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The Man Behind the Transit

We have before called attention to the folly of hasty or careless work in the location of interurban electric roads. It is equally important that the civil engineers engaged in this work be men of experience and good judgment. A civil engineer of our acquaintance who has been watching the game for a good many years ventures to suggest that the mere fact that the county surveyor has offered to do the work proposed for about one-third the fees asked by an engineer who has given up many years to this branch of engineering should not carry any weight with the promoters of such enterprises. The experienced engineer in question may not know just where the corner of Brown's east 80 comes, but he knows a whole lot more than that. He knows that if the road does go through that east 80 he will avoid making a 20-deg. curve on a 3 per cent grade, and that is just the kind of knowledge he is charging his price for. There are no doubt meritorious projects which have found their graveyard in the offices of the banker and bond broker that would have gone through had the promoters been far-sighted enough to ignore the "east 80 man." Railroad location is a fine art acquired only by years of experience. Interurban electric railway location is a special branch of this art, and can best be handled by specialists in that line. A location man who constantly has in mind the kind of a compromise that the interurban railway must be between the steam railroad and a street railway is the best man for the work. To be sure, the local surveyor cannot be blamed for not knowing these things, and it would be rather difficult in the intervals between locating a new drainage ditch and finding the boundary lines of 20-acre tracts to acquire a knowledge of a special nature which others devote all their time to. Furthermore, the local surveyor's personal acquaintance through the country is likely to be a drawback rather than a help in his work, as his knowledge of who owns various tracts of lands may lead him to select routes avoiding certain tracts, to the everlasting detriment of the operating account of the road. Location work cannot be too good; the total cost in any event is so small a per cent of the cost of the work.

Interurban Traffic Figures

The paper read by L. J. Shlesinger, superintendent of the Muncie, Hartford & Fort Wayne Railway Company, before the February meeting of the Indiana Electric Railway Association, is a very valuable addition to the gradually increasing fund of generally available knowledge of traffic figures on interurban roads. Every interurban railway company which is figuring on extensions, and every engineer who is called upon to report on proposed roads, is seeking all the information possible to aid in making an intelligent guess as to probable revenue. Mr. Shlesinger's paper is chiefly valuable because of the minute analysis which has been made by his company of the passenger traffic from various portions of the road, which, by the way, is a purely interurban proposition in which city traffic cuts no figure whatever. These conditions as they exist on this road are described very fully, in order that an intelligent use can be made of the figures on traffic from different portions of it given in the latter part of his paper. Mr. Shlesinger's road makes a showing of track-mile earnings per annum somewhat better than the average of the thirty-two purely interurban roads of Ohio given in an editorial in these columns Jan. 28 last. The road earned $4,335 per mile of track, while the Ohio average was $3,960. The car-mile earnings of the road under consideration will be looked upon with envy by many interurban managers, as they amount to over 32 cents. The road is evidently one which serves short-distance riders, the 15-cent fares

proving the most profitable and, with the exception of the 5-cent fares, the most numerous. In this respect this road will differ considerably from many other interurban roads. One of the most interesting things about the paper is the information about the relative amount of traffic furnished by the rural population as compared to the population located in the towns along the line. According to these figures, the rural population yields a revenue of $6.27 per capita per annum, while the average for the entire road is only $2.95 per capita per annum. Leaving out of account the terminal city Muncie, the per capita earnings are $6.14. There has been considerable speculation as to what revenue would be yielded by a rural population, the general impression being that, since the farmers along the line of an interurban road are dependent entirely upon the interurban road for transportation, they will furnish a much greater revenue per capita than the people in the towns along the line. Mr. Shlesinger's figures show that this impression is correct as regards the whole road, counting in the population of the terminal city. An inspection of the figures on a basis of per capita revenue from different towns along the line, however, shows that the smaller towns run away above the rural population as well as above the larger towns, in revenue per capita per annum. This is probably due in part to the fact that some of the road runs through an oil field, which causes considerable riding from small towns not having a very great resident population. We are inclined to think, however, that a great deal of revenue for which the smaller towns get the credit in reality comes from the rural population surrounding these smaller towns. It is a custom for farmers to drive into these smaller towns and leave their teams at livery stables there, taking the cars to the larger county seat towns along the road, to do shopping or attend to business at the county seat. The amount of this kind of business is best illustrated by a case which came under our notice on a neighboring road in Indiana, and which has probably been duplicated many times in that and other States: The livery stable keeper in a small town through which an interurban was to pass opposed the granting of the franchise vigorously because he supposed it would ruin his business. Since the interurban road has been built he has had to enlarge his quarters and never has had anything like the business he is enjoying now, for the simple reason that his town has become a small center into which farmers drive to take interurban cars for larger towns, leaving their teams at the livery stable. Then, too, those coming out from Indianapolis and other towns to visit farmer relatives along the line must patronize the livery stable in order to get to their destination.

Interurban Way Stations

The development of passenger stations in interurban railway work has thus far been largely in the direction of city terminal buildings, and in many parts of the country the interurban way station has received but inadequate consideration. There are, of course, notable exceptions to this policy of letting would-be passengers at rural points shift for themselves while waiting for the cars; but, in general, there is little appreciation of the part a comfortable waiting place carries in preventing the desertion of the passenger to the nearest steam road in severe weather. Considering the small expense of putting up a suitable way station, it is singular that so many roads have failed to take advantage of this opportunity to offset the inducements of the steam railroad passenger agent.

While there is no specific limit to the amount of money which it is possible for a road to spend on way stations, provided that ample capital is available, it is, fortunately, a very simple matter to satisfy the requirements, and this without the expenditure of over two or three hundred dollars per station in the vast majority of cases arising in rural districts. First of all, it is necessary that passengers be protected from the direct force of the storm and wind. Secondly, it is advisable that comfortable seats be provided, and of equal importance is the question of illumination. Cleanliness should go without saying—which it seldom does, however—and finally, the matter of heating deserves consideration. In fact, some roads have gone to the point of providing all these features, with toilet facilities in addition. Cases of this kind, however, generally include some sort of operating offices as a part of the premises, and enable the necessary oversight of the station to be maintained without much additional expense.

The working up of way station details is a matter which must be solved by each road on the spot. Certainly every such station should be swept and cleaned once a day; there should always be a printed time-table of the company's cars on the inside wall, and tramps should be vigorously discouraged from turning them into cosy corners at night. A small wooden platform should always be put down, unless, in more extensive work, concrete is used, and the lighting arrangements made secure from tampering. A single series of five 16-cp lamps is admirably adapted to light both the platform and the interior of the average way station. In locations exposed to very severe weather it doubtless pays to install one or two electric car heaters for operation during the coldest months of the year. Both the heaters and the lighting circuits can readily be attended to by the conductors of the cars. A self-closing door is a prime necessity, and in localities exposed to the activities of rowdies, the use of stout wire netting on the outside of the windows affords considerable protection.

The day is yet to come, in the interurban railway field as a whole, when it will pay to maintain employees at the different way stations along the route. At the same time, it is important for electric railway managers to realize that if traffic is to be secured and held, in the face of steam railway competition with its comfortable stations and conveniences, more thought must be taken to insure the reasonable physical contentment of their passengers. In the summer time the electric road has everything on its side which tends to produce enjoyment of travel—cool breezes, frequent service, good ventilation, absence of smoke, cinders and the like—but in the winter season cross-country electric railroading often is beset by great discomfort, particularly at waiting points, and sometimes in poorly heated and ill-ventilated cars. More and more does interurban electric railway practice advance to the standards of speed and responsibility to passengers maintained by steam railroads. With the increasing demand for frequent high-speed service, with heavier cars and higher powered motors than the past decade considered standard—in short, with the whole standard of service raised, it becomes all the more important not to lose a single passenger. To this end, therefore, are certain to come improvements, not only in rolling stock and roadbed, track and power stations, but in that department of the business which is still in its infancy—the department of creating passenger traffic. Finally, as freight and express traffic develops—and has developed on some roads already—the way station will grow in consequence, under the oversight of a responsible agent, until it bears much the same relation to the interurban railway as the present steam railroad way station bears to its system as a whole.

Four-Motor Equipments

The development of electric railway rolling stock within the past decade has witnessed many noteworthy changes in design. In a few words, these changes have practically all been made with one or more of three objects in view—increased speed, greater comfort and added reliability of service. So far as each design contributed to these requirements, to just that extent has it been a permanent influence in electric transportation.

In connection with the maintenance of schedules under trying conditions of traffic congestion and poor adhesion between wheels and rails, as well as in relation to the adoption of heavier cars and higher speeds, the advantages of four-motor as against two-motor equipments are constantly becoming better appreciated by railway managers. At the same time, there is no doubt that a choice often exists between the two. Long as is the list of sales of quadruple equipment to operating roads, the two-motor outfit is still in favor in many localities. It is a fair question, however, if the general use of double-trucked cars of more than double the weight and about three times the cost of those standard seven or eight years ago is not rapidly giving the lead to the four-motor equipment in fast interurban and suburban service.

When through interurban cars are to be operated at the city ends of their journey over densely crowded streets, it is true that the advantages of the quadruple equipment often seem of little value. In fact, a special commutating switch often has to be installed, so that the motors may be thrown all four in series in starting, to keep down the speed. Sixteen horse-power per ton of car weight fits with difficulty into the motive power requirements of a city track populated by an intricate procession of delivery vans, trucks, automobiles, pedestrians and local street cars making a schedule speed of 6 m.p.h. on fifteen-second headway. The saving clause is, of course, the freedom of running possible outside the city. Hence the importance of studying with particular care the conditions along the route, not so much of interurban lines, but of city and suburban lines, before changing from two to four-motor equipments. Here enters a distinction between the true interurban line, connecting two or more cities, and the often misnamed "interurban," but actually "suburban," line, operating over a large percentage of city streets with but a short run over private rights of way. From the standpoint of good service there is much question as to the practicability of substituting four-motor for two-motor city equipments for operation on very crowded thoroughfares where the superior acceleration qualities of the former cannot have full play. Under such conditions the acceleration obtained from a two-motor outfit is often as useful as the quicker but unavailable acceleration power of its competitor. On the other hand, a hilly road, either city or suburban, of course, demands every axle equipped.

It is interesting to sum up the advantages of the four-motor equipment in the interurban, suburban and thinly settled city territory where its characteristics find full opportunity for development. Proper comparisons can only be made between a double-motor and a four-motor equipment aggregating the same rated horse-power and propelling the same weight and style of car body, load and truck, including, of course, equal gear ratios. In the same way the relative energy consumption, motor heating and cost of maintenance of two and four-motor equipments must be determined upon the basis of equal schedule speeds and stops if a fair comparison is to be obtained from the engineering standpoint.

Given a car weighing in body, passengers and trucks, without motors, 20 tons, let us equip it first with two 75-hp motors, and second, with four 38-hp motors. Allowing 11,600 lbs. and 9700 lbs. as the individual weights of the larger and smaller equipments, respectively, the total weight of the two-motor car figures 49,700 lbs., and that of the four-motor car, 51,600 lbs. In the former case the total weight available for adhesion is 29,000 lbs., or 58 per cent of the car weight, and in the latter case, 30,600 lbs., or 100 per cent. The weight per driving wheel is 7250 lbs. in one case and 6200 lbs. in the other. With the track in very poor condition, giving, say, 10 per cent adhesion, the weight available for acceleration in the case of the four-motor equipment is sufficient to permit nearly as high a tractive effort without wheel slippage as in the case of the two-motor car under the favorable conditions of track represented by 20 per cent adhesion. Although in practice the motors could not be permitted to work up to such high accelerations as the above limits specify, the comparison shows what a large margin exists in favor of the four-motor outfit. Thus, high schedule speed is secured without the heavy consumption of energy which rapid acceleration invariably requires with two-motor equipments, thanks to the larger percentage of coasting possible with the four-motor equipment.

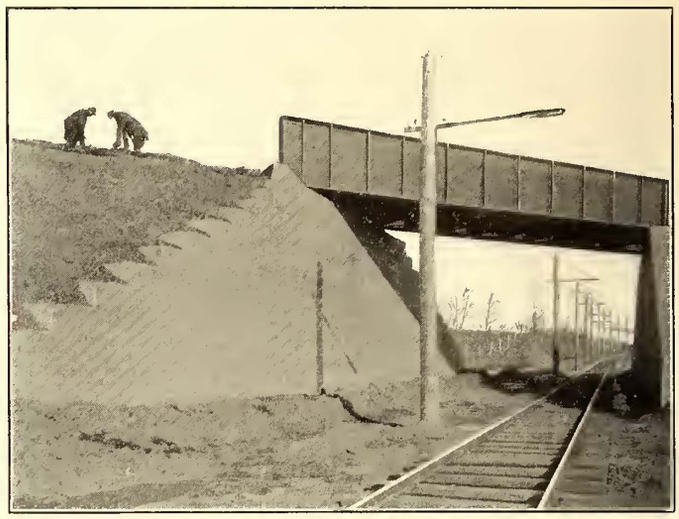
The increase in car weight of the four-motor equipment is but 3.8 per cent, and the loss in efficiency, say a maximum of 3 per cent, is not a serious matter. Quarter a cent per car-mile would seem to be a liberal allowance for the additional cost of power, taking both these factors into account, and in some cases it is reasonable to expect that the four-motor outfit will actually show a lower operating cost for the same schedule on account of the coasting possibilities which it enjoys. The difference is so slight that the personal equations of two motormen may easily throw the balance one way or the other.

As a matter of fact, the work required of four-motor equipments which have replaced two-motor outfits in a given service is often much in excess of the schedule requirements imposed upon the latter. Either the schedule time is cut down or, as is less frequently the case, the number of stops per mile is increased, the old schedule remaining fixed in its total running time. In general, the additional traffic capacity thus secured far offsets the net increase in power cost which the faster schedule brings about. Motor heating for a given service should be less with the four-motor equipment, on account of the greater radiating surface, which more than makes up for the greater losses which take place in the motors themselves. This point is of much influence in determining the question of maintenance, which is reasonably calculated to be at least as low with four motors as with two. In the repair shop and car house the lighter motors can be handled with greater facility, and the reduced strains for a given service on gears, axles, bearings and trucks are all favorable points, both in reference to track wear and car equipment up-keep. In the matter of keeping up continuous service the four-motor equipment has a strong advantage. The chances of being able to run a disabled car into the car house when one or two of its motors break down on the line, without seriously interrupting traffic, are often of great value, especially in interurban service. Then, too, the increased clearance between the track and the motor frame or between the motor and the car body is an advantage of note, enabling the use of a single step in cases where two car steps are undesirable. In regard to first cost, there is little to choose between the two equipments; but it would be most useful if figures could be obtained and published by operating companies in regard to the exact cost of maintenance and depreciation in the same service of four and two-motor equipments of various capacities.

OPENING OF THE INDIANAPOLIS & CINCINNATI SINGLE-PHASE LINE

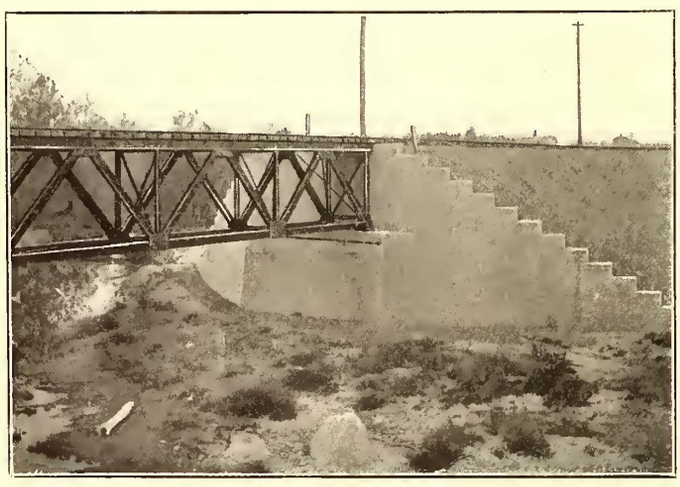
The interest taken in the Westinghouse single-phase electric railway system is so great that the inauguration of the service on the Indianapolis & Cincinnati Traction Company will attract more than ordinary attention. The first car was put in service on Dec. 30, 1904, and, as announced in this paper for Jan. 28, regular operation was commenced between Rushville and Morristown, 16 miles distant, on Jan. 21.

OVERHEAD CROSSING NEAR PALESTINE, IND.

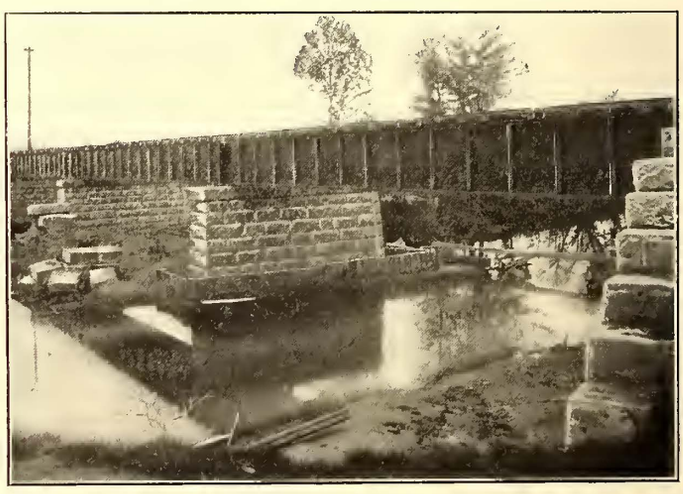


OVERHEAD CROSSING OF THE CINCINNATI, HAMILTON & DAYTON RAILROAD

The Indianapolis & Cincinnati Traction Company was organized on Feb. 4, 1903, under the laws of Indiana, to construct a line from the city of Indianapolis via Rushville and Connorsville, Ind., and Hamilton, Ohio, to Cincinnati. The affairs of the company are managed by a board of directors, constituted as follows: Charles L. Henry, of Indianapolis, and formerly general manager of the Union Traction Company of Indiana, president and general manager; Ephraim Marsh, vice-president; Wm. L. Taylor, secretary; Endorus M. Johnson, treasurer; James W. Fesler, Theodore F. Rose and Wm. M. Frazee.



BRIDGE 105 FT. LONG OVER BIG SUGAR CREEK, NEAR NEW PALESTINE, IND.



BRIDGE OVER BLUE RIVER, NEAR MORRISTOWN, IND.

The dominant idea in the minds of the originators of this company was to build a double-track through line from Indianapolis to Cincinnati, which would take care of the traffic between these two cities in a more satisfactory way than is now done by the steam roads. To this end the company has secured a most desirable private right of way. Where the land is level and there are no considerable fills or cuts, a right of way 4 rods wide has been purchased, but wherever a considerable fill or cut has been necessary, additional width of right of way has been secured. In all the smaller towns a private right of way has been continued through, and the road is not constructed upon streets or highways except in cities or towns of such size as to make it necessary. In all cases sharp curves are avoided, and such an alignment has been secured between cities and towns as will permit of very rapid running, with entire safety to passengers and equipment. In most instances the right of way is protected by a woven-wire fence, erected under an agreement with the land owner, whereby the land owner maintains the fence and keeps all its gates closed. Wherever such an agreement was not secured the right of way is fenced with barbed wire.

Under the provision of the franchise of the Indianapolis Traction & Terminal Company, interurban lines are allowed to enter the city over the tracks of the city company by such routes as the city designates, upon payment to the city company of an agreed or ascertained compensation. The Indianapolis Traction & Terminal Company has made a uniform agreement with interurban roads for entrance into the city over its tracks, whereby interurban roads pay 4 cents for each passenger carried on the interurban cars while on the city lines, and this entitles them to all of the privileges of the terminal station.

The line has already been constructed between Indianapolis and Rushville, a distance of 41 miles, and a through service between those cities has been established. At an early date the road will be extended to Connorsville.

ROADWAY

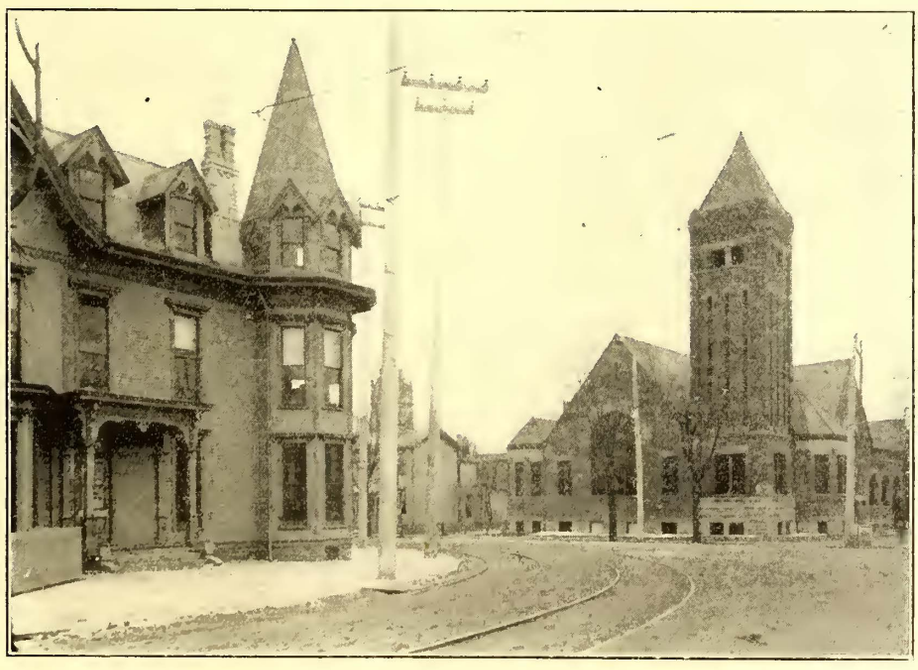
The construction of the roadway is thoroughly first-class and steam railroad standards are used. Between Indianapolis and a point 8 miles east of Rushville—a distance of nearly 50 miles—there is no grade exceeding 1½ per cent. From that point on toward Cincinnati the country is less level, and in some cases straight lines have been preferred, even at the expense of some increase in grade; but with the alignment and grade considered together, greater speed can be obtained, with comfort and safety to passengers, than on any steam road now running between Indianapolis and Cincinnati. So far as the profile of the road has been as yet determined, the heaviest grade will be 4 per cent, and it is believed that no greater grade will be neeessary on the entire line. The roadbed is graded 28 ft. wide on top for a double track, with slopes on fills and in cuts of 1½ to 1, and upon a grade line that puts the track in most instances above the level of adjacent lands, so as to avoid trouble on account of snow.

BRIDGES

The bridges across all streams are constructed either with concrete arches or steel girders with stone abutments. The upper structures are built of the very best steel construction by the Indiana Bridge Company, of Muncie, Ind., of a capacity sufficient to carry a train of cars with a gross weight of 100 tons for each car. All abutments are built for double track; the superstructures at this time are laid for one track only. It will be noted that provision is made for the increased demand for size of cars and length of trains likely to come in the near future.

TRACK

The road is laid with double track in the city of Rushville and on all highways; but on the private right of way, while the grade is prepared for double track, only one has been laid, as a second track can be more conveniently and economically put down later, when a sufficient portion of the road is in operation to require a double track. All ties used are first-class—no culls

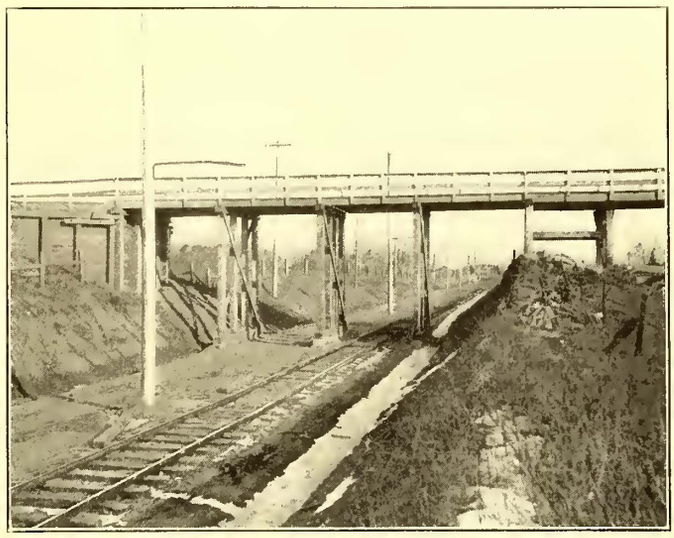


CURVE AT CORNER OF THIRD STREET AND MORGAN STREET, RUSHVILLE, IND.

or seconds—white oak, burr oak and a few chestnuts, 6 ins. x 8 ins. x 8 ft. long, 3280 to the mile. The bridge ties are of long leaf yellow pine.

The traek is laid with 70-lb. T-rail, in 60-ft. lengths, connected with Weber rail-joints, and bonded at the joints with No. 0000 10-in. copper bonds, with ⅞-in. terminals under the plate so as not to be exposed. Cross bonds are put in every half mile and long bonds under all special work. The switches and other special work have been furnished by the Buda Foundry & Manufacturing Company, of Chicago, and are built according to steam railway standards. Turn-outs and cross-overs are constructed so as to avoid danger of open switches.

The company has secured a fine gravel pit, located within ½ mile of its main line at Morristown, Ind. The first layer of ballast has been put on the roads from Rushville to Indianapolis, and the work will be completed as soon as the weather permits.



OVERHEAD CROSSING NEAR JULIETTA, IND.

The road is to be ballasted with gravel 8 ins. under the ties and level with the top of the rail. In the streets of Rushville an 8-in. layer of broken stone was placed under the ties.

TROLLEY CONSTRUCTION

The trolley wire is suspended along the private right of way from poles set in the center of the grade 100 ft. apart, with a bracket made of angle iron looped at the end, so as to carry a large flat porcelain insulator, from the top of which is run a 7-16-in. steel strand cable or "messenger" wire. The No. 000 grooved copper trolley wire is carried 8 ins. under the messenger cable, to which it is attached every 10 ft. with specially made steel clamps, a construction known as the catenary suspension. The steel messenger wire is drawn tight. With this construction, danger from trolley breaks is reduced to a minimum. The insulators are large and strong, and are not likely to break, but if they should the steel cable would remain suspended from the top of the bracket. As the trolley is attached to the steel cable every 10 ft., breaks will be very infrequent, and if one should occur not more than 10 ft. of the trolley would be loose. The catenary construction provides a practically level trolley with no sudden bends at the insulators, as is found with the ordinary suspension, a point which is of great advantage to fast-running cars. The trolley wire is suspended 18 ft. above the top of the rail.

Where the tracks are in the streets the poles are set on the sides of the streets and the trolley is suspended from span wires. Otherwise the construction is the same as along the private right of way. The overhead material for the entire line construction was supplied by the Westinghouse Electric & Manu-

facturing Company, according to the design of Sargent & Lundy, consulting engineers.

HIGH-VOLTAGE LINES

The system of electrical distribution requires transformer stations about 10 miles or 12 miles apart, and the alternating current is transmitted from the power house to these transformer stations at 33,000 volts, single-phase, 25 cycles per second, and is reduced and fed into the trolley at a potential of 3300 volts. The high-tension current is carried from the central power station to the transformer stations on No. 4 bare copper wires, two wires to each transformer station. They make a complete circuit and permit the placing of the circuit breakers and switches at the central power house, so as to do away with the necessity of attendants at the transformer stations. The high-tension lines are carried on a separate line of poles set near the edge of the right of way, provided with carefully and strongly constructed cross-arms and equipped with large porcelain insulators on iron pins.

MOTOR AND GEAR CASE COMPLETE

TELEPHONE LINES

The entire system is provided with two metallic circuit (four copper wires) telephone lines, one of which is used exclusively by the train despatcher. The other line is used for general company business. Each car is provided with a telephone, by means of which the conductor can talk with the despatcher at fixed points. Jack boxes are placed on the poles at intervals of 2000 ft., from any of which the conductor of a car or any one else with a telephone can call up to report an accident or for any other purpose.

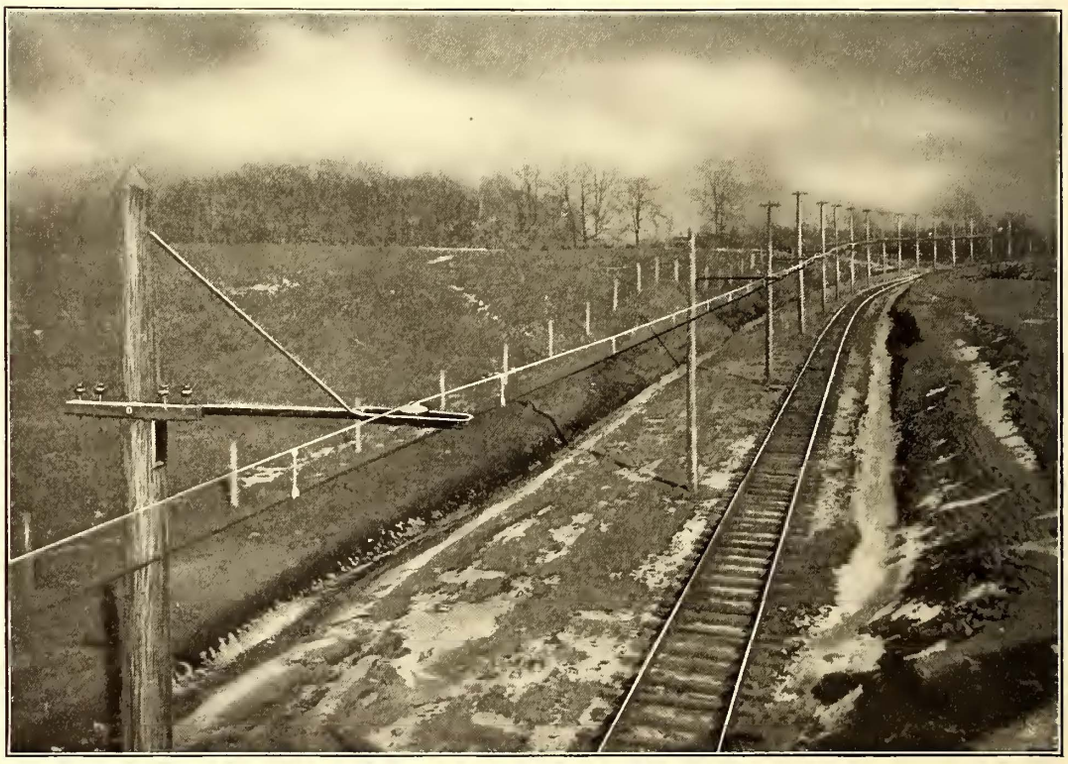
The four telephone wires are carried by porcelain insulators on cross-arms near the top of the trolley poles, and are thus far removed from the high-tension lines. The wires are transposed every 500 ft. in order to avoid disturbances from the current in the transmission lines.

POLES

The poles are all of select white cedar. Those for the center trolley construction are 40 ft. long, with 7-in. top. The side poles for the high-tension lines are 35 ft. long, with 7-in. top. All are set 6 ft. in the ground and are carefully tamped. Along streets on the side where there are no feed wires and the poles are used only to support the span wire, 30-ft. poles are used, while on the other side, where the high-tension line runs, the poles are of varying height from 40 ft. to 60 ft., so as to carry the feed wires above the shade trees. All of the side poles along the streets are neatly shaved and painted and are set in concrete. The tall 60-ft. poles are of Idaho cedar—beautiful, smooth and straight, as if turned in a lathe. The entire pole line was constructed under the direction of A. A. Anderson, general superintendent of the Indianapolis & Cincinnati Traction Company, and under the immediate supervision of Foreman Oscar D. Emery. The work is of such excellent character throughout as to attract the attention of even casual observers, and among experienced linemen it is conceded to be equal to if not superior in its substantial character and artistic appearance to any other line in the country.

TROLLEY VOLTAGE

Within the limits of the city of Indianapolis, a distance of approximately 3 miles, the cars will be run over already existing lines, and will be operated by direct current at 550 volts. Within the limits of the city of Rushville, they will be operated by alternating current at the same potential; on intervening sections the trolley will be fed by alternating current at 3300 volts, 25 cycles per second, single-phase. Thus the first single-phase railway exemplifies the possibility of operating the same equipment from both direct and alternating-current lines, and illustrates the voltage flexibility of the system, one of its most advantageous features.



VIEW ILLUSTRATING THE CATENARY SUSPENSION ADOPTED ON THE INDIANAPOLIS & CINCINNATI SINGLE-PHASE LINE

The power station from which it is intended to operate the entire road is located at Rushville. From this plant 33,000-volt transmission circuits are run to the points of transformation and there reduced to 3300 volts before connection to the trolley.

TRANSFORMER STATIONS

As has been stated, the road is divided into sections of 10 miles and 12 miles, each of which is supplied with current from a transformer station. Three such stations have been erected

between Indianapolis and Rushville by Pulse & Porter, contractors of Greensburg, Ind. The transformer houses are very small, measuring but 21 ft. x 23 ft., but are carefully and substantially built. The foundations are of concrete; the walls are of brick laid in cement mortar, and the floors for both the first and second stories are of concrete upon steel beams. The roof is built upon concrete base. The doors and windows are provided with steel shutters, and the whole structure is made thoroughly fireproof and can be closed and left alone with safety.

In each of the transformer stations there are at present installed two 300-kw oil-insulated step-down transformers, 33,000 volts to 3300 volts. Space has been provided for an additional transformer of the same capacity. On the second floor of each transformer station there are installed the lightning arresters and disconnecting switches. There are no automatic switches of any type in these stations, as they are controlled only through the switchboard in the power station. There is nothing at the station which requires constant attention and only occasional inspection will be necessary. This does away entirely with the expense usually incident to the rotary sub-station of other systems, which, if three men are employed, would aggregate about $6 per day. The annual saving in wages on the three transformer stations between Indianapolis and Rushville made possible by the alternating-current system on this basis, would amount therefore to $6,570, or a total annual saving on the ten transformer stations between Indianapolis and Cincinnati in wages alone of $21,900.

The entire electrical equipment of the transformer stations was furnished by the Westinghouse Electric & Manufacturing

TRANSFORMER STATION AT REEDVILLE, IND.

Company, and was installed under the supervision of Sargent & Lundy. The disconnecting switches were made from a design specially prepared for this service by these engineers.

The power house serves as an additional transformer station, and contains two 300-kw lowering transformers, wound for 3300 volts primary and 550 volts secondary circuits, which are used to feed that portion of trolley included within the limits of the city of Rushville.

The diagram on page 305 illustrates schematically the general arrangement of apparatus and circuits. The two-phase power circuit indicated is a provision for a four-wire power circuit, which it is proposed to run from the power house in Rushville to the electric line between Indianapolis and Shelbyville, which is at present operated by direct current from its own power house through rotary converter sub-stations and direct-current railway motors. It is expected at an early date to operate this branch also from the central power station in Rushville.

POWER STATION

The power house which is located at Rushville, Ind., is a strictly fireproof building of brick, concrete and steel, with

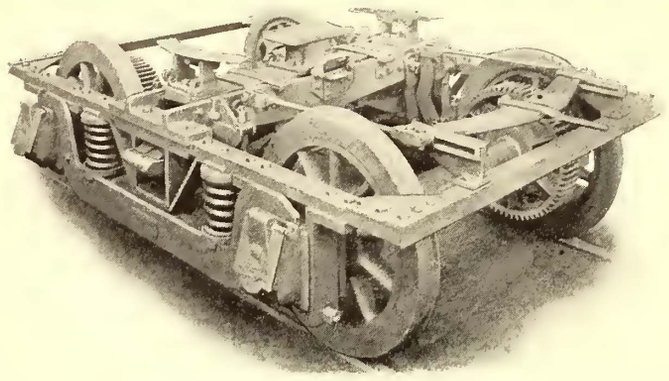
ARMATURE AND COMMUTATOR OF SINGLE-PHASE MOTOR

rooms well lighted and skilfully arranged for future addition and enlargement. The site is adjacent to the Cincinnati, Hamilton & Dayton Railway, with a connecting track from that road to the company's track alongside of the power station. The boiler room occupies one side of the building, and is at present equipped with three 350-hp Babcock & Wilcox boilers. Natural gas is now being used for fuel, but provision is made for the burning of coal, if at any time the supply of gas be-

BOILER ROOM, SHOWING OIL BURNERS

comes insufficient. The engine room occupies the other side of the building, and is separated into two parts by a heavy brick partition. In the main room are installed the two generator units, which consist of a 500-kw Westinghouse revolving field alternator, 25 cycles per second, direct connected to a 700-hp Corliss type, cross-compound, condensing engine, built by the Fulton Iron Works, of St. Louis, Mo. Both engines and generators are designed for an overload capacity of 50 per cent. Each engine is equipped with an independent jet condenser, made by the Dean Brothers Steam Pump Works, of Indianapolis, which takes its water from an underground tunnel con-

necting to a large mill race. Two pairs of 250-kw air-blast transformers are arranged to change the current which comes from the generator at 2300 volts, three-phase, to 33,000 volts, two-phase, for transmission to the transformer station along the line. Air for these transformers is supplied by two motor-driven blowers. The generator field is excited by direct-current



STANDARD TRUCK USED FOR THE CARS OF THE INDIANAPOLIS & CINCINNATI SINGLE-PHASE LINE

generators, one of which is direct connected to an alternating-current type C Westinghouse induction motor; the other to a Westinghouse compound steam engine. The marble switchboard controlling panels are also located in this main engine room, and the controlling apparatus is installed in the other portion of the building, which is known as the high-tension chamber. The main bus-bars are located in the basement and are supported upon a masonry structure and separated by barriers of alberine stone.

CAR SHOPS

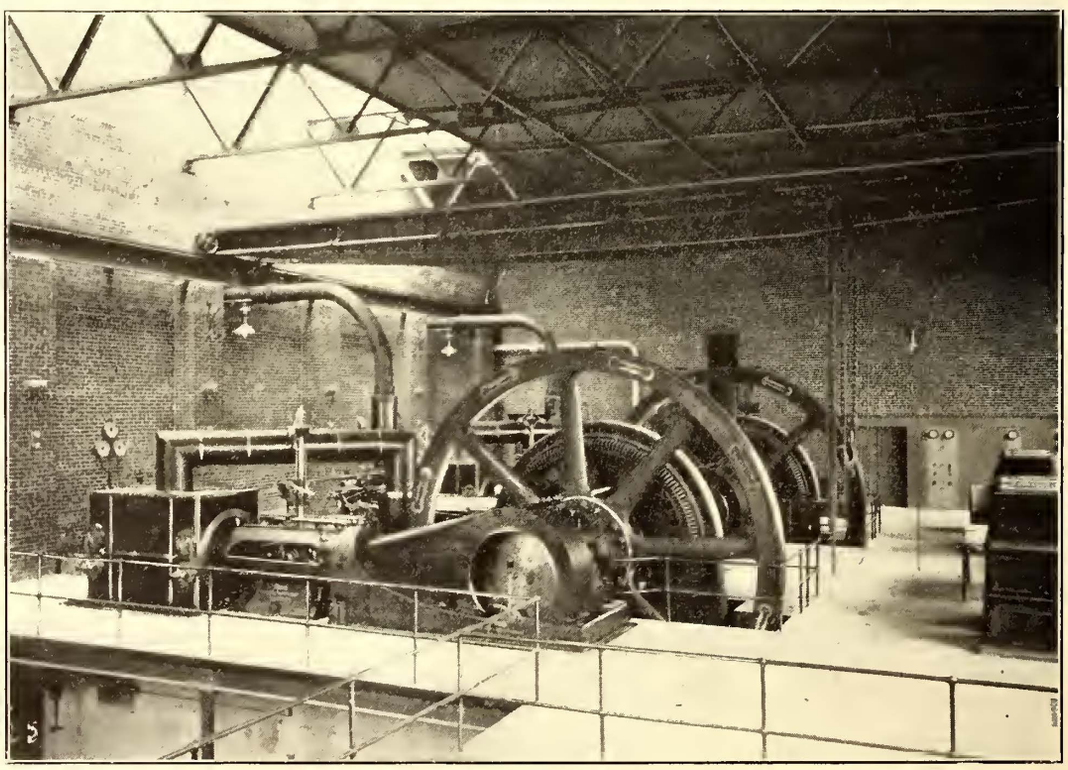
The car shops are located near the power station. The entire building is 205 ft. x 104 ft., and is divided as follows: Offices and waiting room for train crews, store room, blacksmith shop, car wash room, machine shop, truck repair shop, room for winding and drying armature and field coils and for other electrical work, paint shop and carpenter shop. Six tracks enter the building, each of which is provided with a working pit. A transfer track runs across the center of the building. The construction of the building is fireproof throughout, with concrete foundations and floors, brick walls and steel framing. The roofs are made of asphalt gravel laid upon a cinder and concrete base, with louveres and skylights, all in steel frames. Concrete partitions are used where brick walls have not been constructed, and there is a Kinnear rolling iron door over every track. The machine shop is supplied with a full equipment of modern tools. Provision is made in the center for a traveling crane to run the entire length of the building.

CARS

The present equipment of the company consists of ten passenger cars, constructed by the St. Louis Car Company. The framing of these cars was illustrated on page 173 of the Street Railway Journal for Jan. 28. Each car measures 55 ft. over all, and is divided into three compartments. The first compartment is 9 ft. 10 ins. long, and is intended to carry baggage. It is provided with doors opening on either side. The cars are intended for single-end operation, and space for the motorman is provided in the front of the baggage compartment, from which it is separated by a strong railing made of pipe. The middle compartment has a seating capacity of sixteen people and is intended for gentlemen desiring to smoke. The third compartment occupies the remaining portion of the car, and has a seating capacity for thirty-eight people.

The car is finely finished in mahogany, has plate glass in the windows and art glass in the ventilators and upper part of the sash. The trucks were built at the Baldwin Locomotive Works and are of the regular double-bar equalized M. C. B. type. The side frames are of wrought iron 4-in. x 2-in. section, and the end frames of angle iron reinforced, at the corners, with gusset plates. The transoms are hammered iron forgings and the transom of each truck is in one piece. The wheels were made by the Standard Steel Works, are 37¼ ins. in diameter, with steel tires and cast steel centers. They are mounted on axles of locomotive driving axle steel 6½ ins. in diameter, with 5-in. x 9-in. journals. The bolsters are of the built-up type, formed of channels and plates. The weight of each truck, exclusive of motors, is 11,670 lbs. Each truck is equipped with two 75-hp single-phase alternating-current Westinghouse motors.

The cars are equipped with the Westinghouse unit switch system of multiple control, and so may be operated either singly or in trains. The motors are controlled by the rheostatic system, and may be operated on either alternating or direct current. Both straight and automatic air brakes are provided on each car, the straight being used when the cars are run singly, the automatic system when the cars are run in trains. The motors on the present car equipment are geared for a maximum speed of 45 m.p.h. for local service.



500-KW ALTERNATORS IN POWER STATION, DIRECT CONNECTED TO HORIZONTAL ENGINES

Each car is equipped with two trolleys, one of the Union Standard type, with trolley wheel, to be used when operating from the direct-current lines in Indianapolis, or from the low-

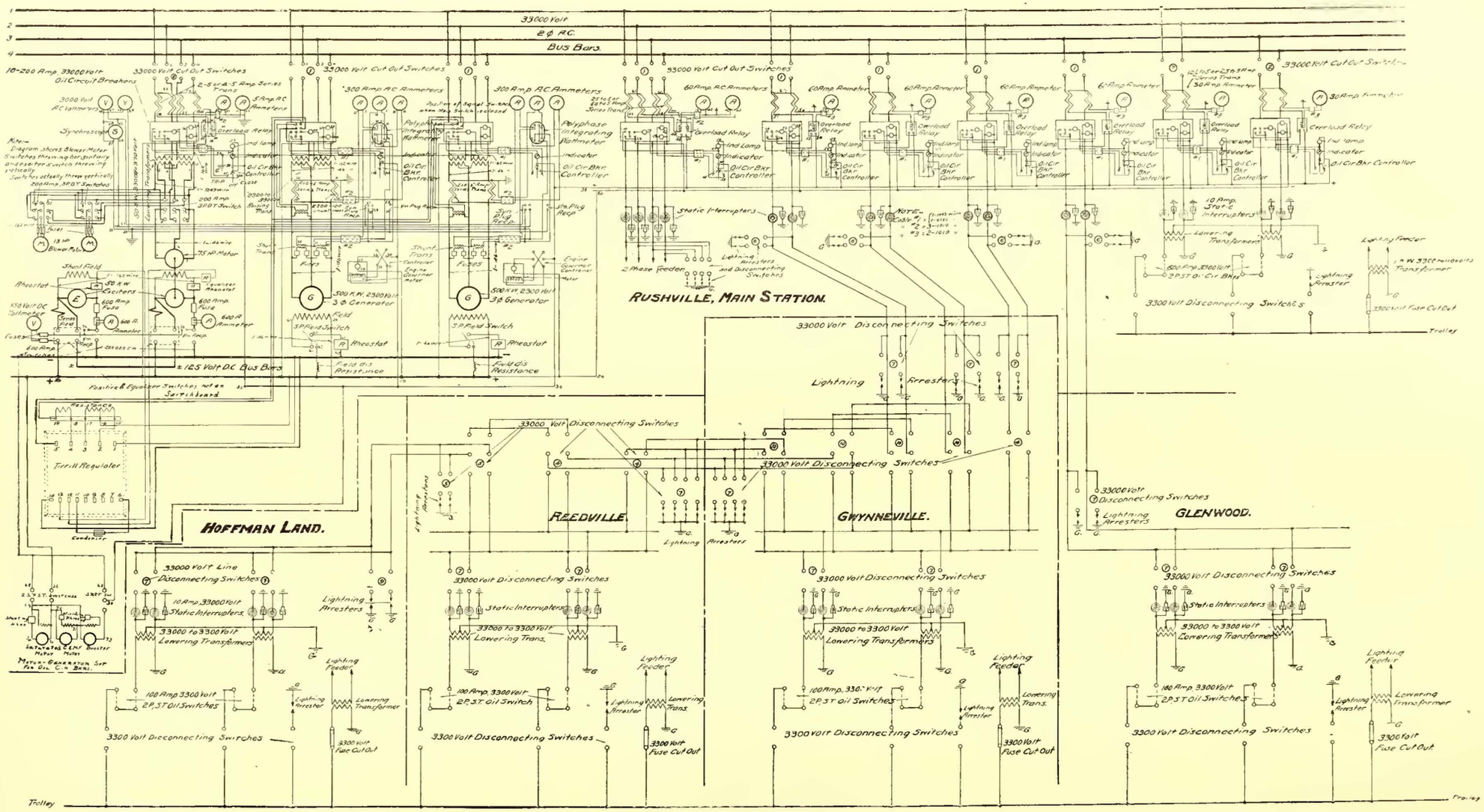


DIAGRAM OF CONNECTIONS FOR MAIN POWER-STATION AND SUB-STATION SWITCHBOARDS FOR INDIANAPOLIS & CINCINNATI SINGLE-PHASE RAILWAY

voltage alternating-current lines in Rushville; the second trolley is of the bow, high-speed type, and has been designed for service at 3300 volts, alternating current.

GENERAL OFFICE

The general offices of the Indianapolis & Cincinnati Traction Company are located at Rushville. The office building is a three-story frame structure, with slate roof; it is equipped with fireproof vaults, steam heat, electric light and a complete interior telephone system connected with the company's own lines and the commercial line. The building also contains waiting rooms and baggage rooms. The executive offices of the company are located in the Traction Terminal Building at Indianapolis.

OPERATION

Local cars are operated each way every hour, making stops upon signals at all of the cities and towns and at the principal highway crossings in the country. These cars are all provided with compartments in which baggage and light express matter may be carried. They are designed to run at a schedule speed of 30 m.p.h. To properly take care of the through service, additional "limited" cars will be put on the line; each of these will be equipped with four 150-hp motors, designed to operate at a schedule speed of 50 m.p.h. or 60 m.p.h., as under the provisions of the various franchises they will not have to make any stops in the country or at any of the smaller towns, and will only be required to make one stop at each of the larger intervening cities. It is expected that when the road is completed from Indianapolis to Cincinnati these "limited" cars will be able to make the trip from the center of one city to the center of the other in three hours' time. It is the intention at a later date to run two express cars per day in each direction, taking care of the light freight and express business.

This road has been built in every detail with a view to the handling of heavy freight, even to the extent of carrying it in long trains. Whenever, in the intervening cities, short radius curves could not be otherwise avoided, the private property of the inside corner has been purchased and the sidewalks and curbs set back so as to make easy curves and permit the handling of heavy trains.

FARES

An average fare of 1½ cents per mile is charged by the company for carrying passengers, the road being divided into 5-cent sections; no fare less than 5 cents is charged for any ride. A school children's ticket is issued, good for use one hour before or after school hours. A mileage or sectional ticket is also issued at a reduced rate, giving 160 5-cent rides for $7, a reduction of 12 per cent from the ordinary fare. No other tickets are sold and cash fares are collected on the car.

John W. Moore, chief engineer of the Indianapolis & Cincinnati Traction Company, has been particularly active in the construction of the roadway, bridges and track work. Arthur A. Anderson, general superintendent of the company, has carefully supervised the entire work of construction and operation. His past experience with the Indianapolis Street Railway and the Mahoning Valley Railway Company, of Youngstown, Ohio, has fitted him in a peculiar way for his present duties.

It is understood that about two years will be required for the Boston Elevated Railway Company to build its extension of elevated structure from Guild Street, Roxbury, to Forest Hills. According to present knowledge, elevated trains will be running between the city proper and the latter point by Jan. 1, 1907. The company has taken up the matter of express trains, and has decided that under existing conditions it will be out of the question to operate such a service. There will probably be several stations between Dudley Street terminal and Forest Hills, all trains stopping at all stations.

TRACK CONSTRUCTION ON CONCRETE IN CINCINNATI

At a recent meeting in Columbus of the Ohio Society of Engineers, J. M. Harper, chief engineer of the Interurban Railway & Terminal Company, of that city, read a paper descriptive of the track construction on concrete in that city. The rail used was the Lorain Trilby girder section, 60 ft. long, 9 ins. deep, and weighing 109 lbs. to the yard. The trenches were taken out 18 ins. below grade, and the rails cribbed up so as to permit 9 ins. of concrete to be tamped under the base of the rail. The form of girder was that of a longitudinal truncated pyramid shape, being 18 ins. at the base, 16 ins. on top and 15½ ins. high, leaving 2½ ins. between the top of the concrete girder and top of the rail. This space was filled with asphalt, the entire roadway of the street proper being paved with this material. Ties 6 ins. x 8 ins. x 8 ft. were placed every 12 ft., and tie-rods were introduced every 6 ft. The forms were held together at the top by U-shaped iron bands.

The proportions used in the concrete were 1, 3 and 5, the stone being crushed to the usual size, unscreened, and the cement Portland. The concrete was permitted to set for ten days, and traffic was switched from one track to the other of the uncompleted to the completed sections by temporary portable cross-overs.

According to Mr. Harper, this construction has been carrying the travel for some seven months and no breaks in the pavement next the rails or at other places have occurred, except at one point, where for some 60 ft. under one rail it exhibits small openings. It is supposed that here the girder has settled and fractured, due to the presence of springs that failed to develop during the progress of the work. The cost of this double-track construction, exclusive of rails and ties, was $3 per lineal foot.

On another highway, paved with granite, shallow rails had to be used on account of quick delivery. To provide sufficient space for the vertical section of the granite blocks, seasoned oak strips were placed upon top of the ties, which were 6 ins. x 8 ins. x 8 ft., and were spaced 2 ft., sometimes more, apart. These strips were immersed in hot creosote oil and then coated with tar. The granite blocks stand flush with the top of the rail and a space 1¼ ins. wide was left between the side of the rail and the granite block. This opening extends down to the concrete foundation and is filled with pebbles ranging in size from a pea to a hazel nut, and the voids are completely filled with Portland cement grout. Not less than seven days must elapse before traffic is permitted on any part of the completed line. Mr. Harper states that certain portions of the tracks (it is a double line) have been operated over now for six months and no breaks or openings next the rails have developed. He attributes this condition almost wholly, however, to the very severe and rigid inspection to which the material and workmanship was subjected.

A party of Cleveland gentlemen, composed of Henry A. Everett, Charles Wason, Will Christy, Warren M. Bicknell, Luther Allen, F. C. McMillan and Louis E. Beilstein, representing a number of Northern Ohio properties, made a trip of inspection a few days ago over the Lake Shore Electric, Toledo & Western, Western Ohio and Dayton & Troy roads. From Dayton the party went to Indianapolis on the "Interstate Limited," and spent a day going over some of the roads out of Indianapolis. The object of the trip was to inspect all these roads and to study the new Indianapolis terminal station, in which the Cleveland managers are greatly interested. It is said in Cleveland that the local roads may build a passenger terminal station in the city in connection with the freight station which they now operate.

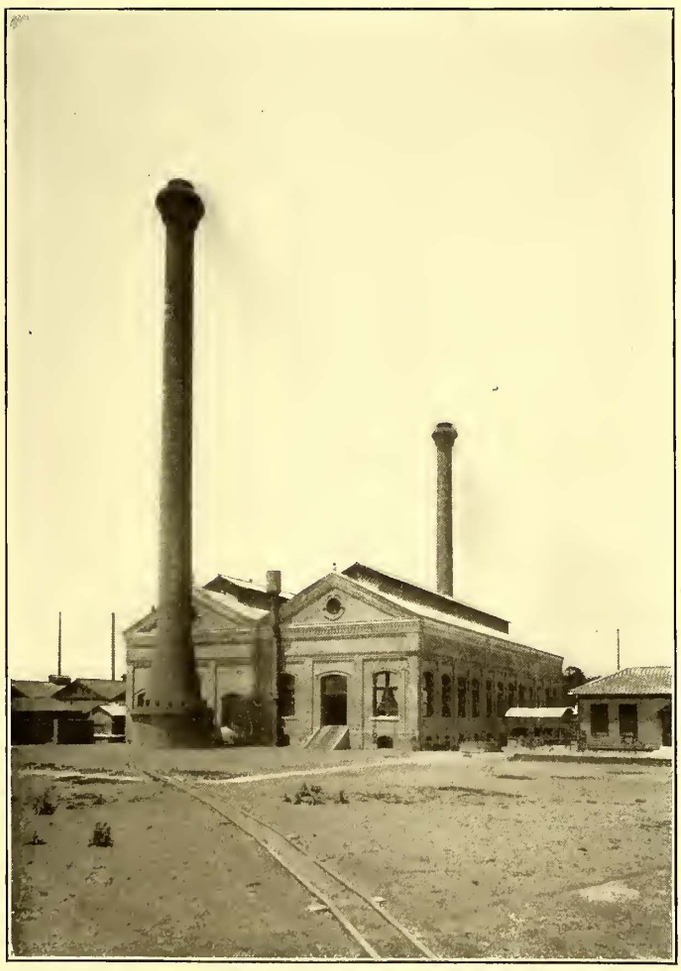
THE TOKIO TRAMWAY COMPANY

BY E. A. BALDWIN

The activity of the Japanese in taking advantage of the modern improvements of Western civilization is nowhere more evident than in the extensive adoption of electricity on the various street railway systems of the Empire. While electric cars are still a novelty in Japan, there is already a large and growing investment in electric street railway systems and a considerable mileage is under operation.

One of the first street railway systems of Japan to adopt electrical operation on a large scale was the Tokio Tramway Company (Tokio Densha Tetsudo Kabushiki Kwaisha), which has now over 250 car equipments in operation. This was the first street railway of any description in the country and was inaugurated about fifteen years ago as a horse railway. The road was then capitalized at $850,000. When it was decided to change to electric traction, in 1901, the capital was increased to $2,500,000, divided into 100,000 shares of $25 each, and an inclusive contract was entered into with the General Electric Company for the supply of the entire new equipment, both steam and electrical, necessary for the complete outfitting of the railway. In view of the fact that extensions to this line are to be made, some particulars of the present equipment may be of interest.

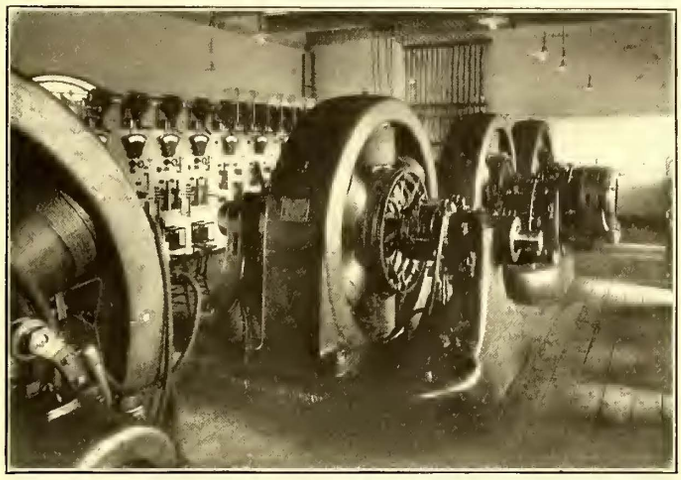
The franchise of the road covers 13 miles of streets, all



AN EXTERIOR VIEW OF THE POWER STATION

within the city. About 10 miles of the line is on the Ginza, the "Broadway" of Tokio, extending through Uyeno Park to Shinagawa, the next city below Tokio, where the power station is located. A branch line runs out to another section of the city known as Asakusa.

To handle the service on these lines the company installed a system of electric generation and distribution conforming to the latest American practice. The generating station, shown in two of the accompanying views, contains three 1200-kw units, each consisting of a 28-pole, 6600-volt, 25-cycle, direct-connected, three-phase generator driven at 107 r. p. m. by a horizontal cross-compound engine. These engines were built by McIntosh & Seymour, of Auburn, N. Y., and have cylinders 30 ins. and 62 ins. x 42 ins., designed for 140 lbs. initial pressure. Two of these units are normally in use, the third being



ROTARY CONVERTERS AND SWITCHBOARD IN THE IMAGAWABASHI SUB-STATION

held in reserve. The excitation is furnished by two MP 6-pole, 100-kw, 125-volt generators direct driven at 225 r. p. m. by McIntosh & Seymour tandem-compound 9½-in. and 19-in. x 15-in. engines, either unit being of sufficient size to excite all three alternators, with a liberal margin besides for the supply of station lighting.

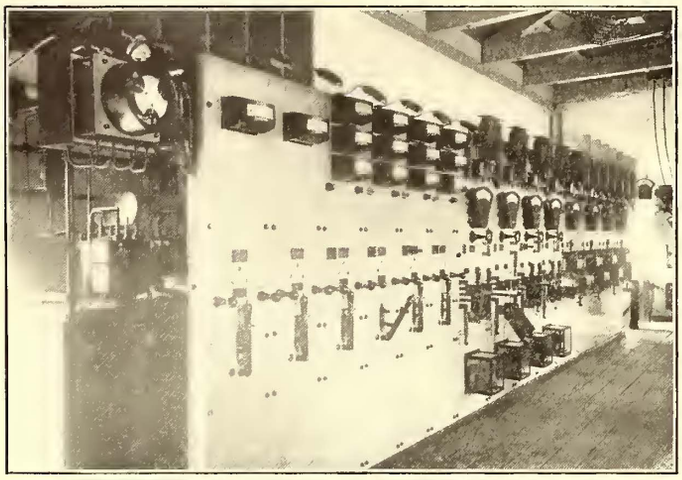
The engine room is served by a 20-ton, 50-ft. span, three-motor Morgan crane, equipped with General Electric motors and controllers.

Jet condensers and air pumps of the Blake-Knowles Steam Pump Works' make are used for the main and exciter engines. The equipment of the boiler room consists of four batteries of Babcock & Wilcox boilers, each comprising two 350-hp boilers generating steam at 150 lbs. The ordinary feed-pumps are in duplicate, and are further supplemented by a small automatic pump, which, acting in connection with a receiver, delivers to the boiler feed system the water of condensation drained from the high-pressure piping. Primary feed-water heaters of the Wainwright type are used with each of the main engines, and in addition one secondary heater is used through which passes the exhaust from the auxiliaries.

The three-phase 6600-volt current from the main generators is carried to a standard General Electric high-tension switchboard (shown in the middle of the interior view herewith), equipped with motor operated form H oil switches. From this switchboard the current is distributed over triple-conductor, paper-insulated, lead-covered cables to the two sub-stations known as Imagawabashi and Hamamatsu Cho. These cables have an aggregate length of about 20 miles, and being laid directly in trench work without conduit are protected from external injury by heavy wrappings of tarred jute and band steel armor.

The Imagawabashi sub-station, illustrated herewith, is the larger of the two and contains four General Electric 6-pole, 400-kw, 500-r. p. m., three-phase rotary converters, compound-wound for 550 volts no load, 575 volts full load. Each rotary is fed from a bank of three 150-kw single-phase air-blast transformers. Three-phase air-blast reactances of 60-kva capacity are placed between the transformer secondaries and the rotaries for the purpose of automatic voltage regulation by phase

control. The transformers are equipped with half-voltage taps in the secondary which, by means of triple-pole, double-throw switches, permit the rotaries to be started from the a. e. side. The rotaries are always started by this method, which from its



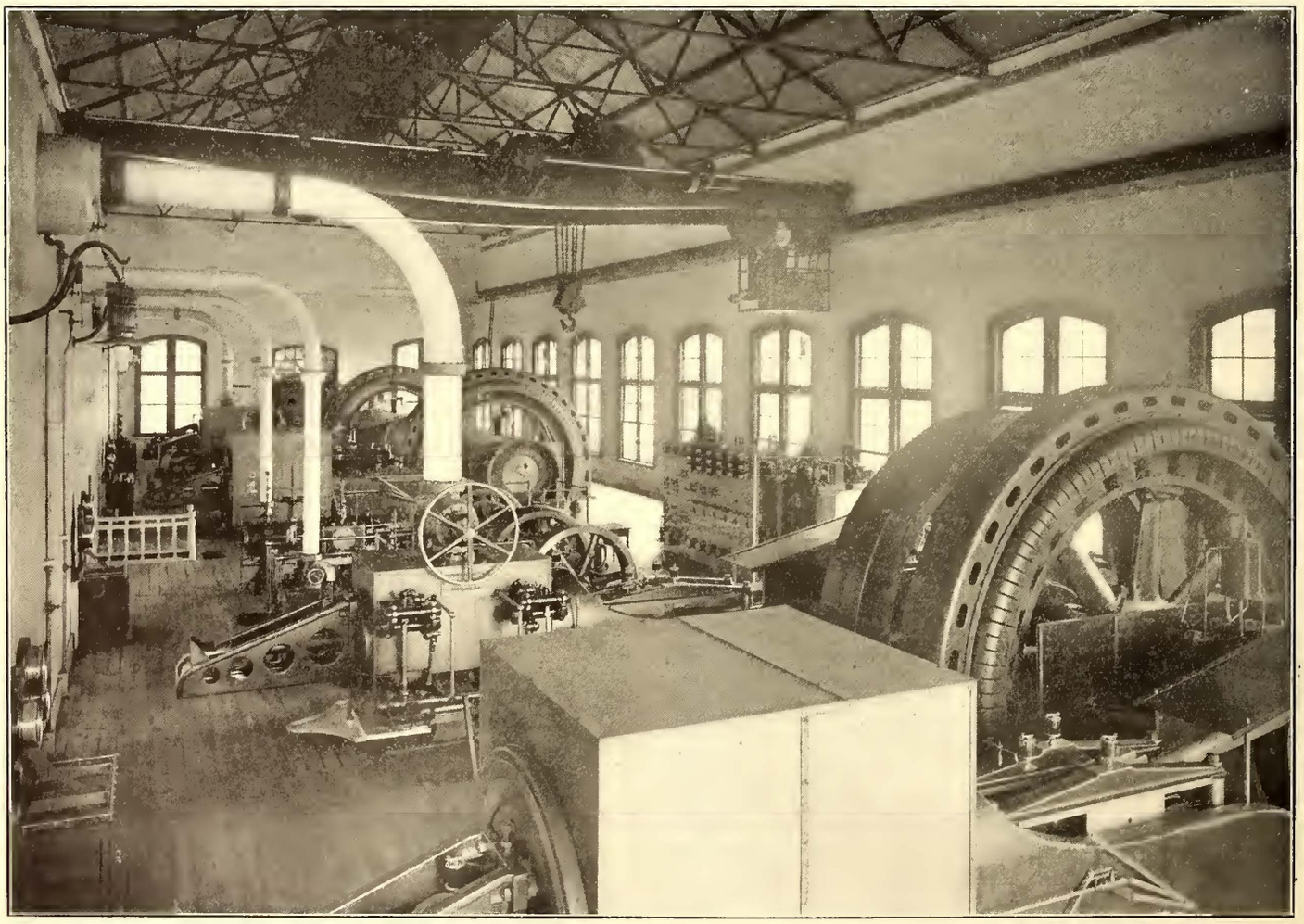
VIEW OF MAIN SWITCHBOARD WITH THREE-PHASE GROUND DETECTOR AT THE LEFT

simplicity and convenience is preferred by the sub-station attendants. However, as the Japanese engineers expressed some doubts of the success of this method at the time the contract was executed, one rotary in each station was equipped with a switchboard, which, it will be noted by inspection of the accompanying view of the Imagawabashi board, is double-pole, the feeder panels being equipped with double-throw switches. This arrangement was necessitated by the fact that a government regulation prohibits the use of rail return circuits. The double-trolley system is therefore used, and the feeder switches are made double-throw for the purpose of changing the polarity of any section of the trolley wire in case grounds should occur simultaneously on two sections normally of opposite polarity.

The equipment of the Hamamatsu Cho sub-station is similar to that of the station described, except that it contains two rotaries instead of four.

Included also in the General Electric Company's contract were trolley wire and overhead line material for 10 miles of double track, together with 250 cantilever motor trucks built by the Peckham Manufacturing Company and equipped with GE 1000 motors. The car bodies were built in Japan, and are of light construction, so that single-motor equipments were found to be of sufficient capacity. The cars are housed in a commodious car house, containing a transfer table, which is also operated by GE 1000 motors.

The electric service was inaugurated on March 17, 1904, and it is of interest to note that the entire work of installation and operation has been exclusively in the hands of native engineers, without direct assistance of any kind from the manufacturing company which supplied the apparatus. The manner in which this work has been carried out, as shown by the accompanying



INTERIOR OF POWER STATION, SHOWING MAIN GENERATING SETS, PIPING, SWITCHBOARD AND CRANE

direct-connected starting motor and all of the rotaries with switchboard arrangements for starting from the d. c. side.

The sub-station switchboards are in accordance with recent practice for this class of work and include no features of novelty. Attention may be called, however, to the direct-current

views, is a distinct compliment to the skill and thoroughness of those in charge.

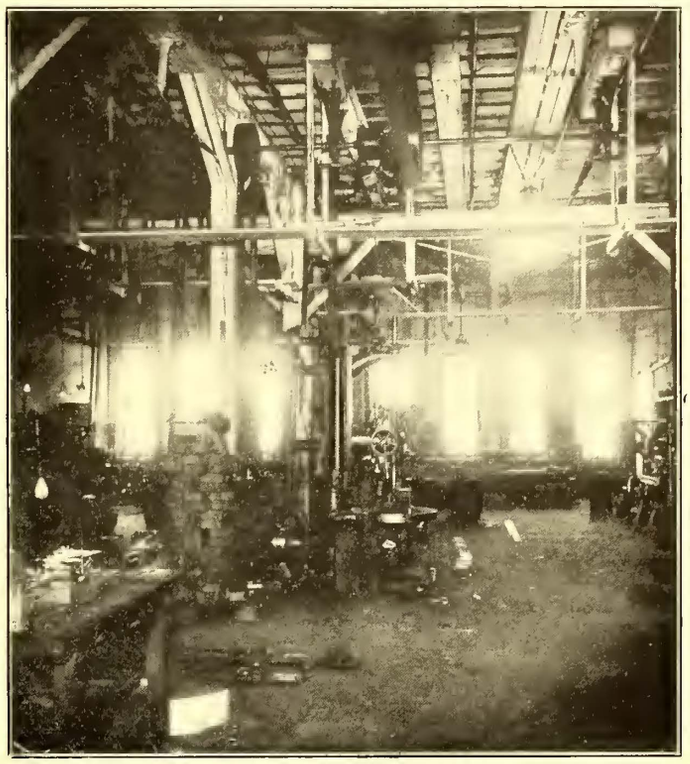
The president of the railway is G. Mudaguehi, and the technical department is in charge of M. Enya, chief engineer, who also directed the entire work of installation.

SHOP EQUIPMENT OF THE NEW REPAIR SHOPS INSTALLATION OF THE DETROIT UNITED RAILWAY COMPANY

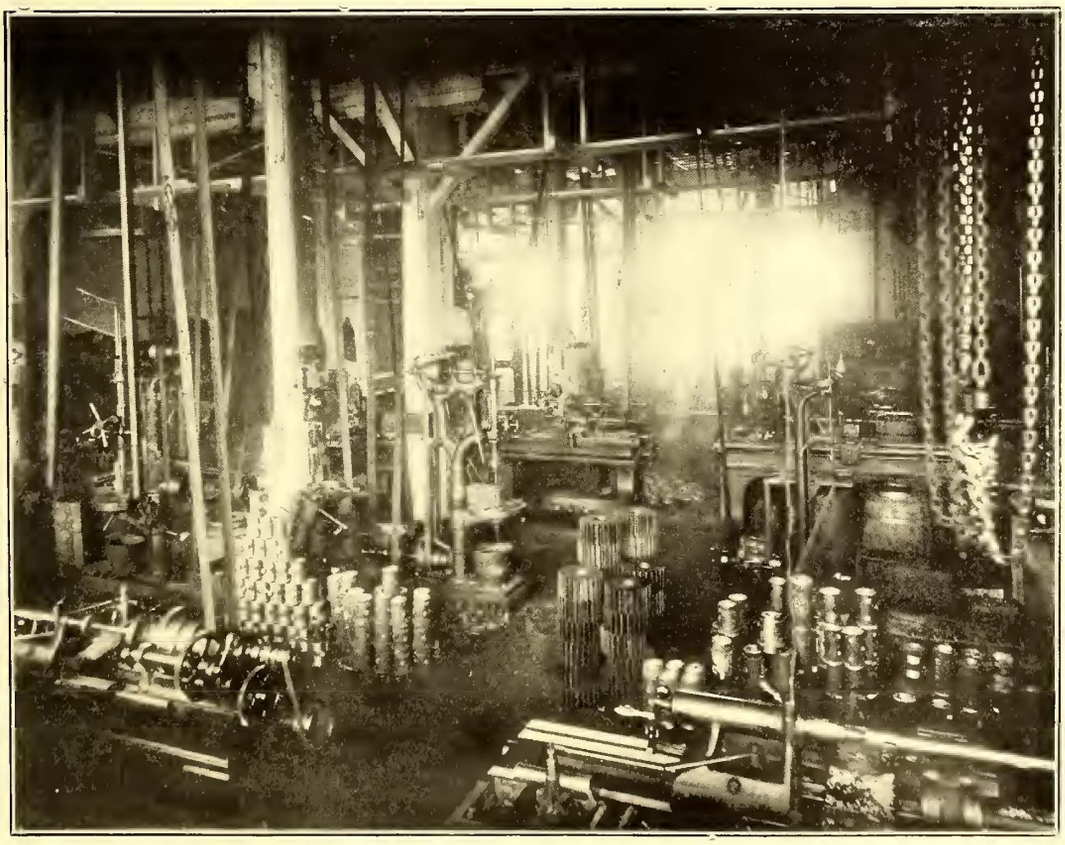
In an article in the preceding issue a description was presented of the shop layout, with details of building arrangement and equipment, of the new repair shop installation recently placed in service by the Detroit United Railway Company, Detroit, Mich. This shop plant, which has been provided by the company as a result of its greatly increased traffic and consequently enlarged problem of rolling stock maintenance, is one of the largest and best equipped shops devoted to electric railway work in this country. On account of the extensive character and completeness of detail of these shops and their equipment—owing to the desire of the company to keep the standard of its mechanical work in advance of the requirements—an account of some of the more important features of the mechanical equipment, as well as the operative methods there, will be of interest to those having to do with the mechanical problems of electric railway systems.

SHOP EQUIPMENT

While careful attention was devoted to all features of this repair shop problem, it is interesting to note in particular that very complete preparations were made for the manufacturing facilities which should be necessary in connection with the repair work. Large and very completely equipped machine, blacksmith and woodworking shops have been provided, and are found of great value in the work of providing repair material and parts for use not only at the main shop but at the various car houses upon the system for light running repairs. The importance of this factor of repair shop work and the necessity of maintaining the adequate manufacturing equipment were thoroughly appreciated by the management, and the results in practice are very gratifying.



GENERAL VIEW IN THE MACHINE SHOP OF THE NEW DETROIT UNITED RAILWAY REPAIR SHOPS



VIEW IN THE LATHE SECTION OF THE MACHINE SHOP DEPARTMENT OF THE DETROIT SHOPS

As may be noted from the shop plan, the machine, blacksmith and woodworking shops are located in a row upon the north, or Macomb Street, side of the plant. It may also be noted in this connection that direct access is provided from this side of the transfer table pit to the stores, not only in the gear and brake-shoe shed adjacent to the blacksmith shop, but also to the stock-yard on the east side of St. Aubin Avenue without necessitating the crossing of the transfer-table pit. Another fortunate feature of the arrangement of these departments may be noted in that the greater part of the heavy work of repairs upon cars is carried out in the erecting shop, which is adjacent to the woodworking shop, thus minimizing the amount of handling required in transferring materials to that department from the machine and woodworking shops.

The wheel department of the machine shop is, however, located on the opposite side of the transfer-table runway, in a section of the truck shop which was obviously the most desirable location on account of the fact that truck work is taken care of exclusively on that side of the plant. In this way the wheel work may be taken care of adjacent to the work upon the trucks themselves, thus minimizing the amount of handling of material necessary in this department. In general, it may be stated that, owing to the carefully planned arrangement of the various departments, the most serious objection to the transfer-table arrangement of repair shops, namely, in regard to the difficulty of handling material across the transfer-table pit, is thereby avoided almost entirely.

THE MACHINE SHOP

The machine shop is a very important feature of the shop work, thirty-three men being employed in this department. It occupies a space of 44 ft. x 82 ft. upon the lowest floor of the three-story section of the building upon the Macomb Street side. As it is adjacent to the blacksmith shop it is evident that forgings which must be machined will be most easily delivered to the machine shop. This department is well lighted, excellent window lighting facilities being provided upon both sides. The southeast corner of the department is devoted to a large and well arranged tool room, in which are kept all the small tools, such as drills, reamers, taps, dies, etc., and other machine supplies for use in this department, as well as also a limited amount of raw stock for the various machining purposes. Considerable storage space is left free adjacent to the tool room, the machine tools being located upon the Macomb Street side of the room. A very liberal machine-tool equipment has also been provided for the work in this department; tools of all classes are in use, with the exception of perhaps the planer. Lathes, drills, shapers and even turret lathes and bolt cutters are in evidence, as well as also the milling machine and cutter grinder. The complete tool equipment is presented in the accompanying table, in which may be noted the sizes of the various tools:

MACHINE-TOOL EQUIPMENT—DETROIT SHOPS

No.	Tool	Size	Maker
2	Engine Lathes	16 inch	F. E. Reed Co.
1	"	20 "	Lodge & Shipley Mach T. Co.
1	"	20 "	Putnam Machine Co.
1	Heavy Engine Lathes	28 "	Pond Mach. Tool Works
1	Turret Lathe	15 "	Warner & Swasey Co
4	Drill Presses	16 to 24 ins.	W. F. & J. Barnes Co.
1	Sensitive Drill	Four Spindle	" "
1	"	Single Spindle	" "
1	Upright Drill	No. 5	New Haven Mfg. Co.
1	Shaper	24 inch	Cincinnati Shaper Co.
1	Milling Machine	No. 9 Plain	Cincinnati Milling Mach. Co.
1	Bolt Cutter	1½ inch Head	Acme Machinery Co
1	Emery Wheel Stand	--------	Leland & Faulconer
1	Universal Tool Grinder	Tool Room	Cincinnati Milling Machine Co.
1	Upright Drill Grinder	Tool Room	Wilmarth & Norman Co.
1	Axle Lathe, 36"	Wheel Shop	Niles Tool Works
2	Wheel Borers, 36"	Wheel Shop	" "
1	Wheel Press, 100 ton	Wheel Shop	" "

Much of the work in this department is of an interesting nature; special methods of machining have been devised in many cases, and jigs are used to facilitate drilling, boring, etc. Armature bearings are bored in a special jig of novel design, which is arranged for mounting upon the carriage of one of the lathes; provisions are made for quickly centering the box in relation to the cutter, which is mounted in a boring bar between the lathe centers, and the boring is then accomplished by merely throwing in the carriage feed and allowing the box and all to traverse as the boring bar revolves. This has proven a very rapid and economical method of handling this work.

Many small parts used in the electrical department and elsewhere are machined to great advantage in the Warner & Swazey turret lathe, while the milling machine is also found a very convenient tool for the duplication of small parts in connection with jigs. Trolley wheels are being finished in quantities from rough castings by special form cutters in the turret lathe, while brush holders are very successfully machined from rough brass castings in the latter tool, in connection with jigs and special cutters; they are made in large quantities in this way very easily and with a minimum of labor cost.

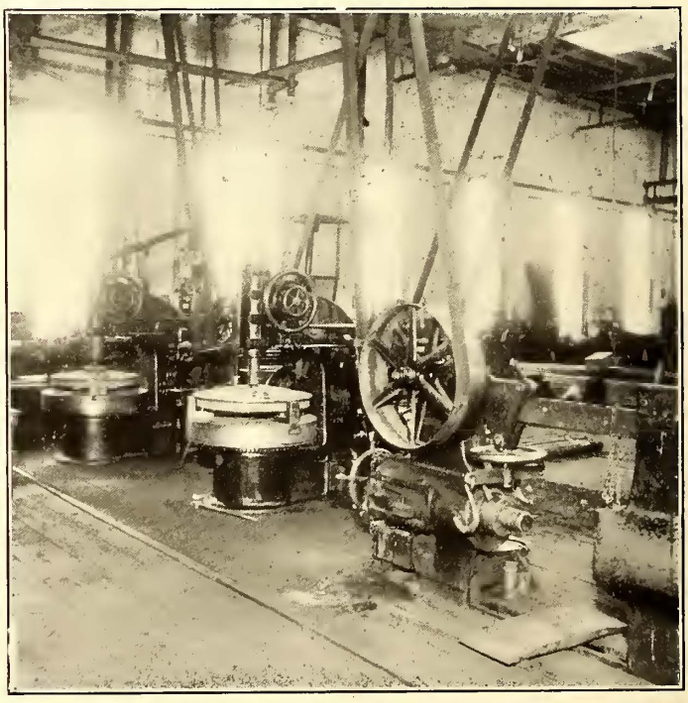
The tool-room equipment consists of the well-known Cincinnati universal tool grinder, and also a Yankee drill grinder of wide range. In the former tool all milling machine and special cutters are ground to advantage, while the grinding of drills and of all lathe and shaper tools are carried out upon the latter tool. These cutting tools are kept in stock in the tool room and supplied to the tool operators as required, the grinding being in charge of the tool room machinist, who is thereby enabled to maintain the cutting edges of all tools at the proper angles for the best results.

As stated before, the tools used for the machining of wheels and axles and for pressing wheels onto and off of axles, are located in the wheel section of the truck shop, as in this place they are most convenient to the work in hand. As may be noted from the view in this department, the tools used include a 36-in. Niles axle lathe, two 36-in. Niles wheel borers and a 100-ton Niles hydrostatic wheel press. These tools will cover a wide range of work and are ample to provide for the maximum requirements in this line from the entire system; the best and most modern tools were secured on account of the importance of the work, and also of the greater capacities thus made available.

The tools are conveniently located between two shop tracks at the east end of the room, which thus facilitates the delivery of wheels and axles by cars direct. Here again an important advantage of the transfer table is emphasized; it permits the delivery of wheels or axles to the shop in carload lots direct from the steam railroad, at one side, without reloading or second handling; also refitted wheels may be loaded here directly onto the material or supply cars which are to deliver them to distant car houses or auxiliary shops. A jib crane of 12-ft. radius swings from an adjacent wall so as to conveniently handle work to the wheel borers and axle lathe, while each of the Niles wheel borers has the auxiliary hoists supplied with them for lifting wheels onto the table chuck and off.

THE BLACKSMITH SHOP

The blacksmith shop, which has a floor area of 44 ft. x 82 ft., occupies the one-story section of the building to the east of the machine shop, this extension having been originally designed especially for this class of work. The roof is amply supplied with ventilators for the removal of the smoke and gases from the forge fires, and, furthermore, the building has the advantage of window lighting upon three sides, in addition to the skylighting; good light, which is so valuable a feature in a smith shop, on account of the very important nature of the work in hand, is thus afforded.

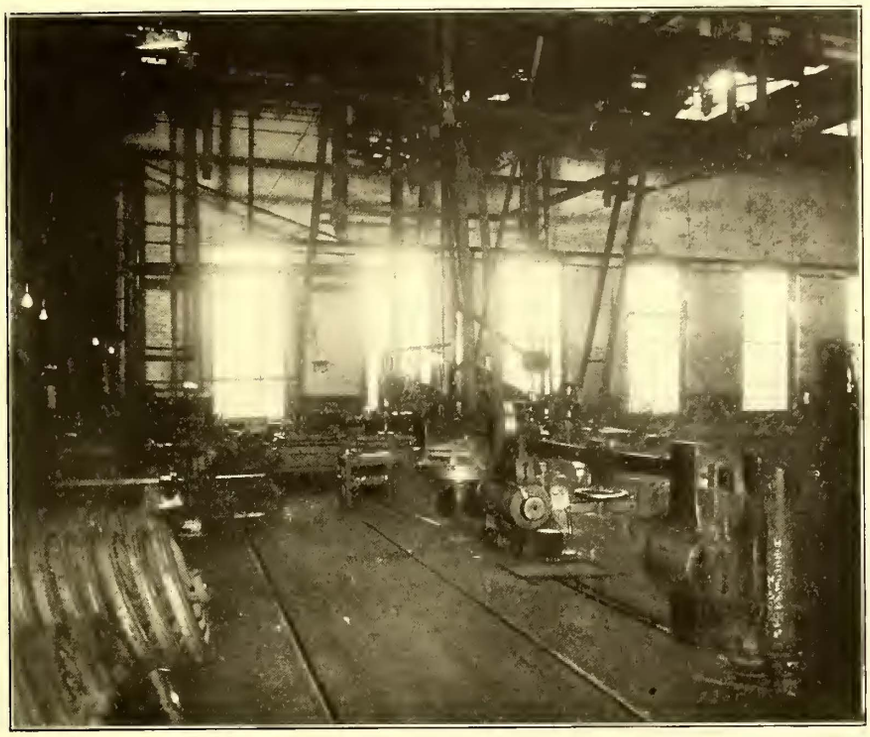


DETAIL VIEW OF THE WHEEL-BORING MACHINES IN THE WHEEL SHOP

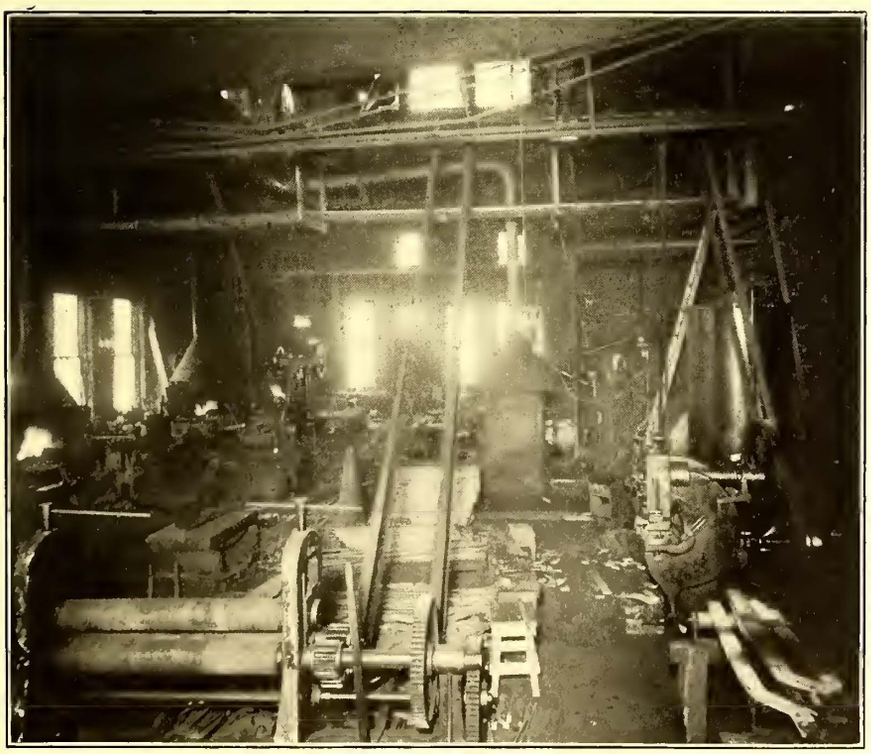
The shop contains seven forge fires, which are conveniently arranged not only for access to the individual anvils and forging clamps and jigs, but also to the power hammers. The

forges are home-made, having been built up of No. 10 sheet iron, with angles riveted to the tops for stiffness; each is 3½ ft. square and sets 2½ ft. high above the shop floor, the top of the tuyere being 10 ins. below the top level of the forge casing. The block method of building up fires is used throughout with excellent results; very clean fires are obtained, and quick and even heating is the result. All of the forges are served with exhauster connections for the removal of the greater part of the smoke from the forge fires through the hoods above them; the exhauster blower is mounted upon a platform beneath the roof and exhausts directly into a stack rising above the top of the adjacent buildings.

In addition to the very complete equipment of jigs, forming plates and forging clamps that are provided for facilitating smith work, there is also provided a Hackney power hammer, which was supplied by the Walker Manufacturing Company, of Cleveland, Ohio; this hammer operates through the agency of an air-cushion cylinder, the hammer piston floating in a practically closed cylinder, which is itself reciprocated by power. A large steam hammer has recently been installed in this shop which will take care of the heavier work of forging; the steam hammer is a Chambersburg hammer of 1250 lbs. capacity, the steam for which is supplied by one of the boilers in the heating plant. The tool equipment of the smith shop consists of a 4-ft. plate roll for the rolling of bumper plates and other heavy rolled work of similar nature; this roll is also a home-made tool, the rolls having been machined from steam locomotive axles. There are in addition two punches in use in the smith shop, one a No. 3 combined punch and shear, furnished by the Long & Allstatter Company, which has a capacity of shearing 5-in. x 1-in. bar or 1½-in. round stock, and punching 1¼-in. holes in the steel plate. The other punch is a small Stiles punch, which is used for lighter work. Twenty-two men are employed in this shop, ten of which are at present kept solely on fender work, embracing not only the repairing of fenders, but also the building of new ones. The machinery in this shop is driven through shafting by a 250-hp Westinghouse motor located in the wood shop, which also drives the line shafts in both the machine and woodworking shops.



THE WHEEL-SHOP SECTION OF THE TRUCK DEPARTMENT OF THE SHOPS, SHOWING ARRANGEMENT OF HOISTING FACILITIES



GENERAL VIEW IN THE BLACKSMITH-SHOP DEPARTMENT OF THE SHOPS, SHOWING ROLLS, PUNCHING MACHINERY AND POWER HAMMER

WOODWORKING SHOP

A large woodworking-tool equipment is provided, and also adequate space is available in the woodworking department to provide for the maximum demands in this line. This shop occupies the west end of the lower floor in the three-story section adjacent to the machine shop. It also is well lighted by windows upon both sides of the building. Excellent bench-work facilities are provided on the north side of the room, while the tools occupy the central portion of the room. The tool equipment was selected to provide for the handling of the repair work in the most effective and economical manner; while the majority of them were moved to the new shop from the old one, still a number of the more important ones are entirely new, having been installed upon the completion of the new shop.

The cabinet shop occupies a part of the floor above the woodworking shop and is equipped with a few special tools for facilitating work of this nature. In this shop all new work as well as repairing, in the line of car furniture and furniture supplies for the system, is carried out. This work is supplemented also by a pattern shop and storage room in a fireproof room adjacent, over a portion of the one-story section occupied by the paint supply room, fireproofing having been considered of special importance here on account of the great value of many of the patterns. This shop is also provided with a few special tools,

including a wood lathe, jig saw, saw bench, etc., for facilitating this particular class of work.

THE CARPENTER-SHOP DEPARTMENT OF THE DETROIT SHOPS

The following is a list of the woodworking department tool equipment:

WOODWORKING TOOL EQUIPMENT—DETROIT SHOPS

Number	Type of Tool	Maker
1	Heavy Wood Planer	Frank H. Clement
1	"	Baxter D. Whitney
1	Universal Wood-worker, with Boring Attachment	J. Fay & Egan Co.
1	Hand Surfacer or Jointer	" "
2	Mortisers, with Boring Attachments	" "
1	Sticker	Schmidt
1	Tenoner	Frank H. Clement
1	No. 2 Two-head Shaper	" "
1	Single-head Shaper	" "
3	Table Saws	J. Fay & Egan Co.
1	Band Saw	" "
1	Band Saw Filer	Chas. E. Wright
1	Swing Cut-off Saw	J. Fay Egan & Co.
1	Jig Saw	" "
1	Sandpapering Mach.	Berlin Machine Works
	Grindstone and Emery Wheels	

ELECTRICAL DEPARTMENT

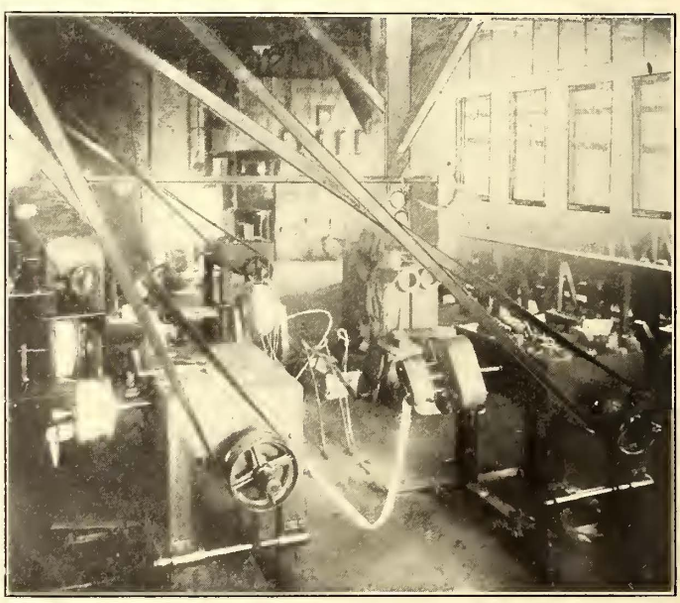
The electrical repair work is carried on upon the two upper floors of the three-story section of the building above the machine shop. Thus an area of 44 ft. x 82 ft. is provided upon each floor, and the advantages of excellent lighting, which is so necessary in this work, are obtained; upon the upper floor skylighting is also provided. Easy access to either of the two upper floors is afforded by a hydraulic freight elevator which is entered through the machine shop on the ground floor. Material, as well as armatures, motor fields, etc., are transported to and from this department by trucks, which are thus easily handled on the elevator and across the transfer table. Accompanying engravings illustrate the facilities, as well as also the character of the work in various sections of this department.

Special attention is given to the winding of fields and armatures, a very complete equipment having been installed for this work and, in particular, for the winding of formed armature coils. Power operated winding machines are used, the mechanism of which embraces the usual worm-gear drive through a friction clutch, operated by a foot pedal, for starting and stopping. One of the illustrations on this page shows a group of four winding machines, from which a general idea of their construction may be obtained. The mechanism is in each case mounted upon a heavy wooden framework, the top of which is covered with a boxing that serves as a very convenient table; this box cover also effectually keeps out dust and dirt from the worm gearing. The friction clutch is located within the driving pulley at the front side and is operated by levers from the foot pedal, shown below the winding shaft.

The two forward machines are shown as arranged for winding field coils, the field-forming frames being mounted upon the worm-driven shaft extending out from the box to the left, as shown. For armature coil winding these coils are replaced by the special collapsible or sectioned winding forms of the usual types, which are thus driven by power with correspondingly increased production. The stock of winding forms provided embraces every type of coil, both armature and field, that is used upon any part of the system, so that any style of armature may be repaired upon short notice.

In another portion of this department, apparatus is provided for the taping of the formed armature coils, and afterward for pressing them to shape after the insulating board has been glued on. The taping machines are of the usual well-known type of construction for this work, the coil of the tape being made to revolve in a "ring path" around the armature coil which is held within the hollow space. These machines are shown mounted upon a table at the right hand of the above-mentioned view, there being three of the machines upon either side. The machines are driven from countershafts beneath the table, each being controlled by a separate foot pedal for starting and stopping, as desired. They are, as is well known, very rapid in action and very effective, permitting a very much greater production than is possible with any other method.

The presses for shaping and setting the insulating board when glued upon the form coils are shown mounted upon tables at the left in the view. There are eight of these air operated



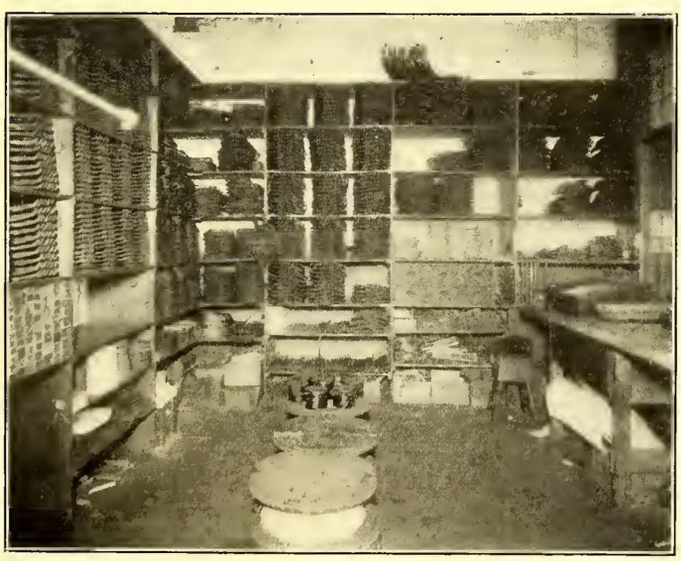
VIEW OF THE COIL-WINDING MACHINES IN THE ELECTRICAL DEPARTMENT

presses, which accomplish their purpose by gripping the side portion of an armature coil where it is to be dropped into the slot in an armature core; this results in pressing the insulating board to shape and holding it firmly until the glue has properly set. Each press is operated by an individual Christensen straight-air brake valve, located at the right of the cylinder, as shown, by which air is admitted and released from the cylinder;

the piston in the air cylinder is raised to release position by internally arranged springs, as in air-brake cylinder construction. It is found that coils stand up very much better in service when finished in this way than by former methods; it is also found that the operation of compressing is very rapid and effective, little extra time being required for this portion of the work.

Two other interesting operations are carried on in this portion of the electrical department, namely, stripping the leads from the armature coils and tinning them. All armature coils when completed are brought to the corner of this room at the rear of the air press table and there put through this process. First the leads from each armature coil are run through a tinsmith's roll, the rolls of which have been spaced so as to tightly press the wire. The wire leads are run through a distance of 2 ins., or as far as it is desired to strip the insulation, after which it is found that the insulation is practically cut off on both sides so that it may be easily picked off by hand. Care must be taken, of course, in this operation to not flatten the wire, as by placing too much pressure on the rolls the wire may be seriously flattened; but by properly gaging the pressure of the rolls the insulation may be cut by the mere action of the pressure, with scarcely any effect of flattening of the wire. The tinning of the leads is then carried out in the usual manner, the ends being dipped in a cleaning and fluxing solution and then dipped into a pot of hot solder; the latter operation is very rapid, as the coils are dipped and tinned in lots of twelve in a bunch. The entire process of stripping and tinning is very simple, and one boy, experienced in the work, can handle the entire daily output of the department in a very few hours.

THE COIL-TAPING MACHINES AND AIR PRESSING MACHINES FOR FINISHING ARMATURE COILS



THE STOCK ROOM OF THE ELECTRICAL REPAIR DEPARTMENT

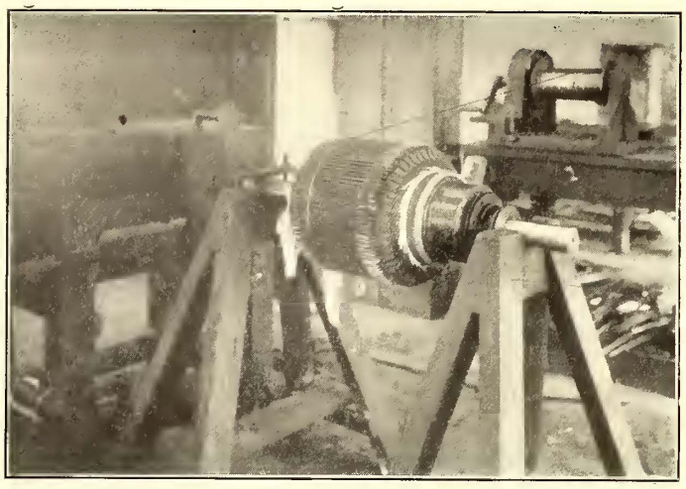
An accompanying view of the electrical store room shows the method of storing the armature coils of the various types in accordance with the practice at Detroit. The coils when completed are delivered to this stock room and are thereafter issued to the armature winders only upon requisitions. Careful records are kept of the number of coils made and those delivered for rewinding, so that an accurate account of the costs of this feature of the work may be kept. A large number of coils are kept for each type of armature in use upon the system, so that the least possible delay will be experienced in rewinding armatures. The scope of this stock room is also extended to include all other supplies which are used in the electrical department, including the insulating paints, mica insulation, etc., down to machine screws and bolts. The armature storage scheme is shown at the left in the view of the testing department.

A detail view is presented of the arrangement which is used for banding rewound armatures. The completed armature is, as indicated, mounted upon adjustable horses with the armature shaft in line with the driving crank upon one of the above-mentioned coil-winding machines. This winding machine is identical in construction with those illustrated upon page 312, with the exception that a crank protrudes from the opposite side of the worm-driven shaft, from which the coil form is usually carried. Then, by merely clamping a projecting strut upon the gear-seat end of the armature shaft and bringing this in contact with the projecting driving crank, the arrangement is complete and ready for operation. The banding wire is carried in a coil upon a nearby table, this coil being arranged with a retarding band brake, which may be tightened or loosened so as to give any desired strain upon the wire in banding. The armature shown in the view is in the process of being banded, from which an excellent idea of the scheme may be had. The arrangement is very simple and effective, and excellent results are obtained by its use.

In another illustration is shown the testing corner of the electrical department, in which field coils, armatures, circuit breakers and all other electrical apparatus is tested for insulation resistance and ground. This department is upon the top floor adjacent to the armature storage section, and is served by a traveling hoist arrangement, which facilitates the delivering of armatures to and from the testing block. All armatures, coils, etc., are here tested and tagged to show their condition and to provide for the records which are kept of the service.

The testing transformer consists of a special semi-circular core with a field winding so arranged as to set up an alternating-current field which will locate short-circuited coils upon armatures. The transformer is of a type of construction which has been very much used for this work and will therefore not necessitate detailed illustration. In use the armature is dropped into the semi-circular opening, which is of a size near to that of the average size of armature. Then when alternating current is turned into the field coil a strong alternating-current field will be set up in the armature, which will indicate at once

the presence of a short-circuited coil by its heating effect upon that coil. Current is supplied to the transformer by means of a special motor-generator supplied by the Commercial Electric Company, which operates upon 500-volt direct current and delivers single-phase alternating current for the above work



DETAIL VIEW OF THE ARMATURE-BANDING MACHINE

and testing for grounds. A special detachable secondary is used in connection with the armature tester, which is set across the gap of the semi-circular alternating field core in place of the armature. This secondary has several windings which may be connected in different combinations so as to deliver either 1200 volts, 1400 volts or 1600 volts alternating current for high-voltage testing.

Armatures are also tested very largely at present here by the millivolt drop method; the armature shown in the illustration of the testing corner is undergoing such a test. The armature is placed in a special supporting cradle, which has brush holders mounted upon the arms so as to be located at an angle of 90 degs. apart upon the commutator. Then a 500-volt current is impressed upon the brushes and the drop read across each combination of bars by means of a millivolt meter. This method has been found to be preferable in many ways to the alternating-current method of testing, as it gives a more accurate knowledge of the conditions present in the armature.

The testing of circuit breakers is carried out by the usual water rheostat method, the water rheostat being shown at the right in the testing corner. The circuit breakers are mounted upon the projecting partition and are calibrated by passing definite amounts of current through them, as indicated by an ammeter in the testing circuit. The water rheostat permits ready adjustment of the current values, which may, of course, be easily determined by the ammeter. The breakers are tested repeatedly and are thereby brought to the best condition of repair, so that they may go out with an assurance of being in proper condition; all necessary repairs to the breakers are also made at this time.

An interesting work is being carried out at Detroit in the rebuilding of the old type of controllers which were formerly used in connection with the "steel" motors manufactured by the Lorain Steel Company. A large number of these equipments were in use upon one of the former systems in Detroit, and these controllers are being rebuilt and retained in service. The old form of drum with large round disc separating and deflector plates is being replaced by controller drums of modern construction, using hardwood mountings for the staff upon which the plates are fastened. The entire controller is rebuilt for this purpose and the magnetic blow-out arrangement changed so that very satisfactory operating results are obtained.

Each department of the shop is in the charge of a foreman, who reports directly to the master mechanic, S. Potter. The foremen of the above departments are as follows: Machine shop, N. McCuen; smith shop, Louis Zinke; wood shop, John St. Amour, and electrical department, James Ulley. The further details of equipment and operative methods in the other departments of this interesting shop, a description of which is here prohibited by lack of space, will appear in an article to follow in the succeeding issue.

VIEW IN TESTING CORNER OF THE ELECTRICAL REPAIR DEPARTMENT, SHOWING ALSO SCHEME OF ARMATURE STORAGE IN USE

The formal opening of the new club rooms and gymnasium provided by the management of the Oakland Traction Company for the use of the car men employed on its Oakland, Alameda & Berkeley system and those on the lines of the San Francisco, Oakland & San Jose Railway took place recently. The new quarters, which have been completely furnished by the company, are in the headquarters building at the corner of San Pablo Avenue and Jones Street, Oakland. They include a spacious gymnasium, fitted throughout with modern apparatus, a splendid bowling alley, billiard, card and reading rooms, tub and shower baths and a locker room. All the work of fitting up the club has been done by the management of the Oakland Traction Company, and the rooms, light, water and fuel will be provided without cost to the club members. An interesting programme was arranged for the opening night, when the quarters were turned over to the men by General Manager W. F. Kelly. Addresses were also made by Assistant General Manager J. Q. Brown, Superintendent J. P. Potter and C. E. Parsons, president of the Oakland Traction Club.

FUEL, ASH AND GAS TESTING: III, SAMPLING AND TESTS

BY J. STANLEY RICHMOND

OUTSIDE SAMPLING

The value of any chemical test, however correct the results may be, is absolutely dependent on the correctness with which the sampling is carried out. When coal is being unloaded, a spadeful should be thrown every few minutes to one side on some boards or in a box reserved for such purpose. When all the coal has been unloaded, the sample which has been collected should be well mixed and then divided by a cross into four quarters, as shown in Fig. 8. *A* and *D* or *B* and *C* should then be thrown away and the remaining two quarters be again mixed, quartered and two of the quarters thrown away. When the pile is reduced by this method to a quantity which will about fill three buckets, the sample is taken to the laboratory for the inside sampling. In the outside sampling of ash, the same method is adopted. In sampling furnace gases from the stack, the apparatus required is as shown in Fig. 9; in which *A*, *B* and *C* are three bottles, having about 1 quart capacity each, which are fitted with corks and bent glass tubes. *D* is a fourth bottle fitted with two corks (one near the bottom and the other at the top) and glass tubes. The glass tubes *F* and *E* are provided with short pieces of rubber tubing and pinch-cocks *G* and *H*. To take the sample, *A*, *B* and *C* are filled with distilled water, and *D* with ordinary water. *F* is then connected to a metal tube which has been driven through the smokestack wall, and the two pinch-cocks are opened, care being taken that the bottle *D* is lower than the three other ones. As a result, the water in *A*, *B* and *C* will be drawn off by *D*, and will be replaced by gas from the stack. The pinch-cocks should then be closed and the apparatus disconnected and taken to the laboratory. The sample in *C* should not be used, and that in *B* be only used if that in *A* is not sufficient. The pinch-cocks *I* and *J* are for the purpose of separating *A*, *B* and *C* without spoiling the samples.

INSIDE SAMPLING

The outside sampling completed, preferably in the afternoon, the sample of coal is taken to the laboratory and emptied into a ½-in. or ¾-in. mesh sieve placed on the lead-covered floor of the sampling room. The lumps remaining in the sieve are then thrown on the sampling table and broken up with the flat-faced hammer so that they will pass through the mesh of the sieve. The sample on the floor is then well mixed—kid gloves are not wanted in the laboratory, for hands often serve as the best mixers—and the sample is then spread out and quartered. Two quarters are then thrown away and the remaining ones again mixed and quartered, two of the quarters being thrown into another sieve having about ¼-in. mesh, and the other two quarters are thrown away. The lumps which will not pass through the sieve are broken up on the sampling table until all the sample is sifted, when it is well mixed, and a copper dish is filled with about 1 lb. of it, taken in small quantities from different parts of the sample. The dish with the sample is then placed on one side of the scale and a 1-lb. weight and a counterweight to the dish are placed on the other side of the scale. When an accurate pound of the sample is thus weighed out, the dish and its contents are placed in the water bath and left there over night. The inside sampling of ash is carried out on similar lines.

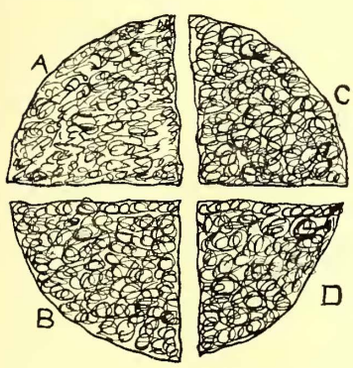


FIG. 8.—SAMPLE, SPREAD OUT AND QUARTERED

The first operation when the laboratory is opened in the morning is to open the water bath and take out the samples of coal and ash. These are then taken to the sampling room and allowed to cool, when they are weighed and the loss due to the evaporation of the water is calculated and worked up on a percentage basis. The sample is then placed in a large cast-iron mortar and the bigger lumps crushed, after which it is emptied

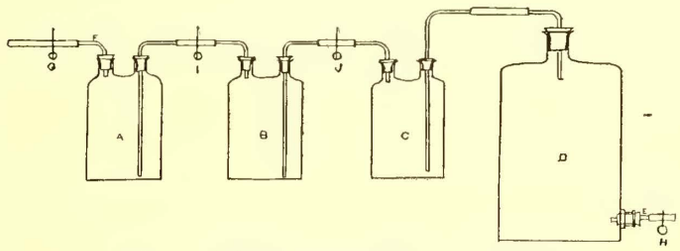


FIG. 9.—FLUE-GAS SAMPLING APPARATUS

out on a sheet of coarse brown paper, quartered and two quarters thrown away. The remaining two quarters are again crushed in the mortar until reduced to the size of coarse-grained gunpowder. The sample is then well mixed on the brown paper, spread out and portions taken from different parts of it with the spatula. About 2 ozs. should be taken and wrapped up in a sample paper, similar to the way in which seidlitz powders are put up. The outside of the package should be marked with the name and date and percentage of water found in the sample. The package, after being placed in the water bath for a few minutes, is then enclosed in a desiccator to cool, preparatory to weighing out portions on the balance for the tests.

TESTS

The furnace having been lighted, 2 grammes of the coal or ash is weighed out on the balance and transferred with the aid of one of the camel-hair brushes to one of the porcelain crucible covers which has had the ring pinched off. The cover with its contents is then taken to the furnace, and, when the doors have been removed, is placed in front of the muffle near to its mouth. As the contents of the cover gradually heat up, the cover is little by little pushed forward until it is well within the muffle entrance, where the heat, combined with the freely entering air, gradually burns all the carbonaceous matter and leaves nothing but the true ash. This operation is accelerated by stirring the coal now and again with the platinum wire before described. That the cover is not introduced into the muffle at the start is due to the fact that the escape of the volatile matter in the commencement of the operation, if allowed to take place too rapidly, causes spitting and, thereby, inaccuracy of the determination. Owing to the inexperience of the novice, the first few tests which he commences will prove, owing to this fact, a case of "love's labor lost," but, with a little patience, he will soon meet with success. When the carbonaceous matter is all burnt, the doors are removed from the front of the muffle and the cover and its contents taken out by the aid of the cupel tongs and placed for two or three minutes on one of the fire-brick tiles on the furnace table. It is then picked up with the crucible tongs and taken to the balance room, where it is placed inside of the desiccator to cool. When the ash is cool, it is transferred to the balance pan and weighed. The weight of such ash in grammes multiplied by fifty will give the percentage of ash in the dry sample.

While the ash is being obtained in the muffle, 5 grammes of the sample are weighed out on the balance in one of the porcelain crucibles. The crucible and its cover, which should always be kept in the desiccator, has, of course, to be first balanced on the balance. The cover is then placed on the crucible and the cupel tongs used to introduce such into the muffle, the front of which is immediately closed with the doors. This can be done while the ash determination is going on. When three minutes

have elapsed, the doors are taken away and the crucible placed for a couple of minutes on one of the small fire bricks to partially cool. It is then removed with the crucible tongs to the desiccator and given twenty minutes to cool. The crucible with its cover and contents is then reweighed on the balance and the loss in grammes multiplied by twenty will give the percentage of volatile matter in the dry sample.

In working up the results obtained, the embryo chemist should remember that the engineer requires information in regard to the material as handled in the boiler room. Using arbitrary figures, allow that the percentage of the water in the original sample as taken is 5 per cent, and that the percentages of both the volatile matter and the ash in the dry sample is also 5 per cent in each case. As a result, there are only 95 parts of coal in every 100 parts of the original sample. The percentage of ash in the coal as received will be, therefore, $5 \times \frac{95}{100} =$ 4.75 per cent, and will give the following on analysis:

	Per Cent
Water	5.00
Ash	4.75
Volatile matter	4.75
Carbon (by difference)	85.50
Total	100.00

Allowing that the volatile matter is considered on the same basis as carbon, which is not always done, the engineer should only pay for 90¼ tons of the 100 tons gross weight of coal received, and, at $2 a ton, he will save, by paying for such on the basis of composition, (100 × 2) — (90¼ × 2) = 200 — 180.50 = $19.50.

The determination of the composition of the ash is undertaken with a view to check the firemen. For no good engineer cares to have his firing so carried out that the ash contains more than a negligible amount of carbonaceous matter.

Each and every sample should also be examined with the naked eye and with the magnifying glass, and it will soon become easy to pass a fairly accurate opinion on the coal received by simply making a superficial examination of it.

Gas analysis is undertaken in order to find out if the amount of air admitted to the boiler furnaces is excessive, insufficient or approximately correct. As combustion is the combination of the oxygen of the air with the carbon of the fuel, and as carbon forms two oxides with oxygen (carbon monoxide, CO, or, as sometimes termed, carbonic oxide; and carbon dioxide, CO_2, or, as sometimes termed, carbonic acid), it follows that the composition of the flue gas, if the combustion has been perfect and the amount of the air admitted has been correct, should contain very little oxygen or carbon monoxide. As to whether carbonaceous matter is or is not being wasted, such can be determined by watching the escape of the gases from the top of the stack.

The first operation is to make up the necessary solutions. Six ounces of caustic potash (not purified by alcohol) should be dissolved in about 12 or 14 liquid ounces of distilled water and the solution be placed in one of the glass stoppered bottles, the stopper of which has been greased with vaseline. The potassium pyrogallate solution is made up as required. Two grammes of pyrogallic acid is dissolved in about three times its weight of distilled water, and the solution is mixed with eight times its volume of the caustic potash solution. The cuprous chloride solution is made by placing about 60 grammes of cuprous chloride in one of the glass stoppered bottles and pouring on it about 300 cu. cm of concentrated hydrochloric acid (1.124 specific gravity). The contents in the bottle are then well shaken and, when the chloride is dissolved, a copper spiral (copper turning) long enough to extend from the bottom to the top of the solution is placed in the bottle. The solution will be dark at first, but will finally become colorless and clear. The solutions having been made are placed on a shelf at the back of the gas apparatus. The shelf should be located about the middle of the two tubes, and should be long enough to also hold the gas sampling apparatus before mentioned. This permits the sample of gas and the solutions to acquire a temperature about equal to that of the water in the gas apparatus. This apparatus is illustrated in Fig. 10, in which the burette to the right is the working tube and the graduated one to the left is the measuring tube, the zero being on the bottom end, the 100 c. c. mark being to the left of the stop-cock on the capillary tube between the two bulbs. The top of the working tube is provided with a stop-cock and a glass funnel, while the bottom of it is arranged with a stop-cock which can be closed, or permit the liquid in the tube to run into a beaker placed below the stop-cock, or permit water to run from the right-hand aspirator bottle into the tube. To prepare the apparatus for the tests, all the stop-cocks are opened and the distilled water in the two aspirator bottles is permitted to run into the tubes until they are full and the water rises in the funnel. The stop-cocks are then all closed and the funnel is removed. The first of the three gas sample bottles is then connected to the top of the working tube, and the third bottle, having been disconnected and filled with distilled water, is reconnected to the second bottle, but reversed. The right-hand aspirator bottle is then lowered and the stop-cocks at the top and bottom of the working tube are opened. The water in the tube will then run into the aspirator bottle and will be replaced by gas. When the tube is nearly full of gas, both stop-cocks are closed and, the gas sample bottle connection having been removed, the funnel is replaced. The aspirator bottle on the left is then lowered, while the one on the right is raised, and, by opening the stop-cock between the tubes and the one at the bottom of the working tube, the gas will be transferred to the graduated burette. To measure off an accurate amount of the gas, the aspirator bottles are held at such a height that the level of the water in each of them is the same as in its corresponding tube. The stop-cock between the tubes is then closed and the funnel one opened, when, by raising the right-hand aspirator bottle, the remaining gas in the working tube is driven out. When the water appears in the funnel, its stop-cock is closed, the right-hand aspirator is lowered, the left one raised and the stop-cock between the tubes opened, when the gas will return to the working tube. All the stop-cocks being closed, the funnel is filled with some of the caustic potash solution and its stop-cock then slightly opened. The solution will then trickle slowly down the sides of the working tube and absorb the carbon dioxide. Great care should be taken to prevent the liquid in the funnel from getting too low and thus allow the gas to escape through the funnel. When the absorption is completed, the gas is retransferred to the graduated burette and the loss by absorption measured. By closing the stop-cock between the tubes and by opening the other two, the liquid in the working tube will run out of the second passage in the bottom stop-cock into a beaker placed below it. The funnel is then filled two or three times with distilled water, which is allowed to run freely down the sides of the tube, and thus wash it free from the chemicals. The gas is then again

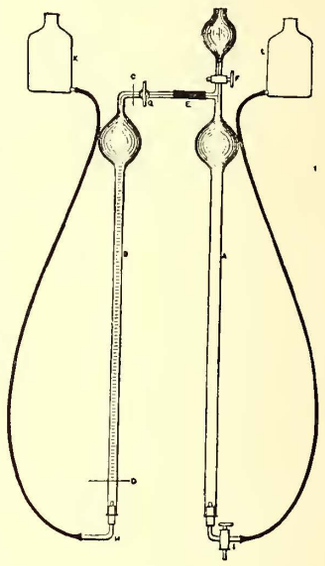


FIG. 10.—DR. ELLIOTT'S ABSORPTION APPARATUS FOR GAS TESTS

returned to the working tube and the oxygen in it is absorbed with some of the potassium pyrogallate solution. The gas is then again measured and the further loss calculated, and, after the working tube has been rewashed, it is returned for the absorption of the carbon monoxide. The cuprous chloride solution is used for this purpose, and it should only be allowed to trickle very slowly into the working tube. This absorption will take from ten to twenty minutes, when the gas is again measured in the graduated burette and the still further loss calculated.

While the above description of absorption work appears to be somewhat complicated, it will be found in actual practice that a little experience will soon enable the operator to run through the manipulations smoothly and rapidly. This experience can be gained by practice with air and water only.

DISCUSSION ON OVERHEAD LINE CONSTRUCTION

The discussion on the paper read by H. M. Sayers before the Tramways and Light Railways' Association, of London, and published in this paper for Feb. 4, brought out a number of interesting points.

W. M. Mordey spoke highly of the V or horn lightning arrester which is used in South Africa, where lightning discharges are frequent and severe. With this arrester he had counted twenty-three flashes in one minute successfully carried to the ground. A. J. Lawson believed that pole No. 1, recommended in the paper, was too light; he thought that the medium weight pole should be No. 1 pole, and that a pole weighing about 1270 lbs., with diameters 8 ins., 9 ins. and 10 ins., should be the No. 3 pole. He also advocated the discontinuance of the lap at the end of the ear, and believed that the ear should be cut back to the point where it is strengthened by the back rib. He also advocated the abolition of the use of iron scroll work on bracket poles.

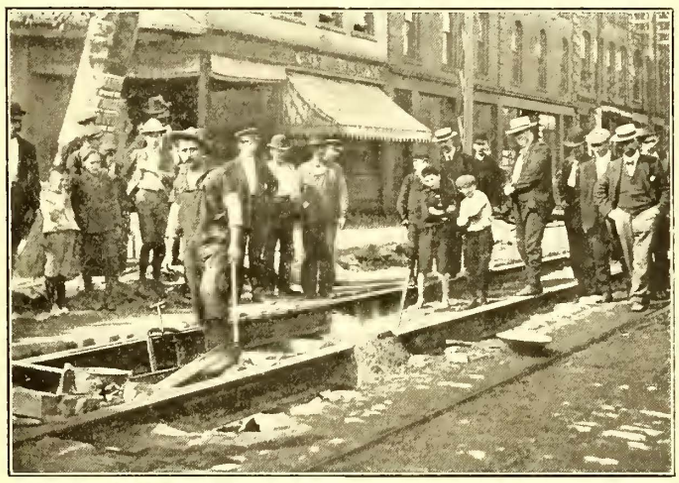
A. L. C. Fell recommended the use of a larger copper trolley wire than No. 0, or else the installation of bronze or other special wire. While believing that span-wire construction is the best system to use, he did not think there was any danger in long bracket arms, and had employed them up to 22 ft. in length. He pointed out that sectional poles were much more convenient than tapered poles, because the cross pieces can easily be raised or lowered to take up variations of the roadway, whereas on tapered poles the cross-arms must fit the poles. He also recommended larger span wire than that generally in use, and mechanical ears. He believed the latter better than soldered ears, first, because it is difficult to make a good soldered connection without injuring the temper of the wire; and second, because there is no temptation for the wiremen to mark the trolley wire where the ears have to be attached to it, and thus cause a weakness which later might cause a broken wire.

Mr. Sayers, in replying to these remarks, stated that moderate lightning potentials and discharges, such as encountered in these latitudes, could not be so satisfactorily cared for with the horn lightning arrester as with the types mentioned in his paper. While heavier poles might be desirable, he thought it better to secure the additional metal by making the metal in the poles thicker rather than by using larger diameter, as the poles would thereby be more conspicuous. As regards internal corrosion of poles, he suggested that it might be desirable to fill the inside with weak Portland cement, which would also give it additional strength. He believed a tightly strung overhead system was less liable to disturbances by wind or blows than a slack system. As regards solder, he had found that the hotter the soldering iron the less heated the wire becomes and the less softening takes place. He believed that the No. 0 wire was amply large enough, as it had a larger margin of safety, as regards breaking, than the supporting structure.

THERMIT RAIL WELDING IN HOLYOKE

G. E. Pellissier, civil engineer of the Holyoke Street Railway Company, presented on Jan. 27 a paper before the Civil Engineers' Society of the Worcester Polytechnic Institute on thermit welding. The following is a resume of his paper, together with additional matter furnished especially to this journal. Before taking up the main subject, Mr. Pellissier reviewed briefly the various types of mechanical and welded joints which are now in use.

When the thermit process was introduced in the United States the Holyoke Street Railway Company decided to try it on a mile of track which was about to be reconstructed, and accordingly an order for 160 joints was placed with the Goldschmidt Thermit Company and preparations made to do the work. All of the apparatus except the crucibles was made at the company's shops by its own men, the molds being manufactured at the power house and dried on top of the boilers. Later, however, some of the molds were made at a local foundry, as

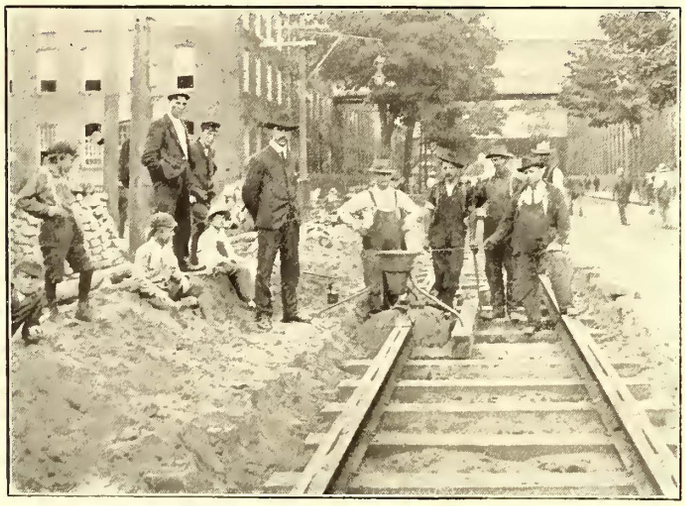


WELDING STREET TRACK IN HOLYOKE

the facilities for drying them in the manner described were not sufficient to keep pace with the work. The welding was commenced on Aug. 8, 1904. The section welded consists of 1 mile of single track on Main Street, Holyoke. The rails are of the 9-in. grooved girder type, the section being similar to that used by the New York City Railway Company. The rails are laid on kyanized ties placed 28 ins. on centers, with white sand as a foundation, the same material being used also to fill in between the ties. No tie-rods were used, malleable cast-iron braces placed on every third tie taking their place and interfering less with the paving. The joints are suspended.

The track was first laid, spiked and brought approximately to line of grade, the joints being made temporarily with fish-plates, one bolt in each end sufficing to hold the rail in position until the welding gang came along. This gang was composed of three or four of the company's workmen, who did the work under Mr. Pellissier's supervision. One man removed the fish-plates, cleaned the sand off the rails with a wire brush, dried them off with the torch and removed the molds from the joints already made. The other two brought the ends of the rail into exact alignment, put on the molds, banked them up with sand and poured the joint. Where the entire section of the rail is welded, the top of the rail is also painted with a thin paste of clay and water, which, when dry, prevents the slag and iron from adhering to the top of the rail. It has been found sufficient, however, to weld only the base and web of the rail. From eight to fifteen joints were made a day, the smaller number being due to the fact that the laying gang could not put down more rails on some days, particularly when special work was being put in. All joints were welded except those around the

special work, it not being deemed advisable to do this around the latter on account of the difficulty of making the repairs or renewals in case of the breaking of a frog or switch. The work, with the exception of the paving, was practically completed in eighteen days, and was the first piece of track in the United States laid with thermit joints. Two joints were faulty and had to be repoured. This occurred while the work was in progress, and Mr. Pellissier believes that it was due more to the "innate cussedness of inanimate objects" than to any fault of the process or awkwardness on the part of the workmen, as about 100 joints had already been successfully poured. No breaks have occurred since the completion of the work, although the welding was done in August. As may be seen from the illustrations, no trouble was experienced with spattering. No slip joints were left, as in Mr. Pellissier's opinion these are not



PREPARING TO SET OFF THE IGNITION POWDER

THERMIT REACTION IN PROGRESS

necessary where the tracks are buried in the pavement. The longest piece welded continuously is about 2500 ft., and both ends are bolted tightly to the special work. These bolted joints have not been opened at all since they were put in, showing that whatever contraction has taken place has been neutralized by the elasticity of the metal.

The cost of the joints was as follows:

Thermit	$4.98
Molds per pair	.35
Labor	.40
Supervision	.20
Crucibles per joint	.25
Incidentals (shims, gasoline, etc.)	.05
Total	$6.23

With the experience obtained and a little better equipment for making the molds on a larger scale, it is believed that the molds can be made for considerably less than the sum mentioned. The flasks used in Holyoke for this work cost $1.50 each and are made of sheet iron. This material is preferred to cast iron, despite its higher cost, on account of the rough usage to which the flasks are subjected by the track men.

Tests of the joint with a Conant bond tester show that the conductivity of the joint is equal to that of any other part of the rail. Mechanically the joints seem to be perfect. To determine this quality, Mr. Pellissier subjected a sample joint to the following test: A section of rail 13 ft. long, with the joint in the middle, was placed in the track on two ties, distant center to center of bearing, 12 ft. 6 ins., and three loaded double-truck cars weighing about 20 tons each allowed to pass over it. The joint suffered no harm, but a crack developed between two bolt holes. The rail was then taken out and broken; the fracture extended from the top of the joint, where the rail is not welded, diagonally through the bolt holes to a point on the face of the rail about 6 ins. from the joint. A chemical analysis of the joint metal indicates that it compares very favorably with the ordinary steel rail in toughness and ductility.

None of the joints put in last fall has yet failed, although the temperature has been as low as 10 degs. below zero, F., while the welding was done when the temperature was between 80 degs. and 90 degs. in the shade. Although it is not anticipated that they will pass through the winter without a single break, nor that perfection has been attained in the first attempt on an entirely new kind of work, it is thought that the percentage of breaks will be so small as to be negligible. From what experience Mr. Pellissier has had with this joint and from reports he has received from other sources, it seems to him that it comes nearer to fulfilling the requirements of street railway service than any other heretofore used, and that it is destined to occupy a very prominent place in permanent way construction in the future. Mr. Pellissier says that, granting the results obtained are not superior to those secured from electric or cast-welding (which he will hardly admit), the lack of expensive apparatus, the simplicity of the process and its adaptability to repairs and construction on moderate-sized systems are bound to give it a commanding position.

In conclusion, some interesting figures were given in regard to the saving which the continuous rail represents. Assuming the additional life of track to be five years, which experience has proven to be a low estimate, this item alone represents between $5,000 and $10,000 per mile of single track. Next, taking the loss of energy due to a poor return circuit, figures were quoted by Mr. Pellissier from Dr. Louis Bell's "Power Distribution for Electric Railroads," from which it is shown that assuming a 90-lb. rail with an average of 90 amps. flow and bond resistances of .002 ohms each represents about $500 per mile of single track per year, "and this represents not at all an extremely bad case, but a very common one." When, in addition to this, is considered the saving in car repairs and the additional comfort to passengers, the value of a process of this kind may readily be seen. Mr. Pellissier remarked that he had said nothing about electrolysis damages for which his company had not yet been obliged to pay, but he felt that the day was coming when city railways would have to give more attention to that phase of the subject.

A unique organization, known as the Trolley Club of the Sons of Veterans, has just been formed at Boston, with headquarters at Chelsea. The club is arranging a schedule of trolley trips to the various Sons of Veterans' Camps accessible by electric railways in Eastern Massachusetts. Five experimental trips were taken before a permanent organization was formed. F. E. Warren, of Somerville, is secretary and treasurer of the club.

THE QUESTION BOX

Some weeks ago announcement was made in these columns that the STREET RAILWAY JOURNAL had decided to introduce a question box as a regular feature of the paper. In line with this decision, preliminary sets of questions were made up and sent broadcast over the country; these questions were also printed in the columns of this paper for Jan. 14, page 85, and Jan. 21, page 120. Judging from the number and nature of answers received, this question-box idea has met with the entire approval of street railway men in all departments of electric traction work, and this opportunity is taken for thanking all those who have sent in answers and suggestions.

It is earnestly hoped that this section of the paper will form a convenient department for a free discussion and exchange of ideas and suggestions on all topics relating to electric railways. Every man connected with the traction industry is called upon to settle a thousand and one perplexing questions in the course of his work, and undoubtedly every man at one time or another has had the feeling that he would like to know what someone else is doing or what somebody else thinks about a particular problem. It is to fill this desire that the question box has been started. Every reader of the paper is invited to make his wants known through the medium of this department, and the editors will endeavor, so far as it is possible, to obtain answers to all questions submitted.

The success of the question box will, of course, depend entirely upon the co-operation extended to the editors by the readers in the matter of answering the questions. It is not asked or expected that any one man will take the time necessary to answer all the questions or any large number of them, but among so many topics and in so diversified a collection of questions as will appear from week to week in these columns, there will be some questions that will appeal directly to every man as being in direct line with his work or investigation. Replies, therefore, are requested from any or all of the readers of this paper who can shed light or offer suggestions on any topic concerning which inquiries are made. Oftentimes the answers themselves as printed will suggest replies, and these additional answers are invited and will be printed in succeeding issues. It is therefore to be understood that a free and open discussion, both of questions and answers, is invited and desired. There is but one restriction. Statements of an advertising nature relating to manufacturers' specialties and patented articles cannot be published in the question box; otherwise these columns are open to any and all of the readers of this paper, whether they be representatives of operating companies, independent engineers or supply men.

For the present, the question box will be a regular feature of each week's issue. In publishing the questions and answers no regular order will be attempted, except that when questions pertaining to any one topic are published, an endeavor will be made to publish all the answers to those questions that may be on hand at that time. However, because a question and its answers have appeared once it does not mean that that particular topic is closed, but, as before stated, additional answers to the same question will be welcomed and will be published in subsequent issues.

A.—GENERAL

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

The "Detroit United Weekly," published by this company is issued on Thursday of each week. We furnish the printing office a regular list of how many are to be sent to each of our distributing points. The printers then put them up in packages according to our list furnished them, addressed as we direct, and indicating the number of weeklies in each package. These are delivered on Thursday afternoon to our general office, and from this office are distributed on that evening to all the car houses, etc., of our system, both city and interurban. Before the cars start out the following morning, the car house foremen see that every car is supplied with a sufficient number of copies of the paper. Each car contains two small boxes or racks and the papers are placed in them, one being at each end of the car, on the inside. From day to day as the supply is exhausted the car house men are under instructions to see that the boxes are kept filled as long as their supply continues. We print an edition each week of 37,500. Each edition costs for printing, paper, general supervision, etc., about $45 per week. No outside advertising is accepted for the paper. We are now upon our third year, the first number having appeared on Thursday, June 26, 1902. Each issue contains a digest of our interurban time-tables, and all the principal events that are to occur in the way of theaters, special entertainments, etc., during the week following. This gives us opportunity to call special attention to attractions that take place during the different seasons of the year. It enables us to keep before the people our own lines, attractions along the same, and the advantages that the public receive from the operation of these lines. We can talk to the people more clearly regarding the rules and regulations of the company, and call attention to matters of interest to us and our patrons in the way of educating the public, far better by this means than we can through any other channel, as there are frequently matters in connection with the operation of our system that we often want to talk about. For example, we are now running on our rapid railway system, what we call the Detroit-Port Huron Specials, making few stops and rapid time between Detroit and Port Huron. Nearly every week, along different lines, we write about these specials and keep them before the people. The above are a few of the advantages that a publication of this kind gives to a street railway company like our own. I am not able to state just to what extent it encourages travel, but believe it is a very helpful medium in that direction.

J. H. FRY, Asst. Gen. Pass. Agt.,
Detroit United Ry. Co.

[The "Detroit United Weekly" is probably the most pretentious effort along the line of a company periodical in this country. As stated by Mr. Fry, the paper is in its third year, and the weekly edition has grown to 37,500 copies. The weekly is a four-page leaflet, 5¾ ins. x 4 ins., printed on ordinary newspaper. One means that has been taken for creating interest in the paper and in street railway matters, has been the holding of popular contests. Last year the Detroit United Railway offered through the "Weekly" cash prizes aggregating several hundred dollars for the best designs and verses to be used as posters for advertising the street railway business. This year the company is offering a prize of $200 in cash, for the best "Trolley Song," taking into account the merit of the music and appropriateness of the words. This contest has attracted attention in musical circles all over the country, and it is stated that some of the best known writers of popular songs have taken the trouble to compete for the prize.] EDITORS.

We publish a little periodical known as "Trolley Talk." It is issued monthly, and the edition runs from 3000 to 4000 copies. In each car is placed four small racks made to fit the size of the paper when folded. At the stations also "Trolley Talk" is distributed. These are the only means used to put it in circulation. As to what benefits accrue, we find that during the past summer season our special car business increased very considerably, and as it was advertised and made a feature of "Trolley Talk" we feel justified in saying that a considerable amount of this business originated through this medium of advertising. Another benefit which we feel has accrued from "Trolly Talk," has been a greater interest taken in the road and its operation by the traveling public and a more kindly feeling towards it. As to the cost of getting this little paper out, it has been very modest in its get-up and consequently has not been expensive. The cost of printing is $2.50 per thousand. As for the articles, that work is done principally by myself at odd moments, and by jotting down little points of interest, and clipping here and there for bits of humor. We have not, so far, had to expend any money other than the actual printing. Illustrations are generally views of some of the points along the line or in the parks and are made from cuts already in stock, which have been used at other times in advertising Olympia Park.

J. W. BROWN, Supt. Trans.,
Pittsburg, McKeesport & Connellsville Ry. Co.

["Trolley Talk" is a four-page leaflet, 8-in. x 6-in., printed on good paper, without alien advertising. The "educational" feature consists of a cleverly written "sermon" to the public, the text for each issue being a topic of mutual interest to the public and the street railway employees.] EDITORS.

An article by the undersigned in the STREET RAILWAY JOURNAL for Aug. 13, 1904, page 236, gave a complete description of methods of advertising used by this company.

As stated in that article, we believe the best method of advertising is a publication of our own called "Street Railway Chat." This is a little three-section folder, folding to 2¾ ins. x 6 ins. It is published twice a week, on Wednesday and Sunday mornings. The pamphlets are delivered at the car house on Tuesday and Saturday nights, and placed in holders in the cars for distribution next morning. The value of the publication lies largely in the method of distribution. By placing the pamphlets in holders in the cars we get them directly into the hands of the street railway passengers, the very persons we wish to reach. It may be well to state that numerous offers have been made for advertising space by local business houses, but these offers have been refused in every instance, as it has been deemed best to keep it strictly a street railway publication. As to the cost of publishing the paper, will say that we issue 7500 a week, 3500 on Wednesday morning and 4000 on Sunday morning, the two editions, of course, being different issues. They cost us for printing, etc., $3 per thousand. The cost of getting out this publication is divided between the railway, lighting and gas departments, the railway using the major part in summer time, the lighting departments using more in winter time.

As to the nature of the reading matter used, might say that this is made up of announcements and short articles calling attention to changes in schedule or service, and anything in the nature of improvements to car equipment, or any part of the business. We use a cut on the first page of each issue, the folder being placed in the brass holder in the car in such a manner that the front of the box makes a frame for the picture. Pictures of actors and actresses at the local theaters are used in winter time, and cuts of summer resorts or features to which particular attention is called in summer time. As showing what I think of the value of a publication of this kind, will say that I am about to take charge of the Lexington Railway Company, at Lexington, Ky., as general manager, and as soon as I arrive there I expect to start a similar publication for that company, covering the electric light, street railway, gas and ice making departments.

R. T. Gunn, Gen. Supt.,
Norfolk Ry. & Lt. Co.

For the past three or four years the Rochester Railway Company has put out weekly during the summer months a little paper which we call "The Four Corners." (The intersection of Main and State Streets in the city of Rochester is the meeting place for all cars and forms the business center of the city. This intersection is commonly referred to as "The Four Corners"; hence the appropriateness of the name for the paper.) We usually publish from 3000 to 5000 copies each week, and it cost us at one time from $15 to $25 for each issue. We have scaled this down, however, so that now we get the paper for practically nothing, letting the contract for editing, publishing, etc., to one concern, and they get what they can out of it from the advertisements inserted. We have a boy distribute the papers on the cars. He boards each car and walks through, handing a copy to each passenger or leaving a few scattered on the seats. When we have gotten out a 10,000 edition (on some special day) we have had same distributed from door to door by a distributing agency. Of course, in this case it cost us a small amount. We think it pays for itself (even when we are at some expense), as it brings to the passenger's notice, whether or not he desires it, the fact that certain events of interest take place at certain places on certain dates. It gives him a handy time-table which he can stick in his hat for reference; it keeps him posted as to special excursions and gives information regarding the kind of ticket to use for certain popular trolley outings and combination steamer and trolley trips; it also advertises band concerts in the parks, and in fact aims to keep the public posted about things and places of interest which are reached by the trolley cars. We do a small amount of newspaper advertising, some of this being necessary; but the bulk of this business is done through our own medium, "The Four Corners." We hope to have something better this year, but it will be the same idea only in a somewhat better dress.

G. G. Morehouse, Sec., Rochester Ry. Co.

["The Four Corners," as published by the Rochester Railway Company last season, consisted of a sheet 8½ ins. x 16 ins., printed on both sides and folded to 8½ ins. x 4-in. size. The front page contains the title with a line below reading "A Guide to the Pleasure Seeker." Below this appears an appropriate engraving which was changed for each issue. One issue gave a picture of a sailing party; another a humorous sketch of a small boy going fishing; and so on. At the bottom is printed a list of the parks and pleasure resorts reached by the lines of the Rochester Railway Company. The remainder of the pages was given over each issue to announcements of current attractions at the pleasure resorts; time tables for all through lines; and advertisements of local firms; the whole enlivened with well-selected humorous anecdotes and sayings.]

Editors.

At the present time the New Orleans Railways Company does not publish a periodical, but several years ago, I am informed, one was published by the New Orleans & Carrollton Railway, Light & Power Company. The company had several thousand copies printed weekly and placed them in the cars, inviting the passengers to take them. The cost was $7.50 per week. It was thought by the management at the time they were issued that they were of considerable benefit, and I can readily see, where there is competition as it existed at that time, that it might be of very material interest to the company to publish it. But where the entire system in a city is controlled by one company, it does not seem to me that any material benefit would accrue from its publication and distribution, as there are many other ways of advertisement which I think appeal to the people equally as well. To my mind, the best advertisement any corporation can have is that of rendering good service and catering to the wants of its patrons. I do not wish to convey the idea that I am opposed to this method of advertising, for under some circumstances, no doubt, it would be very valuable.

E. C. Foster, Rec., New Orleans Rys. Co.

I think the publishing of regular leaflets for distribution would certainly bring about a better relation between the company and the public, and while the Boston & Northern and Old Colony Street Railway Companies have not, up to the present time done anything in this way, the matter has been favorably considered, and we expect during the coming summer to be in a position to issue a regular magazine. Each number should have a detailed description with illustrations of some particular lines or places, and in addition, other general information of interest to the public. To sum the matter up, the street railroad, like the department store, must have the goods to advertise, and should adopt all reasonable agencies for making these attractions known to the public. The most valuable advertising is to be talked about favorably, and if a company treats its patrons well and advertises liberally, it will find itself more largely advertised "by its loving friends."

Robert H. Derrah, Pass. and Adv. Agt.,
Old Colony St. Ry. and Boston & Northern St. Ry.

We do not issue a periodical of the kind mentioned. Our employees, however, publish a paper called "Street Railway News." The company has nothing to do with its publication, and does not attempt in any way to dictate its policy. We are familiar with the leaflets published by the Detroit United Railway and the United Railways of San Francisco, and believe that their influence upon public sentiment must be good.

H. J. Davies, Sec.,
Cleveland Elec. Ry. Co.

While this company does not print a periodical of its own in the sense referred to, we print a programme which is used twelve weeks during each season at our park, and in the programme we occasionally enlighten the people in regard to some things they do not understand about street railway operation.

Fitchburg & Leominster St. Ry. Co.

[The programme referred to in the above letter is printed in the form of a four-page folder, 6¼ ins. x 9½ ins. It is called "Whalom Breeze," and consists largely of announcements concerning Whalom Park, which is owned by the Fitchburg & Leominster Street Railway Company. A limited number of local advertisements are accepted for the programme. It is issued once a week during the park season.]

Editors.

I believe the best way to get at the public is by means of articles appearing as reading matter in the local papers. It need not be known that these articles come from the street railway company.

H. C. Page, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

A few companies may make a success of publishing periodicals, but I do not think the many would.

Theodore Stebbins, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

We believe the idea a good one if you can make the venture self-sustaining, or nearly so by selling advertising space. We expect to start a publication of this kind this coming spring.

J. R. Harrigan, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

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

We have made up the schedule on our interurban road so that we shall get 1½ cents a mile per passenger. In some of the towns and cities where the franchises were made to carry a person from one part of the town to the other for a 5-cent fare this schedule could not be followed.

H. C. Page, Gen. Mgr.,
Berkshire St. Ry. Co., Pittsfield, Mass.

Based on mileage, subject to occasional restrictions.

Theodore Stebbins, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

On mileage. W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

Our practice is with reference to mileage and taking into consideration the municipalities also. For instance, should we have a town that contributes liberally, we concede a little to them in the way of mileage; in other words, make the fare proportionately a little less. J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

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

Our method of handling snow is as follows: We run large double-truck plows. We also have a rotary. As soon as it commences to snow we have men assigned to the plows, and put out the plows as needed. Each plow in a heavy storm is given a certain section to handle, and the crew on this plow are held responsible for keeping their section open. Each plow covers about 15 miles straight-away. In a heavy storm the plows are kept running ahead of each regular car, and schedule time is made by the plows the same as the cars. We do all the leveling of the snow with the plow; that is, with a long wing, leveling down the ridges. We do not haul off any snow, the cities and towns doing the hauling and we doing the leveling.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

In Ohio we do not experience much difficulty with snow. We keep a Taunton snow plow to handle the snow on the interurban road, and a rotary swceper to handle the snow on the city tracks. As soon as it is designated that it is necessary to use the snow plow we run it over the city tracks with the regular cars. On the interurban tracks where the road runs east and west we do not need the use of a snow plow very often, unless the snow is drifted. The horse-power capacity of the motors under our heavy interurban cars is such that they can go through most any snow storm in Ohio. J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

Interurban lines in this section have almost no trouble from snow, except where the tracks traverse city streets, and if there is any depth of snow, we try to get the tracks in the best possible condition before cars start in the morning, by sweeping the snow away at either side so that it will not fill into the grooves. We operate the sweepers at night to avoid accidents, and to avoid overtaxing the power stations in the daytime.

THEODORE STEBBINS, Gen. Mgr. for Receivers,
The Appleyard Lines in Ohio, Columbus, Ohio.

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

We find the snow-plows which we are using the most effective in this country, and would recommend the rotary sweeper for all city tracks. J. R. HARRIGAN, Gen. Mgr.,
Columbus, Buckeye Lake & Newark Tract. Co.

We use a nose plow entirely, as ours is a single-track road. A four-motor plow is the most effective plow, with proper sized motors, according to the weight of the plow and the severity of the storms.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

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

We use a simplified form of the New York Central snow fence. The sections are in 14-ft. lengths instead of 16-ft. The following is a statement of the cost of a section:

10 pieces 1-in x 6 ins. x 14 ft.	$1.33
3 pieces 2 ins. x 6 ins. x 8 ft.	.46
3 pieces 2 ins. x 6 ins. x 7 ft.	.38
3 pieces ¾-in. x 5-in. bolts with 2 flat washers	.04
Nails	.02
Cost of materials	$2.23
Labor to build and erect	.60
Total cost per length	$2.83

Total cost per foot of fence, $0.20.

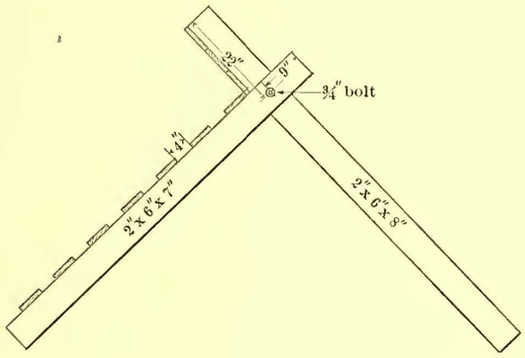
The fences are placed from 100 ft. to 150ft. from the track.

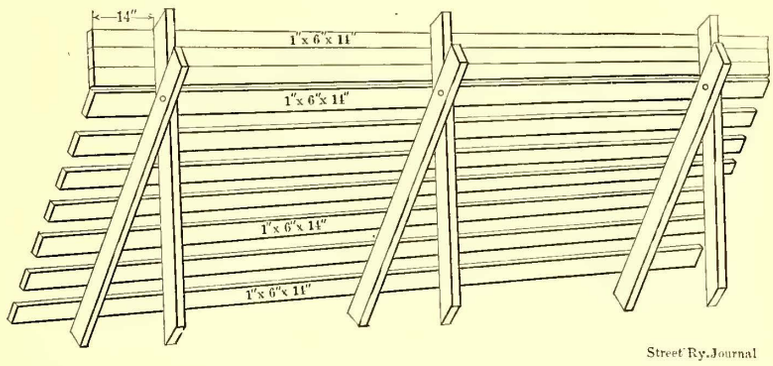
E. J. WILCOXEN, Supt., Rochester & Sodus Bay Ry. Co.

Snow fences for a country road are the best kind of an investment. We use a six-board fence made saw-horse fashion, so it is braced from both sides. Fences should be placed wherever drifts are likely to form, so that snow when drifting will strike the fence and fall short of the track. In summer the fences are taken down and stored away for use the following winter. The cost of snow fences will of course depend upon quality of lumber. We pay for 4 in. x 4 in. stuff $22 per thousand, and for boards 1-in. x 8 ins. x 12 ft., $20 per thousand. W. T. NARY, Supt.,
Hoosac Valley St. Ry. Co., North Adams, Mass.

We put our snow fence about 150 ft. from the track, putting up a four-rail fence, each rail 6 ins. wide, making the fence so as to have the drifts between it and track, rather than to stop the snow from coming over the fence. The fence is made in sections 16 ft. long. The sections are set up and a stake is driven in the ground with a board running from the stake to the top of the fence and nailed securely. The fence is taken down in the spring of the year and stored, if possible, under cover. This kind of a fence costs to build about $2.75 per 16-ft. section.

H. C. PAGE, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.





SNOW FENCE USED ON ROCHESTER & SODUS BAY RAILWAY

In reply to your inquiry regarding snow fences I take pleasure in handing you drawings illustrating the New York Central standard snow fences. H. FERNSTROM, Chief Engineer,
New York Central & Hudson River R. R.

[The drawings refered to by Mr. Fernstrom are reproduced herewith. They are self-explanatory and give all the dimensions. The list of materials for one complete 16-ft. panel of the portable type is as follows:

10 pieces, 1-in. x 6 ins. x 16 ft.
2 pieces, 1-in. x 6 ins. x 10 ft. 3 ins.
3 pieces, 1-in. x 6 ins. x 7 ft. 6 ins.
3 pieces, 2 ins. x 6 ins. x 8 ft.
3 pieces, 2 ins. x 6 ins. x 7 ft.

Total lumber board measure, 146.5 ft.

Nails and bolts: 60 tenpenny common nails; 106 eightpenny clinch nails; 3 ¾-in. machine bolts 5½-in. under head; 6 ¼-in. x 2-in. diameter wrought-iron washers.

In placing the portable fence the panels are set with the boarded side facing the direction from which blow the prevailing winds, the idea being that the large angle made by the top piece and the boarded side will tend to deflect the wind so that the driving snow will be deposited close to the fence on the leeward side. The fences are placed to windward of the tracks and far enough away

from the track so that the drift will form before the snow reaches the line of the road.] Editors.

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

We have a State law in Massachusetts that requires the companies to level all snow satisfactory to the town authorities, and for the excise tax we pay to the towns and cities, they are supposed to haul all snow. This is an open question still to be decided by the courts, whether or not the companies should haul the snow away. On our road we do not haul any snow with teams.

H. C. Page, Gen. Mgr., Berkshire St. Ry. Co., Pittsfield, Mass.

E.—MASTER MECHANIC'S DEPARTMENT

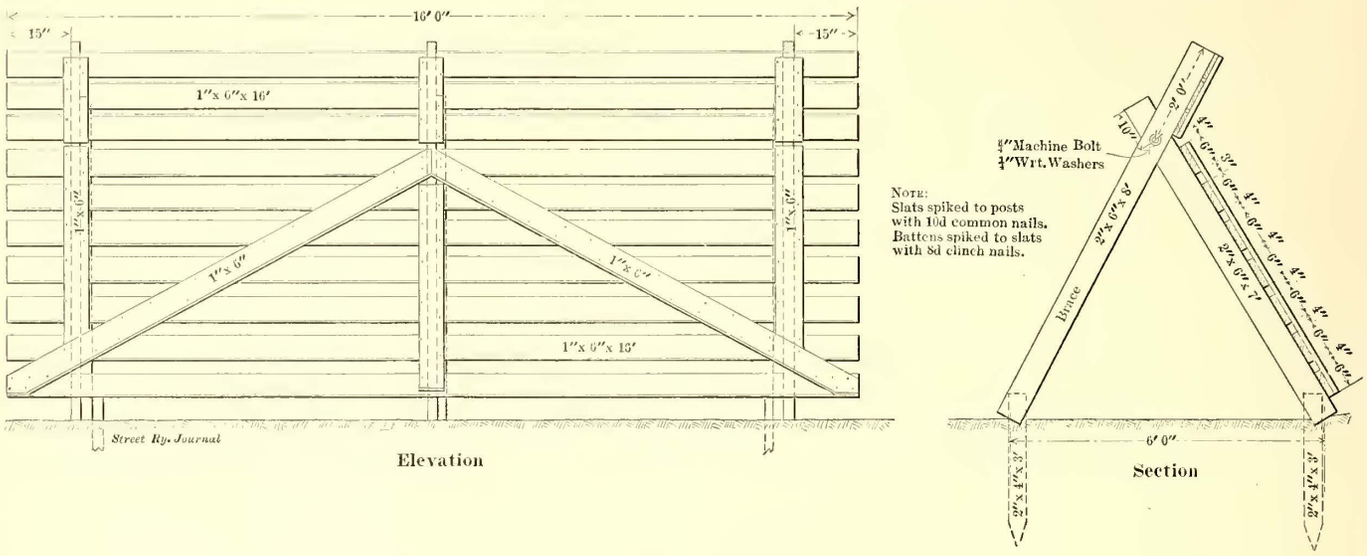
E 1.—What do you consider the essential features of a satisfactory set of car specifications?

Specifications should be as complete as possible, and should admit of competition between the manufacturers from whom the car builder buys his supplies, to as great lengths as possible. They should give all general dimensions and all special ones which are different from usual practice; also, all special appliances and furnishings which are wanted, including those which are not made in car-building shops. They should also give motor and truck information. Complete general plans and, where possible, photographs accompanying are of great help. The most satisfactory specifications are those which go into detail fully.

D. F. Carver.

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

The specifications for the new 4000-type car for the International Railway Company, of Buffalo, designate that floors are to be of yellow pine 13-16-in. thick, tongued and grooved, the under floor laid transversely, upper floor longitudinally with best heavy felt paper between. Maple strips in aisle to be ¾ in. wide at base, tapering to ⅝ in. at top, and ½ in. high, and placed ⅝ in. apart at base, and securely screwed to floor with 1¼-in., No. 10 flat head, bright screws, spaced about 12 ins. apart. Editors.

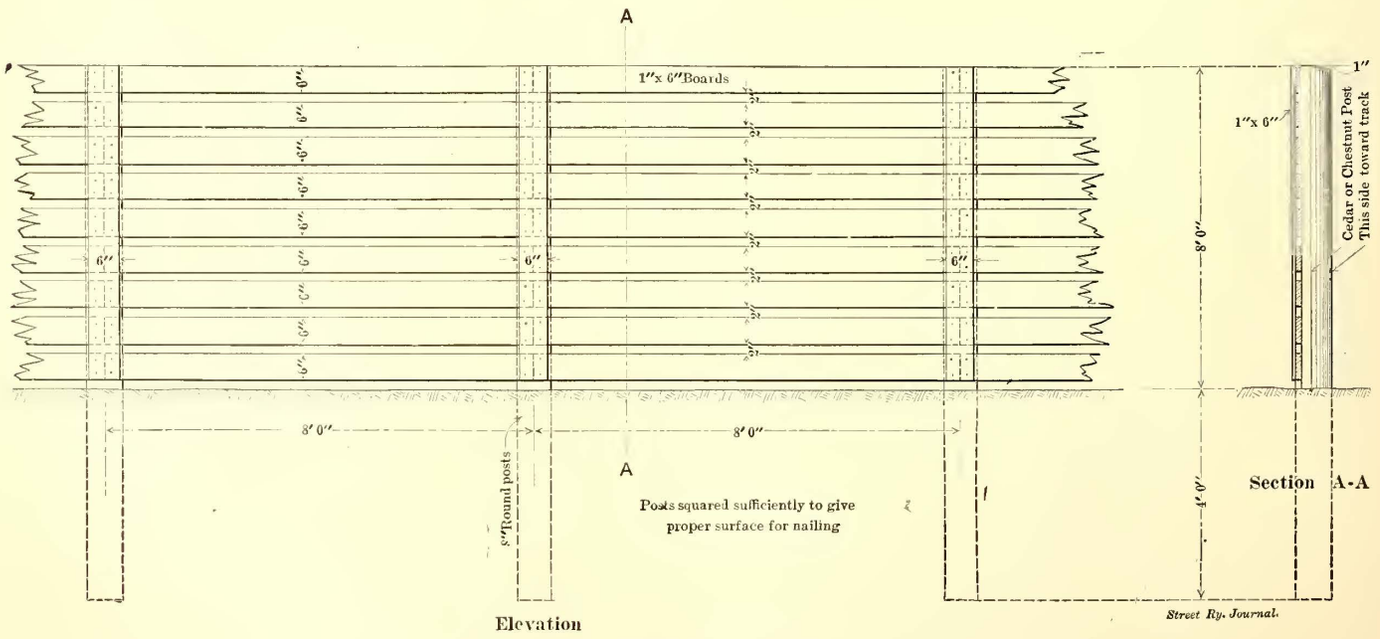


NEW YORK CENTRAL STANDARD SNOW FENCE—PORTABLE TYPE

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

It is quick and convenient to use the air-brake compressing outfit on an air-brake car to drive small tools used in making small repairs to individual cars, especially if the pits are not piped for air from a stationary compressor. The capacity of an air-brake compressor is, however, too limited to use economically on extensive work.

D. F. Carver.

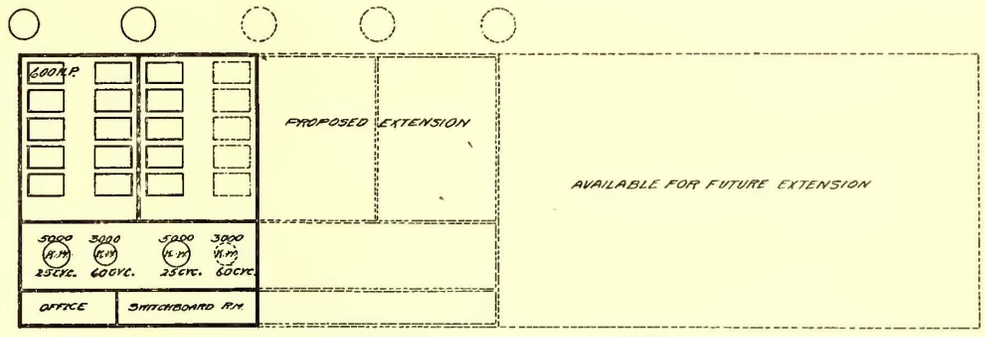


NEW YORK CENTRAL STANDARD SNOW FENCE—FIXED TYPE

THE NEW STEAM TURBINE PLANT OF THE PUBLIC SERVICE CORPORATION

Probably no electric railway system in this country has experienced more rapid development of the power supply problem than has the street railway department of the Public Service Corporation of New Jersey. The railway development in New Jersey has been very rapid during the past few years and has assumed great magnitude, causing greatly increased consumption of power and bringing very heavy overloads upon the power stations. Many extensions of lines have been made, and the increases in service and the use of the heavier double-truck cars have combined to make the railway power loads especially severe.

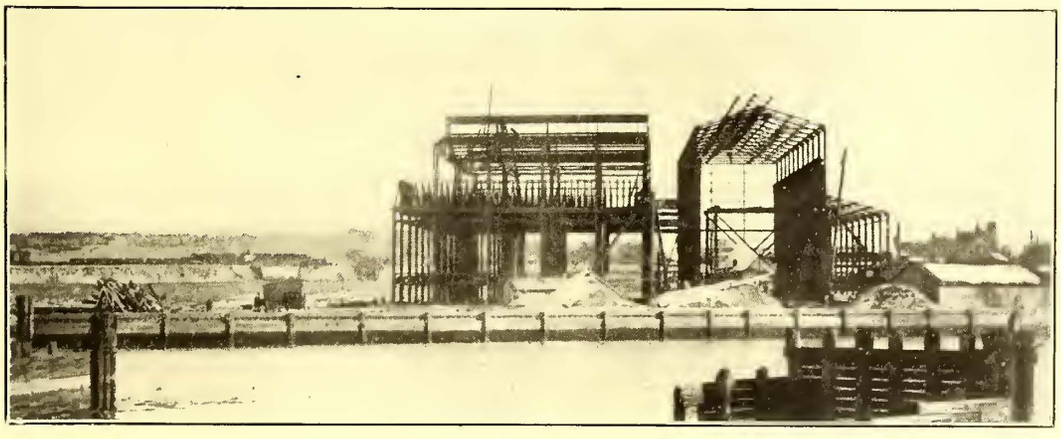
During 1903 and 1904, a large addition was made to the Coal Street station in Newark, bringing the total generating capacity of the new addition of the station up to 14,800 kw. But even with this, it was foreseen that, with the present rapid rate of development, the large Coal Street station would soon be outgrown, and, accordingly, a careful study of the problem was instituted, with special reference to the present tendency of development and the probable requirements for several years in the future. The result was a decision to provide for extensive additions to the present power-generating facilities in the eastern districts operated, but on account of the large size of the present central station at Newark, amounting to 23,000 kw, including the adjoining lighting station, it was deemed advisable to arrange for an entirely new and distinct plant to be installed at a different location from that of the Newark plant, as the location for such a plant could be selected with particular reference to facilitating further growth, and also proximity to the best water and coal supplies. It was further seen that, by the use of "tie" lines between the new and old stations, each plant would be able to use to the reserve capacity of the other, thus cutting down to a large extent the amount of reserve apparatus that would otherwise be required in a single very large station.



PLAN OF THE NEW TURBINE POWER PLANT OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY, SHOWING EXTENSIONS PROVIDED FOR

The scope of the plant that has been provided for and is now under construction is comprehensive and far-reaching, and is very interesting in its relation to power-plant development. A careful study of the question of prime movers has resulted in the adoption of the steam turbine to the exclusion of reciprocating engines. This has made it possible to cut down the floor space by taking full advantage of these possibilities and not providing for any contingency where reciprocating engines would have to be used. The location selected is also advantageous on account of the valuable facilities secured; it is located upon the east side of the Jersey "meadows," in close proximity to Jersey City, so as to be convenient to the large power consumption districts on the New York side of this territory. In this location ample real estate for the maximum desirable extension was secured, as well as also excellent dockage facilities upon the river. The dock shown in the view of the building from the river has a length of 230 ft. and width of 20 ft. A good stage of water is always available here, as at low tide there is still a depth at the dock of about 20 ft.

The site chosen is upon the east shore of the Hackensack River, in a section of Jersey City known as Marion. It is conveniently located for shipping connections by railroad, being close to and between the main lines of the Erie and Delaware, Lackawanna & Western Railroads where they approach their Hudson River terminals; this, together with shipping facilities by water via New York Bay and the Hackensack River, renders the site easily approachable for all classes of freight. This site was also found to be very convenient for the transmission system connections, and in addition, it offers excellent provisions for extension as is necessary for further growth.



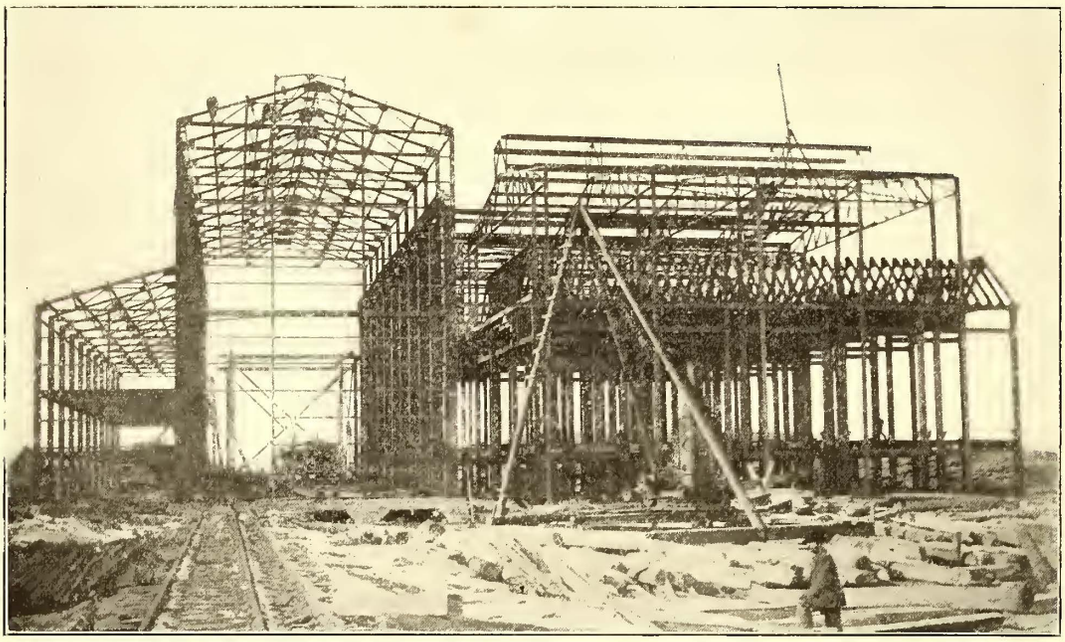
GENERAL VIEW OF THE SITE OF THE NEW TURBINE POWER PLANT, FROM THE OPPOSITE SIDE OF THE HACKENSACK RIVER, SHOWING EXCELLENT DOCKAGE FACILITIES

The plant is laid out for an ultimate capacity of 64,000 kw, which will give it, when completed, an important place among the large power plants recently built. At the present, however, only a portion of the equipment will be installed, one-quarter of the proposed structure being under construction. The building has been planned in sections of 8000-kw capacity each, which are repetitions of each other, thus permitting additions to be made to the present structure in small sections, if desired, without alteration of the initial installation.

As may be noted from the accompanying plan, the general scheme involves a large longitudinal operating room for the turbines, with separate individual boiler rooms for each two turbines, which may thus be extended to any distance as required for the 8000-kw turbine capacity; this arrangement is in accordance with the most approved practice in turbine plant construction, being similar in general detail to both the Fiske Street turbine station of the Chicago Edison Company and the new turbine plant of the Boston Edison Company. The two accompanying half-tone views show this general arrangement, and also indicate the present condition of progress upon the build-

ing construction; the steel work has been completed and the construction is now being pushed rapidly to completion. It may here be stated that the architectural features of the building will be very plain, although, while ornamentation is absent, still the general effect will be that of great strength and stability.

Each individual steam plant, which will supply one of the 8000-kw sections, will embrace ten 600-hp Babcock & Wilcox boilers of the horizontal water-tube type. They will operate at 175 lbs. pressure, being fitted with Babcock & Wilcox superheaters for raising the temperature of the steam to 150 degs. F. above temperature of saturation. The boilers will be operated under natural draft, 225-ft. Custodis stacks being provided between each double row of boilers, as indicated in the plan. These stacks are located directly in line with the rear walls of the boilers, so that the flue connections may be straight and most direct; ordinarily each stack will serve ten boilers, although the stack at the west end of the building is, on account of its peculiar arrangement, of smaller diameter and will serve only five. Elevated coal hoppers are provided for above the boilers, from which coal will be delivered directly to the boiler room floor by chutes. Coal will be delivered to the bunkers by a belt conveyor, while ashes will be removed from the ash bins beneath the furnaces by cars upon a narrow-gage industrial railroad operated by a trolley locomotive. No economizers or stokers will be used.



DETAIL VIEW OF PROGRESS UPON THE STEEL STRUCTURE FOR THE NEW POWER PLANT FOR THE PUBLIC SERVICE CORPORATION

The turbines will be of the Curtis vertical type, furnished by the General Electric Company, and will be installed in the plant in two different sizes, on account of peculiar requirements of the service, the first and third, of 5000 kw, to deliver current at 25 cycles, while the second and fourth turbines will be of 3000-kw capacity, delivering at 60 cycles. At present, however, only the first three turbines will be installed, the fourth, of 3000-kw capacity, as well as the corresponding one-half of the boilers in the second boiler room, being omitted until required by further development.

The condensers will be of the surface type, supplied by the Wheeler Condenser & Engineering Company, and will have steam-driven pumps. The other power station auxiliaries, including the boiler feed-pumps and the exciter units, will also be steam-driven. The arrangement of condensers will be two condensers for each of the 5000-kw turbines and one for each of the 3000-kw machines. Ample circulating water will be available for condensing purposes, as the river at this point is between 300 ft. and 400 ft. wide and ranges from 50 ft. to 60 ft. deep; furthermore, the supply will be clean, as no large cities are drained by the Hackensack. In addition to the exciter equipment, there will be one motor-generator set, which may be operated as a spare exciter, if needed, and also to supply current to auxiliary motor-driven machinery of various types in the plant.

The turbo-generators will deliver three-phase alternating current at a potential of 13,200 volts, which is the transmission voltage for the lines of the company. Both 25-cycle and 60-cycle current will be generated, as this station will, like the Coal Street (Newark) plant, supply power for lighting as well as also for railway power purposes. The 25-cycle generators will be used for the operation of the railway power loads.

All the switching and controlling apparatus will be located in the "lean-to" addition on the opposite side of the operating room from the boiler rooms. This "lean-to" will have three stories, the two lower of which will be devoted to the bus-bar compartments and high-voltage apparatus for the 25-cycle and the 60-cycle systems. Upon the top floor will be located the controlling switchboards and the station office. The "lean-to" will be finished as a separate building, with a brick wall partition, although at a point in front of the controlling board proper, upon the third floor, windows will be inserted so that the switchboard operators may have a view of the turbines and generating apparatus in the operating room below.

ELECTRIC EQUIPMENT OF CLIFF LINE, SAN FRANCISCO

Shortly after the first of the new year, the United Railroads of San Francisco obtained a franchise from the city to change the motive power of the California Street & Cliff steam line from steam to electricity. The steam line, now the property of the United Railroads for about three years, ran from the terminus of the California Street Cable Railroad Company to California Street, and via private right of way along the cliffs overlooking the bay and the Golden Gate to the Cliff House, and is one of the most picturesque trips obtainable in the vicinity of this city.

The change of equipment necessitated double-tracking and widening the roadbed on the later portion of the line, and the company decided to replace the old wooden tunnel, 100 ft. long, situated near Land's End, by an open cut. Work on the new cut was commenced on Jan. 13 last, but owing to recent rains the ground was in a very unstable condition and required but little disturbance to cause it to slide, so that shortly after work had commenced a landslide occurred, engulfing about 25 ft. of the tunnel, and on resuming work the attempt to remove the debris caused another slide of greater magnitude than the former, filling up fully one-half the tunnel with about 3000 cu. yds. of loose rock and earth. The work of clearing away the debris and constructing an open cut is now, however, well under way.

CORRESPONDENCE

STORAGE CAR HOUSES VS. OPERATING BARNS

Troy, N. Y., Feb. 10, 1905.

EDITORS STREET RAILWAY JOURNAL:

The article by D. F. Carver, "Car Storage Houses vs. Operating Barns," has been read by me with great interest, principally perhaps because it advocates the type of car barn construction which I designed and first built some ten years ago. The first of these barns was built at Stillwater, N. Y., and is almost an exact duplicate of the type of barn advocated in the article, being a two-compartment barn with fire wall between, and the pilasters spaced 9 ft. apart, but varying somewhat in the type of roof construction. In the Stillwater barn the pilaster was built out to a bracket, capped by a stone, and the roof was supported by 15-in. I-beams spaced 9 ft. apart, on top of which was laid a 3-in. loose tongue hemlock plank roof placed upon spiking pieces attached to the top of the I-beams and covered with the ordinary tar and gravel roof above. A pitch of 5/8 in. to the foot was given for drainage. The compartments were not built "en echelon," which strikes me as being a good idea. No openings were allowed between the compartments, and, of course, on this first barn no provision was made for carrying off roof drainage, except by extending the 3-in. plank roof slightly over the eaves of the building. The building was lighted by windows at the side. The walls were 12 ins. thick, built of brick, with a 4-in. pilaster on each side of the center wall and 8-in. pilasters inside on the outer walls. The I-beams were not built into the walls, but merely allowed to project into a recess 4 ins. deep, so that in case the roof was burned through and fell in, the fire wall would not be destroyed.

A car barn of the same type with four compartments was afterward built by the writer at Burlington, Vt. Each of these barns had three tracks in each compartment. At Burlington the car barn was about 100 ft. deep and a slight slope was allowed on the flat roof at the rear of the building to allow for drainage. Of course, the tar and gravel roof was properly flashed into the brick work. It strikes me that the type of roof advocated is in no wise an improvement upon the simpler design mentioned in the foregoing. If roof trusses are to be used it would be much better to place them 8 ft. or 9 ft. apart and to lay the 3-in. plank directly on the roof boards, and do away with the 6 x 8-in. yellow pine purlins. But there is really no reason in a storage barn either for ventilation or for light, and an absolutely closed roof is a much better protection against fire, and for the few occasions when it is necessary to visit these car barns a few incandescent lights will give all the necessary lighting at nominal expense.

The writer has been talking this type of barn to the insurance people for ten years past, and he is glad that someone has been able to make them see the benefits of a sensible form of car barn construction at last. Storing of a great number of cars under one roof has always seemed to me to approach criminal negligence. Cars are always extremely combustible and a fire once started will spread with great rapidity, providing sufficient air to support combustion can get in. No fire department can, in my opinion, furnish protection against this rapid spread in a barn full of cars, and the obviously sensible thing to do is to limit the number of cars that any fire can reach. This type of car barn, possibly safeguarded by automatic sprinklers to retard the spread of fire as much as possible, ought to enable the insurance companies to make reasonable rates on this class of risk and to make money beside.

As to the cheapness of this type of barn, the first barn constructed in 1894 at Stillwater, N. Y., consisted of two compartments, 32 ft. x 160 ft., and the building, without tracks, cost us $5,500 plus the cost of the front doors. These doors were sliding doors, covered with tin, after the plan of approved fire doors, one to each track, so that any two tracks could be open at once. The placing of swing doors inside the car house always reduces the car space, while swinging them outside is almost always disastrous in times of high wind, particularly if the doors are carelessly left unhooked.

In conclusion, I would say that substituting for the 8 x 14-in. yellow pine sticks, timbers of sufficient size to carry a 9-ft. or 10-ft. bent, or using 15-in. I-beams in their place with flat roof, will save considerable expense. Should it be deemed necessary, the 15-in. beams can be easily covered by concrete and woven wire, or some other fireproof covering.

The ordinary type of light iron roof truss construction has always seemed to the writer the worst possible design, in spite of the fact that he has been engaged in bridge and roof designing for many years. The first lick of the flames on the slight steel members is sure to bring the roof down bodily, to say nothing of the most flagrant waste of space, to which Mr. Carver calls attention.

The writer notes with particular interest the careful demonstration of the fact that barns of this type are much less expensive per cubic foot of contents than the usual type of car barn with truss roof.

J. A. POWERS.

THE PAINTING OF CAR HOUSES.

Bound Brook, N. J., Feb. 10, 1905.

EDITORS STREET RAILWAY JOURNAL:

I have read Mr. Carver's description of the Plank Road storage house of the Public Service Corporation in your issue of Feb. 4 with a great deal of interest, for, to my mind, one of the most important subjects to railway managers to-day is the proper and safe housing of surplus cars, both as to the risk of fire and proper regard to the protection of the car bodies, etc.

After the installation of the automatic sprinkler system, I am of the impression that the building Mr. Carver describes comes as near perfection, for combatting the danger of fire, as the ingenuity of man can devise. However, from the standpoint of a painter, it occurs to me that a reference to the proper protection of those heavy timbers used in the construction of the building, and also the possible effect the damp contained in the side walls will have upon the varnish on the cars, will not be out of place.

Mr. Carver does not mention the kind of paint he used on the beams and other woodwork. If he employed an oil paint I fear that the application of oil will tend to make the wood inflammable and liable to catch fire more readily and "char" deeper than it would if treated in other ways. Of course, it is necessary to preserve the wood from natural decay, and to those who in the future contemplate building on Mr. Carver's plan, I would suggest that instead of any oil paint it would be better to treat the wood in the following manner: First apply a heavy coat of a mixture of alum, copper sulphate and a little quicklime, applied with a powerful spray pump. The best time to do this is on a day when it is raining, as damp atmosphere allows the liquid to penetrate into the wood more deeply than if the wood is perfectly dry. After a few days apply another coat of the same liquid, with the addition of more lime, common yellow ochre and Prince's metallic, ground through a mill and strained into the spray pump and applied as before. Repeat this until you have a good heavy coat all over the surface. Add a little salt after the first coat to make it hold on to the wood more firmly. This I have used myself, and it will be found that wood so treated will withstand the attack of fire for a long time, and will char very slowly.

As to the varnish on car bodies, some years ago I had to store a number of winter cars in a brick building. The tracks were so arranged that the car bodies were distant about 3 ft.

from the side walls. It was found that the varnish on the cars stored nearest the walls used to lose its gloss, turn white and generally perish, while the other side of the cars was not in the least affected. I presume the trouble was the dampness contained in the brick work, which the hot summer weather brought out, to the detriment of the varnish as above described. Probably a good coat of Portland cement applied to the walls near the cars would overcome this trouble.

John C. Weaver.

THE CONGESTION POINT IN RAILWAY OPERATION

Towanda, Pa., Feb. 6, 1905.

Editors Street Railway Journal:

I was much interested in your article of Oct. 1, 1904, on "The Congestion Point in Car Headway," and have been hoping you would return to the subject, or that some of your readers would take it up. You mention a headway of "about twenty-five seconds" as having proved to be just about short of "congestion point" on Olive Street, St. Louis; while in your issue of Sept. 24, 22.5 seconds (forty cars in fifteen minutes) were stated as not having decreased the carrying capacity per hour. Even these statements show a variation of about 10 per cent, thus bearing out your remark that the question is not one generally well understood. Starting with any given time schedule, it will be found that increasingly better results are obtained, theoretically, by increasing the number of cars per unit of track, while decreasing the time schedule in about an even inverse ratio, until "congestion point" is reached. But "congestion point" is a variable dependent on the time schedule, as well, of course, as upon rates of acceleration and retardation and number of stops per mile. But just what time schedules can be safely maintained in practice with different numbers of cars per mile of track would be very interesting information. That the facts in connection with headway and schedule speed must be obtained from practice, and not from calculation, is clearly shown by the brake tests made by Mr. Taylor, and described in the Street Railway Journal of Dec. 24, 1904, in which there were almost seven "slow-downs" to each full stop made.

R. E. Dunston.

PIETERMARITZBURG AND DURBAN

THE PIETERMARITZBURG MUNICIPAL TRAMWAYS

Jan. 6, 1905.

Editors Street Railway Journal:

I am writing to correct a slight error which I have noticed in the Dec. 4 number of the Street Railway Journal. On page 1004, in an article headed "A Glimpse of the Durban, Natal, Tramways," you state, "as exemplified in the modern overhead trolley system operated by the Municipality of Durban, the flourishing *capital* of Natal." This city, namely, Pietermaritzburg, or Maritzburg as it is more often called, enjoys the distinction of being the capital of Natal. Durban is the only seaport of Natal. Instead of the word "capital," the word "seaport" should be substituted.

P. Finlayson, Tramway Manager.

At the February meeting of the Electric Club of Cleveland, E. P. Roberts, of the Roberts & Abbott Company, presented a paper on the new interurban terminal station at Indianapolis. He gave a lot of interesting data on the location and construction of the terminal building, the methods of handling passengers, etc., and illustrated his points with views and prints taken from the description of the station which appeared in the Street Railway Journal some time ago. The paper was of great interest to Clevelanders, as the subject of a station for Cleveland is being discussed at the present time.

OPERATING CONDITIONS IN NEW ENGLAND

At a meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, on Feb. 8, President P. F. Sullivan, of the Boston & Northern and Old Colony Street Railway companies, delivered an interesting address on the status of the street railways in New England.

In a comparison of conditions in the United States and Europe, Mr. Sullivan said that the inquiry was often made why certain fares and other features of European practice were not introduced in this country. Conditions, he said, were so radically different as to make a comparison of many features almost impossible. The cities in Europe were older and the population still congested to a very marked degree. The problems which the street railways had to work out in these cities were simple—a congested population, small municipal area and a low scale of wages. The solution was equally simple, involving a small number of miles of track, low rate of capital invested per capita and a graduated scale of fares sometimes referred to as the "zone" system.

There is no city in Europe, according to Mr. Sullivan, that has a better constructed, maintained and operated street railway than has the city of Glasgow. Those who engineered and managed it showed care and ability; they met the problems and solved them well. The only feature about the system which he would criticise is the type of car used; but inasmuch as the people of that community are satisfied with their cars, any outside criticism fails. They have only one type of car, a double-deck, four-wheel, two-motor car, seating varying from fifty-eight to sixty-two persons; in some the upper deck is open and some enclosed. Mr. Sullivan then made the following comparison:

	Glasgow.	Boston Elevated.
Population	1,000,000	900,000
Miles of track	135	400
Population per mile of track	7,500	2,250
Investment	$10,500,000	$54,000,000
Investment per capita	$10.50	$60.00

The Boston Elevated Company and its leased lines have substantially the same amount of capital invested in cars and their equipment as the total investment in Glasgow for street railway purposes. The Glasgow railways paid in taxes last year $175,000; the Boston Elevated in 1903 in taxes of all kinds, including excise tax, $917,000; and owing to difference in condition of operation and laws with reference to ability, the Glasgow company paid out $83,000 for accidents last year; the Boston Elevated in 1903, $505,000.

The management of the Boston Elevated Company has a more difficult problem, Mr. Sullivan thought, than that of Glasgow.

The fares in Glasgow vary from ½ cent to 10 cents; the fare in the Boston system is 5 cents. In the Glasgow system the longest ride is nearly 10 miles, and only a small proportion of its population avail themselves of it or can afford to do so. In the Boston system a large proportion of its passengers ride twice daily from 5 miles to 8 miles for 5 cents.

The total length of railway route in England, including street, overhead and underground, is, in round numbers, 1900 miles, and of track, 2900 miles, for a population of nearly 33,000,000, or 1 mile of track for each 11,400 of its population. In Massachusetts the track length is over 2700 miles, the population nearly 2,000,000, or a mile of track for less than each 1100 of its population.

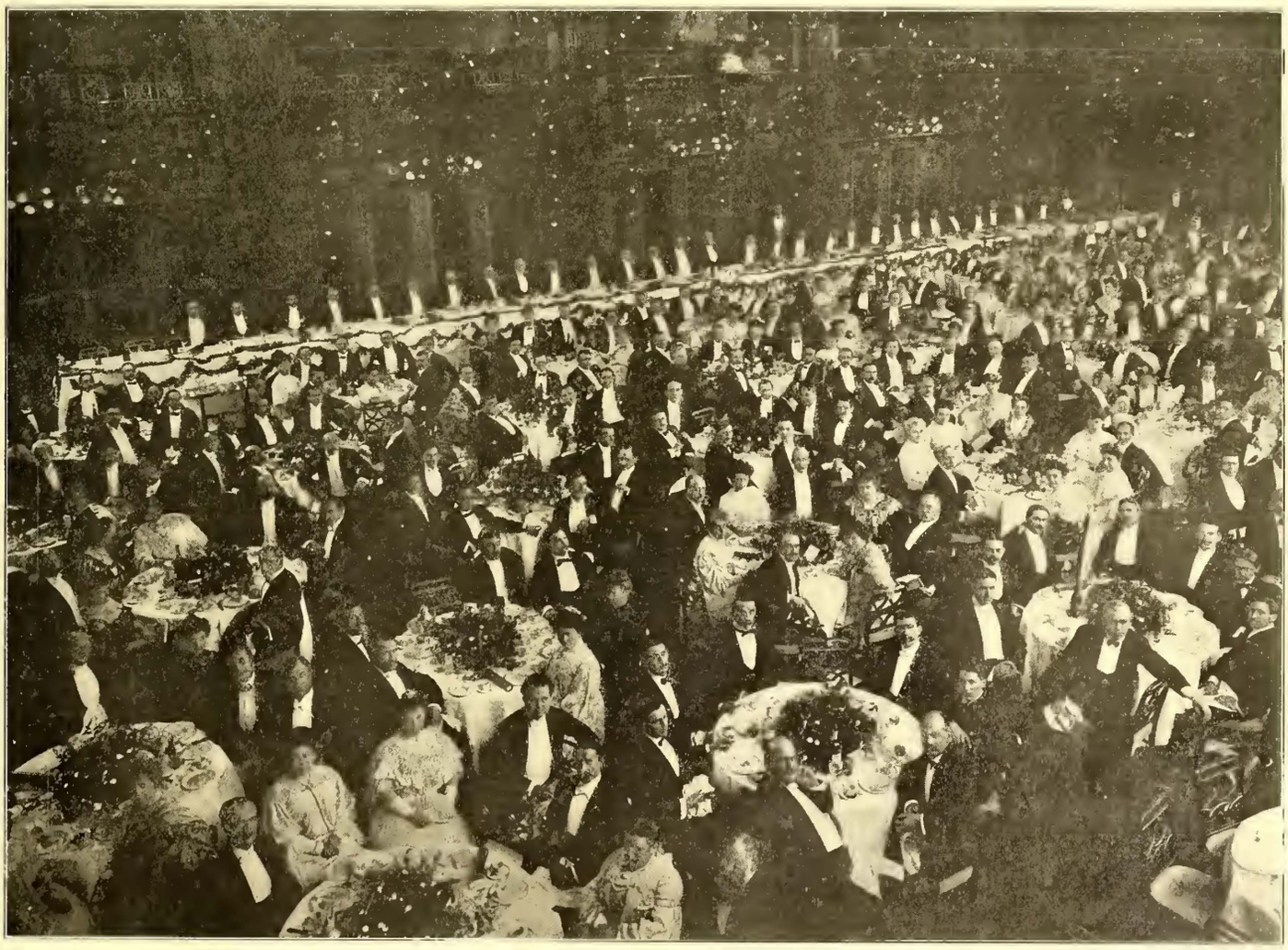
Referring more particularly to operating conditions, he showed that if, for instance, the Boston & Northern and Old Colony Street Railways had been able to secure their fuel at the price paid in Glasgow ($1.38 per ton), they could have saved on this item alone $395,000. If they required only the same amount of power per mile, they would have saved $366,-

000. If they had winter conditions such as exist in the foreign city, they could have saved $175,000 for the year, or a total of $936,000, or equivalent to nearly 6 per cent upon the capital stock of both companies. Under these conditions it was easy for street railway authorities here to answer why it was not possible to carry people as cheaply here as in Glasgow.

Comparing conditions in New England with those in other sections of the country, Mr. Sullivan said that while differences were not so marked as those in Europe, there were still many disadvantages under which the companies in this section had to labor. Lower wages, cheaper fuel and broader streets, he said, were very important factors. He referred to the low receipts per car-mile and per mile of track on the roads in New England, and believed that the companies should increase their fares.

TRACTION DINNER OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The annual dinner of the American Institute of Electrical Engineers was held at the Waldorf-Astoria Feb. 8, and was this year devoted to signalizing the triumphs of electric traction, so that the speakers and speeches had all a specific relation to that subject. The large ball room in the hotel was attractively decorated and the attendance at the dinner was about 400. Preceding the speeches and following the dinner, there was a biographical exposition of electrical manufacturing, of the subway in operation and of the new New York Central locomotive competing with a steam locomotive. A photograph was also taken of the assemblage by means of the Cooper Hewitt mercury vapor light, and a reproduction of this view is presented on this page. The speakers were J. W. Lieb, president; F. J. Sprague, Leo Daft, H. H. Vreeland, L. B. Stillwell and Gen. A. W. Greely; the toastmaster was T. C. Martin. Among the representatives of electric railway companies present were D. F. Carver, J. S. Doyle, Dudley Farrand, W. E. Harrington, Hugh Hazelton, Frank R. Hedley, Edwin B. Katte, J. D. Keiley, I. A. McCormack, W. A. Pearson, C. E. Roehl, Oren Root, Jr., W. G. Ross, A. H. Smith, D. S. Smith, Albert H. Stanley, M. G. Starrett, Col. C. A. Sterling, H. G. Stott, R. C. Taylor, Calvert Townley, W. S. Twining, J. Van Vleck, James T. Whittlesey, Wm. J. Wilgus and E. W. Winter.



GROUP VIEW, TAKEN AT THE TRACTION DINNER AT THE WALDORF-ASTORIA, OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

ANOTHER LOW FARE TEST IN CLEVELAND

The Cleveland Electric Railway Company on Saturday, Feb. 4, abandoned the 3-cent fare zone scheme which had been on trial on portions of its system for two weeks, and which was the subject of an article that appeared in the STREET RAILWAY JOURNAL of Feb. 4. There was substituted for the 3-cent plan on Monday, Feb. 6, a 4-cent cash fare scheme. Under this plan all the lines are operated as before the 3-cent trial, the regular ticket (eleven for 50 cents) or a 5-cent cash fare being accepted if the passenger wants a transfer. Where a transfer is not desired a 4-cent fare is charged. For convenience, tickets are sold at the rate of five for 20 cents. Like the 3-cent fare tickets, the new tickets read "Good for 4 cents toward fare on the Cleveland Electric Railway." One of the 4-cent tickets and a cent entitle a passenger to a transfer under the restrictions heretofore in force.

The company has not yet given out the figures showing the

results of the 3-cent fare zone scheme, but it is evident to everyone that it was a flat failure. Practically the only people who were benefited by the scheme were those who lived within the zone limits and who worked in the downtown section of the city. A man who worked even a short distance from the center of the city had to pay as heretofore because he required a transfer, and if he boarded a 3-cent fare car for the ride to the center of the city it cost him 6 cents and perhaps 8 cents to reach his destination. Only in a small degree did the zone cars relieve the rush-hour crowds on the through cars, and the presence of so many additional cars made a congestion that delayed cars all over the system. Altogether it was a poor scheme, and must have been a revelation to Mayor Tom L. Johnson.

The new 4-cent scheme appears to be more satisfactory to all concerned. Comparatively few require transfers, and the majority of those that do, appear to be willing to pay the extra cent for a transfer. From the standpoint of the company it is probably a much better scheme than the "six tickets for a quarter and universal transfers" scheme, which was tried some months ago and proved disastrous to the company because of the flagrant abuses of the transfer privilege. Under the new scheme the practice has been checked of obtaining a transfer with the avowed intention of giving it away, while many people who have but a short distance to go on the second car, now walk and save the cent that the transfer would cost. Heretofore many people who could reach home by taking any of several routes and transferring would take the first car that came along. Now they wait for the car that takes them directly home. This results in less transferring and delays at transfer points. Conductors are obliged to pay 1 cent each for transfers, which makes them more careful about punching and giving out the slips. This also makes it impossible to secure a transfer on a transfer, cutting out many long hauls upon which the company obtained nothing.

It is by far the best scheme that has yet been tried, but it is safe to predict that it will not be permanently adopted, for there remains the point that it is still possible to get a longer ride for a smaller amount of money than a great many people will have to pay for a shorter ride. For instance, under the present arrangement a person can go from South Brooklyn to East Cleveland, about 15 miles, for 4 cents, yet the man who boards a car at a downtown hotel and wants a transfer to a depot car has to pay 5 cents. The same is true of the working man who lives a mile from the center of the city in one direction, and works half a mile from the center in another direction.

BILL INTRODUCED IN PENNSYLVANIA LEGISLATURE TO PERMIT ELECTRIC RAILWAYS TO CARRY FREIGHT

If the Creasy bill, permitting the electric railways of Pennsylvania to carry freight, survives the opposition of the steam railroad lobby and becomes a law, it is expected greatly to stimulate the construction of electric railway lines through the more sparsely settled sections of the State, which cannot at present support, for profitable operation, lines depending entirely on passenger receipts. One of the counties desiring the passage of this bill is Fulton, as yet without a railway.

Two trolley cars on the Newark line of the Public Service Corporation met in a head-on collision in Franklin Avenue, just inside the limits of Paterson, Feb. 4, and a score of persons miraculously escaped serious injury. Both cars were running the switch, and each motorman asserts that the light at either end of the block signal indicated a clear way.

MEETING OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION

The Indiana Electric Railway Association held its regular monthly meeting for February at Anderson, Ind., Feb. 9. By the courtesy of the Indiana Union Traction Company, a special car was provided for those members going by way of Indianapolis. This car left Indianapolis at 9 a. m. and landed its guests at Anderson in time to open the convention at 10:40 a. m. President Charles L. Henry presided.

The subject selected for the meeting was "Interurban Passenger Traffic," which was opened by the reading of the paper of that title by L. J. Shlesinger, superintendent of the Muncie, Hartford & Fort Wayne Railway Company, an abstract of which paper is printed elsewhere in this issue. This paper is a minute analysis of the passenger earnings of Mr. Shlesinger's road from different points along the road and from different classes of patrons. It is of much interest and value to all who may have occasion to estimate the probable earnings of projected interurban railways. Mr. Shlesinger, when asked how his figures on actual earnings compared with the engineers' preliminary estimates, said that the actual figures were a little better than the engineers' estimates.

J. R. Cravath, of the Street Railway Journal, said that Mr. Shlesinger's figures on track-mile earnings were very close to the average of the thirty-two purely interurban Ohio roads reporting to the Auditor of State, Mr. Shlesinger's figures, however, being a little better than the Ohio average.

J. W. Chipman, general manager of the Indianapolis & Eastern Railway, asked what the probable effect would be were the rate of fare reduced on the road under discussion; whether it would stimulate enough travel to increase the gross revenue, or whether it would simply reduce the revenue in proportion as the rate of fare was reduced.

Mr. Shlesinger though such a move would reduce the gross revenue. The rate of fare had been given much consideration when the road started, as it was much easier to lower than to raise rates of fare when once established.

Mr. Chipman then brought up the question of an interchangeable coupon ticket, similar to that used by Ohio roads, and favored the adoption of some such plan by Indiana roads.

J. H. Merrill, of Lima, Ohio, ex-secretary of the Ohio Interurban Railway Association, explained that the Ohio interchangeable ticket was not as some Indiana men evidently supposed, a mileage ticket, but simply a coupon ticket, the coupons of which call for so many cents worth of transportation on whatever line they may be presented. This did not affect the rates of fare of any road, except that the coupon ticket was sold for less than the face value of the transportation, so as to make it an object to purchase the interchangeable ticket. The sales of these tickets were increasing each month. They undoubtedly brought some traffic to the roads, especially from traveling men. He thought the ticket should not be limited to individuals. If it could be limited only to members of the same family his road could abolish the family ticket it now sells at 25 per cent less than regular rates. It would pay his company to do this.

C. A. Baldwin, superintendent of transportation of the Indiana Union Traction Company, favored the adoption soon of an interchangeable coupon book. Answering Mr. Chipman's questions as to the effect of raising the rates of fare, he said that his experience had been that it did not decrease the revenue. His company had done it in some places.

C. D. Emmons, general superintendent of the Fort Wayne & Wabash Valley Traction Company, favored an interchangeable coupon book something like the Ohio book.

Mr. Merrill, of Ohio, explained that some Ohio roads accepted coupons from the interline books in payment for baggage.

This brought up the question of whether to check baggage free or charge for it.

H. A. Nicholl, general manager of the Cleveland & Southwestern Traction Company, who happened to be present, was asked about the free checking of baggage, which is the rule on his road. He said it was practically forced upon them by steam road competition, but that he believed in it strongly.

F. H. Norviel, traffic manager of the Indianapolis & Northwestern, who is an earnest advocate of the free checking of baggage, here read an extract from the STREET RAILWAY JOURNAL of Feb. 4, 1905, page 205, citing the experience of the Lake Shore Electric Railway Company as regards the large number of traveling men carrying trunks on those roads which might otherwise patronize the steam roads.

On motion of A. W. Brady, president of the Indiana Union Traction Company, it was voted to appoint a committee of five to arrange for interchangeable coupon tickets and discuss interline baggage arrangements. This committee, as appointed by President Henry, will consist of C. C. Folsom, of the Fort Wayne & Wabash Valley Traction Company; C. A. Baldwin, of the Indiana Union Traction Company; W. R. McKown, of the Indianapolis & Eastern Railway Company; F. D. Norviel, of the Indianapolis & Northwestern Traction Company; J. McM. Smith, of the Indiana Railway Company, South Bend, and one member from Southern Indiana, to be appointed later.

Upon the suggestion of Mr. Chipman, Secretary White was instructed to call a meeting of representatives of all roads using the Indianapolis terminal depot to arrange for the maintenance of a joint ticket office and information bureau at the Indianapolis depot.

A communication was read from Paul Richey, formerly of the Indiana Union Traction Company, who proposes to publish an attractive monthly time-table and guide book of Indiana interurban roads, asking that his publication be made the official guide for roads represented in the Indiana Electric Railway Association. The proposed publication was authorized by the association and a committee appointed to arrange details with Mr. Richey. The idea is that the publisher shall make the guide self-supporting by the advertising that it contains and that the roads represented in it agree to give it a certain circulation each month. The committee appointed on this consisted of L. J. Shlesinger, J. A. Berry and C. A. Baldwin.

As this finished the regular business of the meeting, F. W. Norviel, of the Indianapolis & Northwestern, was asked to tell how his company had increased Sunday traffic during the summer. Mr. Norviel explained that his road was peculiarly situated in that it had no parks or special attractions of that kind to bring out pleasure riding in summer on Sundays. The steam roads, moreover, had been giving low excursion rates on Sundays to Indianapolis and Chicago, so that for his road Sunday was the dullest day of the week instead of the best day, as on many other interurban roads. His company had therefore adopted the plan of making a special Sunday round-trip rate of $1 to any point on the 90 miles of road the company owns, where the rate is not regularly less than $1. The gross earnings were increased 100 per cent on Sunday by this change.

Mr. Chipman asked what effect the low Sunday rate had on Saturday and Monday traffic. Mr. Norviel thought it had none.

President Henry favored making "week-end" reductions in rates to cover Saturday, Sunday and Monday. This would appeal to more people and avoid congestion on Sundays. The purely Sunday excursion was not altogether a desirable thing.

Adjournment was then made until the second Thursday in March, place and programme to be left to the executive committee.

President A. W. Brady, of the Indiana Union Traction Company, played the part of host to the convention and entertained the members at an elegant luncheon at the Hotel Doxey.

After lunch, the special car was again ready to take the party to the company's large power station at North Anderson. The special test car of the Electric Railway Test Commission was also a matter of interest during this visit.

The return was made to Indianapolis via Tipton and the new "Northern" division of the system, so that the company's latest construction work, recently described in these columns, could be inspected. The special car used by the party was the one exhibited at the World's Fair. Most of the distance over the new track was covered at a mile-a-minute clip, and the easy riding qualities of the car demonstrated that the interurban sleeping car is not by any means the impossibility that some people think it is.

A. S. Richey, chief engineer, and C. A. Baldwin, superintendent of transportation, accompanied the party, and would have been justified in feeling considerable pride in the rapid and comfortable transportation they were able to offer. The hospitality of the Indiana Union Traction Company and its officers was much appreciated by all who enjoyed it.

INTERURBAN PASSENGER TRAFFIC*

BY L. J. SHLESINGER

The State of Indiana has been one of the foremost in the development of the modern interurban road. Encouragement has been given investors by the attitude of the legislative authorities of the State and considerable outside capital has been attracted. We have to-day within the limits of the State twenty-three different companies operating 818 miles of interurban track, all of which has been constructed within the past seven years, with the exception of the 23 miles previously mentioned. This is truly a wonderful growth. For the purpose of obtaining a fair notion of the total results accomplished by Indiana within these past few years, let us imagine that the 818 miles of interurbans were placed in one continuous line. We would have a railroad track extending from the city of Indianapolis to the city of New York. If a passenger were to undertake this journey, making direct connections upon leaving the lines of each company and taking advantage of the limited service in vogue on a number of the roads, the trip would occupy a period of thirty-eight hours and thirty minutes. This represents an average speed of 21.25 m.p.h., and varies from 8.5 m.p.h. to 27.5 m.p.h. on the various roads. Without the limited service mentioned, the time required to make the journey would be forty-two hours and thirty minutes. Our traveler, unless supplied with free transportation, would find that $12.75 would be required to pay his fare for the entire distance, an average of 1.56 cents per mile. Some portions of his route would be traveled for 1.05 cents per mile, while other distances would require an expenditure of 2.23 cents per mile.

In preliminary work on interurban enterprises one of the engineer's chief sources of perplexity is to establish a basis upon which to estimate gross receipts. Each proposition necessarily presents local conditions which must be carefully studied before comparison is made with apparently similar conditions in other localities.

Whether prospective earnings are calculated upon the basis of car mileage, track mileage, population or any other method, it is only by a study of results actually obtained that we may arrive at any sort of rule to apply in an effort to eliminate as much as possible the element of "guess."

The Muncie, Hartford & Fort Wayne Railway represents a type peculiarly and distinctively interurban. The company has its own track extending from court house to court house of the terminal cities. Outside of towns, the road is located entirely upon private right of way, three-fourths of the entire mileage

* Abstract of a paper read before the Indiana Electric Railway Association, Anderson, Ind., Feb. 9, 1905.

lying adjacent to the right of way of the Lake Erie & Western Railroad. No city cars are operated, nor are the tracks of any other company used. In the terminal city of Muncie but four minutes' time is required for the run from the court house to the corporation limits, so that practically no city service is given. The towns, mileage, rates of fare and population served are shown by the following table:

City or Town	Miles	Local Fare	Population	Additional Rural Population of Township 1 Mile from Track
Muncie	0.	$.0	32,000	1,000
Royerton	5.2	.10	300	400
Shideler	2.9	.05	300	
Eaton	2.5	.05	2,000	400
Hartford City	7.9	.15	8,000	600
Montpelier	9.3	.15	6,000	800
Keystone	3.0	.05	400	800
Poneto	4.5	.10	500	200
Bluffton	6.5	.10	7,000	800
Totals	41.8	$0.75	56,500	5,000

The total population served, 61,500, is approximately one-third the number of people in the city of Indianapolis. The population per mile of track averages 1470; excluding the principal terminal, Muncie, the average per mile is 705. The average rate of fare charged approximates 1.8 cents per mile. No local or round-trip tickets are issued, but 5-cent coupon and commutation books are sold at from 20 per cent to 25 per cent reduction. Reduced rate tickets to the company's park at Eaton are on sale during the summer months. The company has not yet developed the freight business, although packages are handled on all cars; consequently, all the succeeding figures given refer to passenger business purely. The use of the Ohmer fare registers enables complete traffic statistics to be maintained at a minimum of clerical expense.

The following table shows the number of passengers carried during the year 1904, classified according to fare denominations:

5 cent fares	276,202	50 cent fares	33,634
10 " "	128,559	55 " "	4,592
15 " "	199,701	60 " "	230
20 " "	95,091	65 " "	1,013
25 " "	46,615	70 " "	106
30 " "	12,720	75 " "	9,740
35 " "	80,341	Tickets	117,995
40 " "	14,453	Passes	7,908
45 " "	664		
		Total	1,029,564

It will be noted from this table that over one-fourth the total number of passengers represent 5-cent cash fares. The 15-cent fares are the most profitable, followed closely by the 35-cent fares, while the least remunerative are the 70-cent fares. The average cash fare per passenger is 17 cents, while the average value of tickets used is 15.5 cents. At the rates of fare charged, this indicates that the average passenger rides a distance of nearly 10 miles. The average number of passengers carried per day is 2813, indicating that 4.6 per cent of the total population make a one-way trip each day, or every available person in the territory served rides seventeen times per year. Introducing the element of car mileage, it is found that there are 1.8 passengers registered for every car-mile of service. The receipts per car-mile figure 32.05 cents, of which 27.32 cents represents cash fares, 3.23 cents represents ticket sales, .69 cent represents packages, .24 cent represents newspapers carried, .16 cent represents chartered cars, and the balance comprises miscellaneous minor items. On the basis of receipts per mile of track per annum the figures for 1904 show this item to be $4,335.

The table showing the number of passengers representing each denomination of fare indicates general facts in reference to passenger traffic. The following method was adopted for determining more specifically what might be termed the "location" of business: During the last week of January all conductors were supplied with blank forms on which they were required to keep a record of the number of passengers boarding and leaving trains at and between towns. At first thought this would seem to be a gigantic task with which to burden a trainman in addition to his other duties, but it must be remembered that no transfers are in use and that the type of register employed requires duplex tickets to be issued for an average of less than two fares for every 1000 collected. Consequently, the results obtained may be considered as fairly accurate, inasmuch as a considerable personal error would have no appreciable bearing on the total amounts. A tabulation of the statistics thus collected shows the following results, which are the total figures for seven consecutive days:

	Passengers On	Passengers Off	Total On and Off	Percentage	Mileage	No. of Rural Passengers On and Off per Mile per Day
Muncie	2,826	2,812	5,638	16.1	.7	
Intermediate distance.	354	364	718	2.1	4.5	23
Royerton	392	410	802	2.3	.0	
Intermediate distance.	204	225	429	1.2	2.9	21
Shideler	483	438	921	2.6	.0	
Intermediate distance.	146	168	314	.9	1.9	24
Eaton	1,399	1,313	2,712	7.8	.9	
Intermediate distance.	634	682	1,316	3.8	6.6	28
Hartford	3,905	3,857	7,762	22.2	2.0	
Intermediate distance.	681	752	1,433	4.1	7.7	27
Montpelier	2,274	2,285	4,559	13.0	.8	
Intermediate distance.	156	187	343	1.0	2.6	19
Keystone	818	806	1,624	4.6	.3	
Intermediate distance.	306	358	664	1.9	4.1	23
Poneto	731	713	1,444	4.1	.5	
Intermediate distance.	383	428	811	2.3	5.5	21
Bluffton	1,800	1,694	3,494	10.0	.8	
Totals	17,492	17,492	34,984	100.0	41.8	

By combining the number of passengers on and off, each town or rural district receives credit for every incoming and outgoing passenger; comparative results are thus obtainable, using as a base the figure representing the total number of passengers on and off. The column of percentages given in the table indicates the relative amount of traffic furnished by each town and by the rural districts lying between adjacent towns. The proportion of business furnished by the towns is shown to be 82.7 per cent of the total, in comparison with 17.3 per cent supplied by the rural districts, a ratio of nearly 5 to 1. Incidentally, it might be mentioned that similar statistics were gathered for one week during the month of August, 1903, at which time only that portion of the road between Muncie and Montpelier was in operation; the results showed 88.3 per cent for the towns and 11.7 per cent for the rural districts, a ratio of over 7 to 1. In the preceding table a column of figures is given showing the mileage in towns and in the intervening country. By using these figures, the results in the last column of the table are obtained, the purpose being to show the relative traffic value per mile of track of all the rural territory traversed. The general results of the table indicate that the greatest volume of town and rural traffic is supplied by Hartford City and the adjacent territory. On account of geographical and local conditions, this result is a natural one to expect.

Proceeding further in an effort to determine the relation between gross receipts and population, the following earnings per capita per annum are obtained, the method used being to credit each community with its proportion of the total receipts to which it is entitled, according to the percentage values given in the preceding table. The results are as follows:

Muncie	$0.91	per capita	per annum
Royerton	13.89	"	"
Shideler	15.70	"	"
Eaton	7.07	"	"
Hartford City	5.03	"	"
Montpelier	3.93	"	"
Keystone	20.84	"	"
Poneto	14.86	"	"
Bluffton	2.59	"	"
Rural population	6.27	"	"

The average receipts per capita per annum show a figure of nearly $2.95. Omitting the population of the principal terminal city, which method is sometimes used in calculating per capita earnings where the terminal is a large city, though hardly applicable in the present instance, the per capita value increases to 6.14.

The question of providing the requisite number of stopping stations for any road is one which should be carefully considered as having more or less bearing upon passenger traffic. The tendency has been to establish stations at rather too frequent intervals, with the result possibly of stimulating rural traffic to the detriment of through business, operating schedule, car maintenance, etc. Each problem must be considered according to its own conditions, bearing in mind the endeavor to provide the greatest good for the greatest number. On the road under consideration in this article, the established rural stopping stations vary from ½ mile to 1½ miles apart. There are forty-seven stations provided in the rural districts and twenty-three within the corporate limits of the towns. Of these seventy, fifteen may be classed as regular or compulsory (i. e., on account of occurring at railroad crossings or at the principal stations in the towns), and the remaining fifty-five may be considered as flag stations. While the passenger statistics previously referred to were being collected by the conductors, a record of the number of train stops was taken by the motormen. The result for the week showed an average of twenty-eight stops made per single trip, twelve of these being within the corporate limits of the towns and sixteen in the rural districts. Of the twenty-eight stops, fifteen were compulsory and the remaining thirteen were at flag stations. That is to say, with fifty-five flag stations along the line, an average of thirteen are used per single trip.

In conclusion, it should be stated that the Muncie, Hartford & Fort Wayne Railway was first opened for traffic between Muncie and Hartford City in February, 1903. The mileage between Hartford City and Montpelier was added the following May. The division between Montpelier and Bluffton was opened in December of the same year with bi-hourly trains, continuing with this inadequate service until July, 1904, at which time the full hourly schedule was inaugurated. Consequently, although general traffic statistics should preferably be based upon second-year results, it will be noted that in the present instance all figures applying to the year 1904 are hardly indicative of the fully developed results which may be expected for the coming year.

ONE WAY TO PLOW A PARK

At the meeting of the Indiana Electric Railway Association at Anderson, Ind., recently, some of the members were heard asking J. W. Chipman, general manager of the Indianapolis & Eastern Railway, whether he intended to go into the gold mining business again this season. Further inquiry revealed a novel scheme worked by the Indianapolis & Eastern Railway Company last season. The company buried $500 in gold coin in its park. The company wanted the ground thoroughly plowed up and pulverized, and it also wanted to attract some traffic to the park. The plan worked like a charm, and all the company's patrons who desired were given the privilege of digging for this gold coin buried in the park. Nothing but small hand implements were allowed. It is hardly necessary to say that by the time all of the coin was found (as it was) the entire surface of the park was loosened up and pulverized to an extent never equaled by any other scheme of ground preparation in vogue among landscape gardeners. Like many gold mines, the profits did not all go to the miners by any means.

MEETING OF EXECUTIVE COMMITTEE OF THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

A meeting of the executive committee of the American Railway Mechanical and Electrical Association was held at the Holland House, Feb. 3, the following members of the committee being present: President C. F. Baker, of Boston; First Vice-President H. H. Adams, of Baltimore; Second Vice-President John Millar, of Buffalo; Secretary S. W. Mower, of Detroit; D. F. Carver, of Jersey City, and J. S. Doyle, of New York.

At the morning session the committee thoroughly discussed the relation of the Mechanical and Electrical Association to the reorganization of the American Street Railway Association, and on motion made by Mr. Adams, President Baker was authorized to represent this association on the executive committee of the American Street Railway Association. The meeting adjourned at 12 o'clock noon and attended a joint meeting of the executive committee of the American Street Railway Association, the Accountants' Association, the Manufacturers' Association and the Claim Agents' Association, to consider with them the question of reorganization. A report of the discussion and action taken at this joint session of the executive committees has already appeared in the columns of this paper.

At the afternoon sessions of the executive committee of the Mechanical and Electrical Association the following papers were assigned for the coming convention:

"Power Transmission," by C. H. Hile, superintendent of wires, Boston Elevated Railway.

"Maintenance and Inspection of Electrical Equipment," by William Pestell, of J. G. White & Company, New York City.

"Way Department Matters," by F. G. Simmons, Milwaukee Electric Railway & Light Company.

"Power Stations," by Fred Bushnell, chief engineer, the Rhode Island Company, Providence.

The following-named gentlemen were appointed chairmen of standing committees on the subjects indicated for a term of three years; these to choose two associates, one to serve for two years, the other for one year, with full power to act in regard to papers, etc. By this arrangement the work will be continuous, one member of the committee being replaced each year or continued, but in either event, there will be two old members of the committee remaining:

"Controlling Apparatus," J. S. Doyle, Interborough Rapid Transit Company, New York.

"Brakes," D. F. Carver.

"Wheels," John Millar, International Railway Company, Buffalo.

"Shops," W. D. Wright, Rhode Island Company, Providence.

"Way Matters," F. G. Simmons, Milwaukee Electric Railway & Light Company.

The Question Box will again be handled by the secretary.

The resignation of C. C. Lewis, formerly of Schenectady, was read and accepted, and President Baker was authorized to fill the vacancy on the executive committee. Motion was made and carried that members desiring extra copies of the Second Annual Report, 1904, be charged $3 a copy therefor, and that new members joining the association and wishing to obtain back numbers will be charged $1 per copy.

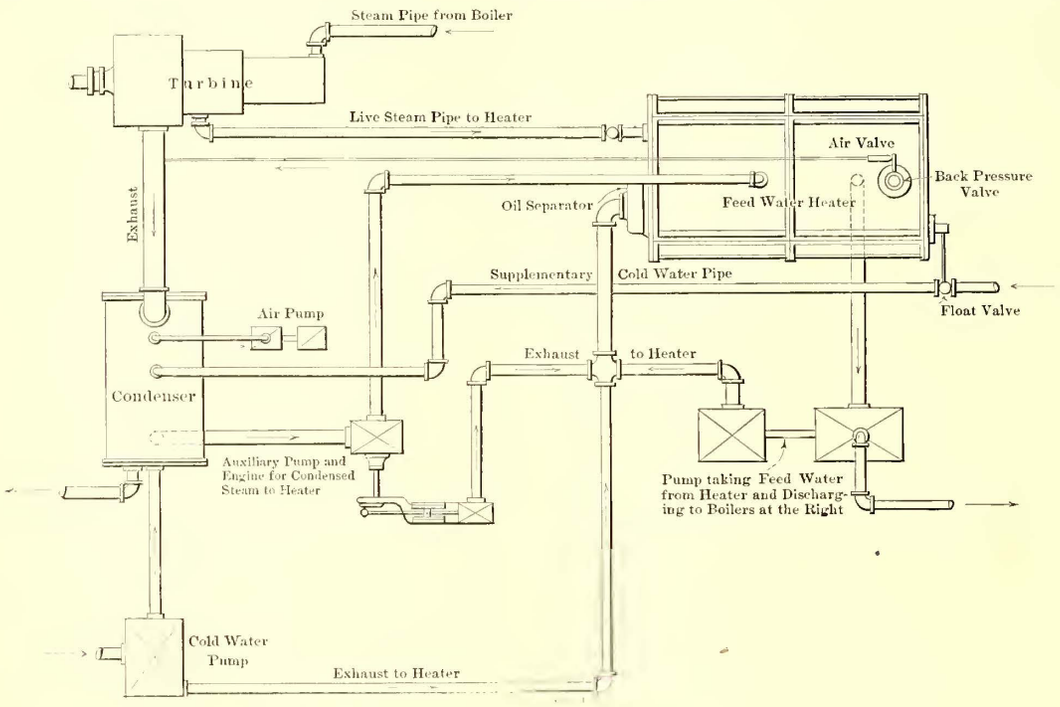
The meeting adjourned until 3 o'clock the following afternoon, at which time the members accepted the invitation of Mr. Doyle to take a trip through the subway of the Interborough Rapid Transit Company with him.

The Springfield, Troy & Piqua Railway Company has opened a park and baseball grounds west of Springfield, and has placed contracts for the erection of a grand stand to seat 2500 people. Regular league games will be played there next summer.

A SYSTEM FOR HEATING AND REGULATING BOILER FEED-WATER

Among the new problems and opportunities presented by the recent commercial development of the steam turbine is the application of the auxiliary equipment in plants operated by turbines. The Harrison Safety Boiler Works, of Philadelphia, Pa., manufacturers of the well-known Cochrane feed-water heaters, have paid special attention to the adaptation of these heaters to such plants (the actual and contemplated installations of Cochrane heaters in connection with steam turbines already exceeding 25,000 hp) and have developed some features which should prove of considerable interest to engineers.

The accompanying illustration shows a method patented by the Harrison Safety Boiler Works for heating and regulating the boiler feed-water, and is particularly adapted to plants where steam turbines are operated in connection with surface condensers, although this method is also applicable to plants where surface condensers are used in connection with reciprocating engines.



PLAN OF PIPING FROM STEAM TURBINE AND ITS AUXILIARIES TO FEED-WATER HEATER

Steam from the boiler enters the turbine through the upper pipe, the exhaust passing to the condenser. The pump below the condenser takes cold water through a suction pipe coming from the left and forces it into the condenser to liquefy the exhaust steam therein, the circulating water being discharged finally through the bend at the lower end of the condenser. The condensation of the steam is drawn from the condenser through its lowest horizontal connecting pipe by an auxiliary engine and pump and is delivered to the open feed-water heater. Another connection to the open heater consists of the joined exhaust piping from the various pumps and small engines, the combined exhausts first passing through the oil separator of the heater. The feed-water from the heater is taken through the vertical pipe connected with the pump below and is discharged to the boilers by way of the bend underneath the pump. As shown in the diagram, the exhaust from this last pump combines with the exhaust from the other auxiliaries before entering the oil separator. The middle horizontal pipe connected to the condenser carries a supplementary cold-water feed supply to make up any difference between the quantity of the condensed steam and the amount of water required by the boilers. This supplementary water supply is controlled by the valve at the extreme right of this pipe, according to the water level in the heater. This valve is automatically opened or closed by the float and connecting mechanism. In cases where the condenser air pump is steam driven, its exhaust is also connected to the combined exhaust piping of the various auxiliaries before entering the oil separator. The heater exhaust is provided with a back-pressure valve. The pipe above it is joined to the piping between the turbine and condenser. It is provided with an air valve at its right end for passing to the condenser the air which is liberated from the water by heating it in the heater. By this means the air in the heater is disposed of without permitting the escape of steam.

Should there be more exhaust from the auxiliaries than can be condensed in the heater, the pressure increases until it is high enough to open the back-pressure valve of the heater and allows the surplus to escape to the atmosphere. It often occurs, however, that the steam from the auxiliaries is insufficient to heat the feed-water to the temperature of the steam itself. In order to cover such cases a pipe is carried to the heater from such a point of expansion in the turbine as will insure the least loss of effectiveness with the greatest potentiality, for the purpose of making up any possible deficiency in the auxiliary exhaust. In this pipe is placed an automatic throttling valve, so adjusted that the pressure of the steam when it enters the heater shall be below the pressure at which the back-pressure valve is set. Thus the supply of supplemental steam from the turbine depends upon the pressure in the heater, and is regulated by the needs of the heater itself.

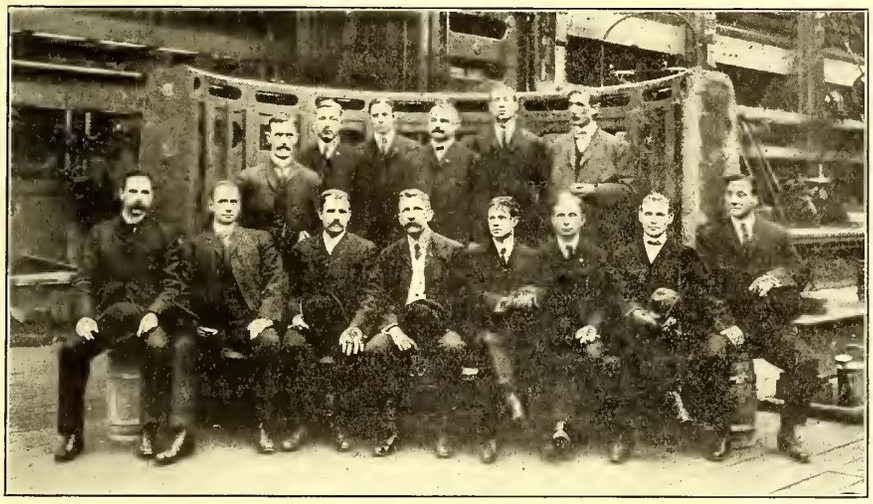
The operation of this novel arrangement has important advantages. In addition to all of the condensation of the main exhaust being utilized in the heater, the supplementary cold water is automatically regulated and supplied, and is partially heated in the condenser by the utilization of the latent heat in the main exhaust. All of the exhaust from the auxiliaries is utilized up to the point where they provide more exhaust than is required in the heater, and should the supply fall below the maximum quantity required it is automatically supplemented by steam in the manner already described. The boilers are furnished with water at a uniformly high temperature, there being no sudden fall in the temperature due to variations in the quantity of steam available for heating the water or in the quantity of the supplemental cold water required. The methods by which these desirable results are obtained are simple, positive and entirely automatic.

It will be seen that in a plant in which this method of heating and regulating the boiler-feed supply is used, the auxiliaries are of the independent, steam-driven, non-condensing type. The manner in which the exhaust from these auxiliaries is utilized, however, makes them far more economical than the turbines or main engine run condensing, even though the latter may show an efficiency of 15 per cent or better. If the auxiliaries were run condensing they could not exceed and probably would not equal this efficiency of 15 per cent, but when operated in the manner described above, their efficiency is practically

100 per cent, for all of the heat in the steam which is not converted into work or accounted for by losses from radiation, etc. (and these quantities would be identical whether the auxiliaries were run condensing or non-condensing), is utilized in heating the feed-water and turned back into the boilers. This efficiency of 100 per cent compares with the absolute loss of 85 per cent which must occur if the auxiliaries are run condensing and the heat in the exhaust dissipated and wasted in the condensing water.

MEETING OF ELECTRICAL CONTRACTORS

On Feb. 6 and 7 the board of directors of the National Electrical Contractors' Association, comprising twenty-six delegates from electrical contractors' associations from the various States, met at the Hotel Schenley, Pittsburg, Pa. Plans for the annual convention to be held this year and the business outlook for 1905 were discussed. Owing to the large amount of business transacted, little opportunity was afforded the visitors to visit the many industries for which Pittsburg is noted, but a party of twelve, accompanied by E. McCleary, of the McCleary Electric Company, Detroit, Mich., and president of the National Electrical Contractors' Association, spent a day in the works of the Westinghouse Electric & Manufacturing Company at the end of the convention. They found the trip interesting and



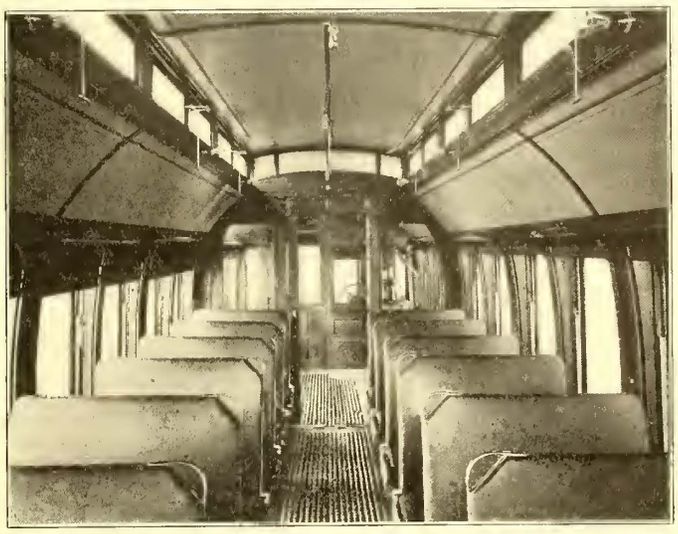
VIEW OF A GROUP OF MEMBERS OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION, IN THE WORKS OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

enjoyable, and only regretted that lack of time prevented a more thorough investigation of the works of the Westinghouse interests. A group of the delegates as they appeared in the works of the Westinghouse Company is shown in connection with this item, Mr. McCleary appearing as the central figure in a sitting posture.

The interline tickets adopted by the Ohio Interurban Railway Association have been placed in use by practically every road identified with the association, and a number of roads in Indiana have agreed to accept these tickets when they are issued by Ohio electric railway companies.

FIRST CAR FOR BLOOMINGTON, PONTIAC & JOLIET SINGLE-PHASE SYSTEM

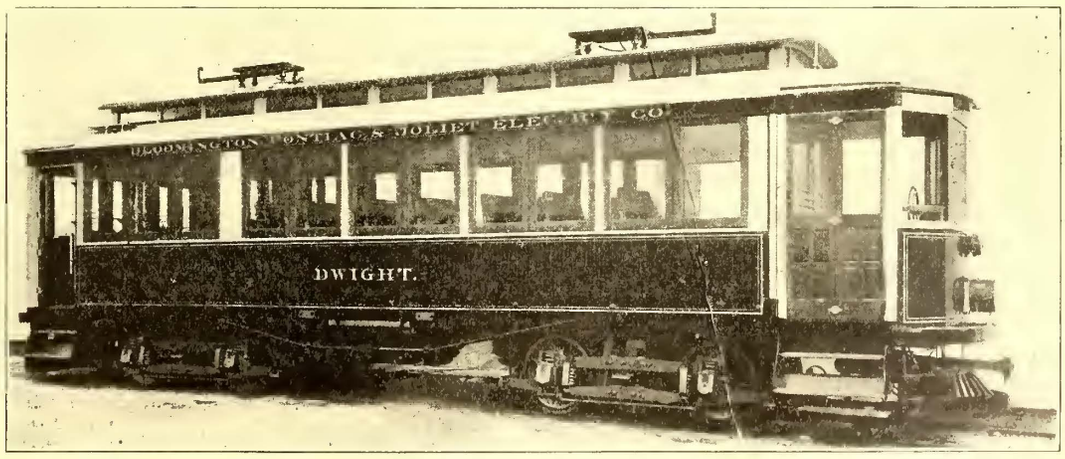
The American Car Company has delivered to the Bloomington, Pontiac & Joliet Electric Railway a large high-speed pas-



SEATING ARRANGEMENT OF BLOOMINGTON, PONTIAC & JOLIET INTERURBAN CAR

senger and smoking car of the semi-convertible type, built under the Brill patents and ordered through the Arnold Electric Power Station Company, of Chicago. The road has recently been completed and connects many towns between the above-named cities. This is the first car in Illinois to be operated with the single-phase system. It is equipped with a transformer, which steps down a trolley potential of 3300 volts. The new system has been so thoroughly described in recent numbers of the STREET RAILWAY JOURNAL that it is not necessary to enlarge upon it.

The company has constructed and equipped its lines after the latest methods, and in choosing its car adopted this type of semi-convertible as being best adapted to the requirements of thoroughly modern high-speed service. For the same reasons the Brill No. 27-E-1½ trucks were selected, which are capable of the highest speeds, and may be run around curves of short radii in very fast time because of the cushioned side swing. The trucks have solid forged side frames and are well adapted



AN EXTERIOR VIEW OF THE FIRST CAR IN ILLINOIS OPERATED BY THE SINGLE-PHASE SYSTEM, SHOWING ALSO THE MOUNTING OF THE TROLLEY BASE ON INSULATORS

to service under a heavy passenger car of this type.

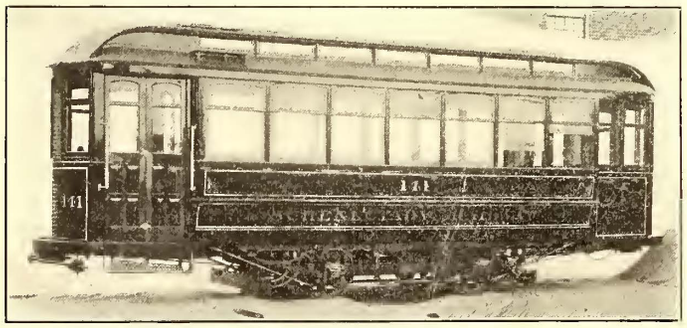
The car is divided into two compartments, one the regular passenger compartment and the other for smokers. The semi-convertible window system allows the windows to be held at any desired height or raised entirely into the roof pockets. The interior finish is cherry, with green ceilings decorated in gold. Transverse seats upholstered in green leather and with reversible high backs are used in the regular compartment, while longitudinal seats are in the smoking compartment. Removable storm sashes are included in the equipment. Among the furnishings are Brownell accelerator doors, Brill angle-iron bumpers, "Dedenda" gongs and radial draw-bars, and American Car Company pilots.

The car is 31 ft. 8 ins. over the end panels, and 41 ft. 8 ins. over the crown pieces, including the vestibule sheathing; from the panel over the crown, 5 ft.; width over the sills, 8 ft. 7½ ins.; distance between centers of posts, 2 ft. 8 ins.; side sill size, 4 ins. x 7¾ ins.; end sill size, 4¾ ins. x 6¾ ins.; sill plates, ⅜ in. x 12 ins.; thickness of the corner posts, 3¾ ins., and of the side posts, 3¼ ins. The length of the seats is 38 ins.; width of the aisles, 23½ ins.; height of the steps, 15¼ ins., and of the risers, 13 ins. The No. 27-E-1½ trucks have a wheel base of 6 ins. and 34-in. wheels.

NEW EQUIPMENT FOR THE SCHENECTADY RAILWAY

A shipment of six cars like the one shown in the illustration was lately delivered to the Schenectady Railway Company by the J. G. Brill Company. The wonderful growth of Schenectady, which has tripled its population since 1890, necessitates frequent additions to the equipment of the railway company, which now operates about 175 cars with 115 miles of trackage, and also owns the large pleasure resorts, Brandywine Park and Forest Park, on Ballston Lake.

The new cars are for use in Schenectady, and are mounted on No. 21-E trucks, which the builder claims carry the car



ONE OF THE NEW SINGLE-TRUCK, DOUBLE-VESTIBULE CARS FOR THE SCHENECTADY RAILWAY COMPANY

body lower than any others. The roofs are of steam car form and add to the strength, longitudinally, of the upper structure, as well as to the general appearance of the cars. The interiors are handsomely finished in mahogany, with ceilings of decorated birch. Longitudinal spring cane seats in two parts are used. Instead of the usual dropped sash arrangement of windows, the windows have a pair of sashes, the upper one stationary and the lower one raised partly into a pocket behind the letter board. This arrangement gives additional width by getting rid of wall pockets, and saves much glass, as the sashes when dropped into pockets are usually allowed to fall with considerable force. Folding doors give entrance to the vestibules on one side only, the other side being solidly paneled.

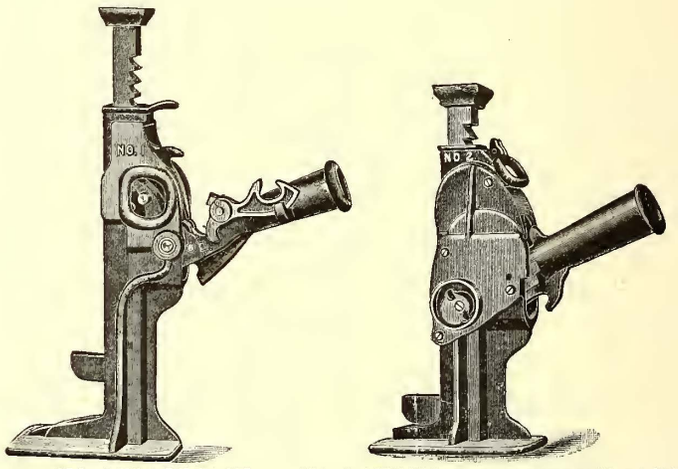
The general dimensions are as follows: Length over the end panels, 20 ft., and over the crown pieces and vestibules, 29 ft. 6 ins.; width over the sills and plates, 6 ft. 4 ins., and over the posts at the belt, 7 ft. 4 ins.; over the water table, 7 ft. 7 ins.; sweep of the posts, 6½ ins.; side sill size, 5 ins. x 8 ins.; end sill size, 4½ ins. x 8 ins.; sill plates, ⅝ in. x 7 ins.; thickness of the corner post, 3¾ ins., and side post, 2 ins.; bottom of the sill to the top of the trolley boards, 9 ft. 2 ins.; floor to ceiling, 8 ft. 1⅛ ins.; length over the bumpers, 30 ft. 6 ins.; panel over crown piece and vestibule, 4 ft. 9 ins. The Brill specialties used are angle-iron bumpers, radial draw-bars and "Dedenda" alarm gongs.

TRIP AND AUTOMATIC LOWERING JACKS

The jacks shown in the accompanying cuts are made by the Buckeye Jack Manufacturing Company, of Louisville, Ohio, and represent two types widely used for railway work.

The No. 1 track or trip jack has a lifting capacity of 10 tons. The leverage is compound, double-acting, lifting the load half a notch on both upward and downward strokes. The load can be dropped instantly from any operation at the will of the operator. This is a standard track jack, strictly conforming in its construction to the requirements of the Roadmasters' Association. It is recommended for track work only.

The automatic lowering jack No. 2 is also of 10 tons capacity, and is a very popular style because of its suitability for all lifting purposes. It can be used as a track jack as well as for a car jack in cases of derailment. The load is moved up or down half a notch at each stroke on both upward and downward movements of the lever. The direction is easily controlled by the eccentric at the side of the frame, the jack operating at any angle. It has no trip, consequently its load cannot be dropped through carelessness. The adaptability of this jack has made it especially popular on electric railways.



NO. 1 TRACK JACK NO. 2 AUTOMATIC LOWERING JACK

In general, the jacks constructed by this company are made of high-grade carbon steel for the drop forgings and malleable iron castings. Owing to the simplicity of construction and interchangeability of all parts, replacements can be quickly made without the help of a skilled mechanic. These features have been chiefly instrumental in bringing this line of jacks into extensive use.

The Pennsylvania & Mahoning Valley Railway Company has announced a new schedule for all the lines in its city and interurban system radiating from Youngstown, and the schedule has been indorsed for trial by the City Council. It provides for ten, fifteen and twenty-minute headway on the various local lines and half-hourly headway on the interurban lines. Cars on the hour in both directions out of Youngstown will be limited cars, and will stop only at a few of the most important streets in Youngstown. This settles a long-standing dispute over the handling of local passengers by limited cars.

NEW RAILROAD CURVE PROJECTOR AND SCALE

The drafting instrument shown in Fig. 1 has recently been designed by Queen & Company, of Philadelphia, for drawing track work where curves of varying radii are required. This railroad curve projector and scale combines, in one, all the different curves required in the plotting and investigation of the alignment of a railway. The application and facilities offered by the use of this instrument will be apparent to the railway engineer, as explained in connection with Figs. 2 and 3.

Fig. 2 shows the curve projector as applied to plotting and fitting simple curves to the conditions shown on a contour map. Using proper care, the line may be put on the plan by aid of the curve projector, straight edge, triangle pencil and scale, or only the curve projector, pencil and scale; to get the notes for the field it would be necessary to check up the line as to central angles and pluses.

Fig. 3 illustrates the application of the curve projector to the plotting of compound curves. It facilitates the work by allowing the engineer the use of 1640 different combinations with the forty-one curves on the two sheets; he can also hold the combinations he is trying in a fixed position on the paper without marking the plan, thus saving the erasing which would result from the use of compass and curves.

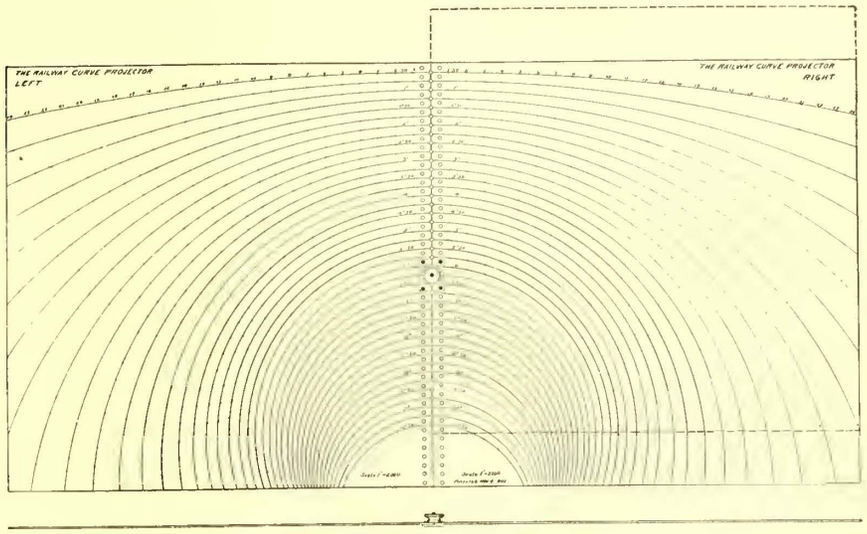


FIG. 1.—DRAFTING INSTRUMENT FOR DRAWING TRACK WORK OF VARYING RADII

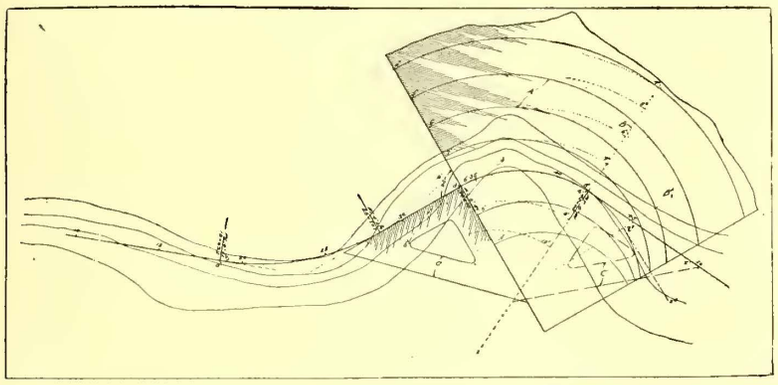


FIG. 2.—CURVE PROJECTION AS APPLIED TO PLOTTING AND FITTING SIMPLE CURVES TO CONDITIONS SHOWN ON A CONTOUR MAP

The curves are all carefully scaled. At each ½ in. along the curves an aperture is made large enough to allow the passing of a pin or pencil through the sheet, allowing the points to be transferred to the plan. A clamp is provided to hold the sheets together while any combination of curves is being made.

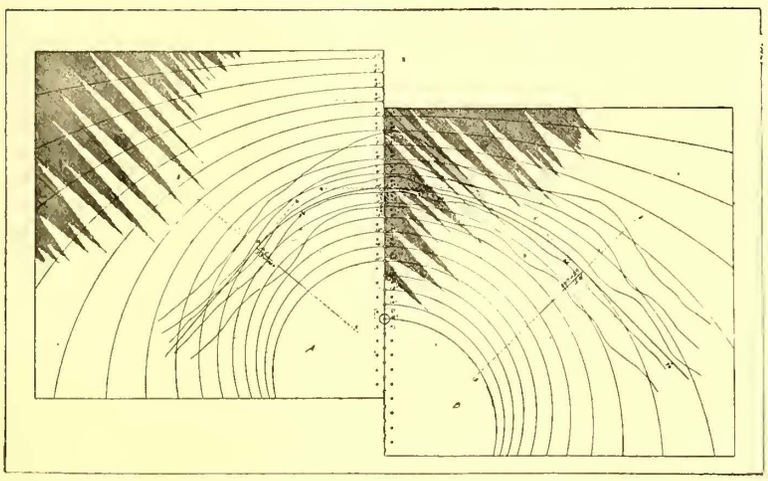


FIG. 3.—APPLICATION OF THE CURVE PROJECTION TO THE PLOTTING OF COMPOUND CURVES

The following figures will give some idea of the wide range of this instrument. There are forty-one different curves on each sheet, varying by fifteen minutes, and running from 0° 30′ to 10° 30′, for a scale of 1 in. equals 200 ft., or varying by thirty minutes, and running from 1° 00′ to 21° 00′, for a scale of 1 in. equals 100 ft.

DR. LOUIS DUNCAN LECTURES AT THE BROOKLYN POLYTECHNIC

The Brooklyn (N. Y.) Polytechnic Institute recently made arrangements with a number of specialists in different branches of electrical engineering to give a series of practical lectures in connection with their work. All of these lectures are given in the evening and are designed especially to fill the wants of operating men who are anxious to obtain a broader knowledge of their respective fields.

A course of eight two-hour lectures was also arranged on the subject of electric traction, to be given by Prof. Louis Duncan, the well-known railway expert. Mr. Duncan's first lecture, which was given on Feb. 15, was devoted to a general consideration of load factors and cost factors, including the presentation of a number of interesting load curves obtained in both city and interurban electric railway operation. The main point emphasized by the lecturer was that the percentage of load factor could not be taken as conclusive, but that it would first be necessary to study the character of the load factor, since two load factors of the same percentage might be due to entirely different causes. Dr. Duncan then showed how much copper would be required on a line with a given drop for different kinds of load factors.

The second lecture by Prof. Duncan will be given on March 2, and will be devoted to car and train resistance, track construction, interurban roads and city railways.

The Hocking Valley Railway (steam) is trying to overcome the competition of the electric lines between Marion, Columbus and Lancaster, Ohio, by selling a new form ticket good for two trips by one person in either direction, or for two persons in one direction, at about the same rate as for a single-trip ticket heretofore. It has also placed a thirty-ride ticket on sale which is transferable.

FINANCIAL INTELLIGENCE

Wall Street, February 15, 1905.

The Money Market

The principal feature of the money market this week was the sharp advance in the price of sterling exchange at Paris to 25 francs, 21 centimes, and a decline of 15 points in the local rate for sterling to 4.8790. This, following upon the reduction in its discount by the Imperial Bank of Germany, and the expectations of a reduction in the Bank of England rate later in the week, were regarded as a forerunner of further ease in the European money markets. At the present rates of exchange gold exports to Paris are unprofitable, and unless the market develops decided strength it is unlikely that further shipments of the precious metal will be made by the end-of-the-week steamers. Gold, however, continues to be sent to Cuba in payment for Cuban bonds, but present indications are that the final consignment on this account will be made this week. Otherwise, the market was not materially changed. The tone was called firmer, but rates for all maturities were practically the same as those ruling at the close of a week ago. The demand for accommodations was not large, but at the same time there was no pressure of funds upon the market, the banks generally being disposed to strengthen their reserves by holding off in expectation of better returns. Call money was fairly active throughout the week at rates ranging from 1¾ to 2¼ per cent. In the time loan branch business was extremely quiet. On high-grade collateral five and six months' contracts were easily obtainable at 3¼ per cent, but where ordinary mixed securities were offered the borrower was obliged to pay 3½ per cent. There was no inquiry for the short periods, and rates were nominal at 2½ to 2¾ for sixty days, and 3 to 3¼ for three and four months. Prime mercantile paper continued in good demand, but the volume of business was somewhat restricted by the light offerings of choice names. Rates were unaltered at 3¾ to 4 per cent for the best double-named endorsements, and 4 to 4¼ for choice single names. The bank statement published last Saturday was unfavorable. There was a decrease in cash of $7,307,000, making the total loss sustained by the banks for the first half of February of $12,656,700. Loans increased $14,019,300 and deposits increased $5,992,000. The surplus reserve decreased $8,805,000 to $11,036,925, as against $20,379,225 in the corresponding week in 1904, and $15,529,675 in the same week of 1903. Open markets discount rates in Europe were firmer. At London the rate advanced 3-16 to 2⅝ per cent; at Paris the rate was 1 15-16, as against 15-16 a week ago, while at Berlin the rate stood at 1½ per cent.

The Stock Market

There was a noticeable falling off in the volume of business on the Stock Exchange this week, and although prices displayed considerable irregularity at times, the undertone was decidedly strong. During the early part of the week prices generally continued the upward movement, despite the passage by the House of the railroad rate bill, but subsequently reactions occurred throughout the list on selling by traders who were not disposed to carry too many stocks over the double holiday. On Saturday the selling from this source was renewed, and was helped by the unfavorable bank statement. On Tuesday the market opened strong, but became dull and heavy after the first hour. During the last hour the market started up violently under the lead of Union Pacific, which made a new high record. A factor of strength in all the railroad issues was the belief that the breach between the President and the Senate over the arbitration treaties would effectually prevent the President's desired railroad legislation. Other important factors were the improvements in the European markets, suggesting an early termination of the war between Japan and Russia, and the prospects of an early decision by the United States Supreme Court in the Northern Securities matter. The bond market was rather less active than a week ago, but prices generally ruled strong. The features were the Union Pacific convertible 4s, which made a new high record, and the Japanese war loan bonds.

The traction stocks were generally strong under the lead of Manhattan Railway, which responded to a heavy demand, and closed with a net gain of 2¼ points to 173¾. Metropolitan Street Railway was also strong, showing a gain of 1¼ to 122⅛. Metropolitan Securities and Brooklyn Rapid Transit were fairly active, but without material change in prices.

Philadelphia

Considerable activity developed in the local traction issues this week, and prices generally displayed decided strength. The feature of the trading was the unusually heavy trading in United Gas & Improvement, which was accompanied by a sharp advance in price on reports of valuable rights to be given to the stockholders. There were also rumors of a "deal" of some kind which included Philadelphia Rapid Transit. These rumors were subsequently denied by President Dolan of the first-named company. From 109½, at the opening, United Gas & Improvement declined to 108½, but subsequently the price rose sharply to 115. At the close there was more or less profit-taking, on account of the double holiday, which, together with the official denial of pending deals, caused a reaction of 1⅜ points from the highest. About 30,000 shares were dealt in. Philadelphia Rapid Transit was extremely active and buoyant. From 26⅝, the price ran off to 26, but later, on heavy buying, said to be for New York interests, there was a rise of 3½ points to 29½. At the close there was a reaction of ⅝. Upward of 72,000 shares changed hands. American Railways was also strong, with sales at 51. Philadelphia Company rose from 42 to 43 and closed at 42½, while the preferred declined from 47½ at the opening to 45, and subsequently to 46¾. Philadelphia Traction was exceptionally quiet, the trading for the most part being confined to odd lots at prices ranging from 100½ to 101. Other transactions included odd lots of Consolidated Traction of New Jersey at 82¼ to 82, United Companies of New Jersey at 273½, Union Traction at 58¾ to 59. United Railways of San Francisco at 31⅜ to 31, and of the preferred stock at 79½ and Railways General at 3⅞.

Chicago

Trading in the street railway shares were unusually quiet this week, the market for them reflecting the extreme dullness prevailing in other quarters of the market. Dealings included a very small number of issues, but prices were not materially changed from those prevailing at the close of a week ago. North Chicago held firm at 98, and small lots of Chicago Union Traction brought 13. Of the Elevated Railway shares, Chicago & Oak Park and South Side Elevated were strong, over 1000 shares of the first-named changing hand at 6½ to 6⅞, while several hundred shares of the latter brought 95 to 95⅛. Northwestern brought 62 for small amounts. Metropolitan issues were quiet and steady, pending the meeting of the directors, the latter part of the week, to take action on the preferred stock dividend. It is said that the company could make a distribution of 5 per cent, and still have a surplus of $230,000, the same amount it had on hand a year ago.

Other Traction Securities

The overshadowing feature of the Baltimore market was the extraordinary activity and strength in United Railway incomes. The demand for this issue was extremely heavy during the early part of the week, causing an advance from 55⅛ to 58. At the close profit-taking carried the price off 1½ points. Upward of $400,000 changed hands. There was no news to explain the advance. The 4 per cent bonds were extremely quiet and firm at 95¼ to 95½, while several hundred shares of the stock brought 13½ to 14¼, the closing transaction taking place at 14. Norfolk Railway & Light 5 per cents brought 94 to 94¼ for about $10,000. The Boston market was dull and irregular. Boston Elevated advanced a point, about 1000 shares selling at from 155½ to 156½. West End common and preferred sold at 95½ to 96 and 115 to 115½, respectively. The Railroad Commissioners have authorized the West End Street Railway Company to issue $200,000, 4 per cent, thirty-year bonds, and the Worcester & Holden Street Railway Company to issue $25,000 5 per cent, twenty-year bonds. Massachusetts Electrics were conspicuously weak, the common declining from 15⅛ to 13½, and the preferred from 59½ to 55½. Trading in Interborough Rapid Transit stock on the New York curb has been considerably less animated, but price movements have been more or less erratic. From 217 at the opening there was an advance to 222, but toward the close the price reacted to 215, or 10 points below the high price attained in the previous week. There was no news to explain the decline. New Orleans Railway common sold at 3⅝, and the preferred at 13¾. The new stock "when issued" was dealt in for the first time at from 15 to 16. Washington Railway & Electric 4s held strong, $21,000 selling at 87.

Traction bonds featured in the trading at Cincinnati last week. The 4s of the Indianapolis Street Railway sold to the extent of

$175,000, repeating the performance of the previous week. Cincinnati, Dayton & Toledo 5s sold at 86½ to 87½ for $45,000 worth. Columbus Railway 4s sold at 92½ for $35,000 worth. Cincinnati, Newport & Covington second 5s at 109 for $17,000 worth. The common stock of this company sold at 31¼ and the preferred at 9½. Detroit United sold at 77 and Cincinnati Street Railway at 141½.

Cleveland Electric moved up to 85 at Cleveland. Northern Texas Traction advanced to 48 on small lots, and little is to be had at near this figure. Northern Ohio Traction & Light sold at 18⅞ to 19¼. Northern Texas Traction 5s to the amount of $116,000 worth at 93½ to 95. Aurora, Elgin & Chicago 5s, to the amount of $26,000, sold at 81½ to 83. Western Ohio 5s sold at 73 to 74, and Cincinnati, Dayton & Toledo 5s at 86⅜.

Security Quotations

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

	Feb. 8	Feb. 15
American Railways	50½	50
Aurora, Elgin & Chicago (preferred)	—	—
Boston Elevated	155	*155
Brooklyn Rapid Transit	62⅛	62¼
Buffalo Con. 5s	109	109½
Buffalo Deb. 6s	104	104½
Chicago City	198	198
Chicago Union Traction (common)	12¾	11¾
Chicago Union Traction (preferred)	51	50
Cleveland Electric	81	83
Consolidated Traction of New Jersey	80	—
Consolidated Traction of New Jersey 5s	109	110
Detroit United	77½	78½
Interborough Rapid Transit	217½	217
Lake Street Elevated	—	—
Manhattan Railway	171¼	173⅝
Massachusetts Electric Cos. (common)	15	13½
Massachusetts Electric Cos. (preferred)	59½	55
Metropolitan Elevated, Chicago (common)	21⅛	20½
Metropolitan Elevated, Chicago (preferred)	60	60
Metropolitan Street	120½	122⅛
Metropolitan Securities	81⅞	81¾
New Orleans Railways (common)	3¼	3
New Orleans Railways (preferred)	13	12⅛
New Orleans Railways, 4½s	79	a81
North American	103¼	103¼
Northern Ohio Traction & Light	—	—
North Jersey Street Railway	22	22½
Philadelphia Company (common)	41¾	41¾
Philadelphia Rapid Transit	25¾	28½
Philadelphia Traction	100	100½
South Side Elevated (Chicago)	94½	94½
Third Avenue	130	132
Twin City, Minneapolis (common)	105⅜	105½
Union Traction (Philadelphia)	58¾	58¾
West End (common)	95¼	96
West End (preferred)	115	115

* Ex-div. a Asked.

Iron and Steel

The "Iron Age" says it is estimated that in the past ten days leading Southern producers have sold 100,000 tons of pig iron, of which 40,000 tons was taken by a large firm of merchants. The extraordinary statistical position has aroused much interest, and buyers are inclined to cautiously feel the market for deliveries well into the third quarter. The position of the United States Steel Corporation is shown by the fact that a few days since a lot of 65,000 tons of pig iron was bought for immediate shipment to the Lorain steel plant. This comes on the heels of recent buying, which was supposed to have taken care of the February needs. It is important that the Illinois Steel Company is withdrawing as a seller. Some good additional orders have come in for steel rails; the Illinois Steel Company now has 425,000 tons on its books. Tin plate mills are running to their full capacity, and yet they are getting behind in deliveries. Premiums are appearing and the trade expects an advance.

The four-cent plan of operation of the Cleveland Electric Railway Company, referred to elsewhere in this issue, has been abandoned by the company as unprofitable, and it is not likely that any further low-fare tests will be made. At the time of going to press President Andrews, of the company, had not made public the result of the trials. He will, however, make a report in full within a few days.

THE APPLEYARD SITUATION

It is rumored that application will soon be made to the court to raise the receivership of the Dayton, Springfield & Urbana, Columbus, London & Springfield, Urbana, Bellefontaine & Nothern Electric Railways, and the other properties of the Appleyard syndicate now in the hands of receivers, and that the systems will be reorganized and placed in charge of Guy Morrison Walker. A plan whereby the roads may be consolidated is also said to have been agreed upon. Mr. Walker is regarded as an expert in matters interurban. He formerly was connected with the Everett-Moore syndicate, and is well known throughout Ohio, Indiana and Michigan and in New York.

At a meeting of stockholders of the Appleyard properties held in Springfield a few days ago, officers were elected as follows:

Dayton, Springfield & Urbana—Directors, A. E. Appleyard, Boston; W. R. Pomerene, Columbus; Adam Newsalt, S. H. Carr, Dayton; J. S. Harshman, C. A. Alderman, Springfield; C. C. Williams, Columbus; president, A. E. Appleyard; vice-president, S. H. Carr; secretary, W. R. Pomerene.

Columbus, London & Springfield—Directors, A. E. Appleyard, W. R. Pomerene, Adam Newsalt, H. L. Dowd, Columbus; C. C. Williams, J. S. Harshman and C. A. Alderman.

Urbana, Bellefontaine & Northern—Directors, A. E. Appleyard, W. R. Pomerene, Theodore Stebbins, W. T. Haviland, A. J. Miller, W. R. Nevin, Bellefontaine; C. A. Alderman.

The officers of the last two companies were not elected.

The Ohio River & Western Railway, another Appleyard property, has been thrown into the hands of a receiver. This is the steam road which Mr. Appleyard bought and proposed to electrify, making it a part of a system crossing Ohio. The Farmer's Loan & Trust Company, of New York, made application for the receiver. It claimed it held $600,000 worth of Appleyard bonds, on which no interest had been paid for eighteen months. J. K. Geddes, of Zanesville, general manager of the road, has been appointed receiver.

INTERBOROUGH REPORT FOR QUARTER AND SIX MONTHS

The Interborough Rapid Transit Company, operating the elevated and the subway lines in New York, has made public a report of operations for the quarter and for the six months ended Dec. 31, 1904. The passengers carried in the last quarter were 16,245,582 in excess of the number for the corresponding quarter in 1903, and gross earnings for the quarter increased $815,145. Surplus for the quarter, after all charges and the guaranteed dividend on Manhattan, decreased $310,766, but amounted to $439,569, indicating a surplus for the year of about $1,800,000, or just about enough to pay 5 per cent on the capital stock of the Interborough Company. The statements follow:

Quarter ended Dec. 31:	1904	1903
Gross receipts	$4,472,855	$3,657,709
Operating expenses	1,888,087	1,396,395
Net earnings	$2,584,768	$2,261,314
Other income	96,015	85,599
Total income	$2,680,783	$2,346,913
Charges	999,213	768,579
Balance	$1,681,570	$1,578,334
Manhattan guaranteed dividend	828,000	828,000
Balance	$853,570	$750,334
Extra dividend Manhattan	414,000	.....
Surplus	$439,570	$750,334
Passengers carried	90,105,066	73,859,484
Six months ended Dec. 31—	1904	1903
Gross receipts	$7,705,804	$6,596,463
Operating expenses	3,257,181	2,704,016
Net earnings	$4,448,623	$3,892,447
Other income	175,013	165,886
Total income	$4,623,636	$4,058,333
Charges	1,702,756	1,437,054
Balance	$2,920,880	$2,621,279
Manhattan guaranteed dividend	1,932,000	1,932,000
Surplus	$988,880	$689,279
Passengers carried	155,557,130	133,302,788

BROOKLYN RAPID TRANSIT REPORT FOR YEAR ENDED DEC. 31, 1904

The results of the operations of the Brooklyn Rapid Transit system for the year ending Dec. 31, 1904, were presented by the company in reply to the New York Stock Exchange for the listing of its first refunding bonds. These figures compare with those presented on a similar occasion a year ago, for the operations during 1903, as follows:

	1904	1903
Gross earnings	$15,459,660	$14,025,825
Operating expenses	9,261,916	8,392,607
Net earnings	$6,197,744	$5,633,218
Other income	237,141	207,522
Total net earnings	$6,434,885	$5,840,740
Taxes and charges	4,961,614	4,702,514
Balance	$1,473,271	$1,138,226
Additional improvements	844,909	338,611
Balance surplus	$628,362	$799,615
Surplus, Dec. 31, 1903	2,657,726	
Total surplus	$3,286,088	
Discount on bonds sold, old accounts, adjustments	1,158,852	
Surplus	$2,127,236	

The following is a consolidated general balance sheet as of Nov. 30, 1904, of Brooklyn Rapid Transit Company and constituent companies:

ASSETS

Cost of road and equipment		$101,046,143
Advances account of construction for leased companies		6,711,126
Construction expenditures, constituent companies		1,331,712
Guaranty fund—securities and cash		4,005,755
Treasury bonds		6,905,000
B. R. T. first ref. gold mortgage, 4 per cent	$6,795,000	
Other issues	110,000	
Treasury stock		146,228
Current assets		1,792,895
Cash on hand	$481,442	
Due from companies and individuals	368,232	
Construction material and general supplies on hand	784,798	
Prepaid accounts	158,421	
Bond discount		346,800
Total		$122,285,660

LIABILITIES

Capital stock		$45,959,605
Bonded debt and real estate mortgage:		
B. R. T. Company		23,795,000
Bonded debt of constituent companies		45,866,140
Brooklyn Heights Railroad Company	$250,000	
Brooklyn, Queens County & Suburban Railroad Company	6,624,000	
The Nassau Electric Railroad Company	15,000,000	
Sea Beach Railway Company	650,000	
Brooklyn Union Elevated Railroad Company	23,000,000	
Real estate mortgages	342,140	
Current liabilities		4,516,175
Loans and bills payable	$1,250,000	
Audited vouchers	626,168	
Due companies and individuals	89,185	
Taxes accrued and not due	1,293,193	
Interest and rentals accrued and not due	1,205,443	
Interest accrued on real estate mortgages and not due	755	
Insurance reserve fund	51,428	
Long Island Traction trust fund		9,439
Accounts to be adjusted		17,922
Surplus		2,121,337
Total		$122,285,660

THE TUNNEL FROM NEW YORK TO LONG ISLAND CITY

From information now to hand the Belmont interests have been quietly at work perfecting the plans for building the subway from Forty-Second Street, Manhattan, to Long Island City, of which mention was first made in the Street Railway Journal several months ago. It seems that the consents have all been obtained of property owners on Forty-Second Street, and that a terminal has been acquired in Long Island City for the road. This terminal is to be on the block between Fourth and Fifth Streets, upon which formerly stood the plant of the Smith Varnish Works. It is here that the work has been begun of sinking shafts for the tunnel under the river. The plan for the new road as generally admitted to be authentic is for a line from the Grand Central Station, in New York, at a connection with the subway in that city by way of Forty-Second Street and thence under the East River to Long Island City, where connections could be made with the New York & Queens County Railway Company, operating to Jamaica, Flushing and other places in Queens County. As Mr. Belmont's connection with the Queens County Company is generally admitted, and as he is president of the Interborough Rapid Transit Company, operating the subway lines in New York, it is evident that the connection between the two systems that the new line would supply would tend greatly to develop the territory through which the New York & Queens County Company operates. The tunnel is to be built under the grant made to Mr. Steinway, of Long Island City, long ago.

BILLS BEFORE THE CONNECTICUT LEGISLATURE

Of matters before the Connecticut Legislature there are several concerning the incorporation of new companies that are of interest. The bill that, perhaps, is causing the most discussion is the one looking toward the revival of the project of building an electric railway from New Haven to Hartford by way of Middletown, thus paralleling the New York, New Haven & Hartford Railroad. This project was first before the Legislature several years ago. The plan was for one set of interests to incorporate two companies to build the road, one company to carry out the work between New Haven and Middletown, and the other between Midletown and Hartford. Now it seems that only one company is proposed. It will be known as the Hartford, Middletown & New Haven Railroad Company. Cornelius J. Danaher, of Meriden, presented the application to the Legislature. Inasmuch as the New York, New Haven & Hartford Railroad has fortified itself so well in the territory through which the proposed road is to build, by the purchase of existing systems, there is considerable speculation as to the significance of the new application.

Another application receiving considerable attention is from the Norwalk, Bridgeport & Bethel Traction Company for an extension of time in which to organize and build its lines. This company was chartered in 1901, and was given permission to build an electric railway from Norwalk to Bethel, thence to Easton and to the outskirts of Bridgeport, there to connect with the lines of the Connecticut Railway & Lighting Company.

The Lebanon Street Railway Company, a petition for the incorporation of which is now before the committee on railroads, proposes to build from the Chestnut Hill station, on the Air Line division of the New York, New Haven & Hartford Railroad Company, through Lebanon, Liberty Hill, Franklin, Bozrah, Fitchville and Yantic, to connect with the line of the Norwich Street Railway in Norwich. The incorporators are: N. C. Barker, W. L. L. Spencer, Frank P. Fowler, George H. Hewitt, Isaac J. Gillette, L. P. Smith, L. E. Livermore, S. W. Thropp, Dr. E. L. Danielson, J. H. King, George E. Manning. The charter also provides for the right to sell and distribute electricity for lighting and power purposes.

Improvements of an important character to the Hartford Street Railway are provided for in a bill from that company which seeks an increase of stock from $2,000,000 to $5,000,000, and asks an extension of time to July 1, 1907, in which to build from Broad Street, Hartford, to Wethersfield. The increase in stock is to be used for general improvements to the system. Cited as among these improvements are considerable track work, the building of a power house, and the erection of repair shops and car houses. Another bill of concern to this company is from the Hartford & Glastonburg Railway Company, of which the Hartford Company is the owner, for permission to increase its capital stock from $200,000 to $1,000,000. The plan is to unite under the charter of this company all the lines owned by the Hartford Street Railway Company on the east side of the Connecticut River.

RAILROAD COMMISSIONERS' RECOMMENDATIONS FOR BROOKLYN

The recommendations of the Railroad Commissioners of New York for reforms looking to the improvement of transit facilities in Brooklyn urge that several tunnels be built between New York and Brooklyn and that the Brooklyn and the Williamsburg Bridges be connected by an elevated structure to relieve congestion of traffic at the terminals of these structures. The Poulson plan for relieving congestion at the terminal of the Brooklyn Bridge in New York, which has been given considerable attention by municipal bodies, and in a short test proved to be a failure, is not approved by the Commissioners. The recommendations to the Brooklyn Rapid Transit Company are general in their character, and in many instances are merely for expediting work already under way. The lengthening of platform on the elevated structure, one of the recommendations of the board, is practically completed on the Fifth Avenue line, and will be extended to the other lines at once. Perhaps the most important recommendation is that for the third-tracking of the elevated structure so that express service may be operated. This work would require the removal of a number of "island" stations, but would provide outlying districts with a means of ready transit that would tend to develop the territory rapidly.

MONTEREY ELECTRIC TRACTION DEAL

William Mackenzie, president of the Toronto Railway Company and other electric traction systems in Canada, who is also primarily interested in the Sao Paulo Tramway, Light & Power Company, of Sao Paulo, Brazil, and other South American electric traction enterprises, has concluded arrangements for the purchase of the existing horse car lines, and what is known as the Mackin & Dillon concession, in and around Monterey, the Pittsburg of, and one of the principal cities in, Mexico. About 30 miles of track will be converted into electric lines, in the first instance, at an estimated cost of about $1,250,000. The construction work will begin in about two months, under charge of Mr. Keating, of Toronto, who has just returned from Mexico, after making an exhaustive examination of the situation. It is the intention, ultimately, of the new interests to build and operate upwards of 50 miles of electric tramways in the Mexican city and suburbs.

The Ferrocarriles de Monterey y Topo Chico—a horse road, formerly controlled by the Hayden family, the president of the company being ex-Congressman G. W. Hayden, of the financial house of G. W. Hayden & Company, of 50 Broadway, New York City—is included in the deal. This system is about 15 miles in length. It runs from Monterey to Topo Chico. Included in the purchase of the Hayden line is a long lease of the park, baths and pavilions at Topo Chico. A hotel of large size will be built by the new interest, the bath-house accommodations will be enlarged, new pavilions are to be constructed, and other up-to-date improvements will be brought about.

The Ferrocarriles Urbano de Monterey "Empresa Mexicana," S. A., has also been bought. This system's operations are at present confined to Monterey proper. Francisco Belden, the president of one of the big British-Mexican financial institutions, was the prime factor in the "Empresa." It is a mule line, about 24 miles long.

The concession held by the American contracting firm of Mackin & Dillon, which, as previously stated, has now become the property of the Mackenzie interest, permits of the construction of about 15 miles of lines in Monterey and to one of its principal suburbs. The purchase price, on a cash basis, for the Hayden & Empresa systems, and the Mackin & Dillon concern, is in the neighborhood of $450,000 gold.

There have been various unsuccessful projects within the last three years to buy up the Monterey horse lines and convert them into electric traction. Late in 1902, the late Baltimore financial house of Sperry, Jones & Company secured options on the systems but were unable to finance the scheme. The same fate attended the efforts of a Philadelphia syndicate, which some months ago endeavored to float the undertaking in New York. Edward F. Walker, of Philadelphia, was one of the principals in the scheme.

At time of writing, it is not known definitely whether Mr. Mackenzie intends to build and operate the new system alone, or whether he is acting on behalf of the powerful Canadian capitalists who control the Sao Paulo Tramway Light & Power Company, the Havana Electric Railway Company, the West India Electric Company, Limited, of Kingston, Jamaica; the Trinidad Electric Company, Limited, of Port au Spain, Trinidad, British West Indies; the Mexican Light & Power Company, and the Rio Janeiro Tramway Light & Power Company. At any rate, Mr. Mackenzie, who left last week for Europe, to be gone for about six weeks, is one of the most influential capitalists in the Dominion, so that from a monetary standpoint, there seems no reason why Monterey should not have, for the third time of asking, an extensive up-to-date electric traction system. The purchases of equipment, etc., will in all probability be made through F. S. Pearson's office, 29 Broadway, New York City.

CLEVELAND LOW-FARE INJUNCTION MADE PERMANENT

The Cleveland Electric Railway Company has scored a decided victory over the Forest City Street Railway, the so-called 3-cent fare company, for Judge F. J. Wing, in the United States Circuit Court, has made permanent the injunction prohibiting the Forest City Company or the city from taking possession of the Woodland Avenue and the Kinsman Street routes for 3-cent fare lines. The Forest City Company was granted a franchise over these routes to start Sept. 20, 1904, the date Mayor Johnson and the city administration claim the franchise of the Cleveland Electric Railway Company expired. A temporary restraining order was secured by the latter, which has now been made permanent. The court established the allegation that the franchise in contention does not expire until Feb. 10, 1908. The case will probably be appealed to the Supreme Court of the United States.

REORGANIZATION OF THE NEW ORLEANS COMPANY

Details are announced of the plan of reorganization of the New Orleans Railways Company, prepared by the reorganization committee in the interest of the security holders of the company. A new company will be created under the laws of Louisiana, or such other State as the committee may deem desirable, or an existing charter or company will be used for the purpose of reorganization. This new company will authorize an issue of $30,000,000 thirty-year 4½ per cent gold bonds, $10,000,000 non-cumulative 5 per cent preferred stock, and $20,000,000 common stock, making the total capital liabilities $60,000,000.

Of the total of $30,000,000 bonds, $12,821,500 is to be reserved to retire underlying bonds of constituent companies, $13,356,750 is to be issued to depositing bondholders at the rate of 75 per cent of bonds deposited, and $3,818,750 is to be reserved for betterments, improvements and the general business purpose of the company. These bonds, as previously stated, are to bear interest at the rate of 4½ per cent, payable semi-annually. They are to be of the denomination of $1,000 each, and are to be redeemable at the option of the company on any interest-payment date, upon sixty days' notice, at 105 and interest.

The preferred stock of $10,000,000 is to be entitled in preference and priority over the common stock to non-cumulative dividends up to but not exceeding 5 per cent per annum, said preferred stock to be entitled to no other or further share of the profits. No dividends shall be declared or paid on the common stock of the company in any year until the full 5 per cent (5%) dividend is declared on the preferred stock for such year. This preferred stock is to be applied as follows: To depositing bondholders to the amount of 25 per cent (25%) of the deposited bonds, $4,452,250; for subscription by depositing preferred stockholders, $1,758,480; for subscription by depositing common stockholders, $2,758,890; at disposition of reorganization committee for purposes of the reorganization, $1,030,380; total, $10,000,000.

Of the $20,000,000 of common stock, $8,792,400 is to go to depositing preferred stockholders to the amount of 100 per cent of deposited preferred stock; $9,656,115 is to go to common stockholders to the amount of 35 per cent of the deposited common stock, and $1,551,485 is to be at the disposition of the reorganization committee for purposes of reorganization.

Depositing bondholders shall be entitled to receive for each $1,000 par value of bonds, with coupons due Jan. 1, 1905, and subsequent annexed, deposited by him: Cash to amount of interest due Jan. 1, 1905, on deposited bonds, $22.50; new bonds to the par value of $750.00; new preferred stock to the par value of $250.00. Depositing preferred stockholders shall be entitled to subscribe for and to receive in respect of each share of preferred stock (par value, $100) deposited by him and upon payment of $20: One-fifth of a share of new preferred stock of a par value of $100 per share; one share of new common stock. Depositing common stockholders shall be entitled to subscribe for and to receive in respect of each share of common stock (par value, $100) deposited by him and upon payment of ten dollars ($10): One-tenth of a share of new preferred stock at a par value of $100 per share; thirty-five one-hundredths of a share of new common stock of a par value of $100 per share. Securities are to be deposited on or before Feb. 28, 1905, with the New York Security & Trust Company, depository, New York City.

CAR HOUSE FIRE IN NEW YORK

The car house of the New York City Railway Company on the block between Eighth and Ninth Avenues, Fifty-Third and Fifty-Fourth Streets, New York, was gutted by fire early Thursday evening, Feb 9, entailing a loss to the building and its contents estimated at about $175,000. In the car house at the time of the fire were stored some 75 cars of Columbus, Sixth and Ninth Avenue lines. Of this number 40 are said to have been burned. The flames were first discovered by employees of the company issuing from one of the cars. An alarm of fire was turned in, and an effort was made by the employees of the company to check the progress of the flames. The department was slow in responding, for it had stormed all day and the streets were well-nigh impassable. Second and third alarms brought forty pieces of apparatus to the scene of the conflagration.

DISCUSSION ON TWO-MOTOR AND FOUR-MOTOR EQUIPMENTS

A paper on the above subject is scheduled for the next meeting of the American Institute of Electrical Engineers, to be held in the chapter room, Carnegie Hall, New York City, on Feb. 24. It will be presented by N. McD. Crawford, general manager of the Hartford Street Railroad Company, of Hartford, Conn.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEB. 7, 1905

781,639. Railway Signal; Frank L. Dodgson, Rochester, New York. App. filed March 27, 1903. Relates to that class of signal comprising a counting device at each block for counting-in and counting-out cars in a block.

781,651. Stringer Support for Electric Third Rails; Frank E. Kinsman, Plainfield, N. J. App. filed July 28, 1903. Comprises a stringer of wood provided with a conductor attached thereto and with sockets to receive the heads of insulator pins which support the stringer.

781,721. Guard for Trolley Wheels; Merwin M. Hart, Chicago, Ill. App. filed April 15, 1904. Idler wheels mounted on each side of the trolley wheel have inwardly directed lugs which retain the wire on the wheel.

781,740. Fender for Cars; Jesse T. Rice, Grand Rapids, Mich. App. filed Dec. 26, 1903. The body of the fender consists of a yieldable surface connected at one end thereof and the other end connected to a roller, a tension device for the roller and means for controlling the reaction of the tension device.

781,785. Circuit Controller; Louis Pfingst, Boston, Mass. App. filed April 4, 1904. The circuit controller handle is mounted upon an ordinary brake handle and can be actuated with the latter.

781,835. Switch Operating Mechanism; Joseph P. Lowe, South Seattle, Wash. App. filed May 4, 1904. Details of construction.

781,902. Street Car Fender; James J. O'Dell, Erie, Pa. App. filed Sept. 17, 1904. Relates to a fender which may be readily attached to the ends of a car and which may be folded up in front of the car so as to occupy small space.

781,931. Means for Protection Against Short Circuits; Charles E. Barry, Schenectady, N. Y. App. filed July 15, 1904. In case a short circuit occurs between the collector shoe and the car truck, a circuit breaker is caused to automatically cut out that section of the feeder supplying the shoe.

781,953. Brake; Sheshbazzar Kennedy, Riverview, Pa. App. filed Aug. 3, 1904. Relates to the manner of mounting and applying a combined wheel and track brake.

781,962. Trolley; Edward H. Miller, Pittsburg, Pa. App. filed Sept. 30, 1904. Spirally grooved cylinders each side of the trolley wheel, the grooves serving to conduct the wire toward the wheel in case it leaves the same.

781,984. Magnetizable Conductor Conduit System; William J. Alexander, Philadelphia, Pa. App. filed July 1, 1904. A magnetizable conductor in a closed conduit, the conductor being divided into convenient lengths for removal should any one length become damaged, and devices for taking up slack in the conductor, and for securing the ends of the cable divisions.

781,991. Car Fender; Louis A. Bechtel, Jr., Benwood, W. Va. App. filed Sept. 23, 1904. Relates to a novel manner of mounting the fender.

781,993. Circuit Closer; Walter J. Bell, Los Angeles, Cal. App. filed Oct. 9, 1903. A magnet carried by the car lifts a body of iron filings into bridging contact with two terminals in order to close the circuit between the car and a signal to be actuated.

782,007. Third Rail; Leonard T. Crabtree, Cranton, Wis. App. filed April 14, 1904. Details.

782,195. Trolley Pole Controller; Clarence V. Greenamyer, Los Angeles, Cal. App. filed Feb. 4, 1903. Pneumatic pressure maintains the wheel in proper contact with the wire and the pole is withdrawn in case the wheel leaves the wire.

PERSONAL MENTION

MR. EDWIN T. AISTHORPE has been elected superintendent of the Cairo Electric & Traction Company, of Cairo, Ill., to succeed Mr. Edwin W. Halliday, resigned.

MR. N. C. DRAPER has accepted the position of manager of the street railway and lighting department of the Cleveland office of the Westinghouse Electric & Manufacturing Company. Mr. Draper has previously been connected with operating companies, among them the Peoria & Pekin Terminal Railway, the Central Railway, of Peoria, the Joliet Street Railway, the Chicago City Railway, and the Independent Light & Power Company of Quincy, Ill.

MR. A. S. RICHEY, electrical engineer of the Indiana Union Traction Company, has recently had his duties extended to include charge of track as well as electric transmission and distribution, his title now being chief engineer. Mr. Richey has planned and carried out the electrical transmission and distribution system for all the Indiana Union Traction Company's work the past four years and has made a practical study of the actual daily performance of the systems that has been of benefit to his company and the electric railway business at large.

MR. H. S. REYNOLDS, who for the last four years has managed the Columbus Railway Company, of Columbus, Ga., which owns the street railway, electric light and gas properties in that city, has resigned from the company to accept a position in the operating department of J. G. White & Company, of New York. Before going to Columbus, Mr. Reynolds was connected with the Brockton Street Railway Company, of Brockton, Mass., in charge of construction. He is a graduate of the Massachusetts Institute of Technology, class of 1894, and since graduation has devoted his entire time to the construction and operation of street railway, electric light and gas plants.

THE WILKESBARRE & HAZLETON RAILWAY COMPANY and the Lehigh Traction Company, of Hazleton, Pa., announce changes in the officers of the companies. Effective Feb. 1, Mr. C. J. Kirschner was elected comptroller of the Wilkesbarre & Hazleton Railway Company; Mr. C. B. Houck, general superintendent and purchasing agent, with offices at Hazleton; Mr. A. F. Harger, superintendent of transportation, with offices at Hazleton. The office of traffic manager was abolished. Effective Feb. 1, Mr. C. J. Kirschner was elected secretary of the Lehigh Traction Company; Mr. C. B. Houck, general superintendent, with offices at Hazleton; Mr. A. F. Harger, superintendent of transportation.

MR. L. S. WELLS, whose appointment as electrical superintendent of the Long Island Railroad Company was announced in the last issue of this paper, has had charge, for the past twelve or thirteen years, of all of the electrical work of that company, including the various isolated electric railway, lighting and power plants. During this time his title has been that of superintendent of telegraph, although the actual telegraph service formed only a small part of the department under his charge. Mr. Wells has had an experience in electrical work, both constructive and operative, extending over some seventeen years. His first work was in the telegraph field as operator, and in the electrical testing department. Since the year 1890 his duties have covered the installation and operation of electric generating plants, and he has grown up with this class of machinery. In 1892, as stated, he became superintendent of telegraph of the Long Island Railroad, and as the various trolley lines now owned by the Long Island Railroad were acquired or constructed by that company they became part of this department. In this way Mr. Wells has had immediate supervision and has been electrical superintendent of the Huntington Railroad, the Northport Traction Company, the Nassau County Railway Company, the Ocean Electric Railway Company, and the trolley lines operated over the Long Island Railroad Company's tracks. The extensive electrification of the Long Island Railroad, which has been described in recent issues of this paper, made necessary additions to the duties of departmental heads, and the creation of the office of electrical superintendent. In the new organization of this work the maintenance of the contact rail and track bonding is assigned to the maintenance of way department, the maintenance of rolling stock, including motor equipments, comes under the mechanical department, while the preparation of plans, specifications, etc., for extensions and new equipment, and the making of all electrical tests is placed under the electrical superintendent. In addition to his other duties, Mr. Wells also has charge of the maintenance and operation of power houses, sub-station equipments, transmssion lines, electric lighting, telegraph and telephone lines, etc.