly in mind in the installation of 1000-kw rated capacity of machinery. At present the load is far below the capacity of the sub-station, but the anticipated summer traffic between Denver and the Rocky Mountain foot hills, and the probability of increased transportation facilities between Denver and the northern part of Colorado, warranted the installation of ample power. Acknowledgements are due to Colonel Wilson, superintendent of the Denver Tramway Power Company, for the drawings used in this description.

CIRCUIT-BREAKERS ON DOUBLE-END CARS

BY CALE GOUGH

In wiring circuit breakers or overhead switches for double-ended cars two methods are available, that is, the two breakers may be wired either in series or in parallel.

From the standpoint of first cost the series method is without doubt preferable. While a greater length of wire is used, but

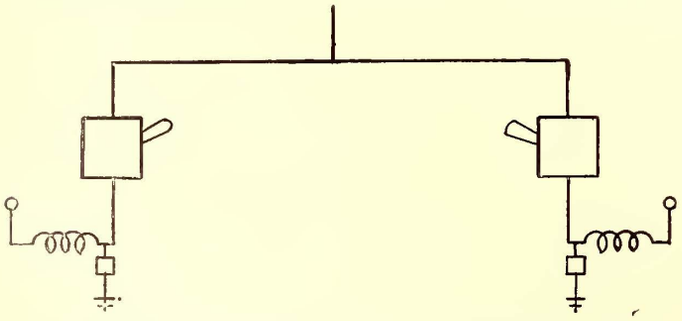


FIG. 1.—PARALLEL CONNECTION FOR CIRCUIT BREAKERS USING TWO LIGHTNING ARRESTERS AND CHOKE COILS

one lightning arrester and choke coil are necessary. Lightning arresters in themselves are a rather troublesome item, and this fact alone may cause many managers to adopt the series connection.

In the parallel connection the trolley wire of the cables is omitted. As is readily seen in Fig. 1, the trolley leads, after passing through the choke coil, go directly to the blow-out coil of the controller. Aside from the fact that two lightning arresters and choke coils are required this method is undoubtedly the more simple. It requires fewer wires on the roof of a car, and eliminates the use of a trolley wire in the cable, which is

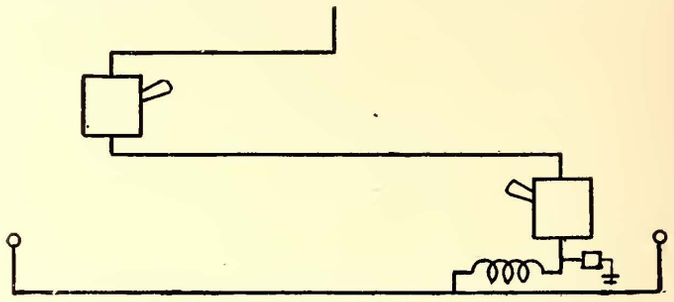


FIG. 2.—SERIES CONNECTION OF NON-AUTOMATIC CIRCUIT BREAKERS

often, from a standpoint of safety, run separate from the other wires under the car.

Fig. 3 shows a method of parallel connection requiring but one lightning arrester. This method, however, would not be countenanced in practice. Its great objection is that the motorman on the front end would have no assurance that, by throwing the breaker over him, the power would be cut off. The rear breaker might have been carelessly left in.

The fact that the current can be controlled absolutely from either end makes the series connection, Fig. 2, so popular on smaller equipment having the non-automatic breakers. When making an inspection of the controller, replacing fuse, etc., the motorman is absolutely sure of freedom from shock if he throws either breaker.

For automatic breakers the series connection has one great drawback. An overload would throw the breaker set at the

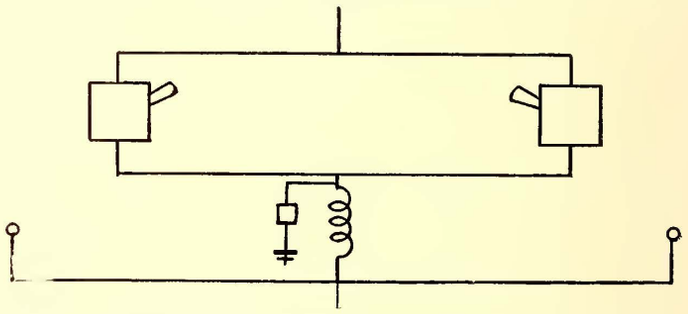


FIG. 3.—PARALLEL CONNECTION OF CIRCUIT BREAKERS USING ONE LIGHTNING ARRESTER

lowest load. This might be the breaker on the opposite end to that occupied by the motorman, and in such an event would necessitate a trip to the other end to set the breaker.

After considering the advantages and drawbacks of the two systems of wiring, it is readily seen that, generally considered, the series method is preferable, and should always be used with non-automatic breakers. With automatic breakers, however, it is better to go to the expense of an additional lightning arrester and choke coil rather than be bothered with repeated trips to the other end of the car to set the breaker.

The second annual meeting of the shareholders of the Trinidad Electric Company was held recently at Halifax, N. S. The year's receipts from the tramway and light services amounted to $176,631. After paying bond interest and operating expenses, and providing for the last quarterly dividend, at the rate of 5 per cent per annum, the balance of $52,285 was carried forward to the credit of surplus account. The net earnings were $101,185 and the interest charge $36,000. W. D. Ross, Toronto, general manager of the Metropolitan Bank, was added to the board of directors, of which John F. Stairs is the president. The company's rails extend over 13 miles in the city of Port of Spain.

THE PRINCIPLES OF THE REPULSION MOTOR

BY GEORGE T. HANCHETT

The alternating-current repulsion motor has for many years been considered nothing more than an interesting theoretical tour de force. As it now bids fair to be developed into a practical machine, and to presently find itself in the hands of practical electricians, a short discussion of its principles of operation, stripped of mathematical signs and symbols, may be of interest.

The repulsion motor in its electrical construction differs but little from the ordinary direct-current motor. It is composed of a magnetic circuit corresponding to the field magnet of an ordinary direct-current motor except in the fact that it is laminated. Its revolving part is an armature wound on practically the same principle as that of the direct-current motor, and the only difference between the two machines in the connection

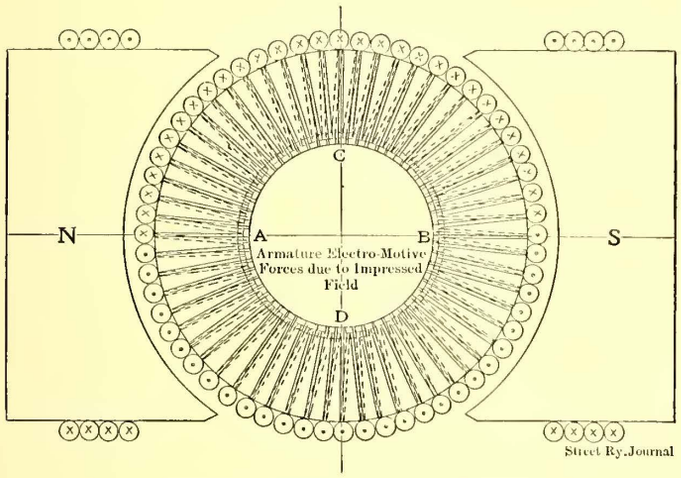


FIG. 1.—VOLTAGE DISTRIBUTION IN REPULSION MOTOR

of the wiring systems, is that the brushes of the repulsion motor are located in a different position on the commutator, and are short circuited together.

The field magnet of the repulsion motor is supplied with alternating current, and this induces in the armature currents in such a direction as will give the motor a torque, and the commutator assists by means of its short-circuited brushes to continually replace the torque-producing wires, as they move out of the influence of the magnets, with new wires carrying similar currents. The machine may be regarded as a transformer, of which the field magnet is the primary, and the armature is the short-circuited secondary.

Considering Fig. 1, which represents a repulsion motor without the short-circuiting brushes, flux will travel through the armature, alternating rapidly in direction, but following the distribution common to direct-current motors. Therefore, in each half of the armature will be induced electromotive forces. When the pole at the left is north, the current direction in the armature wires will, naturally, be in the direction to produce reverse magnetism upon the magnetic field and in quadrature therewith, according to the ordinary transformer law.

If the brushes are placed in the position A B, Fig. 2, the currents will flow in phase with the resultant electromotive forces, and it will be readily seen that in front of each of the poles there is for every wire carrying current in one direction another carrying an equal current in an opposite direction. Consequently, so arranged, the motor would have no torque, although the armature current would be very large. If the brushes were arranged as shown at C D, Fig. 3, it will be seen that on the two halves of the armature circuit there is for every wire carrying an electromotive force in one direction another carrying an equal and opposite electromotive force. Consequently, in such a case no current will flow in the armature in response to the magnetic action of the field, and, again, there would be no torque. If, however, the brushes were placed in an intermediate position between these two, as shown at E F, Fig. 4, the electromotive forces in one-half of the armature circuit would preponderate over the electromotive forces in the other half, and the result would be a current distribution such as is shown in Fig. 4, and, if certain conditions, presently to be discussed, obtain, a torque would result, causing the armature to turn in the direction of the arrow.

By a similar system of reasoning it will be at once apparent that if the brushes are arranged at points E F, Fig. 5, the current direction will be reversed, and the torque will be in an opposite direction.

The repulsion motor, considered as a transformer, therefore, is rather an inefficient one, for the reason that it contains electromotive forces which oppose the torque-producing currents, and is precisely analagous to a transformer which had, say, 100 turns, producing 1 volt each, of which ten were wound in one direction and ninety in the other, giving a net electromotive force of eighty volts, which could be just as easily obtained by using eighty turns all wound in the same direction, and would produce a secondary coil of much lower resistance, lower, in fact, by 20 per cent. This, moreover, is made even worse by the reaction of the armature, which acts precisely like a direct-current armature and distorts the field so as to tend to cover the non-torque-producing bands of wires and drags the field away from those that would produce a torque.

The phase of the armature currents with reference to the field is a very important factor in torque discussion. The armature currents will, of course, flow in phase with the resultant electromotive force in armature circuit, and if the components were due solely to the electromotive force generated by the impressed field, the current would be in quadrature therewith, and no torque would be produced, because the flux and current curves would multiply together in precisely the same way as the current and voltage curves of wattless power, giving lobes above and below the zero line of equal area, and consequently equal torque first in one direction and then in the other, which would produce no rotation.

Fortunately for the operation of the motor, the armature currents generate a field of their own, and a second electromotive force comes into play, which combining with the originally generated electromotive force produced by the impressed field, causes a resultant electromotive force lagging behind the original electromotive force, and to which the current responds in magnitude and phase. This effectively upsets the quadrature relation of field and current and the motor starts. However, these lagging currents reflect magnetic reaction into the fields, the coils of which must supply demagnetizing lagging currents according to the transformer law, and the motor starts with a very bad power factor.

The angular displacement of the brushes for maximum starting torque is, of course, a matter of great interest. The armature voltage, due to the impressed field which is effective in circulating current through the wire, is proportional to twice the angle of displacement, and, of course, should be increased until a position is reached where further motion would diminish the torque by cutting out torque-producing conductors. This cutting-out action begins at the edge of the field, or, in other words, the pole tip. Up to the point the torque steadily increases with the angular rotation, but beyond further movement does not produce proportional increase, because a factor enters to reduce the torque by cutting out wires, but further by replacing them by wires giving a reverse torque. The preliminary calculation, which is subject to modification when self induction is considered, is as follows:

For simplicity assume one wire per degree or per unit of angular measure.

Let V = the angle of displacement.
R = resistance of one-half armature.
T = torque.
n = number of wires in front of pole pieces.
f = flux.
K = a constant, which allows for units and makes equation out of the proportional relations.

Consider the torque for one side of the armature:

$$\text{Current} = \frac{2V}{R} K; \quad \text{Torque} = \frac{2VK}{R} n f$$

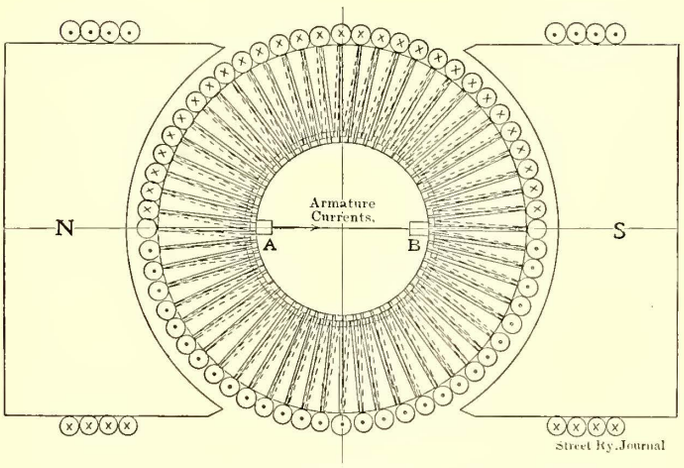


FIG. 2.—CURRENT DISTRIBUTION WITH BRUSHES OPPOSITE POLES

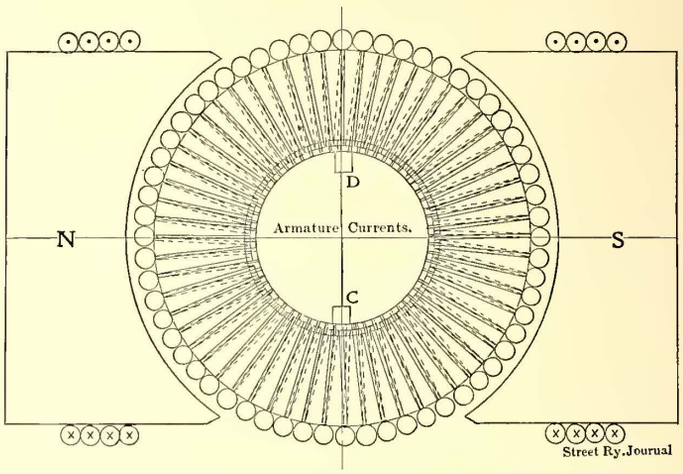


FIG. 3.—CURRENT DISTRIBUTION WITH BRUSHES MIDWAY BETWEEN POLES

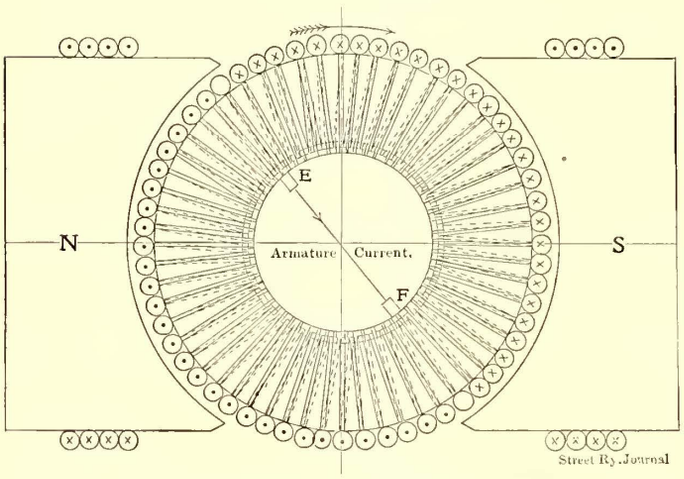


FIG. 4.—CURRENT DISTRIBUTION WITH BRUSHES AT ANGLE WITH NEUTRAL POINT

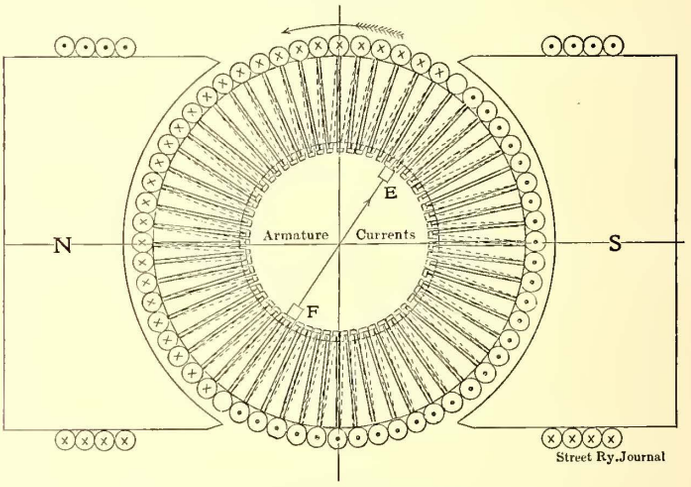


FIG. 5.—CURRENT DISTRIBUTION WITH BRUSHES AT ANGLE WITH NEUTRAL POINT

This is true till the brush begins to cut out torque-producing wires. As soon as this happens

$$T = \frac{2VK}{R} f \left\{ n - 2 \left(V - \frac{180 - n}{2} \right) \right\}$$

$$= \frac{2VKf}{R} \left\{ 180 - 2V \right\}$$

$$= \frac{360\,VKf}{R} - \frac{4V^2Kf}{R}$$

differentiating

$$\frac{dT}{dV} = \frac{360Kf}{R} - \frac{8VKf}{R} = 0 \text{ for a maximum}$$

whence

$$V = \frac{360}{8} = 45°$$

In practice the position will be found to differ, for the current will not increase proportionally with the voltage, due to variable impedance of the armature and the position of angular displacement, for maximum torque will, therefore, be a different amount.

As soon as the motor has started a third electromotive force comes into play. This is the electromotive force induced in the wires, due to their motion in the field, and is, of course, directly in phase with the latter, being large when the field is large and vice versa just as in the case of the direct-current dynamo. Like the direct-current analogue it tends to reduce the armature current, and further, but not analagously, it tends to draw the phase of the current back to the quadrature position. Hence, as the motor speeds up, the torque reduces and the power factor improves. Unlike the series motor, however, it has a limiting speed, which is that which obtains when the electromotive force, due to motion, has reduced the torque to fit the friction load.

From the foregoing it is seen how the torque-producing currents are generated in the armature, and it is now interesting to consider some of the reactions in the armature and the commutation problems. The field generated by the armature has its dividing line at the brushes in precisely the same way as in the case of direct-current armatures. In good modern direct-current dynamos the brushes can be set almost at the theoretical neutral point, in which case the magnetizing reaction is purely that of cross magnetizing, and does not tend to shift the initial field one way or the other. In the case of the repulsion motor, however, the brushes must be inclined with reference to the neutral axis in order to produce rotation, and the field is reacted upon. As the load on the motor increases this reaction is still greater, and, consequently, the position of the flux lines with reference to the structure of the field magnet

and armature, shifts with the load, and brings into the machine all the commutation troubles which appear with the old-fashioned, badly designed direct-current dynamos, but to a far greater degree because of the extreme displacement of the brushes. In addition to this there are the commutation troubles due to the alternating currents generated by the alternating field in the short-circuited bobbins, and these will depend in magnitude upon the phase of the current at the instant of commutation, and may have almost any value. These variables make it a practical impossibility to predict what the current in the short-circuited bobbin will be. It may vary from zero to several times the current in the adjacent coils.

For good commutation, therefore, all devices which will keep this short-circuit current down must be exhausted. Chief among these is the introduction of leads having a sensible resistance between the commutator bars and the coils to which they connect. This will materially reduce the sparking by reducing the current to be commutated. The pole pieces can also be shaped so that the commutated coil will find itself in a field which is favorable for that purpose.

Advantage can further be taken of the fact that the transformer ratio between the field and armature can be anything that is found desirable. The fields can be excited at high voltage, while the armature of secondary coils can be wound so as to have a total potential of only a few volts, thereby much reducing the commutation troubles.

By carefully exhausting all of these plans by the employment of ingenious design, the commutation is brought within the limits of practical working.

The motor has an attractive feature in that the speed may be varied by the adjustment of the brushes. When the brushes are in the positions C D, no current flows in the armature, and there is no torque. By moving them to the right or left the motor starts in one or the other direction, and the possibilities of economical control are very great, for in such a case the controller resolves itself into simply a rod connected with the brush holder and arranged with a suitable leverage system to give the brushes proper angular displacement. This, supplemented by a main switch which cuts off the current, and which may be connected to the lever system so as to operate when the brushes are midway between the pole pieces, complete the control. The motor is furthermore under control by the insertion of a variable resistance or reactance in the circuit between the brushes, which having low-voltage currents to handle can be constructed without difficulty in many desirable forms.

To briefly sum up the situation, it may be said that the motor certainly presents some advantages with reference to control. Its torque characteristics are suitable for railway work, and the difficulties which the commutation problem has heretofore presented may be overcome by the employment of low frequency, large ratio of transformation and ingenious dynamo design. Not the least feature to recommend the motor is the fact that the revolving wire may be of very low voltage, thereby minimizing troubles from short circuits, and the stationary wires can be wound and insulated so as to receive currents directly from the line without the interposition of transformers on the car, as the motor is its own transformer. It would, therefore, appear that when the motor is thoroughly "worked up" in practical shape it has commercial possibilities which are very attractive.

As late as April 21 snow threatened to tie up one of the lines in the central part of New York State. On that date a car of the Auburn & Syracuse Electric Railway, leaving Auburn at 10 a. m., encountered drifts so deep that it became necessary to put one of the rotary snow-plows ahead of the car as far as Marcellus. Conditions near Skaneateles and Marcellus are said to have been as bad as at any time during the winter.

CORRESPONDENCE

REPAIR SHOP PRACTICE

Denver, Col., May 14, 1904.

Editors Street Railway Journal:

A few days ago the writer went through the repair shops of a large steam railway company, thinking that he might pick up something of interest to the street railway man. The problems of the locomotive and car shop are, of course, heavier than those we encounter in the street railway repair shop, as far as mere size goes, but the use of electric cranes, compressed air and motor-driven tools, arrangement of yard trackage and power plants, brings up about the same questions of flexibility and economy, whether we are running a locomotive or a motor hospital.

The intense activity of the place was striking. Every employee seemed to be on hand for business, and there was no sign of hesitation in the work, from planing down cross-heads to riveting boilers. One does not always see a like attention to work in the street railway repair shop, or an equal comprehension of exactly the thing to be done next, by every employee. The opportunity for employees of the train service to loaf in this shop is almost nil, and even outside visitors are not allowed without a permit from the master mechanic—a condition much different from a shop the writer once visited in a Massachusetts street railway system, where the doors were open to all the relatives and friends of the workmen without the least formality. The effect on discipline was plainly evident.

In passing through the locomotive shop, where engines were seen in all stages of dismantlement and repair, one could not but feel that the handling of electric locomotives in the repair shops of the steam lines which are rapidly coming to adopt them is going to be an easier and, therefore, a less expensive task than the repair of steam locomotives is at the present time. The elimination of the boiler, which grows to be of literally tremendous proportions in the compound consolidation engines which haul modern freight trains, and the greater simplicity of motor equipments in comparison with all the details of cylinders, valve motions, eccentrics, spark arresters, crank pins, counterbalances, piping, levers and throttles which make up the harness of the iron horse, form the basis of this prediction. The electric locomotive ought to become far more accessible than the steam machine, when it comes to detail parts.

An interesting notice posted on the shop walls described the apprentice system of the place, stated the rules in force as to working hours, conduct of employees and the wages paid to machinists. Apprentices' wages run from 10 cents per hour in the first year of their four years' term to 20 cents per hour in the last year. The minimum wage for full-fledged machinists is 34 cents per hour. A clear statement of these matters, posted in the shop where everyone can consult them at will, is certainly a good precedent to follow, and such a course has considerable effect in reducing misunderstandings on the part of the man. I quote the above figures as a matter of general interest.

In various parts of the shops an elaborate set of rules for the prevention of fires was posted. This was, perhaps, the most suggestive thing which the writer saw. The fire risk is a question which never leaves us, and the constant occurrence of severe conflagrations in different parts of the country justifies its discussion at almost any time. Among these rules was one forbidding the use of unventilated or closed lockers. Strange to say, the rules were posted upon the end of exactly this forbidden kind of a locker. Then, again, the most stringent precautions were specified in regard to the wiring of the electric motors, switchboards, etc. Within a few feet of the regulations were three or four 220-volt motors, operating woodworking machinery. Each of these motors was a machine of

from 25 hp to 35 hp, entirely exposed to dust, shavings and chips, and, to cap the climax, so covered over with sawdust that even the raised letters of the name plates were undecipherable. The field spools looked as though they had been dipped in a flour barrel. Some of the switches were mounted upon wooden bases, and in the machine shop, incandescent lamp cord, carrying 220-volt current, was run about promiscuously in all manner of oily places. There were some excellent rules about the use of metal match boxes, the storage of oil, gasoline, etc., outside main buildings; the prohibition of smoking, reporting of defects, the accumulation of rubbish, disposal of oily waste, the use of sand instead of sawdust, provision of ladders, fire-alarm box keys and fire pails, and the use of coal oil lamps. The piling of coal in heaps over 7 ft. high was forbidden, without the provision of ventilation through the center or the placing of thermometers in pockets. The setting of stoves on concrete, cemented brick, stone or metal footings was specified, as well as the protection of woodwork by sheet metal and air spaces; the annual inspection of chimneys and flues, the separation of steam pipes from woodwork, disposition of ashes in metal cans and their daily removal, and the use of rigid gas fixtures.

The drawing of such regulations is well enough, but they are useless in cases where they are not enforced. Far too often are rules of this character posted, read by all employees, accepted by everyone as wise and then—forgotten. The reason does not lie so much in lack of discipline as in the time-honored fact that "everyone's business is no one's business." It is a pretty safe plan for both electric and steam roads to place upon some individual employee the responsibility of seeing that rules pertaining to the fire risk are enforced, and that no fires occur through carelessness in regard to the regulations. The question is an important one, and with the experience of this year in Toronto, Buffalo, Rochester and Baltimore as object lessons, we should need little additional stimulus toward all "getting down to business" in the matter of fire prevention and doing our united best to stamp the great curse of conflagration out of modern industrial life.

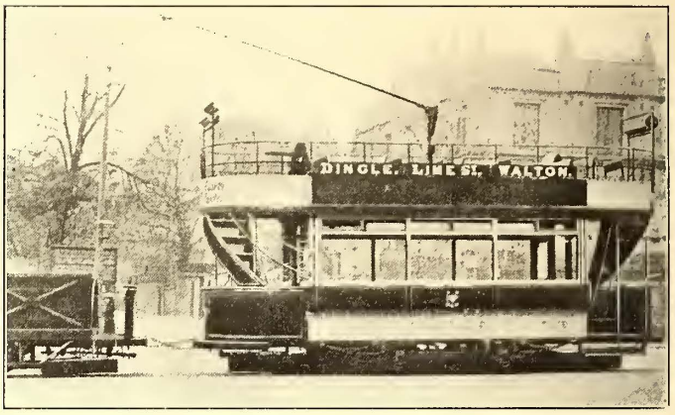
Observer.

WHEEL GUARDS IN EUROPE

Boston, May 13, 1904.

Editors Street Railway Journal:

Since you published an illustrated account in the issue of Aug. 15, 1903, of the fender used in Liverpool, another year's records are available with interesting results; for, in the three years now since its introduction, no person has ever been run over by cars equipped with it, though 132 persons have been actually under the cars. All of these people were pushed off the track clear of the wheels, owing to the plow-shape of the fender, only 20 per cent requiring medical assistance. Besides the tendency to reduce the extent and the cost of accidents there are no waits for a wrecking wagon to come and jack up a car. As the fender pushes snow off the track as well as people, a trial in this country would be interesting for more than one reason. Since in Liverpool some snow was found to collect in the rear half of the plow, the rear nose can now be kept lifted up by a chain from the platform above, leaving a free opening for any snow to pass through.

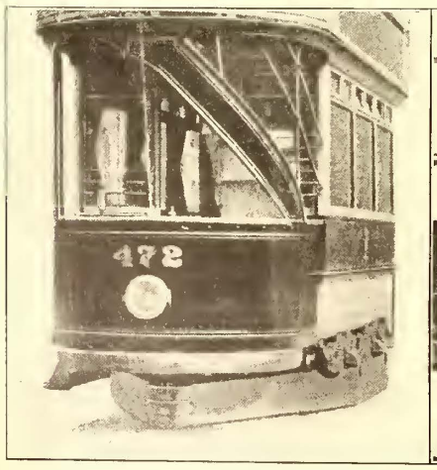


DOUBLE-DECK CAR IN LIVERPOOL, SHOWING WHEEL GUARD

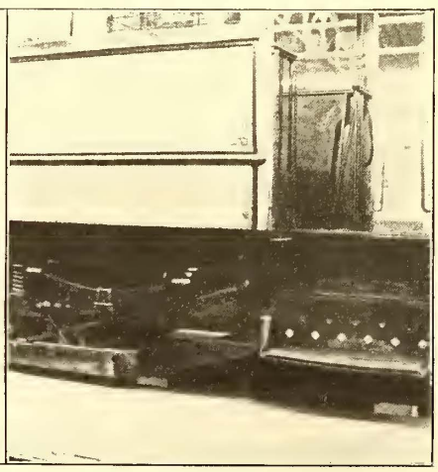
The plow-shaped wheel guard may be found in this country, but it is more common in Europe, especially Paris. In no place, however, have the details been so perfected as in Liverpool, where the great length of the plows, the bluntness of the rubber-covered ends, the attachment of the guard to the axle boxes, thus keeping the belting at the bottom always at the same height above the tracks, all contribute to the success of the device. While the prefect of police in Paris announced last year as conditions for fenders that they must not project beyond the platforms, and must be capable of being lowered on to the track either by the motorman or automatically, on the principle adopted in Marseilles and Munich, the Tramways Union of France objected to all these proposals and preferred having a fixed fender like the Liverpool one, and powerful brakes and alert motormen to any complicated system of movable gratings or nets.

The upper view shows a Liverpool salt car as well as a car fender. While the city has snow-plows and a snow sweeper the first thing done in a snowstorm is to salt the entire street railway track, 100 miles being covered in about 40 minutes, requiring about 70 tons of salt. The second cut shows an end view of the same car, while the third engraving illustrates a different type of wheel guard used by the Cie Générale Parisienne de Tramways.

John P. Fox.



END VIEW OF LIVERPOOL WHEEL GUARD



WHEEL GUARD USED IN PARIS

A decision, handed down by the Court of Appeals at Brooklyn, N. Y., holds street railway companies liable for accidents on their cars and for courtesy by their employees as well. A women sued the Brooklyn Heights Railroad because a conductor refused to return her change and characterized her as a dead beat and swindler in the presence of the other passengers. Justice Stover ruled that the company was not responsible for the language of the conductor, and directed a verdict for the 20 cents change. Now the Court of Appeals has sent the case back for a new trial, declaring that the carrier is responsible not only for the safe carriage and delivery of the passenger but for his respectful treatment also.

TWO-BELT CONVEYOR SYSTEM

The extent to which belt conveying has become a factor in modern engineering practice, makes any radical departure, especially in the line of improvement, particularly interesting. Belt conveyors have been, without exception, designed on the fundamental principle of causing the belt to be troughed or cupped. This has been accomplished by using concentrators, either independently of the horizontal carrying pulley or in various combinations. This, to-day, with the exception of the system to be described, represents the most common type of belt conveyors.

The angles of the concentrating rollers have been varied from 45 per cent to as low as 20 per cent, these changes being made because experience showed that the wear on the belt, by causing it to bend abruptly, is very damaging and destructive to its life. As the belt is forced to make an angle more or less sharp, all the strain is concentrated on two points. Again, the three-pulley type of carrier requires that the pulleys be loose on the shafts, the friction surface is very great, and the tendency of the side rollers is to wear in such a manner as to produce in time a gyrating motion.

FIG. 1.—CARRIERS USED IN TWO-BELT CONVEYOR.

In the two-belt conveyor system, designed by the Ridgway Belt Conveying Company, of New York, an interior troughing and supporting belt runs over its individual head and tail pulleys, having separate take-ups, and is entirely independent of the conveying belt proper. The conveying belt is threaded over its head and tail pulleys in the usual manner, and has its separate take-up, so that the two belts, although moving together in the same direction at the same speed, are entirely separate and distinct. This enables the conveying belt to be lifted off the supporting belt and out of the troughing blocks and passed through either a stationary dumper or a moving tripper.

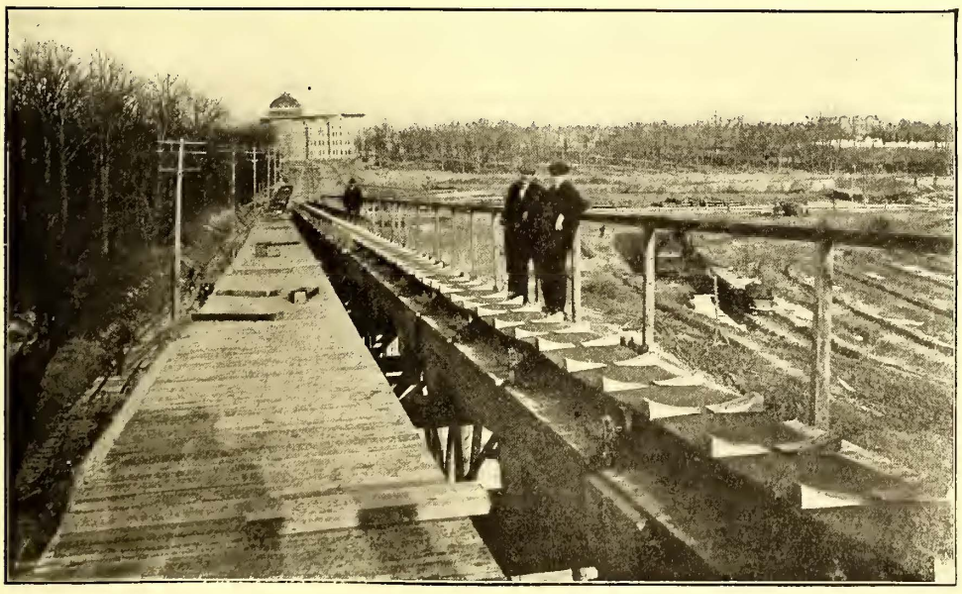


FIG. 2.—INTERIOR TROUGHING AND CARRYING BELT

The conveying belt has no work put upon it other than that required to drive the lower carriers and its own head and tail pulleys, all the carriers on the upper line, which comprise two-thirds of the total number used, being revolved by the inner supporting belt. The strains, therefore, are divided, the belt revolving two-thirds of the moving parts not being subject to the wear and tear of carrying the load, and the belt carrying the load being relieved of the strains and wear and tear of revolving the greater part of the moving parts of the machine. This produces a divided labor in wear and tear which enables both belts combined only to represent in strength what would be required of one belt in any one-belt system.

The interior belt is driven by a roller or block-chain sprocket drive from the main driving shaft, and with the two belts in tension just sufficient to prevent slip on their driving pulleys; both belts move at exactly the same speed in the same direction, and there is no rub of the conveying belt on the troughing blocks. At the points where the conveying belt meets the interior supporting belt, to prevent the rub and wear caused by the troughing blocks moving in a larger radius (the conveying belt being at the same height as the center of the supporting belt) a pair of concentrating rolls lifts the edge of the belt and drops it into the troughing blocks. The same method is used where the conveying belt leaves the troughing blocks at the opposite end.

Fig. 1 represents the carriers used in the two-belt system. They are straight rollers fastened to steel shafts revolving in babbitted boxes, the boxes being ball and socket, ring oiling, felt washered and dust proof. In the two-belt system the conveying belt proper lies in a natural position, a true segment of a circle, with the strains distributed over its whole width uniformly. This increases the life of the belt from 75 per cent to 100 per cent over any type of pulley-troughing belt.

Fig. 2 shows the interior troughing and carrying belt with its troughing blocks attached. This interior belt, by a compensating drive, is driven at the same speed as the upper carrying belt, and the two move together through their entire travel

on both the upper and lower sides. The conveyor belt proper for the two-belt system is a machine-made belt with a protective cover of average good material. The special belts, which are made to conform to the hard conditions of continuous flexing, are hand-made belts, and to give satisfactory service must be made of the highest grade of material to stand the wear and tear of angular bending.

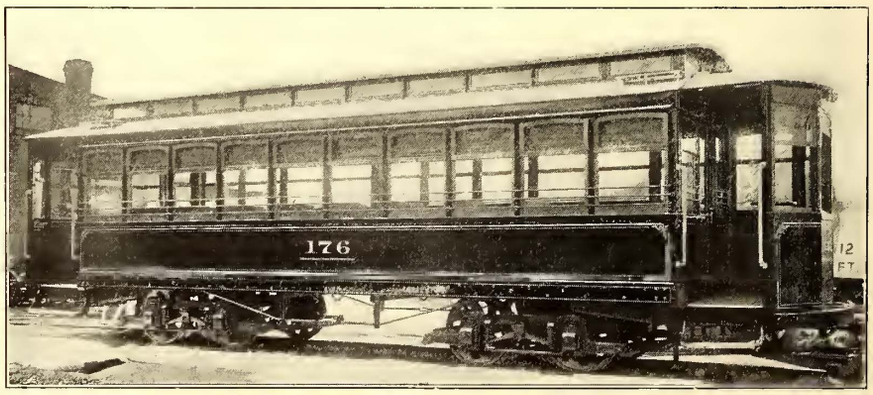
The inner or troughing belt carries the outer or conveying belt through the upper line of working travel and the outer belt carries the inner belt on its return, and through its travel in the lower line. The ability to use straight rollers, all strains being compression strains and not bending or breaking strains, enables the use of the lightest castings that can be machined and finished. This reduces the weight, cost and power required. Only a clean belt comes in contact with the upper carriers, which comprise two-thirds of the total number used. When the conveying belt proper, the only one necessary to be renewed, gives out, the cost of its renewal is stated to be approximately one-half in the two-belt system of what similar material would cost in any type of single belt conveyor.

NEW CARS FOR DES MOINES CITY RAILWAY

The Des Moines City Railway Company has received twenty new cars like the one shown in the illustration from the American Car Company, of St. Louis. Evidently the seating arrangement, which the interior illustration shows, is satisfactory, for the company had eighteen cars with this arrangement built for it last year by the American Car Company. The purpose, of course, is to obtain the largest seating and standing capacity possible to the area of the floor. The transverse seats are 32 ins. long, and made so that a person's body may extend a trifle over the end without discomfort. The wide aisle obtained by having the seats on one side placed longitudinally accelerates the movement of passengers in and out—an important consideration in city service, for which the cars are intended. The entrances of the vestibules are both at the same side, as the cars run in one direction only. The sashes in the vestibules are arranged to drop into pockets, while in the car the upper sashes are stationary and the lower arranged to be raised. The interiors are finished in cherry with ceilings of the same made of tongued and grooved boards.

SEATING ARRANGEMENT OF DES MOINES CAR

The length of the cars over end panels is 28 ft.; over crown pieces, 37 ft.; from panel over crown piece, 4 ft. 6 ins.; width over sills, including panels, 8 ft.; from center to center of posts, 2 ft. 8¾ ins.; side sills, 4¾ ins. x 7¾ ins.; end sills, 4 ins. x 7¾ ins. The side sills are plated on the outside with ⅝-in. x 8-in. steel. The thickness of the corner posts is 4½ ins., and of side posts, 2¼ ins. From the rail to top of step is 18 ins., and from step to platform, 14 ins. The cars are furnished with Brill sand-boxes and angle-iron bumpers, and cars are mounted on Brill No. 27-G trucks, with 4-ft. wheel base and 33-in. wheels, having 2½-in. tread and ¾-in. flange. The trucks are equipped with 38-hp motors.



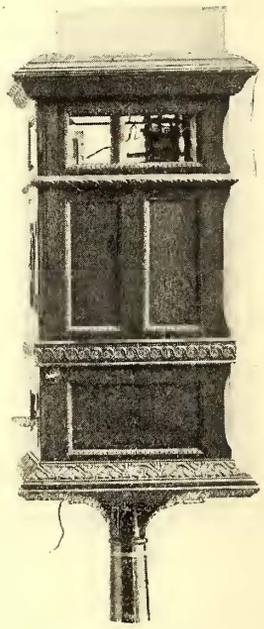
EXTERIOR OF CAR USED BY THE DES MOINES CITY RAILWAY

THE PHOTOSCOPE

Among the many ingenious devices invented for the edification of visitors to picnic parks is the nickel-in-the-slot photographing machine made by the Photoscope Company, of New York. This machine is operated simply by pressing a button at the end of a flexible cord, held by the person whose photograph is being taken. It is reported to be giving excellent results and should prove a highly profitable attraction wherever introduced.

This machine takes pictures continuously as fast as a person can pose in front of it. Its capacity is from six to eight exposures per minute, and during the time of exposure others which have preceded are being developed and finished inside of the machine. It delivers a perfect photograph,neatly framed and finished, in less than 1 minute, and will operate regardless of the weather, making as perfect a likeness under the electric light as on a bright, sunny day.

The simplicity of the photoscope is one of its most advantageous features. Every movement is a rotary one, which gives the least friction, and is the least liable to get out of order. By removing the top of the cabinet, the mechanism is entirely exposed to view, and all parts made accessible.



THE PHOTOSCOPE

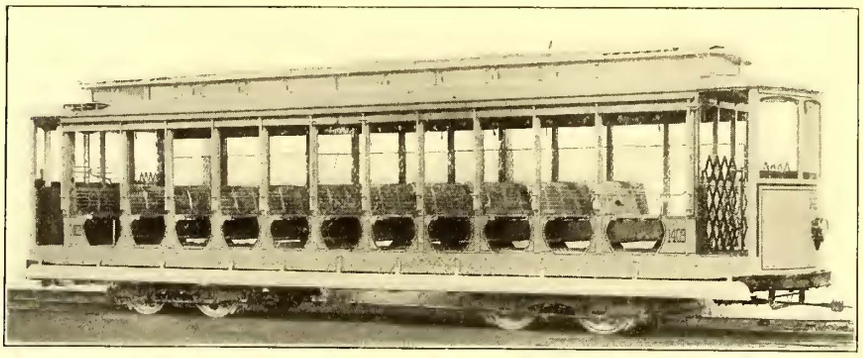
The great advantage which this machine has over other nickel-in-the-slot machines is that its novelty does not wear out, and it gives a permanent value for the money spent. As

a person sees himself in the mirror on the front of the photoscope so will the picture be produced. The manufacturer states that this is the only self-operating photographing machine in the world that delivers a picture completely finished and framed.

It is possible to take from six to eight pictures a minute, but as it takes some little time to seat each person three pictures per minute is believed to be a conservative estimate. The pictures made by this machine are about 1 in. in diameter. As many people desire brooches for such photographs the manufacturer has arranged to supply them to machine users at a slight additional charge.

OPEN CARS FOR THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

The Public Service Corporation of New Jersey has just added to its rolling stock sixty new open cars of the type shown in the accompanying illustration for use on various sections of its lines between Jersey City and Trenton, which, though extensive, form but a part of the great system operated by the company. The cars and trucks were built by the J. G. Brill Company, and have a number of interesting features in plan and construction. The body framing is of unusually powerful construction. The long-leaf yellow pine side sills are 4½ ins. x 7⅞ ins., plated on the outside with 10-in. x ¾-in. steel plates the full length of the sills. The end sub-sills are of white oak, 3¼ ins. x 4 ins. The center and intermediate crossings and the diagonal braces are of the same material. One ¾-in. tie-rod at the side of each crossing extends through the outside sill, and is bolted against and bears upon the outside sill plates. The short framing and the trap door framing have ½-in. rods, and are plated to obtain the greatest possible strength. The wooden sills are protected by plating on the inside from the wheels in case of derailment. The side posts are 2¾ ins. thick, and the corner posts 4⅜ ins. The top rail, of yellow pine, is secured by a heavy letter panel gained into it as well as into the posts. This panel is 1⅛ ins. x 7½ ins. There are steel carlins to every post in addition to the usual wooden rafters. The ceilings are of three-ply maple veneer, neatly decorated. The sashes in the bulkheads and in the vestibules are arranged to drop into pockets. In addition to guard rails, which slide behind the grab handles on both sides of the car, net guards, 18 ins. wide, and in two sections, are provided for one side and may be readily changed from one side to the other. It is only intended that the motorman shall occupy the front platform; therefore, the platforms are short, with folding gates at the entrances. The height of the running board from the railhead is 19½ ins., and from running board to car floor, 17½ ins. The cars are furnished with ratchet brake handles, radial drawbars, round-corner seat-end panels, and other specialties of the builder's make. The trucks are Brill No. 27-G. E.-1, with 4-ft. wheel base, 33-in. wheels and 4¼-in. axles. The radius of the shortest curve on the lines is 30 ft. The motor equipment consists of four 40-hp motors.



OPEN CAR FOR PUBLIC SERVICE CORPORATION OF NEW JERSEY

EMERGENCY CAR-LIGHTING EQUIPMENTS

The advantage of having auxiliary car-lighting equipments for use in emergencies, particularly in dark and lonely places, is undisputed, but hitherto very few have been installed, owing to the complexity and expense of the methods suggested. Recognizing the need for some simple and reliable scheme, the Federal Electric Company, of New York, has placed on the market a very compact arrangement for this purpose.

The method employed by this company obviates any necessity for specially charging the storage batteries used in the auxiliary lighting system. An automatic switch is placed in series with the regular 500-volt lamp circuit ordinarily used. This switch can be placed in circuit with either one, two or three series of lamps. The storage batteries are in series with the switch. Although the flow of current to the batteries is very small, they are always well charged, as they are constantly in circuit.

Four to six additional lamps are placed in each car for operation by the batteries whenever the trolley current is interrupted from any cause. The switch automatically throws the storage batteries into circuit, and as soon as the trolley circuit is restored automatically throws off the current from the auxiliary or emergency lighting circuit.

The storage batteries required do not weigh over 150 lbs., and can be placed underneath the car seats together with the automatic switch. Separate indicating switches are also supplied to cut out of service the storage batteries either from the charging or the lighting circuit as desired. Each car is supplied with a voltmeter, so that the motorman may know at all times the condition of the batteries.

By using this auxiliary system it is possible to have lamps in service either for the front or rear headlights, such an arrangement being very serviceable in preventing collisions on single-track roads. In addition to this, one lamp is sometimes placed above the top of the car with a reflector to assist the conductor to replace the trolley pole on the wire.

ELECTRIC RAILWAY TIME-TABLE BETWEEN PHILADELPHI AND NEW YORK

The Trenton & New Brunswick Railway Company has just issued a through time-table of the train schedules via that line between Philadelphia and New York. As at present arranged the trip from Philadelphia to Trenton is made by steamers of the Delaware River Navigation Company; the trip from Trenton to New Brunswick by the Trenton & New Brunswick Fast Line, from New Brunswick to Bound Brook the traffic passes over the Middlesex & Somerset Traction Company, and from Bound Brook to New York over the lines of the Public Service Corporation. The fare charged from Philadelphia to New York is $1.10 single fare, and $2 a round trip. The running time from Trenton to New York is 5½ hours, and fromTrenton to New Brunswick 1½ hours. Tickets must be purchased at the ticket offices of the company to secure the benefit of these low rates of fare, and are good until used.

Buenos Ayres, Argentina, probably stands pre-eminent as a city of street cars. With the exception of two streets, there is a line in every one of the principal thoroughfares, with a total of 275 miles of track. Leading out to the suburban towns of Belgrano, Palermo and Florest, there are overhead trolley lines equipped with American apparatus. In 1900 a total of 116,447,982 passengers were carried.

FINANCIAL INTELLIGENCE

Wall Street, May 25, 1904.

The Money Market

If the usually accepted signs may be trusted, the end has about been reached in the season's extraordinary gold movement; sterling exchange has gradually eased off until it is fully a half cent in the pound lower than two weeks ago. Except for a few comparatively small consignments, contract for which has already been made, no further engagements are in prospect, nor does it appear at the lower exchange level that further shipments would be profitable. It is understood that nearly the whole $40,000,000 involved in the Panama Canal purchase has already been sent abroad, and that whatever small amount may still have to go will be postponed until such time as suits the shippers. Now that money rates have risen to a parity with the foreign markets there is no immediate cause for the outflow to continue. Reviewing the whole of this remarkable episode in American finance, there is good cause for congratulation in the way our money market has behaved during the trying interval. Within the last six weeks over $57,000,000 gold has been sent to France. Our money rates have risen less than an average of 1 per cent, and the surplus reserve of the New York banks still stands at the comfortable figure of $12,000,000. For this result a great deal is due to the skillful handling of the Panama transaction on the part of the banks engaged in it, and to the intelligent co-operation of the treasury officials. The plan of drawing down government deposits from different sections of the country, instead of confining the treasury call to this city alone, has lessened the strain by diffusing it. The interior banks have made good a large part of the losses to the New York institutions, and the cash reserves of the latter have therefore suffered no very severe decline. Another very important relieving factor has been set in operation automatically as it were by the advance in money quotations. Trust companies and banks outside of New York, which for months past have not cared to place their funds on the market directly, owing to the unprofitable interest return, have now begun to lend again. In consequence, they have assumed a portion of the credits hitherto carried by the Clearing-House members, and have thereby, through the reduction in liability, supplied another important means of sustaining the surplus reserve. Last Saturday's bank statement reflected this shifting process in a $22,000,000 decrease in loans, which was slightly more than enough to offset the $7,000,000 decrease in cash holdings of the week. The surplus remaining stationary in a period where gold exports amounted to $13 000,000, it can be safely assumed that bank resources have passed the low level for the season, and from now on will improve. It may also be concluded that money will work no higher than it has during the past two weeks until the autumn crop demands begin to be felt. Within the last few days, in fact, call money has begun to relax, the ruling rate at this writing being 1½ to 1¾ per cent, as compared with 2 to 2¼ per cent a week ago. Sixty-day money is also a shade easier at 2½ per cent, and six months money at 3½ per cent. At these figures offerings of funds are much more liberal than they were, while the demand is very moderate.

The Stock Market

A better feeling has developed on the Stock Exchange this week, partly because of improvement in outside conditions, but more largely because of the belief that liquidation at the recent low level of prices was pretty well completed. Cessation of gold exports has removed whatever misgivings there were lest the money market should cause trouble. Advices from growing crops have been decidedly more cheerful, so much so indeed that hopes are expressed that the June report on winter wheat will show a condition equal to the one of a year ago. Meanwhile both spring wheat and corn are making good progress on a considerably larger acreage than last year's. In these two respects the financial situation has taken a positive turn for the better, and the week's movement of security prices has reflected the change. But the condition we now have in the market is one in which technical considerations—those relating to the quality of the buying and selling, to the thoroughness of the liquidation, the size of the short interest, etc.—play the most prominent part. Wall Street has become convinced that there can be no real improvement in prices until many things which now appear dubious in the financial outlook are settled—until more light is thrown upon the outcome of the presidential campaign, upon the fate of the harvest and upon the tendency of general trade. Railroad earnings are not as good as they were, reports from the steel industry are not encouraging, business elsewhere everybody agrees is dull. Under these circumstances, with nothing but an occasionally over-extended short interest to put prices up, the leading question is whether prices can or cannot be forced down any lower, in other words, whether there are any more stocks to be thrown on the market for no other reason than sheer disgust on the part of their owners. The answer to this question contains the main interest there is in the dealings of the immediate future.

The local traction stocks have been favorites in the week's operations for the rise. Brooklyn Rapid Transit, both stock and bonds, has been conspicuous in the movement. The best explanation undoubtedly lies in the fact that the inside speculative party is more inclined to help a bull campaign, in these issues, than is now the case with any other group of securities on the list. Brooklyn Transit's earnings are, of course, increasing, and this is the season when its business reaches the maximum. These are matters of common knowledge. It is also well to consider the possibility that one of the chief objects in making the stock strong, is to create a better market than has heretofore existed, for the bonds. The rise in Manhattan and Metropolitan has been more or less sympathetic, the buying in the latter instance coming mainly from recent short sellers.

Philadelphia

One of the interesting episodes in the week's Philadelphia dealings was the discovery that for some time past many holders of Electric People's Traction 4 per cent bonds have been swapping their investment for Philadelphia Traction stock. Both are guaranteed 4 per cent dividends by the Union Traction and are accordingly assumed to be pretty near equal in investment value. The stock, however, has for a long while been selling considerably below the bonds, and this difference has provided the incentive for the exchange. The recent heaviness of the Electric People's bonds—now selling around 98⅝—and the recent activity and strength of the stock between 95⅝ and 96 are now satisfactorily explained. The declaration of the regular dividend on Philadelphia Electric was already anticipated by last week's sharp recovery in the stock. This week the stock eased from 5⅝ to 5⅜, and later, with the dividend deducted from the price, sold at 5¼. Philadelphia Company common rose from 37⅝ to 38¼ on fairly active trading, but the preferred dropped a half point from 44½ to 44. Union Traction was dull and steady at 49⅞. American Railways sold up from 44½ to 45, and later reacted to 44⅞. One sale of Rapid Transit at 13 was all that was done in that stock. Only one sale of Consolidated Traction of New Jersey at 65 was reported. Odd lots were recorded of Pittsburg Traction preferred at 49¾, Union Passenger Railway at 230¼, Union Traction of Indiana preferred at 70⅞, and Rochester Passenger preferred at 99¾ and 100.

Chicago

There is a report, which, however, lacks confirmation, that New York capitalists identified with the new regime in the Union Traction Company have obtained options on large holdings of City Railway stock, with a view to the consolidation of the two properties. If this be true, the market at least has failed to give any intimation of it. Only 50 shares of Union Traction common sold all the week at 5½, and only one transaction of the preferred was reported at 27½, while there were no sales of City Railway at all. Metropolitan Elevated issues were stronger, the preferred rising from 46 to 48 an sales of 300 shares, and the common gaining a point from 15⅛ to 16⅛ on sales of a like amount. Good increases in earnings were the cause of this improvement. North western Elevated common changed hands at 16, and 50 shares of the preferred at 44. An odd lot of South Side went at 91. Lake Street receipts after touching 3 sold at 3⅛. A small block of North Chicago passed at 69¼ after which 100 shares sold at 70. One trade in West Chicago was reported at 40.

Other Tractions Securities

Boston traction specialties have varied very little during the week on a light volume of trading. Prices are about the same as they were a week ago, Boston Elevated holding steady around 141, West End common between 90½ and 90, and West End Preferred at 111. Massachusetts Electric common, after selling as high as 18½, weakened to 17¾. The preferred, on a few transactions, recovered from 69¼ to 70¾. In Baltimore

the United Railway issues have been depressed again, more particularly the 4 per cent mortgage bonds and the stock. The first named fell a half a point from 90 to 89½ and rallied to 89¾. After 900 more shares of the stock had passed over at 6½, the quotation was lowered to 6¼, and 180 shares went at that figure. The income bonds sold up to 48¼, 1½ points above their low record of a week ago, but subsequently they eased to 47¾. Other sales in Baltimore for the week comprised Virginia Electric Railway and Development 5's at 93¼, Atlanta Street Railway 5's at 106, Anacostia and Potomac 5's at 97½ to 98, and Lexington Street Railway 5's at 102. On the New York curb the feature has been the strength of Interborough Rapid Transit, which has made a new high record for the season. Three thousand shares changed hands last week between 108¼ and 112½. Six hundred more sold Monday, the high price being 112⅝, while yesterday the stock touched 112¾ and then dropped to 112 on sales of 400 shares. One hundred New Orleans common sold at 8½, and 200 of the preferred from 27 to 26⅝. An odd lot of Washington Traction went at 14. The bonds were strong, rising from 76¾ to 77. Nassau Electric 4's sold at 80 and 80⅛.

Cincinnati Street Railway showed considerable activity in Cincinnati last week. About 900 shares sold at 137½ to 138½, the latter the closing price. Cincinnati, Dayton & Toledo stock was in good demand and about 300 shares in small lots sold at 19½ to 20. Cincinnati, Newport & Covington common was firm at 85½ for a number of sales, and the common sold at 29⅝. Several blocks of the 5 per cent bonds of this company sold at 109, and $20,000 worth of Cincinnati, Dayton & Toledo 5's sold 81.

Cleveland Electric gained a trifle, and several lots sold at 72 in Cleveland last week. Syracuse Rapid Transit came into the market at 75½ for several lots. Northern Texas Traction 5 per cent bonds sold at 78 for $18,000 worth, a trifle lower than last week. There is considerable demand for small lots of these bonds.

Iron and Steel

The leading authority in the iron trade reports a sudden rather remarkable increase in the export movement, which it estimates will shortly reach a rate of 100,000 tons per month for steel and finished products. This is a very gratifying development, in that it provides the one sufficient offset needed for the decrease in home consumption. The home demand continues very light, and the Southern furnace men have found it necessary to make a further concession in their quotations on pig iron. A moderate increase is reported in standard steel rail order, and a more active trade in lighter rail, although at a considerably lower price level. Quotations are as follows: Bessemer pig iron $13.60, Bessemer steel $23, steel rails $28.

Metals.

Quotations for the leading metals are as follows: Copper 13 and 13¼ cents, tin 27¼ cents, lead 4½ cents, and spelter 5 1-16 cents.

Security Quotations

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

	Closing Bid May 17	May 24
American Railways	44½	44½
Aurora, Elgin & Chicago	—	a14
Boston Elevated	140	140½
Brooklyn Rapid Transit	45⅜	46⅜
Chicago City	155	156
Chicago Union Traction (common)	5¼	5½
Chicago Union Traction (preferred)	29	29
Cleveland Electric	—	71
Consolidated Traction of New Jersey	65	64¾
Consolidated Traction of New Jersey 5s	107½	107
Detroit United	61¾	61⅜
Interborough Rapid Transit	110⅜	112
Lake Shore Electric (preferred)	—	a35
Lake Street Elevated	3	3
Manhattan Railway	142¾	143¼
Massachusetts Electric Cos. (common)	17½	18
Massachusetts Electric Cos. (preferred)	69½	71
Metropolitan Elevated, Chicago (common)	15	16
Metropolitan Elevated, Chicago (preferred)	46	48
Metropolitan Street	110	110¼
Metropolitan Securities	75	77
New Orleans Railways (common)	8	8¾
New Orleans Railways (preferred)	26	26⅝
New Orleans Railways 4½s	76	74
North American	83½	81
Northern Ohio Traction & Light	—	13½
Philadelphia Company (common)	37⅝	37⅝
Philadelphia Rapid Transit	a13½	12½
Philadelphia Traction	95¾	95⅝
St. Louis (common)	13	13
South Side Elevated (Chicago)	91	91
Third Avenue	116	116
Twin City, Minneapolis (common)	93½	94½
Union Traction (Philadelphia)	49⅞	49⅝
United Railways, St. Louis (preferred)	57	57
West End (common)	90	90½
West End (preferred)	a111	111

a Asked.

THE McKINLEY SYNDICATE'S OPERATIONS

The McKinley syndicate, which owns a number of important street railway properties in the West, decided last year on the construction of an extensive system of interurban lines with Springfield, Ill., as a center. Accordingly construction was commenced last year upon 150 miles of line extending from Decatur, Ill., west to Springfield, and south from Springfield to East St. Louis. This line, however, is to be only part of the entire system, which will embrace about 250 miles of road in all. For the convenience of financing, it was found advisable to divide the scheme into small corporations. The name of the Decatur, Springfield & St. Louis Railway Company was dropped and the St. Louis & Springfield Railway Company is now building a road from Springfield south, and the Illinois Central Traction Company is constructng a line from Springfield east. All material is on the ground for 80 miles of the track, extending east and south from Springfield, and this portion of the road, it is expected, will be in operation by Aug. 1. It is planned to begin operating at once about 25 miles of the road from Riverton, on the east of Springfield, to Auburn, on the south. A $400,000 power house is now under construction at Riverton, a town on the Sangamon River about 8 miles east of Springfield. Nearly all the machinery for this power house is on the ground, and same will probably be completed inside of sixty days. W. B. McKinley, of Champaign, Ill., the president and general manager of the Danville, Urbania & Champaign Railway Company, is also president of the Illinois Central Traction Company and the St. Louis & Springfield Railway.

CHICAGO RECEIVERS APPLY FOR INJUNCTION AGAINST MINORITY STOCKHOLDERS

Notice has been served on the attorneys for the minority stockholders of the North & West Chicago Street Railway Companies that the receivers will make application in the State Supreme Court at Springfield for a review of the recent decision of the Court of Appeals by which the injunction against the minority stockholders was dissolved and the decision of Judge Grosscup reversed.

Separate petitions for writs of certiorari are to be filed by the receivers of each company against the plaintiffs in the two cases now pending in the State Court. Practically the same arguments will be made in each application for a writ. It will be alleged that Judge Grosscup in no way exceeded his rights in restraining the minority stockholders from pressing their suits in the State Courts, and that what he did was for the best interests of all concerned.

While planning for this move in the State Supreme Court, the attorneys for the traction companies filed an answer in the State Court in the Jacob Miller suit, denying the right of the State Court to investigate the affairs of the underlying companies and asserting that the Federal courts are the only courts having jurisdiction over them.

This latest move is merely another attempt by the receivers of the North and West Chicago Companies to have the minority stockholders in the companies enjoined from interfering with the operation of the line by the present management and from seeking in the State courts to have the amended leases existing between these underlying companies and the Union Traction Company annulled.

An American syndicate, represented on the spot by Hugo Gruning, proposes to construct an extensive electric traction system in Rosario, Argentine Republic. The new lines will traverse portions of the city at present unserved by tramways. The existing lines represent an aggregate of about 40 miles, and are mostly horse roads. The principal system is operated by the City of Rosario Tramways Company, which has about 12 miles of track.

TRACTION OFFICIALS MAKE LONG TRIP

Henry A. Everett, Charles Wason and several other prominent Cleveland traction men, started Monday, May 23, on a trip over the various traction lines in northern Ohio, Pennsylvania and New York, between which there now are connections. They went as far east as Westfield, N. Y., traversing the Cleveland, Plainesville & Eastern Railway, the Cleveland, Plainsville & Ashtabula Railway, Ashtabula Rapid Transit Company, Pennsylvania & Ohio Railway, Conneaut & Eastern Railway, Erie Motor Company and the Erie Rapid Transit Company. The trip was made in the "Josephine," the private car of Mr. Everett, which was described in the Street Railway Journal of Aug. 29, 1903. While no plans for connecting up the various lines and operating through cars are considered for the immediate future, it is quite probable that the inspection trip may lead to negotiations for arrangements whereby better connections may be afforded passengers who desire to travel considerable distances by the electric lines.

INTERPRETATION OF TRANSFER DECISION UPSETS ENGINEERS

The city engineer of Toledo, Ohio, is just now concerned with the question of what the meaning is of the recent transfer decision handed down by the Circuit Court, and which affects the giving of transfers by the Toledo Railways & Transit Company, which controls all the lines in the city. The whole question, it may properly be said, had its beginning in the action of the City Solicitor, Brailey, who instituted a suit for universal transfers. He passed it on to City Solicitor Denman. The Court rendered a decision, and when it could not be interpreted the judges gave it back to the solicitor and the attorney for the railway. The attorneys, so a supposed reliable authority says, gave their findings to the Court, and the Court gave them back to the attorneys. The problem to be settled rests in the interpretation of the words "the same general direction," which seems to have been the basis covering transfer provisions in all franchise grants. The words of the Court on this matter follow:

"The meaning of the phrase 'the same general direction' as contained in the statute hereinbefore mentioned and herein, is to be determined at the point of intersection or junction of two street railway lines, where such separate lines conjoined and prolonged as herein described will produce the least angle, and is ascertained by drawing straight lines, passing through the most distant point within the city of Toledo of each of such lines of street railway tracks to the point of intersection."

A SAN FRANCISCO RAILWAY PAPER

The United Railroads of San Francisco has commenced the publication of a semi-monthly paper for car distribution entitled "Transit Tidings," very similar in general appearance to those published in Detroit and a few other cities. The first issue of the new paper appeared on April 1, and the four succeeding issues indicate that the paper is readable and newsy and well able to fulfill the function for which it is intended. This, to quote from the official announcement, is to be "a vehicle by which to convey to our patrons and to the public generally, useful items of information concerning our street railway service." The paper contains general news and comments on the first of its four pages, and information in regard to the rent of special cars, observation and funeral cars on the last page.

ORDINANCE AGAINST END-SEAT OCCUPANT IN NEW YORK

San Antonio, Texas, recently passed an ordinance to compel persons who ride in open cars to occupy seats at the far side of open cars, so as to facilitate the ingress and egress of passengers, or in other words passed an ordinance against the individual who has come to be commonly known as the end-seat hog. It is just possible that the ordinance can be enforced in San Antonio, or that the residents will meekly comply with the mandate. That is matter for speculation. But it is not matter for speculation when an Alderman of New York introduces into the Council of that city an ordinance imposing penalties on street railway companies and passengers in any instance when a person occupying the end seat of an open car refuses to change to a vacant seat near the inside.

LUNA PARK SEASIDE FESTIVAL OF BROOKLYN RAPID TRANSIT EMPLOYEES' BENEFIT ASSOCIATION

By special arrangement with Thompson & Dundy, owners of Luna Park, Coney Island, the Brooklyn Rapid Transit Employees' Benefit Association is holding a grand seaside festival at that famous amusement resort. It was intended to begin the outing on May 16, but as some of the principal attractions were not ready on that date, the opening was postponed to May 23. The festival will continue for about two weeks.

The association has placed on sale at all Brooklyn Rapid Transit stations and ticket offices two forms of admission tickets. The ticket sold for 50 cents entitles the holder to visit a number of attractions which usually cost $1.00, while the 25 cent ticket is good for an entertainment which usually costs 50 cents.

PROPOSED MONTREAL-OTTAWA ROAD

The Ottawa River Railway Company, recently chartered by the Dominion Parliament for the purpose of building a railroad system between Montreal and Georgiana Bay, a distance of about 350 miles, proposes to start construction work practically immediately on the Montreal-Ottawa section, which will be electrically operated. Power will be derived from the Ottawa River. T. W. Raphael, a prominent member of the Montreal Board of Trade, is primarily interested in the scheme. The Montreal-Ottawa line is estimated to entail an expenditure of about $3,000,000.

THE ACCOUNTANTS' CONVENTION

A circular issued by W. B. Brockway, secretary and treasurer of the Street Railway Accountants' Association of America, announces Thursday, Friday and Saturday, Oct. 13-15, as the date of the eighth annual convention of that association. Originally but two days were assigned to this association, but as it is impossible to condense the program into that time and still give it good consideration, arrangements have been made to extend the time one day by using a different hall for the opening session. The full program will be published by the association about Aug. 15. The "Inside Inn," which is located within the grounds of the Exposition, has been adopted as the headquarters of the association.

A particularly interesting program is under course of preparation. Part of it will be a joint consideration, with the American Railway Mechanical & Electrical Association, of a subject equally interesting to both associations. Another part will be an expansion of the question box idea into what it is believed will be one of the best of the new branches of association work. This is somewhat of a novel feature in any national association, and blanks are being sent to each of the members of the association upon which queries can be filed. These questions will be printed and sent to each member of the association, with the omission of the name of the member making the inquiry, which will not be known to anyone outside of the secretary. The replies to these questions will then be printed before the convention and will be published for circulation among the members. They, with their answers, will also form part of the program, with opportunity for further discussion. As the compilation and printing require some time, members are requested to send all questions to the secretary by July 1, 1904.

By this action, the association places the combined experience of its members in a very positive way, at the disposal of the smallest and furthest company as well as the largest, which is an advantage of great value. The only condition imposed is that, naturally, the question should relate to an accounting subject.

The last convention directed the rebuilding of the collection of blanks. The secretary announces that this is progressing finely and will be completed and exhibited in the association's meeting room. At the present date over 20,000 blanks have been filed, which, together with others to be mounted, will make the most valuable library of contemporary practice in electrical railway records in the world.

From the above it will be seen that the convention will be an important one, and enough has been said to show that the association does not intend to make it any the less important this year because it is to be held within the grounds of a world's fair. The location means a large attendance, and the value of the program means interest.

NEW RECORDING FARE REGISTER

The patent, No. 758,444, for a fare register issued April 25 to Hyram Tyler, of Dayton, Ohio, and illustrated in the issue of this paper for May 14, has been assigned to John F. Ohmer, and by him to the Ohmer Fare Register Company, of Dayton, Ohio.

DEVELOPMENTS IN THE WESTINGHOUSE ORGANIZATION

A recent development of commanding interest in American industrial organization is the acquisition by the Westinghouse Machine Company of several well-known engineers and officials formerly prominent in the ranks of other industrial concerns. The Westinghouse Machine Company has within recent years been gradually building up its organization in order to more effectively handle the increase of business brought about to a large degree by its development of the steam turbine and the high power gas engine. Its latest action is therefore another step in this direction.

JOHN B. ALLAN

John B. Allan, formerly vice-president and general manager of the Allis-Chalmers Company, will shortly commence his duties as Western manager of the Westinghouse Machine Company, with headquarters at 171 LaSalle Street, Chicago, having direct charge of the entire western district. Mr. Allen has been prominently associated with the Allis-Chalmers Company for the past twenty-four years, and has filled positions of progressively increasing importance, including those of sales manager, general manager and vice-president.

Mr. Allan can truthfully be held up as a shining example of a self-made man. He was born in 1860, at Davenport, Iowa, and received a common and high school education in his native city, followed by a course at the Wooster Polytechnic Institute, from which he graduated in 1880 as a mechanical engineer. He immediately commenced practical work, entering the service of the Edward P. Allis Company, shortly after leaving college, wherein he was successively employed as draughtsman, machinist and erecting superintendent.

During this time Mr. Allan also had charge of making economy tests of engine and steam plants. In January, 1896, the company opened a general sales office in Chicago, of which Mr. Allan was made manager, the engineering as well as the selling departments coming under his supervision. Mr. Allan's subsequent career has been one of continuous advancement. He is a prominent member of the American Society of Mechanical Engineers and the Engineers' Club, of New York.

Arthur West, formerly engineer with the Allis-Chalmers Company, will also augment the organization of the Westinghouse Machine Company as chief engineer. He will make his headquarters at East Pittsburg. Mr. West is eminently fitted for his new position by his experience with the Allis-Chalmers Company, with whom he has been associated with for about seventeen years in various positions. For several years past he has had full charge of that company's entire pumping station work. Mr. West was born at Milwaukee, Wis., in March, 1867, and received a common school education at Milwaukee public schools, supplementing this by a technical course at the University of Wisconsin, from which he graduated in the class of 1887. This was followed by post-graduate work at the same institution, and he then entered the employment of the Edward P. Allis Company as a machinist, and his career with that concern has likewise been one of continuous advancement. Some of the positions which he has filled are those of erecting engineer, assistant to shop superintendent, assistant superintendent, private engineer for Edwin Reynolds in his special work, general trouble engineer on all steam engine work, salesman in pump department, engineer of tests, manager of pump department and finally assistant chief engineer. He is a member of the American Society of Mechanical Engineers and the Engineers' Club, of New York. Mr. West recently started for Europe to investigate the most recent practice of British and Continental engine builders.

It is further rumored that several other engineers of wide reputation will be retained by the Westinghouse Machine Company within a short time.

CHANGES IN PERSONNEL IN PITTSBURG—NEW ROUTINGS FOR CARS

Important announcements have recently been made regarding changes in the personnel of the operating force of the Pittsburg Railway Company, also regarding new routings for cars which are expected to work greatly to the public benefit and reduce the complexity of operation of the various lines involved.

The changes in the personnel are almost entirely confined to division superintendents and minor officials. J. S. Shedd, who was assistant superintendent of transportation, has been made superintendent of the Birmingham division, including the Carson Street, Hilltop & Suburban lines. Charles E. Long, who was superintendent of overhead lines, has become superintendent of the Second Avenue division. John B. Loftus, chief despatcher of the Monongahela division, has been made assistant superintendent of Second Avenue. He will have charge of the McKeesport sub-division. J. M. Loftis, superintendent of the Butler Street division, has been transferred to the Homewood division, of which he will be superintendent. C. J. King, chief despatcher in East Liberty, has been made superintendent of the Highland Park division. W. J. Fleming, despatcher on the Butler Street division, has been made superintendent.

The change in the routing of the cars effects several important lines. The Verona cars, which have been running through to the city, will have their terminus at Wilkinsburg Junction, where city-bound passengers will be transferred to the Swissvale and Rankin and East Pittsburg and Wilkinsburg cars. The Lincoln and Ellsworth route has been discontinued, and a new route, known as Lincoln and Liberty, substituted. Instead of coming to town via Elleworth and Forbes Avenue, the Lincoln Avenue cars will come in by Liberty Avenue to Wood, to Water, to the Baltimore & Ohio Station and return east by the same route. Changing these two routes will help the congestion of cars in Sixth Avenue and Wood Street, and at the same time benefit Wilkinsburg. They will now have a cross-town, through service which they never had before for 5 cents. The transfer car between Crafton Junction and Thornburg, on the West End division, has been abolished on every other car on the Crafton and Ingram route will run through to Thornburg. This will give Thornburg people a ten-minute service from Pittsburg.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MAY 17, 1904.

759,858. Air Brake Mechanism: Gus. A. Brooks, Covington, Ky. App. filed June 15, 1903. Means whereby when the car motor is driven as a generator by the momentum of the car, the current will be supplied to a motor to drive an air compressor for operating the brakes.

759,870. Unbroken Main Line Switch; George M. Ervin, Johnstown, Pa. App. filed Aug. 1, 1903. A movable defleeting tongue in the outer side of the branch track or turnout, a movable lifting tongue at the inner side of the track and a connection between said tongues whereby they may be moved in unison.

759,871. Unbroken Main Line Switch; George M. Ervin, Johnstown, Pa. App. filed Aug. 1, 1903. A deflecting tongue at the outer side of the switch, a lifting tongue at the inner side thereof and movable to and from the head of the adjacent main rail from the inner side of the same.

760,079. Trolley; Frank A. Overdier, Columbus, Ohio. App filed June 30, 1903. Two wheels arranged tandem in a harp mounted upon a vertical axis at the end of the pole.

760,145. Guard for Trolley Wheels; Charles O. Phillips, Kalamazoo, Mich. App. filed March 2, 1904. Details.

760,163. Trolley Catcher; Irwin W. Smith, Dayton, Ohio. App. filed Jan. 25, 1904. Details of a spring drum and pawl and ratchet arrangement for controlling the cord.

760,184. Trolley Pole Head; Robert I. E. Dunn, Dallas, Tex. App. filed Aug. 29, 1903. Details.

760,223. Electric Railway; Thomas D. Lovell, Beverly, Mass. App filed Jan. 22, 1904. A system for single roads wherein the movement of the cars in a block automatically cuts off current from adjacent blocks.

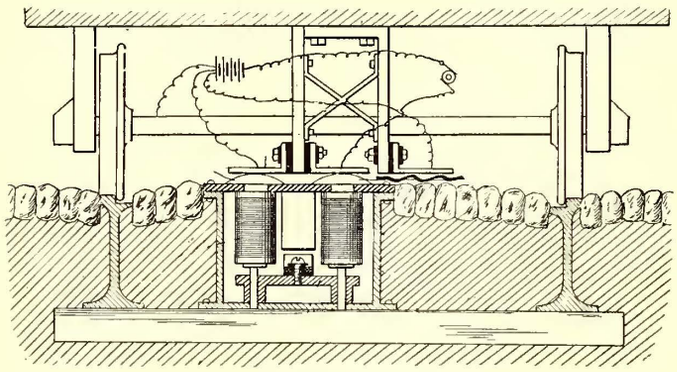
760,231. Trolley Base; Peter David Milloy, Buffalo, N. Y. App. filed Nov. 16, 1903. The object of the invention is to produce a low-down base in which the revolving section surrounds and incloses a large portion of the fixed section and revolves upon horizontal bearings which are concealed from exposure to the elements.

760,292. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Aug. 29, 1903. The car body is supported by a frame which is swung from spring supports on the side frames of the truck.

760,293. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Aug. 29, 1903. See preceding patent.

760,294. Maximum Traction Truck; Walter S. Adams, Philadelphia, Pa. App. filed Aug. 29, 1903. See patent 760,292.

760,305. Coupling for Electric Wires; Ricardo Garibay Castillo, Mexico, Mex. App. filed Sept. 9, 1903. Comprises a block of insulating material, a coupling wire secured thereto, conductor wires attached to the block and mercury cups carried by the conductor wires to receive the ends of the coupling wire.



PATENT NO. 760,325

760,325. Electric Railway; William R. Fearn, Camden, N. J. App. filed Dec. 16, 1903. Details.

760,330. Trolley Pole; James Furgason, Montour Falls, N. Y. App. filed May 28, 1903. Details.

760,379. Convertible Car; John A. Brill, Philadelphia, Pa. App. filed Aug. 29, 1903. Relates to the provision of a step for use when the car is used as an "open" car.

760,380. Maximum Traction Car Truck; John A. Brill, Philadelphia, Pa. App. filed Aug. 29, 1903. Details.

PERSONAL MENTION

MR. GEORGE O. NAGLE, general manager of the Wheeling Traction Company, of Wheeling, W. Va., is to be married on June 8 to Miss Helen S. Williams, daughter of the Rev. Hugh Spencer Williams, of Memphis, Tenn.

MR. E. H. RAUPP, chief train dispatcher of the Rochester & Eastern Railway, of Rochester, N. Y., has resigned to accept a similar position with the Detroit, Monroe & Toledo Short Line, with headquarters at Detroit, Mich.

MR. S. W. CHILDS, who superintended the building of the Kalgoorlie & Perth (Western Australia) Electric Tramways, has been appointed to take charge of the construction of the Conneaut Traction Company's system at Conneaut, Ohio.

MR. W. S. TURNER, who recently returned from New Zealand, where he superintended the construction of the extensive Auckland Electric Traction system on behalf of the contractors, J. G. White & Company, will supervise the building of the Youngstown (Ohio) & Southern Railway.

MR. CHARLES T. YERKES arrived in New York from London last week. Mr. Yerkes says rapid progress is being made in the construction of the underground lines in the British metropolis, and that he hopes to have the Metropolitan District line in operation by Jan. 1.

MR. BRIGGS KECK, formerly treasurer of the United Railways & Electric Company, of Baltimore, Md., has returned from the Philippines, where he recently went in behalf of J. G. White & Company, of New York, who have the contract for the construction of the Manila Electric Traction system.

MR. J. A. McFARLAND has resigned as superintendent of the Steubenville, Mingo & Ohio Valley division of the Wheeling Traction Company, of Wheeling, W. Va., so as to go west for the benefit of his health. Mr. McFarland is succeeded by Mr. John Marsh, assistant superintendent of the company.

Mr. GEORGE M. HENRY, formerly general passenger and ticket agent of the Detroit Southern Railway (steam), and later with the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., in the capacity of special inspector, has been appointed general passenger and freight agent of the Detroit, Monroe & Toledo Short Line, which is now operating between Toledo and Detroit.

MR. M. R. McADOO, president of the Compania Mexicana de Traccion (the Mexican Traction Company), which concern, as noted in the Street Railway Journal, April 9, has merged with the Compania de Ferrocarriles del Districto de Mexico, S. A. (the Federal District Tramways Company, Mexico City, the system which is usually referred to as the Wernher-Beit road), is now in New York. He expects to be here for three weeks or so, and will make his headquarters at his brother's offices, 15 Wall Street.

MR. A. E. WORSWICK, formerly chief engineer of the extensive electric traction system in Mexico City, controlled by Wernher, Beit & Company, of London, has been appointed consulting electrical engineer for Sir Weetman D. Pearson, M. P., chairman of the British contracting concern of S. Pearson & Son, Limited. The Pearson people have considerable electrical work in hand in Mexico, and are now contemplating the conversion and extension of the Ferrocarril de Veracruz, of which Sir Weetman is the president. The existing line is about 12 miles long. It is a horse road. Mr. Worswick will make his headquarters in Mexico City.

HERBERT E. REED, formerly superintendent of the Northampton Traction Company's lines in and around Easton, Pa., is now in charge of the Trenton & New Brunswick Railroad, of Trenton, N. J., having succeeded Mr. A. C. Harrington, who resigned on account of ill health. Mr. Harrington succeeded E. T. Wagenhals as superintendent of the Trenton & New Brunswick Railroad, the latter returning to Cincinnati, Ohio, about two months ago to assume charge of railroad construction work. Mr. Reed brings to the Trenton & New Brunswick Company a wide range of experience in the electric railroad field, which has been crowned with success.

MR. EDWARD C. BOYNTON has been retained as electrical engineer of the Poughkeepsie City & Wappingers Falls Electric Railway Company, of Poughkeepsie, N. Y. Mr. Boynton has been connected for a number of years past with the New York office of the National Electric Company. He was one of the pioneers in the application of electricity to heavy electric railroading and was for a long time a member of the electrical engineering staff of the New York, New Haven & Hartford Railroad, and at the time he left that company to associate himself with the National Electric Company, was electrical engineer of the New Haven road. Two contributions from his pen have appeared in recent issues of this paper.

MR. E. H. McHENRY has been appointed fourth vice-president of the New York, New Haven & Hartford Railroad, a position just created, and in which he will have charge of all the electric railway lines controlled by the company. Mr. McHenry is 45 years old, is a graduate of the Pennsylvania Military College, and completed his education abroad. He was for nineteen years connected with the construction and operation of the Northern Pacific Railroad, and was chief engineer and receiver of that property pending its last reorganization. He spent some time in China, Japan and the Philippines, returning two years ago to become chief engineer of the Canadian Pacific Railway. He will assume the duties of the new office with the New Haven July 1.

MR. J. T. HAMBLETON, superintendent of the Susquehanna Traction Company, of Lock Haven, Pa., has resigned from the company, his resignation to take effect not later than June 1. Mr. Hambleton has accepted the position of superintendent of the Slate Belt Street Railway, of Pen Argyl, near Allentown, which comprises the Slate Belt and the Bethlehem & Nazareth Companies. Both these roads were constructed by Mr. Hambleton about four years ago, and were operated by him until he accepted the position in Lock Haven. About that time both lines were leased by the Lehigh Valley Traction Company, of Allentown, but the properties recently reverted to the original owners, owing to the reorganization of the Lehigh Valley Company.

SEVERAL CHANGES are announced in the management of the Pennsylvania & Mahoning Valley Railway Company, with headquarters at New Castle, Pa. Mr. M. E. McCaskey, who has been in charge of the New Castle division of the system, has been made second vice-president and general manager of the entire property. Mr. W. C. Smith will act as manager of the Youngstown division of the system. Mr. J. M. Walker has been appointed chief engineer, succeeding Mr. John Wolff. Mr. F. C. McGonigle succeeds Mr. Wolff as purchasing agent and will continue in charge of the lighting department. Mr. W. T. Burns has been appointed auditor and assistant treasurer. Mr. Fred Carpenter, who has been excursion agent for the company, has been promoted to the position of general freight and passenger agent. The operating headquarters of the system will be located in New Castle, and it is probable that all the offices will be centralized there.