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

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Infractions of the Rules

There are two principal methods of enforcing discipline on street railways. In one the offender is penalized by suspension from work for one or more days without pay; in the other, the Brown system, there is no suspension, but a record is made of the offense, and if a man's misdeeds, after or within a certain period, are greater than a certain standard, he is discharged. There is no doubt that the tendency of street railway companies, at present, is toward the adoption of the Brown system in some form or another.

The old method of "lay-offs" has a great many disadvantages, yet it has one important merit—the punishment quickly follows the offense. In the Brown system this is not so. The notification of the demerit marks or the reprimand are promptly delivered, and, of course, make an impression on most men. There are some, however, to whom no penalty, provided it is far enough off and by no means certain at that, carries much weight, even if it is expulsion from the company. Men of this kind require to be impressed with the fact that they have violated the rules of the company, in other words, to be brought up with a sharp turn occasionally, but if this is done give as satisfactory service as could be desired.

A combination of the two methods, except that the ordinary lay-off is not employed, has been used on some roads with satisfactory results. A motorman or conductor who, through carelessness, has violated some important operating rule of the company, is required to "break in" again for a day or two. That is, he is obliged to serve for this period without pay on a car with an experienced motorman or conductor, just as he would if he had never had charge of a car before. It is needless to say that a man in this position receives an unmerciful amount of guying from his comrades and rarely forgets the lesson. The practice also has the advantage over that of the ordinary suspension in requiring the time of the employee. To some men the lay-off involves no particular hardship, especially if the fishing about that time happens to be good, and instances have been known where men have committed some petty fault in order to secure a short holiday. But to assume again the position of learner is a different matter, especially to an experienced employee. A man who is obliged to act as "student" again cannot complain that the punishment is not logically correct for one who disregards the rules, but one or two experiences of this kind are usually enough to make the man remember the rules.

Electrical Canal Haulage

Elsewhere in these columns will be found a full account of the regeneration of the Miami & Erie Canal, a work which is of peculiar interest, both as the first attempt at mechanical canal haulage in this country, and as the first serious application of three-phase traction motors on this side of the water. Both phases of the innovation are noteworthy. As to the first, electric haulage has been talked about and feebly promoted off and on for the past decade, but nothing, save blue prints and wind, has come of it. It has remained a mere subject of talk, like the use of polyphase motors for traction, until now. A broad mechanical canal haulage has been successfully introduced in several different forms, and alternating motors have for some years past been successfully applied to electric traction, but foreign examples are at the present time rather wasted upon us. However, in the present instance one engineer was able to break away from the chains of custom, and the result is a highly interesting plant which gives excellent promise of usefulness.

Briefly, the plan of operation is the haulage of tows of eight or ten canal boats by a locomotive running on a track beside the canal. The locomotive uses three-phase motors for traction, and takes current from a pair of trolley wires at high voltage, which is reduced by transformers on the locomotive itself. Here, again, our congratulations to the engineer for escaping (a) a multiple-unit control of the tow with motors and propellers on each boat; (b) half a dozen reducing stations, with nice slow-speed rotaries (the slower the better); (c) low-voltage trolley wires and reducing stations every 40 rods; (d) divers other things to be found in the canons.

The requirements of canal haulage are decidedly special. The speed cannot be high, because of the model of the boats and danger of wash on the banks of the canals. For simplicity any towing scheme must include the towing of a considerable chain of boats so that the local loads are rather heavy. Also locks and other sources of delay render it quite common for several tows to bunch together, forming a very

severe local load. The speed, however, is naturally uniform, stops are rather infrequent, and the rate of acceleration is a matter of indifference. It will be noted that these conditions are the very antipodes of those formed in ordinary interurban railroading, and the engineers had the good sense to see the point and to act accordingly. The transmission of power is over a long stretch, 244 miles being the length of the whole canal, and 68 miles that of the section between Cincinnati and Dayton, the major part of which is now in operation. All the necessities of the case indicated the use of high-voltage working conductors, fed by a relatively small number of sub-stations, and feeding in their turn alternating-current motors upon the locomotives. Briefly, the arrangement of the system is as follows: Power for the section now constructed is taken from the lines of the Cincinnati Gas & Electric Company, as a matter of convenience. This power, as 4200-volt, 60-cycle, three-phase current, is received in a motor-generator station, which changes the frequency to 25 and separates the haulage system from the local lighting and power system. Part of the output, at 390 volts, feeds directly the first section of working conductors. The remainder is stepped up to 33,000 volts, and transmitted along the canal bank. At four reducing stations transformers receive the 33,000-volt current and deliver it to the working conductors at 1170 volts. The locomotive receives this current and transforms it to 390 volts for use in the motors. There are, of course, two trolley wires of the grooved No. 0000 description, the track serving as the remaining conductor.

The principal interest of the system centers in the locomotive itself. This is of the compact type designed for mining work, and weighs 55,000 lbs. It has four 33-in. wheels mounted on 6-in. axles with 5-in. journals, and to each axle is geared with a double-speed reduction an 80-hp three-phase induction motor. These two motors are normally operated in tandem. The primary winding of the first motor is connected to the transformer secondaries, its secondary winding to the primary of the second motor, and the armature of this last is closed through a controller and a set of iron-grid resistances. This controller serves for reversal and speed variation when required, although the motors in tandem are designed to give the 3 m. p. h. to which the speed is, at present, limited by statute. In this normal operation the motors give 40 hp each, and a horzontal effort with 25 per cent coefficient of adhesion of 9600 lbs. The locomotives have not only hooks for making fast the towing cable but M. C. B. couplers for the direct haulage of freight cars whenever desirable. As the track is well-laid with 70-lb. rails such haulage is quite feasible. On the whole the system seems to be well worked out, and it ought to be an object lesson of no small value in the use of alternating motors for electric traction. The trolley-wire voltage in this case strikes one as perhaps ultra conservative, but the necessary situation of the line and the large number of bridges and locks to be passed, some in very contracted quarters, rendered extra precautions desirable. We shall be greatly interested to learn the financial results of this proposition. How far can the canal, generally regarded as an obsolete means of transportation, be regenerated by modern methods of traction? No one yet knows from experience, although foreign experiments have given hope of success. But whether canal traction, as such, can continue to hold its own under improved conditions is a matter of less importance than the final success of long-distance electric freight haulage on which the plant here considered will give very valuable information.

Physical Examination of Motormen

The outcome of the controversy between the Interborough Company and the motormen employed on the Manhattan Railway over the order of the management directing the men to submit to a physical examination might have been anticipated by the men. It was certainly expected by the public, and while the company is to be congratulated upon having escaped a strike the patrons of the L road should appreciate their good fortune in having this important transportation service controlled and directed by men of convictions, integrity and moral courage. An examination of the requirements specified must prove convincing to any unprejudiced mind that the tests prescribed were in the interest of the public and the employees as well, and that the company could not demand or accept less and discharge its duty. No question of wages, hours or other details was injected to affect the issue. It was plainly a test of the qualifications of the present employees to continue in their old places. The exacting nature of the service, the high speeds and the headway maintained call for unusual experience and exceptional ability on the part of motormen on L trains; they must be quick, alert, watchful, and in perfect command of all their faculties. A man with a weak heart, impaired vision or defective hearing is not to be trusted with an L train, nor with a trolley car, either, for that matter.

To the layman it must seem strange that the employees should object to such a rational and reasonable demand as that made by the Manhattan management, but the fact, plainly stated, is that many of the men who had long been in the service feared that they would be disqualified. They had not been examined for years, and they shrewdly suspected, no doubt, that the test awaiting them would probably confirm the suspicion that had been haunting them and which they had fought against. It was the old story of the infirmities of advancing age, which the victim persistently refused to recognize. They were all right when they entered the service, and, they argued, they felt as young and fresh as ever. They had deceived others about their failings, especially in the matter of hearing and seeing, and they had tried to deceive themselves, but now they found the old fear coming over them again when summoned for the test. The results of the investigations already made prove the wisdom of the company's claim that periodic examinations should be made of men occupying such positions. Most electric railway companies and steam lines require applicants to submit to a medical examination, but we do not know to what extent the practice of requiring periodic examinations is carried.

It should not be assumed that the examination prescribed is an unusual one; on the contrary, it is not more severe than the requirements on steam lines of prominence. It deals merely with the eyesight, hearing, color sense and general physical condition of the employee—surely not an unreasonable test.

The tendency of modern railway operation is to provide against every possible contingency that might interrupt the service and endanger life; hence the employment of despatching systems, electric signals, derailing switches at grade crossings, quick-acting power brakes, and all the numerous details and accessories that have been worked out for the protection of the traveling public, both on steam and electric lines. But in order to prove effective, reliable and operative, the cooperation of competent engineers, motormen and trainmen is essential; those afflicted with defective sight or hearing, or color blindness cannot be depended upon. It should not be difficult for anyone to appreciate the fact that, because of the dependence placed upon this combination of human and me-

chanical elements, these provisions for safety may become a source of positive danger if men are employed as engineers or motormen who are not entirely competent and physically qualified to pass every test prescribed in this examination. This is particularly true of such service as that furnished by the Manhattan Railway, and it is because of these considerations that the management very properly insists upon its employees submitting to a physical examination which will not only indicate their present condition but enable the proper department to keep track of the men who are liable to fail.

Comparing Notes on Track

We were favored recently with an expression of opinion by a well-known manager, active in the affairs of the American Street Railway Association, who was thoroughly worked up over what he considers the indifference shown in the discussions of that body to the matter of track construction and maintenance. And we are not sure that his indignation was not warranted. He pointed out that the largest investment made in any one department of an electric railway goes into the track, and yet this important factor probably receives the least attention in the proceedings of the electric railway organizations. There is no subject upon which exchange of experience between street railways would represent a greater saving in dollars and cents than in matters relating to track. Defects in rolling stock or power houses and possible improvements in equipment are evident after a much shorter period of use than are needed changes in track construction. The lessons taught by experience in this department are the kind which it takes years of trial to obtain. Every company has probably learned several things about track construction which are not a matter of common knowledge among its neighbors, and if all could benefit by the experience of each one what an improvement there would be in methods of track construction and maintenance.

When the American Railway Mechanical and Electrical Association was first organized it was thought that electric railway track men might be admitted, and that the new organization would cover track work in its papers and discussions, but there appears to be a general understanding among members that it is not to take up track work, and, in fact, some members expressed themselves at the last convention as decidedly opposed to such a move. It is probably just as well that this organization should confine itself to rolling stock and power houses. To broaden its work too much might defeat the ends it has in view. The time is coming, and, in fact, is already here, when there is need for an organization of electric railway track superintendents and engineers, conducted as are the accountants' and master mechanics' organizations. It is not likely that there will ever be a thorough discussion of track matters by the practical men most acquainted with the subject until there is some such organization especially for track men. Experience has demonstrated that master mechanics, who would never think of taking part in discussions in meetings of the American Street Railway Association, where presidents and general managers are principally in evidence, will take a very active and helpful part in the discussions in an organization of their own. The same would be equally true of track superintendents and engineers.

It was thought a short time ago that electric railway track construction was settling down to certain standard forms, and that soon there would be little of interest in the discussion of track matters. Affairs have taken exactly the opposite turn, however. Just now there are a dozen questions which are undecided about almost every detail of electric railway track construction. First, there is the ever-present joint question. Is the cast-welded or the electrically-welded, or some form of bolted joint, best? The practice of the leading roads of the country, as shown in our last souvenir issue, lacks uniformity, so much so in fact that it can still be considered entirely open, although there was a time when it was thought closed. Then there is the tie question, or rather the question whether to use ties at all. The tendency, as we have before pointed out, has been recently in the direction of laying track on concrete foundation without ties; but the first road to adopt this construction in the United States has recently abandoned it. Other roads which have adopted it more recently may find that their confidence in this construction has been misplaced, or time may demonstrate that it is possible, after all, with proper workmanship, to maintain a track on a concrete bed without ties.

Millions of dollars are going into track construction every year, and thousands can be saved by a frank exchange of experiences on these points. The only thing that cannot be brought out in this way is the care and attention to details given to track construction and maintenance by the companies contributing to this exchange of experience. Track laid according to the same specifications by different track engineers and foremen may give widely different results, simply because of the lack of attention to details in one case and strict attention to them in another case. Nevertheless, one of the results of such an exchange of experience would be to call attention to the importance of these details which are often forgotten, so that they might be incorporated in the specifications and rules of track construction, and would be looked after. There are hundreds of details which the uninitiated never think of that occur to the experienced and thoughtful track man and are made use of in his daily work.

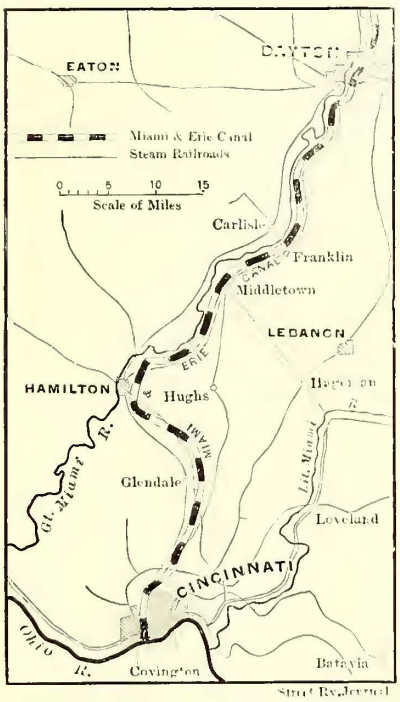
Car Finish

There was a well defined sentiment at the recent Saratoga Convention in favor of painting and varnishing cars in such a way as to produce a somewhat elastic finish, rather than attempt to secure a highly polished surface similar to that given to fine carriages. This is in accordance with common sense, as the ordinary electric railway car does not demand an extremely high finish. The high degree of polish and extremely smooth surface on expensive carriages is secured by means of brittle varnish which chips and cracks easily and is not suited to electric railway service. The idea to be carried out in modern car painting should be first to preserve the wood, and second, to preserve the surface so that it will be presentable in appearance. Very few people give the painting and finish of an electric railway car a close inspection, and it is judged mainly by the general appearance at a distance of several feet. There is not enough difference between an extremely high finish and one less smooth, but more durable, to make the cost of putting on and maintaining the high finish worth while. The Saratoga discussions also brought out the fact that an economical way to maintain the rolling stock finish in good condition is to give the finish a little attention frequently, rather than to wait until both paint and varnish have gone before running a car into the paint shop. In other words, it is an easy matter to apply a coat of varnish frequently enough to keep the car looking well, but if the matter is neglected until both paint and varnish are partially gone, not only does the car look badly but the entire work of painting and varnishing must be gone over from the bottom. It is simply another instance where a "stitch in time saves nine."

ELECTRICAL EQUIPMENT OF THE MIAMI-ERIE CANAL

BY CHARLES W. RICKER

During the last year a strong effort was made to have all the canals belonging to the State of Ohio abandoned, on the ground that the tolls were not enough to pay for their up-keep.



MAP SHOWING PORTION OF MIAMI & ERIE CANAL WHICH HAS BEEN ELECTRICALLY EQUIPPED

A few months later the Legislature of New York voted $101,000,000 to improve the canals of that State, subject to the approval of the electors at the State election Nov. 3. In view of the discussion of the value of canal transportation, caused by this great appropriation, the opening of a new system of canal operation on the Miami & Erie Canal of Ohio is of especial interest.

The Miami & Erie Canal was built by the State, and opened for traffic in 1828. It was built from both ends, and was completed from Cincinnati to Toledo in 1844. In early days it was the principal carrier in Western Ohio, and largely determined the development of that region, the largest towns of which grew up along its course, so that now it passes through eighteen cities having a total population of over 650,000 persons. Some conception of the great though varying importance of this canal may be drawn from the following statement of gross receipts from tolls during the periods indicated:

1828-43.	Total.....	$891,825	Average annual.....	$55,714
1844-60.	Total.....	4,018,440	Average annual.....	236,379

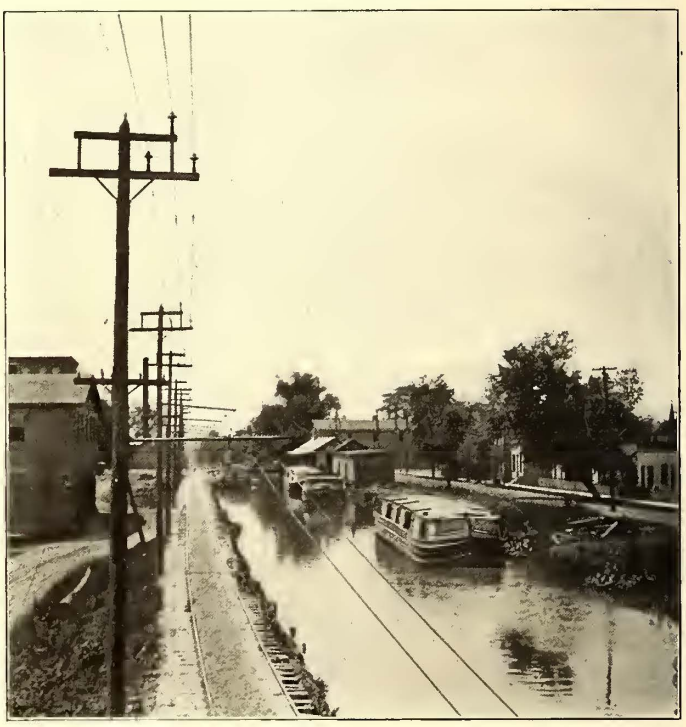
In 1861 all the Ohio canals were leased to a private corporation for a yearly rental of $20,050, the lessee to maintain the canals. This lease was abandoned in 1877, and the canals were returned to the State, but they had been so neglected by the lessee that they had suffered injuries that have never been fully repaired.

In 1879 the tolls of the Miami & Erie Canal amounted to $112,090, and since that time they have steadily decreased, so that in 1900 they were only $61,896.

Along the canal are many and large manufactories, which were located there to secure the benefits of canal transportation or the use of water for power or manufacturing purposes, and which can ship a large amount of freight by the canal if reasonable facilities are provided for handling it. For many years this business has been neglected; no money has been appropriated for canal improvement, and though local canal transportation near Cincinnati has been profitable on a small scale the impression is general that the canal is played out.

In 1900 Thomas N. Foredyce got permission of the Board of Public Works to build a track along the canal, and run on the same an electric locomotive towing several canal boats, to show on a working scale the practicability of such a mode of operation. The trials were made for Mr. Foredyce by the Westinghouse Electric & Manufacturing Company, and were considered successful, so that on March 29, 1901, Mr. Foredyce was given a contract and lease permitting him to occupy and use any and all State lands adjoining the canal, for the purpose of building and operating thereon an electric railway for towing canal boats. This franchise is good for thirty years from the beginning of operation, and requires that the canal shall be equipped from Cincinnati to Dayton within two and one-half years after the date of the grant, and from Dayton to Toledo within four years thereafter. The franchise also provides that the speed of towing shall not exceed 4 miles an hour, foreign boats must be towed for a reasonable charge, and the ordinary operation of the canal must not be interfered with. All construction is made subject to the approval of the Board of Public Works, and in case the franchise lapses or is abandoned the owner may remove all his materials and apparatus from the canal lands.

To carry on this work the Miami & Erie Canal Transportation Company was organized and took over the franchise. The Cleveland Construction Company, of Akron, Ohio, was engaged as engineers, and under its direction active work on



VIEW ALONG CANAL, SHOWING LINE AND TRACK

the Cincinnati-Dayton section, 68 miles long, was begun in July, 1901. This is nearly complete, and is now in operation from Cincinnati to Middletown, about 42 miles.

THE CANAL

From	To	Distance Miles	Width in feet Water line	Width in feet Bottom	Depth Feet
Cincinnati	Dayton	66	40	26	4
Dayton	Junction	114	50	36	5
Junction	Toledo	64	60	46	6
Cincinnati	Toledo	244	..	..	..

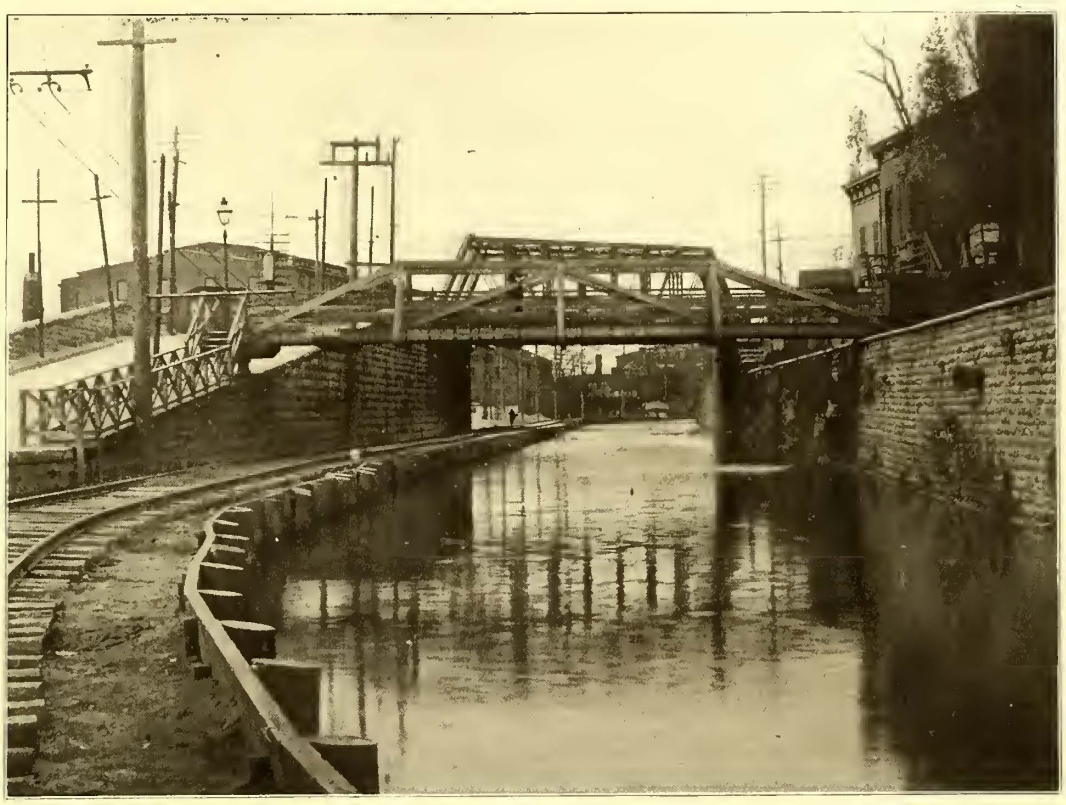
There are ninety-five locks, 90 ft. long and 15 ft. wide, with wood swinging miter gates, operated by hand. There is but one summit level, which is 395 ft. above Lake Erie and 512 ft. above the Ohio River, and is 23 miles long, beginning 100 miles north of Cincinnati.

Three artificial lakes supply the high levels. The Lewiston and Loramie reservoirs, containing 9000 acres of water, feed the summit level, and the Grand reservoir, containing 17,000 acres, empties into the canal about 7 miles north of the summit, at St. Marys. Water is also received at a number of other places from rivers.

The canal once communicated with the Ohio River at Cincinnati, passing through what is now the business part of the city, and descending 120 ft. to river level by ten locks. This

connection was abandoned in 1863, and there is now only an overflow, the water passing through which is used for power by lease from the State.

The foregoing were the original dimensions of the canal and reservoirs, but they have been much impaired by the neglect of the lessees and the State. Recently the State, with the assistance of the transportation company, has cleared out the canal bed and repaired the banks and other works in the Cincinnati-Dayton section, but more work is needed even there.

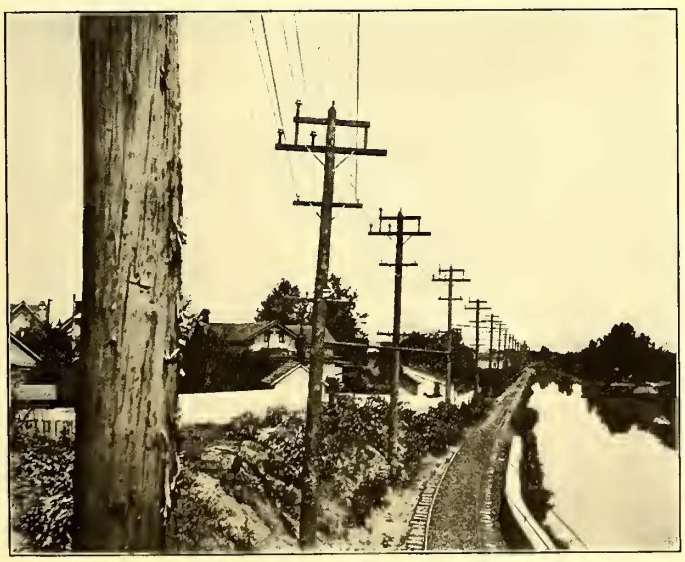


CANAL IN NORTHERN PART OF CINCINNATI, SHOWING SHEET PILING BANK PROTECTION

GENERAL METHOD AND EQUIPMENT

The method of operation adopted by the transportation company consists in towing a number of canal boats in a string by a locotive running on a track built on the tow path. The saving in running cost over animal towage must be effected by the lower cost of mechanical power, lower labor account and higher speed. In the old manner each boat required for twenty-four hours' operation a crew of two steersmen, two drivers and one cook, in all five persons, and five mules, and was towed at an average speed of about 2 m. p. h. With the new method each boat has only two men and the locomotive four men for the same period, while the speed is uniformly 3 m. p. h.

Tows must contain as many boats as possible, but owing to the crooked and irregular channel and frequent locks, it is probably impracticable to operate more than ten in a string. About 200 ft. of line is used between the motor and the first boat and 50 ft. between boats, the boats are 80 ft. long, so with ten boats each "mule" would drag a tail 1500 ft. long. The longest tows used in regular traffic during the writer's connection with the company contained only five boats, and were operated without difficulty.



VIEW ALONG CANAL, SHOWING LINE AND TRACK

The conditions governing the choice of the power distributing system may be stated briefly as follows:

The transmission of power is for long distances in a single line.

The load consists of a small number of heavy train units, which, owing to traffic conditions, may become bunched. The power demand of each unit is steady and continuous instead of intermittent with high maxima, as used with interurban traction lines.

If the whole length of the canal is to be supplied from a moderate number of generating stations, it is evident that the principal transmission must be by alternating current at high tension, with reducing sub-stations at intervals along the line.

Owing to the small number of large units forming the load and their liability to bunch, the sub-stations must be far apart, or some of them will be idle a large part of the time, involving a low all-day efficiency. The average demand per unit is high, involving a high average line loss. All the foregoing considerations made a high trolley voltage desirable.

It is evident that the conditions are favorable to alternating-current motors. With them the trolley voltage may be as high as desired, and static transformers on the locomotives will keep the motor pressure low. The sub-stations need contain no rotary machines and need no attendants, so their original and operating cost are both diminished and the all-day efficiency much improved.

The running conditions readily allow the use of induction motors. Stops are infrequent, and as a string of boats must be set in motion slowly and gradually, to prevent breaking the tow lines or damage to the boats, the lower starting torque, as compared with series motors, is not a serious objection. The higher trolley voltage possible assures good regulation and good starting torque without excessive expense for overhead copper.

Economy of speed control is not important, as the acceleration periods are brief compared with the runs which usually last several hours at uniform speeds.

The Cleveland Construction Company, as engineers, recommended an alternating-current system throughout, and a con-

tract was made with the Westinghouse Electric & Manufacturing Company to furnish and install the same. The locomotives are equipped with three-phase induction motors, and energy is supplied to them through a three-conductor line, consisting of two overhead trolley wires and the track.

This is the first application of alternating-current motors to traction purposes in the United States, and has developed problems new to American railway practice, and with all pos-

CANAL BOAT AND CINCINNATI FREIGHT HOUSE

sible care new and unforeseen conditions may be expected to arise during the early operation of the plant which may, and indeed have already, require unexpected modifications in the apparatus and methods used, which were kept as near those used in standard railway practice as possible.

CONSTRUCTION

A construction department was organized, which, directed by the engineers, purchased and installed all material and apparatus for the complete equipment, except that the Westinghouse Company installed the electrical apparatus furnished under its contract.

Track and pole line material was distributed by canal boats drawn by mules. The track and overhead construction were carried on together, and as soon as a section of line was completed it was supplied with 550 volts continuous current from neighboring railway lines, and construction trains were used to distribute ballast and filling and transport laborers.

The construction locomotives were flat cars equipped with two Westinghouse 35-hp motors, one trolley and one controller, and weighted with rails. The trolley poles were of hard pipe, 2½ ins. in diameter, iron shod at both ends and set in No. 1 United States bases. The trolley wire varied from 6 ft. to 22 ft. above the rails, and though the contact was rather light at the high places the service was reliable. The whole equipment for 66 miles consisted of four small motors like the illustration, two eight-wheel flat cars with the same equipment, six 6-yd. capacity side-dump cars and thirty-four 10-ton capacity center dump cars.

The construction motors were also used to tow canal boats for transporting both construction material and in the regular freight traffic before the alternating-current equipment was ready, a barrel-water rheostat being used to cut the speed down to 4 m. p. h.

The overhead line gang contained from 100 men to 150 men, and was quartered in a floating hotel of three canal boats, with sleeping and mess fittings and a store room boat. The bonding gang also lived in houseboat, which followed their work.

ROADBED AND TRACK

The track is built along the tow path, with the finished surface 2 ft. above water level. Between Cincinnati and Hamilton the canal is mostly along hill sides with the tow path on the outer bank, which is about 16 ft. thick at water line, with slopes of 1¾ to 1, so sub-grade is 12 ft. wide. The center line of the track is about 6 ft. from the water's edge.

The ties are white oak, from Southern Ohio and Kentucky, inspected at point of shipment, and are 6 ins. x 8 ins. x 8 ft. The rails are 70-lb. A. S. C. E. section with standard four-bolt angle-bars.

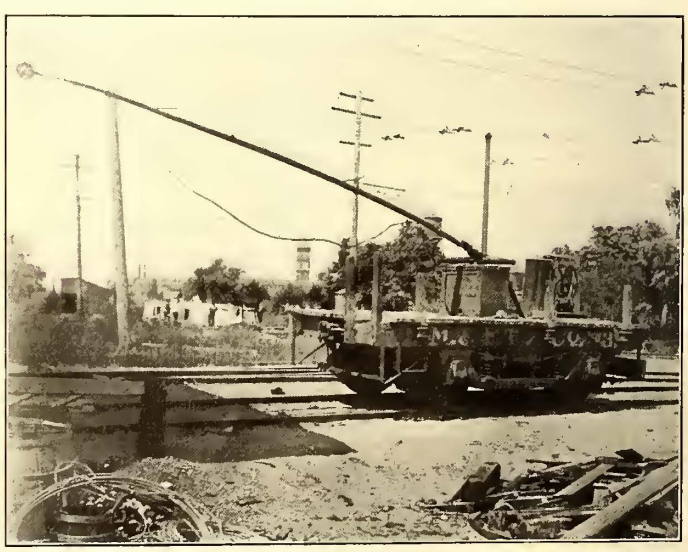
Gravel of excellent quality is found in several places along the line, and a minimum thickness of 4 ins. was tamped under the ties. The entire track was then filled, so that when the gravel is compacted its upper surface shall form a smooth and level roadway, as required by the franchise, which forbids the transportation company to interfere with the ordinary operation of the canal.

To protect the roadbed from wash and support the slope in narrow places, about 12,000 ft. of pile and plank shore protection was built. Oak piles were driven 3 ft. apart and 8 ft. deep and cut 2 ft. above water, and 3-in. oak planks spiked to the land side of the same, and the space behind filled and tamped with earth.

Along the main line the maximum curvature is 25 degs., though in Cincinnati there are sharp curves which require a very short wheel base for the locomotives. The only grades are at locks and depressions under low bridges, and the steepest slope is 2 per cent.

In the Cincinnati-Dayton section 134 bridges cross the canal and tow path. The clear height over the tow path was seldom over 9 ft., and sometimes as small as 6 ft., as they were built only high enough to allow unloaded boats to float under.

Railroad bridges and street bridges within city limits could not be raised, so that track under them had to be depressed to or even below water level to allow the locomotives to pass. At such places concrete walls have been built outside the track and the hollows drained to remove surface and seepage water. These walls are 8 ft. high, 1½ ft. thick at the top and 3½ ft. at the bottom, and extend from 2 ft. above water level to 2 ft. below the canal bottom. The track has been depressed in this



CONSTRUCTION MOTOR

manner under fourteen bridges, using about 1 mile of concrete wall. The concrete was mixed of a coarse gravel from pits along the canal and Portland cement, rammed in water-tight wood moulds without draining the canal. The greatest depression is 4 ft. below water level.

The clearance between bridges and rails is at least 10 ft., save under the first seven in Cincinnati, which are in important business streets, where only 6½ ft. could be had. The trolley wires are 6 ins. below the bridges.

The track and retaining walls are built not less than 2 ft.

above water level, because it is found that a string of boats towed at 3 miles to 4 miles an hour raises the water more than 12 ins. several hundred feet ahead.

At three places the towing track crosses the canal and draw-bridges have been installed, which must be opened immediately after the motor has passed to allow the boats to float through, so that quickness of movement is important. At Twelfth Street, Cincinnati, an ordinary swing bridge is used, at present hand-operated. At Carthage and Flocton there is not room for a central pier, and an unusual type was selected. One end of the bridge is pivoted at the bank and the other rests upon a circular track on the bottom of the canal.

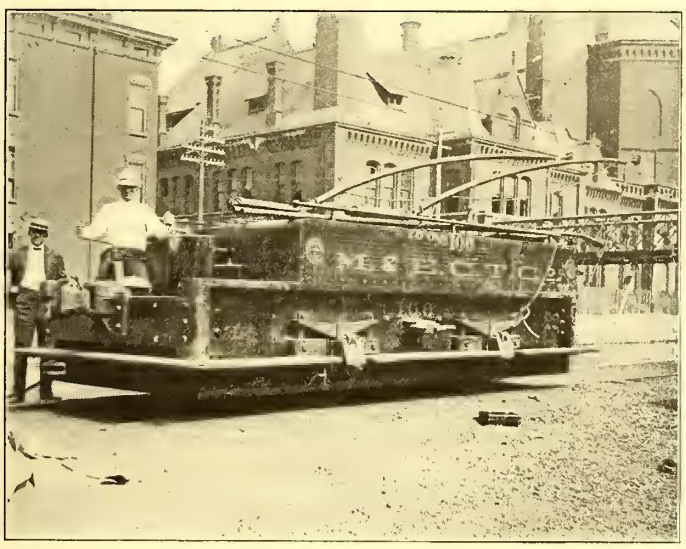
The bridges are to be swung by an induction motor, which, through a train of gears, operates a pinion engaging in a rack at the bottom of the canal beside the submerged rail. A water jet from a rotary pump, driven by the same motor, keeps the track and rack clear of mud. The span is 60 ft. obliquely across the canal. All draw bridges are deck-plate girders, designed by Cooper's specification for a live load of 3500 lbs. per foot.

During construction an ingenious temporary swing bridge was used in such places. One end of the movable span was pivoted to a timber bent near one bank, and the other end when closed was stepped upon a similar bent at the opposite side, and when open was floated on a scow. The draw was 16 ft. long, composed of two 12-in. x 14-in. oak timbers, framed together to support the rails directly.

At convenient points along the canal double-ended sidings with spring split switches are placed to allow locomotives and construction trains to pass.

BONDING

The track rails are connected at each joint with one No. 0000 copper bond, 10 ins. long, with terminals 7/8 ins. in diameter and flexible shanks. Most of the bonds are the American Steel & Wire Company's United States bond, having a shank made

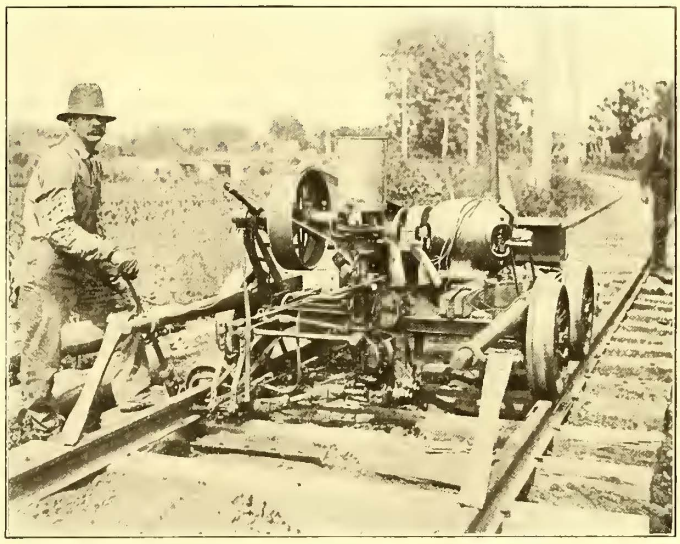


SWITCHING LOCOMOTIVE

up of copper ribbons hot-welded to the terminals, but later in the work the one-piece all-wire bonds, having cable shanks and drop-forged terminals, made by the Ohio Brass Company, were used.

The bonds are placed under the joint plates with the shanks embracing the two bolts nearest the joint and equally divided above and below the bolts, with especial care that they are not pinched by the plates. The bond holes are drilled through the rail web at the same height as the bolt holes and the terminals expanded into them with the usual screw press. The presses have a compression screw of tool steel, 1 3/8 ins. in diameter, with a wedge-shaped thread. At first wrenches, 40 ins. long, were used to operate them, but the compression of bond terminals was not enough to make complete contact between the copper and steel, and this length was increased to 66 ins., which resulted in considerable compressor breakage but much better bonding.

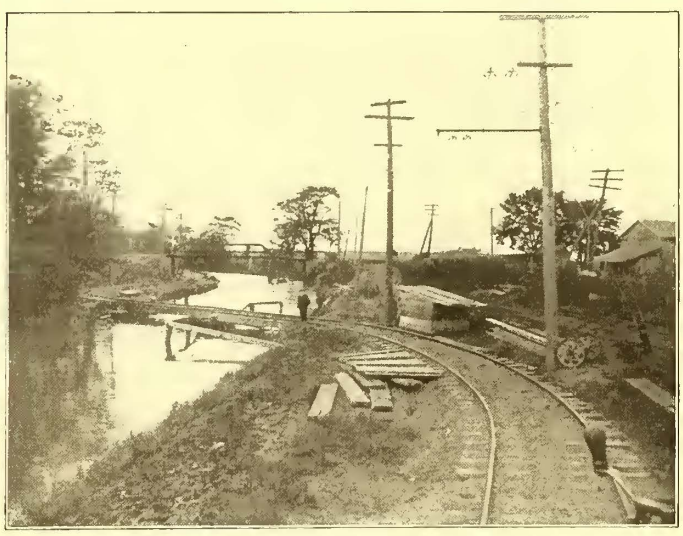
In all cases where the bond holes are made with a portable drill after the rails are in the track, the holes are slightly larger at the side from which they are drilled, usually the inside, and



TRACK-DRILLING MACHINE

as it is harder to expand the head part of the bond terminal than the tip, there is frequently a ring of imperfect contact at the inner edge of the rail if the bond is placed inside the track, as it usually is. In this work better results were obtained by placing the bonds on the outer sides of the rails.

The track rails are cross-connected every 1000 ft. with one No. 0000 solid copper bond, 6 ft. long, with Crown terminals.



TIMBER DRAW-BRIDGE USED IN CONSTRUCTION

Only the outer rails of turnouts are bonded, and switches and frogs are jumped with special long bonds made by brazing joint-bond terminals to lengths of annealed trolley wire. All cross and jumper bonds are buried as completely as possible to protect them from too enthusiastic collectors of copper and from injury by the mules using the tow path, and all joints in the same are brazed to prevent corrosion.

The bond holes were drilled by a Gosling portable power track drill. This is mounted on a four-wheel truck, and is light enough so that the ordinary bonding crew can easily lift it from the track to allow trains to pass. It drills two holes at once, spaced by a jig. At first a gasolene motor was used, but as the track and line were in temporary operation for construction trains it was found advantageous to replace it with an

electric motor, taking power from the trolley. A 3-hp, type C. E., General Electric Company motor was used, and drilled two holes 7/8 in. in diameter through the rail web, 9-16 in. thick, in one minute, with an average use of 3 amps. and a maximum of 4 amps. at 550 volts, the drills making about 100 r. p. m.

With this machine a crew of ten men and a foreman could unbolt, drill, bond and rebolt an average of 170 joints per day without interfering with the construction trains, and as many as 200 joints per day were done. When driven by a gasolene motor the engine, after the manner of its kind, required much more attention than an electric motor, and frequently delayed the work. The gasolene motor was also heavier than the electric. In cases where bonding is done before the overhead work is ready for use the gasolene motor has been found very valuable.

POWER DISTRIBUTION

As the transportation company did not want to build a steam power plant for the first section of the canal, a contract was made with the Cincinnati Gas & Electric Company for the supply of power from its station, situated on the canal near its terminus.

Three-phase, 60-cycle current at 4200 volts is delivered at the switchboard and transmitted over the transportation company's line to Station No. 1 at Spring Grove, 5 miles distant, and just within the northerly city limit. This is a motor-driven generating station and supplies the first trolley section extending from the Cincinnati terminus northerly 7½ miles, at 390 volts, three-phase, 25 cycles. Static transformers raise the pressure for transmission along the canal to the other stations, where it is reduced to 1170 volts for the three-phase trolley circuit.

There are to be four reducing stations, about 12 miles apart, the most northerly about 6 miles south of Dayton. Station No. 2, at Rialto, is complete, and is supplying temporarily the trolley from 4 miles south of Lockland to Middletown, about 33 miles in all, and 23 miles in one direction. The remaining stations are expected to be ready during the current year.

THE STATION BUILDINGS

The stations are fireproof buildings of uniform construction, of one story and basement with flat roofs, and are 60 ft. x 25 ft. inside. The main story is 18 ft. high and the basement 7 ft. high. Station No. 1 also contains another room, 33 ft. x 30 ft., built against one end of the standard station building and of similar construction, in which is placed the motor-generator set.

In all the buildings the foundations are of gravel concrete, moulded in place, and the walls are brick, carried 2 ft. above the roof and finished with tile coping. The main floors consist of flat arches, 12 ft. square, between steel 12-in. I-beams, and are of gravel concrete reinforced with No. 10 gage-expanded metal. The roofs are of the same construction, 4 ins. thick, and covered with prepared felt and asphalt roofing. The basement floors are concrete and are drained by tile sewers, which also receive the water from a tile extending around the outside of the foundation footings.

To secure partial insulation from ground a covering floor of narrow white oak is laid 2 ins. above the concrete floors of the transformer rooms with openings for ventilating the space below it.

In all stations the static transformers are set upon the concrete main floor, which was stiff enough to carry them without appreciable deflection after hardening five weeks. The motor-generator set in No. 1 is set on a gravel concrete pier extending from the level of the building footings to the main floor, and a similar foundation is provided for another unit to be added later.

STATION EQUIPMENTS

At Station No. 1 the 4200-volt, three-phase transmission line runs to two 150-kw, 60-cycle, oil-cooled transformers, the sec-

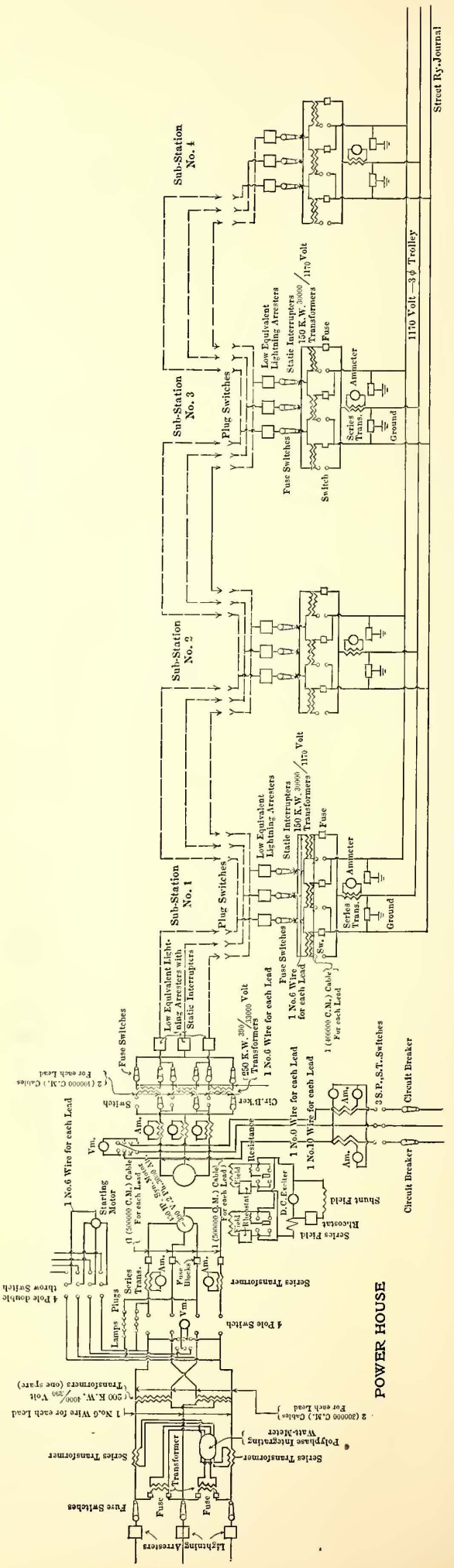
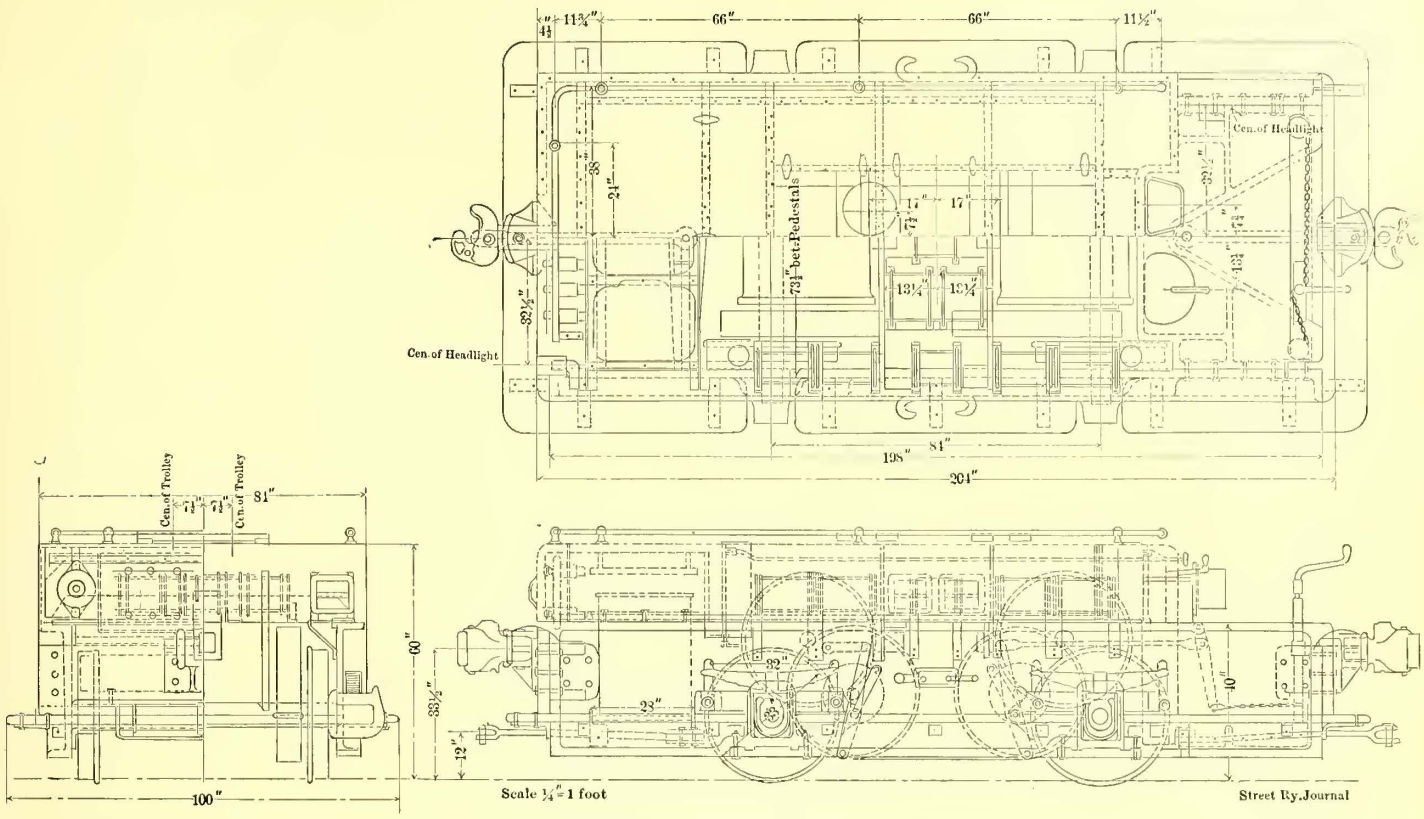


DIAGRAM OF CINCINNATI, MIAMI & ERIE CANAL ELECTRIC SYSTEM



PLAN AND SECTIONS OF SWITCHING LOCOMOTIVE

ondaries of which are connected by the Scott method 1or two phases. There is another like transformer set and wired so it can be connected in place of either of the others in case of trouble. All are protected by low-equivalent lightning arresters, with reactance coils and fuse switch circuit breakers in the primary leads.

These transformers supply a 450-hp, 390-volt, quarter-phase synchronous motor, which drives through a flexible shaft coupling a 300-kw, 390-volt, three-phase, twenty-five cycle compound-wound generator.

The starting motor for the set is a 40-hp, two-phase induction motor, connected to the pulley overhanging the outer bearing of the large motor by an endless leather belt, 10 ins. wide by 5-16 ins. thick, arranged so it can be thrown off after starting. This is a liberal starting motor and holds the larger unit steadily at speed so synchronizing is very easy. The

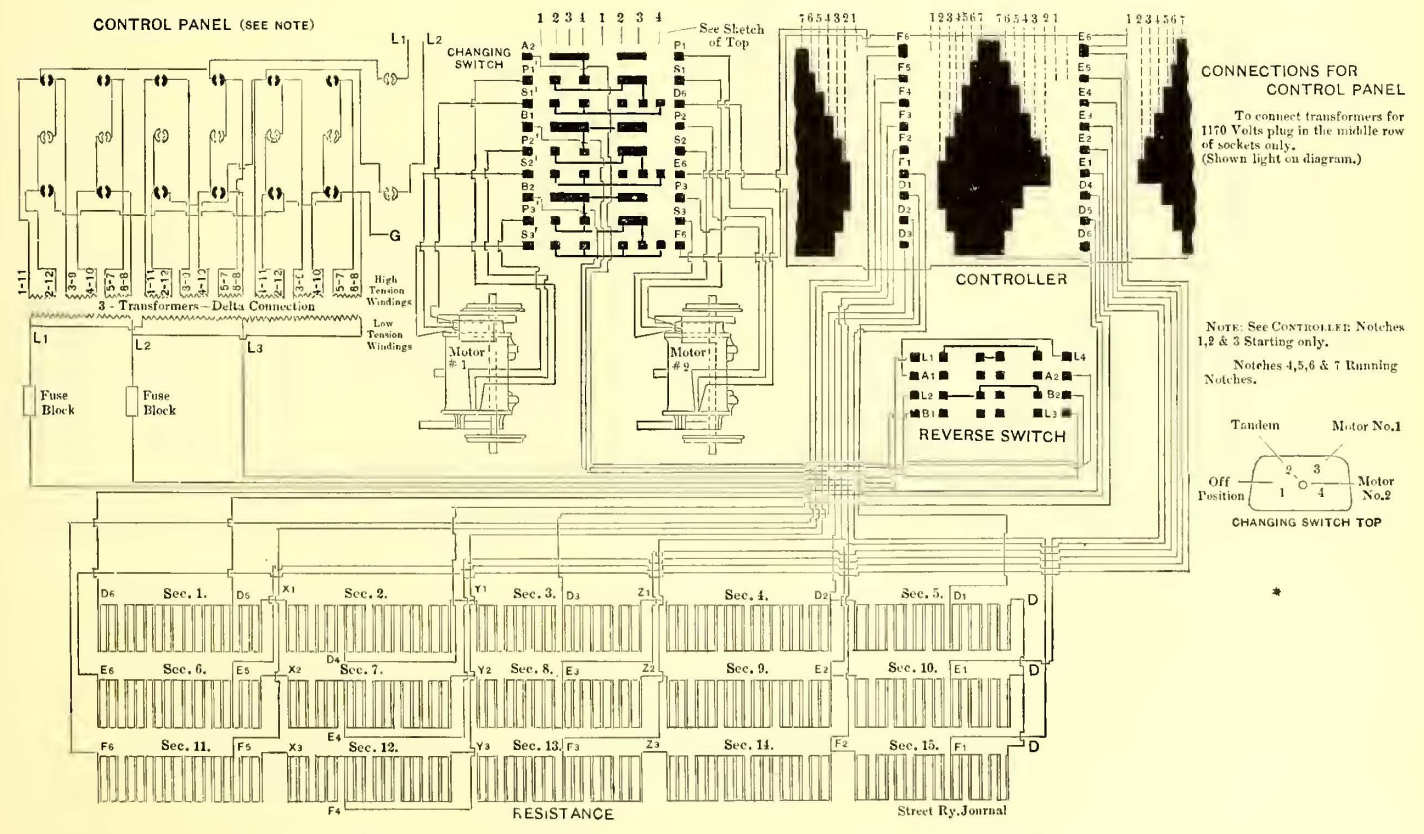
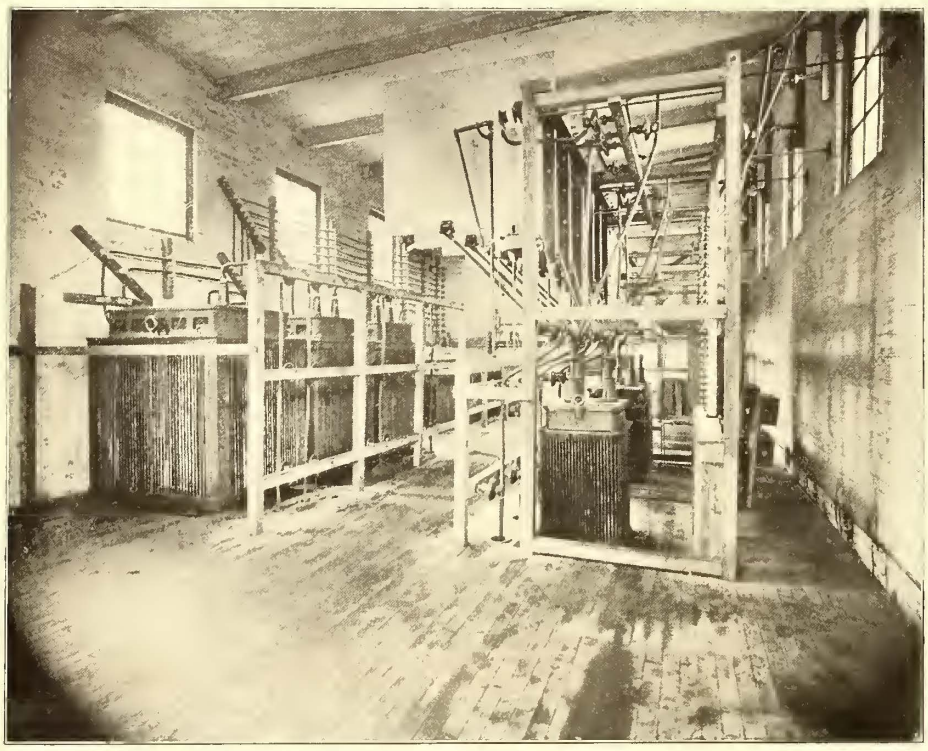


DIAGRAM OF CONNECTIONS OF ALTERNATING-CURRENT LOCOMOTIVE

exciter is a 15-kw, 125-volt continuous-current generator, belted to the large unit. The starting motor and exciter do not show in the illustration, as they could not be got within the field of the camera; the nearer machine is the 450-hp synchronous motor.

The switchboard for this apparatus consists of two marble



INTERIOR OF SUB-STATION NO. 1, SHOWING RAISING TRANSFORMERS AND HIGH-TENSION SWITCHBOARD

panels, shown in the illustration. The generator panel contains a three-phase time limit circuit breaker, three ammeters and a voltmeter on a swinging bracket with a plug switch to connect same to any phase. The motor panel contains two ammeters and a voltmeter with a plug switch, and the usual lamp synchronizing device which indicates similarity with the lamps dark. Under the motor panel is mounted a polyphase recording wattmeter connected to current and pressure transformers in the 4200-volt, three-phase mains, so as to measure the entire input of the station.

The three-phase generator supplies the Cincinnati trolley section through the temporary feed panel shown beside the generator board, and which is to be replaced by a marble panel now building.

The principal output of the generator is carried to three 250-kw oil-cooled transformers, which raise it to 33,000 volts for transmission along the line. In both primary and secondary circuits the transformers are connected in delta and both leads of each coil are carried to the switchboards, so that any single transformer may be cut out there and the line operated by the remaining two. In each of the 33,000 volts leads is connected a fuse switch circuit breaker, six in all, separated by marble barriers, and beyond the circuit breakers the delta is formed. Each outgoing line then passes through a static interrupter, beyond which is connected a low equivalent lightning arrester.

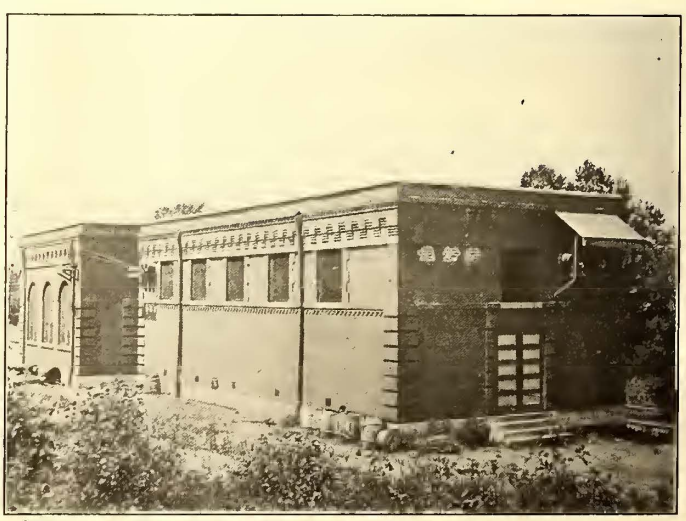
The 33,000-volt conductors inside the building are of No. 4 copper with 16-32-in. rubber insulation and a protecting braid and are supported not less than 12 ins. apart on porcelain insulators like those used on the high-tension line. Where the wires pass through the floor they are supported at the centers of 6-in. vitrified tiles.

The 33,000-volt aluminum transmission cables enter the building at one end and are supported in a vertical row against the side wall 18 ins. from each other and from the building, and pass over and along the aisle behind the circuit breaker rack, where the insulated wires are connected to them by brass "T" clamps.

Where the aluminum cables leave the building they pass through the centers of 12-in. vitrified tiles set in the wall and projecting both sides, the inner ends of which are closed by discs of ¼-in. plate glass strung upon the wires, the downward inclination of which makes the plates rest against the ends of the tiles. Outside the building are steel brackets with inclined roof and gutter to protect the lines from drip and icicles. The roof is tinned and made smooth as possible to reduce the accumulation of snow.

Two ground plates of No. 12 sheet copper, each 4 ft. square, are buried one at each end of the station, and are brazed to each end of a No. 0000 copper conductor, which runs into the transformer room and along one side of the same just above the floor in plain view. Each static interrupter, lightning arrester and transformer case is connected by a No. 6 copper wire running under the wooden floor to the ground wire, so that both ends of each connection are in plain view. A similar arrangement is used in all the other stations.

Station No. 2, at Rialto, may be described as a type, as all the other reducing sub-stations are to be exactly like it. The building is of the standard size and construction described before. The equipment consists of three 150-kw, 25-cycle, 33,000-volt to 1170-volt, self-cooling oil transformers, connected in delta in both primary and secondary. The incoming transmission line is connected to a set of three plug switches, from which bus-wires run across the top of the circuit breaker rack, shown in the illustration, to another set of similar plug switches connected to the outgoing transmission line. Between these

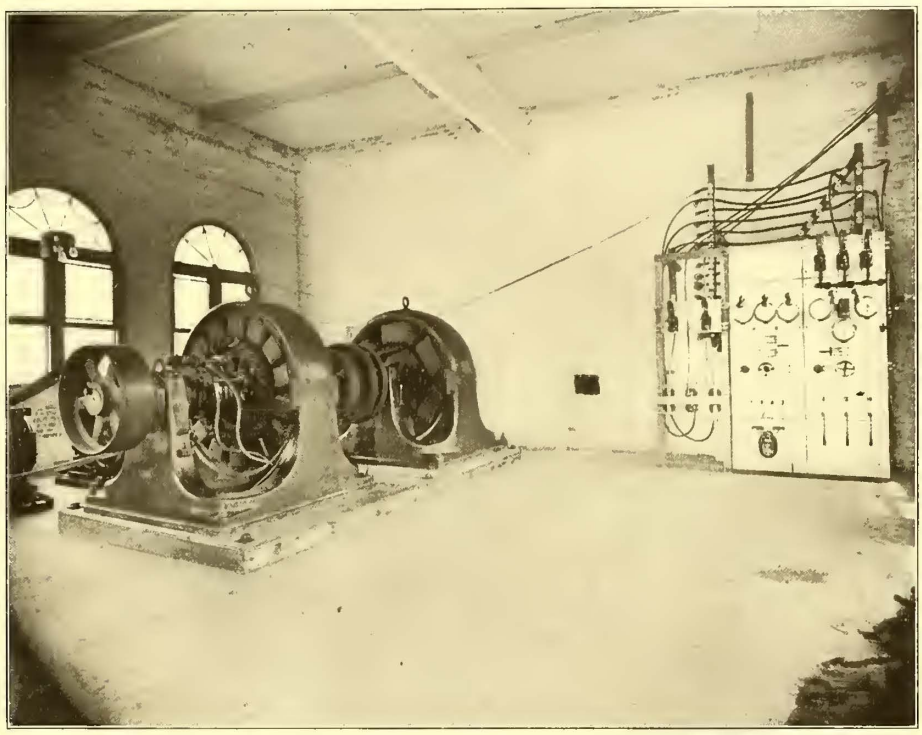


EXTERIOR OF SUB-STATION NO. 1

two sets of plug switches the primary taps of the transformers are taken off and pass through three fuse switch-type circuit breakers, and then through static interrupters to the delta formed by the transformer primaries. Low-equivalent, type-lightning arresters are attached to these taps on the line side of the circuit breakers. The sub-station contains one marble panel for the three-phase feeder to the trolley circuit, having 1 ammeter and voltmeter, Wurts lightning arrester and expul-

sion-type fuses. Each sub-station is placed at the middle of the trolley section which it is to supply. At the end of each trolley section is a section insulator, across which is connected a jumper containing a double-pole automatic circuit breaker, which is normally closed, making the trolley continuous.

The object of this arrangement of lines is to secure a continuous transmission line and trolley wire, from which any section may be cut out for repairs without disabling the system. By opening the circuit breakers at both ends of a trolley section and opening the sub-switch that section is completely disconnected, but this does not interfere with operation of any other section. In case of trouble in any section of the transmission line the plug switches at both ends may be opened, leaving the section dead, while the sub-station at the further end is fed through the trolley circuit from the next sub-station south, and in turn supplies the transmission line beyond it, so that the operation of the system will not be entirely suspended.

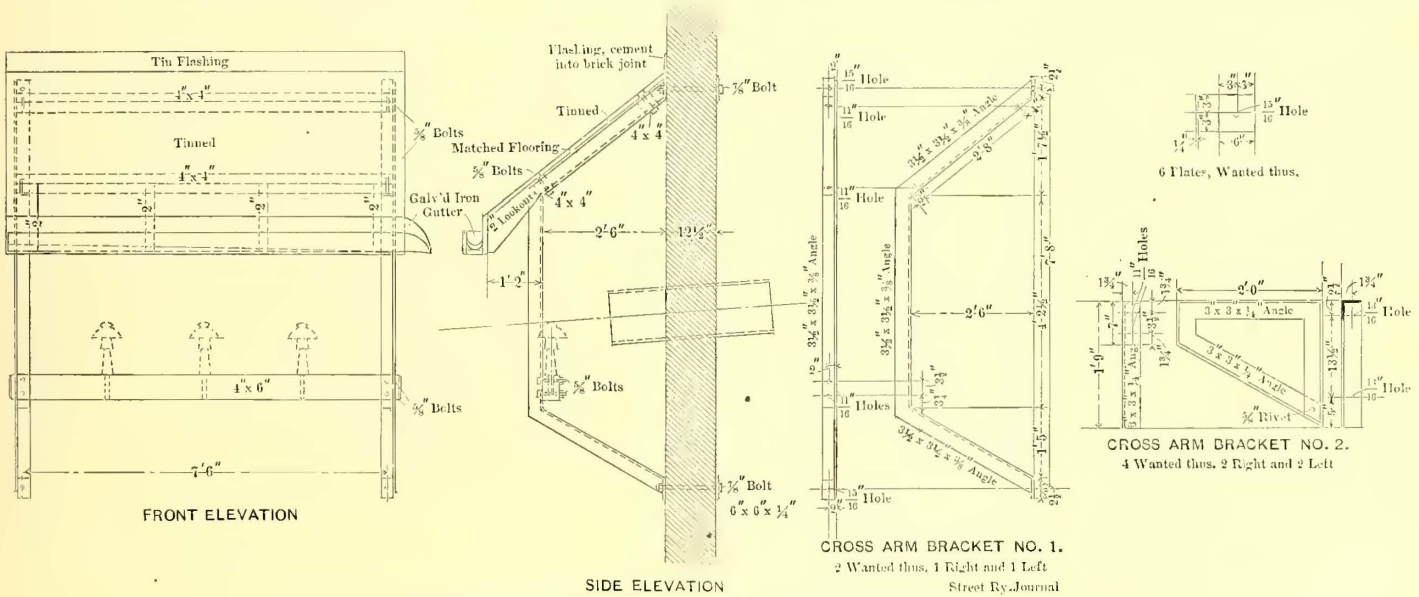


INTERIOR OF STATION NO. 1, SHOWING MOTOR-GENERATOR SET

TRANSMISSION LINES

The 33,000-volt transmission line from the transportation company's station No. 1 consists of three aluminum cables laid up of seven strands of No. 6 wire, which, with a guaranteed conductivity of 62 per cent of copper, is equivalent to one No. 0 B. & S. copper conductor. These are arranged in the form of a triangle at the top of the poles, as shown in the illustration, with one wire above and two below, and spaced 30 ins. apart. Several different joints were tried but the best success was had with an ordinary laced cable splice similar to that commonly used with standard copper conductors, and this was adopted. The cables are transposed spirally one-third of one turn every 2 miles.

The pole line consists of Southern cedar poles, 40 ft. long, lower one 4½ ins. x 5½ ins. x 8 ft., and the upper one 4 ins. x 5 ins. x 5 ft. 6 ins., and are bolted to the pole 22 ins. apart with one ⅝-in. bolt each. The lower arm is further supported by two braces of ⅜-in. x 1½-in. iron 28 ins. long, bent to fit against the sides of the pole instead of the face. Between the upper and lower arms are struts of yellow pine, 2½ ins. x 2½ ins. x 22 ins., which support the ends of the upper arm. The insulator pins are oak creasoted under high pressure, about 8 lbs. per cubic foot, so that they are completely impregnated. Those in the lower arm are 14 ins. long, while the one in the upper arm is 16 ins. long. The shanks are 2 ins. in diameter. The insulators are of brown porcelain, Victor type, without



BRACKETS FOR HOLDING HIGH-TENSION WIRES, SPRING GROVE STATION

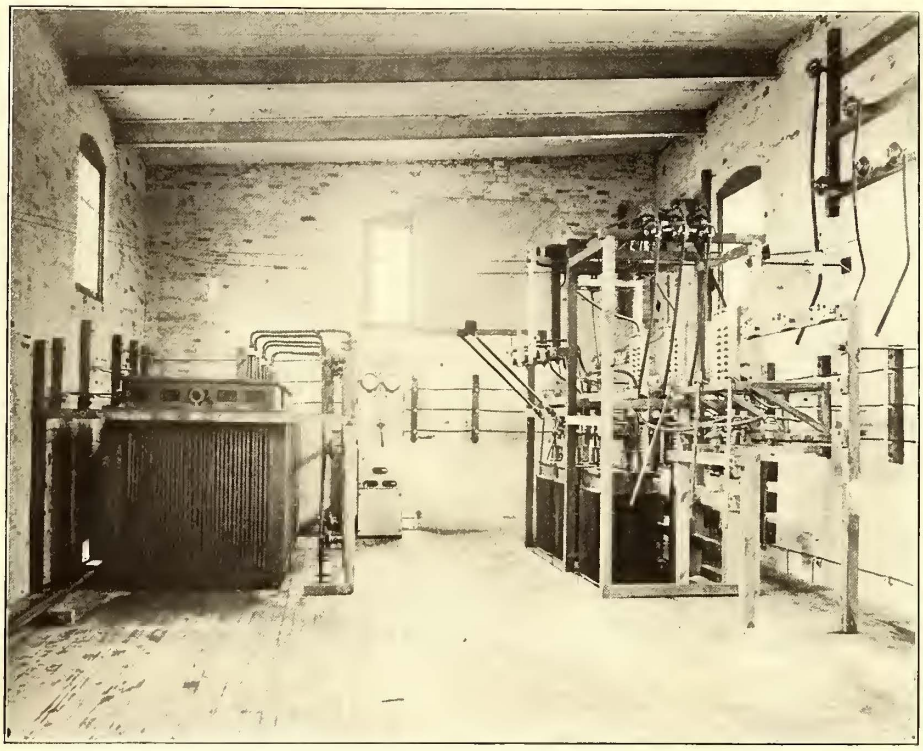
with 7-in. tops, set about 90 ft. apart on tangents, but owing to the large number of curves average 72 per mile. The poles are set 6 ft. deep in the ground, but not concreted except in special cases where the soil is loose or soft. The distance between the center line of track and the poles is 7 ft.

The transmission line cross-arms are of yellow pine, the gutters, made by the F. M. Locke Company. The outer petticoat 7 ins. in diameter. The lower wires are supported halfway between the upper and lower arms.

Along the tops of the poles is carried a ground wire of No. 6 galvanized B. B. iron, supported upon glass insulators, divided into sections one-third mile long and grounded every tenth pole.

The ground connection is not run down the transmission pole but runs horizontally from the ground wire to anther pole, usually across the canal, down which it is carried and soldered to an iron pipe driven 6 ft. into the earth.

About 10 ft. under the lower transmission arm two telephone



INTERIOR OF TYPICAL REDUCING STATION (STATION NO. 2)

circuits are carried on a 4¼-in. x 3¼-in. x 5-ft. cross-arm. They are strung with No. 8 B. W. G. galvanized B. B. iron wire, supported on double petticoat glass insulators and each circuit is transposed on every fifth pole.

The 4200-volt transmission line from the generating station to the transportation company's station No. 1 is strung of the same cable as the 33,000-volt line, and the construction is similar in all respects except that the pins are ⅝-in. steel with wooden tops, and the insulators are Locke No. 17 glass.

It was originally intended to equip the 33,000-volt line with the Locke No. 17 glass insulators and steel pins, but it was later decided to use the Victor porcelain insulators mentioned above, as they were considered more reliable, and the F. M. Locke Company filled the order.

All bolts, washers and cross-arm braces used in the line are galvanized. The cross-arm bolts are fitted with a plate washer 3 ins. square at each end, and the brace bolts in the arms with one similar washer.

OVERHEAD WORK

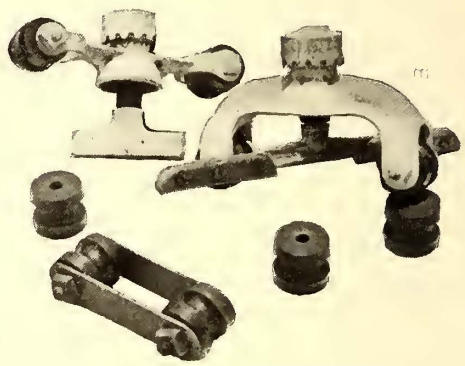
The overhead trolley circuit consists of two No. 0000 General Electric groove hard-drawn copper wires, supported 15 ins. apart by special double insulated hangers from flexible brackets. At curves and over crossings switches span-wire construction is substituted for the brackets.

The trolley wire hangers were designed and made for this work by the Ohio Brass Company, and consist, as shown, of that company's standard type D. W., with the addition of an insulator compound spool in a clevis, attached to each side of the hanger body, to which spool the span wires are attached. These double insulated hangers have given very satisfactory service except in some long spans and pull-overs, in which the tension exceeded 1000 lbs., where the spools crushed and had to be replaced. This is an excessive pressure for the span strand upon moulded insulating compound, and to make the insulation secure it will probably be necessary to reinforce the spools with metal brushings and thimbles, to distribute the stresses where it is necessary for them to exceed 1000 lbs. For straight line work the type D. W. galvanized ear is used, and on curves a brass clamp ear about 12 ins. long.

The brackets are of 2-in. extra heavy structural steel tubing 9 ft. long, supported by overhead brace rods.

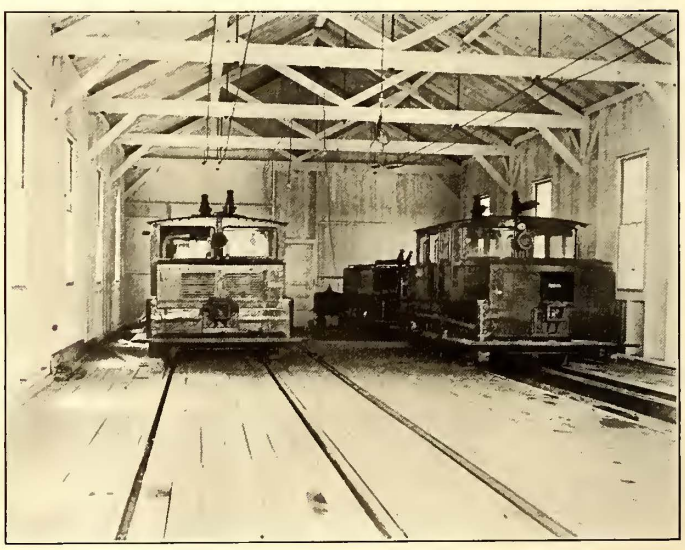
Garton-Daniels lightning arresters are connected to each trolley wire every one-half mile, and grounded with No. 6 galvanized iron pipes driven 6 ft. in the ground. Copper wires were first used for the ground connections, but were stolen so fast that they could not be depended upon.

The overhead trolley wires are divided into sections, each being fed from a sub-station at or near its middle point.



SPECIAL TROLLEY-WIRE FITTINGS

The trolley is interrupted by section insulators of ordinary pattern, with a break 27 ins. long. Around each section insulator is a jumper, into which is connected a special automatic circuit breaker, made by the Cutter Electric Company, of Philadelphia, for this work, and arranged so that excessive current



LOCOMOTIVE REPAIR SHOP

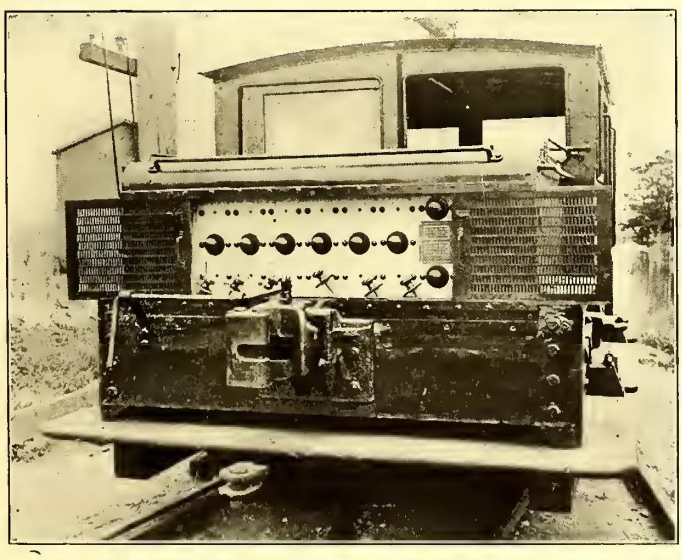
in either wire will open both breakers so that any trolley section which becomes grounded or crosses will automatically cut itself out of the circuit.

No auxiliary feeders are used if parallel with the trolley wire of the 1170-volt section, but in the 390-volt section in Cincinnati an aluminum cable, equivalent to No. 0000 copper, is in multiple with each trolley wire 2 miles north and 4 miles south of Station No. 1.

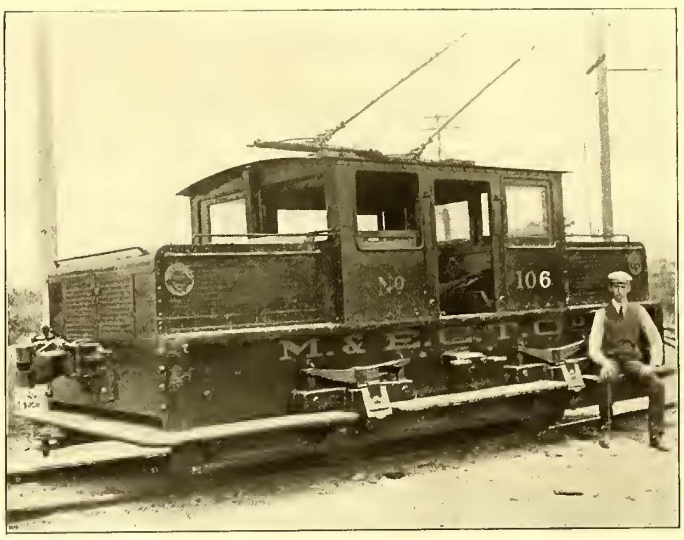
Ultimately the 390-volt section will be of the same length as the other section—12 miles—and extend from Lockland to the southern terminus, and at Lockland will be placed a set of equalizing transformers connected across the 1170-volt, three-phase trolley circuit on one side, and the 390-volt circuit on the other side, so that either trolley circuit may feed the other. This is designed particularly to hold up the voltage at the extreme end of the 390-volt section. These transformers are not yet in place, and it was found impracticable to operate at the lower voltage to Lockland, which is 6 miles north of substation No. 1, so the section point was moved 4 miles further south, making the Station No. 2 at 1170 volts feed 10 miles through the trolley circuit, which it did successfully. It is rather interesting to note that the load upon the three phases is almost exactly equal with any number of locomotives in operation, and that the drop between the two overhead conductors is equal to that between either of the same and the track, from which it would appear that the conductivity of the return circuit is considerably less than for continuous currents.

ELECTRIC LOCOMOTIVES

The original equipment consists of seven four-wheeled locomotives of mining type, each weighing about 55,000 lbs. Each locomotive is equipped with two 80-hp induction motors, delta connected, of a normal speed of 720 r. p. m., rated on a temperature rise of 75 degs. centigrade above the surrounding atmosphere for ten hours' run at full load. These are connected to the axles through double reduction gearing, and when operating in tandem propel the locomotive at about 3 m. p. h., which is the towing speed selected. Either motor alone will propel the locomotive at double this speed, but under the State law boats cannot be towed at the higher speeds. Each locomotive contains three 25-kw self-cooling oil transformers, which reduce the trolley voltage from 1170 volts or 390 volts to 200 volts for the motors. The motor changing switch, similar in pattern to an ordinary railway controller, serves to connect the two motors in tandem, or connect either one to the line and cut out the other or both. When connected in tandem the stator of the first motor is connected to the secondary circuit of the locomotive transformers, its rotor to the stator of the second motor, while the rotor of the second motor is closed upon a ventilated rheostat built of iron grids. A controller, similar in form to the changing switch, serves to vary the resistance of the rheostat in circuit and to operate the reversing switches, so that the movement of the controller handle in one direction operates the locomotive ahead and in the other direction reverses it at the middle position of the handle. At one end of the locomotive is a plug switchboard, by which the primary connections of the locomotive transformers are changed to suit the trolley voltage when passing between the high-tension and low-tension sections. To facilitate this change the high-tension and low-tension trolley wires are run side by side for about 100 ft., and all four trolley wires are dead-ended, so the locomotive must be stopped and the trolleys changed from one pair of wires to the other before it can proceed, at which time the switchboard connections are changed. Having to dismount to change the trolley poles the driver is not likely to forget the switchboard.



END OF LOCOMOTIVE, SHOWING PRIMARY SWITCHBOARD



STANDARD LOCOMOTIVE

The locomotives were built by the Baldwin Works; the electrical equipment for the same were forwarded by the Westinghouse Company to Philadelphia and installed in the Baldwin Works.

The locomotive side frames consist of very heavy cast girders of channel section, framed across at the ends with similar castings. The axles are 6 ins. in diameter with 5-in. journals, and the wheels are 33 ins. in diameter, of standard railroad pattern, with 1¼-in. flanges and 4-in. tread.

At the extreme forward end of each locomotive is the plug switchboard, behind that the transformers, then one motor, then the cab, with the controllers, then the second motor and behind that the rheostat, which fills up the rest of the space.

The locomotives are 14 ft. long, 8 ft. 4 ins. wide, and have a wheel base of 7 ft.

Owing to the large number of low bridges, which it was impracticable to raise, the extreme height of the standard locomotives was limited to 8 ft. 6 ins., and the extreme height of the switching locomotive, to be used at the southerly end of the line in Cincinnati, was made only 5 ft. 6 ins. In this last, to save head room, the cab was omitted, and a cockpit provided for the motorman at the rear end, as in common practice with mining locomotives.

The height of the trolley wires above the rail varies from 6 ft. under some bridges in Cincinnati to 22 ft. over railroad crossings, and is ordinarily 18 ft. Under the bridges north of the first half-mile in Cincinnati the minimum height of the trolley wire is 9 ft.

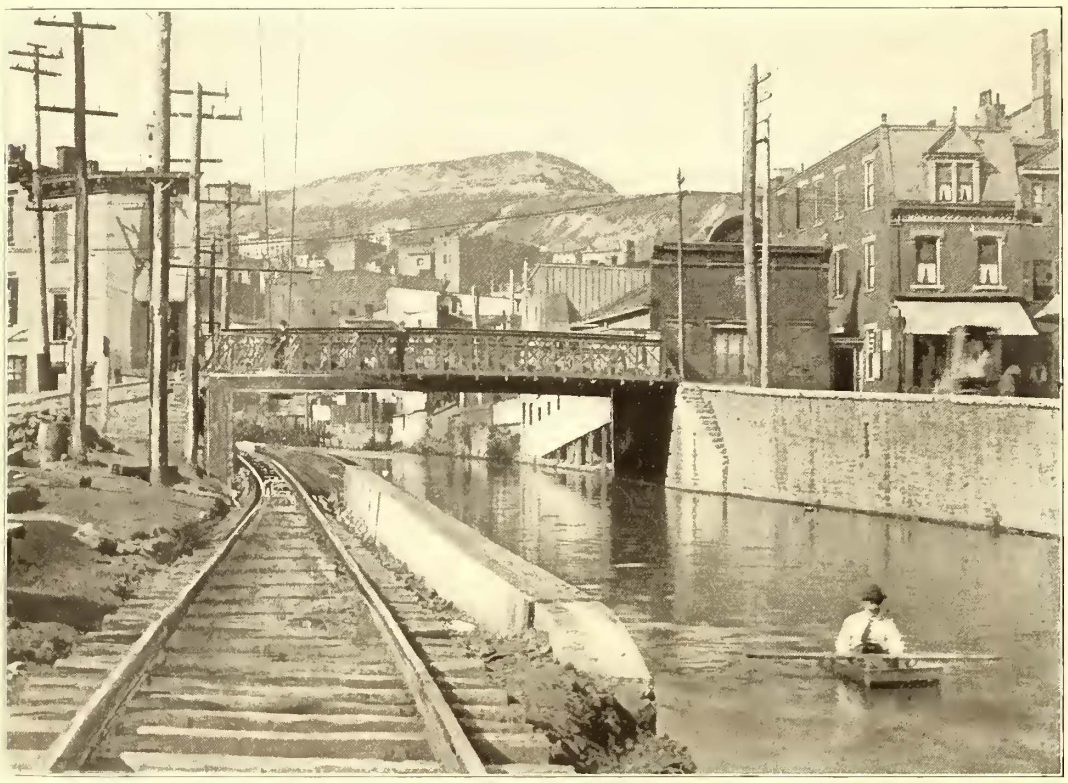
Each locomotive is provided with a double hook at the middle of each side for the attachment of the towing rope. In addition thereto there are two standard M. C. B. couplers, which may be used to pull ordinary railroad freight cars. As it is proposed to do a through business, in the course of which freight must be transferred from cars to boats, and vice versa, it is convenient to be able to handle cars with these locomotives.

The locomotives are guaranteed, when operating on level track with clean dry rails, to exert the following horizontal effort, based on an efficiency of 95 per cent for each pair of

gears, and a tractive resistance for the locomotives of 20 lbs. per ton and the coefficients of adhesion as stated:

Co-efficient of adhesion. Per cent.	Horizontal effort. lbs.
25	9,600
20	7,600
16	6,350

Starting and running continuously at 3 m. p. h., with the motors connected in tandem and developing 40 hp each. The motors when operated in tandem are guaranteed to have practically the same efficiency as direct-current series motors operating in series, and when running singly at full speed of 6 m. p. h., full load, at 80-hp per motor, are guaranteed to have as high an efficiency as direct-current series-wound motors at full load.



TREATMENT OF CANAL TRACK UNDER LOW BRIDGES, SHOWING CONCRETE RETAINING WALL

The unusually high voltage largely increased the difficulty of insulating the trolley bases. As the locomotive cabs and housings are of sheet iron and completely grounded the insulation of the bases from each other and from ground must be perfect, and the supports strong while the head room is very limited. When received the trolley stands were secured to hard wood strips, supported upon other strips crosswise, bolted to the cab roof, trusting for insulation to the long surface over which leakage must take place. The first hard rain grounded both trolleys and disabled the locomotive for the time. To remedy this saturated wood blocks smaller than the upper board were placed between it and the lower strips, so that the upper projected over the blocks all around, and an apron of rubber packing was tacked around the edges of the upper boards to form a drip, so that its under side and the supporting blocks were kept dry. The small carriage bolts which passed through the three thicknesses of wood were insulated from the cab roof by countersinking the heads in the lower strips, filling the holes with melted shellac and placing sheet mica and sheet rubber packing between the same and the iron roof. This raised the trolley stand only 7/8 in. and was effective.

In each trolley rope, about 2 ft. below the wheel, is placed an ironclad bell insulator, similar to those used for hanging arc lamps. This insulation is good, but the ironclad bell weighs 2 lbs., which is a serious load at the end of the trolley pole, and it is proposed to have similar bells made of hard wood boiled in paraffine oil, which will be quite as effective and much lighter and cheaper.

The first three cab locomotives have No. 8 United States trolley stands with steel poles 18 ft. long. The other three, shipped later, have No. 1 United States stands, so that the poles may be reversed without walking them around in a horizontal plane, as must be done with the No. 8, for in some places the track embankment is so narrow and steep that there is not a fair path outside the running boards of the locomotives. The ordinary springs sent with the No. 1 stands proved too weak for the long poles and great range required, and had to be replaced with springs of 5/8-in. diameter steel rod. When swinging the poles around in the dark the trolley man would sometimes carry them around one at a time, especially if the bank were narrow and he had to use one hand to steady himself. On several occasions while doing this a trolley pole was allowed to touch the telephone wires, which promptly put the switchboard out of business.

On the switching locomotive Larry No. 2 stands were tried to save head room, but were not able to hold up the long poles, so the United States No. 8 stands, originally sent with this machine, were replaced. Wood poles were substituted for the steel poles in the switching motor, because in passing under the low bridges they lie very close to the cockpit, and one rainy day a motorman allowed his hat to touch one of the steel poles, causing him much discomfort, but fortunately no serious injury. The use of wood poles also simplifies the problem of insulating the trolley stands from the locomotive frame.

The writer is strongly in favor of wood trolley poles for locomotives where the trolley voltage is high enough to be dangerous to life, as electric locomotives usually have iron housings which are grounded, and a man climbing over them can easily come in contact with the long horizontal springs used with the ordinary types of trolley stands, especially if the springs happen to project before or behind the cab roof.

Another and more serious danger of high-tension trolley circuits using a track return is referred to in the editorial pages of this journal in the issue of Aug. 22, 1903. In case the locomotive becomes insulated from the track by a film of sand or dry snow over the rail the whole frame is raised to trolley voltage, and as the iron parts are exposed it is dangerous to touch. This was the cause of one most distressing accident within the experience of the writer.

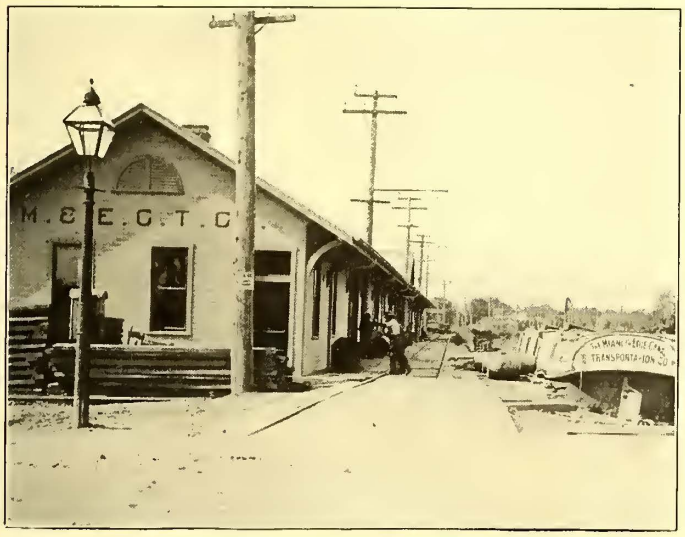
TELEPHONES

Two telephone circuits extend the whole length of the line and terminate in a switchboard in the Cincinnati building, into which are also connected telephones in the various offices in that building.

One of the two lines is used for despatching, and telephones connected to this are placed at frequent intervals along the line in large wood boxes on the poles. In the connection to each telephone and inside the box is a double knife switch, placed

so that the door of the box will knock it open when the same is shut, so that all these telephones are disconnected when not in actual use, which protects them from lightning and heavy current crosses and avoids overloading the line. Locomotive drivers report to the despatcher at all such pole telephones. Each locomotive has also a portable telephone with a hook pole, which can be attached to the line anywhere in case of trouble. The other telephone circuit is used by the freight offices and for the general business of the company.

At places about 6 miles apart both lines are looped to telephones with switches on both sides of each telephone, so that



FREIGHT HOUSE AT HAMILTON

the lines may be opened in either direction and trouble located between two test stations.

BOATS

The standard boat is 80½ ft. long exclusive of rudder, 13½ ft. wide and 9 ft. high, measured over all. Most of them are decked, leaving a clear height of 7 ft. 8 ins. in the hold. There are some open boats for coal, gravel, empty barrels and other coarse and bulky freight.

Loaded to a draft of 3 ft. such boats can carry about 65 tons, but in the present condition of the canal bed it is seldom practicable to load deeper than 30 ins., at which they carry about 50 tons of freight.

The transportation company has now about twenty serviceable boats, acquired with a canal packet company which was purchased, and which also included a dry-dock and boat yard at Lockland, 12 miles north of Cincinnati, in which the company now builds and repairs boats. There are now three boats on the stocks, and the yard is able to turn out about two boats per month. The present fleet and yard capacity are altogether too small for the business offered, even at the beginning.

DEFECTIVE WIRING FOR RAILWAY BUILDINGS

A source of constant complaint among insurance inspectors is the carelessness displayed in the wiring of car houses and shops, and even in power plants, where the importance of complying with rules should be appreciated fully. Generally speaking, the original wiring plant is all right, or, at least, it complies closely with the requirements of the code, but in the structures mentioned there is a constant demand for temporary work in supplying light and power, and sometimes important changes are made from the original plans without sufficient consideration. It is in work of this kind that the chief trouble arises, and because of this tendency to resort to makeshifts that inspectors are required to be ever vigilant. An examination of the notebook of one of these inspectors, who has been engaged very largely on railway properties, disclosed a number of common defects, most of which might be said to be of little importance themselves yet sufficient to cause trouble, and because of the frequency of the reports it would seem that those in charge of the properties did not realize the danger to which they were exposing the structure and its contents. Following is a list of defects noted in incandescent and arc wiring and attachments, incandescent lamps, arc lamps, motors and resistance and heaters:

INCANDESCENT WIRING AND ATTACHMENTS

1. Insulation and supports of wires entering building, not standard.
2. No bushings at entrance, through floors and partitions.
3. No entrance fuse.
4. No entrance switches.
5. Circuits not fused.
6. Bare fuses.
7. Bare fuses over combustibles.
8. Bare wire resting on woodwork.
9. Wire on woodwork throughout.
10. Wiring in moulding.
11. Not protected against mechanical injury.
12. Concealed in places.
13. Carrying capacity too small.
14. Smaller than No. 14 used.
15. Wires too close together.
16. Twisted pair used for light circuits.
17. Flexible cord used throughout.
18. Cluster lighting used.
19. Wires in danger of contact with other wires.
20. Wires exposed to moisture.
21. Switches broken and unapproved.
22. Fused rosettes not approved.
23. Insulators for wire supports not approved.
24. Pit wiring not in conduit.
25. Joints not approved. Not taped in places.
26. Connections to trolley in building not approved.
27. Wires in contact with trolley not approved.
28. In contact with iron-work, piping, etc., not approved.
29. Unguarded incandescent lamps in contact with woodwork and combustible materials.
30. Unapproved lamp sockets.
31. Wiring could touch floor in case of break.
32. Wires stapled or strapped to woodwork.
33. Arc wiring smaller than No. 12.
34. No fuses for arc circuits.

INCANDESCENT LAMPS

1. Sockets not weather-proof.
2. Lamps in pits, storerooms and other points in contact with combustible material, without wire guard to protect same.

ARC LAMPS

1. Without outer globe.
2. Without any globes.
3. Single globes without wire netting.
4. Not properly fused.
5. In position to be constantly struck by trolley poles.

MOTORS

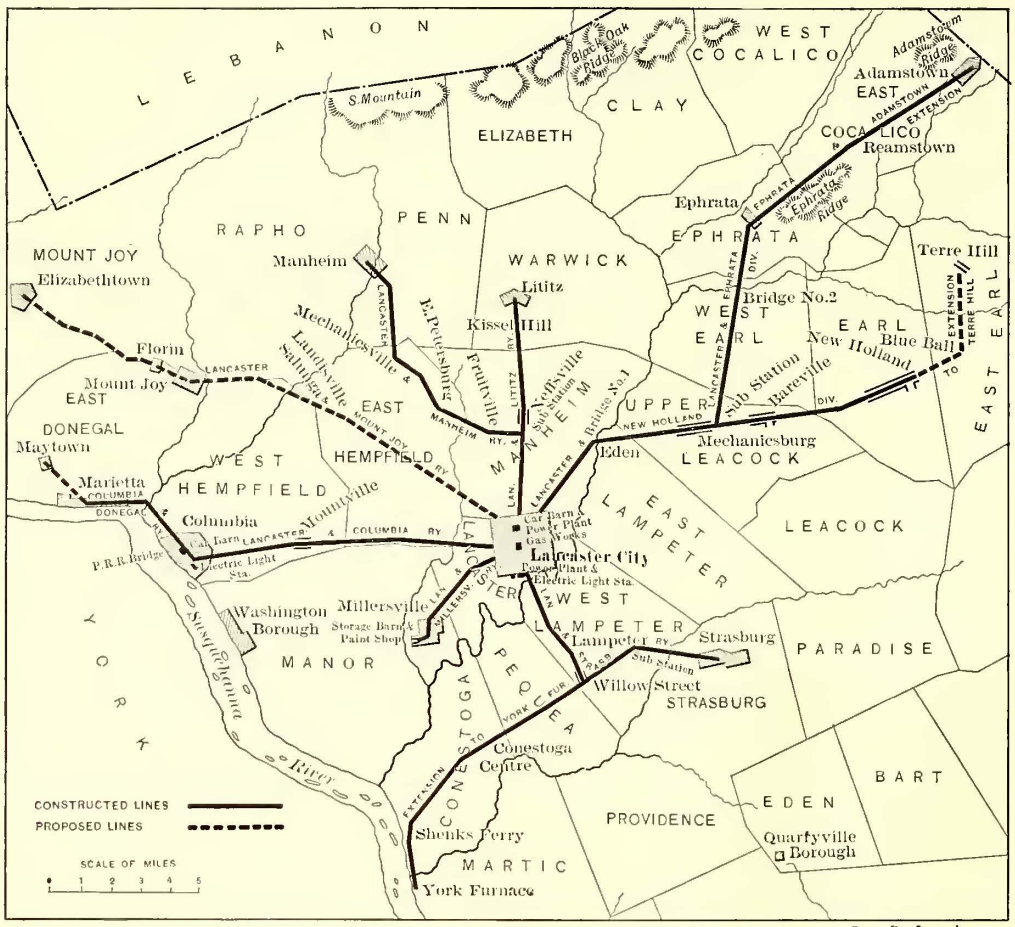
1. Dirty and, in instances, covered with oil.
2. In pits in woodworkers, surrounded by shavings.
3. Wiring for same on floor unprotected and in wood mouldings.
4. Canopy switches unapproved.
5. Open fuses unapproved.
6. No drip-pans provided.
7. Under-load switches not provided.
8. Several instances of no fuses or circuit breakers.

RESISTANCE AND HEATERS

1. Water resistance not approved.
2. Regular cast-iron grid resistance resting on combustible floor—covered in instances with combustible materials.
3. Wiring to resistance resting on floor and otherwise unprotected.
4. Wire spirals on insulators on wood frame not approved resistance.
5. Resistance mounted in merry-go-rounds and the like should be enclosed in fireproof box.
6. Heaters made of spirals, on wood frame, not approved.
7. Heaters mounted on wood surface and in proximity to combustibles, unapproved.

THE CONESTOGA TRACTION SYSTEM

The city of Lancaster, Pa., and the surrounding country within the boundaries of Lancaster County enjoy excellent transportation facilities through the establishment of the electric railway system operated by the Conestoga Traction Company. This section of the country was almost entirely without transportation facilities prior to the construction of the electric lines, and, consequently, a great change has been wrought in the last few years. Indeed, much of the prosperity of this region may be rightly attributed to the advantages afforded by the establishment of this comprehensive system of electric railways.



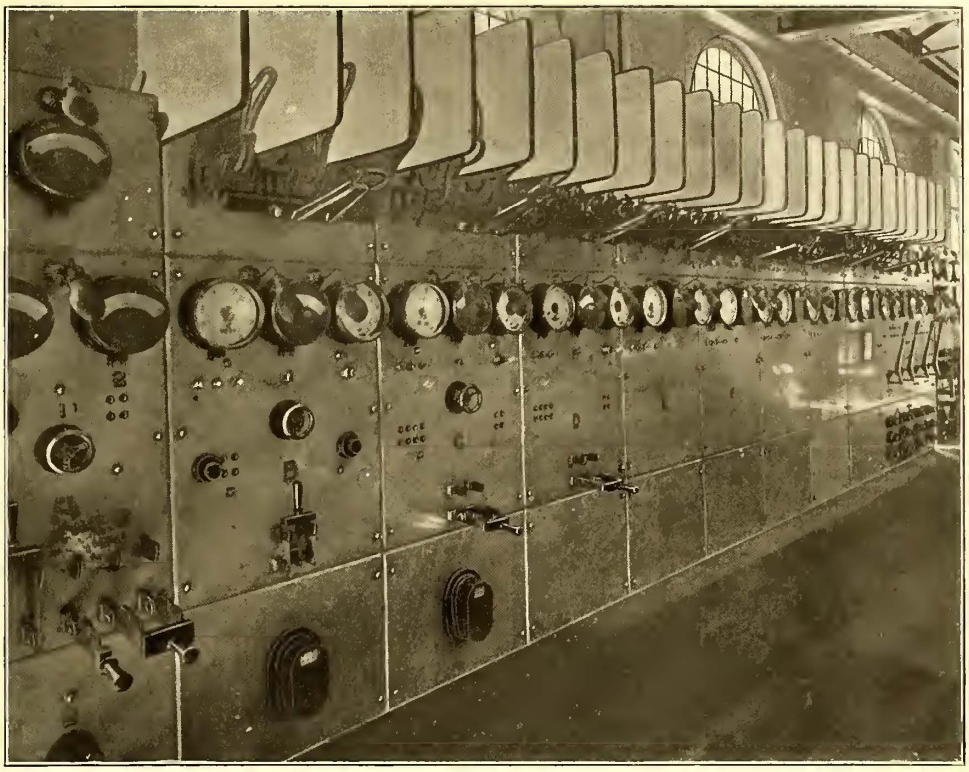
MAP OF CONESTOGA TRACTION LINES

The city of Lancaster is the center of the system, the lines radiating for a distance of 20 miles in all directions, with numerous branches, forming a network covering the entire county. Some of the points reached are of considerable local interest and importance, Lititz, for instance, being the headquarters for the Moravian settlement, and containing a fine church edifice and seminary of that denomination. Lititz Springs have more than a local reputation, because of the curative powers of the waters. This resort is in a beautiful park of about 7 acres, and is visited by large numbers of people of that section. Ephrata is the headquarters for the Seventh Day Baptists of Lancaster and the surrounding counties, and has several fine buildings owned by that sect. The town is located along the foot of the Ephrata Hills, 15½ miles by trolley from Lancaster, and is reached through a very picturesque country. It is also famous as a health resort, and has a beautiful park and picnic grounds. The State Normal School, located at Millersville, has 1000 pupils. Manheim, which was settled by Baron von Stigel, is another important point. Here the Feast of Roses is celebrated each year, and is an event of considerable importance throughout that region.

The traction company is particularly fortunate in having several very attractive parks, picnic grounds and pleasure resorts along its lines in the immediate vicinity of Lancaster. Rocky Spring is probably the best known of these. It is situated on Conestoga Creek, and enjoys one of the most beautiful locations in the State. It comprises about 45 acres, and has a theater with a seating capacity of 2000 persons, a dancing pavilion, a large merry-go-round and several other attractions and buildings such as are usually found in resorts of this character. The park is not owned by the railway company, but is in the hands of friendly interests, and an arrangement has been made for operating harmoniously. Chickies Park is another beautiful spot, and contains 90 acres of woodland, situated on a bluff 300 ft. above the Susquehanna River, and overlooking the famous Donegal Valley. This park is reached from all points along the lines of the Conestoga Traction Company, and during the summer season cars are run

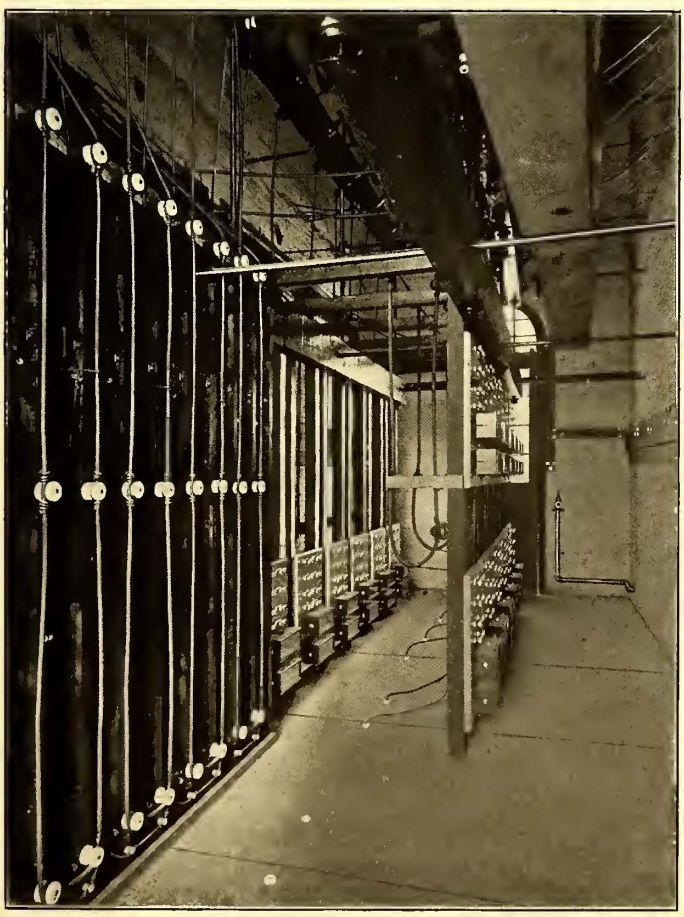
TRANSFORMER HOUSE

to it on a half-hour schedule. Lancaster City itself has a population of about 45,000, and the county, according to the census report of 1900, contains 159,241. Last year the company carried 5,500,000 passengers, and also did considerable light freight and express business. This is a very prosperous community, and Lancaster County claims to be the wealthiest agricultural section of the United States. The freight business consists principally in handling agricultural products, cigars, tobacco and milk. The company for some time has operated a freight car between Lancaster and Columbia, making regular schedule trips. Small packages are also carried on combination express and passenger cars.



MAIN SWITCHBOARD AT ENGLESIDE POWER HOUSE

At the present time all of the light and power interests as well as the railway lines in Lancaster County are controlled by the Lancaster County Railway & Light Company, which is a holding corporation chartered under the laws of New Jersey. Through its ownership of the securities of the Conestoga Traction Company, Lancaster Gas Light & Fuel Company, Edison Electric Illuminating Company and the Columbia Electric Light & Power Company, this corporation controls the electric railways and electric lighting of Lancaster County and the only gas company in Lancaster City, thus virtually securing a monopoly of the lighting, power and transportation service of the entire community in the district served. A brief resume of the operations in this territory and the successive steps which finally culminated in the formation of the present system and its development, will be of particular interest at this time, in view of the recent changes in the control and personnel of the management.



LIGHTNING ARRESTERS

The Edison Electric Illuminating Company has been furnishing electric power and light in the city of Lancaster since 1889, and now has a contract for lighting the streets as well as a very large commercial patronage. It has also acquired, and now utilizes, the 400-kw distribution plant of the Lancaster Electric Light, Heat & Power Company, which was formed as an independent company. The Columbia Electric Light & Power Company occupies a similar position in the borough of Columbia to that of the Edison Company in Lancaster, furnishing all the current for commercial service and also having a contract for lighting the streets of the borough, as it is the only electric light company of that place. The Lancaster Gas Light & Fuel Company furnishes all of the illuminating and fuel gas used in the city of Lancaster.

The Conestoga Traction Company was organized Dec. 12, 1899, and it now controls, through ownership of securities and by lease, the following electric railways in Lancaster County:

Lancaster City Street Railway, into which the Lancaster & Millersville Railway, the West End Street Railway, and the East End Street Railway were merged, 17.12 miles of track.

Lancaster & Columbia Railway, 9.16 miles.

Lancaster & Lititz Electric Railway, 10.10 miles.

Lancaster, Mechanicsburg & New Holland Railway, 23 miles.

Columbia & Donegal Railway, 5.67 miles.

Columbia & Ironville Street Passenger Railway, 3.59 miles.

Lancaster, Willow Street & Strausburg Railway, 11 miles.

Lancaster, Petersburg & Manheim Railway, 8 miles.

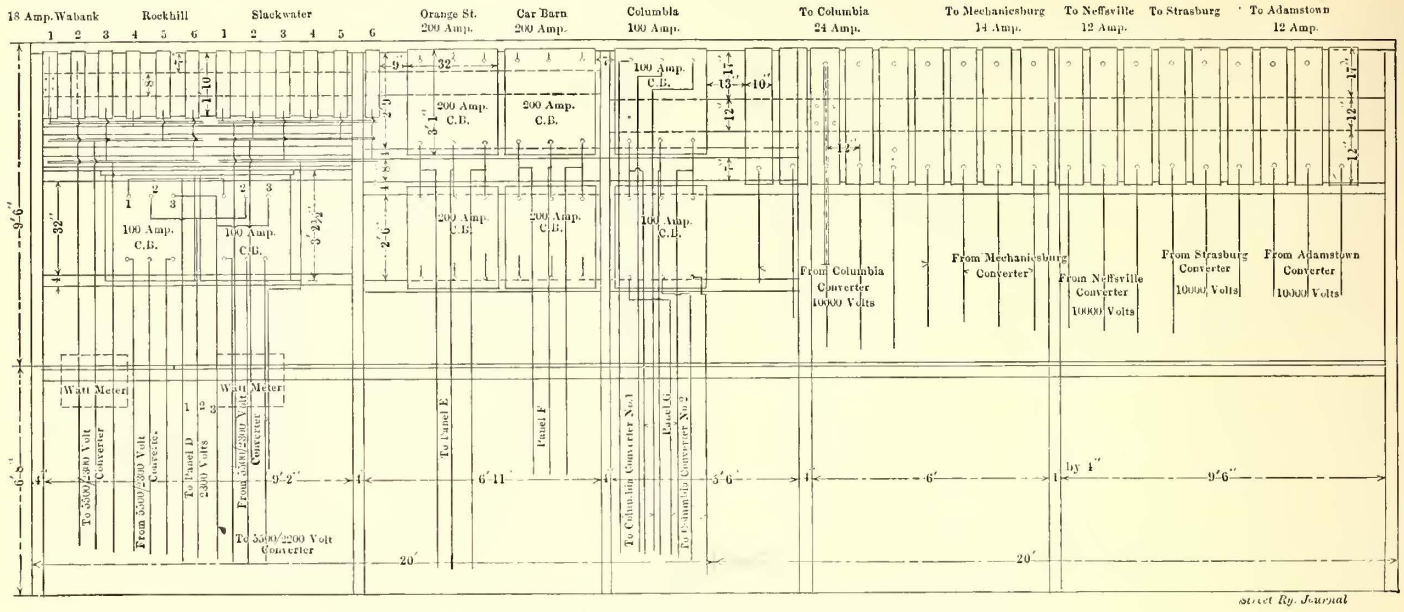
Ephrata & Adamstown Railway, 8 miles.

Lancaster & Rocky Springs Railway, 5 miles.

Lancaster & York Furnace Street Railway Company, 12 miles.

The latest acquisitions include the Ephrata & Adamstown Railway and the Lancaster & Rocky Springs Railway, both of which were completed last year and leased by the Conestoga Traction Company.

The Ephrata & Adamstown Railway extends from Ephrata Borough to Adamstown, and the construction of this road completes a through line of electric railway from Lancaster to

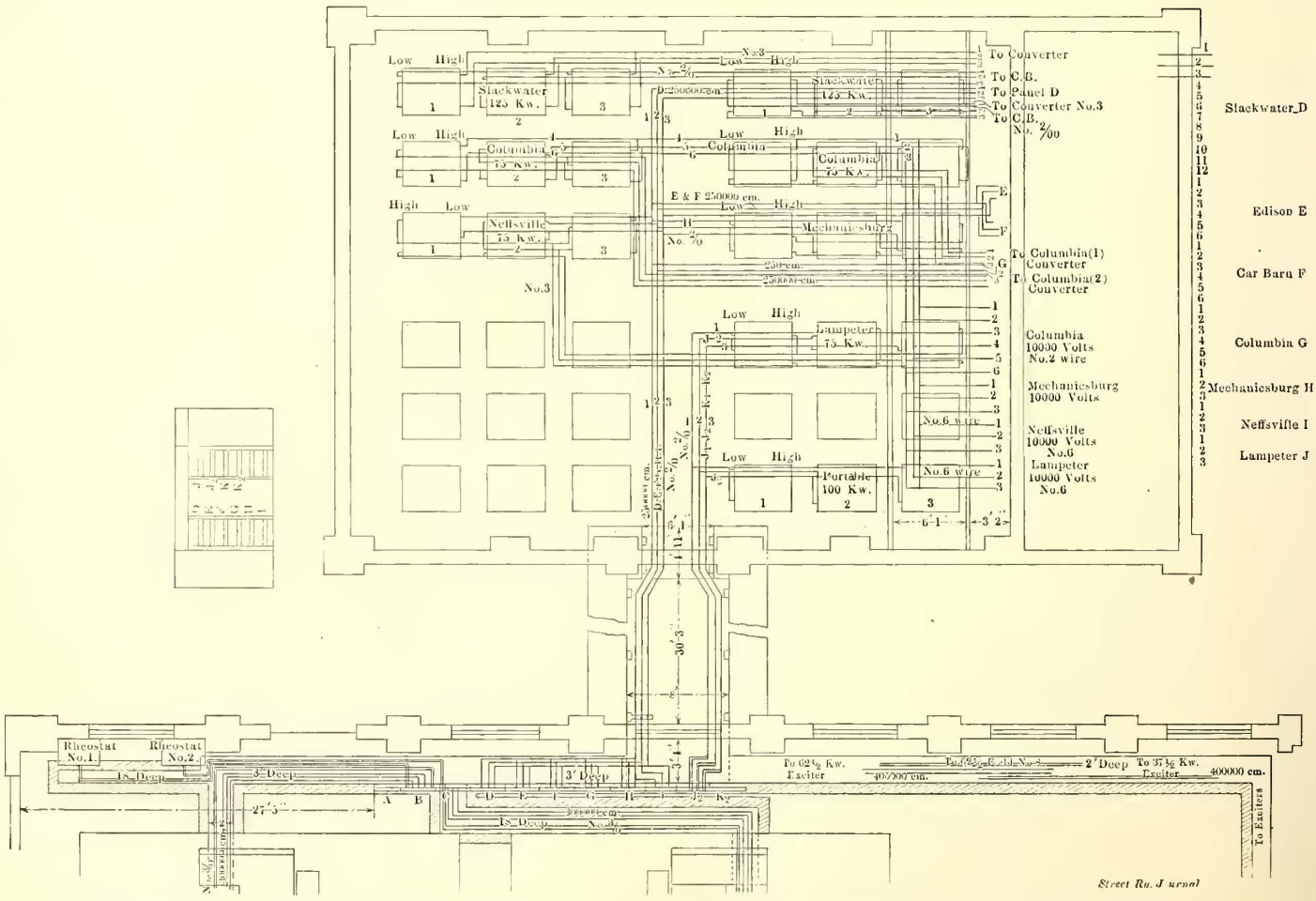


PLAN OF WIRING SWITCHBOARD IN ENGLESIDE POWER HOUSE

center of Lancaster to Rocky Springs Park, which has already been mentioned, and is intended principally for accommodating pleasure traffic.

Reading. From Adamstown to Reading the railway will be owned by the United Traction Company, of Reading, and work on this section has been about completed. The route from

During the last year the Lancaster & York Furnace Street Railway Company has made considerable progress with the building and equipping of an electric railway from Millersville



PLAN OF WIRING, SHOWING UNDERGROUND SUBWAY CONNECTING SWITCHBOARD OF POWER HOUSE WITH DISTRIBUTION SYSTEM

Lancaster to Adamstown, a distance of 23 miles, is now fully completed and in operation, but it is expected that when the other end of the line is opened the traffic will be much heavier.

The Lancaster & Rocky Springs Railway extends from the

to York Furnace, which will traverse the southwestern part of Lancaster County, and will form an important feeder to the Conestoga system. This line is controlled under contracts providing that the Conestoga Company shall carry the passen-

gers between Millersville and Lancaster City, and also furnish current for the operation of the entire line to York Furnace. It is also proposed to operate a line between Lancaster and Mt. Joy, by way of Roherstown, which is projected by an independent company.

Several of the lines here mentioned are constructed along township roads, which are controlled by the company through leases of a perpetual character. These include the Lancaster & Columbia Railway, which is built along the Lancaster and Susquehanna Turnpike, the Lancaster, Mechanicsville & New Holland, the Lancaster & Lititz, the Lancaster & Manheim, and the Lancaster & Millersville, which follow the respective turnpike roads of these districts.

The original companies which were consolidated in this system had a checkered career. The Lancaster City Street Railway Company, which formed the nucleus of the present organization, was incorporated Nov. 28, 1883. The next line to be projected was the East End Passenger Railway Company in 1886, and the West End Passenger Company at the same time. The West End Street Railway Company was incorporated two years later.

The first extension of the Lancaster City lines was made when the Lancaster & Millersville Railway Company was formed in 1890. This was followed a year later by the Lancaster & Columbia Railway Company, and about the same time by the Columbia & Ironville Street Passenger Railway Company, and the Lancaster & Strausburg Railway Company. The Columbia & Donegal Railway Company was formed early in 1893, as was also the Lancaster Traction Company. The Lancaster & Lititz Electric Railway Company was not established until 1894, and the Lancaster & New Holland Railway Company was projected the same year.

Meanwhile, the Pennsylvania Traction Company was organized, July 19, 1893, with a view of consolidating in one system the several companies here mentioned. Before this time, however, the work of merging and transferring these properties had begun. The East End Passenger Railway Company and the West End Passenger Railway Company had been absorbed by the Lancaster City Street Railway Company in 1890, and the Lancaster & Millersville Railway Company was leased to the West End Street Railway Company early in 1892, the latter corporation in turn being merged in the Lancaster City Street Railway Company before the end of the year. In 1894 the Lancaster Traction Company and the Lancaster City Street Railway Company were leased to the Pennsylvania Traction Company, as were also the Lancaster & Columbia Railway Company, the Columbia & Ironville Street Passenger Railway Company, the Columbia & Lititz Electric Railway Company, the Lancaster & Terre Hill Street Railway Company, and the Lancaster & New Holland Railway Company, thus consolidating all the existing traction interests of the county under one management.

The Pennsylvania Traction Company, however, became involved in financial difficulties, and on Nov. 30, 1896, William B. Given was appointed receiver of the entire property by the Circuit Court of the United States for the Eastern District of Pennsylvania. After passing through foreclosure proceedings the entire property was reorganized and acquired by a syndicate comprising the Conestoga Traction Company, which was incorporated on Jan. 16, 1900, with a capital of $4,000,000.

This company has since been engaged in developing and improving the property, and during the last few years has expended large sums for power house, sub-stations and equipment, rolling stock and extension and improvement of lines.

The fact that the roads follow the highway prevents the operation of the interurban lines at high speeds. The company during the last two years has rebuilt a large part of the roadbed and overhead work, with the view of securing better construction and material, and establishing a uniform standard, so that the entire system is now in excellent condition. The average grade is only 2 per cent, and the highest maximum grade, which is on the Donegal division, is 8 per cent. Late additions to rolling stock are all standard equipments, and the old cars have been brought up as nearly as possible to present standards by introducing improvements, and in some cases by practically rebuilding them.

The most important improvement undertaken by the company was in the construction of a new power house and the rearrangement of its transmission and distribution systems. The old systems had several generating plants scattered throughout the county, but it is now proposed to generate all the current used for lighting, power and railway operation in one main power house and establish sub-stations at convenient points for transforming and distributing it.

MAIN POWER PLANT

The new power house is located at Engleside, in Lancaster County, on the banks of the Conestoga Creek, just outside of the city of Lancaster, and was designed with a view of furnishing sufficient current to operate all the railways and lighting of Lancaster, Columbia and other points in the county. The structure is of stone and brick, and is divided into boiler and storage room and an engine room by means of a brick wall running through the building. At the extremity of the division wall is a chimney, 175 ft. in height and 96 ins. in diameter. It is a self-supporting steel plate structure. Diagrams are presented herewith showing the general layout of the plant, the arrangement of the boilers, superheaters and engines and the piping system, also the details of the wiring system.

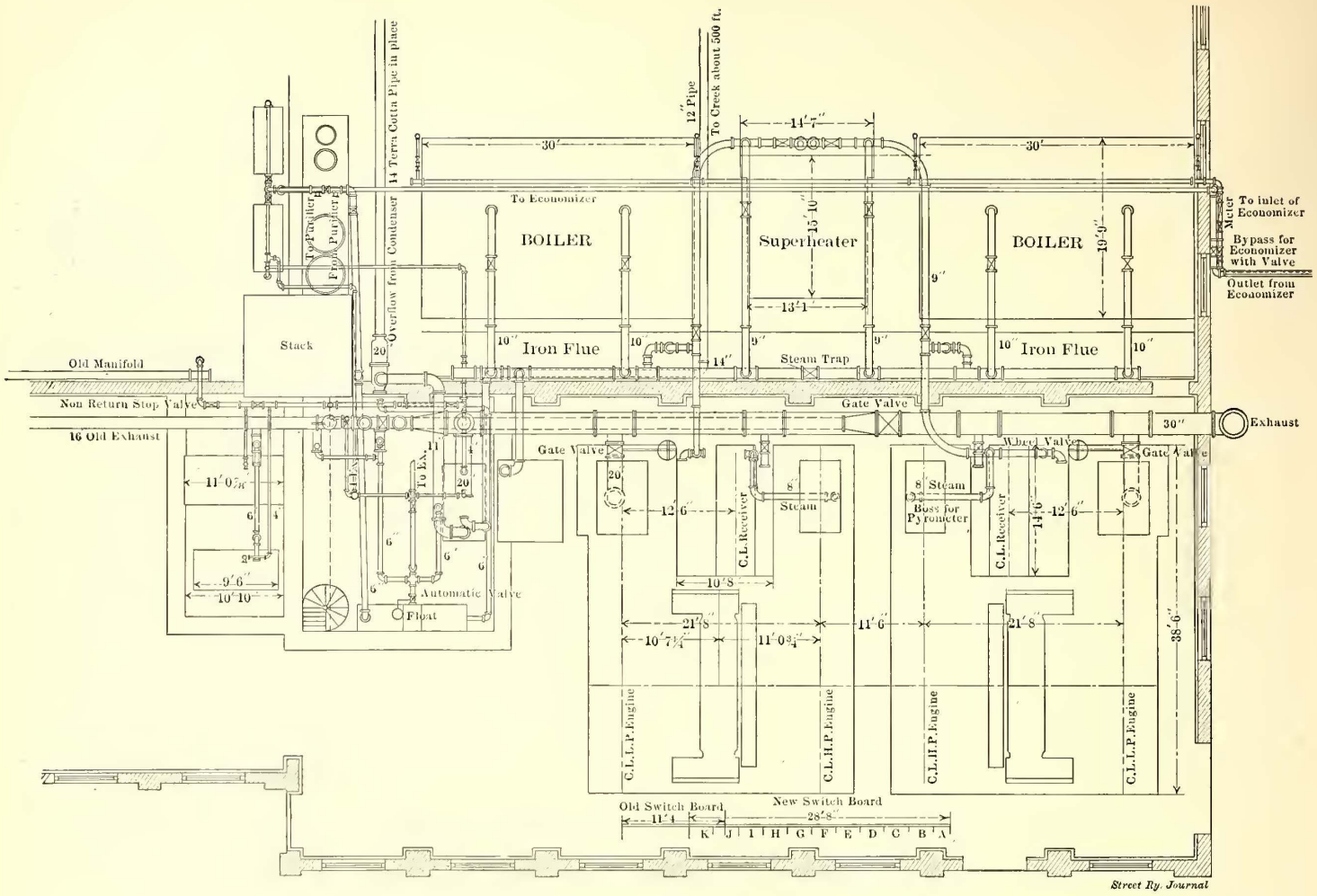
The boiler section contains four 520-hp Babcock & Wilcox boilers, arranged in two batteries, designed for a working pressure of 160 lbs. The boilers are hand fired. Coal bunkers have been arranged immediately in front of the boilers, and coal will be dropped into these bunkers from cars which are run into the power station on heavy trestle work immediately over the coal bunkers. An abundant water supply is always assured from Conestoga Creek. The steam plant includes a Green economizer, having 9792 sq. ft. of heating surface, one Worthington horizontal duplex jet condenser, 18 ins. x 22 ins. x 18 ins., two 12-in. x 7-in. x 10-in. Worthington horizontal duplex outside-center packed brass-fitted pumps, and one 4-in. Worthington hot water meter, designed for a working pressure of 185 per square inch.

ENGINE ROOM

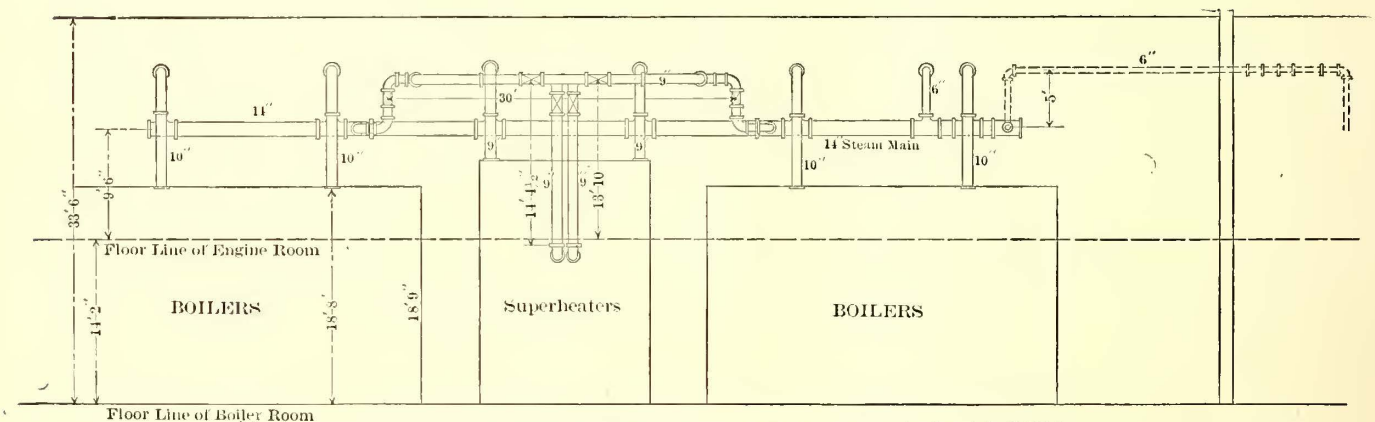
In the engine room provision has been made for three units, each comprising a 1000-kw alternator, directly driven by a 1500-hp engine. Two of these units have already been installed, and space has been provided for the third.

The engines are of the Rice & Sargent horizontal cross-compound condensing type, and were designed to utilize steam superheated to a temperature of 650 degs. to 750 degs. The cylinders are 26 ins. and 50 ins. in diamter by 48-in. stroke. They operate at 94 r. p. m., and the fly-wheels are 18 ft. in diameter, weighing 100,000 lbs. The boiler pressure is 150 lbs. The high-pressure cylinders on these engines are provided with poppet valves and with a special valve gear which, it is claimed, embodies some features of simplicity not possessed by similar engines abroad operating these valves. The clearance which usually in poppet valve engines is two or three times as much as in the Corliss type, in this case has been reduced to about the same figure without introducing any disadvantageous conditions. The poppet valves are so designed that they remain tight whether operated under saturated or highly superheated steam, the expansion of seat and valve being so balanced as to produce this effect.

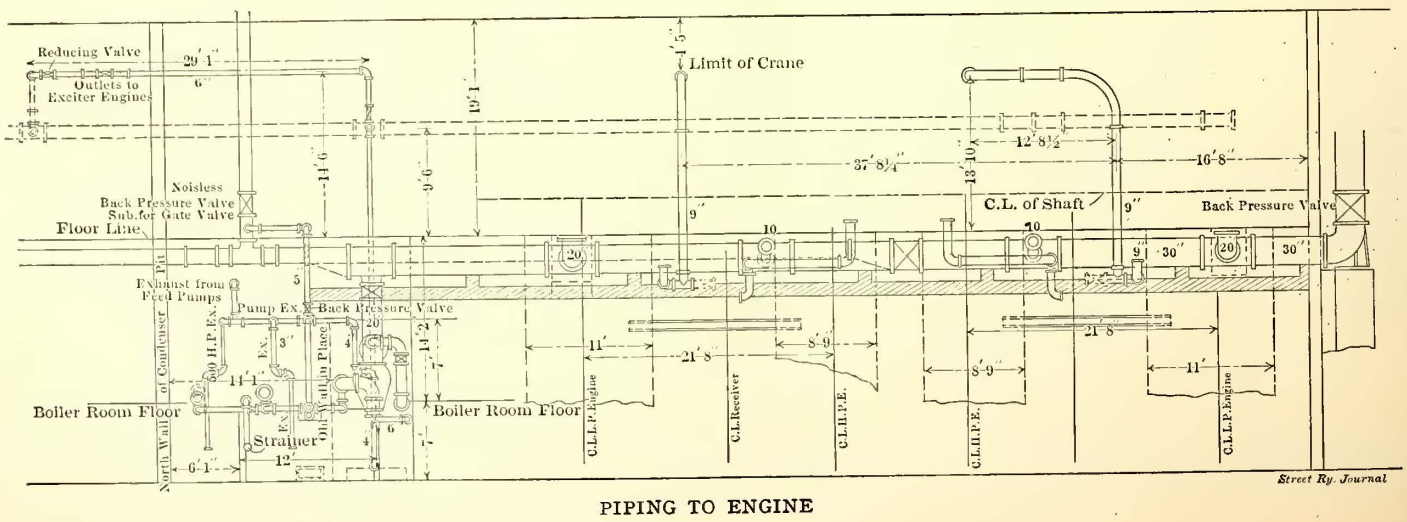
There are a number of special features on the high-pressure cylinder designed to overcome any difficulties which might be experienced in ordinary construction by the use of the high



PLAN OF STEAM PIPING FOR ENGLESIDE POWER HOUSE



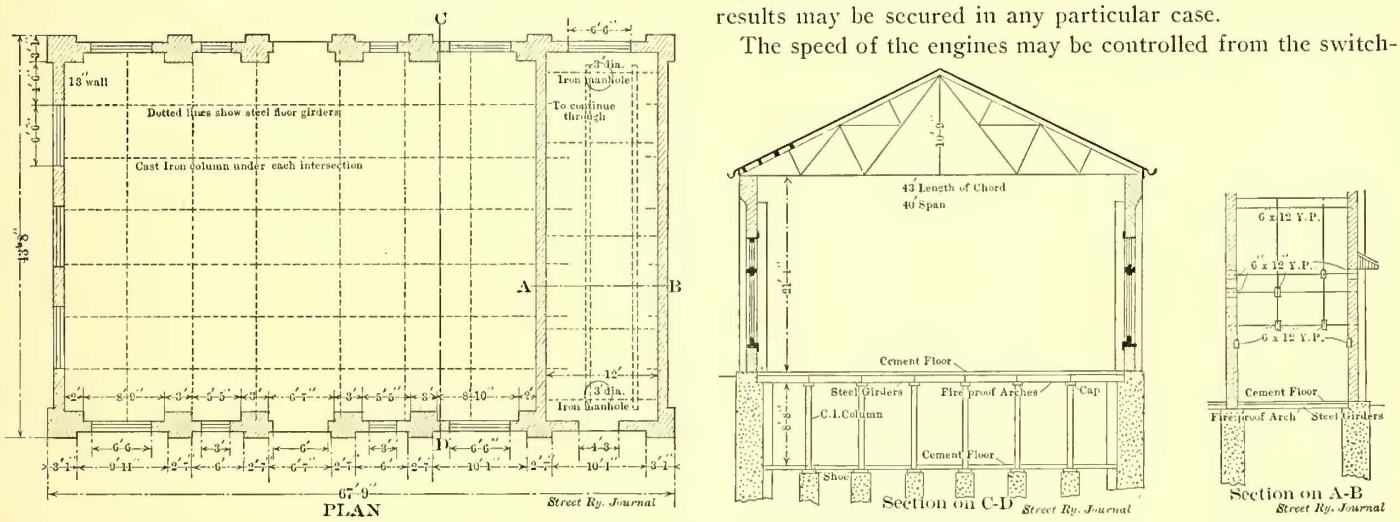
ELEVATION OF PIPE SYSTEM, LOOKING AT FRONT OF BOILERS



PIPING TO ENGINE

temperatures, including the arrangement of packing for piston rod and valve stems, construction of the piston and its packing and the design of the cylinder.

The principal feature of the engine, however, is the intermediate receiver, which has two functions; namely, to dry and superheat the steam passing from the high-pressure cylinder to the low, and to remove a portion of the superheat from the high-pressure cylinder, and give it up to the low-pressure cylinder. By this means the temperature in the high-pressure cylinder is kept down to a point which does not cause trouble from the defective lubrication or otherwise, and the temperature in the low-pressure cylinder being correspondingly raised, the efficiency of this cylinder is very much increased. To this end the main steam line is brought to the intermediate receiver before going to the high-pressure cylinder, and the receiver is provided with a valve which automatically by-passes a portion of the main steam through the coils of the receiver, where the superheat is taken from it, and the steam is then returned to the main steam line; mixing with the highly superheated steam and reducing its temperature. This reduction of



PLAN AND SECTIONS OF STANDARD SUB-STATIONS

temperature is greater for the late cut-offs than for the early ones. It was found that it was not possible to operate with late cut-offs at such high superheat as with early cut-offs—say 1-5 stroke or 1-6 stroke. The temperature in the low-pressure cylinder varies exactly in the opposite direction; that is, when the load is heavy, the low-pressure cylinder gets a higher superheat than when the load is light. This is possible, because at heavy loads the receiver pressure is higher, and, consequently, the temperature range in this cylinder is greater, permitting of a higher superheat.

The low-pressure cylinders are also provided with special packing pistons, etc., to utilize the temperatures met with, although this is not so necessary in the low-pressure cylinder as in the high. The valves and valve gear of the low-pressure cylinder are of the usual Rice & Sargent construction.

The Schmidt direct-fired superheaters are used with independent furnaces. The superheaters in general consist of coils of steel tubes, arranged so that they have absolute freedom of expansion and contraction, and all joints are kept out of contact with the flame or hot gases. These coils are secured to steel manifolds, which take the steam from the boiler, lead it to the tubes, and take it from the tubes to the engine.

The vital principal in this arrangement is the manner in which the steam is circulated through the two sets of coils, upper and lower. The upper set being of comparatively low temperature, the steam flows in them contrary to the flow of the gases; that is, the coldest steam meets the coldest gases. In the lower coils the circulation is reversed; that is, the coolest steam meets the hottest gases, and at the center where the two sets of coils meet the steam is taken out in a highly superheated condition. The object of this reversal of circulation is to protect the lower coils from burning out. If the hottest steam were allowed to be present in the tubes exposed to the hottest gases, the tubes would soon burn out; whereas, by protecting them with cooler steam the life of these coils is indefinitely prolonged.

The furnaces of these superheaters are arranged to ensure that the gases be thoroughly burned in a large firebrick combustion chamber immediately behind the grate, after which they are forced through a passage of fire-brick from the back to the front of the superheater, and there admitted to contact with the coils. In this way no flame is allowed to reach the tubes, and they are simply surrounded with hot gases in such a way as best to utilize the heat which these gases contain.

Tests of the superheater in active service have shown a very high efficiency, and the use of a separate furnace which can be operated to advantage gives not only very high efficiency of operation but also permits the superheat to be very exactly adjusted to the temperature at which, it is estimated, the best results may be secured in any particular case.

The speed of the engines may be controlled from the switchboard so that they may be regulated to take equal loads when the two alternators are operating in parallel.

ELECTRICAL EQUIPMENT

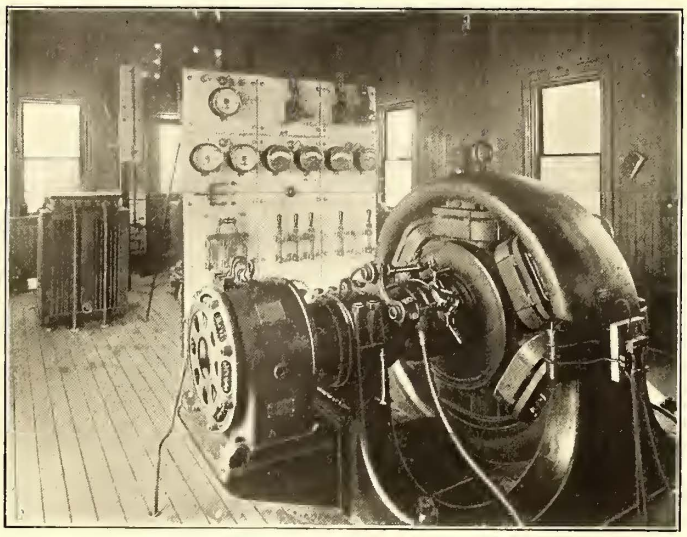
The generators are of the Westinghouse engine type, with rotating field, the rotating part being built upon a spider and arranged to be pressed upon the engine shaft, and thirty-two poles, designed for operation at 25 cycles, three-phase, developing 1000 kw at 7500 volts under normal conditions. The external frame is in a horizontal plane, and is movable parallel to the shaft to allow access to both field and armature winding. The field is designed so that the entire magnetic circuit shall pass through laminated sheet steel, and the pole pieces and field winding are especially proportioned so as to reduce the armature reaction and self-induction. The field coils are wound with strap on edge, and the armature winding also consists of strap-wound coils formed and insulated before being placed in the slots, and capable of withstanding a breakdown test of 5000 volts alternating current.

A load of 251 amps. per terminal at 2300 volts and at 100 per cent power factor may be thrown off, and the pressure will not rise more than 8 per cent, the speed and excitation remaining constant. The machine is capable of operation for twenty-four hours at full load with a rise in temperature not to exceed 40 degs. C., and at 25 per cent rise not to exceed 50 degs., 50 per cent overload bringing the rise up to 60 degs.

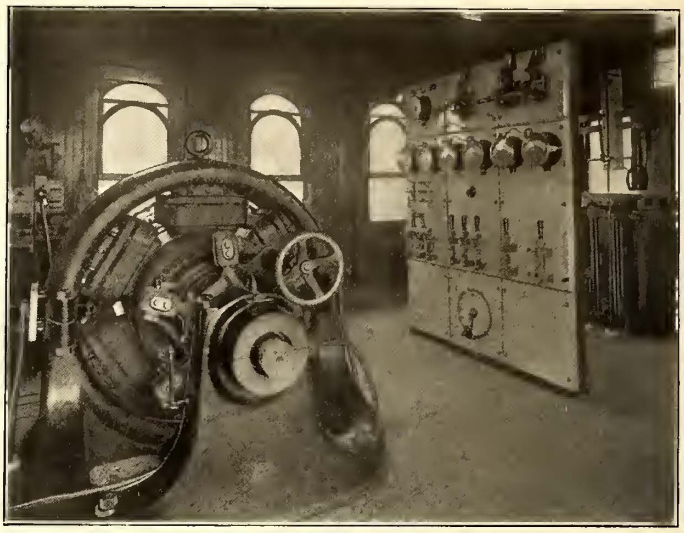
TRANSMISSION AND DISTRIBUTION

Alternating current is used for lighting, power and railway work. It is taken from the main power house and transformed

into direct current by means of rotary converters, and utilized for incandescent lighting throughout the city of Lancaster.



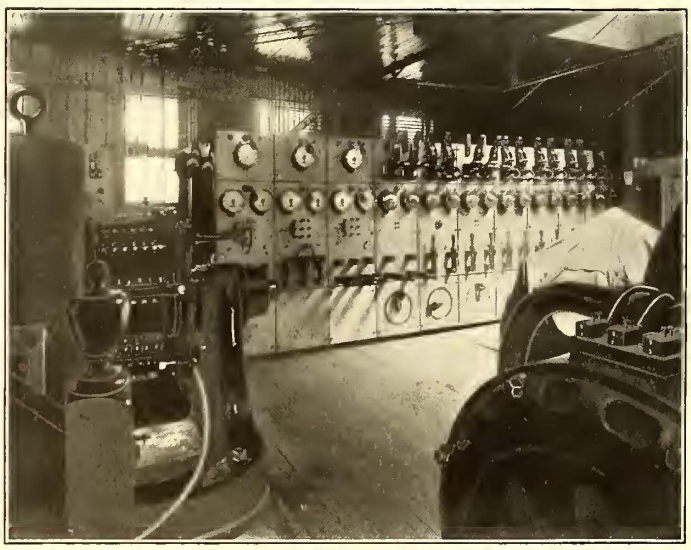
LAMPETER PLANT FOR STRASBURG LINE



NEFFSVILLE STATION

The alternating current from the power house is also used to operate induction motors, located in the factories in and about Lancaster. The greater part of the power, however, is distributed throughout the county for the operation of railway lines.

The generating station and the transforming apparatus are housed in independent buildings, each designed for its particular purpose. The leads from the generators are carried to the switchboard through non-automatic circuit breakers, which are directly connected to the bus-bars, and from the bus-bars through automatic circuit breakers to the feeder switches, and from there are carried through an underground tunnel, supported on petticoat insulators to the transformer house, which is in a separate building about 30 ft. from the main power house. Here it is connected with Westinghouse oil-cooled transformers, stepping up the voltage to 10,000 volts, then passing through high-tension circuit breakers and from there conductors are carried through a 12-in. wall to the lightning arrester room, which is entirely separate from the transformer house, and thence out on the line to be transmitted to the sub-stations, and distributed to the trolley feeders.

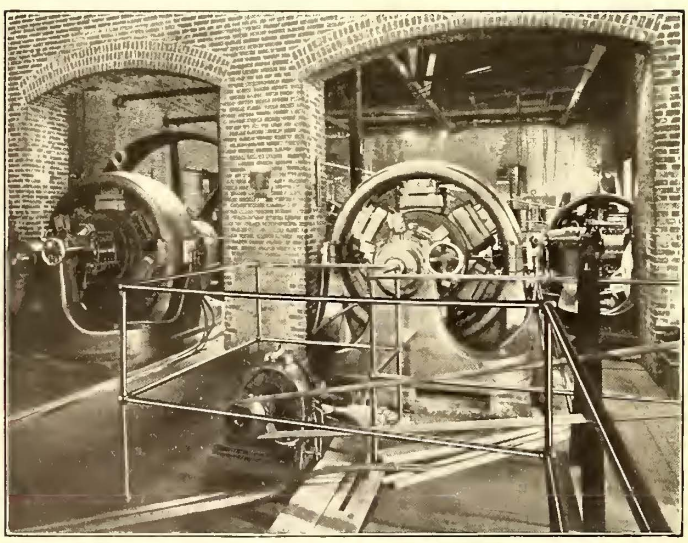


ORANGE STREET SWITCHBOARD

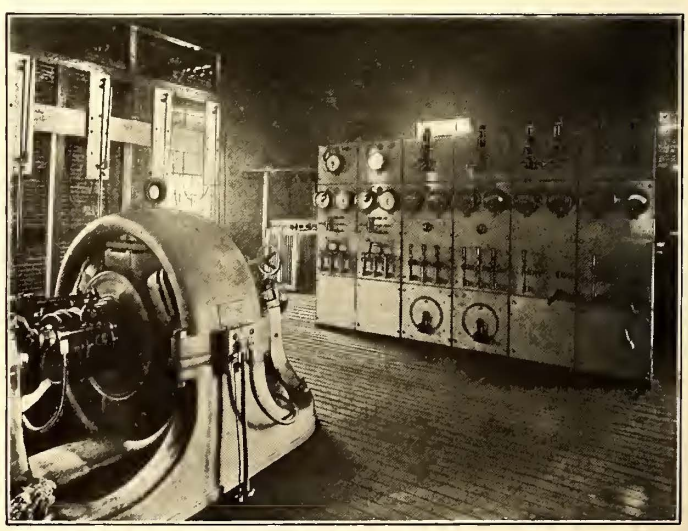
SUB-STATIONS

Sub-stations have been established at Lampeter, Mechanicsburg, Neffsville, Columbia, Reamstown and in the old power house and car house at Lancaster. The company also has a portable sub-station, which has been found to be a valuable adjunct, the equipment of which is fully illustrated herewith.

The main railway sub-station is located in the center of the



TEMPORARY PLANT AT CAR HOUSE



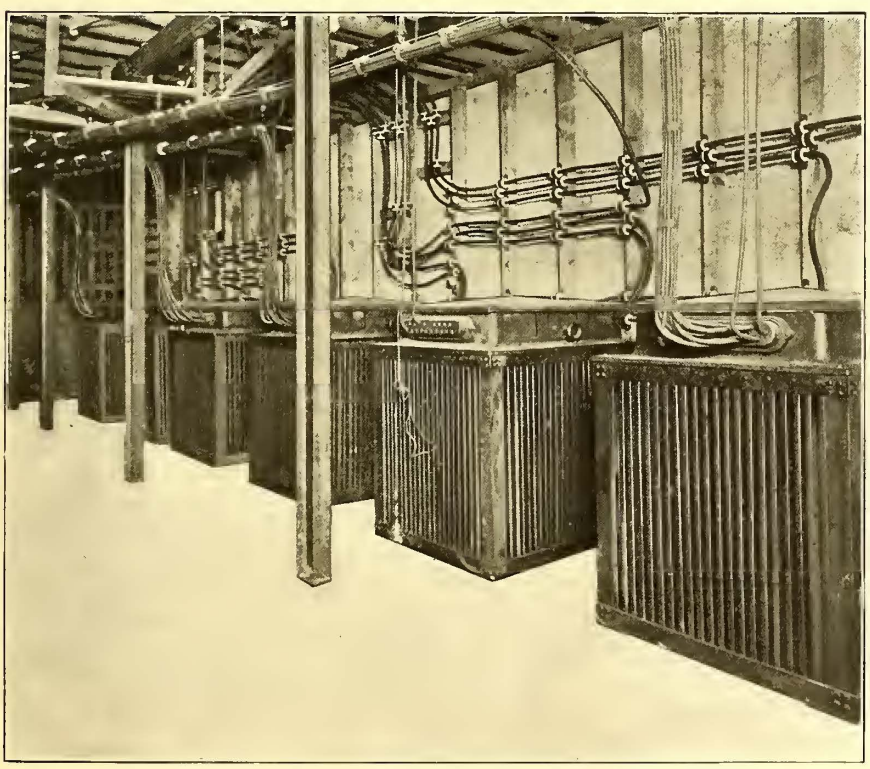
SIX-PANEL SWITCHBOARD AT MECHANICSBURG

TYPICAL SUB-STATION EQUIPMENTS

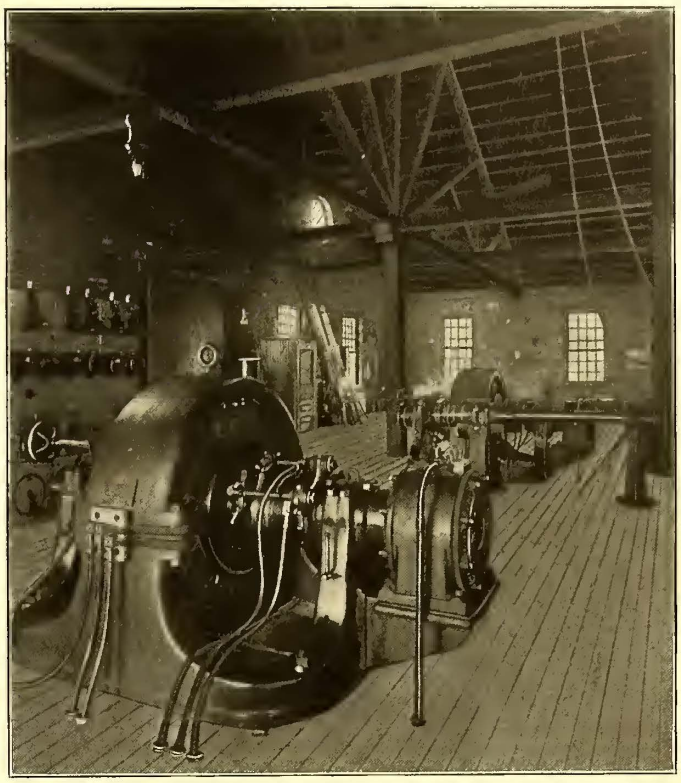
city of Lancaster, and is known by the name of the car house sub-station. It contains three 300-kw rotary converters, also a belted 350-kw, two-phase, 3000-alternation, double-current generator, with the necessary transformers and switchboards to control the feeder circuits. The Orange Street sub-station is 1½ miles from the power house and contains two 300-kw rotaries. Located at Columbia, Pa., is the Columbia sub-station, which contains two 200-kw, three-phase, rotary converters, with the necessary transformers and switchboard. The sub-station at Neffsville feeds the Lititz and Manheim lines, and contains a 200-kw rotary with the necessary step-down converters, circuit breakers and arresters. A similar sub-station is located at Mechanicsburg of 250-kw capacity, to feed the Ephrata and New Holland lines. A 200-kw rotary sub-station is also located at Lampeter, which is operated in connection with the Strasburg line.

Miles of Track from Lancaster to	Sub-station; Number and Sizes of Machines	Track to	Miles from P'w'r H'se
Near ends of all suburban lines	Car-barn sub-station—three 300-kw rotaries Orange St. station—two 300-kw rotaries.	City Lines 18.18 miles Rocky Springs 4.64 miles Millersville 5.07 miles	2 1½
4.92 miles from Lancaster-Center Sq. to.....	Neffsville, 1-200 kw	5.21 miles to Lititz 8.01 miles to Manheim	6
7.22 miles from Lancaster-Center Sq. to.....	Lampeter, 1-200kw	4.74 to Strasburg	5
10.62 miles from Lancaster-Center Sq. to	Columbia, 2-200kw	6.50 to Marietta 2.00 Columbia Belt Line	11
7.87 miles from Lancaster-Center Sq. to.....	Mechanicsburg, 1-250 kw	7.33 to Ephrata 5.56 to New Holland	9
3.33 miles from Ephrata to...	Reamstown, 1-300 kw	4.67 to Adamstown	20

The company's portable sub-station of 250-kw capacity with step-down converters, circuit breakers and arresters, can be utilized at any point on the road where there is an unusual demand. This station is now operating on the Ephrata and Adamstown line. It has a 250-kw rotary, and the high tension is now controlled by a 10,000-volt oil-circuit breaker mounted on two marble slabs back of the other switchboards. The old 300-kw double-current machine will later replace the tempo-



TRANSFORMER COMPARTMENT, ORANGE STREET SUB-STATION



ROTARIES AT COLUMBIA

rary equipment at Reamstown. All the electrical apparatus for the main power house and sub-stations was furnished by the Westinghouse Electric & Manufacturing Company.

The accompanying table shows the size of each of the rotaries employed, the name of each sub-station and approximately the number of miles of track fed by each one. The feeders from all the sub-stations run into the bus-bar at the car house, and all run in parallel with the three machines in the car house station. The average load at the power house during the morning is about 700 kw to 900 kw, and sometimes there is a demand for 1200 kw to 1300 kw for a short time. In the afternoon the load will average 500 kw to 600 kw on each machine, and 800 kw to 900 kw in the evening, with all the lights on. There are sometimes demands of 1200 kw on each generator.

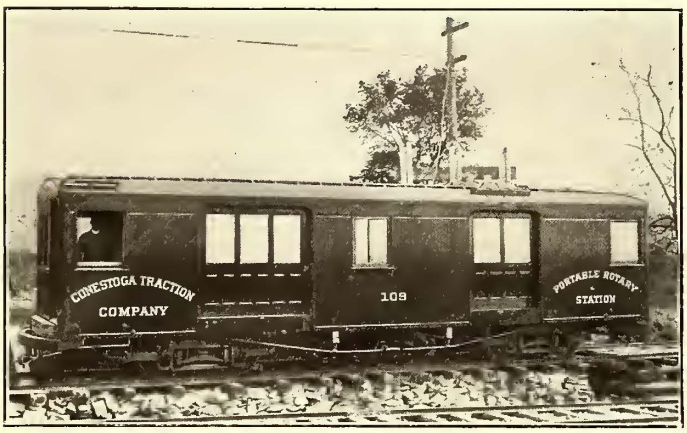
The distance from Lancaster to the principal points reached are:

	Miles
Ephrata	15.20
Adamstown	23.11
New Holland	13.46
Lititz	10.13
Manheim	10.93
Strasburg	11.96
Columbia	11.46
Marrietta	16.69

ROLLING STOCK

During the last two years the company has endeavored to standardize the equipment throughout, and much of the rolling stock has been overhauled with this in view. The cars for the several lines differed considerably in many particulars, the equipment comprising half a dozen different types and nearly all the prominent manufacturers being represented among the

builders of the cars. A recent inventory showed that the company had forty-eight closed cars, ranging from 24 ft to 41 ft. in length, 32 open cars, 25 ft. to 36 ft. long, nine work cars and snow plows, and nine ballast trucks. The latest equipments include semi-convertible and open cars of the Brill pattern.

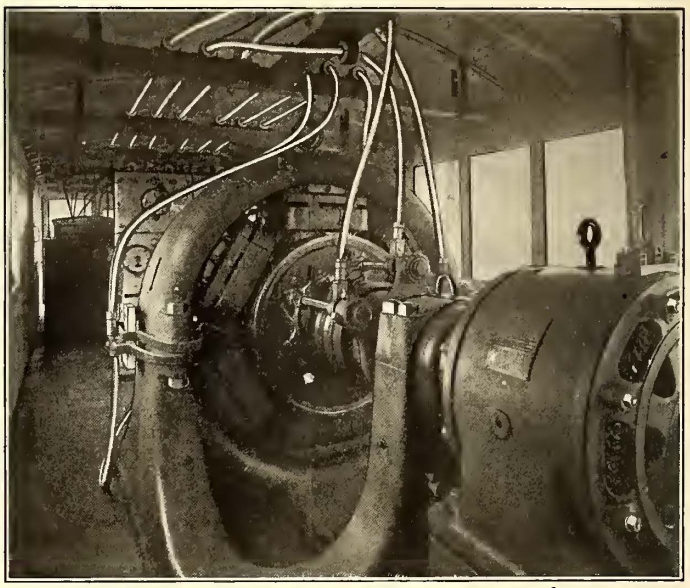


PORTABLE SUB-STATION

The company's semi-convertibles include four combination and eight passenger cars. These are 41 ft. long over all, and each car is equipped with four 30-hp Westinghouse motors, K-12 controllers, electric heaters, electric headlights and Christensen air brakes. The general dimensions of the two semi-convertible cars recently ordered for the Lancaster & Rocky

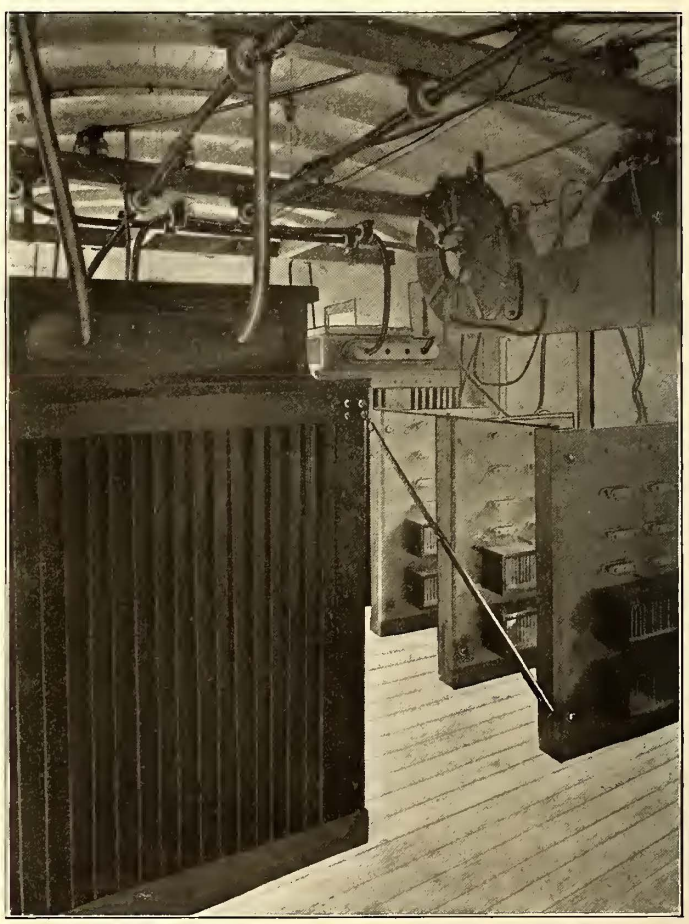
SWITCHBOARD IN PORTABLE SUB-STATION

Springs division are as follows: Length over end panels, 28 ft.; over crown pieces, 37 ft. 5 ins.; width over sills, 7 ft. 10½ ins.; over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; center posts, 2 ft. 8 ins.; side sill, size, 4 ins. x 7¾ ins., plated, ⅜ in. x 12 ins.; end sills, 5¼ ins. x 6⅞ ins.; thickness of corner posts, 3¾ ins., of side posts, 3¼ ins. The inside finish is in natural cherry with decorated birch ceilings. The cars are mounted on Brill 27-G trucks, with 4-ft. wheel base, 33-in. wheels, 4-in. axles, and are equipped with four 30-hp motors and K-12 controllers. The general dimensions of the four ten-bench open cars are as follows: Length over crown pieces,



ROTARY IN PORTABLE SUB-STATION

28 ft. 8⅜ ins.; center corner posts over crown pieces, 4 ft.; width over sills, 6 ft. 6 ins.; over posts at belt, 7 ft. 4½ ins.;



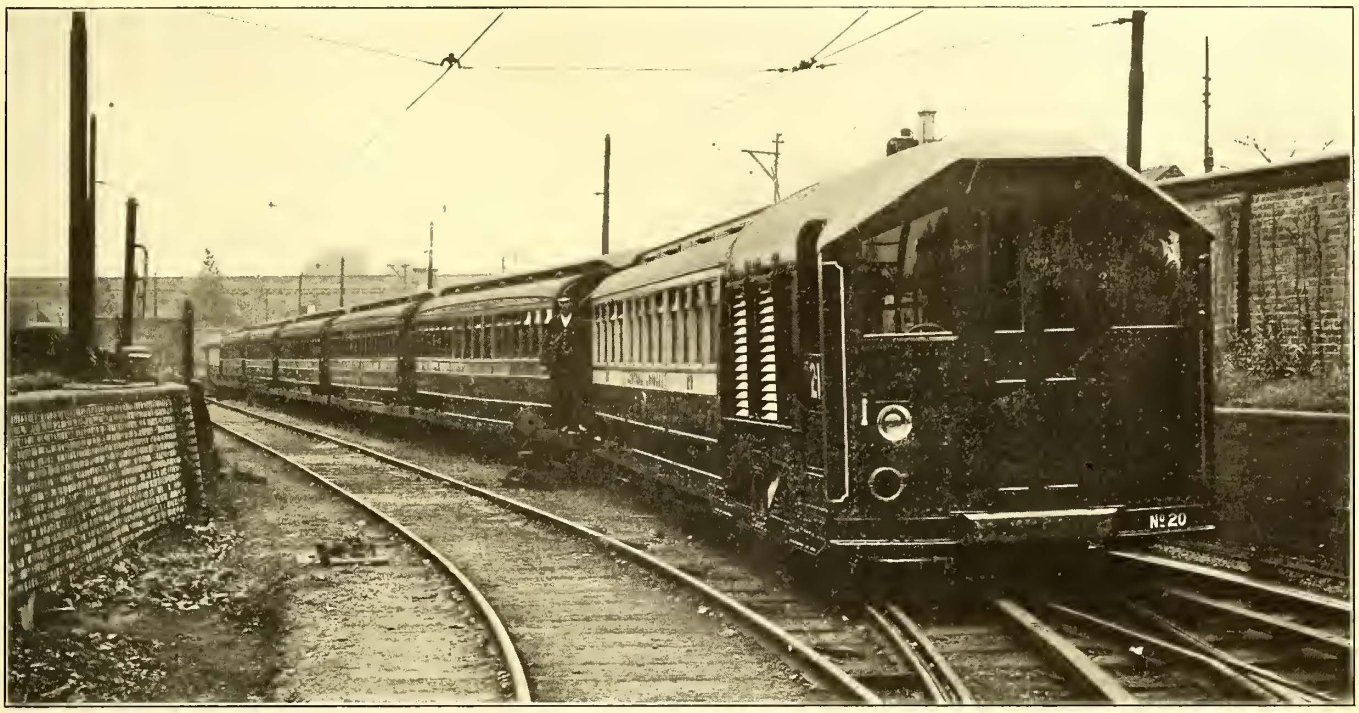
TRANSFORMERS AND LIGHTNING ARRESTERS

sweep of posts, 5 ins.; centers of posts, 2 ft. 8 ins.; side sills, size, 3¾ ins. x 7 ins., plated, ½ in. x 7 ins.; thickness of corner posts, 3⅝ ins.; outside posts, 2¾ ins. These cars have cherry and ash finish and decorated birch ceilings. They are mounted on Brill 21-E trucks with 7-ft. wheel base, 33-in. wheels, 4-in. axles, and are equipped with two 30-hp motors and K-10 controllers.

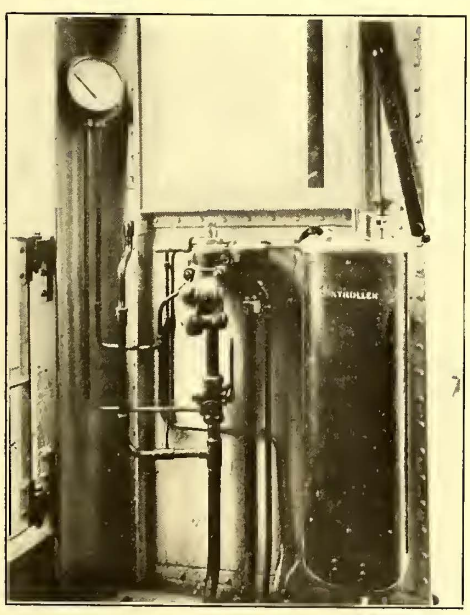
FIREPROOF CARS ON THE CENTRAL LONDON

Announcement was made in this paper last year of the decision of the Central London Underground Railway Company to adopt motor cars in place of locomotives. The change was made partly to avoid vibration, due to the uncushioned weight of the motors on the axles of the locomotives and partly to secure better acceleration. The old locomotive train had a maximum acceleration of 1.4 ft. per second per second, and an average acceleration of 0.7 ft. per second per second, while with a motor-car train, consisting of two motor cars and five trail cars, the maximum acceleration could be increased to 2½ ft. per second per second, and the average acceleration to 1 ft. per second per second. Owing to the limited amount of head room a special design of motor car had to be built, and that finally selected was illustrated in the STREET RAILWAY JOURNAL for Oct. 11, 1902 (International edition for October). Two experimental trains of this kind, consisting of two motor cars and four trail cars, and equipped with the type-M controller system, have been on trial on the Central London Railway for the past eighteen months, and have been adopted as standard for the future operation of the line, except that as a rule five trail cars will be used with two motor cars to make up a train.

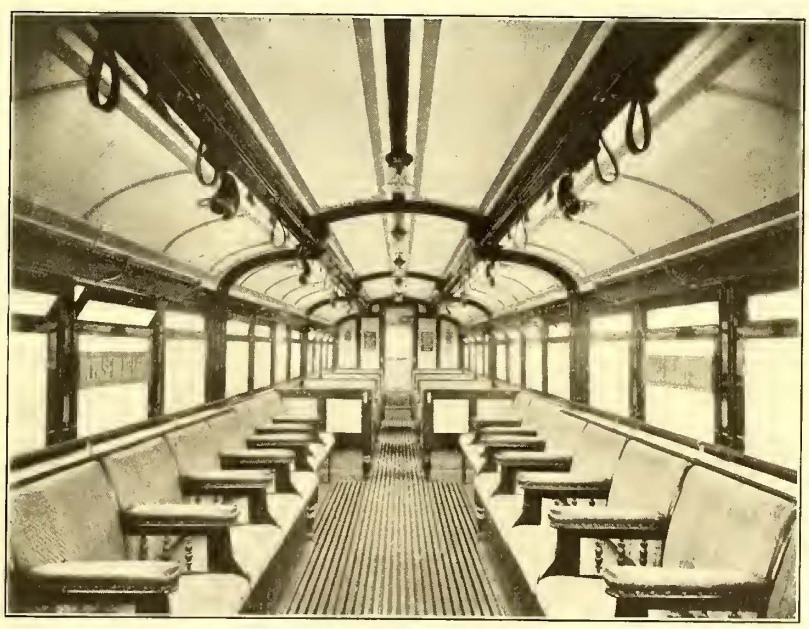
The motor cars are equipped with two 125-hp motors, supplied by the British Thomson-Houston Company. Both motors are mounted on the same truck, which is equipped with 34-in. wheels, and which is at the front end of the car in the case of the forward motor car or at the extreme end in the case of the rear motor car. The wheels on the trail trucks of the motor cars and on the trail cars are only 29 ins. in diameter.



TRAIN OF FIREPROOF CARS ON THE CENTRAL LONDON



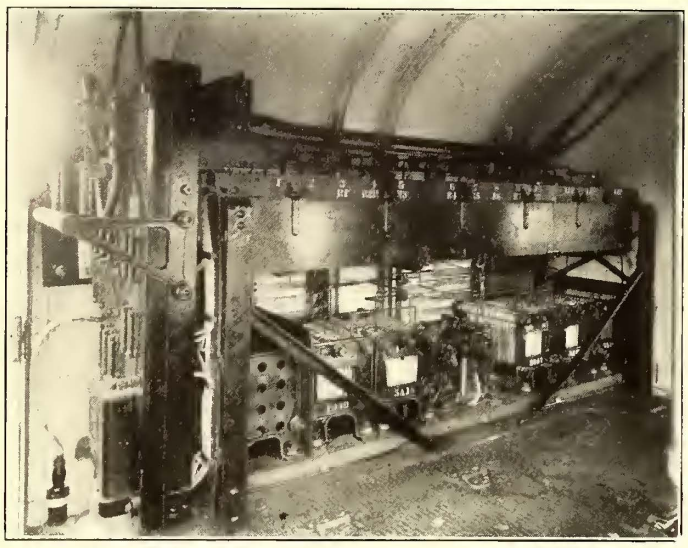
CONTROLLER AND BRAKE MECHANISM



PASSENGER COMPARTMENT

A special motorman's compartment has been designed over the motor trucks to accommodate the electrical equipment. The frame work of this compartment is bolted to the frame work of the car, and is a self-contained steel structure. The framing is made up of steel angles with a front screen of sheet

steel glazed in the upper part and provided with a double sliding steel door, also glazed. The sides of the cab are closed for a portion of their length by swing gates with outside handles. The remainder of the side is of sheet steel with louvres in the angle-steel sliding frame, which are suspended by rollers on steel rails. The rear portion of the cab is also



CONTROLLING MECHANISM ON DRIVING PLATFORM

sheet steel, and is provided with an opening to the passenger compartment. This entrance is normally kept closed by a sheet-steel door. This door is lagged with ⅛-in. uralite or asbestos on the side nearest the passenger compartment, and is covered with uralite panels veneered with sycamore and framed with teak on the passenger compartment side. The rear partition of the cab is 1 in. clear of the nearest part of the end panels, the space being filled in with fire-resisting material. A sheet of ⅛-in. uralite or asbestos is placed over the whole rear partition between it and the body framing. The floor of the cab is composed of chequer plates, except on the front platform, which is the same as the passenger compartments. These chequer plates are hinged to give access to the motors. The roof of the cab is also of sheet-steel.

Each motor weighs 4375 lbs., including gears. Of this weight 2040 lbs. is borne by springs. With 200 amps. at 500 volts, each motor gives a tractive effort of 3150 lbs. at a speed of 14½ m. p. h., measured at the tread of the wheel, which, as stated, is of 34 ins. diameter. The temperature rise after a day's service of sixteen hours is about 30 degs. C. above atmosphere.

The collector shoe is of chilled iron, suspended from the truck by four links. The truck supporting the passenger end of the carriage is, to all intents and purposes, the same as that of the trailer carriage, save that it has a wider wheel and carries a collector shoe like that on the motor truck.

The master controllers, contactors, reversing switches, resistances and the various other apparatus, are carried on the driving platforms of the motor cars. The contactors are carried on an angle-steel frame inside the cab, and below them are located the reversing switch and rheostats. A slate panel behind the driver carries the switches and fuses for the main motor circuit, control circuit, lighting and air compressor circuit. The motor circuit connections on the switchboard are of bare copper rod, while those of the control circuit are of asbestos-covered wire.

The air compressor, main reservoir, tool chest and sand box are situated on the opposite side of the cab to the switchboard. A series motor directly drives the compressor, which compresses 20 cu. ft. of free air per minute, and is provided with an automatic governor which cuts off the current when the reservoir pressure reaches 90 lbs. per square inch, and switches it on when the pressure falls to 80 lbs.

The master controller, as mentioned before, is situated on the driving platform, together with the apparatus for operating the air brake, as are also the ammeter, voltmeter, air-pressure gage and hand-brake wheels.

Each motor car, with the full complement of passengers, weighs 23 tons, 16½ tons of which are supported by the motor truck, and 6½ tons by the truck at the passenger end of the car. The trailer cars have a seating capacity for forty-eight passengers, the motor cars for forty-two.

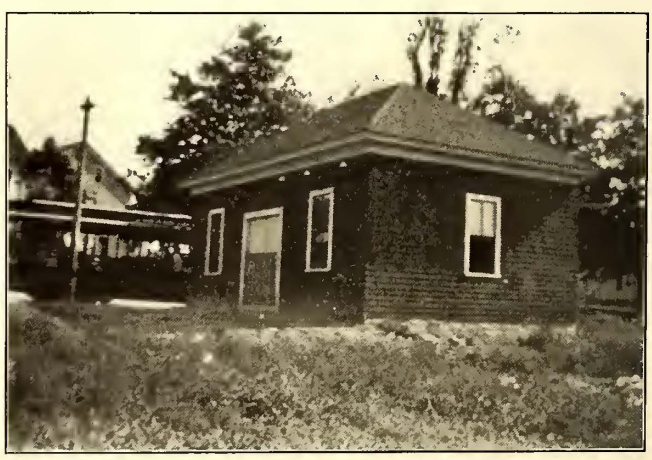
The weight of one of these seven-car multiple-unit trains is 132.5 tons, while a seven-car train with gearless locomotive weighs 159.6 tons.

NEW SUB-STATION ON THE PORTSMOUTH, KITTERY & YORK STREET RAILWAY

A new sub-station has recently been placed in operation by the Portsmouth, Kittery & York Street Railway, at York Corner, Me., a junction of three roads leading to York Village, Dover, N. H., and Kittery Point. It is designed to furnish power to cars operating between Kittery, York Beach and Dover, and helps out the existing station at Kittery Point. It is also operated in conjunction with the company's storage battery at Long Beach.

Power is supplied to the sub-station at 10,000 volts over a three-phase transmission line of No. 6 B. & S. bare copper, running from the Dover station of the United Gas & Electric Company. The building is of dark wooden shingle construction, one story in height, and presents an unusually neat appearance. The roof is of the usual pitched variety, painted a tasteful green. The location of the station is on the edge of a meadow, and light and fresh air are present in abundance for the comfort of the attendants.

The interior of the building is 30 ft. long by 20 ft. wide, and is divided into two rooms, one for the machinery, switchboard and transformers, and the other for a passenger waiting room. The waiting room is neatly finished, has comfortable benches on three sides, and is well lighted from two large windows of



PORTSMOUTH SUB-STATION

north and west exposure. Mounted on the wall of the waiting room is a telephone for the use of car conductors in reporting their arrivals to the despatcher at the Kittery Point car station. When the cars are late this duty is performed by the sub-station operator. The waiting room is 12 ft. long by 8 ft. wide.

The machine room contains a 200-kw, twelve-pole, 550-volt, 60-cycle three-phase Westinghouse railway rotary converter, running 720 r. p. m., three 76-kw Westinghouse stationary transformers, a two-panel switchboard, and the usual complement of lightning arresters. The rotary has horizontally-split fields, compound wound, and is brought up to synchronism in starting by a special induction motor, mounted on the armature

shaft. The end play attachment of the rotary shaft is operated by springs. The induction motor is overhung, and is run from the low-tension side of the transformers, which are conected in delta. The designated primary voltage is 11,000, and the secondary 391. The transformers are oil-cooled, and are operated without oil switches. They are insulated from the concrete floor, and in working upon them the attendant stands upon a varnished platform supported above the floor by triple petticoated glass insulators. Rubber floor mats protect the operator when adjusting the brushes of the rotary. The high-tension wiring passes from the transmission-pole insulators to porcelain insulators on a horizontal wooden beam, supported near the roof on the west side of the building. The conductors spread in descending to a width of about 36 ins. between centers, and pass into the building through porcelain bushings set in the wall. These bushings are given an outward and downward inclination for the purpose of carrying the drip water of drainage away from the machine room. The conductors pass through three choke coils, one for each phase, after entering the station, and then go to three single-throw, spring-break pole switches, fitted with fuse attachment. The lightning arrester leads top off before the station switches are reached. No oil switches are in use in the station. The high-tension insulators are all porcelain, and are supported on stout oak pins. From the pole switches the 10,000-volt current passes to the transformer primaries. The secondary leads are carried below the sub-station floor in pipes to the switchboard, and from thence to the alternating side of the rotary through series transformers for instrument purposes. The direct-currrent and induction motor wiring also passes beneath the floor. The outgoing feeders pass up the wall and through bushings to the outside of the building, back of the switchboard.

The switchboard consists of two blue Vermont marble panels, supported by angle-irons. The distance between the wall and the nearest angle-iron is 30 ins., and the clearance between the wall and the nearest switchboard projection about 20 ins. One panel is for direct-current control, and contains an automatic circuit breaker in series with the 550-volt supply to the trolley; a direct-current ammeter for the rotary output, a field rheostat, double pole positive and negative switch, a voltmeter plug for reading both sub-station and Kittery Point station voltage, and a bracket lamp.

The other panel contains three alternating-current ammeters, one in each phase of the rotary leads, two synchronizing lamps for throwing the rotary into connection with the Dover power supply, two synchronizing buttons, a triple pole, double-throw horizontal knife switch for the induction motor, and a triple pole, single-throw low-tension knife switch for connecting the rotary with the transformer secondaries. The instruments are all round pattern, Westinghouse make. There are also two voltmeters on brackets, direct and alternating current respectively, and two bracketed lamps for the instruments on the alternating panel.

The machine room is lighted by a cluster of five-series incandescent lamps, set overhead in the middle of the room, and has ample windows. A large double sliding door permits the ingress or egress of supplies, and the room is fenced off to prevent the entrance of the too curious public. A water supply from the town mains is brought to the sub-station in a vertical pipe just outside. On top of the waiting room and in the north corner of the machine room is ample storage space.

ELECTRICAL EQUIPMENT OF THE DUNEDIN TRAMWAYS, NEW ZEALAND

The work in connection with the installation of the Dunedin electric tramway system, at Dunedin, New Zealand, is proceeding rapidly. Messrs. Noyes Brothers, the engineers, have already laid about 5 miles of track and erected most of the poles for the overhead work. The car house is completed, and ten of the cars are assembled. The cars are of Brill manufacture with 21-E trucks, fitted with Westinghouse magnetic brakes, and are equipped with Westinghouse motors and controllers with brake notches. It is proposed eventually to operate the generating plant by water power, but until the hydraulic work is completed a temporary steam plant is installed for the time being. The steam plant consists of three 200-kw Westinghouse generators coupled directly to Belliss Morcom engines, the boilers being of Babcock & Wilcox type. The steam plant is well under way, and it is anticipated that some of the cars will be operating in December. W. G. T. Goodman is the engineer in charge of the designing and construction, on behalf of Messrs. Noyes Brothers, his principal assistants being J. H. D. Brearley and F. R. Shepherd.

OPERATING TROLLEY CAR THROUGH FLOODED STREET IN LOS ANGELES

TROLLEY OPERATION UNDER DIFFICULTIES

The accompanying illustration shows a car of the Pacific Electric Railway Company, of Los Angeles, passing through Grand Avenue on its way to Redondo Beach. This photograph is one of particular interest, as it was taken during the rainy season on the coast, and it illustrates very strikingly the peculiar difficulties the street cars have to encounter in several streets of Los Angeles during the rainy season.

In the recent vote by the people of San Francisco on the question of authorizing the city to issue bonds to take over the Geary Street, Park & Ocean Railroad, the returns showed that in the lodging-house districts the vote was largely in favor of municipal control; that in the residence districts the vote was almost evenly divided, and that in the wealthier sections the sentiment was against the issue.

CENTER GRAB HANDLES

A novel feature in grab-handle construction in use on a number of European tramways is illustrated in Figs. 1 and 2. It consists of a post supported from the center of the step and extending to the hood. Of course, one use for this post is as a support to the upper deck of a double-deck car, but the post has other advantages which might make it of value on single-deck cars when a broad platform is used. In the first place, it divides, to a certain extent, the incoming and outgoing passengers, the latter leaving through the space nearest the car body, while the incoming passengers enter between the post and the dash, and then it furnishes something to grasp firmly

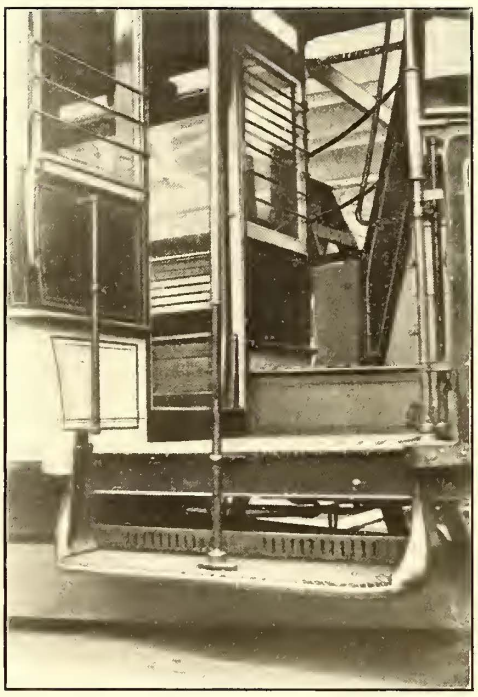


FIG. 1.—GRAB-HANDLES AND CENTER-POST

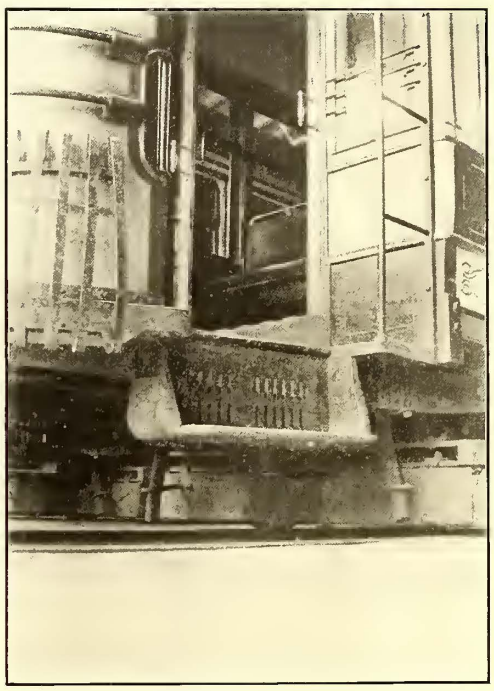


FIG. 3.—GRAB-POST AND LADDER

with both hands, which is convenient for many people, especially elderly passengers, and often prevents accidents. In the two illustrations shown, the step is on the left-hand side of the

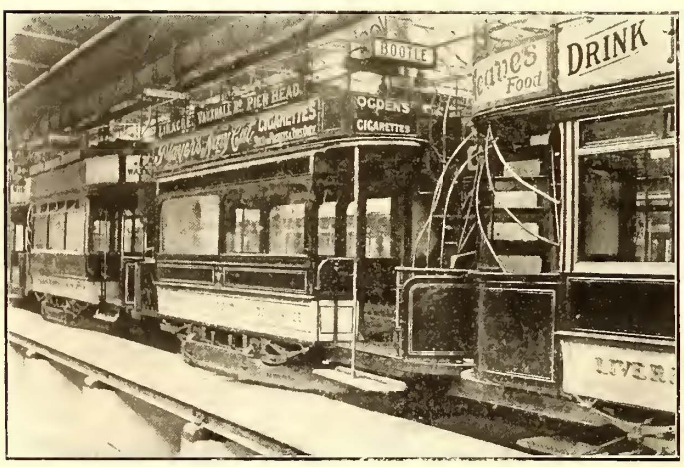


FIG. 2.—POST MOUNTED ON LIVERPOOL CAR

car, as they are of cars on the Liverpool Tramways, and the practice in England is for the cars on a double-track road to use the left-hand track. Fig. 1 shows the post mounted on a wooden step and Fig. 2 on a Stanwood step.

In these Liverpool cars the distance between the center post and the dash post is 22½ ins., and the distance between the center post and the end panel of the gate post is 21½ ins. The post is of iron covered in the center with a brass pipe.

Fig. 3 illustrates a combination grab post and roof ladder used on some of the cars of the Grosse Berliner Strassenbahn, of Berlin, Germany. These are single-deck cars, and the ladder is used only by repair men who have to mount the roof. The construction is neat in appearance, gives assistance to the boarding passenger and affords a certain amount of protection at the end of the platform near the car door.

CAR HOUSE TESTING ROOM

COLORADO SPRINGS & INTERURBAN RAILWAY COMPANY
Colorado Springs, Oct. 12, 1903.

Editors Street Railway Journal:

A description of the "testing room" located in our new car house may be of interest to some of your readers. This is a small room equipped with a small switchboard, carrying a standard Weston voltmeter and ammeter. The switchboard is also equipped with two General Electric magnetic blow-out hand switches, from which two motors can be tested, one against the other or singly, as desired. The switchboard is protected by a General Electric automatic circuit breaker, with a range of from 100 amps. to 300 amps. capacity. The board has binding posts, so that any switch desired can be used to open or close the circuit under test.

From one of these binding posts is a wire leading to a trolley wire run alongside the main trolley wire, on which the trolley on any car can be placed and readings taken from the meters in the testing room without running wires to or from the car under test. If desired, a standard resistance can be connected across the binding posts at the switchboard and in series with this false trolley wire. By taking readings from volt and ampere meters the total resistance of the circuit under test can be readily determined, and by subtracting the standard resistance from total resistance the resistance in car circuit may be obtained. By this method one can readily observe how cars work on different notches of the controllers, thus enabling one to adjust the resistances under the car satisfactorily.

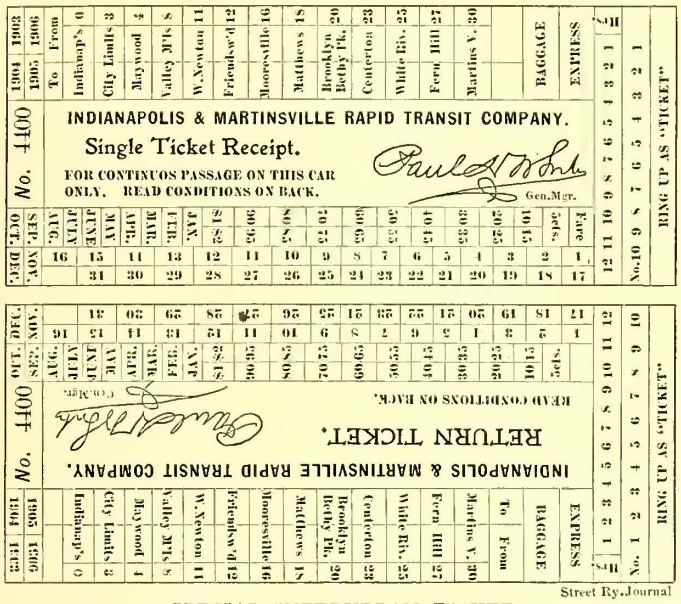
There is a small window on one side of this room, directly in the center of the testing track, from which the man making the test can see the operator of the car under test. Directly under the eyes of the man making the test are the meters, and to the right and within easy access is the switchboard. In connection with this switchboard are the switches, plugs, resistances, etc., for testing arc lights, headlights, incandescent lights, etc.

This room is equipped with a standard direct-reading ohmmeter, a Conant coil-tester, a Whitney bond-tester, a magneto bell and small tools, etc., for making tests. On the wall of the room is an air gauge and coupling for testing and setting air governors for air-brake cars. After the governor has been repaired and tested electrically it is then put under the final air test, after which it is ready for use. On two sides of the room is a small bench used for making light repairs. In one of the corners is a desk used for keeping all records of tests, car records, etc. We have found that this little room with its conveniences is a very indispensible feature in an electrical street car shed or barn.

D. L. Macaffree, General Manager.

TICKETS ON THE INDIANAPOLIS & MARTINSVILLE LINE

The accompanying illustrations are reproductions of the form of ticket used on the Indianapolis & Martinsville Rapid Transit Company's line, as designed by Paul H. White, general manager. One peculiarity of this ticket is that when half of it is used it constitutes a single ticket receipt for the passenger,



Street Ry. Journal

SPECIAL INTERURBAN TICKET

and the return ticket part is turned in by the conductor as the stub of this receipt. If a return ticket is issued to the passenger the whole ticket is torn out, including both the single ticket receipt and the return ticket. Either ticket must be punched or torn from the book in the presence of the passenger and rung up as a ticket on the fare register. The same ticket is used for transportation of baggage or express when so punched.

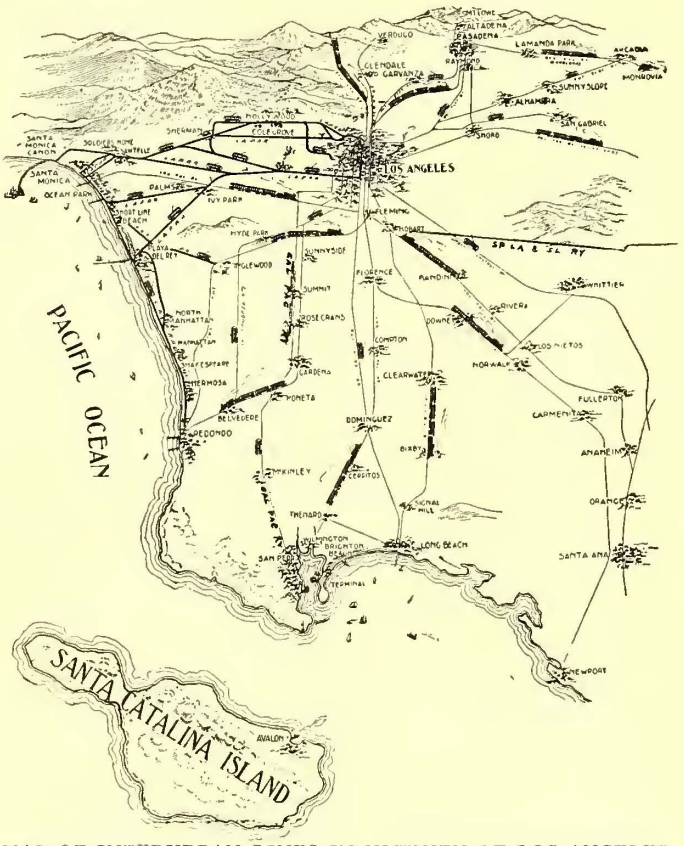
PROPOSED ELECTRIC RAILWAY BETWEEN HOUSTON AND SOUR LAKE, TEX.

The announcement is made that the Houston, Liberty & Sour Lake Interurban Railway has been financed. The plan of the company is to build an interurban electric railway between Houston and Sour Lake, covering a distance of 57 miles, or 8 miles less than the distance on the Southern Pacific Railroad, which it will parallel between those points. Houston, the main terminal, has a population of 100,000, and for the first 10 miles east of that city the line runs through one of the finest truck farming countries in the world and a region that is developing very rapidly. For the next 10 miles the road runs through forest land that has not yet been developed; then for 10 miles it runs through what is known as "the rice belt." It then touches Liberty, a town with a population of 3000. Between Liberty and Houston there are scattered along the line small towns with populations ranging from 500 to 1000. The first city of importance after leaving Liberty is Big Hill, which is about 10 miles out. The country between Liberty and Big Hill is principally devoted to agriculture. At Big Hill oil development is being carried on that promises to be almost as extensive as that at Sour Lake or Spindle Top. Ten miles east of Big Hill is Sour Lake, a city of 7000 inhabitants. At the latter place connections will be made with the Beaumont & Sour Lake Electric Railway, and connections will also be made with the line projected to Saratoga. The Beaumont & Sour Lake road is already under construction, and while interests identified with the Houston, Liberty & Sour Lake Railway are connected with it, it is denied that there is any connection between the two companies. Practically all of the right of way has been obtained for the Houston, Liberty & Sour Lake Railway. It is planned to build the line up to the standard of recent interurban practice. Seventy-two-pound T-rail will be used and the track will be thoroughly ballasted. Timber sufficient for bridging, piling and other work is at hand. It is planned to handle passengers, freight and express traffic. Edward Kennedy, of Beaumont, is in active charge of the affairs of the company.

INTERURBAN ELECTRIC ROADS OUT OF LOS ANGELES

The Los Angeles-Pacific Railroad Company has just issued a map showing the city and suburban lines, steam and electric, in and about Los Angeles, Cal., and connections with surrounding towns. The map is drawn to scale and the relative positions of the various localities are correct, except for Santa Catalina Island, which should be much farther from the mainland. Proposed lines do not appear on the map. One from Los Angeles to Glendale, a distance of 10 miles, is about to be built by the Los Angeles & Glendale Electric Railway Company, while the Pacific Electric Railway Company has completed surveys for an extension from Monrovia to Azusa, Covina, Lordsburg, Pomona and Ontario, a distance of about 20 miles. The latter company will also extend its proposed line from Whittier to Santa Ana on to Newport, and a branch is also building from Dominguez to Wilmington.

The map shows, furthermore, how the electric road has paralleled the steam roads to almost every point, and this practically all within two years, except to Santa Monica and Pasadena. Managers of both the Southern Pacific and the Santa Fe now admit that their passenger traffic to seaside resorts is almost nil.



MAP OF INTERURBAN LINES IN VICINITY OF LOS ANGELES

While the Los Angeles & Redondo Railway Company has an electric line into Redondo it is agreed that all territory north of that point is for the exploitation of the Los Angeles-Pacific Railroad Company, while the great Huntington-Hellman interests are spreading out in every other direction, touching many places around Pasadena, Whittier, Long Beach and San Pedro.

Their future plans will also take them north, but they have no designs on the fertile country that lies west of Los Angeles down to the sea.

Mr. Huntington has said that his original plan for Southern California in the way of electric railways will mean the expenditure of $30,000,000. The work thus far done represents $10,000,000. To spend another $10,000,000 he recently organized the Los Angeles Interurban Railway Company.

AIR SAND BOX

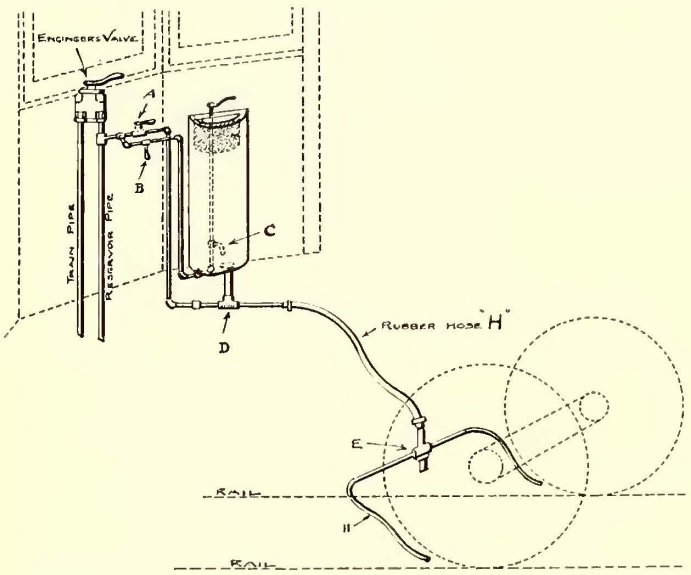
The accompanying illustrations refer to a sanding device manufactured by the Newark Air Sand Box Company, of Newark, Ohio, for all cars equipped with air brakes.

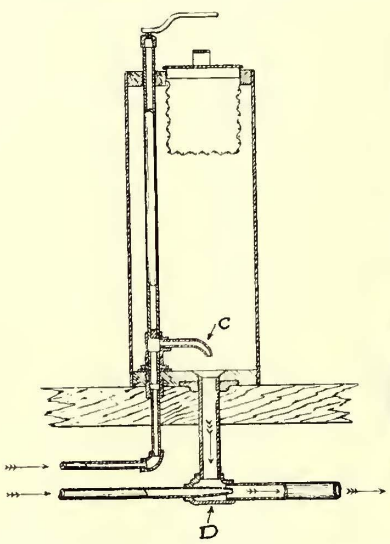
Fig. 1 gives a general outline of one equipment. The sand box proper has a screen or basket at the top, made of 3-16-in. wire mesh, which prevents stones or gravel passing through the pipes, and thus avoids clogging. This basket is removable and can be emptied at any time. The box is provided with a mixer, "C," as shown in Fig. 2. By applying the air at valve "B" the compressed air passes through this mixer, and by moving the handle on top of the box, blasts loose any sand which might be clogged. One of the advantages of the mixer is that it will dry damp sand almost immediately. By applying the air at valve "A" it passes through the T "D," which has a combining cone, as shown in Fig. 2, which forces the sand through pipes, is divided at "E," and delivers the sand in front of both wheels simultaneously.

Pipe 11, as shown in Fig. 1, is fastened to the truck, and a rubber hose, "H," allows it to swing with the truck so as to always throw the sand directly in front of the wheels, even on the shortest curves, while other boxes deliver the sand from 20 ins. to 24 ins. from the wheel.

All pipes are air tight, and, therefore, exclude all water, which naturally collects in the spiral pipes.

This sanding device has been on the market a very short time, but it is already in extensive use on some prominent electric railways, among them being the following: Indianapolis & Northwestern Traction Company, Cleveland, Painesville & Ashtabula Railway Company, Columbus, Buckeye Lake & Newark Traction Company, Columbus, Newark & Zanesville Electric Railway, Canton & Akron Railway, Newark & Granville Street Railway Company, Columbus, Delaware & Marion Electric Railroad Company, and Indianapolis, Columbus & Southern Traction Company.



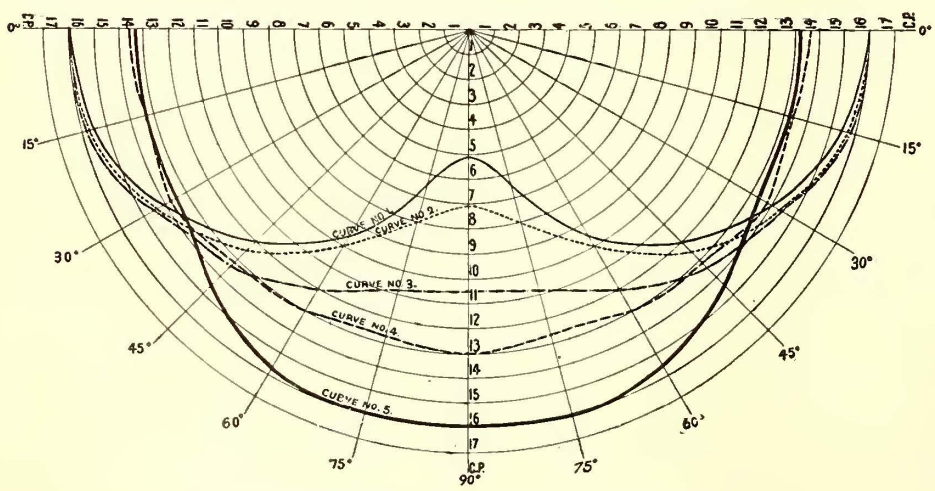


FIGS. 1 AND 2.—GENERAL OUTLINE OF AIR SAND-BOX EQUIPMENT AND DETAILS OF BOX

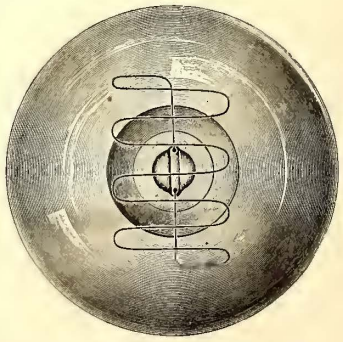
TIPLESS INCANDESCENT LAMP

DOWNWARD LIGHT TIPLESS INCANDESCENT LAMP

The accompanying cuts illustrate a novel incandescent lamp which has been placed on the market by the Downward Light Electric Company, of New York. The two features which radically distinguish this type from all other incandescent lamps are the arrangement of the filament and the abolishing of tips.



CURVES SHOWING DOWNWARD ILLUMINATION



VIEW, SHOWING ARRANGEMENT OF FILAMENT

By referring to the illustrations it will be observed that the filament has been designed to permit of a maximum downward light distribution, as this lamp is particularly intended for use in places where illumination of that character is preferable to

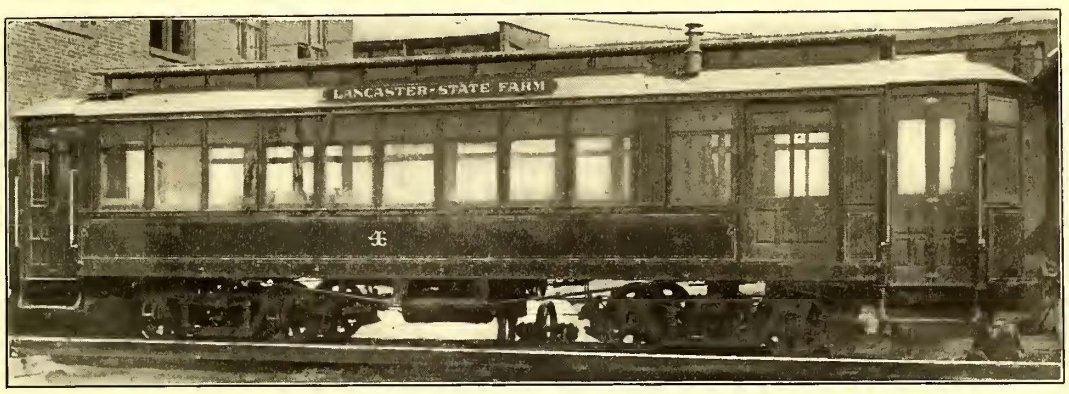
the usual method of light radiation. That the manufacturer has succeeded in developing this type will be evident from an examination of the light curves shown herewith. The curves as numbered represent the following types, which were tested by the Lamp Testing Bureau, of New York, and show total candle-power at 90 degs.

Curve No. 1 is for a 16-cp double-carbon lamp (5.1 cp); curve No. 2, 16-cp oval anchored lamp (7.1 cp); curve No. 3, 16-cp double round-coil lamp (10.5 cp); curve No. 4, 16-cp flattened double-coil lamp (13 cp), and curve No. 5, 16-cp "downward light lamp" (16 cp).

The tipless bulb avoids a great deal of breakage and helps to make the lamp especially serviceable when necessary to examine machinery details or seek for objects in obscure corners.

COMBINATION CAR FOR COLUMBUS, OHIO

The car shown in the accompanying illustrations is one which the American Car Company, of St. Louis, recently sent to the Fairfield County Traction Company, of Columbus, Ohio. It is mounted on the American Car Company's No. 14 M. C. B. type of trucks, and intended for high-speed service. Single platform steps are used at either end of the car, and platforms dropped low to bring these steps about 18 ins. from the rail-heads. Substantial vestibules have folding doors and sashes that drop into pockets. The side windows have two sashes, the upper being stationary and the lower arranged to drop into pockets which extend to the bottom of the double sills, the sills being spaced apart for this purpose. The sills are 2¾ ins. x 7¾ ins. each, with sill plates ⅝ in. x 8 ins. The center sills are composed of 7-in. I-beams. The vestibules, as well as the car sides, are sheathed with tongued and grooved poplar boards. Heavy under-trusses are anchored at the bolsters; platform knees are reinforced with angle-iron, and angle-iron bumpers protect and strengthen the platform. The seats are of spring cane with reversible backs, nine to each side, giving a seating capacity of thirty-six. The seats are 34 ins. long, leaving the aisle 25 ins. wide. The baggage compartment is 8 ft. 7 ins. long, and has sliding doors at both sides.



EXTERIOR OF COMBINATION CAR

INTERIOR OF COMBINATION CAR, SHOWING SEATING COMPARTMENT

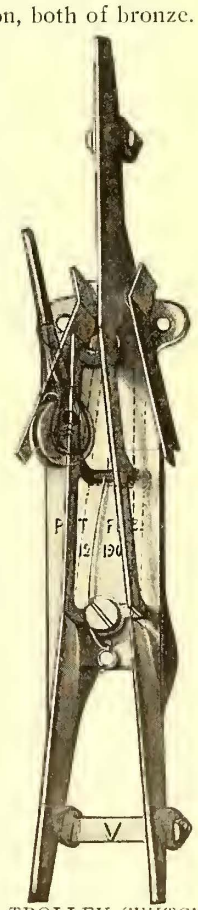
The general dimensions are as follows: Length over end panels, 34 ft.; over crown pieces, 44 ft.; from panel over crown piece, 5 ft.; width over sills, including sheathing, 8 ft. 3 ins.; from center to center of posts, 2 ft. 8 ins.; end sills, 4¾ ins. x 7¾ ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. The interior is finished in cherry natural color with similar ceilings. The wheel base of the trucks is 6 ft., and 33-in. wheels are used. The car has a four-motor equipment of 38 hp.

TROLLEY SWITCH

A simple and durable trolley switch which, it is claimed, will not cause the trolley wheel to leave the wire, has been developed by the Cornell-Easton Company, of Syracuse, N. Y. The manufacturer says that many severe tests have demonstrated that this contrivance works with the same reliability under any weather and speed conditions. The device is shown in the accompanying illustration, and consists of but two main parts, a top plate and a movable switch section, both of bronze.

The top plate, or support, the stationary rails at the end of the top plate and the flanges on either side of the top plate, are in one piece. The tops of the stationary rails from the top plate are grooved diagonally to their ends to receive the trolley wire. These stationary rails are also provided with one set of ears, used to fasten the trolley wire. The main trolley wire is placed in the single stationary rail and passed over the top of the top plate and out of one of the two stationary rails. The stub, or short wire, which is used over one side of the ground track, is placed into the groove of the other stationary rail. After this wire has been firmly secured the small piece may be left on top of the top plate. As the top plate is made solid and the flanges on either side extend 1⅝ ins., no rain or sleet can get into the movable switch section to freeze it up or otherwise impair its efficiency.

The movable switch section is composed of two rails placed between the stationary rails and fastened to the top plate at one end by one pivot bolt and to a small movable plate at the other end. This small movable plate is provided with a tongue working in a groove in the top of the single stationary rail, thus making it impossible for the movable switch section at this end to drop



TROLLEY SWITCH

down. All rails are made 3-16 of an inch wide, being narrower than the average trolley wire, and will therefore stand more of a cramp from the trolley wheel than the wire without causing the trolley wheel to jump off. In fact, after a trolley wheel has entered the switch there is nothing for it to do but go right through.

The spring used to retain the movable switch section in one position is made of bronze spring wire, is reversible, and is used to retain the movable switch section either to the right or left, as may be necessary. It is fastened to the bottom of the top plate by a spring cotter pin and to the small movable plate by being placed in a hole in said plate.

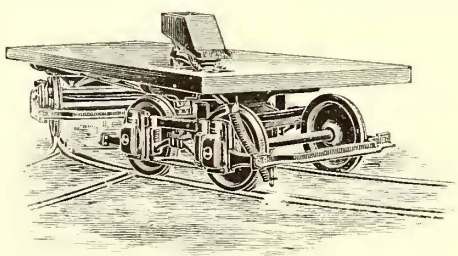
When the switch is hanging on the trolley wire the right-hand rail of the movable switch section is in alignment with the single stationary rail. Thus it will be seen that a trolley wheel entering the switch takes the right-hand rail and proceeds through the switch and out onto the wire toward the opposite switch. Assuming that the trolley wheel has reached the switch, has entered on the stationary rail on the left side of the switch and is proceeding on its way out on the main trolley wire, it will be observed, by reference to the cut, that the trolley wheel has come in contact with the left flange, crowded the left rail of the movable section into alignment with the single stationary rail and at the same time has also crowded the right rail of the movable switch section against the right-hand flange, thus giving the trolley wheel an uninterrupted passage through the switch on to the main wire. Immediately after the trolley wheel passes the connection of the rails the small bronze spring pushes the left rail back and draws the right rail into alignment with the single stationary rail, thus leaving the switch in its original position.

This switch is now in use under very severe conditions on the Syracuse, Lakeside & Baldwinsville Railway, of Syracuse, N. Y., and the manager of that company speaks very highly of its efficiency.

POSITIVE TRACK SANDER

The accompanying cut is an illustration of a railway track sander which has been placed in service on a large number of street railways after numerous practical tests by the makers—the Positive Railway Sander Company, of Lancaster, Pa.

The arrangement of the parts is such that with every stroke



POSITIVE TRACK SANDER ON FLAT CAR

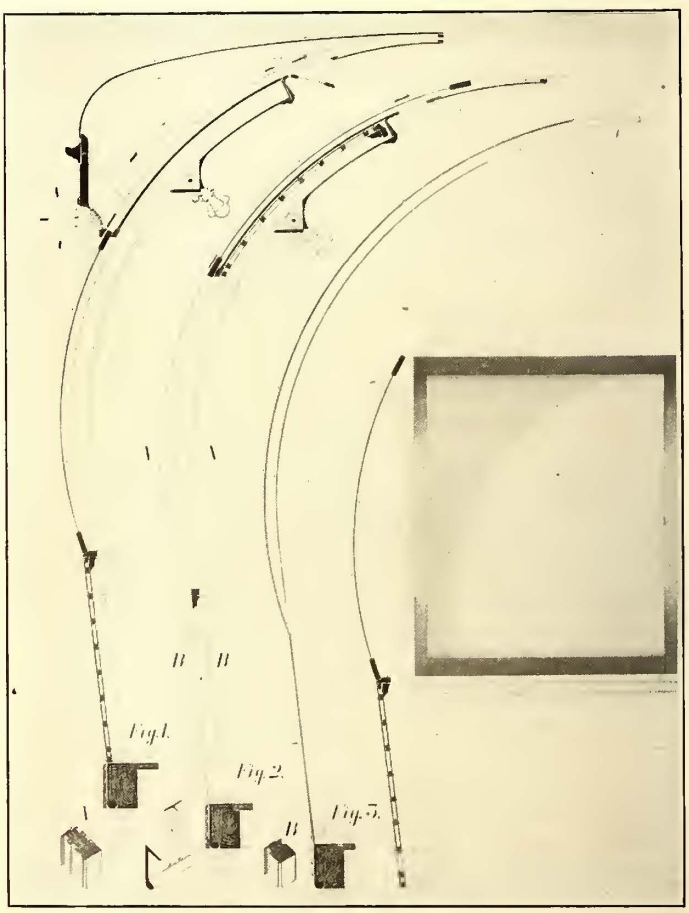
of the lever, or foot pressure, the sand will leave the box and pass down the pipe. The end of this pipe is attached to the car truck and is kept central with the wheel, so that the sanding can go on irrespective of the track radius. Owing to the connection of the sanding pipe with the car truck it conveys the truck vibration to the sand box, thereby keeping the sand in constant motion and preventing freezing or hardening.

The sand box is made of durable galvanized iron, and is placed under a car seat to prevent freezing. It is stated that the sand can be thrown wet or dry, and that there is no necessity for screening or drying.

If the device is operated with a hand lever it is only necessary to move the latter back and forth; if with the foot, press it up and down like a gong. The brush under the lower part of the sand box is stationary, but the corrugated parts coming in contact with it give it a vibratory motion, throwing the sand against a check or dam, located about 1 in. back in the forward part of the box. The loosened sand flows out on an inclined spring lip in the front and passes down the pipe. At no time is any sand lost through the motion of the car, because the sanding depends entirely upon the operation of either the hand lever or foot pressure. One car requires two boxes—one at each end. A sheet-iron fender, about 14 ins. long by 12 ins. wide, is fastened beneath the car floor to prevent any refuse from getting into the upper part of the pipe. This fender does not form an integral part of the sander but is recommended by the maker as a valuable though inexpensive auxiliary.

NOVEL CONVERTIBLE CAR

A new convertible car which embodies some radical departures from present practice has been designed by Hermann Romünder, of Bloomsbury, N. J. The characteristic features of construction of this car are side sections, each consisting of two parts, a large curved window and a flexible panel with window sill underneath it, movable between vertical side posts or ribs; the posts being made of a T-shaped steel rib covered with wood containing the necessary grooves in which the side



DETAILS OF CONVERTIBLE CAR

sections slide. These posts are reversible and interchangeable, and the car, owing to the steel frame construction, can, therefore, be made of any desired width.

The lower part of these side posts up to the line of the windows is straight, the upper portion being bent in a circular arc to accommodate the curved windows, both open and closed. By means of this construction sufficient floor area is obtained for seats and aisles as well as abundant space in the upper part of the car.

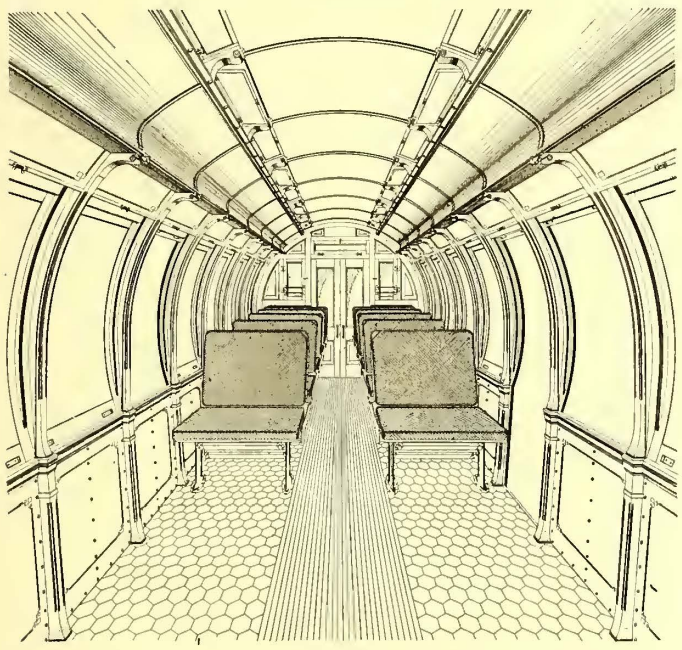
The large windows are of one sheet of curved glass, each held in a steel frame, providing an absolutely rigid curved

window sash, and are stated to be larger than those of any other car now in use. On this account alone it is an ideal observation car.

The flexible panels below the windows are composed of two plates of veneered wood, each consisting of three or more ply veneer, with reversed grain and united by a waterproof cementing composition; both plates being held together by lateral slats. The air space provided betwcen the veneer plates serves to keep out cold, wet and draft. The panel is light in weight and of the usual thickness, also, owing to the reversed grain of the adjoining veneer layers in the veneer plates, of great strength and durability and lateral stiffness, but sufficiently elastic and flexible longitudinally, so that panels made of this construction can be easily raised and lowered in the lower straight and upper curved grooves between the side posts. At its upper end the flexible panel is provided with a regular window stool or sill which serves as an arm-rest.

When the windows and flexible panels of all side sections are closed down the car is completely tight on all sides. Any or all of the windows may be raised without disturbing the flexible panels, whereby the car is converted into an ordinary closed car with open windows. When the flexible panels are also raised into the roof the car offers every advantage of the open type during warm and dry weather.

The roof is constructed of the same material as the flexible panels, wood veneers with layers of reversed grain, united by

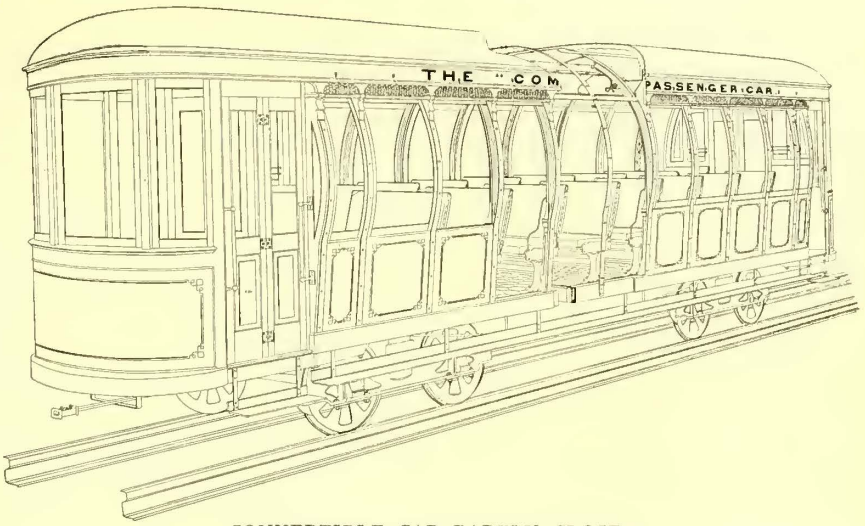


INTERIOR OF CONVERTIBLE CAR

a waterproof cementing composition, making it considerably lighter in weight than the present roof construction, of greater strength and durability and impervious to moisture and atmospheric influences. This roof extends over the entire upper portion of the car from side to side and end to end, overhanging the body of the car, so as to furnish one continuous strong and permanently closed outer cover for the car.

Another striking feature of this car which distinguishes it from all other cars now in use is the system of ventilation, whereby the monitor roof is entirely dispensed with and all the space otherwise occupied by the same is utilized to make the interior of the car higher and roomier; thus the car, while being 6 ins. higher inside than the ordinary trolley car, is 3 ins. lower outside.

The ventilation is accomplished by an air space formed between the overhanging outer roof, supported by the curved rafters and side posts and the inner veneered ceiling of the car. Perforated curved metal sheets or screens, placed in openings between the side posts above the window line, under the eaves of the overhanging roof, admit the outside air to this air space,



CONVERTIBLE CAR PARTLY CLOSED

after which it enters the interior of the car through openings in the ceiling of the car, which, when required, can be closed partly or entirely by panel sashes. By reason of this arrangement the outside air on entering the air space must rise up to these openings in the car ceiling and through same into the interior of the car. Consequently, it has been tempered somewhat in cold weather before reaching the interior of the car, affording a maximum of ventilation while at the same time all impurities, dust, soot, cinders, etc., are deposited during the upward course of the air, and only pure air can enter the car.

The details of the car are shown in the accompanying cuts. Fig. 1 shows a side post complete, with window and panel in closed position, the lamps being directly over the middle of the seat; also cut through the roof, the arrows indicating the travel of the air, rising upward from the outside and passing down into the car through the panel sashes in the ceiling of the car.

Fig. 2 shows the post with window and flexible panel in the upper part of the post when the car is open.

Fig. 3 shows the steel skeleton frame of the post covered with wood, and the grooves in which the window and flexible panel slide.

"A" shows cut through the post at A-A, with both grooves, one for the window the other for the flexible panel. "B" shows cut through the posts at B-B, with the groove for the flexible panel. Between both is a cut showing how the T-bar of the side post is riveted to the bulb angle-iron of the underframing, extending the entire length of the car body on both sides.

The other views show the window with lower flexible panel, from the inside of the car, as well as a cut through same.

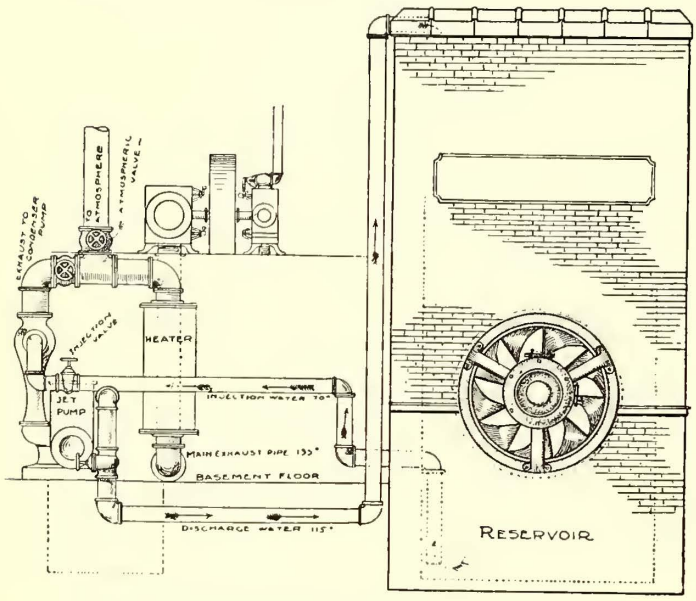
The inventor believes that this design and construction cover better than other types all the requirements sought for in a first-class convertible car as regards durability, comfort and attractiveness. This car can be built with or without baggage, smoking, toilet or other compartments, as may be required by the character of the service.

A high-speed suspended railway, to operate under the Romanoff system, is to be constructed in the grounds of the St. Louis Exposition. Mr. Romanoff, the inventor of the system, is a well-known Russian electrical engineer, and is expected to arrive in the United States within a few days.

COOLING TOWER AND FEED WATER SYSTEM

The accompanying illustration shows the piping arrangement used in connection with the Jennison water-cooler tower, manufactured by the International Steam Engineering Company, of Atlanta, Ga. This cooling tower is intended for use in places where it is impossible to easily secure enough water for condensation. It allows the same water to be used again and again, thus eliminating the necessity for a continuous volume of water.

A novel cooling method is employed in this tower, for instead of using tilings or boards arranged like checker work, the water enters the top of the tower through the discharge pipe into a steel trough, from which lateral pipes extend. These pipes are bored to throw the water upward at an angle of 30 degs. As soon as the water loses its pressure it falls, its gravity being greater than the surrounding air currents. Disintegration takes place and the water falls in separate drops similar to lead in a shot-tower. Thus every drop of liquid becomes enveloped by a cooling air current instead of the water being evaporated in mass. After passing through the first trough the water percolates through an indefinite number of troughs until the desired reduction in temperature is attained.



PIPING ARRANGEMENT FOR COOLING TOWER

By this method and the erection of a cupola a great quantity of water is retained which would otherwise pass off to the surrounding atmosphere.

The tower is built of brick, wood or steel, as may be desired, brick being preferable on account of its durability. The brick towers are made water-tight through the employment of cement. The use of this construction will keep the tower and cupola absolutely clean and dry. The interior construction is chiefly of steel-channel and I-beams. The fans, which are also built of steel, are motor driven and of the propelled type. The use of this type is said to remove the danger of freezing in cold weather, thus avoiding the wreckage of fans, which has heretofore been a serious difficulty in connection with other types. This also eliminates the question of moisture thrown out by the back lash from straight flat disc fans.

The manufacturer believes that further economies may be obtained when this tower is used in connection with a modern feed-water system. It has long been the practice in many power stations to send the feed-water to boilers in a compound-condensing system at about 140 degs. F. This can be greatly improved upon in modern installations of primary and secondary heaters, using the exhaust steam from the auxiliary condenser and boiler feed pumps and heating the water to a temperature of over 200 degs. F.

LIMITED SERVICE ON THE CLEVELAND & SOUTHWESTERN

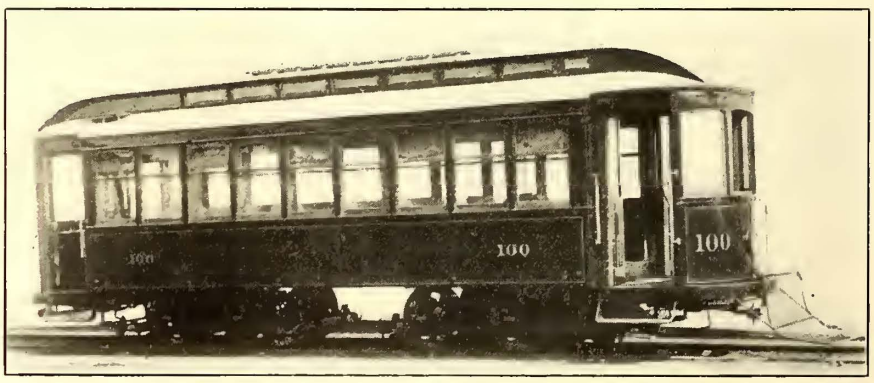
Following the example of other interurban roads running into Cleveland, the Cleveland & Southwestern Traction Company has announced limited service over its Wellington and Norwalk divisions. A limited car will leave Wellington at 7 a. m., and reach Cleveland at 9 a. m., cutting thirty minutes off the regular schedule. The Norwalk limited will leave at 7:30 a. m., and reach Cleveland at 10:00 a. m., cutting forty-five minutes off the regular schedule. The outgoing limited cars will leave Cleveland for Norwalk at 3:40 p. m. and for Wellington at 4:40 p. m. The half-hourly cars on all lines will be dispensed with for the winter, and there will be two extra cars each way to Berea and return.

SEMI-CONVERTIBLE CARS FOR BUFFALO

The J. G. Brill Company lately furnished several of its patented semi-convertible cars to the Buffalo & Williamsville Electric Railway Company. Buffalo was one of the first cities to use this type, the wide streets permitting the use of cars of suburban character. Williamsville is about 5 miles from the center of Buffalo, and the line between is almost a straight one.

As will be seen from the illustration the cars have steam car roofs and completely enclosed vestibules. The sashes in the vestibules are composed of single lights; the vestibules are wainscoted and have pockets for the windows in the sashes. As the side windows are arranged to be raised into roof pockets in the usual method of the Brill semi-convertible car, and there are, therefore, no wall pockets, several inches of transverse space are gained.

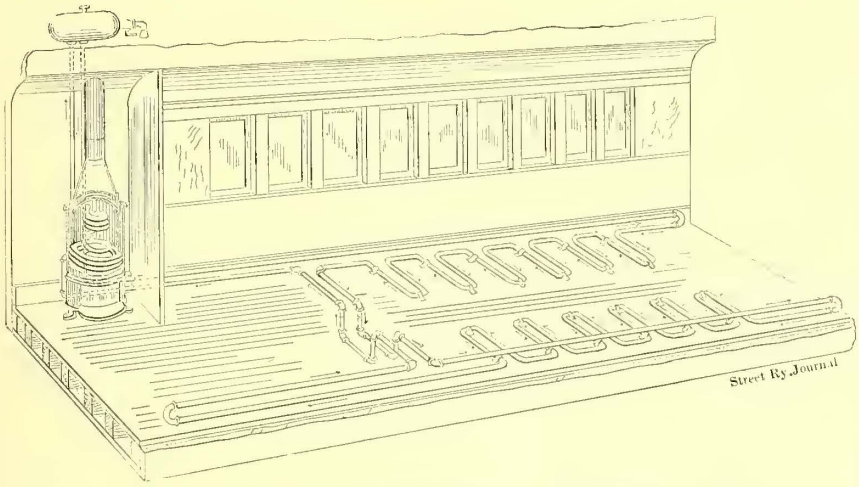
The outside width of the car is 8 ft. 2 ins.; deducting 2 ins. on each side for the walls the interior width is 7 ft. 10 ins., allowing 36-in. seats to be used, leaving aisle 22 ins. wide. The interiors are handsomely finished in cherry with ceilings of three-ply veneer birch. The cars are 25 ft. 4 ins. long over the end panels and 34 ft. 9 ins. over vestibules; width over sides, 8 ft. 2 ins.; center of posts, 2 ft. 8 ins. The side sills are 4 ins. x 6¾ ins., plated on the inside with ⅜-in. x 12-in. steel, which plates extend well up the posts to which they are secured. Corner posts are 3¾ ins. thick, and side posts 3¼ ins. The trucks are Brill 27-F, with 4-ft. wheel base, 33-in. wheels and 4¼-in. axles, and are equipped with two 38-hp motors per car.



SEMI-CONVERTIBLE CAR FOR BUFFALO

HOT WATER HEATING

The approach of cold weather again brings up the subject of satisfactory heating apparatus for both urban and interurban cars. Of the different systems in use hot-water heating in connection with independent heaters has found great favor,



CAR-PIPING PLAN IN CONNECTION WITH HOT-WATER HEATER

because it is simple, economical and reliable, and with proper piping makes possible any desirable heat radiation.

A piping plan, which is sometimes used in connection with hot-water heating, is shown herewith in connection with the "Mighty Midget" heater made by William C. Baker, of New York. The piping may be arranged as considered desirable, although straight-line piping is most commonly used. The receptacle shown above the heater contains the water supply. It is protected by a thick coating of an asbestos compound which also prevents the radiation of heat.

This heater is especially suitable for railway cars, as it may be placed in any convenient position. If placed in the vestibule of the motorman it can be easily cared for by him, there will be no ashes or cinders to annoy the passengers, and the vestibule will be kept well heated, thus preventing the frosting of the vestibule windows and giving the motorman a clear view of the track ahead.

The hot-water pipes leading from the heater are laid out to radiate the proper amount of heat to each portion of the car. As the operation of the system only depends upon a good supply of fuel there is little danger that the passengers will be obliged to suffer from cold in stalled cars during a power breakdown.

It is interesting to note that these heaters are in successful service, using soft coal for fuel, on the White Pass & Yukon Railroad, in the Klondike gold fields, where, in winter, the temperature sometimes falls as low as 50 degs. below zero. It is said that they have never failed to comfortably warm the cars even at this low temperature. A prominent interurban railway in the Middle West is using over 1000 of these heaters, and many others are in use on steam and electric railways.

By arrangement with the Boston Elevated Railway the Boston & Worcester Street Railway Company is now operating cars from Worcester through to Park Square, in Boston. Heretofore the Worcester cars have run only as far as the terminus of the Elevated line at Chestnut Hill, Brookline, where it has been necessary for passengers to change cars.

CARS FOR THE ATLANTIC CITY & SUBURBAN RAILWAY

The J. G. Brill Company has completed eight fifteen-bench "Narragansetts" and seven semi-convertible cars for the Atlantic City & Suburban Railway. In the issue of the STREET RAILWAY JOURNAL of Oct. 10, the destruction of the Pleasantville car house and power house of the railway, by a severe wind storm, was described. It was mentioned in that article that a number of the new cars were standing in the car house at the time of its demolition by the hurricane. Pleasantville is situated several miles inland from Atlantic City, and there is considerable travel between the two communities. The line has lately been opened and would now be in good running order had not the catastrophe occurred. A limited number of cars are being run for the present until the cars, which were only slightly injured, are repaired.

The semi-convertibles are 30 ft. 8 ins. over end panels, and 40 ft. 1 in. over vestibules; from panel over vestibules, 4 ft. 8½ ins.; width over sills, 7 ft. 10½ ins., and over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¼ ins. The side sills are 4 ins. x 7¾ ins., plated on inside with ⅜-in. x 12-in. steel; the end sills are 5¼ ins. x 6⅞ ins.; corner posts, 3¾ ins. thick, and side posts, 3¼ ins. Interiors are finished in natural color cherry, and ceilings are of birch.

The "Narragansett" type of cars are 40 ft. 4⅜ ins. over crown pieces, and from center of corner posts over crown pieces, 4ft.; width over sills, 8 ft. 1 in., and over posts at belt, 8 ft. 2½ ins.; sweep of posts, 2¾ ins.

Cars are mounted on Brill 27-G trucks, with 4-ft. wheel base, 33-in. wheels and 4-ft. axles. Four 30-hp motors per car are used.

SEMI-CONVERTIBLE CARS FOR TEXAS

The accompanying illustration shows one of a lot of semi-convertible cars built by the G. C. Kuhlman Car Company, of Collinwood, Ohio, for the Northern Texas Traction Company. This car is 42 ft. long over all, finished in cherry, with bird's-eye maple ceiling, and has highly finished bronze trimmings. The windows are in two sections, and by lowering them in the sides, the car is made an open one. The windows are completely concealed in the side of the car by a window stool to give it the effect of an open car. The car has swinging gates on both ends, so as to be run on double track, and can be equipped with side or Hale & Kilburn walk-over seats. The construction throughout is the Kuhlman standard.

SEMI-CONVERTIBLE CAR FOR TEXAS

A company is being organized by Dayton (Ohio) interurban interests to erect a terminal station there. Dr. J. E. Lowes, of Dayton, is the principal promoter.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR.

CONTRACTUAL POWERS OF CITIES AND STREET RAILWAYS

The celebrated Rapid Transit case in the courts of New York (Sun Pub: Assn. vs. Mayor, 152 N. Y., 257) went to very considerable lengths in upholding the authority of a city to undertake, and pledge its credit for, elaborate improvements for the benefit of the public. A clause of the New York constitution forbids cities from giving money or property, or loaning municipal money or credit to or in aid of any individual, association or corporation, or from becoming directly or indirectly the owner of stock in, or bonds of, any association or corporation, and from incurring any indebtedness except for city purposes. The object of this provision was to suppress the notorious abuses that had grown up through the issue of municipal bonds and the use of municipal credit and funds to promote the construction of railroads. The majority of the Court of Appeals, however, in view of the peculiar geographical situation and topographical condition of the city of New York, were able to say that an underground rapid transit railroad was so clearly a matter of municipal necessity as, under a liberal construction of the constitutional clause, to constitute a city purpose. Accordingly, the Rapid Transit Act, providing, as it did, for the issue of bonds by the city for the construction of a railroad within its limits and for a lease of the same for a period of years to a private corporation upon such terms as the Legislature might prescribe, was held constitutional.

This was a case of peculiar, almost unique, municipal conditions, and the power exercised by the city was under a special statute. A similar liberal view of "city purposes" and of the discretionary authority of cities to make reasonable contracts in furtherance of such purposes is coming more and more to be taken by the courts, even in cases where cities enter into obligations under their inherent powers and without relying upon special legislative permission. One of the most recent and significant illustrations of municipal freedom of contract is furnished by City of Detroit vs. Detroit United Rys., decided by the Supreme Court of Michigan in June, 1903 (95 N. W., 736). It appeared that a street railway company taking over certain franchises granted to another company consented to a low fare as a consideration for an agreement with the city, that all paving, repaving, or repairing of pavements on streets used by the company should be at the expense of the city, except in certain instances, and that there should be no charge whatever, in any form or manner, against the company for repaving and repairing of pavements and streets on which the company operated its cars. It was held that by this agreement the city bound itself to repair the foundation necessary for the support of the company's tracks; that the city had authority to so bind itself, though the foundation must be heavier and stronger than that required by the ordinary traffic on the streets; and that such agreement did not contemplate the engaging by the city in a work of "internal improvement." The following language from the opinion of the Michigan court is well worthy of quotation:

"It is claimed, however, that the city had not the authority to bind itself by such a contract, for the reason that the construction and use of a street railway requires a heavier and stronger foundation than is required in the other portions of the highway used by lighter vehicles. A street railway is a public utility, it is an appropriate and necessary method of using the highway, and the municipalities may permit them to occupy and use portions of the streets. Such occupancy is in common with that of the general public, all persons being at liberty to drive upon and over them where they are laid in the traveled portion of the street. The street railway law does not in any way relieve the municipalities from the responsibility of maintaining the highways in a reasonably safe condition for public travel, and, as it cannot shift its liability to a railway company by contracting with it for the maintenance of the way, it would seem that it should be authorized, if it is not under a legal obligation, to repair the way when out of repair, whatever the cause. The right to assess the cost of pavement upon adjacent landowners is settled, and a wide discretion as to kind, solidity and cost is left to the authorities. There can be no doubt that they may specify such a pavement as the present or prospective traffic of the street may require, and provide varying foundations according to circumstances. In all ordinary cases the same are made adequate to sustain the vehicles that will traverse the streets. If street cars could be run without a fixed way of special construction, so that they could run upon any portion of the highway, the foundations of the entire roadway would need to be heavier and stronger, and in such case there would be no impediment to the construction of the same in the ordinary routine of building and repairing highways, unless it be the fact that the running of such cars might be a monopoly. Street railways are adapted to aid travel in the public highways, and, while the laws providing for their use impose upon private corporations the burden of constructing and operating them, all such laws contemplate that they will be constructed upon the highway. They presuppose a highway maintained by the public, and we are of the opinion that it is not beyond the authority of the public officers to build a highway that will support such traffic, even though it need a heavier pavement than ordinary traffic requires. We are also of the opinion that it cannot be said that the city engages in a work of internal improvement by making a contract whereby it shall construct and repair its highways and pavements, instead of allowing the railroad company to interfere with them."

In the legal department of this journal for Sept. 26, 1903, under the title, "Police Power and Roadbeds," there was discussed the right of cities to require street railways to perform such special acts in and about their tracks and roadbeds as are rendered necessary by the existence of the roads. The doctrine of the Michigan case is supplementary to that laid down in the previous article in that it upholds a city's power expressly to contract to perform the special acts—to furnish and keep in repair special kinds of pavement or foundations or other accessories of the roadbed—and recognizes the city's liability under a contract of that class. The policy of both the cases referred to is progressive, and in accordance with common sense and justice. The general judicial tendency at present is to presume in favor of liberty of contract between municipalities and street railway companies, and not to condemn agreements as beyond the power of either party, merely because they are of unusual and special character. Perhaps the very latest example is affored by the decision of the U. S. Circuit Court, N. D. N. Y., in Thompson vs. Schenectady Ry. Co. (July, 1903, 124 Fed., 274). It was held that a grant to a street railway company of the right to maintain a line of road on a certain street has no relation to its corporate franchise, and is not a franchise in such sense that it cannot be abandoned by the company by agreement with the city and the property owners without the consent of the State.

Note—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York.

LIABILITY FOR NEGLIGENCE

ALABAMA.—Street Railways—Injury to Passenger—Evidence—Trial—Cross-examination—Instruction.

1. On the cross-examination of plaintiff in a personal injury case, the witness complaining that counsel was trying to cross her so she would tell something that was not so, and asking for time to answer, the court said, "Give her time to answer it." Counsel said, "I have given her plenty of time," to which the court replied, "Sometimes you don't." Held, not error.

2. On cross-examination of a physician called by plaintiff in a personal injury case, defendant sought to show that, if she had been injured as claimed, she could not have walked as she afterward did. On redirect, the physician was asked whether, supposing she had limped and hobbled along, stopping frequently to rest, "couldn't she still have received the injury she complains of now, and done that?" Held, that the question was not

objectionable as calling for "a conclusion from the facts stated that the jury should draw, and not the witness, as an expert."

3. Where, in an action for personal injury, defendant had introduced testimony tending to show that plaintiff's physical condition was as bad before as since the injury, it was not error to permit her to be recalled and examined as to her condition before the accident.

4. Where plaintiff claimed to have been injured by the sudden jerking and stopping of a street car as she got on, a question to another passenger, "Did you see anything happen there that would have a tendency to hurt anybody?" was properly excluded as not calling for facts, but for the witness' opinion.

5. Where witnesses who have been put under the rule have violated the instructions of the court not to talk to any one about the case, it is not error to permit them to be questioned about such violations when called as witnesses.

6. A witness who had testified that, before the accident, plaintiff was weak and delicate, was properly asked on cross-examination if during such time plaintiff had not sat up at witness' house at night, when her baby died.

7. Where, in an action for personal injury, a physician called by defendant had testified that plaintiff was hysterical, and as to the symptoms and effects of such condition, it was proper cross-examination to ask him, "Is a patient any more responsible for a hysterical condition than for any other condition?" to test his knowledge as an expert on hysteria.

8. The physician having testified that it was taught that people who have lawsuits pending, and who are claiming to have been injured by accidents, and claiming money for them, imagined they were hurt, etc., and having further stated that he did not say such persons were necessarily hysterical, plaintiff was entitled to ask him on cross-examination, "Are they hysterical?"

9. The question was not objectionable as calling for a matter of common knowledge.

10. In an action for personal injury, to permit a physician to be asked whether another physician who has testified in the case is a skilled physician, and how he stands, is error.

11. Where, in an action for personal injury, a physician testified that he treated plaintiff several years before the accident, detailing her complaints, and that he examined her the day before, and stated her complaints then, refusal to permit him to testify whether they were not the same complaints she made when he treated her before was error.

12. Where, in an action against a street railway company, the negligence alleged was in starting the car with a jerk as plaintiff was getting on, and then suddenly stopping, it was error to permit the conductor to be asked on cross-examination how fast they ran when approaching the crossing.

13. Where the conductor had testified as to how he started the car, it was proper cross-examination to ask him how he usually started his car from the station.

14. Where a witness for the defendant was asked on cross-examination if he had not served a term in the penitentiary, or been convicted, and answered "No," it was not competent for defendant to afterwards call a witness to testify to his general character in the community.

15. Defendant objected to a certain clause in the charge, but said that if a certain word was inserted he would withdraw the objection. The court said that he did not think it necessary, but, to oblige counsel, he would insert the word. Held, that the remark of the court was not error.

16. Where, in an action against a street railway company, negligence was charged in one count in starting the car with a jerk, and in another with suddenly stopping, an instruction that if the jury "believe from the evidence that by the starting of the car the plaintiff was not jerked, slung, or thrown one way, and by the stopping of the car she was not jerked, slung, or thrown the other way, the verdict must be for the defendant," was properly refused.—(Birmingham Ry. & Electric Co. vs. Ellard, 33 Southern Rep., 276.)

ALABAMA.—Carriers — Assault by Servant — Liability — Complaint—Sufficiency—Witnesses.

1. An allegation of the complaint, in an action against a street railway company for an assault, that it was committed "while plaintiff was engaged in or about becoming a passenger on said car," did not show that plaintiff was a passenger.

2. A carrier is not liable for an assault committed by its servant or agent on a person not a passenger, and having no relation with the carrier, nor in any way encroaching on its rights, unless committed by its authority and under its direction.

3. A count in the complaint in an action against a carrier for an assault committed by one of its servants having alleged that plaintiff was at the time a passenger on defendant's car, it was not necessary to aver that it was committed within the scope of the servant's duty.

4. A Jew was asked on his cross-examination if he considered an oath binding when he took it with his hat off. A general objection to the question was interposed and overruled. He answered that under the Jewish law an oath is not considered binding unless one is sworn with his hat on, and that, if he had been in the old country, he would not have considered himself bound to tell the truth unless his hat were on. Held, that there was no error in overruling the objection.—(Birmingham Ry. & Electric Co, vs. Mason, 34 Southern Rep., 207.)

ALABAMA.—Street Railways—Killing Dog—Sufficiency of Complaint—Residence of Defendant—Plea in Abatement—Judicial Notice—Jurisdiction of Notary—Instructions.

1. A complaint in an action against a street railway for the killing of a dog, which averred that defendant, while operating its railway, through its agents, "did carelessly and negligently run over and kill" plaintiff's dog, sufficiently alleged negligence on the part of defendant.

2. Where a complaint in an action against a street railway for the killing of a dog alleged in one count that defendant, while operating its railway, through one of its agents, "did recklessly, wantonly, and willfully run over and kill" plaintiff's dog, it was not necessary to allege in that count specific acts of negligence on the part of defendant.

3. The circuit court of a county will take judicial notice of what ward in a city located in the county a notary public has been appointed for.

4. Where an appeal to the circuit court from a justice in an action against a street railway for the killing of a dog was tried on a plea in abatement, in which defendant averred that it resided outside the justice's ward, and that the dog was killed outside that ward, and the evidence as to defendant's residence was conflicting, plaintiff was entitled to an instruction that the verdict should be for her, if defendant resided in such ward, even though the dog was not killed there, as the averment in regard to defendant's residence made it necessary to find the truth thereof in order to sustain the plea.

5. In an action appealed to the circuit court from a justice, defendant, a street railway, pleaded in abatement that it resided without the justice's ward. Held, that plaintiff was not entitled to an instruction that defendant could be sued in any ward in which it did business by agents, as the issue raised by the averment in the plea was merely whether defendant resided in such ward.—(Russell vs. Huntsville Ry., Light & Power Co., 34 Southern Rep., 855.)

ALABAMA.—Master and Servant—Injuries to Servant—Street Railroads — Defective Track — Switches — Loose Tongue—Pleading—Evidence—Notice of Defect—Question for Jury.

1. Where, in an action for injuries to a street railway conductor by the derailment of a car at a switch, the complaint charged that the want of a spring at the switch, or other appliance to hold the switch rail in position, was a defect in defendant's ways, and that such defect had not been remedied by reason of the negligence of defendant, and that such defect was the cause of plaintiff's injury, the complaint presented an issue of fact, as to whether the want of such appliance constituted a defect in the track or switch, and was therefore not demurrable.

2. In an action for injuries to a street railway conductor by reason of an alleged defective switch, a plea alleging that the line was constructed under a contract with the city, under supervision of the city engineer, and that the switch was approved by such city engineer, and was first-class in every respect, was demurrable, since, if the switch was defective, its approval by the city engineer was no defense, and, if it was not defective, the matter covered by the plea was included in the general issue.

3. Where plaintiff alleged that he was injured by derailment of a street car, caused by the fact that the track at the point of derailment was out of gage, evidence that defendant's employee intrusted with seeing that the track was in proper condition was notified that the track was out of gage, and his response thereto, showing that he understood the existence of the fact stated, was admissible.

4. In an action for injuries to a street car conductor, caused by derailment at a switch, evidence that, by reason of defendant's failure to have the switch tongue fitted with a spring, it would become loose, and on numerous occasions the jarring from the front trucks of a car would turn the switch so that the rear trucks would leave the main track, which occurred on the occasion in question, presented a question for the jury, as to whether the switch as constructed was not defective, and, if so, whether such defect was the proximate cause of plaintiff's injuries.

5. Where, in an action for injuries to a street car conductor by derailment of his car, there was evidence that the track at the point

of derailment was out of gage, and that such defect was the proximate cause of the injury, as alleged, defendant was not entitled to an affirmative charge on such issue.—(Alabama Traction Co. vs. Reville, 34 Southern Rep., 981.)

ALABAMA.—Conclusion of Witness—Irresponsive Answer—Street Railway Company—Crossing Accident—Wantonness—Harmless Error.

1. Plaintiff's testimony, in an action against a street car company for injuries at a street crossing, that he had to get on the electric car track, or right at it, in order to cross a railroad track that an engine was on, is objectionable as a conclusion.

2. The testimony of witness that he was not aware the car was moving toward him before it struck him is not the statement of a conclusion, but of a concrete fact.

3. The answer, "He was doing all he could to stop," is not responsive to the question, "Did you see him do anything to stop?" and therefore may be excluded, though no objection was made to the question.

4. Though a motorman is not aware of the peril of one on the track in time to avoid injuring him, yet the company is liable if the motorman was guilty of wantonness in running his car over the crossing at the time and under the circumstances.

5. In an action for injuries, admission of plaintiff's conclusion is harmless; it tending merely to show he was not negligent, and the case being tried on the theory, and the jury being charged, that he was negligent.—(Birmingham Electric Co. vs. Jackson, 34 Southern Rep., 994.)

CALIFORNIA.—Servant — Injury — Negligence—Appliances—Duty to Adjust—Question for Jury—Expert Evidence—Damages.

1. Intestate was engaged on a construction train in distributing ties along defendant's road, when by reason of a sudden slackening of speed some of the ties fell off, carrying him with them in front of the car, and he was killed. There was no defect in the car other than stakes were not placed in the loops or pockets on the sides and ends to keep the ties in place. Intestate and his fellow servants loaded the car, and failed to place the stakes in position, though defendant had furnished stakes for that purpose. There was evidence that it was their duty to adjust the stakes. Held, error to charge in effect that it was defendant's duty to adjust the stakes; that being a question for the jury.

2. Whether stakes or uprights were necessary to make the car reasonably suitable and safe was a question for the jury.

3. The question as to the proper height of stakes to be used at the ends of a car loaded with ties is not a matter for expert evidence.

4. In an action against a railroad for the death of plaintiff's husband, an employee, an instruction that the jury might consider the fact that deceased was the sole support of the plaintiff was improper, though not ground for reversal.—(Kerrigan vs. Market St. Ry. Co., 71 Pacific Rep., 621.)

CALIFORNIA.—New Trial—Appeal—Discretion—Review.

1. On appeal from an order granting plaintiff a new trial on the ground of insufficiency of the evidence to sustain a verdict for defendant, and for newly discovered evidence, the order will be affirmed, unless it clearly appears that the trial court abused its discretion in granting such new trial.—(Hausmann vs. Sutter St. Ry. Co., 72 Pacific Rep., 905.)

CALIFORNIA.—Street Railways—Injuries to Passengers—Evidence—Statements of Conductor—Res Gestæ—Prejudicial Error—Duty of Employees—Contributory Negligence—Proof.

1. In an action for injuries sustained by a street car passenger while attempting to alight, statements of the conductor after he had gone from where the car stopped to where plaintiff lay on the ground, almost half a block away, and back again to the car, formed no part of the res gestæ.

2. The admission of incompetent statements of a street car conductor that the passenger, injured while attempting to alight, blamed him, and thought it was his fault, was prejudicial error, in an action for injuries sustained.

3. Where, in an action for injuries sustained by a street car passenger while attempting to alight, there was evidence that after the passenger was thrown off her balance she held to a stanchion and was dragged some distance, the testimony that, in response to call by passengers to ring the bell, some one answered that it was no use to ring the bell, as the car would not stop unless the conductor rang it, was immaterial.

4. Where, in an action for injuries sustained by a street car passenger while attempting to alight, the evidence showed that before the car had entirely stopped it again started suddenly, and thus caused the passenger to be injured, and instruction that, when a car was stopped to allow a passenger to get off, it was the duty of the employees of the company to see that no passenger was in the act of alighting before again starting the car, was inapplicable to the evidence.

5. The duty of a street railway company to afford its passengers reasonable opportunity to get off its cars is no greater than that of the ordinary steam railroad company.

6. The proof of the injury to a passenger casts on defendant the burden of proving that it was occasioned by contributory negligence of the passenger, unless the evidence on his part tends to show that the injury was due to his negligence.—(Boone et ux. vs. Oakland Transit Co., 73 Pacific Rep., 243.)

CALIFORNIA.—New Trial—Review—Street Railways—Appliances for Stopping Cars.

1. An order granting a new trial will not be disturbed, being general in its terms, and one of the grounds of the motion being insufficiency of the evidence, and the testimony being substantially conflicting.

2. Ordinary prudence requires that a street railway company, for the safety of pedestrians, exercise great care to keep its appliances for stopping cars in good condition.—(Mock vs. Los Angeles Traction Co., 73 Pacific Rep., 455.)

COLORADO.—Street Railroads—Persons on Track—Killing Children—Safety Appliances—Duty to Furnish—Damages—Evidence—Instructions—Appeal—Waiver of Error—Harmless Error.

1. Errors not discussed on appeal, either in the brief or oral argument of appellant's counsel, will be deemed waived.

2. Where a motion for a new trial on the ground that the verdict is contrary to the evidence has been denied, the verdict will not be set aside on appeal, unless it appears from the record that serious legal error occurred in the admission or rejection of evidence or in the instructions given.

3. Where, in an action for the killing of plaintiff's child by defendant's street car, there was nothing tending to prove that the car was not properly equipped, or that other appliances than those in use were more safe, or that there was any law or ordinance requiring the use of a fender, it was not error to refuse to permit a witness to testify that the car was not equipped with a fender like those subsequently used by defendant.

4. Where there was no evidence that defendant's street car, at the time plaintiff's child was killed by its operation, was not properly equipped to avoid accidents, an instruction that if defendant had been negligent in not providing the car with suitable contrivances for avoiding accidents of the kind in question, plaintiff would be entitled to recover, was properly refused.

5. The liability of a street railway company for failure to equip its cars with safety appliances, by reason of which plaintiff's child was alleged to have been killed, must be determined by the character of appliances in use at the time of the accident.

6. An instruction in an action for the death of plaintiff's infant son, charging that the amount of plaintiff's recovery must be limited to the value of the services of the son from the time of his death until he would have attained the age of twenty-one years, less what it would be worth to feed, clothe, educate, and care for him in a manner proper to his station in life, was not objectionable on the ground that under it the jury could not have found a verdict for plaintiff in any sum whatever.

7. Where the jury found for the defendants on the merits of the case, error, if any, in an instruction on the subject of plaintiff's damages, was harmless.—(Zimmerman et al. vs. Denver Consol. Tramway Co., 72 Pacific Rep., 607.)

COLORADO.—Master and Servant—Injuries to Lineman—Defective Poles—Res Ipsa Loquitur—Appliances—Inspection—Safe Place to Work—Assumption of Risk.

1. Where defendant's electric railway company had furnished plaintiff with a repair car, on which were appliances for bracing and securing poles, and, just prior to plaintiff's injury by the breaking of a pole, which he had ascended, in the course of his duty, without bracing the same, or examining to ascertain whether or not it was safe, a pole which plaintiff had ascended had been braced and secured by these appliances, defendant was not guilty of negligence in not furnishing proper appliances.

2. Where plaintiff was employed as a lineman, and was frequently required to climb poles supporting electric wires, and to reset poles and wires, and remove decayed poles, defendant was not liable for his injuries sustained by the falling of a defective pole, which plaintiff had ascended to change certain wires thereon.

3. Where plaintiff had worked as a lineman on poles in the construction and repair of electric lines for many years when he was engaged to work for the defendant, and it was plaintiff's duty to go upon poles that might be decayed for the purpose of taking down and putting up wires, defendant did not owe plaintiff the duty to inspect its poles, and inform him whether or not any of them were so decayed that it was unsafe to work on them.

4. Where plaintiff, a lineman in defendant's employ, was in-

jured by the falling of a defective pole which he had ascended to change certain wires thereon, mere proof of the accident was insufficient to establish defendant's negligence.

5. Where plaintiff was employed as a lineman, and was required to climb poles in the course of his business, the risk that some of the poles might fall on account of weakness was a risk incident to plaintiff's business.—(Kellogg vs. Denver City Tramway Co., 72 Pacific Rep., 609.)

DELAWARE.—Injury to Employee—Defective Appliances—Pleading—Description of Defect.

1. Where a declaration charged that defendant negligently used a car with a defective air brake, on a street, and that, by reason of the premises,—that is, such defective air brake,—the car, while being so used, could not be stopped, and ran into another car, on which plaintiff was engaged in discharging his duties as a conductor, by reason of which he was injured, etc., it was not objectionable for failure to allege wherein the car was defective.—(Jones vs. People's Ry. Co., 53 Atlantic Rep., 1065.)

DELAWARE.—Injuries to Servant—Negligence—Burden of Proof—Contributory Negligence—Master's Duty—Dangerous Employment — Youth — Inexperience — Rules — Measure of Damages.

1. A master owes its servant the duty of providing a reasonably safe place to work in, and reasonably safe and proper tools.

2. It is a master's duty to a servant to keep its premises and tools in a reasonably safe condition.

3. Where a servant is young or inexperienced, it is the duty of the master to inform him of the dangers incident to his employment.

4. A servant must obey and follow the instructions of his master as to the work he is employed in.

5. It is the duty of both master and servant to exercise reasonable care and diligence to avoid accident, varying according to the dangerous nature of the employment.

6. Plaintiff in an action against a master for injuries has the burden of proving defendant's negligence.

7. Plaintiff in an action against a master for personal injuries cannot recover if guilty of contributory negligence.

8. In an action for personal injuries, plaintiff can recover for loss of time and wages, past and future pain and suffering, and for resulting impairment of ability to earn a living.—(Karczewski vs. Wilmington City Ry. Co., 54 Atlantic Rep., 746.)

DELAWARE.—Carriers—Street Railroads—Injuries to Passengers—Motive Power—Care Required—Negligence—Actions—Issues and Proof—Damages.

1. The degree of care required of a carrier to be exercised for the safety of passengers is the same whether the motive power is steam or electricity.

2. A carrier is required to use the highest degree of care and diligence reasonably practicable in securing their safety by keeping its cars and appliances in a safe condition and at all times under the control and management of skilled and competent servants.

3. Where, in an action for injuries alleged to have resulted from a collision on a street railway, the declaration averred that plaintiff was thrown from his seat to the ground by the force of the collision, proof that plaintiff jumped from the car on which he was riding, and was injured, in his endeavor to escape the danger of the collision, would not justify a recovery.

4. In an action for injuries by reason of a street car collision, evidence that the motorman lost control of the colliding car by reason of the fact that a snap switch on the rear of the car was closed when it should have been open, was inadmissible under the declaration charging that the car was improperly equipped with a defective air brake.

5. Where a snap switch on a street car was closed when it should have been open, and by reason of its being closed, the air brake thereon failed to act effectually, which resulted in a collosion, the failure of defendant's employees to discover that the switch was closed, and open the same, constituted negligence.

6. A passenger injured by a carrier's negligence is entitled to recover reasonable compensation for his injuries sustained, including pains and suffering, impaired capacity to labor since the accident, and his probable loss of time and labor in the future, resulting from his injuries; and, if the injuries are permanent in character, he is also entitled to recover for any impairment of earning capacity in the future.—(McAllister vs. People's Ry. Co., 54 Atlantic Rep., 743.)

DELAWARE.—Carriers—Injury to Passenger—Pleading—Demurrer—Certificate of Counsel.

1. 21 Laws Del. p. 269. c. 126, requiring a demurrer to be accompanied by certificate of counsel that he believes it good in law and not made for delay, is not repealed by 21 Laws Del. p. 582, c. 303, requiring judgment of respondent ouster to be entered on issues joined on demurrer in certain cases, and containing no requirement for a certificate.

2. In an action against a street railway for injuries to a passenger, a narr. averring generally that the company negligently used insufficient and defective brakes and other appliances, by reason of which its servants lost control of the car, and plaintiff was injured while endeavoring to escape, was demurrable for not specifying the particular appliances that caused the injury, and how the injury was received.—(Newton vs. People's Ry. Co., 55 Atlantic Rep., 2.)

DELAWARE.—Street Railroads—Collision with Vehicles—Injuries—Care Required—Contributory Negligence—Damages.

1. The rights of a street railway and the public to use the streets of a city must be exercised in a reasonable and careful manner, so as not unreasonably to abridge or interfere with the rights of the other.

2. A street car company, in operating its cars in a street, must move them at a reasonable rate of speed, and reduce the speed or stop, if need be, when danger is imminent.

3. Persons using the streets of a city on which street cars are operated are required to use reasonable care to avoid collision by stopping, and, if need be, turning out and keeping off the tracks in the presence of danger.

4. A person attempting to cross a street railway track is bound to look for approaching cars in time, if possible, to avoid collision, and, if he does not look and does not see an approaching car until it is too late to avoid a collision, he is guilty of negligence.

5. Though the right of a street railway within its lines to use the street is superior to that of other users of the street, the public, in the exercise of due care, are entitled to cross the tracks as well within the blocks as at street crossings, in which case both the traveler and the railway company are required to use care, commensurate with the danger, to prevent a collision.

6. A person injured by reason of a collision with a street railway car is entitled to recover for pain and suffering, loss of power to labor, in the past and in the future, resulting from the injuries, loss of time and necessary expense in procuring labor which but for his injuries he would have performed himself, and expenses for medicine and medical attendance.—(Wilman vs. People's Ry. Co., 55 Atlantic Rep., 332.)

GEORGIA.—Street Railways—Collision—Evidence of Damages—Pleading.

1. The petition alleging that there was a collision between the plaintiff's vehicle and a car of the defendant, which threw him upon the ground, injured his back, left leg, and hip, caused concussion of the spine, and inflicted other bruises and injuries upon his body, it was permissible to introdue evidence showing injury to plaintiff's urinary organs.—(Central Railroad Company vs. Mitchell, 63 Ga., 173, 3.)

2. The evidence authorized the verdict, and there was no error requiring the granting of a new trial.—(Atlanta Ry. & Power Co. vs. Maddox, 43 S. E. Rep., 425.)

GEORGIA.—Street Railway—Injury to Passenger.

1. It is the duty of a street railway company to exercise extraordinary care for the safety of its passengers. As an incident to this obligation, where, in compliance with a city ordinance, street cars are brought to a full stop just before reaching a crossing of tracks, and it is customary on such occasions to stop long enough for passengers to get on and off without giving any signal therefor, it is the duty of the proper servant of the company to exercise extraordinary diligence, before signaling the car ahead, to ascertain if any passengers desire to alight from the car, and, if so, to give such passengers a reasonable opportunity to alight in safety.—(Atlanta Ry. Co. vs. Randall, 43 S. E. Rep.)

GEORGIA.—Street Railroads—Injury to Employee—Negligence of Fellow Servant.

1. A chartered street railroad is a railroad company within the meaning of sections 2297 and 2323 of the Civil Code of 1895, and therefore is liable to one servant for injuries inflicted by the negligence of a fellow servant.—(Savannah, T. & I. of H. Ry. vs. Williams, 43 S. E. Rep., 751.)

GEORGIA.—New Trial—Review—Street Railroads—Presumption of Negligence.

1. If the law and the facts do not require the verdict, this court will not disturb the first grant of a new trial, although it was put upon a single ground; nor will it determine whether the court below was right in granting the motion for such special reason.

2. A chartered street railroad company is a railroad company within the meaning of the Civil Code of 1895, section 2321, and the presumption is against such company where damage was done to person or property by the running of the cars or machinery thereof.—(Cordray vs. Savannah, T. & I. of H. Ry.; Savannah T. & I. of H. Ry. vs. Cordray, 43 S. E. Rep., 755.)

LONDON LETTER

(From Our Regular Correspondent.)

A successful trial run has been made of the electrical trains on the Tynemouth line of the North Eastern Railway Company, particulars of which have been printed from time to time in these columns. The whole work is in the hands of Charles H. Merz, consulting engineer for the company. Power is at present being taken from the Newcastle Electric Supply Company, at Wallsend, but will eventually be taken from the new power house which was illustrated in the STREET RAILWAY JOURNAL of June 20, and which is being erected at Carville. The electric trains have been equipped by the British Thomson-Houston Company with the multiple unit train control system. The car bodies were built by the Brush Electrical Engineering Company, and, as is usual on all of the existing electric railways, are long, open corridor type, supported on two four-wheel bogie trucks. The cars are divided into three divisions, having transverse seats in the center division, while in the end sections the seats are placed longitudinally. The system comprises about 37 miles between Newcastle and Tynemouth on two routes. Each train consists of two motor cars and one trailer, the whole train accommodating over 200 passengers. A successful trial took place on Sept. 27. It is a very interesting coincidence that it was on Sept. 27, 1825, that the first passenger railway line in England was opened between Stockton and Darlington. It is also interesting to note that the electrical equipment fulfilled all expectations and the motors had no trouble in attaining 30 miles an hour for the train within 30 seconds from starting.

The tide appears to have turned with the Mersey Railway Company, which was electrically equipped by the British Westinghouse Company early this summer. This is an old steam tunnel railway from Liverpool under the River Mersey to a number of points on the opposite shore. For some years this company has been working at a loss, all possible profits having been exhausted by its working expenses, large sums having been consumed for ventilation of the tunnel, with little hopes of a dividend ever being forthcoming. At a recent half-yearly meeting it was stated that the number of passengers during the last half year distinctly increased and that the receipts have been steadily going upward, while before the electrification the receipts had been steadily going downward. The results of the succeeding six months will be much more important and will be awaited with considerable interest.

One or two accidents on the Central London Railway have called forth some criticism as to equipping electric railways with a multiple unit system. The accidents have been in the nature of derailments, and have always occurred while the trains have been shunted at one or other ends of the line and on a curve. It has brought forth the criticism that it is dangerous both to pull and push trains, especially on curves. The Board of Trade long ago decided that on railways the practice of pulling and pushing was dangerous, and now insists on trains which require more than one locomotive that the two locomotives should be in front of the train. The present system of electric traction, however, is rather opposed to this practice, and as the above criticism brings up an interesting point, doubtless more will be heard of it in the future.

Belfast City Council has unanimously approved the scheme for the purchase and electrification of the tramway system of Belfast submitted by Charles H. Merz at a cost of close upon a million pounds, including the purchase price of the owning company. It has also been decided to promote a bill in Parliament for the purpose of acquiring the undertaking. Mr. Merz has recommended the overhead system, and as all the lines will have to be relaid, the cost of electrification would mount up to about £664,621. This amount does not cover, however, the cost of a generating station, nor of certain necessary street alterations, so that the total cost of £1,000,000 will doubtless be readily reached.

Aberdeen has decided to try the "Thermit" system of welding rails, and it has been resolved to weld a hundred joints of the present rails in Albyn Place as an experiment. The report of the burgh surveyor was to the effect that if these rails, which were originally laid for horse traction, were welded, they would last for another four years.

At a recent meeting of the Town Council of Wolverhampton, it was decided to make important extensions of the surface contact system in use in that city, and a contract has been awarded the Lorain Steel Company for the necessary apparatus. The total cost of the extensions will aggregate about £60,000.

The important experiment of running a motor car service on their line between the Chalford and Stonehouse stations has been started by the Great Western Railway Company. At present the number of ordinary trains calling at these places and intermediate stations is but limited. Under the new arrangement, however, the facilities for traveling between these two points will be greatly increased, as it is intended to run a motor car each way every hour for about twelve hours daily. Not only will the car take up passengers at intervening stations, but passengers will also be taken on board at the four level crossings between Chalford and Stonehouse. The car is driven by a steam motor, and can be worked from either end. Divided into three compartments, one of which contains the motor, the car, which can attain a speed of 45 miles an hour, will accommodate fifty-two passengers, sixteen in cross seats in the center, and thirty-six in longitudinal seats towards each end. Space is left for parcels traffic and small hand luggage. Electrical communication is provided for the convenience of the conductor and driver. The vestibule, forming the third compartment, at one end of the car is provided with steps, by means of which passengers can enter and alight at level crossings. Tickets will be issued to travelers on the train itself on the tramway principle. The journey between Chalford and Stonehouse is timed to occupy twenty-three minutes, including stoppages.

A scheme for stimulating and expanding British trade in foreign and colonial markets, and one which promises to have far-reaching results, has been initiated by Ben. H. Morgan, recently Trade Commissioner to South Africa. It is that lectures shall be prepared by eminent engineers and leading experts in various lines of manufacture, who will make a point of showing what progress has been made in Great Britain up to the present time in the manufacture of all classes of machinery and goods, emphasizing novel points of utility, design, etc. It will be a special feature that each lecture will be illustrated with lantern slide views of the machinery or other subject dealt with. Lectures having thus been prepared will be immediately printed, and copies forwarded by previous arrangement for reading before technical and trade societies, Chambers of Commerce, colleges, schools and other educational and trading bodies in the British Colonies and leading centers of trade in foreign countries. The Board of Trade and other Government departments are giving the scheme their assistance, and are working with the Agents-General for the Colonies, with a view to arranging for the reading of the lectures before suitable institutions in the Colonies, while the Foreign Office is instructing Consuls abroad in the principal markets to give the scheme their co-operation. Mr. Morgan is dealing first with the engineering industry, and in this connection has already arranged for the preparation of the following lectures:

British Progress in Electrical Work—Sir Wm. H. Preece, Past President of the Institute of Civil Engineers.

British Progress in Dynamo and Motor Construction—J. Swinburne, Past President Institute of Electrical Engineers.

British Progress in Mechanical Road Traction—Colonel R. E. Crompton, Mechanical Institute Civil Engineers, Past President Institute Civil Engineers.

British Progress in Steam Generation—Professor W. Ripper, University College, Sheffield.

British Progress in Steam Boiler Construction—F. J. Rowan, ex-Vice-President Institute Mechanical Engineers.

British Progress in Machine Tool Manufacture—John Ashford, manager, Robey & Co., Lincoln.

British Progress in Municipal Engineering—W. H. Maxwell, borough surveyor and engineer, Tunbridge Wells.

British Progress in Steam Engine Construction—J. H. Dales, consulting engineer.

British Progress in Gas Works Plant and Machinery—C. E. Brackenbury, civil engineer, London.

British Workshops and Their Equipment—B. H. Morgan, Engineering Trades' Commissioner.

Pneumatic Tools and Appliances—E. C. Amos, Queen Victoria Street.

The Selection of Boilers—C. E. Stromeyer, chief engineer, Manchester Steam Users' Association.

A. C. S.

ELECTRIC RAILWAYS FOR VALPARAISO, CHILE

The Valparaiso Electric Company, formed in Berlin, Germany, by a combination of several leading banks and German electrical companies, with a capital of £250,000, to finance and build a complete electric railway system in Valparaiso, Chile, has taken over the concession granted by the Valparaiso municipality to Saavreda, Benard & Company, for the construction and operation of about 17 miles of electric railways in that city, and for the supply of electric light and power.

THE MICHIGAN AND INDIANA COMPANY'S LINE

The system of the Michigan & Indiana Traction Company, now under construction between Battle Creek and Grand Ledge, Mich., is expected to be completed about February, 1904. In all 56 miles of standard gage, single track line, will be built through Battle Creek, Belleview, Olivet, Charlotte, Potterville, Willetts, Lansing and Grand Ledge. The contract for the work is held by the Peninsula Construction Company. It is to be a third-rail road, and for the most part will be built upon private right of way, 4 rods wide, secured with a view to double tracking the line in the future. All fills and cuts have been made with the provision for double tracks. In Battle Creek, Charlotte and Lansing a private right of way has been secured with the object of running through cars on a fast schedule in these cities. Battle Creek, which is the terminus of the lines of the Michigan Traction Company, gives facilities for transferring passengers to Gull Lake, an ideal summer resort. In addition to this there is a summer resort at Lake Cognac, situated about a mile and a half from Battle Creek. Ledys Park, about three miles from Lansing, is also a pleasure resort. Grand River, through which the road passes, is the headquarters of the Spiritualists Association, which holds annual camp meetings there two months each year. The Michigan & Indiana Traction Company is in no way identified with the Michigan Central Traction Company, with which it has often been confused. The Central Company plans to build a road from Battle Creek to Lansing by way of Grand Ledge. The officers of the Michigan & Indiana Company are: Edward F. Pangburn, president; William M. Dibble, secretary; Charles J. Austin, treasurer; John M. Comstock, chief engineer; Frederick G. Higby, assistant engineer; Nicholas & Durfee, counsel.

NO STRIKE ON THE NEW YORK ELEVATED

The threatened strike of the motormen and firemen of the Interborough Rapid Transit Company, which operates all the elevated lines in New York, was averted Wednesday, Oct. 28, when an agreement was signed which is to be formally ratified at meetings of the motormen and firemen on Saturday, Nov. 7. The agreement was reached as the result of a conference lasting three hours Wednesday afternoon between the officials of the company and the representatives of the men. It was signed on behalf of the company by Vice-President E. P. Bryan. On behalf of the men it was signed by T. S. Ingraham, first grand engineer of the Brotherhood of Locomotive Engineers; John J. Hannahan, grand master of the Brotherhood of Locomotive Firemen; W. L. Jencks, chief of division No. 105 of the Brotherhood of Locomotive Engineers, and Harry B. Pinney, chairman, Brotherhood of Locomotive Firemen Lodges 149 and 155. The following copy of the agreement was given out by the officials of the company after the settlement was reached'

It was agreed as regards the differences between the management and the respective organizations named concerning examination of engineers and firemen that Dr W. R. Townsend, former medical examiner for the Manhattan Railway Company, and Dr. Leonard F. Pitkin, present medical examiner for the Interborough Rapid Transit Company, shall jointly, acting for the organizations named, and the Interborough Rapid Transit Company, determine from the records of the examination made by Dr. Townsend of the engineers and firemen of the Manhattan Railway, which men, from the number of men who on former examination of Dr. Townsend did not show a normal condition, should in their judgment undergo an examination at the present time.

All the men who showed a normal condition at the examination made by Dr. Townsend shall not be re-examined for a period of two years and six months from the date of their former examination, unless any of the men may give indication of weakness in any of the essential points required for the proper discharge of their duties. Those of the men who appear upon the record as very considerably below normal and whose records would seem to indicate that their condition could be improved by treatment, will be given a reasonable opportunity to fit themselves for this examination before they shall be subjected to it.

In the event of the examination or re-examination of the men, if a man examined is not satisfied with the decision reached by the company's medical examiner, he will have the privilege of undergoing an examination by any reputable physician or specialist in New York City. Should the diagnosis of the second physician not agree with that of the company's medical examiner, a third physician or specialist, to be agreed on by the company's medical examiner and the second physician or specialist, shall be called in, and the decision of two out of the three physicians shall be final. The company will pay the cost of all examinations.

When the examination of motormen was ordered some time ago there was considerable opposition to the order, and the men voted "not to submit," but the company insisted, and a series of conferences was held which resulted in the adoption of the agreement on Oct. 28, which is a complete victory for the management.

One reason for ordering a general examination was that the company felt the necessity for having complete, exact and reliable records of the physical condition of its employees. The old method comprised simply in having applicants present a certificate signed by the company's physician saying that the applicant was not disqualified by his physical condition from entering the service. This, of course, gave the company's officers no idea of the man's actual condition, and they could not determine intelligently whether he was liable to maintain the standard set by them or deteriorate physically within six months, a year, or two years. It was therefore determined to complete the records by having each man's condition carefully noted. The present certificate is made out in the following form:

THE INTERBOROUGH RAPID TRANSIT COMPANY,
MANHATTAN RAILWAY DIVISION
Surgeon's Office
No. 195 Broadway

MR. FRANK HEDLEY, New York City, N. Y., ...190...
General Superintendent.

Dear Sir—

In compliance with your instructions of the————I have this day made a physical examination of Mr. .....as to his fitness for the position of ..... and beg to report as follows:

Age.....years		Height .....Ft. .....inches	
Weight.....lbs.		Pulse	
Respiration.....		Heart	
Color Sense	Vision	Right Eye	
Hearing		Lett Eye	

In my opinion the applicant is ..... for the duties of .....

General Remarks .....

.....

.....

Applicant's Signature .....

.....
Surgeon.

This certificate contains two endorsements; the first being the order of the superintendent to the medical department authorizing the examination, and the other the examining surgeon's memorandum. Each form must be signed by the applicant in the presence of the superintendent or surgeon, and countersigned by that officer of the company, thus effectually preventing the substitution of dummies for applicants who were not in good physical condition.

INDIANA COAL ROAD

The recent absorption of the Indianapolis & Plainfield Electric Railway by the Indiana Coal Traction Company divulges an extensive scheme for the operation of a coal carrying electric railway extending from Indianapolis through Sullivan, Clay, Green, Vigo, Owen and Park Counties, Indiana. The present system now covers 14 miles of road in operation between Indianapolis and Plainfield, but the mortgage of $5,000,000 which has just been placed on the property insures the construction of more than 150 miles of additional road.

The Western terminals of the system will be Rockville, Terre Haute and Sullivan. The plan is to build a double-track line between Indianapolis and Terre Haute, and maps already prepared show that the Plainfield line is now almost completed into Cartersburg and Danville, the latter town being reached by a spur from Cartersburg. Beyond Cartersburg the road is to parallel the Vandalia Railroad through Amo, Coatsville and Clayton. From Greencastle the main line is to be carried by a short cut to Brazil, passing between the Vandalia and Big Four Railroads most of the distance. At Brazil it is to cross to the south of the Vandalia, run a mile or two south of that company's tracks and head for Terre Haute by direct route. Starting at Greencastle, a branch line is to run through Vivalia, Ferndale and Lakeland to Rockville. This will be a single-track road, constructed principally as a coal carrier. The other big branch will leave the main line at Plainfield and head southwest by Monrovia, Halls and Eminence, in Morgan County, and Clay City, in Clay County, to Sullivan. A short road will be run south from Asheville to Linton. This line will be single track, and will tap large coal leases including thousands of acres held by the McGowan-McCulloch syndicate, which is interested in the Indianapolis Traction & Terminal Company and the Indiana Union Traction Company. It is said that the rolling stock for handling freight will be especially constructed and that electric locomotives will be used. Detail plans for the construction of these lines will be worked out this winter, and it is expected that their construction will be begun early next year. The officers of the company are: Albert Lieber, president; Fred Francke, vice-president, and J. J. Appel, secretary. It is understood that the road really is an Indiana Union Traction interest, and that Hugh J. McGowan and Geo. F. McCulloch are heavily interested, though their names do not appear connected with the company.

AN AUSPICIOUS OPENING

The Humbolt Transit Company, of Eureka, Cal., has submitted a very interesting statement of the business done on its lines during the first month of operation. The road was opened for business on Sept. 15, having 2¾ miles of track finished at the time, and two cars were operated for seventeen and a half hours a day. The total number of cash fares collected was 50,376, and tickets were sold representing 8946 additional fares, making a total of 59,322, or $2,966.30. Under the terms of the franchise 3½ per cent of the gross receipts is paid to the city of Eureka. This amounted to $103.82; the operating expenses are reported at $1,500, leaving a net income of $1,362.48. The total receipts per day, therefore, amounted to $98.87. During this month, however, a fair was in progress which, of course, greatly increased the business above the normal, and making allowance for this it is estimated that the normal receipts per day were $74.33. The company is now completing 2¼ miles of additional track which will be in operation by the first of the year.

PENNSYLVANIA RAILROAD TO OPERATE TROLLEYS?

The report comes from Philadelphia that indications are growing that the Pennsylvania Railroad, either directly or through interests closely allied with it, proposes to go into the business of operating electric railways for the short haul traffic in and about Philadelphia. A short time ago a company made up of Fourth Vice-President Samuel Rea and several employees of the road took out a charter for an electric railway to run from Bristol to Trenton, and presumably to use the discarded bridge of the Pennsylvania Railroad over the Delaware. On Saturday, Oct. 24, it was announced from Harrisburg that a charter had been granted authorizing the Overbrook, Bryn Mawr & Paoli Street Railroad Company to build a line 23 miles long, from the intersection of City Line Avenue and Lancaster turnpike in Lower Merion township, Montgomery County, to various suburbs. This line is in the territory which for years the influence of Pennsylvania interests has been strong enough to keep sacred from the invasion of the electric railway. Incidentally, it taps the territory that is designed to be used by the mysterious Philadelphia & Western Railroad, which has been thought in some quarters to be an entering wedge for the Wabash into Philadelphia.

NEW CHICAGO TRACTION COMPANY

Application has been made to the Secretary of State at Springfield for articles of incorporation of the Chicago Railways Company, which, it is said, will furnish the solution of the problems confronting the Union Traction Company and its underlying corporations. The corporators are Nathan C. Johnson, W. E. Cooper and Archibald G. Thiselton. Alfred Skitt, of New York, is said to be the prospective president of the company, and Harry B. Hollins, now a director of the Union Traction Company, has tendered his resignation from that company, and will be associated with Mr. Skitt in the directory of the new corporation. The capitalization of the new concern is placed nominally at $10,000, but it is said to be the purpose of its promoters to increase it to $5,000,000, and later to a figure that will cover the amount required for the rehabilitation of the North Side and West Side systems. The new company is declared to be not organized for any purpose unfriendly to the receivership of the Union Traction Company, and any leases which may be made by it will be subject to the termination of the receivership.

NEGOTIATIONS BROKEN OFF BETWEEN CITY AND COMPANY IN CHICAGO

On Wednesday, Oct. 28, the negotiations between the city and the Union Traction Company were brought to a close, at least, temporarily. The deadlock came over Attorney John S. Miller's refusal to agree to a waiver of the ninety-nine-year rights, such as were framed by E. B. Smith, special attorney for the city, and incorporated in the tentative ordinance granting the Chicago City Railway Company a twenty-year franchise. The matter was finally referred to the city's lawyers, who were instructed to evolve some plan, if possible, whereby the negotiations might be continued. Attorney Miller, who represents the traction receivers, based his refusal upon the fact that the ninety-nine-year rights were assets of the bondholders of the underlying companies, which the receivers had no right to give away.

Attorney Miller told the local transportation committee that the Union Traction Company could not accept a franchise exension ordinance on the terms agreed upon with the Chicago City Railway Company, because the receivers could not waive the ninety-nine-year claims without the consent of the bondholders. He also declared he did not see how the company could agree to pay the city any compensation for the extension of its franchise. Mr. Miller was unable to satisfy the committee that he and the receivers had the authority to enter into negotiaions and make terms that would be binding on the stockholders of the underlying companies. The lawyers, therefore, were directed to make another attempt to agree on some method of procedure by which negotiations can be resumed.

MONTREAL COMPANY MAKES OFFER FOR FRANCHISE EXTENSION

The Montreal Street Railway Company has submitted to the Council of that city, in reply to that body's communication of July 6, in regard to the terms it would make to remove snow from the streets, sprinkle, sweep and pave the streets, and make special rates of fare, specifically set forth a counter proposition in which it is practically agreed to assume all of the conditions laid down by the city if an extension of the company's franchise for thirty years is granted. In order thoroughly to understand the conditions, the official communications follow:

WHAT PROPOSITIONS OF THE CITY WERE

1. To remove the snow from the streets in which the company's cars are in operation.

2. To water the said streets at least twice daily, the city to supply the water for street watering free of charge to the company.

3. To sweep the said streets during the night, as far as it is mechanically possible to do so, the area which the company's appliances fail to reach to be swept by the city, and the sweepings to be removed by the city.

4. To sell ten tickets, instead of eight, for 25 cents during working hours. Working hours shall mean from 5 a. m. to 8 a. m., and from 5 p. m. to 7 p. m., from April 30 to Nov. 1, and from 5 a. m. to 8 a. m. and from 4 p. m. to 7 p. m. from Nov. 1 to April 30.

5. To pave the said streets in permanent paving to be selected by the road committee, and maintain the said streets in good repair.

THE COMPANY'S ANSWER

J. H. Dillon, Esq., Secretary of the road committee, City Hall, Montreal:

Dear Sir—After considering the extract from the minutes of Council, held on July 6, 1903, I have to answer your questions as follows:

This company would be prepared to undertake the following:

1. To remove the snow from the streets in which the company's cars are in operation.

2. To water at least twice in twenty-four hours its track allowance, the city supplying water and making provision for obtaining the water, by permitting sidings where convenient.

3. The company would sweep during the night the streets on which it operates by mechanical sweepers with as wide a sweeper as can be conveniently operated on its cars—the city to sweep the balance of the street and remove the sweepings.

4. The company would sell ten tickets, instead of eight for (25) twenty-five cents, for use during certain hours, that is to say, 5 a. m. to 8 a. m., and 5 p. m. to 7 p. m., with an additional half hour in the afternoon in the winter months, so long as the new arrangement is in force.

5. The company would be prepared to consider certain expenditure in connection with crossings, but would not be prepared to assume the whole burden of paving and maintaining the streets. This is an item that would require further discussion.

As a consideration for the foregoing, the company would require, by way of concession from the city:

1. A further extension of the company's contract for thirty years from the time of expiry of the present contract, modifications coming into force at once.

2. An arrangement by which the company would be enabled to consider and deal with questions affecting the use of the streets by other companies by mutual arrangement with such other companies, provided the arrangement be subject to reasonable restrictions in favor of the city. Failing such mutual arrangement, the city to deal with such other company subject to the existing rights of the Montreal Street Railway.

3. At the expiration of the extended period, the city, in event of expropriation, to acquire the whole undertaking of the railway, and not only the part in Montreal, at a price to be fixed by arbitration.

4. The new obligations assumed by the company to be in lieu of taxes, except such general taxes as may be imposed upon all joint stock companies.

5. An arrangement to be made to submit to arbitration in event of dispute, matters involving changes in or additions to the company's system, in territory not now within the city limits, but which may hereafter be within the city limits during the currency of the contract.

I cannot do more than indicate in general terms the lines upon which the company would be prepared to take up the matters referred to in the extract of minutes. Yours truly, F. L. Wanklyn,

Vice-President and General Manager.

A NEW CAR PLANT

The T. H. Buckley Car Manufacturing Company, of Worcester, Mass., which was organized in the early part of the current year, is rapidly pushing to completion its new plant in Worcester, Mass. The plant is located on the corner of Fay Street and Grafton Street, running back to the Boston & Albany Railroad. Three acres of land have been bought in this location. Part of this land is at present occupied by a manufacturing business in which Mr. Buckley is largely interested.

As the land on which the plant is located borders on the railroad, arrangements have been made with the Boston & Albany Railroad to secure switch and sidetrack privileges extending into the works. A track will be built through the main building of the plant, so that lumber and building material of all kinds for car construction can be unloaded inside ready for immediate use. Cars to be shipped from the works can be loaded on to freight cars within the main building. This method of handling material for construction and shipping the finished product will save considerable money to the company in hauling and cartage.

The main building will be 66 ft. wide by 225 ft. long, and is being rapidly completed so that it will be ready to receive the machinery before Dec. 1. The floor of this building will be of concrete. It will be equipped with the best modern machinery for street car construction. Two tracks will be run the entire length of this building and there will be room, at one time, inside, for setting up and finishing for shipment thirty-two standard electric cars. The full manufacturing capacity of the plant will be 300 electric cars a year.

Adjoining the main building is another building covering 15,309 sq. ft. of floor space. This contains the woodworking department, blacksmith shop, setting-up shop, painting and finishing department. It is already equipped with new and improved machinery and appliances for expeditious car construction. On the north end of the main building are located the engine and boiler rooms.

The services of thoroughly competent and experienced draughtsmen and car builders are being secured and work on the first orders for cars will begin by Dec. 1. The capital stock of the company is $250,000, fully paid in. The officers are: T. H. Buckley, president and treasurer, John T. Flannigan, secretary.

DIAGRAM OF TRAFFIC IN AN ANNUAL REPORT

A feature of the second annual report of the Birkenhead Corporation Tramways, recently made public, is a series of diagrams of the fluctuations of weekly receipts, the passenger demands for different hours on week days during a typical summer week, and the number of passengers carried hour by hour on a summer Sunday and a winter Sunday.

The diagram illustrating the number of travelers at the various periods of the day in a typical summer week shows that, commencing at 5 a. m., the cars carried in the first hour from 650 to 700 passengers, the number increasing at a bound in the next hour to 1800, falling again to 1300 between 9 and 10 a. m., and jumping up to 1700 between 11 a. m. and noon, 2100 between noon and 1 p. m., and 4500 during the next two hours. Afterwards the number dropped to 1950 between 3 p. m. and 4 p. m., rising to 2150 before 5 o'clock. From 5 o'clock to 7 o'clock, the "rush hours," the number carried by the cars amounted to 6000. For the remainder of the evening the pressure slackened rapidly, the passengers between 7 p. m. and 8 p. m. averaging 2250; between 8 o'clock and 10 o'clock, 1875 per hour; between 10 p. m. and 11 p. m., 1375; and for the last hour to midnight dropping to 650 stragglers.

The diagram illustrating the average number of passengers carried during each hour on a summer Sunday and a winter Sunday is most interesting. On the Sabbath the service commences at 1 p. m., and in summer the cars on the seven routes during the first hour carry from 1000 to 1800 passengers, as compared with 1200 to 1700 in winter. Between 2 and 3 o'clock the travelers grow from 1800 to 2000 in summer, and from 1700 to 1900 in winter, the numbers increasing in summer to 2200 between 5 p. m. and 6 p. m., and dropping to 1600 and 1500 in winter during the same period. Between 6 o'clock and 7 o'clock in the summer the traffic falls to 1900, and in winter to 1500, rising again in summer to 2200 between 7 p. m. and 8 p. m., 3400 between 8 p. m. and 9 p. m., and the maximum number of 3700 between 9 and 10 o'clock at night. In winter, from 6 o'clock, the traffic grows to 1800 between 8 p. m. and 9 p. m., and reaches the maximum demand of 2600 between 9 p. m. and 10 p. m. For the last hour of the Sunday traffic, between 10 and 11 o'clock, the passengers in summer decrease rapidly to 1200, and in winter to the low-water mark of 700 passengers.

CHANGES IN CLEVELAND CITY ROUTES

The Cleveland Electric Railway Company is again making changes in its routes. Since the consolidation of the two city systems, the company has been combining routes in order to run as many cars as possible directly across the city, thus improving the service by relieving the congestion on Superior Street, around the loop and at the Public Square. Among the routes combined were the following: Cedar and Jennings, Detroit and Wade Park, and Broadway and St. Clair. This took the Cedar, Jennings, Broadway and St. Clair cars off lower Superior Street, and also away from the loop which brought passengers to the point nearest the Union Railway station. The merchants of lower Superior Street immediately made complaint, claiming their trade was being diverted by the removal of cars. The Euclid Avenue line, the only line that had been running to the Union station, was recently tied up by a parade, and demand was made from certain quarters that more cars should be run to the station. Now it is proposed to run all Payne Avenue, Cedar Avenue and half the Euclid Avenue cars to the Union station. The other half of the Euclid Avenue cars will be coupled with the Jennings Avenue cars into a new crosstown line, which, of course, means the abandoning of the Cedar and Jennings combination. The combination of routes has been a good thing for the company, as it has decreased the mileage of cars on loops and has enabled the company to dispense with a number of runs. Besides, it is improving the running time across the city, and is facilitating the handling of crowds during rush hours.

NEW PUBLICATIONS

The Standard Dictionary, Decennial edition (July, 1903). Published by the Funk & Wagnalls Company, New York.

This dictionary has been before the public for a sufficient length of time so that its advantages have become recognized. The fact that a new and enlarged edition has become imperative is sufficient evidence that it meets the wants of a large number of dictionary users. Although containing 317,000 vocabulary terms, the single volume is not unwieldy, as the definitions are remarkable for their conciseness as well as for their accuracy. Several of the valuable features of the work, outside of its dictionary of words, proper names and phrases, are dictionaries of common Spanish-American, Austral-English and Anglo-African terms, an atlas of principal countries, descriptive and statistical cyclopedia, and glossary of abbreviations and contractions.

PERSONAL MENTION

MR. ALBERT H. FLINT, of Flint, Eddy & Company, of New York, has been elected president of the Chesapeake Transit Company, which operates an electric railway between Norfolk and Cape Henry, Va.

MR. A. T. LONG, formerly in the auditor's department of the Aurora, Elgin & Chicago Railway, has been appointed auditor of the Ohio Central Traction Company, with offices at Galion, Ohio, succeeding Mr. Frank R. Green, resigned.

MR. GEORGE W. COLLES, member American Society Mechanical Engineers, has resigned his position as chief engineer of Marion & Marion, Montreal, and opened an office as consulting mechanical and electrical engineer in Milwaukee, Wis.

MR. C. C. SROUFFE, who recently resigned as superintendent of the Yuma & Tucson division of the Southern Pacific Railroad, has been appointed chief engineer of the Los Angeles & Glendale Electric Railway Company, of Los Angeles, Cal.

MR. C. O. WHYSOLL has succeeded Mr. H. A. Fisher as general manager of the Columbus, Delaware & Marion Railway. Both Mr. Fisher and his son, Mr. L. D. Fisher, formerly chief engineer of the Columbus, Delaware & Marion Railway, are devoting their entire attention to the construction of the Elgin, Plainfield & Joliet Railway, which is being constructed between the towns mentioned in the title, which are in Illinois.

MR. ELMER M. WHITE, cashier of the Hartford Street Railway Company, was in New York last week. At the last convention of the Street Railway Accountants Association of America Mr. White was appointed a committee of one to take charge of the association's collection of blanks and forms. Mr. White is planning to bring this up to date and make certain rearrangements which will make the collection of greater value to members of the association.

TABLE OF OPERATING STATISTICS

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

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. & Light Co	1 m., Sept. '03	84,015	43,918	40,097	22,707	17,390
	1 " " '02	67,492	35,997	31,495	17,073	14,422
	9 " " '03	666,302	361,950	304,352	199,665	104,687
	9 " " '02	551,899	304,138	247,761	153,298	94,463
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co.	1 m., Sept. '03	40,446	22,056	18,390	9,172	9,218
	1 " " '02	37,806	20,814	16,992	9,049	7,943
	9 " " '03	346,170	196,577	149,593	75,838	73,755
	9 " " '02	308,240	175,739	132,501	75,715	56,785
BEAVER FALLS, PA.						
Beaver Valley Trac. Co.	12 m., Sept. '03	227,409	126,207	101,203	70,414	30,788
	12 " " '02	177,214	96,399	80,815	62,374	18,241
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Sept. '03	21,932	10,657	11,275	------	------
	1 " " '02	18,432	10,460	7,972	------	------
	3 " " '03	73,507	33,998	39,509	19,108	20,401
	3 " " '02	65,253	33,983	31,270	15,449	15,821
BUFFALO, N. Y.						
International Tr. Co.	1 m., Sept. '03	377,922	201,041	176,881	127,445	49,435
	1 " " '02	321,355	161,525	159,831	125,887	33,944
	3 " " '03	1,198,316	592,926	605,390	398,971	206,419
	3 " " '02	1,019,518	506,664	512,854	381,198	131,656
CHICAGO, ILL.						
Aurora, Elgin & Chicago Ry. Co	1 m., Sept. '03	44,394	20,145	24,249	------	------
	3 " " '03	157,436	67,080	90,356	------	------
Chicago & Milwaukee Elec. Ry. Co.	1 m., Sept. '03	40,921	9,820	31,101	------	------
	1 " " '02	19,347	6,988	12,359	------	------
	9 " " '03	194,636	66,936	127,700	------	------
	9 " " '02	147,407	59,847	87,560	------	------
Metropolitan Elevated Ry. Co	12 m., June '03	2,104,470	1,037,181	1,067,289	901,643	165,646
	12 " " '02	1,833,631	781,210	1,052,421	837,817	214,604
South Side Elevated Ry Co	12 m., June '03	1,555,043	856,127	698,916	151.271	547,645
	12 " " '02	1,412,709	760,212	652,497	177,918	474,579
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co	1 m., Aug. '03	112,576	*61,827	50,749	21,351	29,399
	1 " " '02	96,217	*54,395	41,823	21,113	20,710
	8 " " '03	794,968	*460,490	334,478	168,534	165,943
	8 " " '02	707,436	*401,794	305,642	168,749	136,892
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., Sept. '03	43,159	25,330	17,829	------	------
	1 " " '02	30,464	14,996	15,468	------	------
	9 " " '03	330,232	194,739	135,493	------	------
	9 " " '02	219,968	121,120	98,848	------	------
Cleveland, Painesville & Eastern R. R. Co	1 m., Sept. '03	23,023	12,973	10,050	6,568	3,482
	1 " " '02	19.396	10,933	8,464	6,193	2,271
	9 " " '03	164,886	94,008	70,878	58,302	12,576
	9 " " '02	151,895	84,396	67,499	55,775	11,724
Eastern Ohio Traction Co	1 m., Sept. '03	21,677	12,899	8,778	------	------
	9 " " '03	153,215	97,130	56,084	------	------
DETROIT, MICH.						
Detroit United Ry *a*	1 m., Sept. '03	412,639	*233,596	180,043	84,208	95,835
	1 " " '02	373,097	*204,262	168,835	81,258	87,577
	9 " " '03	3,333,622	*1947478	1,386,144	743,762	642,382
	9 " " '02	2,986,119	*1668017	1,318,102	703,219	614,883
DULUTH, MINN.						
Duluth Superior Traction Co	1 m., Sept. '03	51,577	28,094	23,483	10,832	12,651
	1 " " '02	46,763	23,091	23,672	9,619	14,053
	9 " " '03	465,261	257,041	208,220	94,085	114,135
	9 " " 02	396,258	206,994	189,264	86,819	102,445
FORT WORTH, TEX.						
Northern Texas Traction Co	1 m., Sept. '03	41,949	22,033	19,916	9,673	10,243
	9 " " '03	335,297	178,168	157,129	82,490	74,639
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Sept. '03	49,983	23,401	26,582	15,999	10,583
	1 " " '02	44,090	23,050	21,040	16,251	4,788
	4 " " '03	204,661	99,586	105,075	64,291	40,784
	4 " " '02	184,502	91,206	93,296	65,241	28,055
HANCOCK, MICH.						
The Houghton County St. Ry. Co	1 m., Aug. '03	20,871	10,256	10,614	2,929	7,685
	1 " " '02	17,305	9,814	7,491	2,604	4,887
	12 " " '03	182,103	120,595	61,508	33,850	27,658
	12 " " '02	170,802	101,955	68,847	30,525	38,323
HARRISBURG, PA.						
Central Pennsylvania Traction Co	1 m., Sept. '03	45,753	36,714	9,039	------	------
	1 " " '02	38,391	22,515	15,876	------	------
	9 " " '03	391,143	274,133	117,010	------	------
	9 " " '02	344,539	205,930	138,609	------	------
HAZLETON, PA.						
Lehigh Traction Co.	1 m., Sept. '03	13,291	6,154	7,137	------	------
	1 " " '02	6,379	3,525	2 854	------	------
	9 " " '03	105,522	58,811	46,711	------	------
	9 " " '02	74,717	46 578	28,139	------	------
HOUSTON, TEX.						
Houston Electric Co.	1 m., Aug. '03	40,824	21,809	19,015	7,538	11,477
	1 " " '02	33,639	17,578	16,061	6,250	9,811
	3 " " '03	118,193	66,455	51,739	21.024	30,715
	3 " " '02	96,374	51,590	44,783	18,750	26,033
JACKSONVILLE, FLA.						
Jacksonville Electric Co	1 m., Aug. '03	21,790	14,138	7,652	3,115	4,536
	1 " " '02	17,832	13,730	4,102	2,875	1,227
	12 " " '03	231.785	155,328	76,457	35,138	41,320
LONDON, ONT.						
London St. Ry. Co	1 m., Sept. '03	19,536	10,308	9,228	2,432	6,796
	1 " " '02	18,158	8,648	9,509	2,110	7,399
	9 " " '03	132,517	83,756	48,761	19,873	28,889
	9 " " '02	115,611	70,812	44,849	20,284	24,565
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Sept. '03	272,346	135,460	136,887	75,286	61,601
	1 " " '02	259,591	110,736	148,854	70,591	78,263
	9 " " '03	2,245,436	1,128,481	1,116,956	649,555	467,400
	9 " " '02	2,014,941	946,508	1,068,432	596,811	471,621
MINNEAPOLIS, MINN.						
Twin City R. T. Co	1 m., Sept. '03	372,252	156,924	215,329	60,937	154,391
	1 " " '02	339,669	130,611	209,058	60,233	148,825
	9 " " '03	3,020,843	1,398,887	1,621,955	548,130	1,073,825
	9 " " '02	2,667,095	1,191,320	1,475,775	530,733	945,041
NEW YORK, N. Y.						
Interurban Street Ry. Co. *a*	12 m. June '03	22,122,953	11389 109	10733 844	7,366,190	3,367,654
OAKLAND, CAL.						
Oakland Transit Consolidated Co	1 m., Sept. '03	100,252	49,122	51,130	24,246	26,883
	1 " " '02	83,326	44,592	38,734	21,865	16,869
	9 " " '03	837,911	428,951	408,960	------	------
	9 " " '02	695,717	414,811	280,906	------	------
PHILADELPHIA, PA.						
American Railways	1 m. Sept. '03	132,004	------	------	------	------
	1 " " '02	107,614	------	------	------	------
	3 " " '03	421.861	------	------	------	------
	3 " " '02	353,193	------	------	------	------
RICHMOND, VA.						
Virginia Passenger & Power Co	12 m. June '03	1,368,410	825 672	542,738	770,295	†227,556
Pueblo Suburban Traction & Lighting Co	1 m., Sept. '03	47,191	------	------	------	------
	9 " " '03	368,707	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., Sept. '03	126,000	32,000	94,000	------	------
	1 " " '02	102,960	32,873	70,088	------	------
	9 " " '03	962,300	295,100	667,200	------	------
	9 " " '02	822,020	314,937	507,083	------	------
SAVANNAH, GA.						
Savannah Electric Co	1 m., Aug. '03	50,756	26,859	23,897	9,804	14,093
	1 " " '02	46,196	24.183	22,013	9,583	12,429
	2 " " '03	101,068	54,053	47,015	19,636	27,379
	2 " " '02	92,747	48,632	44,114	19,166	24,947
Scranton Ry. Co	1 m., Sept. '03	78,622	40,561	38,061	19,786	18,275
	1 " " '02	55,647	34,379	21,268	19,086	2,182
	9 " " '03	619,577	348,735	270,842	178,072	92,770
	9 " " '02	378,932	287,333	91,599	171.772	†80,173
SEATTLE, WASH.						
Seattle Electric Co	1 m., Aug. '03	188,541	123,829	64,712	22,257	42,455
	1 " " '02	179.116	112,450	66,667	21,158	45,508
	2 " " '03	373.472	247,610	125,862	45,321	80,541
	2 " " '02	336,954	220,695	116,260	40,857	75,402
SYRACUSE, N. Y.						
Syracuse Rapid Transit Co	1 m., Sept. '03	72,079	39 966	32,113	20,329	11,784
	1 " " '02	61,164	33,545	27,619	19,025	8,594
	3 " " '03	212,593	117,459	95,134	60,883	34,251
	3 " " '02	184,314	101,224	83.090	57,075	26,015
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., Aug. '03	46,255	26,818	19,438	6,665	12,773
	1 " " '02	34,456	21,800	12,656	6,461	6,195
	2 " " '03	88,299	57,075	36,225	13,203	23,021
	2 " " '02	62,258	43,068	19,190	12,891	6,300
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Sept. '03	150,011	*78,237	71,774	41,418	30,356
	1 " " '02	127,639	*62,001	65,638	38 921	26,717
	9 " " '03	1,225,929	*631,174	594,755	366,850	227,905
	9 " " '02	1,069,058	*546,588	522,470	342,708	179,762
Toledo, Bowling Green & Southern Trac. Co.	1 m., Sept. '03	28,915	15,949	12,966	------	------
	1 " " '02	21,974	12,959	9,015	------	------
	9 " " '03	217,393	133,149	84,244	------	------
Lake Shore Electric Ry. Co	1 m., Sept. '03	63,498	36,639	26,859	20,370	6,489
	1 " " '02	46,052	29,796	16,256	------	------
	9 " " '03	467,912	296,136	176,776	179,632	†2,856
	9 " " '02	342,574	215,029	127,545	------	------
YOUNGSTOWN, O.						
Youngstown - Sharon Railway & Light Co	1 m., Sept. '03	43,781	*24,919	18,862	------	------
	9 " " '03	383,220	*226,313	156,907	------	------
ZANESVILLE, O.						
Zanesville Ry., Light & Power Co	6 m., Aug. '03	74,706	36,733	37,973	19,625	18,348