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THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Merchants' Association in Politics

The Merchants' Association having failed to impress the Legislature sufficiently to induce that body to accept its advice on matters pertaining to the transportation problem in New York, has turned its attention to the local political organizations, and has endeavored to persuade the leaders to incorporate in their respective platforms pledges of "reforms" in the present street railway methods and facilities offered the people of this city. The suggestions seem to have been received with scant courtesy, judging from the daily newspaper reports, even in quarters where attention might reasonably be expected. The trouble seems to be that reformers are impatient with each other as well as the world at large, and thus we find very often that one reformer resents as an unwarranted intrusion or interference any suggestion offered by other reformers. Each is engrossed in his own particular brand of reform, and looks upon the evil which he is trying to eradicate as the greatest calamity the world has ever been called upon to suffer. They are all bent upon effecting the salvation of the community—in their own way—even though the people may be openly indifferent. When Jerome and Fulton and Cutting and Russell—all reformers of the first magnitude—cannot agree on what and how to reform, it seems hopeless to look for harmony and unanimity with such a factor as the Merchants' Association "butting in," if we may borrow an expression much in vogue among reformers.

It would seem as if successful business men after suffering rebuffs on all sides and receiving neither encouragement nor approval in any form, would stop to consider the cause of this feeling. We have no doubt that the vast majority of members of the Merchants' Association are honest in their efforts to secure relief, but they have made a grievous mistake in entrusting the direction of the movement to men who lack judgment and discretion. They have accomplished nothing, although they had splendid opportunities, because they did not know how to use them. They antagonized everybody they encountered, denounced corporations and public officials indiscriminately for conditions which the merchants themselves did as much to create as any one else, but the culmination of their folly was in a threat to secure legislation which would place the objectionable officials and the railway companies at their mercy. The bill which they offered the Legislature as a solution of the problem "failed of passage," because it was recognized as unnecessary, impracticable and inexpedient, and when they appealed to the city conventions last week even Mr. Low's political managers did not treat them seriously. The Merchants' Association has itself alone to blame for its lack of influence in this community.

Subway Extensions

In the discussion before the Rapid Transit Commission last week regarding future work upon the subway, the contractors called attention to the fact that an undertaking of such magnitude could not be successfully accomplished without subjecting the public to some inconvenience, and they reminded the board that the great benefits to be derived from the early completion of this improvement ought to reconcile, as they would certainly compensate, the merchants and property owners affected for the temporary annoyance and financial loss sustained. Unless the public was prepared to make sacrifices the work could not be prosecuted expeditiously, and the whole plan might as well be abandoned at once, for the relief sought could not be obtained. It was estimated that under the restrictions proposed by the Rapid Transit Commission it would take at least ten years to finish the extension of the subway in lower Broadway now under construction, whereas the increased facilities are now badly needed. It should not be necessary to call attention to the fact that the present subway operations are only the beginning of the underground construction which will be required; and it must go on without intermission for many years to come, until Manhattan Island and the rivers on each side of it are honeycombed with tunnels, if this city is to enjoy fully the advantages of its position, and the people are to be afforded suitable transportation facilities.

Broadway merchants, hotel keepers and property owners still oppose the tearing up of that thoroughfare through the shopping and theatrical district so strenuously that serious attention is being given the suggestion that the proposed route be changed to Seventh Avenue. Objection is to be looked for in that quarter, also, but the annoyance and loss would not be nearly so great as in the case of Broadway, at least while the work was in progress. The effect upon the respective districts, however, is hard to predict. Many Broadway property owners fear that the subway in Seventh Avenue would raise the im-

portance of that thoroughfare so that Broadway's supremacy would be endangered, and for this reason they are urging the adoption of deep tunnel plans which would permit of the building of the line along the route originally selected without obstructing the thoroughfare seriously.

The Commissioners do not seem inclined to approve such a radical change, yet, in any event, they must assume the responsibility in the settlement of this controversy, and the urgency of the case demands prompt and decisive action.

The Use of Oil Versus Grease

The use of oil as against grease for lubrication of all of the journals on an electric railway equipment is now thoroughly established for all the larger sizes of motors, and its advantages for use in this particular have induced many companies to introduce it on the older, smaller motors, which were designed originally to use grease. It is now being realized that grease as a journal lubricant is somewhat in the nature of a makeshift. Its use, heretofore, has been largely due to the inadequacy or complication of methods of oil lubrication. As soon as heavier motor equipments came into use grease, because of its stiffness, was found to give inadequate lubrication, and the use of oil was practically forced upon elevated and interurban railway companies.

The discussion at the convention of the American Railway Mechanical and Electrical Association showed that even on the smaller motors there is an immense saving in journal wear when oil is substituted for grease, and that there are a number of devices now available whereby oil can be used without undue waste. This, of course, does not mean that oil is to be substituted for grease in locations where it is impossible properly to feed oil to the surfaces to be lubricated without excessive loss of oil, but it has been found that oil can be used on motor bearings of all sizes with advantage.

The Increasing Use of Light Gear Cases

The discussions at the Saratoga Convention of the American Railway Mechanical and Electrical Association also revealed the fact that gear cases of lighter construction than the ordinary cast-steel or cast-iron cases are finding favor in a great many places, and that their use is probably on the increase. Some roads are using gear cases made either entirely or in part of sheet steel, riveted to a frame of angle-irons, which form the corners. Others are using gear cases made of wood fastened to metal frames. Sheet steel and canvas have also been employed. A tendency is noticeable among the larger companies to make various improvements in the methods of fastening gear cases to motors when new motors are being constructed. So far the use of sheet steel or wood-gear cases has been mainly confined to older equipments, but it is a question whether the use of gear cases of this kind will not increase rather than diminish in the long run. A gear case of sheet steel or wood is very much lighter than one of cast-iron or steel, and this fact alone makes the lighter gear case less liable to destroy itself than the heavier gear case, to say nothing of the advantage of saving in weight of equipment. Of course, the sheet steel and wood gear cases are not strong, but those who advocate this form for universal use argue that many of the blows which they receive in service are sufficient to break any gear case, no matter whether it is of cast-iron or made of some lighter material, and that, furthermore, if a light gear case does become loose it is simply torn off the motor like a piece of paper and is left behind, while a heavy cast-iron or steel case would wreck the gears, and possibly wreck the car as well, in high-speed interurban service. It is also argued that as long as a gear case is something that is sure to be destroyed at times in any event, it is better to have a cheap one that will only wreck itself and not endanger the car also. It would seem that the movement toward lighter gear cases is entirely logical.

Block Signals

There is now a number of automatic electric block signal systems offered on the market for use on both single and double-track electric railways. In other words, manufacturers and inventors are making strenuous efforts to meet the great demand which has suddenly sprung up for a simple, reliable automatic block signal system. The block signal systems offered for use on electric roads are nearly all of them very similar from an operating standpoint, although differing considerably in details and in the number of wires required. All of them are radically dissimilar from the automatic block signals used on steam roads. They differ not only in construction and circuits, but require an entirely distinct set of operating rules from steam railroad block signal systems. These rules are a little more complicated than those governing steam railroad block signals, but it is doubtful whether any automatic block signal system for electric roads will soon be offered which will not involve these slightly more complicated rules.

The essential difference in the operation of the two systems is, briefly, that the ordinary signals used on steam roads are two-position signals, while those which have been most commonly used on electric roads are three-position signals. The steam road signal either indicates "clear" or "danger." There is no opportunity for it to indicate anything else. Electric road signals, as commonly installed, however, have three indications, one indicating "danger" and the other indicating "clear," and a third or normal position, which is neither "danger" nor "clear." The motorman must, of course, not attempt to enter nor can a clear signal be safely construed as an indication of a clear block unless upon approaching a signal and passing under its trolley contact the motorman should see it operate from a "normal" to a "caution" or a "danger" position.

The reason that electric railway signals have to be so constructed that the motorman must see them change to "danger" or "caution" when his car goes under the signal contact, is that there is at present no known practicable means of indicating continuously the presence of a car in a block, as there is with the track circuit used on steam road signals. It is necessary with the electric railway signal to have it operated by the passage of the car under a trolley contact, and to have it remain at "danger" until set to "clear" by the passage of the trolley wheel at the far end of the block. It is, therefore, possible to have signals stuck in "clear" position through the interruption of circuits, or the failure of the apparatus to operate, and were the precaution not taken that signals indicate "clear" only when the motorman sees them change from "normal" to "clear," there would be no safe way of operating with such apparatus. The indication of the electric railway block signal is, therefore, dependent on its action before the eyes of the motorman rather than upon its position.

In some ways this is a good point. It also has its objectionable features. There was a time in the history of block signaling on steam roads, and not very long ago either, when a large number of steam road managers strongly preferred, and even insisted on, a signal which should operate from danger to clear position in sight of the engineer as the train approached, the idea being that this would show the engineer

that the signal was in operative condition and not at "clear" because it was stuck there.

The objection to a signal which must assume a "clear" position before the eyes of an approaching motorman in order to really mean "clear," is that sometimes if the motorman sees the signal at clear he may assume that it changed as he approached without his actually having seen it change. This, however, is a matter of operating discipline. No block signal system is worth anything unless there are rules strictly observed in regard to it. No block signal system is an absolute protection. It is only a valuable additional safe-guard that few roads can, in the long run, afford to be without.

The Record Broken

As we go to press the report comes in that the new series of tests on the Berlin-Zossen line has resulted up to date in reaching the tremendous rate of 117 m. p. h. Experiments were in progress for about ten days, beginning at a speed of about 90 m. p. h., and pushing gradually from day to day onwards until all previous records were broken and the car was driven at the prodigious speed noted, faster by at least a few miles than any structure of man's device has ever before run. Only projectiles can claim a higher speed. The cars, we understand, are the same as used in the previous trials, and have been fully described in our columns, while the track and roadbed have, since their failure at speeds above 90 m. p. h. in the previous work, been put in condition to stand the strains of speed never before attempted. The most gratifying feature of the new tests is that neither cars nor tracks have given trouble, and that there is every expectation that when the tests are resumed the speed will be pushed to the rate of 125 m. p. h., which was the original aim of the tests. And unless the track again shows signs of weakness we will venture to predict that 125 m. p. h. will be exceeded by a comfortable margin. The German government happens to need this Berlin-Zossen line, which is a strictly military road, for a few days, and work will then be resumed on this most brilliant series of experiments. We extend our heartiest congratulations to our German friends on the splendid work they have accomplished, and our most sympathetic hopes that before many days they will have passed the goal which they set for themselves in the beginning. We are proud of their success as part of the world's tribute to the twentieth century.

And more than this, we must confess to a large measure of personal satisfaction in the achievement, for at the very beginning of the Zossen work we freely predicted its success, and took the position that the one thing to be feared was the track. We have consistently held to the position that ample power had been provided in the motors and that the contact devices would deliver that power. We have steadily contended that some of our own countrymen who have deduced enormous and forbidding air resistances from coasting experiments, have been in the wrong, and that high speeds instead of verging on the impossible were clearly within reach. The event has already proved the substantial correctness of our views. As the higher speeds have actually been reached the demand for power has uniformly been found smaller than has been predicted, and very high speeds are certainly within reach whenever commercial demand for them arises. With 117 m. p. h. actually attained, and 125 m. p. h. soon to come, the technical status of the art may be considered as already determined. A train speed of 100 m. p. h., or even more, is not a dream but a certainty whenever it is demanded, and our hope is strong that we shall have the pleasure of riding at that speed before we are many years older. We have heard now for years of the hundred-mile-an-hour train, but until the daring Zossen tests were initiated it seemed afar off, for the necessary enterprise was painfully lacking.

Our only source of regret is that this achievement should not have fallen to the lot of some of our own countrymen. Time and again we have tried to goad them into activity, but the necessary initiative was not forthcoming. We are by no means disposed to belittle American work in electric railroading, for it has been by far the most important factor in the art, and American apparatus and methods have been carried by American engineers wherever the sun shines. Even the Pyramids look down upon the American trolley car. But of late there has been too much disposition to look upon our methods and apparatus as finalities, to be subject to minor improvements as a matter of course, but still representating so nearly the ideal that we could afford to standardize and rest upon our laurels. Standardize if you like, but if you rest upon your laurels they will surely wither. The engineer had better follow the suggestion of Kipling's fine old pirate:

> And they asked me how I did it, and I gave 'em the Scripture text,
> You keep your light so shining a little in front o' the next!
> They copied all they could follow; but they couldn't copy my mind,
> And I left 'em sweating and stealing a year and a half behind.

Too much complacency gives the other fellow a chance to catch up, by which he generally profits. It is unfortunately true that the trend of railway affairs in the United States is such as to hamper startling innovations. The main steam railway lines are tied up in large consolidated systems, and all the weight of their influence stands against any enterprise that would tend to force them out of their profitable and comfortable rut. The proposal of building a long electric line to operate at a hundred miles an hour would strike terror, ill hidden by assumed scorn, into general railway circles. But if American enterprise would not be left behind by foreign competition it must be on the move. Our German friends have the pole in the race already, and it will take a hot pace to win out from them.

Construction Work Next Year

The present indications are that the coming year will hardly see the amount of construction of new interurbans that has been done during the last year, owing to the condition of the financial world at present. Beginning with last spring there has been a steady decline in the value of the majority of securities and an increase in rates of interest, which indicates that there is not the amount of money seeking investment in new enterprises that there was a year ago. So many new enterprises have been floated during the last few years that a great drain has been made upon money seeking investment, and it would look as if the long-expected check to the unusual activity in interurban construction had come. This does not mean that there will not be considerable new work during the next few years, but it does mean that abnormal and unjustified activity in this direction will cease. Manufacturing companies have not as yet felt any marked decrease in orders, nor is it likely that they will for some time to come, as so many large companies, which are almost independent of the state of the money market, are being forced to make extensions by great increase in traffic. The only projects that are suffering from the present financial conditions are those new ones which are least attractive and most visionary.

Everything considered, probably it is a good thing that this check has come at this time, as it will prevent the building of roads which are not warranted, and will tend to keep the electric railway industry on a firm basis.

AUBURN & SYRACUSE ELECTRIC RAILWAY

More than usual interest centers in the recently opened interurban railway between Auburn and Syracuse, because of the direct competition with steam lines which is thus created in this territory. From Syracuse, as a center, there are at present three competitive lines in operation, one reaching Auburn, 26 miles distant, by a line paralleling the Auburn road of the New York Central; another to Baldwinsville, 13 miles, paralleling the Lackawanna, and a third to Fayetteville, 14 miles, paralleling the Chenango branch of the New York Central. The Auburn & Syracuse road is at present single track, although graded for double track for half the distance, and it runs on private right of way for 17 miles. Part of the road was built some time ago, and the completed system was opened on June 23.

The Auburn & Syracuse Electric Railroad Company is a consolidation of the Auburn City Railway, controlling the city lines in Auburn, and the Auburn Interurban Electric Railroad Company, which operated a line from Auburn to the village of Skaneateles. A map and profile of the completed line between Auburn and Syracuse are presented in Fig. 1. It will be seen that this line traverses a well-settled and prosperous farming country. Skaneateles Lake, one of the most beautiful spots in Central New York, lies along the route of this line, and contributes greatly to its patronage. There are two other lakes within reach of this road, namely, Owasco, which is 2 miles south of Auburn, and Otisco, 3 miles south of the railroad and several miles east of Skaneateles Lake.

FIG. 1.—MAP AND PROFILE OF INTERURBAN ELECTRIC RAILWAY

Many residents of Auburn and Syracuse enjoy their holidays at the lakes in this vicinity. Owasco Lake is popular as a summer resort and as a fishing ground, and is easily reached by a branch of this road, formerly part of the Auburn City Railroad. Fig. 2 is a typical line view looking toward Syracuse and showing Onondaga Lake in the distance, and Fig. 3 is a view of Long Bridge over Nine-Mile Creek and the tracks of the Marcellus Electric Railway.

The road serves a population of approximately 165,000 in cities and villages which it passes through, besides a large number of people living in the country, who patronize it freely. At the present time it is not giving express service, but this will be provided soon. It is necessary now for the farmers to drive from 4 miles to 8 miles to the nearest station on the Auburn branch of the New York Central to make express or freight shipments.

ROADBED

The country through which this line passes being of a rolling nature, the road necessarily has a number of short but heavy grades, some being as high as 9 per cent. The longest grade is 3½ per cent and 1 mile in length. The sharpest curve is one of 10 degs., having a radius of 574 ft., while the next one is a 6-deg. curve, having a radius of 955 ft. The 6-deg. curve is on a grade of 1¾ per cent.

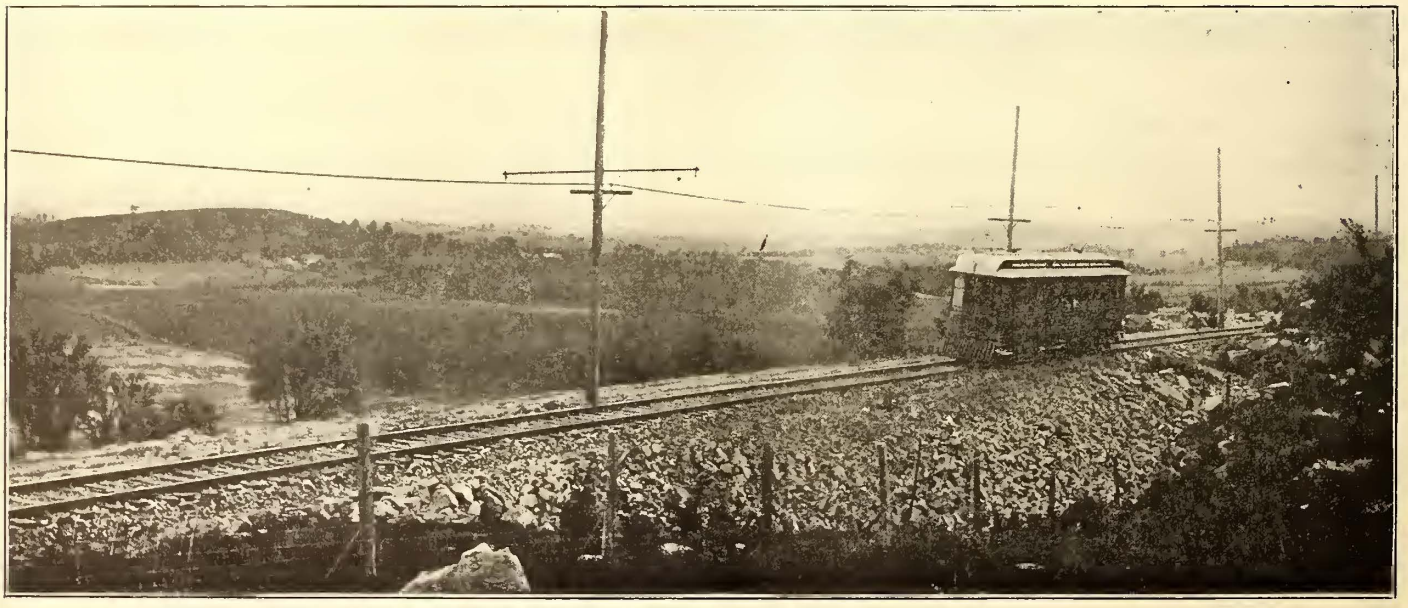


FIG. 2.—TYPICAL LINE VIEW, SHOWING ONONDAGA LAKE IN THE DISTANCE

The roadbed is already graded part of the distance for double track, which it is proposed to lay between the two cities. All rails weigh 70 lbs. to the yard. Cross-ties are 8 ins. x 8 ins. x 6 ft., and of cedar, chestnut or Southern pine.

The regular schedule time required for the run, including all stops between Auburn and Syracuse, is an hour and thirty minutes, with a maximum speed on the level of 1 mile per minute.

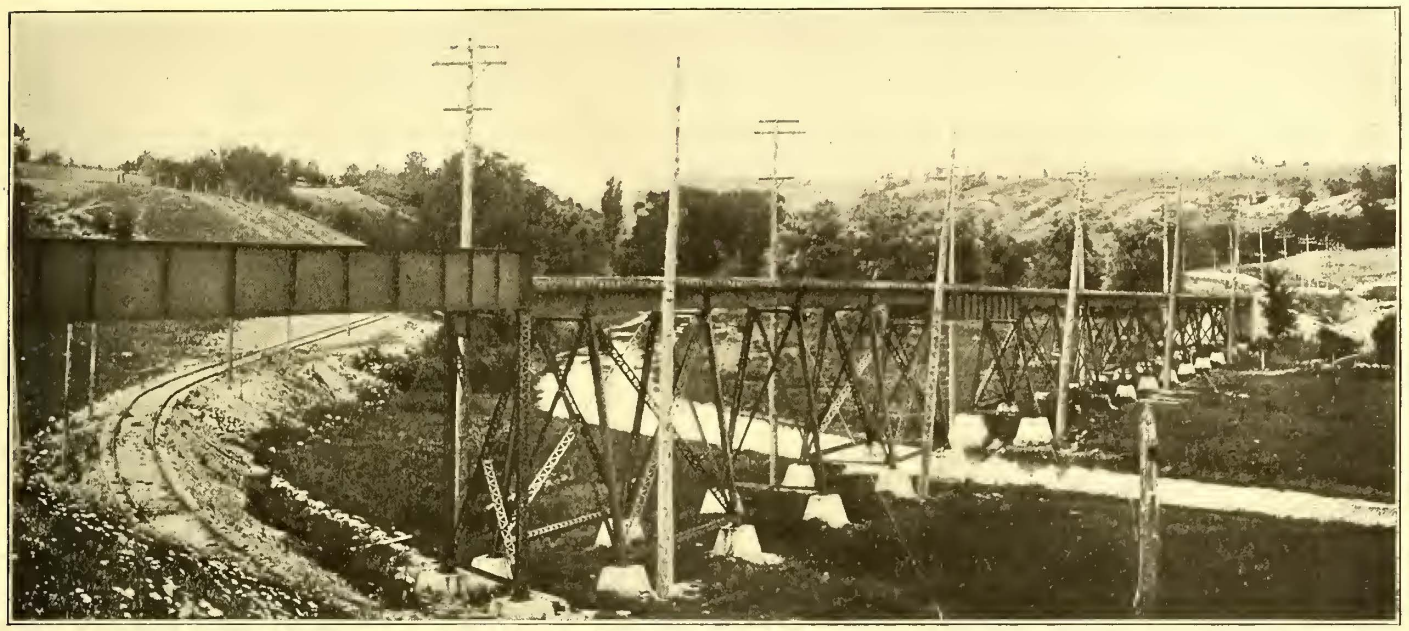


FIG. 3—LONG BRIDGE OVER NINE-MILE CREEK AND THE TRACKS OF THE MARCELLUS ELECTRIC RAILWAY

MAIN POWER HOUSE

The main power plant is located at Auburn, and several views of this station are presented herewith. Fig. 4 is an exterior view showing the Auburn branch of the New York Central & Hudson River Railroad at the left, together with a trestle used in unloading coal. The opposite end of this trestle connects with the Lehigh Valley Railroad, which crosses the New York Central just beyond the power house. Fig. 5 is a view of the engine room, showing two 650-kw, three-phase, 360-volt, 25-cycle Westinghouse generators, driven by two 1000-hp Westinghouse cross-compound condensing Corliss engines. Fig. 6 is another view of the engine room, and shows one 50-hp motor-exciter set, two 400-kw rotary converters and a fifteen-panel switchboard. Fig. 7 is a view of the transformer room of the main power house. This is directly below the engine room and contains three 300-kw oil-insulated self-cooling transformers. The leads and cables going to the main switchboard, which is directly above the transformers, are distinctly shown. These features will be described more in detail in their proper place.

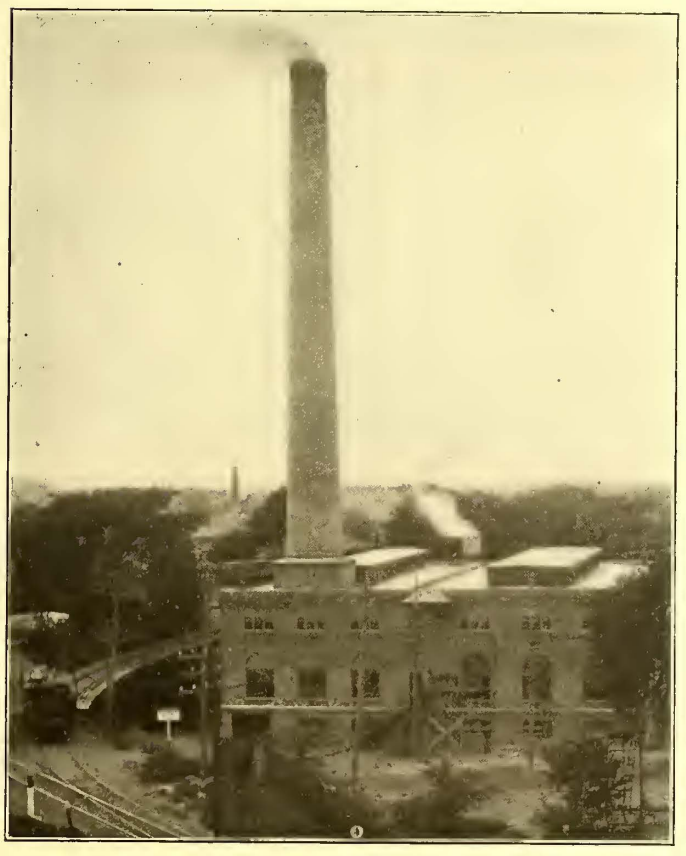


FIG. 4.—EXTERIOR OF MAIN POWER HOUSE AT AUBURN

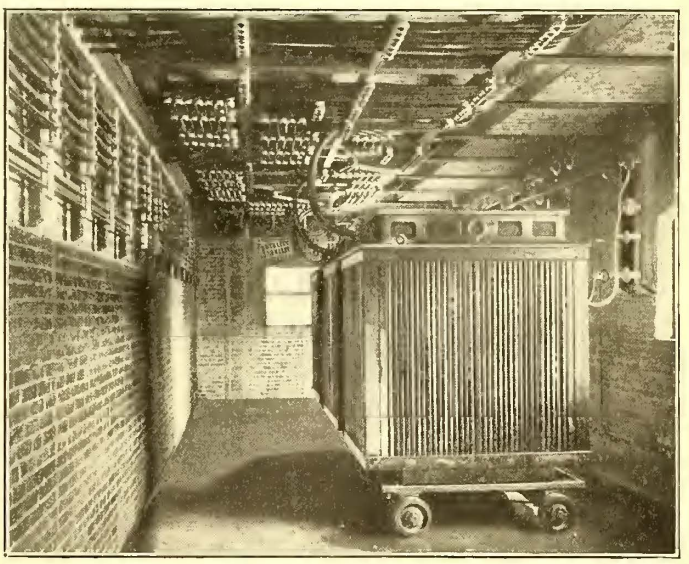


FIG. 7.—VIEW OF TRANSFORMER ROOM, DIRECTLY BELOW SWITCHBOARD IN AUBURN POWER HOUSE

The steam equipment of the power house consists of five safety water-tube boilers, each of a capacity of 250 hp at 125 lbs. steam pressure. They may be operated at a higher pressure when desired. A Greene economizer, having 280 tubes, heats the boiler feed water. All steam piping is extra heavy, and was furnished by the Walworth Manufacturing Company.

The two large engines have a capacity of 1000 hp each, at 150 lbs. steam pressure. They are of the Westinghouse-Corliss horizontal cross-compound condensing type, operating at 100 r. p. m. The cylinders are 22 ins. and 44 ins. x 48 ins. Each engine is fitted with a Deane steam pump simplex condenser.

Directly connected to the engines are two 650-kw, three-phase Westinghouse generators, operating at 100 r. p. m. On ordinary occasions one of these generators is sufficient to carry the load, but on days of heavy travel both are operated in parallel.

There are two Westinghouse rotary converters in the generating station. These receive alternating current direct from the generators at 360 volts, three phase, and deliver direct current at approximately 600 volts. Each has a normal capacity of 400 kw, and operates at 500 r. p. m. They are provided with induction motors mounted upon the ends of the shafts for use in bringing their armatures up to speed for synchronizing. The starting motors are furnished with three-pole, double-throw switches, which admits of applying two different voltages to the primaries of the induction motors, thereby giving different speeds for synchronizing. A closer adjustment in speed is obtained by changing the strength of the rotary fields.

Each rotary converter is furnished with a magnetic oscillator, which furnishes lateral motion to the armature, preventing the formation of ridges on commutator surfaces.

There are two 37½-kw, 125-volt exciter sets in the generating station, either of which is of sufficient capacity to excite the field of both generators. One is directly connected to a 50-hp, three-phase type-C induction motor, giving 3000 alternations, operating at 720 r. p. m., and the other to a Westinghouse 9½-in. x 9-in. standard engine, operating at 300 r. p. m. The steam-operated outfit is used for starting up the plant, after which the motor-driven set is paralleled with it and the first one shut down. The alternating-current generators then operate as self-exciting machines by furnishing alternating current to drive the exciter outfit.

The switchboard consists of 14 panels of blue Vermont marble, placed side by side, 8 ft. from the wall, and contains the usual complement of switches and instruments. The two generators operate in parallel upon a common set of bus-bars, from which are operated the rotaries. All direct-current instruments are the long-scale dead-beat type-F, and are finished in black. Their scales subtend an angle of nearly 300 degs., and have uniform divisions from 20 per cent to full scale deflection.

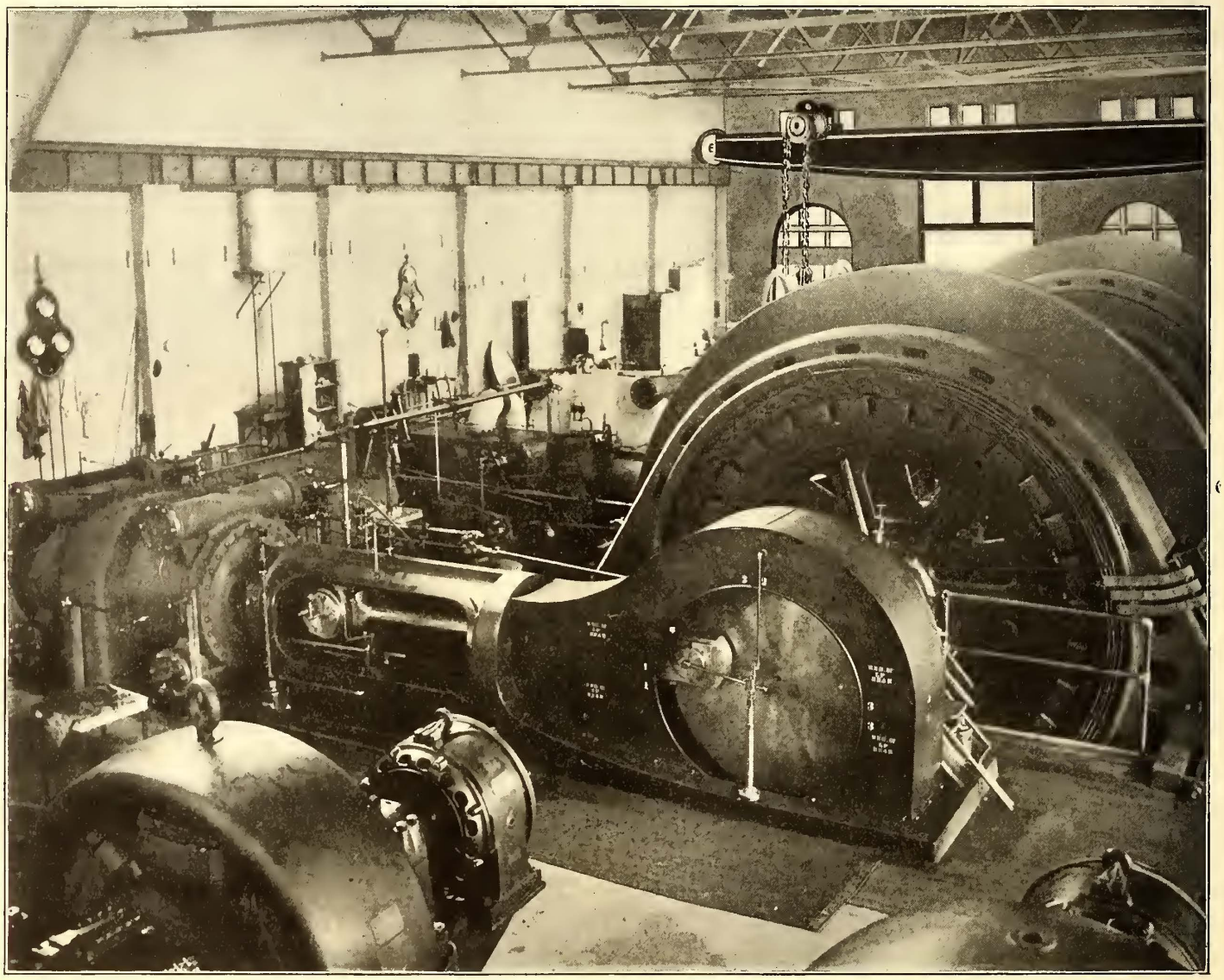


FIG 5.—ENGINE ROOM IN MAIN POWER HOUSE AT AUBURN

In view of the fact that the load is practically balanced one ammeter serves to measure the current for each machine. The current in any phase of the three-phase circuit may be measured with this ammeter by the use of special connections and plug switches. This is accomplished by opening the plug switch which controls the secondary winding of the series transformer connected to the phase whose current is to be measured.

In front of one of the panels is a swinging arm, which has mounted upon it two alternating-current voltmeters, one power factor motor and one synchroscope. This arm may be swung in any position, enabling the instruments mounted thereon to be plainly read at any point along the switchboard. This is

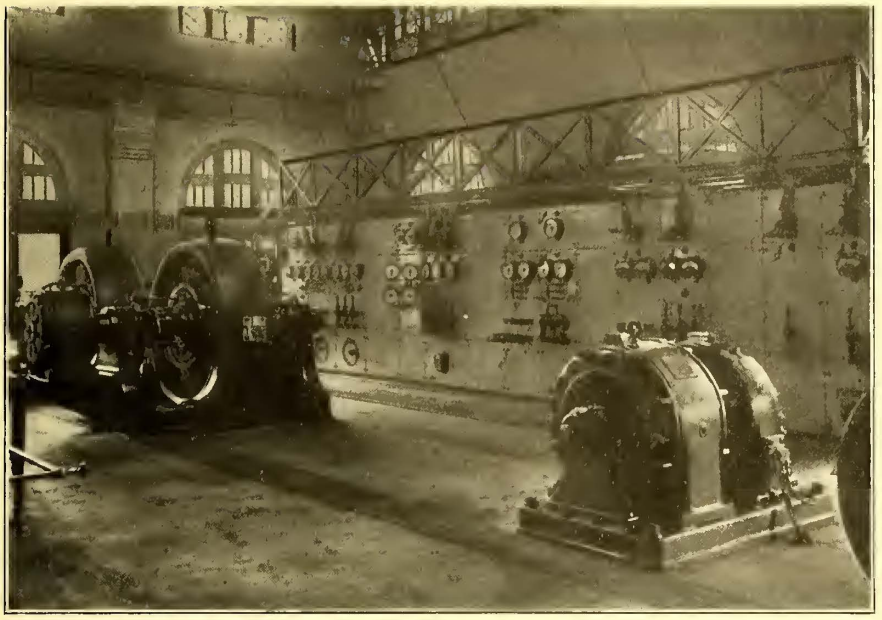


FIG. 6.—SWITCHBOARD, ROTARY CONVERTERS AND EXCITER IN MAIN POWER HOUSE, AUBURN

very convenient for attendants when synchronizing the generators or rotaries, as the voltage of each machine and the relative phase relation are in plain view when operating the field rheostats and switches.

The power factor meter may be connected to either generator or rotary converter by the use of a plug switch. This enables the attendant to adjust the field of the machine for minimum armature current. It also indicates whether the current is lagging or leading. The synchroscope is used to throw the generators and rotaries in multiple, and it shows at all times whether the incoming machine is too fast or too slow and exactly how much. If the incoming machine is too fast the pointer will revolve in one direction, and if too slow it will revolve in the opposite direction. When the needle is in an upright position its pointer is at zero on the scale, showing that the two machines are in step and the paralleling switch may be closed.

The generator voltage is raised to 16,500 volts, three-phase, for transmission to the two sub-stations by three 300-kw, oil-insulated self-cooling transformers. These transformers are mounted in a fireproof apartment directly under the switchboard. The leads are carried from the switchboard to the transformers through an opening in the floor 6 ins. wide, extending the length of the switchboard and immediately back of it. This avoids the necessity of bending the low-tension cables. The high-tension leads from the transformers are carried up along the wall of the building, passing through high-tension switches, all of which are mounted upon the wall, 15 ft. above the switchboard. Adjacent to the switches are also mounted the low-equivalent lightning arresters and choke coils. The transformers in the basement are mounted upon small trucks, having wheels to facilitate handling in case it is necessary at any time to shift their position. There is an extra transformer kept ready to place in service should an accident occur during operation. These transformers are connected in delta, and switches are provided upon the transformer switchboard panel for cutting out any of the transformers without interrupting the service.

The main power house also contains two 120-kw, two-phase, revolving armature-type Westinghouse generators, which furnish current at 2200 volts to the Citizens' Light & Power Company for lighting in the city of Auburn. The power house is laid out for 1000 kw additional generator capacity.

TRANSMISSION LINE

The transmission line consists of two distinct three-phase high-tension lines mounted on opposite ends of the same cross-arms. This pole line, in addition to carrying the high-tension lines, carries the trolley feeder cables. It also furnishes supports for the trolley wire. Only one high-tension line is in service at the same time, the other being kept as a reserve.

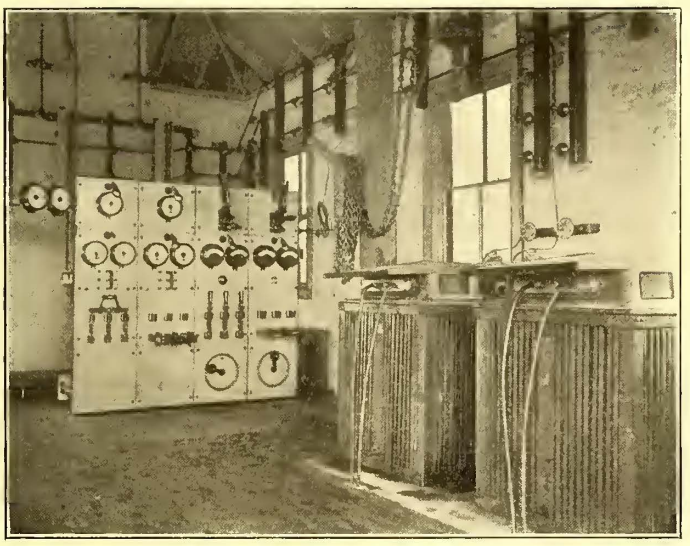


FIG. 9.—SWITCHBOARD AND TRANSFORMERS IN HOWLETT HILL SUB-STATION

SUB-STATIONS

There are two sub-stations, one at Skaneateles and the other at Howlett Hill. The Skaneateles plant contains one 400-kw rotary converter, which is similar to the machines in the generating station, with one alternating-current and one direct-current switchboard panel for controlling it. In this station are three 150-kw, oil-insulated self-cooling trans-

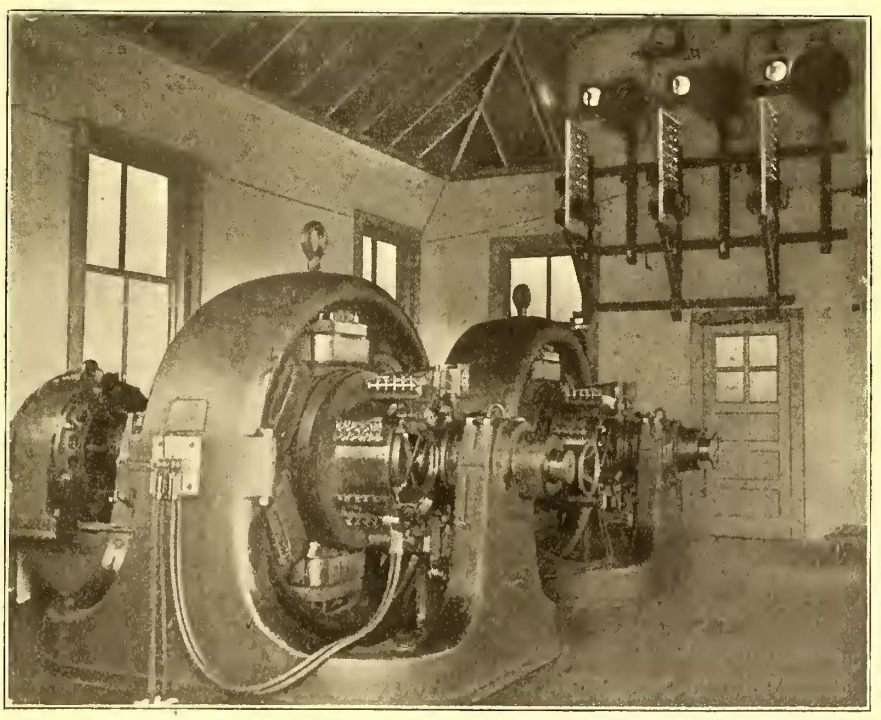


FIG. 8.—ROTARIES IN HOWLETT HILL SUB-STATION

formers, connected in delta, which reduce the line voltage of 16,500 volts to suitable voltage to give 600 volts on the direct-current side of the rotary. This station is protected from lightning by Westinghouse low-equivalent arresters similar to those used at the generator station end of the line.

The Howlett Hill sub-station contains two 400-kw rotaries, also duplicates of those in the generating station. These are fed by three 150-kw transformers, duplicates of those in the Skaneateles station. These transformers are intended for the operation of only one rotary at a time. Both sub-stations are protected by low-equivalent lightning arresters. Fig. 8 is an interior view of the Howlett Hill sub-station, showing two 400-kw rotary converters. Fig. 9 is another view of the same station, showing the switchboard and two of the transformers, each of 150-kw capacity.

EQUIPMENT

The motors used on the Syracuse division of this road are all Westinghouse No. 76, four motors to a car. These motors have a continuous capacity of 55 amps. at 400 volts, and in a shop test, operating at this load for ten hours, the rise in temperature did not exceed 75 degs. C. In actual service, owing to improved ventilation, it is estimated that the temperature rise will be considerably less, probably not over 55 degs. C.

The rolling stock on this road consists of six passenger cars, each with a seating capacity of fifty-six people. Each car is 50 ft. in length outside, 40 ft. inside, weighs 30 tons, and has a smoking compartment. They were made by the Kuhlman Car Company, of Collinwood, Ohio. The weight of these cars, the speed at which they operate, and the steep grades made the question of safety devices an important one. The Westinghouse Air Brake Company furnished the brakes and the motor-driven pumps which are employed on each car.

The cars are mounted on Peckham No. 36-B trucks, with 5½-in. axles and pressed wrought iron steel-tired wheels.

OFFICERS

The officers of the road are: C. D. Beebe, president and general manager; W. A. Holden, vice-president; A. K. Hiscock, treasurer; R. A. Dyer, Jr., assistant general manager and mechanical engineer, and A. G. Davids, general superintendent.

The road was built by the Syracuse Railroad Construction Company, with George D. Grannis as manager and Thomas H. Mather, chief engineer.

NEW POWER STATION AT BRUSSELS

In the Street Railway Journal for Aug. 1, 1903, a notice was published of the completion of a new polyphase power station by the Brussels Tramway Company. This station is undoubtedly one of the most complete of any for railway work on the Continent and compares favorably with that in any other part of the world. It is designed to supply the power for all the tramways in the city of Brussels, which are now being converted to electric power. The Brussels system includes about 80 km (50 miles) of double track, on which an average of 190 trains of 15 tons each are operated in ordinary service, and 295 trains of the same weight in rush-hour service.

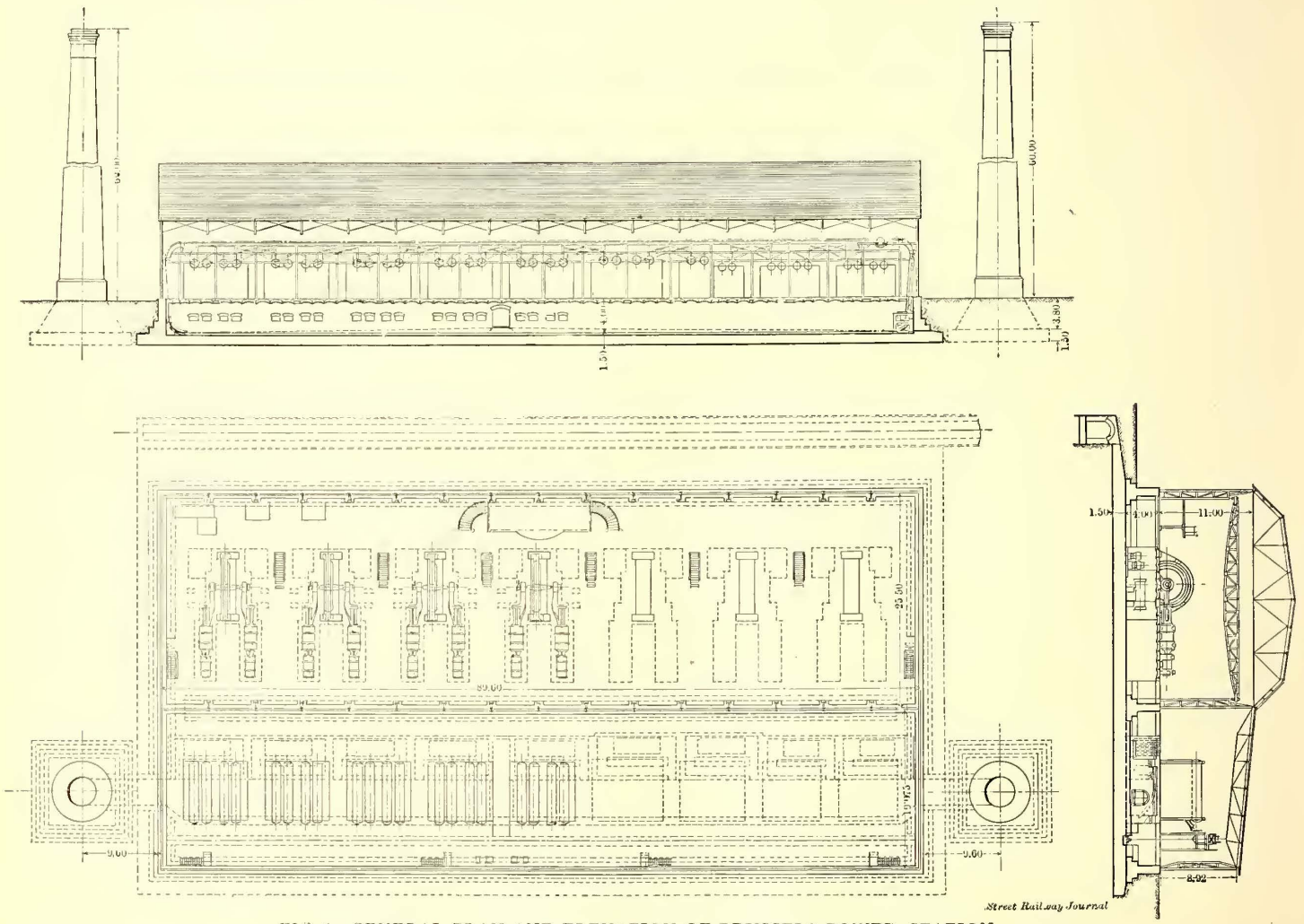


FIG. 1.—GENERAL PLAN AND ELEVATION OF BRUSSELS POWER STATION

The station is situated at Anderlecht, a suburb of Brussels, and at the side of the Charleroi Canal. The general plan of the power station is shown in Fig. 1. The engine and boiler rooms extend parallel to the canal so that they can be easily extended in case an additional power equipment is required. The foundations for the engine and boiler rooms are concrete, 1.5 m (4 ft. 10 ins.) in thickness, braced by two layers of old rails. These

rails are located respectively 20 cm (8 ins.) from the bottom and 25 cm (10 ins.) from the upper surface of the concrete. The foundations extend for 3 m (10 ft.) on each side of the center line of the walls, and on the side of the canal are connected by masonry to the aqueduct. The foundations of the building are carried up to a height of 3.8 m (12½ ft.), on which is constructed the steel frame work, which constitutes the walls proper. The foundations of the stacks are formed by two layers of concrete, 12 m (40 ft.) square and 1½ m (5 ft.) thick, on which is the masonry base of the chimneys. Water for condensing purposes is taken from the canal by means of a masonry aqueduct, and after passing through the condensers is discharged into a basin, whence it is returned to the canal by four pipes, each 0.70 m (27½ ins.) in diameter and arranged in fan shape.

The engine room contains at present four units of 1500 kw each, but there is room for the installation of three additional units of the same size. The engines were built by the Vande Kerchove Company, of Ghent, and are of the twin tandem compound type, there being two engines of from 900 hp to 1400 hp directly connected to the same shaft, which carries the rotor of the alternator. The cylinder dimensions of these engines are 630-mm and 1090-mm x 1200-mm stroke (24.8 ins. and 42.9 ins. x 47.2 ins.). They operate at 94 r. p. m., with a pressure of 9 atmospheres (120 lbs.) with the temperature of the admission steam at 275 degs. to 300 degs. C. (460 degs. F. to 500 degs. F.). The variations in speed are guaranteed not to exceed ½ per cent during constant load, 2 per cent during a rapid change in load of 25 per cent, and 6 per cent during a rapid change from 0 to maximum to vice versa. The rotor of the alternator, whose moment of gyration is 700,000 kg m (7,063,100-ft.-lbs.), is of sufficient weight to insure the synchronous operation of the alternators without any special apparatus.

The normal horse-power of the two twin engines is 1800

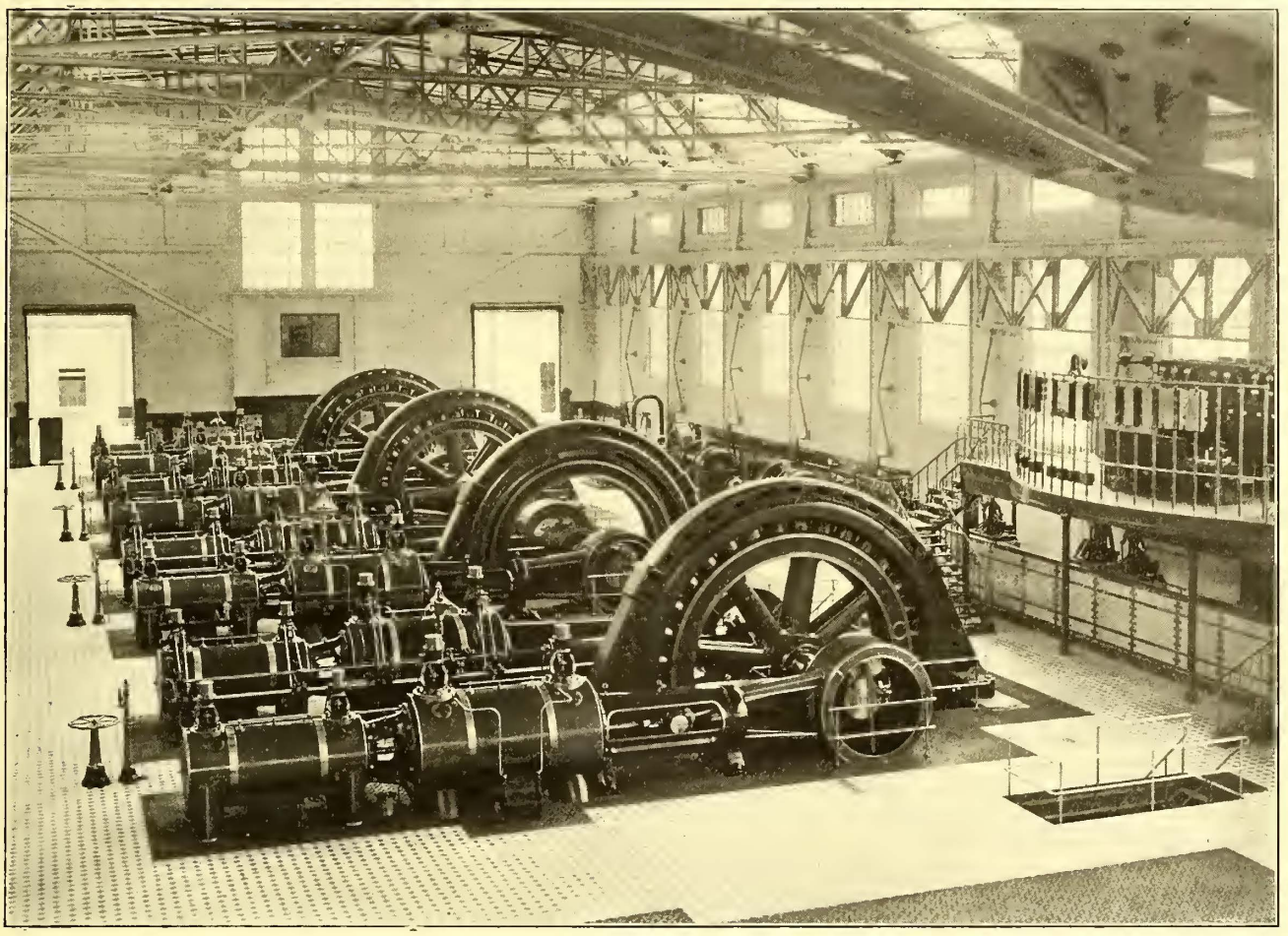


FIG. 2.—GENERAL VIEW OF ENGINE ROOM, SHOWING SWITCHBOARD GALLERY

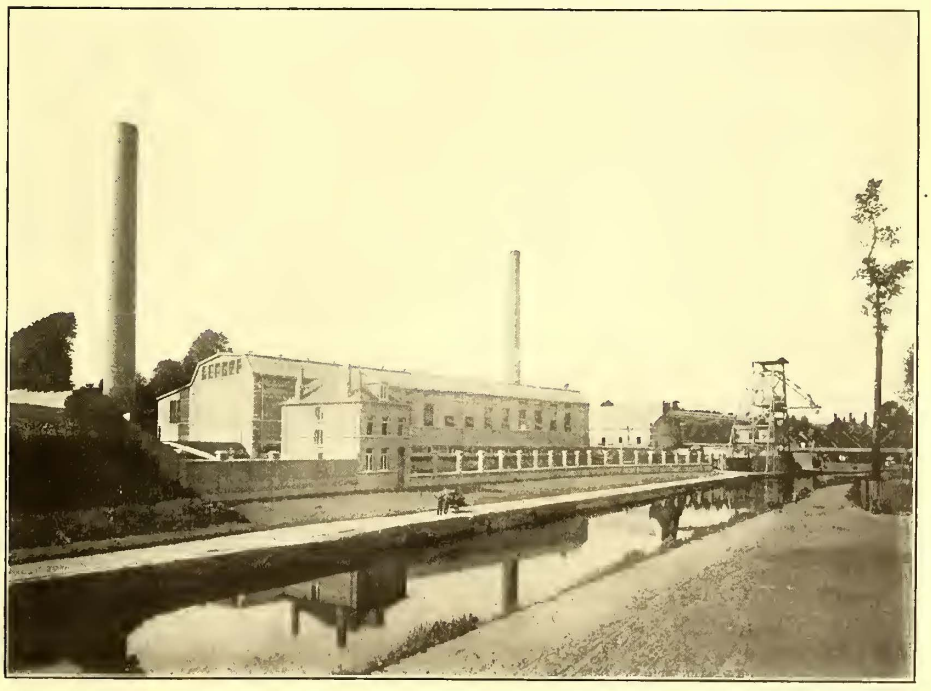


FIG. 3.—EXTERIOR OF POWER STATION

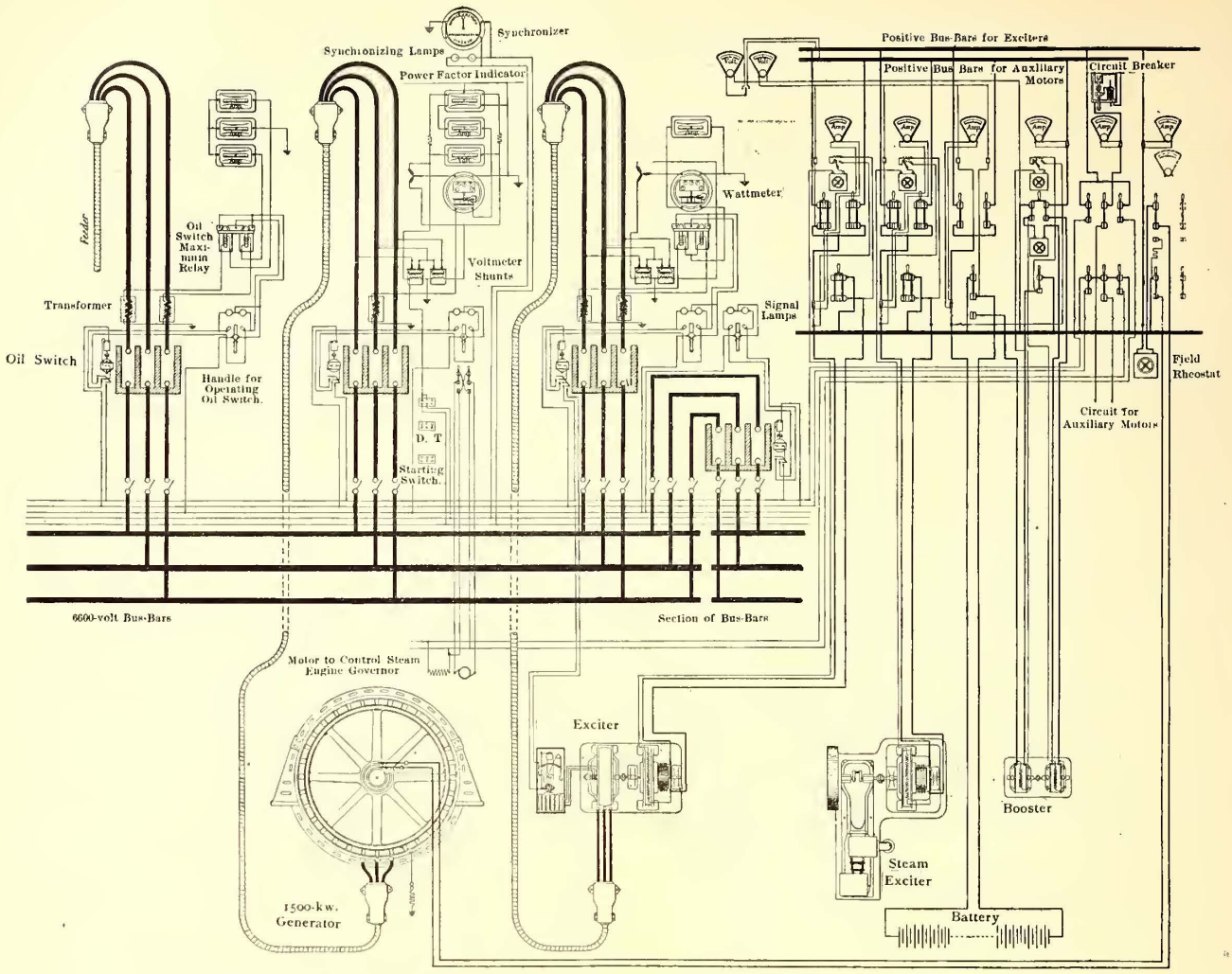


FIG. 4. DIAGRAM OF CONNECTIONS OF MAIN POWER STATION

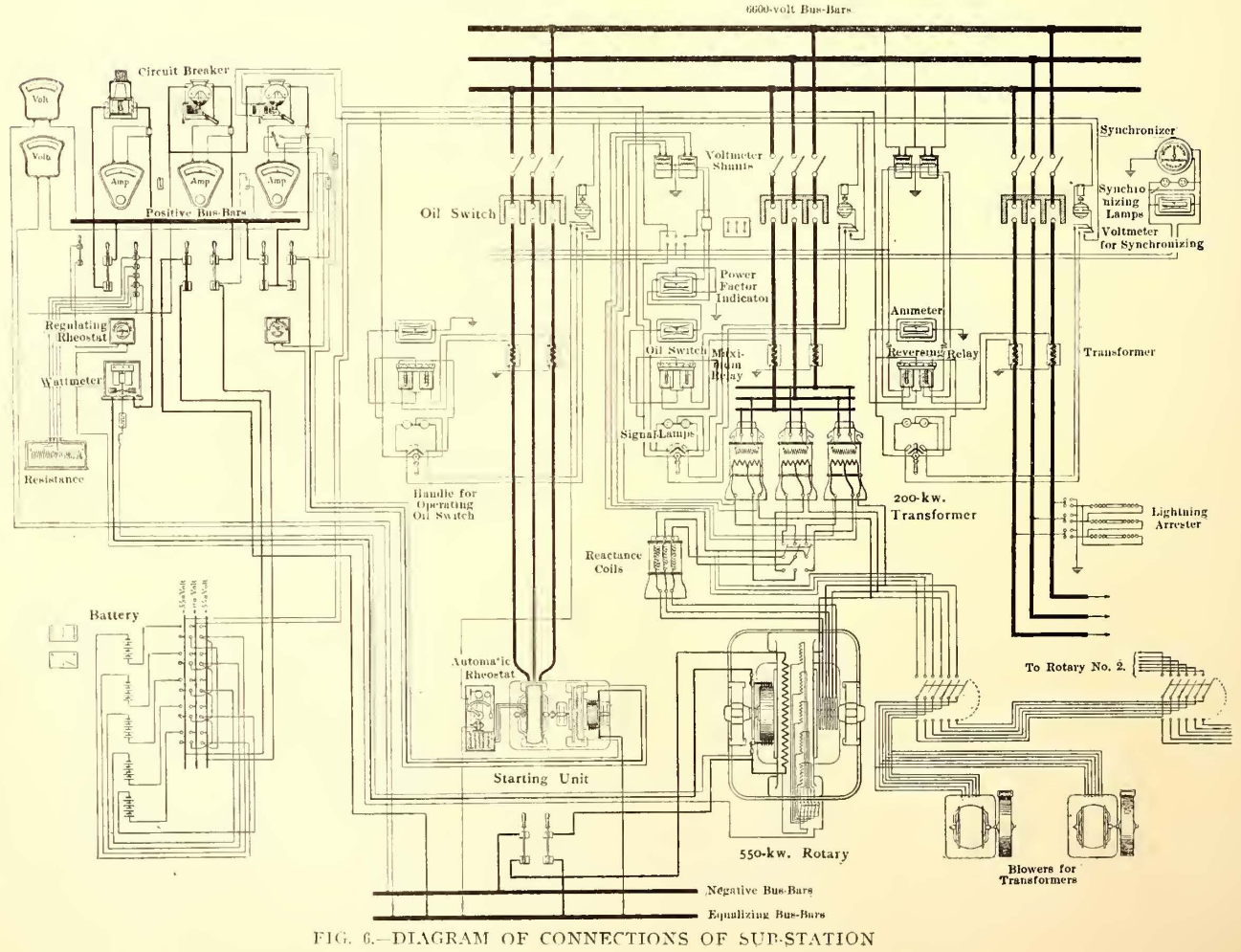


FIG. 6.—DIAGRAM OF CONNECTIONS OF SUB-STATION

hp at cut-off at 23 per cent of the length of stroke, and 2800 hp at 45 per cent cut-off. There are four valves for each cylinder, operated by a simple valve gear.

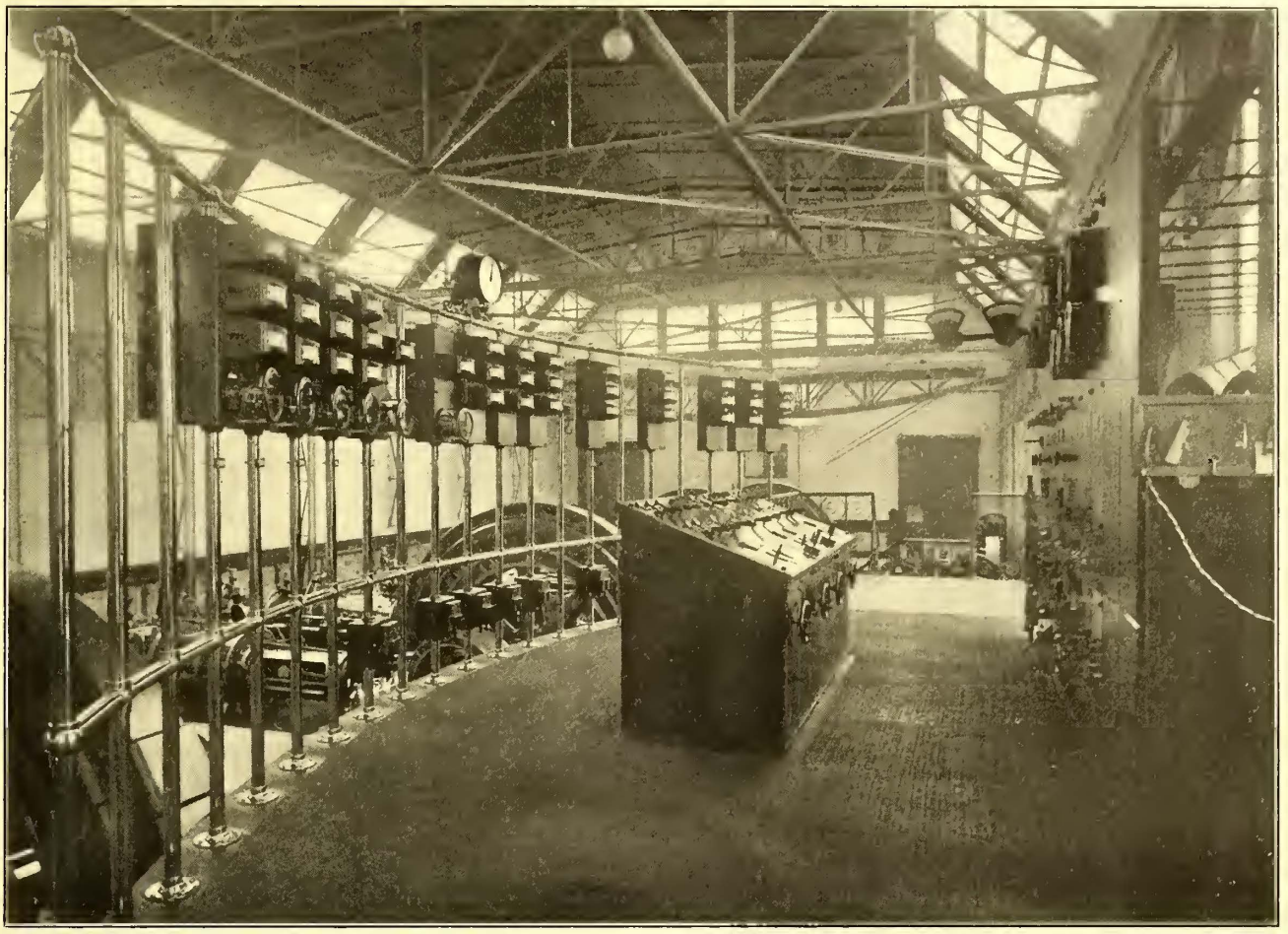


FIG. 5.—SWITCHBOARD GALLERY IN MAIN STATION, WITH DIRECT-CURRENT APPARATUS AT RIGHT, BENCHBOARD IN CENTER, AND ALTERNATING-CURRENT MEASURING INSTRUMENTS ON FRAMEWORK AT LEFT

The high pressure cylinders are not jacketed. A receiver is placed between the two groups of cylinders. The discharged steam from the high-pressure cylinder before passing to the low-pressure cylinder is warmed in this receiver by means of the live steam, which traverses a set of parallel pipes contained therein. Before entering the low-pressure cylinder the steam passes through the low-pressure cylinder jacket.

Each group of engines is served by two surface condensers constructed with sets of parallel brass tubes, through which passes the water of condensation. The circulating pumps, air pumps and feed-water pumps are driven directly from the crank heads of the engines. A single governor is used for the two twin machines, acting on the four cylinders. There is also an electrical governing device controlled from the switchboard, which permits a slight displacement of the counterweight of the governor, so as to vary the speed and facilitate at the same time the synchronizing of the alternators when they are to be put in parallel. The four alternators were built by the Union Elecktricitats Gesellschaft, and supply current at 6600 volts at 25 cycles. Two of the exciters are driven by 6600-volt induction motors, the third by a steam engine.

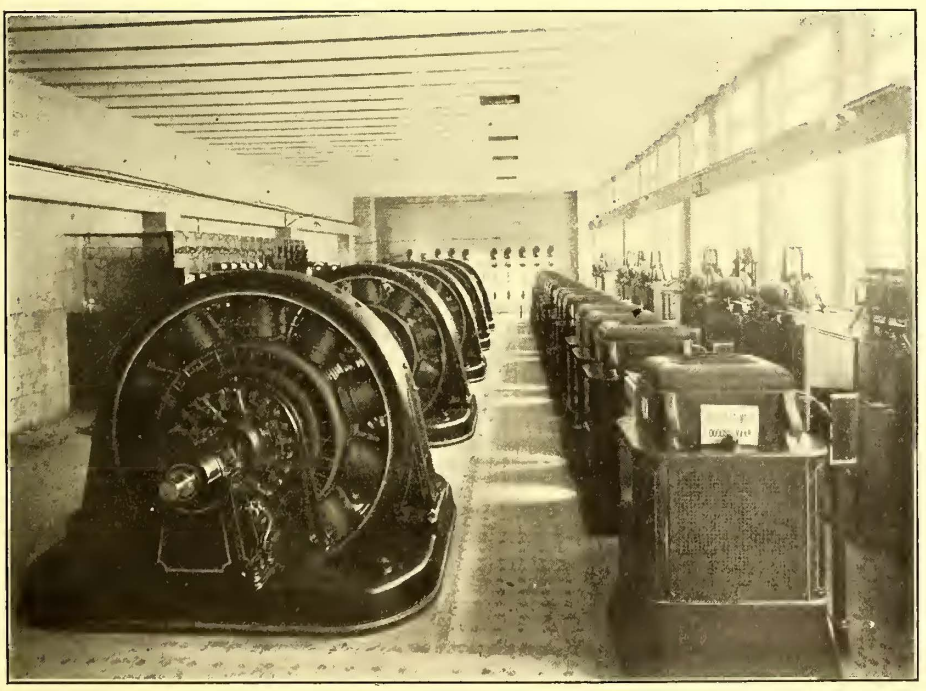


FIG. 7.—INTERIOR OF ONE OF THE SUB-STATIONS

The distribution system is illustrated in Fig. 4. The switchboard, as in all recent American work, has been designed so as to prevent any possible danger from the operator coming contact with the high-tension apparatus. All high-tension switches are inclosed in masonry cells and are operated from the switchboard by means of low-tension direct-current motors.

The switchboard proper, which is mounted on a platform where a complete view of the power station floor is obtained, is of somewhat novel design, being

divided into three distinct portions. The first comprises the low-tension, direct-current apparatus for the exciters, battery, lighting circuits and motors used around the power station.

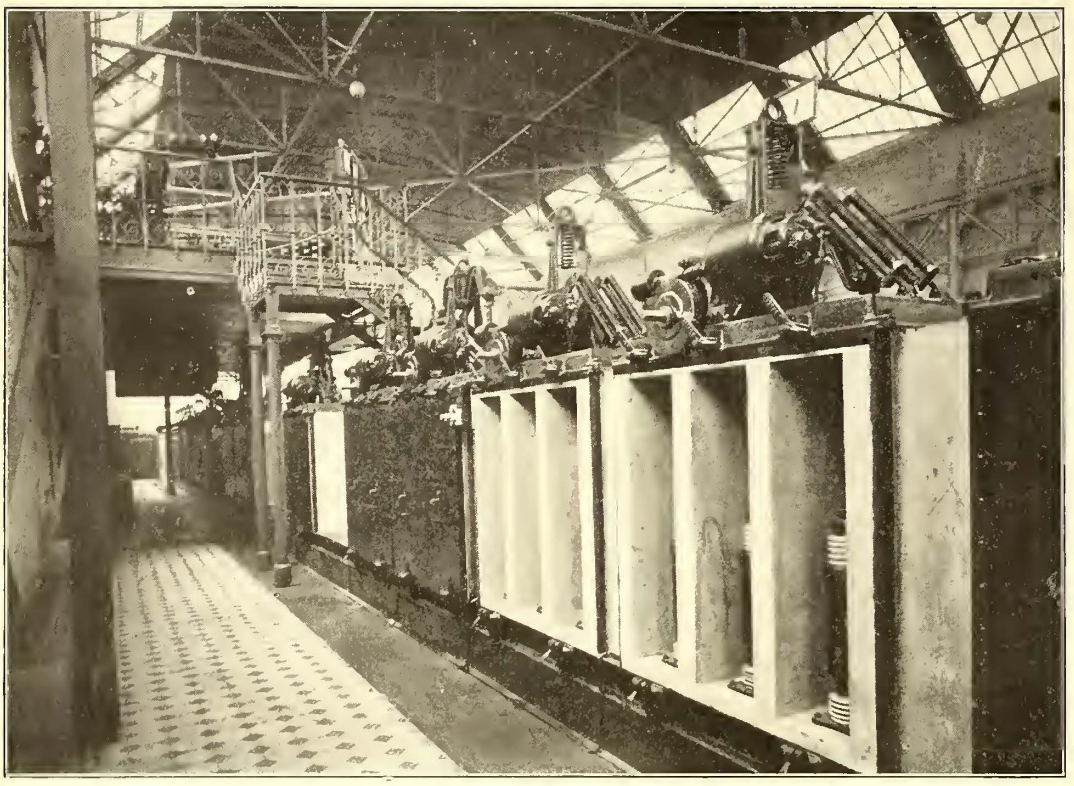


FIG. 8.—OIL SWITCH ROOM

This part of the switchboard is carried on vertical panels placed close to the rear wall, and is composed of three generating panels, one battery panel, three auxiliary motor panels and one panel for the battery booster.

The second part of the switchboard is that for controlling the high-tension switches, and the apparatus is arranged on a bench board in front of the panels already described. As the high-tension switches are operated indirectly, the bench-board carries only the low-tension apparatus for doing this work. An arrangement of signal lamps shows whether the oil switches are open or closed. This bench-board is also fitted with the rheostat connections for the alternators and with the controllers for the electrical-governing device on the engines, to which reference has already been made.

The third part of the switchboard includes the measuring and recording instruments for the alternators, feeders, motors and exciters, and the automatic relays for operating the oil switches. This apparatus is arranged in front of the bench-board, as shown in Fig. 5, and on a level with the switchboard operator's eye. It is supported on a framing of copper tubes, which are spaced about 0.30 m (1 ft.) apart, so that the switchboard operator can watch the instruments and at the same time have in front of him a clear view of the entire engine room. Each feeder, each alternator and each induction motor has its panel or collection of governing apparatus, see Fig. 5. All of these are on low tension. The feeder panels carry an ammeter for each phase. The generator panels carry a phase meter, an ammeter, a voltmeter and a wattmeter. The induction motor panels have an ammeter and a wattmeter. In the middle of the third board is a Lincoln synchronizer with synchronizing lamps. In addition each feeder and induction motor has an automatic relay for controlling its oil switches. These relays are connected in the secondaries of small transformers, and are located at the base of the board. The high-tension circuits and all of the transforming apparatus are placed in the basement of the station, as shown in Fig. 9.

The bus-bars are divided into three sections, to each of which are connected a portion of the feeders and a portion of the alternators. Of the eight feeders uniting the power station with the sub-stations, three are connected respectively to the left section of bus-bars, two to the middle and three to the right. Of the four alternators one is connected to the left section, two to the middle and one to the right. Of the two induction motors which operate the exciters one is connected to the right bus-bar section and the other to the left. The three bus-bar sections are connected to each other by means of two sets of oil switches, and this arrangement allows one section to be cut out in case of accident or repair.

The three-phase cables coming from the alternators pass first to the transformers which operate the recording instruments, then to the oil switches, then to the bus-bars. The leads to the feeders are first taken to the oil switches, then to the transformers for the ammeters, wattmeters and automatic relays for the oil switches, then to the outgoing feeders. Each leg of the feeders is in connection with two switches, of

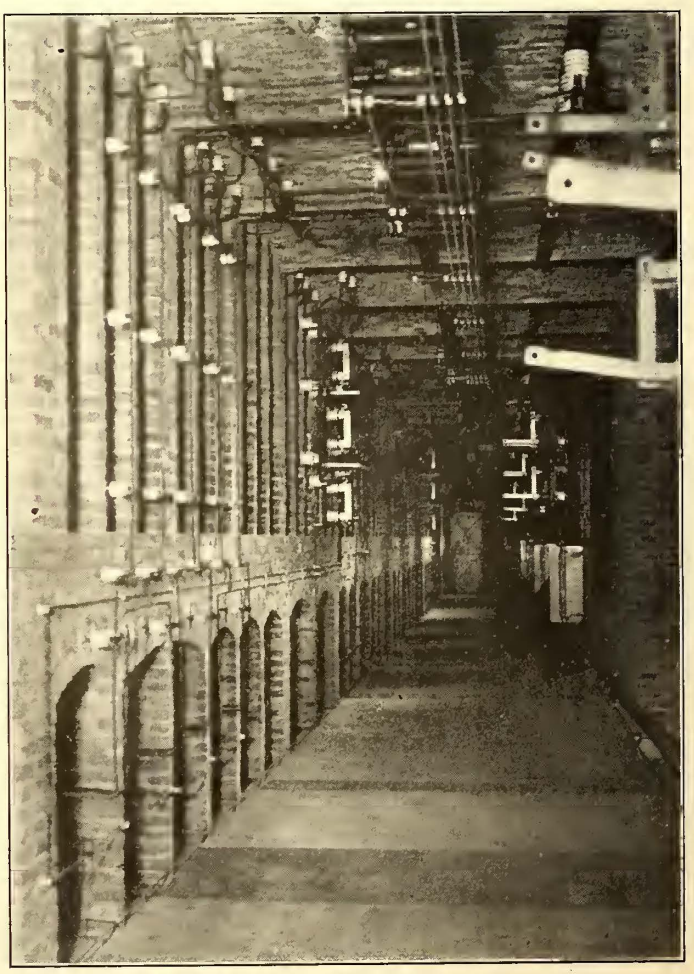


FIG. 9.—BASEMENT, WITH HIGH-TENSION WIRING

which one, always closed, is in connection with the lightning arrester, while the other, usually open, allows the earthing of feeders in case of necessity. A storage battery of 500 amp.-hours is placed in the basement to furnish current to light the station at night and as a reserve for the exciters. The oil switches were supplied by the General Electric Company, and are similar to those used in the Manhattan and other stations in recent work.

BOILER ROOM

The boiler room contains ten Babcock & Wilcox boilers of 350 sq. m (3255 sq. ft.) heating surface, arranged in five batteries of two each. Each boiler is equipped with chain stokers, and each battery with a Green economizer. The boilers are fed normally, as described above, by means of pumps directly connected to the engine cranks. One electric and two steam boiler feed pumps are kept in reserve. In addition to the boilers mentioned above five boilers have been removed from the old stations and have been installed.

The chimneys are 60 m (165 ft.) in height and 3 m (9 ft. 9 ins.) inside diameter at the top.

The coal conveyor is operated by 110-volt motors. It consists of two lines of buckets, one traversing the entire length of the boiler room, the other connecting the boiler room with the coal hoist on the banks of the canal.

SUB-STATIONS

The power station is now supplying current to three sub-stations, which in all cases are located in the old power stations of the company, so that the former direct-current feeder system is utilized. The three sub-stations are nearly at the apexes of an equilateral triangle, whose center corresponds to the center of the system to be supplied with power. The equipment

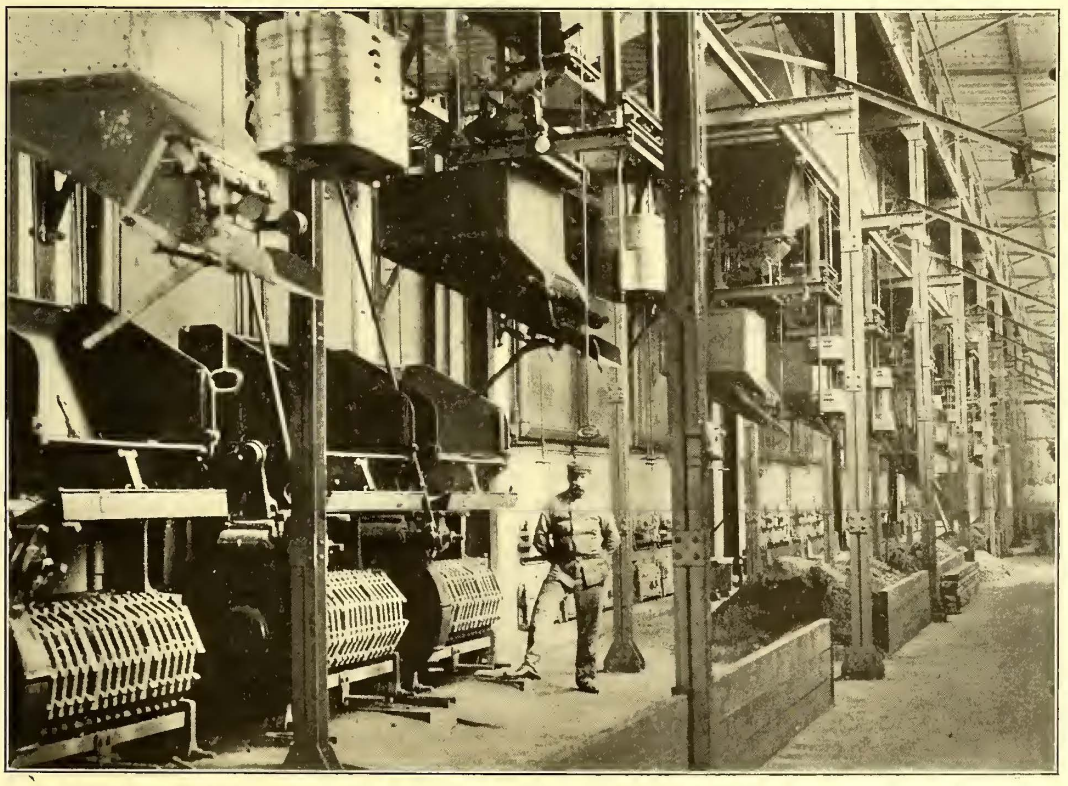
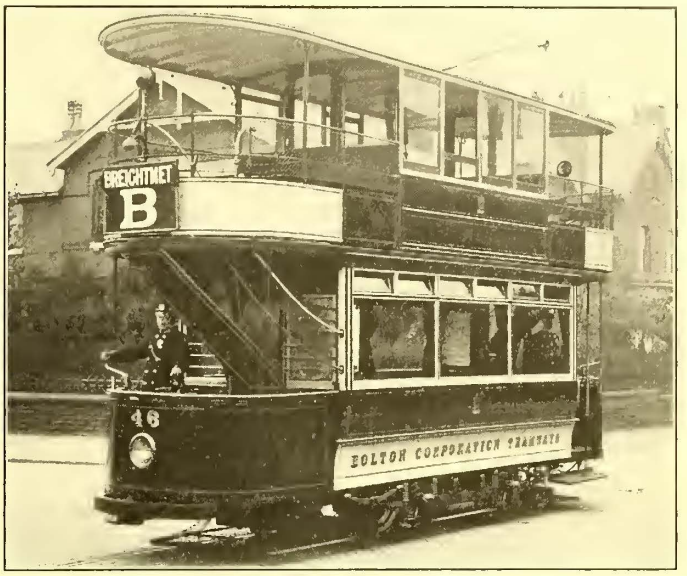


FIG. 10.—BOILER ROOM, SHOWING CHAIN-GRATE STOKERS

of the stations is practically the same. They contain five 550 six-phase rotary converters, each connected with three 200-kw transformers, which reduce the voltage from 6600 to 410. The transformers are air cooled. The rotaries are started from the direct-current side, and for this purpose there is in each station a starting unit consisting of a 6600-volt induction motor connected to a 75-kw direct-current generator. A battery of 60-amp.-hours at 500 volts is in parallel with this starting unit to act as a reserve.

NEW TYPE OF CAR FOR BOLTON, ENG.

The accompanying cut illustrates the Bolton type of top cover for cars which have recently been built for the Bolton Corporation Electric Tramways by Milnes Voss & Company, of



CAR WITH EXTENSION TOP IN BOLTON

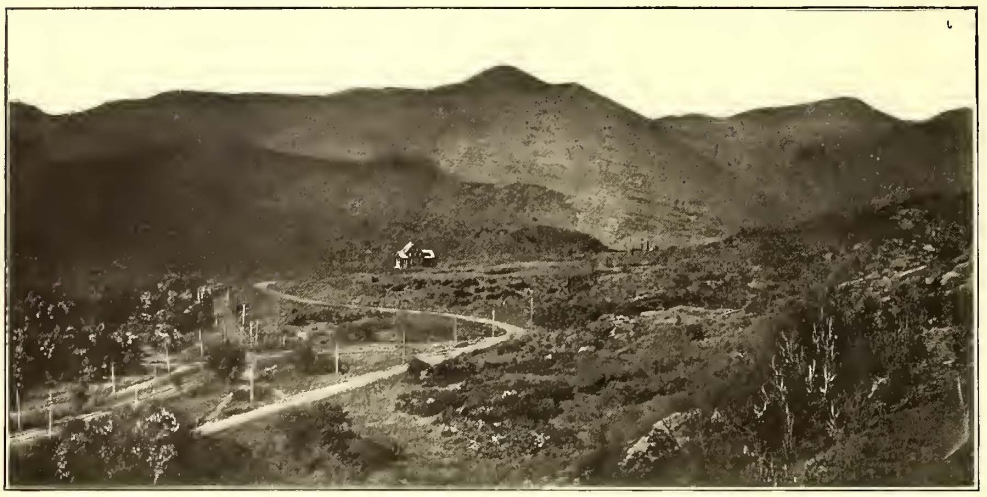
Birkenhead, to the designs of Arthur A. Day, chief engineer of the tramways.

It will be noted that the seating capacity of the top deck is not in any way decreased, in fact, the car now running has seating capacity for four additional passengers. The cover is not a totally inclosed one, it being optional for a passenger to be inside or outside under cover. This enables the top to be utilized either in wet or fine weather, and also enables the design to be made to look less heavy, or perhaps rather less top heavy than a cover covering the full length of the car. The facility for getting in or out of the fully inclosed part is also much greater than in the case of the fully covered top cover, some of the latter being very awkward to get into and get out of. There is in this case fully 6 ft. of head room, enabling a tall man to stand upright on the top deck. This, however, is rather a matter of the lowness of the bridges under which the top cover has to pass. The tramways committee is so satisfied that this type meets the requirements of the public that it has already sanctioned the fitting of twelve more cars with this cover. Mr. Day thinks that there can be very little doubt that the adoption of such a cover, which does not hinder the use of the top deck in fine weather and makes it available in wet weather, will result in considerably increased traffic receipts.

It has been said by a well-known and successful railway man that "the best way to decrease operating expenses is to increase gross receipts."

COLORADO SPRINGS AND INTERURBAN RAILWAY SYSTEM

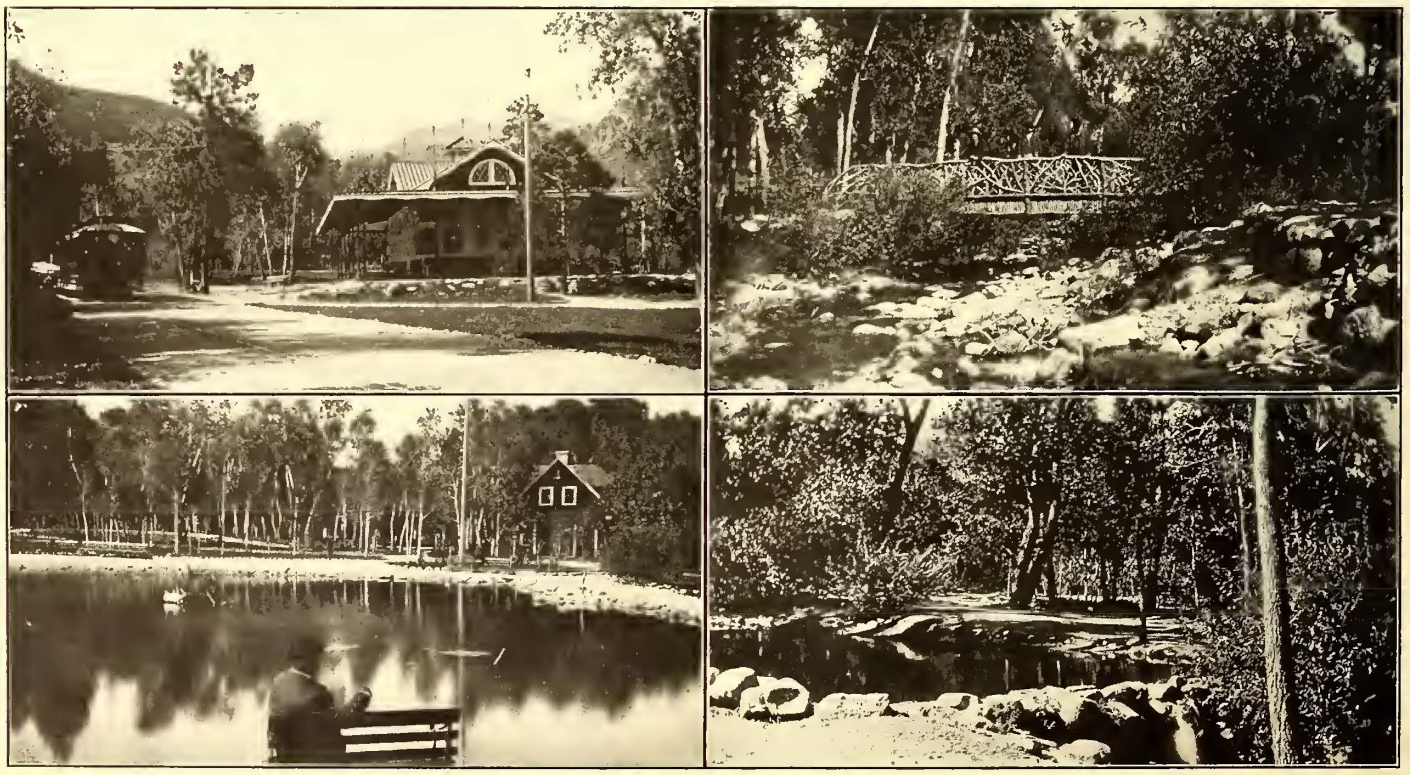
The city and interurban electric railway system of the Colorado Springs & Interurban Railway Company is typical of the West, and its operation shows the results of good management and anticipation of the needs of the public. The company operates 39 miles of track and connects the cities of Colorado Springs, Colorado City and Manitou, Col. A free park, 5 miles south of Colorado Springs and at the entrance to the famous Cheyenne Canon, is owned and managed by the company, and is a source of considerable revenue. This park is named Stratton Park, after the late W. S. Stratton, who was president of the railway company and did much to build up the company's property. The park embraces some 40 acres of ground, through which flows Cheyenne Creek. The railway company has put $70,000 worth of improvements in the park, including a steel waiting room, artificial lakes, band and refreshment stands and rustic work. The lakes are stocked with trout, and the occasion of feeding them every afternoon is quite a sight for both old and young. As may be judged from the accompanying illustrations the park is wild and rustic enough to attract picnickers as well as the many tourists who visit that locality every year. In order to create an evening traffic to the park the company employs one of the best bands in the West for concerts, and during the intermissions an excellent exhibition of moving pictures is given. No admission is charged, and as a result of its liberality the company has carried on this line as many as 3000 people and 4000 people during an evening. This means a good haul for a single line when it is considered that the population of the city is only a little over 20,000.



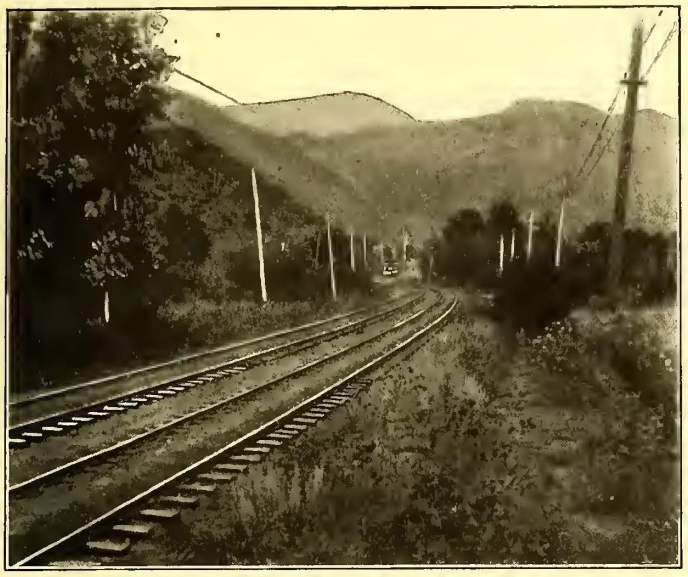
PRIVATE RIGHT OF WAY FOR INTERURBAN LINE, APPROACHING PIKE'S PEAK

Colorado Springs, however, is noted as one of the most picturesque and popular tourist resorts in the West, and the street railway company naturally derives considerable of its traffic from the transient population. This is noticeably true on the Manitou line, which, in its 6½ miles of length, runs through Colorado City, popularly known as "Old Town," passes by the gateway to the famous Garden of the Gods, traverses the principal street of Manitou, by all its hostelries, and finally ends in the center of the city, connecting, by means of a ¾-mile electric line, with the depot of the Pike's Peak cog road. With the exception of a short distance in Manitou the passenger is in full view of Pike's Peak on this entire ride, and the latter portion of the trip is made through a beautiful canon.

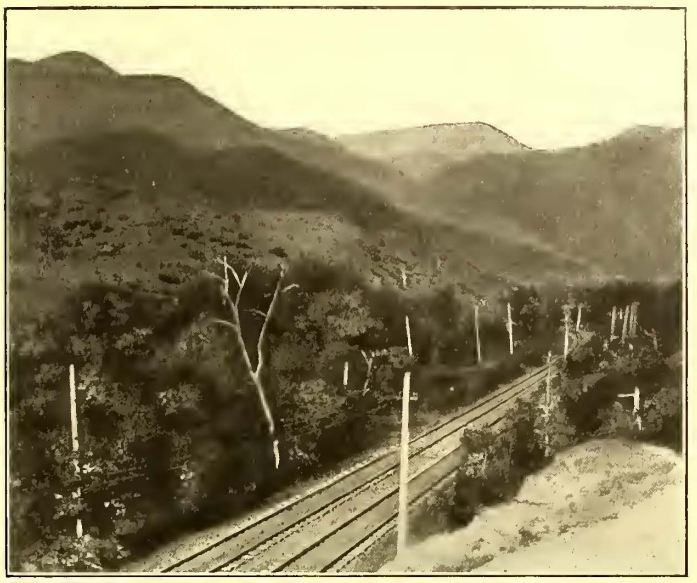
Between Colorado City and Manitou the railway has its own right of way, and this section of the road, which is illustrated in two of the accompanying views, is typical of the standard construction used throughout the system. Sixty-five-pound A. S. C. E. section T-rails, in 60-ft. lengths, are laid on 6-in. x 8-in. x 8-ft. Texas heart yellow pine ties, laid on 2-ft. centers. The track is standard gage, and is thoroughly ballasted with water-washed gravel. This gravel is obtained in the immediate vicinity, and is a disintegrated dustless granite, such as is being used by many of the steam roads in the Western part



VIEWS IN STRATTON PARK



TRACK CONSTRUCTION NEAR MANITOU



VIEW OF CAMERON'S CONE AT LEFT AND PIKE'S PEAK IN CENTER, APPROACHING MANITOU

of the country. The overhead construction consists of No. 0 round trolley, suspended with Dirigo clamps and General Electric switches and cross-overs. Idaho cedar poles in 35-ft. lengths, with 7-in. tops, are used for span suspension and to carry the feeders. For the Manitou line feeders aggregating 1,800,000 circ. mils in area are employed. The Cheyenne Canon line is similarly constructed, and is fed from 1,500,000-circ. mil cables. This line is 22,000 ft. long from the central loop, while the Manitou line is 34,000 ft. long.

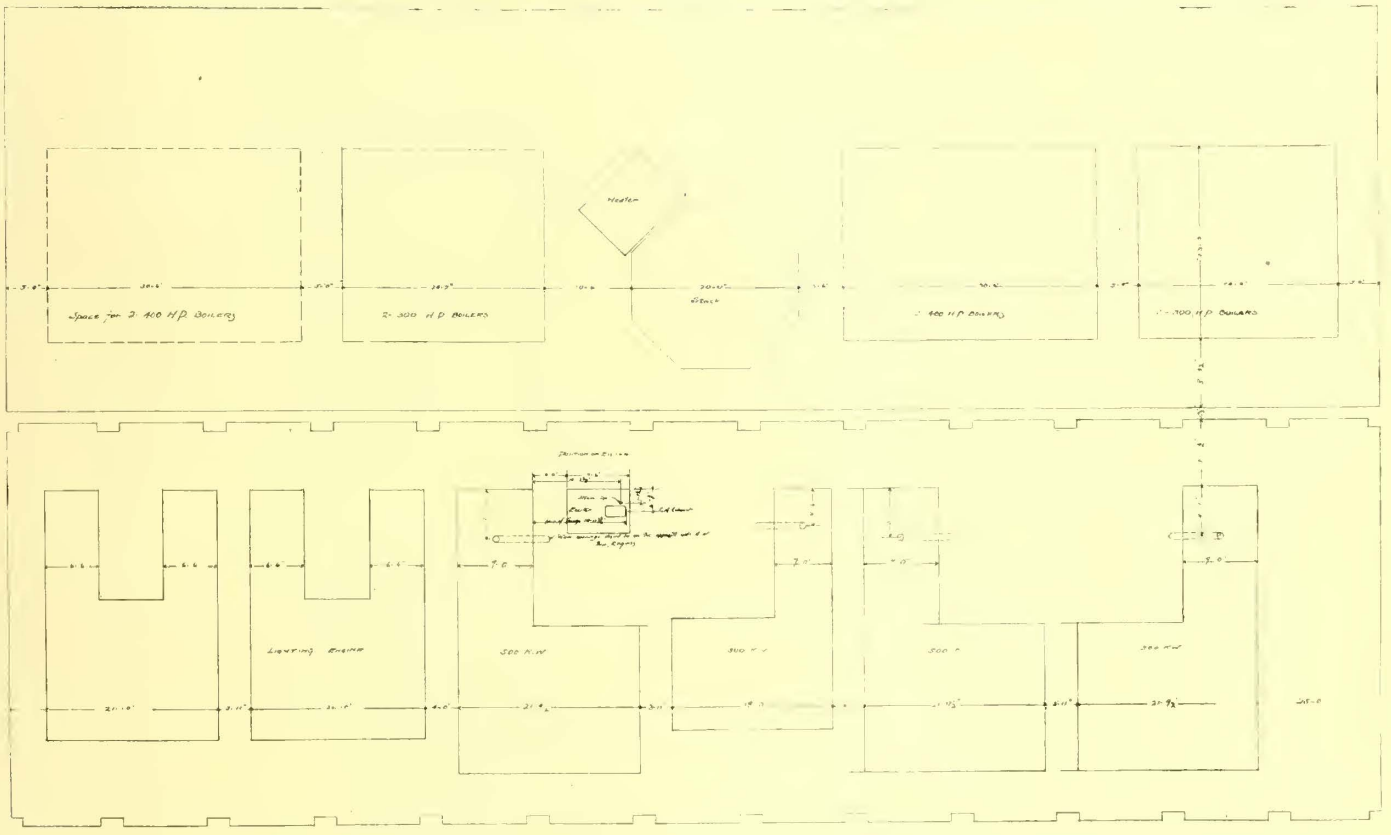
The central loop spoken of passes around a 400-ft. x 400-ft. block in the center of Colorado Springs, and all cars pass through it. It consists of about 2500 ft. of 75-lb. rail, double track, and considerable special work.

The ¾-mile electric line in Manitou, before mentioned, runs between the cog road depot and the Colorado Springs car line, and is operated by the management of the cog road, power and rolling stock being leased from the Colorado Springs & Interurban Railway Company.

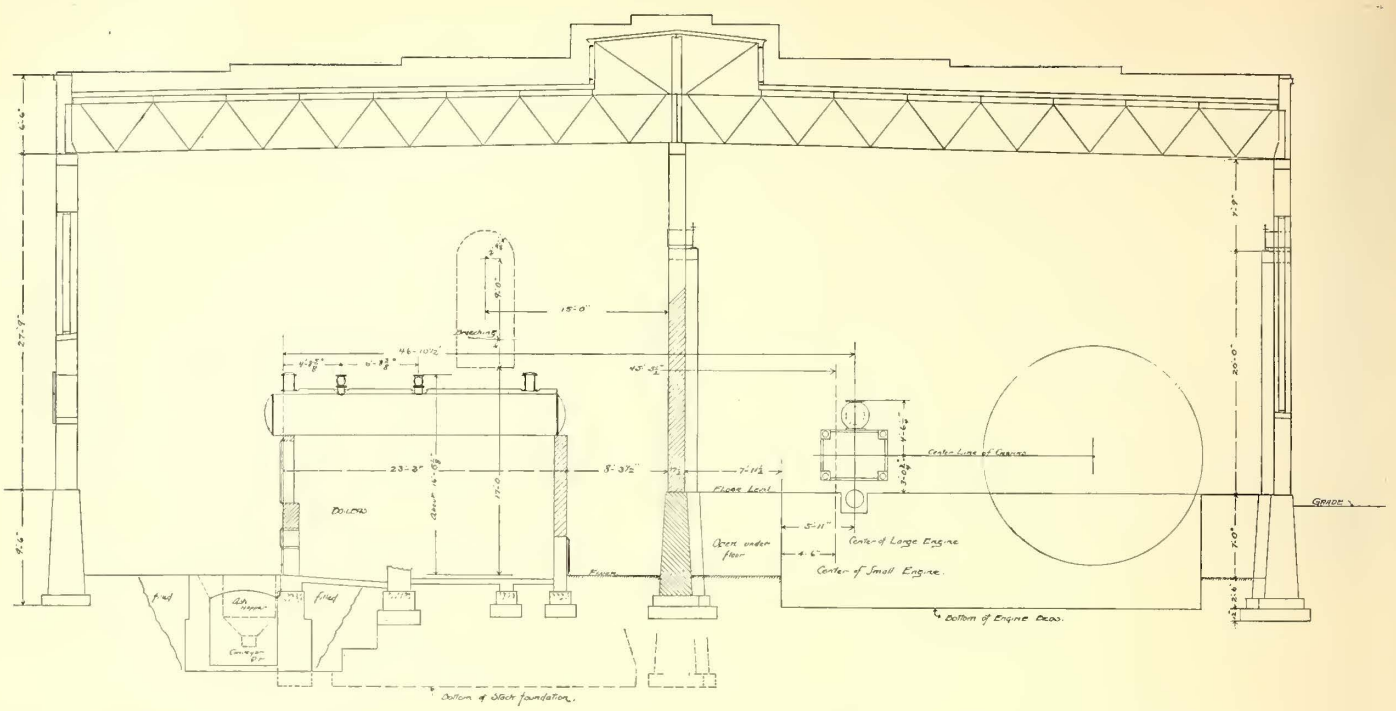
POWER HOUSE

Improvements and additions to the company's property that have recently been completed include the erection of a power house, new car houses and new shops. The power station is located at the corner of Rio Grande Street and Sierra Madre Street, adjacent to the tracks of the Denver & Rio Grande Railroad. It is a red brick structure, and is 164 ft. 6 ins. long and 97 ft. wide, divided longitudinally into two sections by a brick fire wall. One section constitutes the engine room and the other the boiler room, and each is 164 ft. 6 ins. x 48 ft. 6 ins.

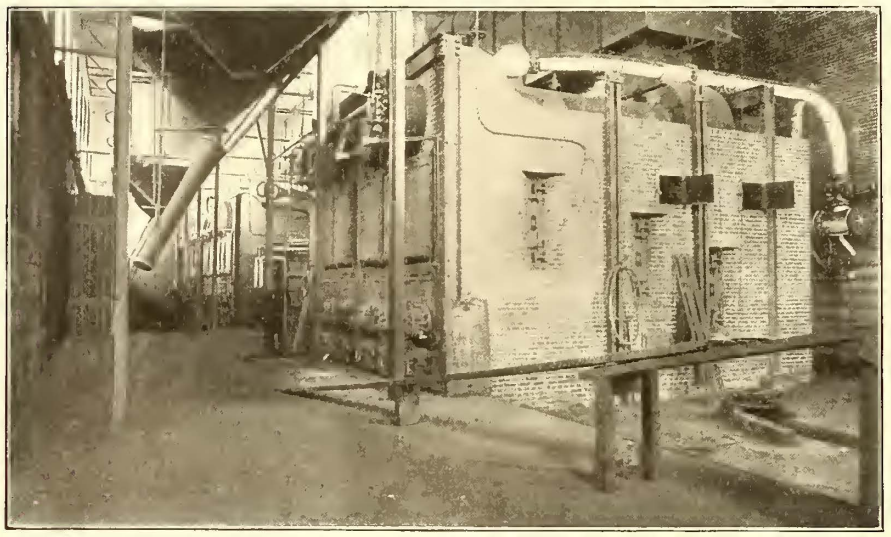
The building is built upon a concrete foundation throughout, the same material being used also for the foundations of the boiler, engine and generator units. The foundation walls go to



PLAN OF POWER PLANT, SHOWING ARRANGEMENT OF BOILERS AND GENERATORS



CROSS-SECTION OF POWER PLANT



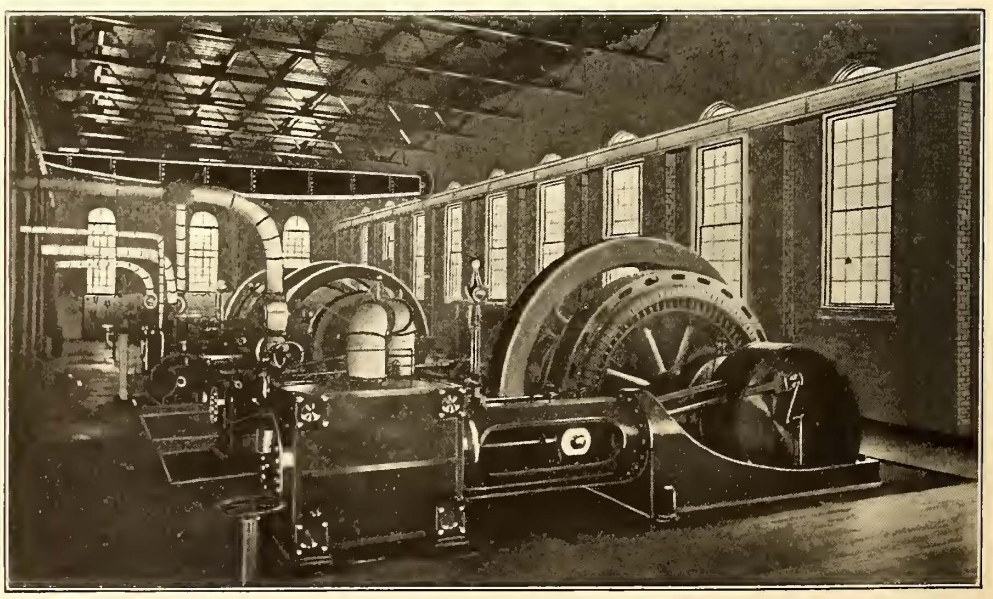
BOILER ROOM

the bottom of all excavations, and average 10 ft. high, 1 ft. 9 ins. wide at the top, and 2 ft. 6 ins. wide at the bottom, being widened at each pier correspondingly. The main walls of the building are 17 ins. thick and average 38 ft. in height. They are built of the hardest brick obtainable in the local market, laid in cement-tempered mortar. The roof is carried on an all-steel construction, composed of 4-ft. lattice girders, 6-in. I-beam purlins and 3-in. T-irons. On this are laid 3-in. hollow tile laid in cement mortar and covered with 1 in. cement, to make a tight construction. The roofing proper consists of a five-ply pitch and gravel covering, making, with the cement top, a perfect fireproof roof.

BOILER ROOM

The boiler room equipment consists of six Cahall-type water-tube boilers. Four of these boilers are of the two-drum, sixteen-section type, with 24-ft. x 42-in. drums, and nine 20-ft. x 4-in. diameter tubes to a section. The grate surface is 66½ sq. ft., and the nominal rating of each boiler is 300 hp. The other two boilers are of the three-drum twenty-one-section type, nine tubes to a section, the drums and tubes being of the same size as in the other four boilers; the nominal rating of these boilers is 400 hp each.

For feed-water purposes there are two single Marsh 12-in. x 7½-in. x 12-in. pumps. A 4000 hp special Cochrane open heater is used for heating the feed water. On the boiler room side of the dividing wall and behind the boilers is a main steam header, 14 ins. in diameter and 140 ft. long, that supplies the

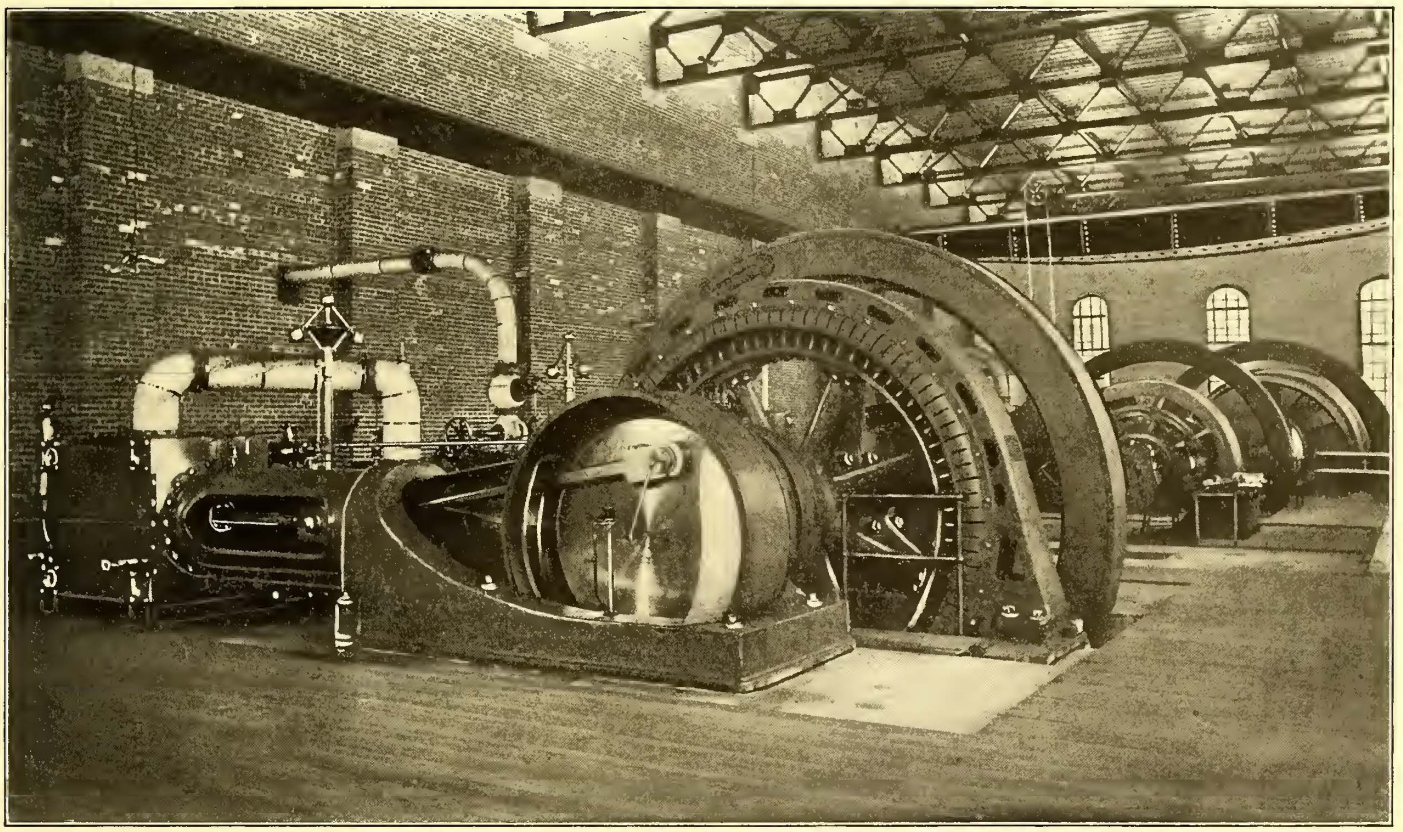


GENERAL VIEW OF ENGINE ROOM

engines with steam. This header is mounted on special roller brackets, which allow the pipe to expand and contract. The exhaust main is 24 ins. in diameter and 120 ft. long.

For handing all the coal and ashes in the boiler room a conveyor system is installed. The coal is a soft lignite, mine run, and costs $1.15 a ton. Three tons of it equal, for fuel purposes, about 2 tons of bituminous slack. It is mined a short distance north of Colorado Springs, and shipped from the mines to the power house in steel hopper-bottom cars, bought by the company for this purpose. The coal is dumped from the cars into a hopper built under the tracks outside the station, and passes through an electrically-driven crusher. It is then taken by a cross-conveyor to a longitudinal conveyor, which runs the full length of the boiler room in a concrete pit, 5 ft. 6 ins x 7 ft. 6 ins. in size. This conveyor carries the coal to the top of the room and empties it into six steel cylindrical bins, which have a capacity of 25 tons each. The coal is taken from these bins by the firemen as needed. The ashes are also removed by the same method, being taken from the ash pits to the top of the building and deposited in a steel bin, whence they are taken in cars to points on the road where they may be used for filling. The coal and ash conveying machinery was installed by the Link Belt Machinery Company.

The self-sustaining steel stack is built upon a concrete foundation, 25 ft. x 25 ft., and extending to a depth of 10 ft. below the boiler room floor. The concrete also extends 32 ft. above the floor, 20 ft. in diameter, making the concrete foundation 42 ft. high. The steel part of the stack is anchored to the concrete by sixteen 2½-in. rods, 42 ft. long, extending to the bottom of the foundation and fastened to T-rails. The steel stack is 152 ft. high, and is made up of three different sizes of steel plates, namely, 70 ft. of ½-in. steel, 50 ft. of ⅜-in. steel and 32 ft. of 3-16-in. steel. The inside diameter is 10 ft., and the total height of the stack above the boiler room floor is 184 ft.



VIEW OF RAILWAY GENERATORS

ENGINE ROOM

In the engine room are installed three direct-connected 575-volt direct-current generating units, and one direct-connected 6600-volt alternating-current lighting unit. Two of the railway-generator engines are indentical, except that one is a right-hand and the other a left-hand engine. They are Allis-Chalmers-Corliss engines, with cylinders 28 ins. in diameter and 48-in. stroke, and are equipped with two wrist plates and 60,000-lb. fly-wheels. The normal capacity of each engine is 750 hp, and each generator is a 500-kw, 10-pole General Electric machine, operating at 90 r. p. m. The third unit consists of a right-hand Allis-Chalmers-Corliss, 22-in. x 42-in., 450-hp engine, with two wrist plates and a 46,000-lb. fly-wheel, driving a 300-kw, 8-pole General Electric 575-volt generator. The alternator unit comprises an Allis-Chalmers-Corliss cross-compound 450-hp engine, with cylinders 18 ins. and 32 ins. x 42 ins., with a 50,000-lb. fly-wheel, connected to a General Electric 72-pole, 300-kw, 6600-volt, 20-amp., 60-cycle, three-phase generator, operating at 100 r. p. m. For exciting the fields of the alternator a 35-kw, 125-volt continuous-current generator is installed. It is directly driven by a marine steeple-compound 7½-in. and 12½-in. x 6-in. engine at 400 r. p. m.

Spanning the engine room and running its entire length is a 25-ton Whiting traveling crane. The crane track rests on 20-in. I-beams, supported on piers 1 ft. x 3 ft., added to the thickness of the wall.

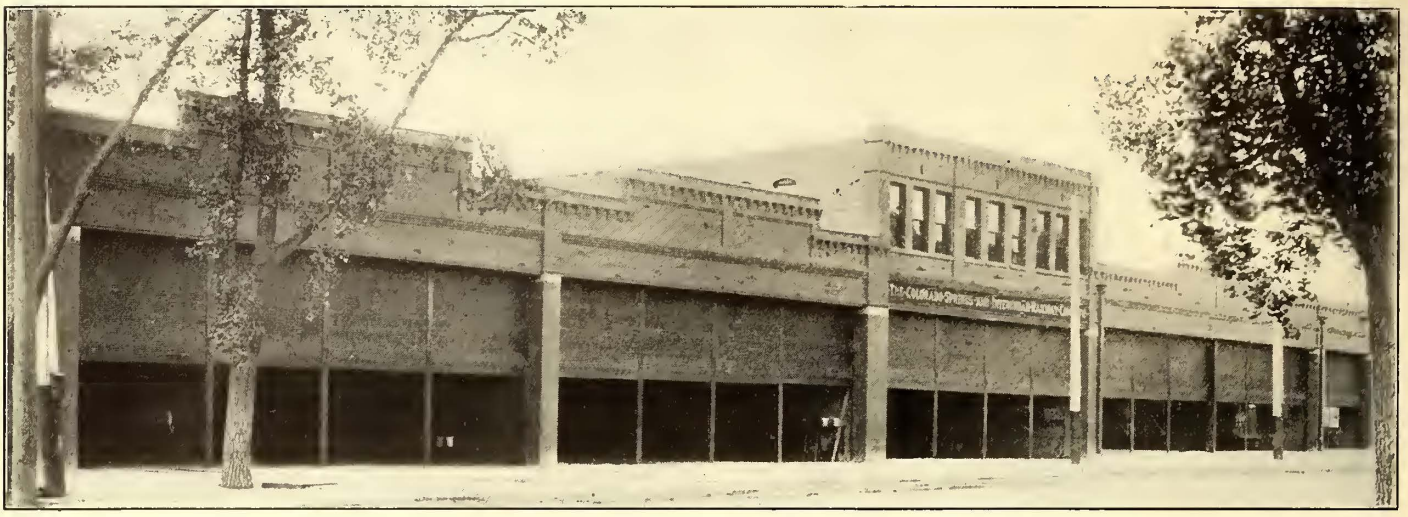
A gravity oiling system is used for the engines and generators, the oil flowing from steel storage tanks fastened to the roof girders to the bearings, then to a filter, from which it is pumped back to the storage tanks.

All of the steam pipes are connected with the Holly system of return, whereby all the water from condensation is returned to the feed-water heaters and is used again in the boilers.

The floors of the engine and boiler rooms are of concrete, the boiler room floor being laid on gravel and that of the engine room consisting of a 6-in. suspended concrete flooring with top dressing, supported by steel construction, leaving a basement below with 8 ft. head room, where all the cables and wires

from the generators to the switchboards are run. The engine beds are all of concrete, and average 10 ft. in height. The tops around the engines are floored with vitrified tile.

machine panel, three circuit panels for multiple lighting and one circuit panel for series arc lighting. This board is built of blue Vermont marble, and is fully equipped with all the



NEW CAR HOUSES

The power house is ventilated by a double row of sash in the roof, operated by a series of sprocket chains from inside.

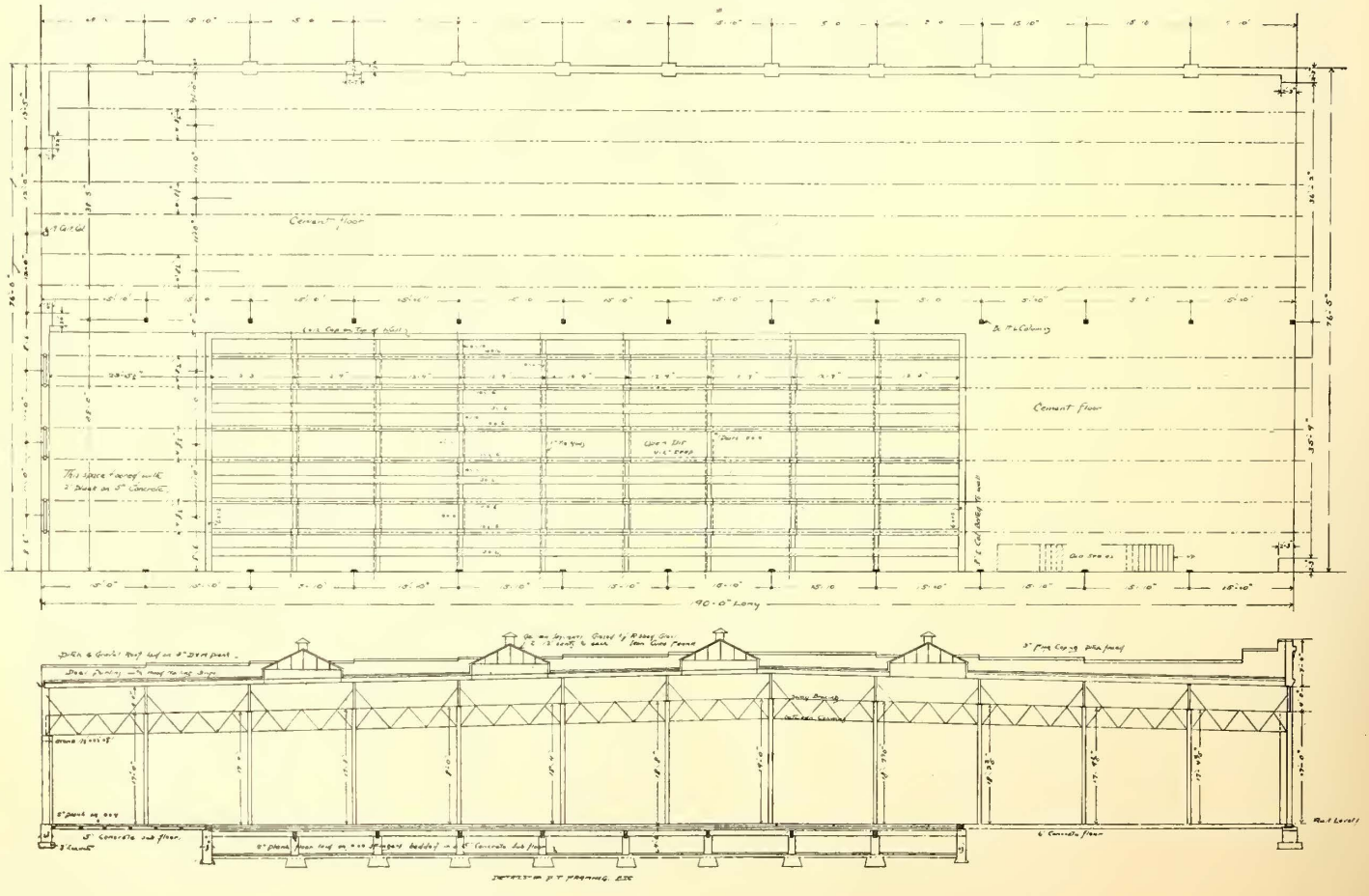
SWITCHBOARDS

The railway power switchboard consists of fifteen panels of slate, enameled black and highly finished. There are three 500-kw machine panels, each equipped with a 1200-2000-amp. circuit breaker, ammeter, field rheostat and two single-pole, single-throw, quick-break switches. A totalizing panel is equipped with a 2500-amp. recording wattmeter and voltmeter and ammeter. The remaining eleven panels are used for the feeder lines, and are provided with the necessary circuit breakers, ammeters and feeder switches.

The lighting switchboard comprises an exciter panel, one necessary instruments, switches, transformers, etc. This board and the alternator were installed for supplying the arc light service at Stratton Park. Both switchboards, as well as the other electric equipment, were furnished by the General Electric Company.

OPERATION OF STATION

Although this is a simple non-condensing plant, the cross-compound alternator unit not running now, a showing of 0.$0073 per kilowatt-hour for the month of July, including labor, repairs, oil, waste, fuel, etc., is an excellent record for operation cost, and reflects credit on the designer of the station and the operating engineer. The station used 8 1-6 lbs. of coal per kilowatt-hour during July, the cost per kilowatt-hour being



FLOOR PLAN AND SECTION OF CAR HOUSE

0.$0047. The maximum load on Aug. 13, 1903, which represents a typical summer day, was 2400 amps., while the average was about 1000 amps. This record shows that an excellent opportunity is offered for the installation of a storage battery to float on the system and smooth out the peaks, and the management of the company is fully alive to this situation, so that a battery will doubtless be the next addition made to the equipment.

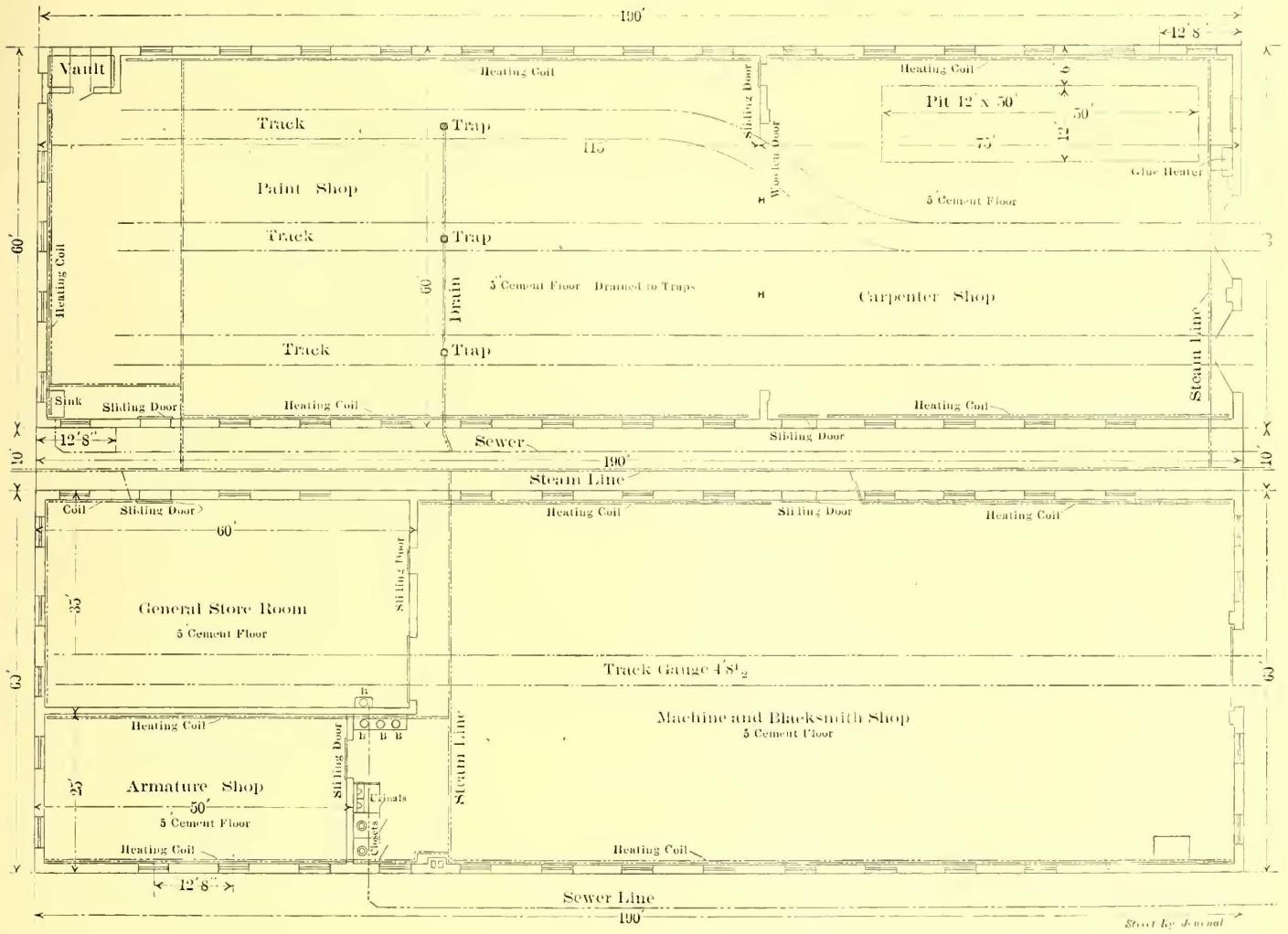
An interesting feature of the load sheet is the separate peak, beginning about 1:30 a. m. and running until 3 a. m. This is caused by the operation of two or three cars between Colorado Springs and Manitou, to connect with the Pike's Peak cog road, in order to get the tourists to the top of the peak in time to see the sun rise, which is a wonderful sight from that point. During the summer months these sunrise excursions are run from one to three times a week, and prove exceedingly popular.

A study of the main curve of the load sheet reveals the existence of a heavy workingmen's traffic about 7 a. m., and other peaks about 7:30 p. m. and 10:30 p. m., caused by the traffic to and from the evening entertainment at Stratton Park. The load during the day is irregular, depending on the weather and the trend of the tourist traffic.

In case the hydro-electric development that is now being made at Manitou by the Pike's Peak Hydro-Electric Company, proves commercially economical, it is possible that the traction company will close down its steam plant and install a transformer and rotary converter equipment to operate its system. This water-power plant will use the water supply of Colorado Springs for the development of about 4000 hp, and it is expected the plant will be completed this coming winter.

CAR HOUSES

A series of four brick and steel car houses are provided on Tejon Street for the storage of the company's cars. Each of these houses is 180 ft. long. Two are each 50 ft. wide and have a combined capacity of thirty-two double-truck cars. The car house with office rooms on the second floor is 50 ft. wide, and has three open-pit tracks with a storage capacity of sixteen double-truck cars. The new car house is 80 ft. wide with a center row of latticed steel columns. It has six tracks, three of which have open pits for repair work. This new car house has a capacity for twenty-four double-truck cars, making the combined capacity for all the houses of seventy-two cars. On the north side of the car houses is a single-track wash house,



PLAN OF SHOPS

25 ft. x 50 ft., with concrete floor for washing. It is the intention to arrange a hollow rectangle of perforated pipe above the track about the size of a car, so the roof can be quickly and easily washed off. The tracks of the car houses are connected by means of nineteen curves, with an independent track laid 14 ft., center to center, from the west track of the main line, with shut-ups at the south and north ends to this west track and a cross-over on the main line. All of the special track work is built in the company's own shops. A view of the car houses is presented herewith. These structures are provided with twenty-six sets of steel rolling doors, made by the Kinnear Manufacturing Company.

SHOPS

In the rear of the car houses are two brick buildings, with steel girders for support of the roof, and with cement floors, each 190 ft. long and 60 ft. wide. One is used for the carpenter and paint shops and the other for the machine shop, store room and armature room. The carpenter shop is 60 ft. x 75 ft., and

is equipped with a wood planer, band-saw and other necessary tools, the motor which furnishes the power being placed under the floor in a concrete pit with all the shafting. There being no shafts or belts above the floor, the result is a very neat and complete shop. The paint shop is 60 ft. x 115 ft., and has three tracks, on which six large double-truck cars can be painted at one time. A 12-ft. 6-in. skylight runs the full length in the center of the building, making a very light and pleasant shop in which to work.

In the other building the machine shop occupies a space 60 ft. x 130 ft. In one corner is installed a Sargent-Ingersoll compound-automatic air compressor, having a capacity of 200 cu. ft. of free air per minute. Compressed air is used for operating the pneumatic lifts in the shops and car houses for blowing out motors, and for instructing motormen in air-brake operation. The compressor is belt-driven, by a 50-hp General Electric, shunt-wound, 500-volt motor. This motor is also belted to a line shaft running at right angles to the shop, from which are driven a 24-in. Lodge & Davis drill press, a combination punch and shear, shearing 6-in. x 1-in. steel, and punching a 1-in. hole in 1-in. steel, a Newton cold-sawing machine for cutting off rails at any angle, a small iron planer, emery wheel, large grindstone and blower for the blacksmith forge.

The main line shaft of the machine shop runs the full length of the shop in the center of the building. It is in two sections, one section running wheel machinery, including one 150-ton hydraulic Watson-Stillman wheel press, one Putnam wheel-boring machine, which will bore and face from 15-in. to 40-in. car wheels, one axle lathe of the Putnam improved type, with crane for taking axles in and out of the lathe. This section of line shaft runs only when the wheel-boring machinery is in use. From the other section of the main line shaft are operated a 36-in. Bickford radial drill, one 26-in. J. B. Reed lathe, one 14-in. Prentice Bros. lathe, one 30-in. shaper, an automatic saw sharpener, a twist-drill grinder, a diamond tool grinder and a car-wheel grinder for truing old and new wheels. This main shaft is driven by an 8.5-kw Edison bipolar shunt-wound motor. For emergency use in case of a burn out on either of the other two motors a 15-hp Sprague motor is kept belted up and ready to run. On this floor there are also three blacksmith forges and one furnace for melting babbitt metal for refilling the different bearings of the motors and cars. A standard gage track runs through the machine shop and into the store room for handling supplies and heavy work.

The armature room is 25 ft. x 50 ft. in size, and is used for winding the armatures and fields and the different electrical parts on the cars. Air valves and pipes are also tested for leaks and defects in this room.

The store room, 35 ft. x 60 ft., contains everything that is used in the repair and maintenance of the track, overhead construction, motors and cars of the company.

Adjoining the shops and in the rear of the car houses is the company's old power-house building, which can be used for storage purposes. Between this old building and the machine shop and between the two new shop buildings are 10-ft. alleys, which will allow the free passage of fire wagons, thus adding to the safety of buildings that in themselves are practically fireproof.

On the corner of the block adjoining the car houses the company proposes to erect a handsome office building and club and athletic rooms for the use of the trainmen.

ROLLING STOCK

The rolling stock of the Colorado Springs Company includes fifteen open Narragansett-type Brill double-truck cars, equipped with 27-F Brill trucks and four General Electric No. 67 motors, giving 152 hp per car; nine closed and one open double-truck Laclede cars, with Milwaukee trucks and four General Electric No. 67 motors; five closed Brill convertible patented type of car, with 27-F Brill trucks and No. 67 motors. The rest of the passenger equipment comprises seventeen 16-ft. and 24-ft. Pullman closed cars with McGuire trucks, and seven combination (part closed and part open) cars.

For overhead work the company has a single-truck line car, equipped with two type-C No. 3 steel motors, mounted on an old-style McGuire truck. Other cars include a double-truck work and snow-plow car, with Milwaukee trucks and four General electric No. 67, 38-hp motors, two single-truck Taunton snow-plows (closed) with two No. 67 motors, two open flat-push plows, three flat double-truck work or construction cars, thirteen open eight-bench trail cars.

Most of the double-truck cars are equipped with Mosier arc headlights, made by the Dayton Manufacturing Company, while a few Syracuse incandescent headlights are also used.

SCHEDULE AND SPEEDS

The cars regularly run on schedules varying from 7½ minutes to 30 minutes, the time being lessened, of course, when the traffic demands it. Within the fire limits of Colorado Springs, a section five blocks wide and six blocks long, the company is required to limit the speed of its cars to a maximum of 8 miles an hour. Outside of that section and also in Manitou the company has no restrictions, and generally operates the cars at about 16 miles an hour. This brings the average speed of the cars up to about 12 miles an hour. An example of the scheduled time of one line is given on the branch running to Manitou. The trainmen on this line are required to make the round trip of 13½ miles in 70 minutes during the summer. For eight months of the year this schedule time is cut down to 65 minutes for the round trip.

The officers of the Colorado Springs & Interurban Railway Company are the following-named gentlemen: President, A. S. Sharp; secretary and treasurer, Carl Chamberlain; assistant secretary and treasurer, William Lloyd; manager, purchasing agent and chief electrician, D. L. Macaffree; assistant superintendent, J. Henry; chief engineer of the power station, C. C. Bibb; master mechanic, J. Eastwood. The power station and car houses were designed and built under the direct supervision of Mr. Macaffree, and he is also entitled to the credit of placing the operation of the road on its present economical and paying basis. Roberts & Bishoff, of Colorado Springs, were architects and builders of the power house, shops and car houses.

NOTES ON THE OPERATING PRACTICE OF THE INDIANA UNION TRACTION COMPANY

The Indiana Union Traction Company, which operates such an extensive network northeast of Indianapolis, has always been known as one of the most progressive and substantial interurban railway companies in the Middle West. Not only on account of the size of its system and the excellence of its territory, but on account of the up-to-date engineering and operating methods, is this company's property notable. In fact, a visit to it and a study of its methods is almost a liberal education in interurban railroading. Several articles regarding its practice have appeared in these columns from time to time, and especially in the issue of Dec. 7, 1901. Recently the attention of electrical engineers has been attracted to this property by the papers presented to the American Institute of Electrical Engineers by Professor Goldsborough and associates on tests made on the efficiency of power house, cars and transmission system. In the Street Railway Journal of Oct. 4, 1902, Clarence Renshaw gave a synopsis of the most complete series of interurban car tests ever attempted, which were carried out on the Indiana Union Traction Company's lines. The present article will serve merely to call attention to certain operating details which may be of interest and value to other interurban railway companies.

LIMITED SERVICE

Since the latter part of 1901 this company has given limited service between Muncie, Anderson and Indianapolis. These limited cars make only a few of the necessary stops, in fact, receive passengers only at the business centers of Anderson and Muncie. This limited service is remarkable, not only for its speed but for the comfort which it affords the traveler, as compared to steam service, especially in warm weather, when it is desirable to have windows open. In a recent trip over the line the writer could not help comparing the comfort and cleanliness of this limited service with the dirt and discomfort of the fast steam railroad service between the cities included in the route, to say nothing of the greater frequency of the electric service.

It goes without saying that to be able to operate cars at from 50 m. p. h. to 60 m. p. h. mile after mile over an interurban road requires first-class roadbed, freedom from sharp curves, easy-riding trucks and overhead work kept in such accurate alignment that there is no trouble from the trolley coming off. This is what the Indiana Union Traction Company has, and the "Limited" speeds over the country with practically as little interruption as the limited trains on steam roads. Of course, there must be a slacking of speed going through the small towns along the road, as frequently the right of way is along one of the streets through such towns. From the Indianapolis city limits to the business center of Anderson is 36 miles, and this run is made in 1 hour, including the time required getting into Anderson. A schedule calling for 36 miles an hour average speed is not slow, even on a steam road. In addition, 20 minutes is required to make the 3½ miles between the business center of Indianapolis and the city limits, making the time between the business centers of Indianapolis and Anderson 1 hour and 20 minutes. The time between Indianapolis and Muncie, including the stop at Anderson, is 2 hours. The fastest limited steam train between those points takes 1 hour and 15 minutes, but there is only one steam train of this kind each way a day. The distance from the business center of Indianapolis to the business center of Muncie is 54½ miles. There are four limited cars each way per day. Higher fare is charged on the limited cars than on the local cars, the fare being approximately 2 cents per mile for the limited service and about 1½ cents per mile for the local service. The limited cars are well patronized.

TRAIN DESPATCHING AND MEETING POINTS

As far as possible the limited as well as the local cars operate without stopping for telephonic orders from the despatcher, that is, as long as the cars are on schedule time and meet according to the time-table, there is no necessity for reporting to the despatcher except at terminal points. This company, it will be remembered from previous articles in the STREET RAILWAY JOURNAL, has a telephone despatching system in which each car carries its own telephone instrument, and "hooks in" on the line at terminal boxes located at sidings. There is one despatching line which is kept entirely for despatching, and no other business is conducted over it except in emergencies. The despatcher's head receiver is connected at all times across the despatching line, so that no bell signals are necessary to call the despatcher. The train crews simply "hook in" and begin to talk, provided that no one else is talking over the line. The telephone instruments on this company's lines are now furnished and maintained by the Central Union Telephone Company (Bell), as it was found more satisfactory to have instruments maintained by those expert in this kind of work than for the railway company to attempt it. It is notable that around Indianapolis the method of carrying telephone despatching instruments on each car rather than placing the instruments in booths along the line is almost universally employed, the Indiana Union Traction Company having set the example. This practice is all the more notable because of the trouble which has been experienced in many places with telephone instruments carried on the cars. In fact, some of the other lines around Indianapolis have experienced considerable trouble in maintaining their car telephones in operating condition. The officers of the Indiana Union Traction Company, however, do not seem to be aware of any special difficulties in maintaining car telephones. An investigation of the matter leads one to the conclusion that the success of the Indiana Union Traction Company with car telephones is simply due to the fact that it does not neglect them or expect them to remain in good order indefinitely without any attention, as do some of the smaller companies. A. S. Richey, electrical engineer of the company, when questioned as to why the Indiana Union Traction Company experiences so little difficulty with telephones carried on the cars as compared with other companies which have tried the same practice, said: "Of course, if we neglected our telephone instruments, and had none in reserve, we should have trouble from interference with the operation of the road, just as we should have trouble with any other piece of apparatus treated in a similar manner. It is simply a question of seeing that the cars are kept supplied with instruments that are in good working order. If a man reports his telephone instrument as not giving satisfaction it is immediately exchanged for one which has just been overhauled. The telephone company keeps a supply of instruments in good order at all times, and as fast as instruments become defective they are taken in to be overhauled and good ones put in their place. If a man has trouble in talking with the despatcher between terminal points he can usually use the instrument of some other car at a meeting point, which will enable him to get to a terminal where he can change his telephone. Of course, telephones give out and have to be overhauled, but I am not aware that our cost of maintenance is excessive. We simply consider it as we would the maintenance of any other piece of apparatus, and do not expect the telephones to maintain themselves."

The company has recently adopted a rule of having the first car to arrive at a meeting point take the siding, allowing the last car to arrive at a meeting point to go through on the main line without interruption. This saves some time over the old plan of keeping to the right at sidings.

SPRING POINT SWITCHES ABOLISHED

The use of spring point switches at turn-outs has recently been abolished. All switches are now operated by hand. The reason for this is the danger that the spring point will not be entirely closed by the spring. With cars operating at speeds of from 40 miles to 60 miles over facing-point switches, these switches cannot be made too secure. Two accidents which recently occurred to limited cars, due to the failure of spring-point switches to close effectually, convinced the management of the advisability of this change. If the spring-point switch is not entirely closed, the passage of the forward pair of trucks is likely to cause enough vibration so that it will snap closed by the time the rear trucks reach it, with the result that the front trucks take the siding and the rear trucks take the main line.

SEMAPHORES AND LIGHTS ON SWITCHES

Hereafter all switches will be equipped with semaphore blades, in place of dwarf targets, to indicate whether the switch is open or closed, and will further be equipped with electric signal lights for use at night. After some experimenting the plan adopted is to use a 300-volt incandescent lamp for each switch signal, two of these 300-volt lamps being, of course, required in series at a turn-out, one in each switch stand. A choke coil and lightning arrester are inserted in the lamp circuit at each turn-out. The 300-volt lamps employed are selected of such low efficiency that they have a long life. The lamp circuits are run each way from a sub-station, and are thrown on and off by switches at the sub-station. When operating at such high speeds as are common on these lines switch lights are cer-

tainly advisable, and are an assurance to the motorman that the line is clear.

THE OVERHEAD TROLLEY FOR HIGH SPEED

It is a matter of wonder to electric railway men who visit this system that the overhead trolley seems to be giving such satisfaction at the high speeds. Although the equipment of the majority of the cars is such that the speed does not frequently exceed 50 m. p. h., there are some equipments with which a speed of 60 m. p. h. is sometimes attained, and this is accomplished without any undue arcing of the trolley wheel or the trolley leaving the wire at curves. The behavior of the trolley at high speeds is perhaps the best proof that could be given of the smoothness of the track and the alignment of the overhead wire. Figure 8 trolley wire has been used throughout, which gives a smooth under-running surface. Practically no trouble is experienced with the trolley coming off, but to provide for such emergencies the Knutson trolley retriever is in use. The amount of wear obtained from trolley wheels in interurban service is somewhat remarkable, and their life is not anywhere as short as might be expected. Five thousand miles is the minimum life of the 6-in. Kalamazoo wheels which are used. Some wheels run as high as 7000 miles. This holds true even on the limited cars.

SHOP AND CAR MAINTENANCE NOTES

J. L. Matson, superintendent of motive power, has adopted the plan of overhauling equipments according to the mileage they have made. That is, the equipment is taken in for general overhauling after it has made a certain number of miles. This is, of course, much more logical than overhauling according to the time an equipment has been out of the shop. The mileage a truck is allowed to make before being taken in for overhauling is 12,000.

The company now uses Standard steel-tired wheels, with malleable iron hubs and spokes, cast-iron hubs having been abandoned. Steel-tired wheels have always been used on motor trucks on this road, as cast-iron wheels have not been considered safe under motors in such high-speed service. The wear on steel wheels, not including turning down, is about ⅛ in. for 13,000 miles. M. C. B. practice is followed as to maximum wear allowed on steel-tired wheels. This practice allows 1-in. thickness of steel tire as the maximum on the main part of the tread.

This company does all of its overhauling of motors and trucks from above, taking the trucks from under the car body and working on them on the open floor. Pit work is avoided as far as possible. New shops are soon to be built at Anderson which will have an overhead traveling crane for lifting car bodies, trucks and motors.

DECEMBER LOAD THE HEAVIEST

This company finds that the heaviest power station load occurs in December, due to the holiday shopping. This is contrary to the experience of many interurban lines, which have the heaviest loads during the summer. It goes to show that the company is dependent upon business rather than upon pleasure traffic for its largest income, and is a condition of affairs which should be satisfactory to those financially interested.

GENERAL EXPANSION

George F. McCulloch, the company's president, is tireless in his efforts to improve the property and to extend it to cover all of the territory north of Indianapolis. New lines are constantly being purchased and projected, and present indications are that the Indiana Union Traction Company, or allied companies, will soon control nearly all the electric railway mileage in Indiana north of Indianapolis, and will have an entrance to Chicago. This rapid expansion has necessitated a somewhat peculiar organization. General operation is in charge of A. A. Anderson, with headquarters at Anderson; A. L. Drum, assistant general manager, has charge of all the extensive new construction, with headquarters at Indianapolis.

CLAIM DEPARTMENT METHODS IN BROOKLYN

BY GEORGE R. FOLDS

The development of electric street railways has not only required the introduction into their accounting systems of many features not found in ordinary railroad bookkeeping, but has made it necessary to develop a type of claim department essentially different from that of steam roads. The vast number of trivial accidents that are continually happening, and the occasional disaster that entails claims running into the tens of thousands of dollars are all first reported by the crews on the cars, so that an easy, simple, full and careful reporting system is by no means easy of accomplishment. Promptness in getting full and accurate news of accidents involving liability to the claim department, equal promptness in acting on this knowledge, coupled with good judgment on the part of adjusters, are three essentials in the routine of this important work. The first can be obtained only by having a system of trainmen's reports perfectly adapted to the trainman of least literary ability; the second by the satisfactory organization of the claim department and thorough co-operation of all the other divisions of the service therewith; and the third, by the employment of good men as investigators, division agents and adjusters, and keeping them up to their best work by a thorough system of checking.

There are two policies which a railway may adopt in its treatment of damage claims: It may try to adjust every claim on a fair basis, or it may make it a rule to fight the majority of them in the law courts. The latter necessitates a large legal department, with often an auxiliary force of trial lawyers. It also not infrequently produces a feeling of antagonism on the part of the public, owing to the publicity given to the cases, whether the company is shown to be at fault or is entirely vindicated. For some time the policy of the Brooklyn Heights Railroad has been to adjust amicably every damage claim possible, and only the grasping unreasonableness of the claimants is now able to force the company into court. This policy has been adopted more completely last year than ever before, the amount of ready cash carried by the adjusters for immediate settlement having, for instance, been trebled. The large decrease in the amount paid for injuries to persons, as given in the last annual report, is undoubtedly due in a considerable measure to the improved work of the claim department.

In a system as extensive and intricate as that in Brooklyn there are, of course, many refinements of detail necessary in its claim department which would not be justified upon smaller or simpler properties, but perhaps some of the methods used to bring the cost of an accident to a minimum may warrant a brief description of the whole. Although the present system has been organized but a few months, and is working with great smoothness and satisfaction to employees and management, one much less elaborate would undoubtedly be more in place on a smaller road. Some of the features are entirely new, however, and others are novel in their application to this work.

The greatest importance in the Brooklyn system is attached to the reports of the car crews. For a long time the custom was almost universal of having these reports made out on loose sheets in duplicate. This work was irksome, and the employees necessarily had to wait until they reached the car houses before writing an account of the accident, and it often resulted in the information getting to persons not acting in the company's interests. A report blank has been adopted by the Brooklyn Heights Railroad, which is of the same size as the conductors' day cards, about 5½ ins. x 11 ins., and both conductor and motorman are intrusted to carry a number of them on each trip. This blank, shown below, is printed on pink paper, and contains spaces for filling in the principal facts and names, together with a few lines for a general description of the acci-

dent. As soon after each accident as possible both the conductor in charge of the car involved in the casualty and motorman are expected to make a brief memorandum upon one of these report blanks. This statement is, of course, written in pencil during lay-over time, if possible. The names and addresses of witnesses are taken on small slips, about 1½ ins. x 3½ ins., furnished for the purpose, only one name being placed on each slip. The conductor is supplied with a number of envelopes addressed to the claim clerk of his depot, in which the data, viz., his own report and that of the motorman's report and the witness slips, are inclosed. Upon arriving at the end of his run, or when passing his depot, he deposits this envelope in a locked iron box, to which the claim clerk and depot master alone have keys.

THE BROOKLYN HEIGHTS RAILROAD COMPANY.
TRIP ACCIDENT REPORT

This is to be made out during run and turned in with names of witnesses and injured party, when passing depot.

Line.....Car No.....
Date of accident.....Hour.....
.....Trip leaving.....at.....m
Place of accident.....
Number of persons on wagon.....No. of passengers.....
Was police officer present?.....Officer's No..... Precinct....
Was ambulance called?.....What Hospital?.....
Name of driver or injured person.....
Address .....
Name of owner.....
Address .....
Description of accident.....
.....
.....
.....
Signed.....Conductor No.....
.....Motorman No.....

There are claim clerks at seven of the largest depots. By employing eight men for this work each clerk gets every eighth day off duty. All the clerks employed in this work are notary publics, and it is their duty to interview the trainmen regarding accidents at the earliest possible opportunity, and take their affidavits regarding the same. This work is nearly always done when the men are on relief. As soon as the report envelopes are deposited, however, the claim clerk makes a typewritten report therefrom and forwards it to the claim department. The clerks are supplied with typewriters, in which the writing is visible at all times, and no difficulty has been experienced by them in soon mastering the art of using these machines.

This claim agent's report forms the basis upon which the investigators, adjusters and other employees of the road proceed, and five copies are made—the original, printed in copying ink, and four carbons. This report calls for the following data:

Depot Number.....Accident Report Number.....
Line.....Car No.....Open or closed....
Conductor.....Motorman .....
Date of accident.....190....Hour.....m.
Place of accident.....Grade.....
From and to what street was car going.....
Was car moving; if so, how fast.....
Direction vehicle or person was going.....
Number of persons in vehicle.....
Number of passengers in car.... { Men / Women / Children
What other cars near.....What other vehicles.....
Damage to car.....
Injury to person or property.....
Description of accident.....

The lower part of the sheet contains the names and addresses of the injured parties and also those of the witnesses. From two of the carbon copies the claim clerk tears off and destroys the lower portion, thus removing the names of the injured parties and witnesses, and sends one each to the general and division superintendents. The remaining three copies, the original pink reports and the witness slips, are sent to the claim department at the end of the day.

The claim clerks at the principal depots attend to the business of the less important depots near. Boxes are provided for depositing the crews' report slips, and these are collected by the nearest claim clerk during the day. The trainmen are allowed to use the company's time in taking the trip to the claim clerk's office for the purpose of making their affidavits.

The claim clerks work from 3 in the afternoon until 2 the next morning. In this way all accidents occurring before midnight are fully reported to both operating and claim departments by 7 the next morning. At this hour a clerk in the claim department enters the office case number on each copy received at that office, and takes a letter press copy of the original in a book used for the purpose. This latter preserves the original information in a compact form, and one in which it can be stored in a safe, and kept free from fire or other loss. The original typewritten report is then used as a basis for the claim file, and is put away, together with the crew's report and witness slips. The two carbons are used in handling the case. One is always kept on a "Shannon" board file as a standing memorandum for the chief investigator or claim agent, and is called the "Case to Watch" carbon. The other is given to the investigator or adjuster, each of whom has a board file of his own. By examining these boards at any time the chief inspector can see just what work a man has on hand, and as the reports are filed in the order of their case number any special instruction which may be given to an investigator at work on a case can be put in the file at the proper place, when it will attract his immediate attention. By using the file system there are never any memoranda of dead cases mixed in with live ones, as when a case is concluded the carbon is taken out, checked off and sent to the file room. Other advantages of this system are that all employees have a readable and uniform style of report on all cases, that adjusters and investigators have practically all memoranda necessary for a case on a single sheet of paper, and that the office has complete information as to the work each man has on hand, and an efficient check on his work.

As soon as convenient after an accident a sworn statement is taken from the trainmen by the division claim clerk. A four-page blank is used for this purpose. The first three pages contain a series of questions as follows, and an affidavit form:

THE BROOKLYN HEIGHTS RAILROAD COMPANY.
EMPLOYEES' ACCIDENT REPORT

(Col., Per. or Veh.) Claim No.
Personal Statement, sworn to by No.

1. Did you see the accident?
2. Where did it occur? Opposite what street number?
3. What day and what hour did it occur?
4. trip leaving at m
5. What first attracted your attention to the accident?
6. Who was other trainman and where was he at time of accident?
7. Were there other people on street in vicinity of accident? Give names.
8. Give names or license numbers on all vehicles in vicinity of accident?
9. Did the party having accident appear to be injured?
10. Did such party appear insane, intoxicated, blind, deaf or lame?
11. About how old was injured party? Race or nationality and sex?
12. What was done with injured party? What ambulance or physician, if any, was called and by whom?
13. Give statements of injured party or driver of vehicle. What did he say about accident and whom did he blame?
14. From and to what street was car going.
15. At place of accident was it up or down grade or level?
16. Was car standing or moving when you first saw danger? If moving, state about how fast?
17. Had bell been given to stop? If so, for whom?
18. Where was last stop made before accident occurred?
19. State condition of weather.
20. State condition of rail, whether dry, wet or slippery.

21. Was street dry, muddy, icy or covered with snow at place?
22. Was there any car passing in opposite direction at time of accident? If so, give line and car number and state about how fast it was going.
23. Was gong on that car ringing?
24. Were there any other cars near at time of accident? If so, give lines and car numbers. Also state what cars came up after accident.
25. Give names and numbers of all employees around at time of accident.
26. Give number and precinct of any police officer who was there at time of accident or immediately after it.
27. Number of passengers. Men Women Children
28. How many on platforms of your car, front? rear?
29. What was the number of car? Was it an open or closed car?
30. Were all parts of car in good working order? (If not, state defects.)
31. Were you on time? If late, state how much.
32. If at night; (a) Was car lighted up? (b) Was headlight shining? (c) Was street lighted up at place of accident?
33. What direction was vehicle or person going with reference to car? State how fast.
34. If vehicle, state how many persons in it and who was driving.
35. State kind of vehicle and what damage.
36. How far ahead of front end of car was person or vehicle when you first saw danger?
37. How far ahead of front end of car was person or horse when first stepping upon your track?
38. Was gong ringing? If so, when and for how long?
39. Was any other warning given? If so, what?

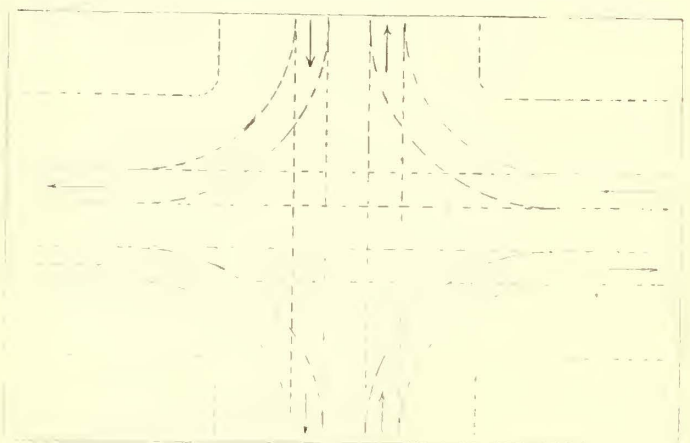


DIAGRAM OF CROSSING

40. What did the person, after having been warned or signaled, do?
41. Was your view or that of injured party obstructed; if so, by what?
42. Where was car with reference to nearest street crossing, at time of accident?
43. Give distance from front of car, after it stopped, to place of accident. If paced or measured, state who did so.
44. After stopping car in consequence of accident, was car moved again until it left the place? If so, state reason.
45. State all that was done, to your own knowledge, to avoid accident after danger became apparent.

The Brooklyn Heights Railroad Company

CLAIM DEPARTMENT

LOCAL AGENT'S DAILY REPORT Dated 190

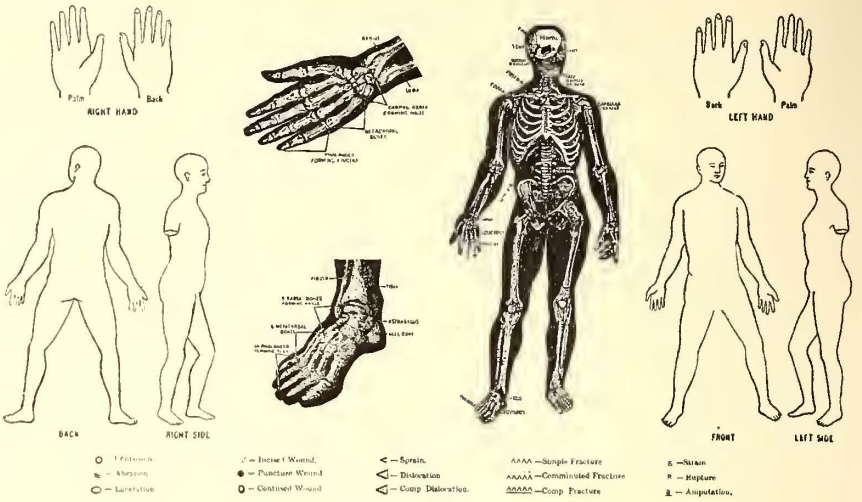
TIME	CASE NUMBER	REPORT	EXPENSE		CALLS	INTERVIEWS
		TOTAL NUMBER HOURS	TOTAL			

ADJUSTER

ADJUSTER'S DAILY REPORT

46. Give general description of accident and state any incidents or features not answered above.

The above is for an accident resulting from a collision with a person or a vehicle. A slightly different form is used for injuries to persons alighting from or boarding a car. On the back



SURGEON'S CHART

of these sworn statements is the outline of a street crossing, printed in light ink. Upon this outline a diagram of the scene of the accident can be readily traced.

A new system of keeping a record of the expenses and work of employees has also been introduced into the claim department. Each morning the agent makes out a report of the work done the previous day, stating after each item the expense, number of calls, interviews or settlements. The investigators instead of settlements give the number of signed statements they can secure on each case. These daily reports are collected and summated on a weekly sheet, thus giving a convenient record of the department's labors.

There are, of course, a number of details of the system of which space does not permit extended description. Besides the carbon report slips a day book is kept of all cases, and the progress made on them. The various steps taken towards settling the claim are recorded on the report slips as they are taken. Much labor is saved by sending a printed form to the witnesses and getting their statements without a personal interview. It was formerly the custom for the division claim agents to report at the respective depots, and start out on their days investigating work from there. Now they all meet at the general offices, and can divide work among them, so as to save much unnecessary traveling and waste of the company's time. As soon as an adjuster can do nothing more with a case his carbon is marked "file," and goes in with the other documents, including the original report. A file is also kept of cases which may be adjusted later, and these are looked over from time to time.

The filing of all documents flat is a great improvement over placing them in envelopes or in pigeon holes. The board file gives easy access to all papers thereon, with the liability of losing them while being inspected reduced to a minimum. Besides these files two auxiliary card catalogues are kept. One contains the names of injured parties and witnesses, and the other the names of trainmen interested in accident cases. The cards, of course, give the file number of the claim and all information regarding the movements of the parties is recorded thereon. If a trainman resigns from the company's employ his record is looked for in the claim department's card catalogue, and if it is found he is connected with any cases of alleged liability his probable changes of address and occupation are noted on his card. Similar card catalogues are also kept by the legal department.

The surgeon's report furnished by the company is similar to

that ordinarily used in accident cases. It contains data as to the injured party's habits, residence for past five years, former physicians, previous condition of health and evidences of old injuries, disabilities or disease, etc. A surgeon's chart is also used, showing in outline the front, back and side of the human body, upon which can be indicated by signs the position and character of the injury. Both report and chart are made the same size as the other documents, so as to be readily filed therewith.

In reorganizing the claim department the following ideas have been kept in mind:

1. To have an easy and simple method for the trainmen to report accidents.

2. To secure promptness in reporting accidents and promptness on the part of the claim department in handling accident cases.

3. To secure careful and full reports from employees.

4. To give each case individual consideration and as carefully directed investigation as it may require.

5. To have men who have good judgment acting as adjusters.

6. To adjust all cases of liability or doubtful liability, and as a general rule to settle a claim as quickly after an accident as possible.

7. To give adjusters considerable latitude in settling cases.

It has been thought better to have the claim department too large than too small in order to handle such cases as collisions of cars and other emergency accidents. Great care is exercised in the selection and supervision of the men, as the management considers that it is more important to have efficiency in the claim department than in the law department, as far as the negligence part of the business is concerned.

ILLINOIS STATE ELECTRIC ASSOCIATION MEETING

The Illinois State Electric Association convened at the Southern Hotel, St. Louis, Saturday, Sept. 19. This Association is mainly composed of electric light companies, but as there are an unusually large number of companies operating both street railway and electric light plants in the State of Illinois, a number of street railway men were in attendance.

The Association was taken by a special car of the St. Louis Transit Company from the Southern Hotel to the World's Fair grounds, where several hours were spent in driving about the grounds. In the afternoon, at 3 o'clock, the Association took the steamer Illinois, which is the property of the Illinois and United States Fish Commissions, for a trip up the Mississippi River and Illinois River, which ended the next day at Beardstown, Ill. The use of the steamer was given to the Association by the fish commissioners, and the courtesy was much appreciated. At Baden the party went ashore for a short visit to the works of the St. Louis Car Company, where they found President George J. Kobusch, Vice-President and General Manager H. F. Vogel and General Sales Agent W. S. McCall ready to receive them, assisted by Messrs. Sutton, Rubenbauer, Smith and others of that company's operating force. Refreshments were served in the company's dining room, and the reception ended with rousing cheers for Messrs. Kobusch, Vogel and the St. Louis Car Company. From Baden the party proceeded to Alton, where the Alton Railway, Gas & Electric Company took the visitors around the town and afforded them an opportunity to inspect its generating station, and later in the evening gave a theater party for all the delegates. The next day, at 7 a. m., the steamer started up the river for an all-day trip, some of the party leaving at Meredotia and some at Beardstown.

Among the street railway men in attendance were W. B. McKinley, of Champaign, president of the lighting and railway properties at Danville, Champaign, Decatur, Galesburg, Quincy and Ottawa, besides the large number of interurban lines controlled by the Portland or McKinley syndicate; H. E. Chubbuck, general manager of the Illinois Valley Traction Company, La Salle, Ill.; W. A. Bixby, general manager of the Decatur, Springfield & St. Louis Railway; S. L. Nelson, manager of the Galesburg Electric Motor & Power Company; S. B. Bartlett and F. W. Bedard, of the Illinois Valley Traction Company, La Salle; C. L. Gerould, of the Galesburg Gas & Electric Company; J. W. Race and W. A. Martin, of the Quincy Horse Railway & Carrying Company.

FIREPROOF CARS

George Gibbs, consulting engineer of the Interborough Rapid Transit Company, of New York, who was one of the designers of the new subway cars described and illustrated in the STREET RAILWAY JOURNAL, Aug. 29, 1903, has been granted a patent upon another form of construction which is in some respects a radical departure from the subway type. This car is intended for service upon electric lines, and includes many of the features of the subway cars, but it is proposed to build it entirely of metal and non-combustible material. It is the intention of the inventor to eliminate wood entirely from the car structure, owing to its tendency to splinter, which would increase the fire hazard materially, it is claimed, in case of a wreck caused by a collision or derailment.

The frame of the car is to be of metal with a non-metallic, non-splintering lining, which shall be either entirely non-combustible or of slow-burning composition. This lining will also serve the additional purpose of deadening sound and providing a heat and insulating partition. It is pointed out that a car constructed entirely of metal would be noisy and uncomfortable, and it is feared that dangers from short circuits would be greatly increased. The non-metallic lining will afford protection against the extreme effects of heat and cold which would be present in an unlined metallic car, and will deaden the sound which would be transmitted to the interior of the car if metal alone were used in the structure.

Provision is made for an all-metal frame above the floor and a metallic outside sheathing, but with a lining of non-splintering board composition, made either of wood pulp fiber, impregnated with metallic salts or of composite board made of wood pulp and asbestos or other non-combustible material capable of being formed into a board of sufficient mechanical strength and toughness. The floor frame may consist of angle-side sills, additional center sills running longitudinally, and transverse angular bridge pieces, all of these parts being of metal. The fireproofing and insulation of the floor may be composed of a board of transite or similar fireproof material laid on top of the bridge pieces. On top of the sills a flooring of metal will be formed of corrugated sheets, and on top of this a plastic flooring of asbestos, magnesia composition or similar material will be laid.

The side framing of the car is formed of iron posts, which also comprise the vertical frame between the side windows and are secured to the outside sheathing of metal so as to form a vertical truss. The sheathing is riveted to these posts and extends from the bottom of the side sills to a window sill angle piece. Around these posts between the windows finishing strips of pressed metal are secured in such a manner as to exert a spring pressure and hold the window sash in place and thus prevent it from rattling.

The roof construction employs metallic carlines extending from one end of the car to the other, while the longitudinal frame between them consists of angle pieces, and the outside roofing may be of sheet metal or of the non-metallic lining material, where lightness is particularly desirable. The interior lining consists of non-metallic, non-splintering material below the window sills and between and above the windows. Several methods of securing this lining to the posts are described.

THE WORK OF THE ACCOUNTANTS' CONVENTION

BY JOHN F. CALDERWOOD

The meeting of the Street Railway Accountants' Association at Saratoga is one upon which every member of the Association can look back with satisfaction. A few years ago there was a sentiment on the part of some persons outside of the Association, that as that body had established its standard system of accounting, there was little left for it to accomplish. Those familiar with its aims and purposes knew at the time, and all who have followed the work of the Association since must have realized, that nothing could be further from the facts. The field widens as we advance further into it, and it will require the best energies and most conscientious thought of all satisfactorily to solve the problems which present themselves at the annual meetings. The Association is fortunate in having selected as its president this year F. E. Smith, one of its five founders and original "war horses," who has been prominently identified with the work of the body ever since, and who will make an excellent presiding officer.

One of the most important fields to be undertaken in the early future by the Association was indicated by the interesting paper presented at the Saratoga Convention on freight and express accounts, by Mr. Fullerton. The system followed in Detroit, under Mr. Fullerton's direction, is probably as complete and as satisfactory as that in any other part of the country, and the Association will do well to consider the classification of these accounts in its form of report. Probably few changes will have to be made in the standard form, but whatever plan is adopted the accounts should be kept entirely separate from those of the passenger traffic. The same statement applies to any other distinctive branch of the company's business, otherwise it would be impossible for the manager to determine whether the freight or other outside business is on a profitable basis or not. This means, of course, that the freight expenses should be separated from those of the passenger business and the net earnings only included in the income account. The subject is an important one, as indications point to an early extension of the functions of the street railways in our large cities from those of the transportation of passengers only, to that of handling freight, express, ashes, garbage and other heavy material. In many cases this work will undoubtedly be undertaken by outside corporations who will compensate the railway company for the use of its tracks and power on a car-mileage basis. Mr. McClary's paper before the American Street Railway Association shows that this has already been done in several large cities in the case of express haulage, and this fact is an additional reason for the inclusion of the net receipts only in the income account.

Mr. Stiver's paper on car maintenance records indicates the differences in desirable practice between a large and small road. On the latter it is an easy matter to keep very close watch on the life of many of the different car equipment parts, while the same policy would lead to confusion if carried out on a large system. With a detailed report before him of the life of all gears, pinions, trolley wheels, bearings and car wheels, the manager of the small property has a most accurate guide in placing orders and the maintenance of such a record is not difficult if the card system is used. But with a large system, while the mileage of armatures can be recorded, it is doubtful whether it pays to keep the individual wheel mileage and a debit and credit account of the smaller parts, such as pinions, gears and trolley wheels, is out of the question. The only available plan is to divide the cost of labor and supplies into the several classifications, and taking the total number of cars work out the cost of the different minor parts on a car-mileage basis.

The bag and receiver systems of handling conductors' remittances was another subject which engaged the attention of the Association, and the additional expense of the receiver system was one of its points of disadvantage upon which stress was laid by a number of the speakers. This, however, is not its only objection, as with the receiver system considerable time is lost by the conductors who are obliged to stand in line to deposit their collections and be checked off by the chief clerk. The bag system eliminates all this and affords the additional advantage that the money is not handled by anyone until it reaches the main office. The receiver system was used in Brooklyn for a considerable time, but was abandoned in favor of "bags" after the adoption of a form of envelope which could be effectually sealed. The conductors have great confidence in the present method, and practically no trouble has been experienced with "overs" or "shorts" in the counting of the deposits, while the saving in expense has amounted to about $12,000 a year.

In addition to the papers presented at the convention several topics were introduced for discussion. Of these, the practice followed in sending money to the banks illustrates one of the differences in local conditions between the Eastern and some of the Western roads. In the Western States, where the use of silver dollars is more common than that of paper certificates, the railway companies receive large quantities of coin, and in many cases have to ship it in bulk to the nearest sub-treasury. In cities where the coin is sent to the local banks the latter usually insist upon having those of each denomination wrapped separately. In the East this practice is not required, and there is usually such a demand for copper pieces from the department stores and small retailers that dealers will call at the office of the company for it.

The subject of enlarging the scope of the Association was also the subject of considerable debate, and the Association did wisely in deciding not to admit to full membership outside accountants or others not directly associated with street railroading. While there are many expert accountants not in direct affiliation with street railway companies, whose experience would be of value to the Association, street railway accounting differs radically from that in any other industry, and it would be extremely unwise to give the right of participation in the councils of the Association to those who are not actively engaged in street railway work. There is also the reason that the outside accountant might make his membership in the Association the means of furthering certain fads in accounting, or for advertising purposes, so that the importance of confining the membership to active street railway accountants is sufficient to justify fully the action taken at Saratoga. The writer believes, however, that it would be of benefit to the Association if some plan were adopted by which outside accountants, investors and others could secure regularly the proceedings of the Association, and thus keep in touch with the changes made from time to time in the classification and the decisions of the body on disputed points in accounting practice. It is not only due those experts who are from time to time called upon to look into street railway properties that they should have a working knowledge of the Association's classification, but it would also be of value to the latter body in furthering the general adoption of its methods. Bankers and investors in street railway properties have also a right to understand the basis of the classifications of the accounts used on their properties, and it behooves the Association to consider whether the adoption of a by-law authorizing some action in furtherance of this end is not now advisable. Such connection should not entitle the subscriber to admission to the meetings, or certainly not to the floor or to a vote, but should carry with it the right to receive the printed copies of the transactions.

THE STREET RAILWAY OF MANILA

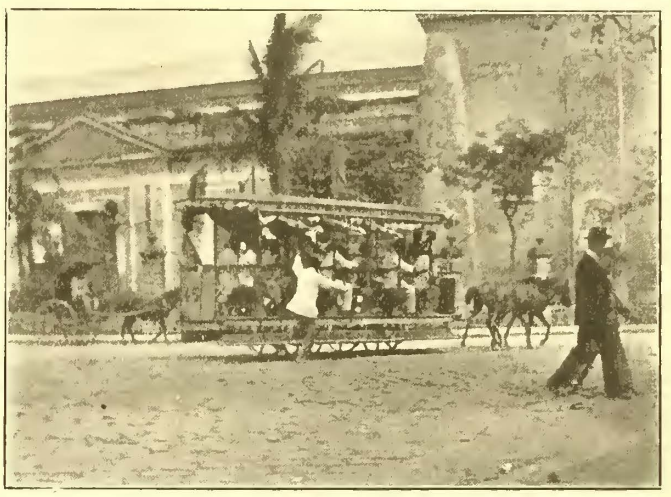
Before the new electric railway system of Manila has been completed and the present antiquated but picturesque bob-tail cars have been finally consigned to the scrap heap, it may be of interest to describe briefly the system which has survived the Spanish regime and is giving away only now to modern methods. Manila enjoys a distinction claimed by only a few cities just now outside of New York, London and Paris, of possessing a transportation system in which animals supply the greater part of the motive power. The cars carry twenty-four people, the law limit, and most of these people are natives. The peculiar attraction of the car is its draft animals. The native horses are all small, but those of the street railway line seem particularly miniature in stature.

The cars necessarily travel slowly. Still, the line is considerable accommodation for the natives, and, in fact, large numbers of soldiers travel from Malate, a suburb of Manila, into the city proper for 5 cents. The line extends through some of the main streets of the city. The bulk of Manila street traffic is with the little native vehicles, but there are not nearly enough to accommodate the people. One has to wait and watch on street corners for half an hour to get a vehicle. Hundreds pass, but they are usually occupied or engaged. The native cabmen do a fine business and they are powerful. They are said to have prevented the introduction of the Japanese jinrickshaws, and, it is stated, they object to the advent of an electric line in Manila and its suburbs. But their objections seem to be carrying little weight.

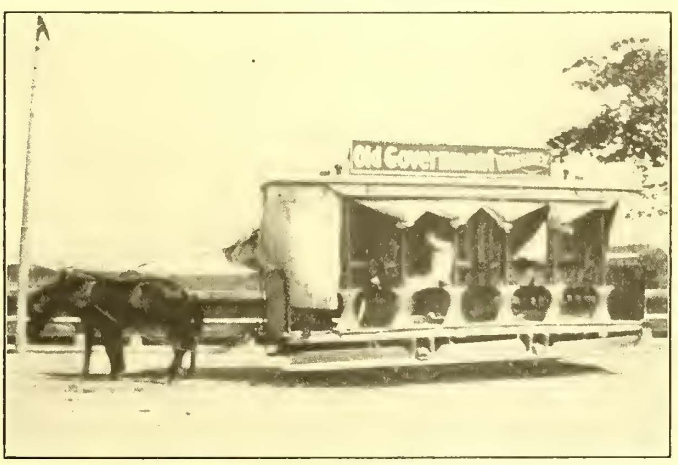
Properly to understand the conditions of street car traffic in Manila reference should be made to the various systems used in the transportation of passengers and freight in the streets of Manila and the several adjoining important suburbs. The slowest medium for freight and passengers is the caribou cart, whose speed is about 3 m. p. h. These carts are in vogue even to-day in the busy streets of modern Manila, running alongside of the up-to-date express wagons of recent importation.

Next in order is the

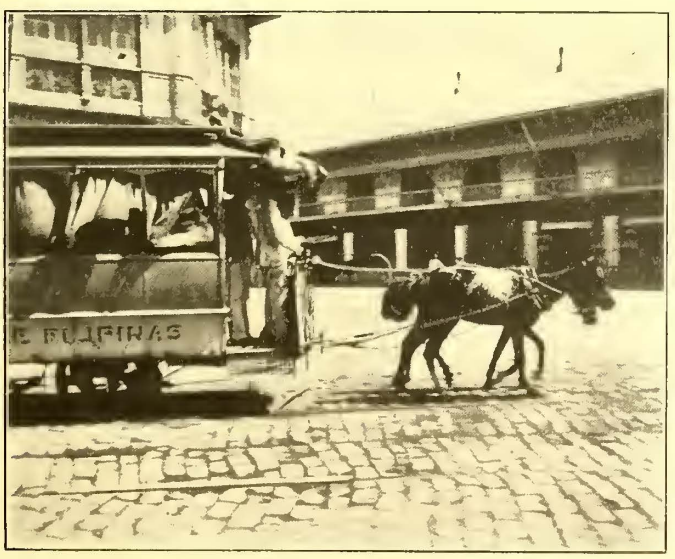
TYPICAL STREET SCENE IN MANILA



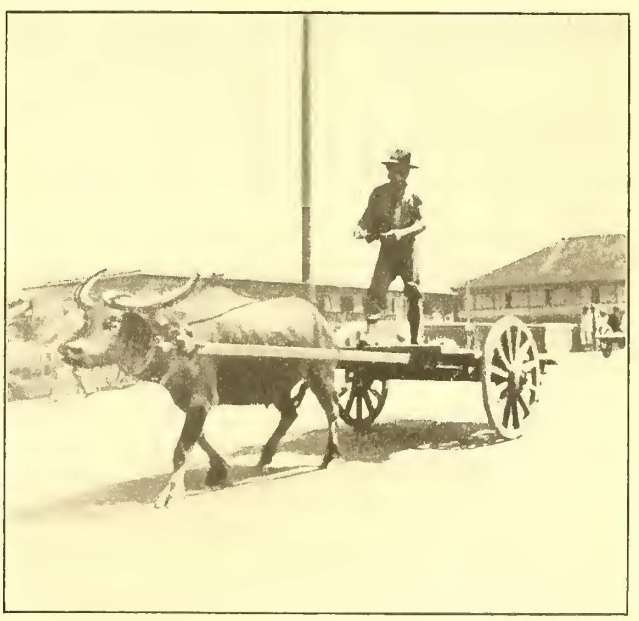
OPEN CAR USED IN MANILA



SPECIMEN OF ADVERTISING ON CARS



SNAP SHOT OF A MANILA HORSE CAR



SLOWEST FORM OF MANILA TRAFFIC

"chicken coop" vehicle, so-called, designed with a box body with lattice sides, much like a chicken coop. This affair rests upon two wheels and has a top, and the passenger has to clamber up over the wheel to get into the coop. The fare charged is 10 cents for same distance served by the street railway line for 5 cents. Then comes the "quilizes." These vehicles are two-wheel topped buggies, and are drawn quite rapidly over the ground. The charge is 20 cents per hour and smallest charge is for a full hour. The Victoria vehicles cost about $2 per hour first hour, and are drawn by two horses. The highest speeded vehicles for passenger traffic are the automobiles. There are not more than forty or fifty in service, but they are used often, and one sees them skimming along the drives very rapidly. The present street car speed is equal to that of the chicken coop carts.

Manila has some very fine roads, which are broad and finely graded for miles, and there are some through which an electric railway line could easily be constructed.

The present railway employs natives for conductors, drivers, linemen, stablemen, etc. Haste is something quite unknown to the Filipino. He has plenty of time for everything. Cars are stopped while he says good-bye to his friends and has quite a chat, and the driver and conductor show no impatience.

The conductors are all uniformed in neat gray with gilt bindings on the cap, and evidently feel proud of their military appearance. Fare receipts are given for each 5-cent fare in place of registers. and as the receipts bear a consecutive number there is a check upon the number of fares collected.

The little narrow-gage cars are, as a rule, worn out and need painting. But the company makes no great effort to keep them up on account of the early date at which the new line will be completed. The cars are freely decorated with advertisements, and are usually crowded.

EARNINGS OF IOWA INTERURBANS

According to the reports submitted to the Executive Council of Iowa by the interurban railway companies of the State for assessment purposes, the gross earnings of every such company for 1902 were in excess of the operating expenses. The Des Moines Interurban Railway Company reported gross earnings, $26,895; operating expenses, $14,839, and net earnings, $12,057. The net earnings amounted to more than 5½ per cent interest on the actual valuation of $234,100. The larger part of the mileage of this company was only in operation during the latter part of the year. The Boone Suburban Railway Company reported gross earnings, $7,495; operating expenses, $4,553, and net earnings, $2,942. The net earnings represent more than 15 per cent interest on the actual valuation of $18,800. The Cedar Rapids & Marion City Railway Company reported gross earnings, $103,694; operating expenses, $76,429. and net earnings, $27,265. The net earnings are more than 15 per cent interest on the actual value, $179,983. The Mason City & Clear Lake Traction Company reported gross earnings, $37,330; operating expenses, $29,261, and net earnings, $8,064. The net earnings represent more than 15 per cent interest on the actual value of $52,632. The Waterloo & Cedar Falls Rapid Transit Company reported net earnings about $40,000, which represents 10 per cent interest on the actual valuation of $400,000. The Tama & Toledo Electric Railway Company reported gross earnings of $9,000; operating expenses, $8,330, and net earnings, $876. The net earnings represent more than 3 1-3 per cent interest on the actual valuation of $19,998. This company had its line in operation only for a few months during the year. The reports show that those companies which had their lines in operation during the entire year of 1902 made from 10 per cent to 15 per cent interest on the actual valuation.

ARMATURE TESTING WITH A MILLI-VOLTMETER

BY CALE GOUGH

The winding formula for street railway armatures is in itself very simple, and a workman with ordinary intelligence can usually follow it correctly. But with the 200 or 300 leads to be connected, each in its proper place on the commutator, the undivided attention of the winder is required. Even with the most experienced operators mistakes are by no means few, and when one does occur, if no method of testing is provided, it may not be discovered until the armature has been placed in the motor, where attempts to make it run properly usually result in several damaged coils and quite an amount of lost labor.

The proper use of a milli-voltmeter in the winding room will eliminate much of the uncertainty; clear up many of the mysteries concerning armatures, and prevent mistakes in connecting and winding from going far enough to cause trouble and expense.

In addition to the milli-voltmeter all that is required for making satisfactory tests is a lamp bank, furnishing about 1 amp. of current.

The terminals from the lamp bank are placed on segments, spaced about one-fourth of the circumference of the commutator apart. The milli-voltmeter leads are then placed successively on adjacent commutator segments until half the bars have been passed over. There is no necessity of going over the whole commutator. All the coils are caught when only one-half the segments have been passed over, as will be seen by following out the windings in one of the accompanying diagrams. When the armature is in no way defective the readings between all the segments will be the same. Any variation in the readings indicates something wrong.

The trouble most frequently encountered is a short circuit between two bars. Between these segments the instrument will show no reading or only a partial one, depending on the nature of the short circuit.

Fig. 1 illustrates this point. Assume the lamp bank terminals on the segments a and d, and the milli-voltmeter terminals on b and c. The milli-voltmeter should indicate the drop in the coils b to i and i to c, marked by heavy lines. But the short circuit across the bars b and c allows the current to pass directly across. The heavy coil then is cut out, and, of course, there is no drop of potential in it. Such short circuits are usually caused by a bridging of solder over the mica. Usually this can readily be seen and easily removed. If, however, the trouble is caused by a globule of solder down behind the segments, or between the bottom leads, it will be more difficult to clear up. If, upon thoroughly scraping out the mica, the reading still indicates the presence of trouble, it must be looked for elsewhere. Probably two leads have been transposed. In such an event the next two segments will show no deflection. The reason for this will be understood by reference to Fig. 2. In this cut the leads from h and i to c and b, traveling counter clockwise, are shown transposed. It is evident that the segments b and i and their connecting coils, shown in heavy lines, are not connected to the remainder of the winding, and are, therefore, dead when the lamp bank terminals are on a and d. For this reason no deflection of the milli-voltmeter will occur so long as one of its terminals is on one of the dead segments; that is, when testing from a to b and b to c, likewise from g to h, h to i.

But shorts between the segments a and b and b and c will also cause the instrument to show no reading between these segments. Doubt as to which of the two causes is present may be removed by testing directly from a to c. If bridging solder is the cause there will still be no deflection, but if the leads

are transposed the same reading will be obtained as between two adjacent segments, where no trouble is present. The reason for this is readily seen by following out the coils between a and c, as a to h, h to c, which is the same number as obtained between two adjacent segments when properly connected.

If two successive readings are smaller, but still half or greater than half of the correct reading, the trouble may be assumed to be due to bridging of solder between two segments diametrically opposite the point tested.

Explanation of this is made by reference to Fig. 1. Assume b and c to be completely short circuited, then the deflection between h and i and i and j will be but half of the correct amount. Under normal conditions the drop obtained between h and i is that in the coil connecting i and b, marked heavy, and the returning one connecting b and h. But the heavily marked one is carrying no current, for reasons already explained. When h and i are tested the short circuited coil acts simply as part of the instrument lead, and the deflection is the same as if the instrument were connected directly across h and b, which would give the drop in one coil. For the same reason the drop between i and j is similarly halved.

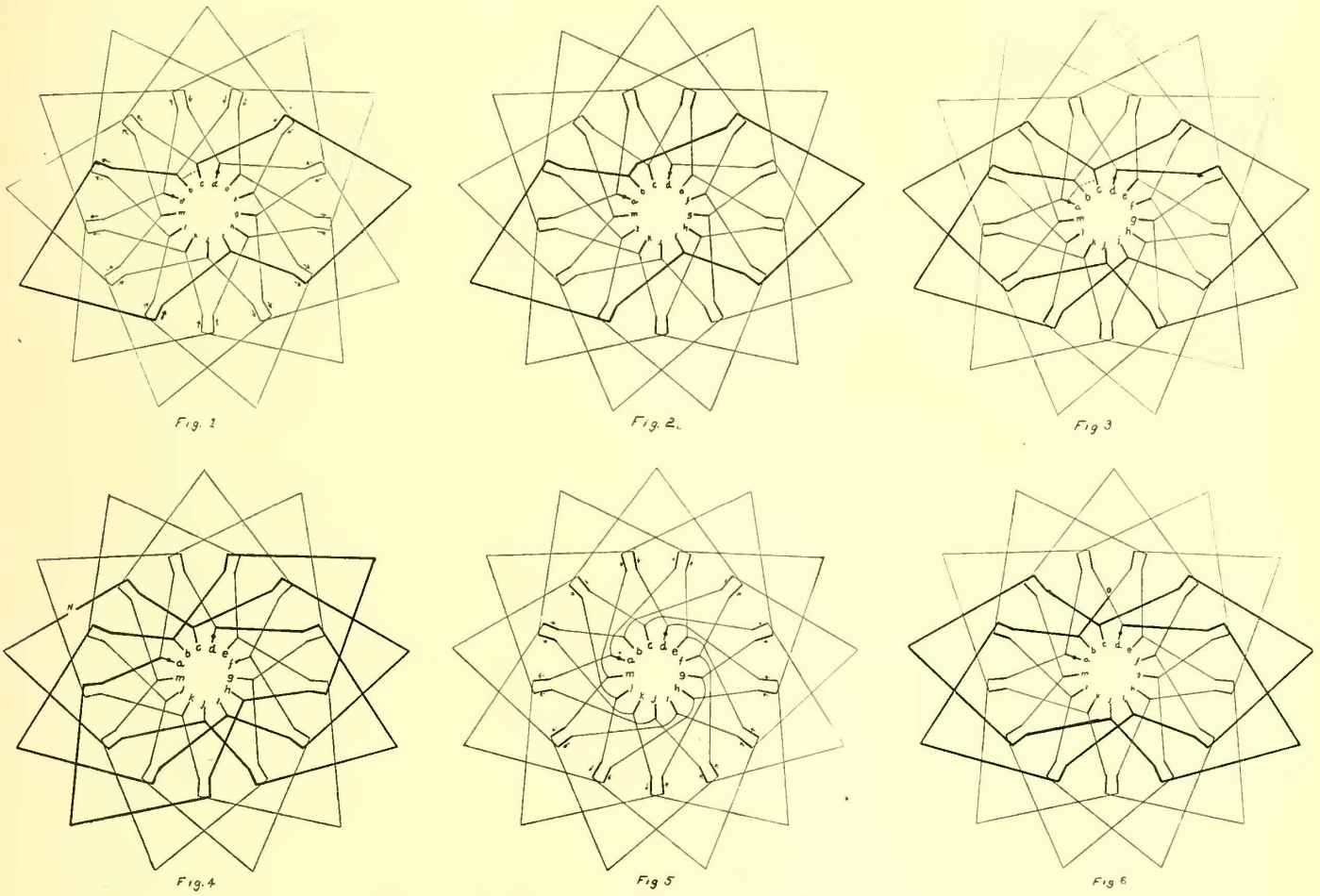
If the short between b and c is not a complete one, some of the current will travel through the heavily marked coils and the readings on the other side will be greater than half the proper amount. One short directly opposite can never cause readings to be less than half.

Two adjacent shorts on the opposite side of the commutator may cause such readings. Suppose, in Fig. 3, b to c and c to d be short circuited completely. The coils representing heavy lines will carry no current. The deflection between h and i will be half. None will be obtained between i and j, while j to k will also show half.

If no readings be obtained between several segments an open circuit may be the cause. Advancement should then be made very carefully, and the instrument leads simply tapped on the segments, for when the segments between which the open is located is reached, a deflection far beyond the scale of the instrument may be obtained and the needle seriously damaged. The reason for this may be seen by reference to Fig. 4. Assume an open circuit at n in the coil connecting j and c. The current in traveling from the lamp bank terminal on a to the one on d will take the path a to g, g to m, m to f, f to k, k to d. The other path, a to h, h to b, b to i, i to c, c to j, j to d, is broken by the open circuit at N. Since no current is flowing through this latter path, shown in heavy lines in Fig. 4, no deflection will be obtained between the connecting segments except between c and d. When the instrument terminals are placed on these segments the effect is the same as if they were placed on the segments a and d, on which the lamp bank terminals rest, for the dead winding simply acts as part of the instrument leads. The drop obtained between these segments is then the drop in the whole winding of the armature, and the deflection is, therefore, excessive. The drop between the segments a and m, m and l, etc., carrying current will be twice as large as normal, for these coils are carrying the total amperage of the lamp bank, whereas they ordinarily carry but half this amount.

It may sometimes happen that all of the top leads are connected in their regular order, but are placed one segment behind or one segment beyond their proper position.

Should the armature happen to be one of those as shown in Figs. 1, 2, 3 and 4, in which on each time passing round the armature one segment is lost, and the top leads be connected one segment beyond their proper position, the effect would not be noticeable in testing. To make one complete revolution around the armature two coils must be passed through. Since with the wrong connections assumed the terminals of each coil



ARMATURE WIRING TESTS WITH MILLI-VOLTMETER

span over one more segment than they should, in passing completely around the armature two segments will be gained. This will give a symmetrical winding, as shown in Fig. 5, but the direction of rotation with armature and field leads connected the same, will be reversed.

Why this occurs is made evident by a comparison of Figs. 1 and 5. It will be seen that the currents in two similar coils of the two diagrams referred to are flowing in opposite directions.

If the top leads of such an armature are connected one segment behind their proper position three segments will be lost in passing round the armature. The deflection between adjacent segments will be excessive, and successive readings will be very irregular in amount. This fault may easily be recognized by placing the milli-voltmeter leads together with the lamp bank terminals on segments between which two segments intervene. A reading so obtained will be the same in amount as in a correctly wound armature, with both instrument and lamp bank terminals on the same and adjacent segments.

If such a mistake as the foregoing be made on an armature having in its commutator a number of segments which is a multiple of three, three separate and distinct windings will result. The length of each winding will be one-third that in a rightly wound machine. If attempt be made to operate such an armature an excessive amount of current will be required; in fact, about nine times the normal amount. This results from the fact that the current has six paths from brush to brush instead of two, and that the e. m. f. generated in each path is one-third that in the rightly-wound machine, so that three times the normal current travels through each of three times the normal number of paths.

Sometimes it happens that through defective insulation the leads of one coil become short circuited across to those of another where they lay on each other. Such a defect will show itself in a decreased reading of the milli-voltmeter on all those segments between the two crossed leads. If the short is a complete one no reading at all will be obtained. Explanation of this feature is given in Fig. 6. With the lamp bank terminals on a and d the path of the current should be a to h, h to b, b to i, i to c, c to j, j to d. But if the leads are crossed on each other at o the current, after reaching b, instead of pursuing the long path to the brush d, will jump directly across to d. The remainder of the path, the coils shown in heavy lines, is idle or nearly idle, depending on the nature of the short. The deflection between b and c and c, d will, therefore, be small, or possibly zero. But local shorts in the commutator may give the same results. To distinguish between the two possible defects let the instrument leads, together with the lamp bank terminals, be placed on the segments b and c. The most direct path between these two segments is b to i, i to c. The short at o has a negligible effect on the current in this path. The milli-voltmeter will then indicate the drop in the path b to h and h to c. This may be compared with the drop similarly obtained between segments on some other part of the armature where no fault exists. If the trouble for which we are hunting is due to a cross, the two readings compared should be similar: if due to short circuited segments the reading between b and c will, of course, be smaller than normal.

Many of the other defects to which armatures are subject and which are often regarded as mysteries, may have their causes made clear by the intelligent use of the milli-voltmeter after the manner explained. No general code of procedure can be outlined for the work. It is only necessary that the investigator be throroughly familiar with the winding of the armature tested and apply reason to each individual irregularity of readings that may occur.

It must not, however, be assumed that an armature standing up under the milli-voltmeter test is a perfect one. Only about 1 amp. is used in testing. When the armature is subject to 100 or more amperes, in actual working, new defects, such as break-down of insulation, heating and consequent short circuiting upon each other of the coils, etc., may result.

The only certain test is to run the armature under load. The milli-voltmeter tests must not, therefore, be regarded as conclusive.

DISCIPLINE AND SAFETY ON INTERURBAN LINES

Accidents on interurban lines from head-on collisions make it daily more apparent that the weakest element in the operation of an interurban road to-day, and the one most detrimental to safety is the difficulty in securing careful employees, thoroughly trained to the essentials of safe operation of trains over a single-track railway. Despatchers on the larger interurban roads are usually men who have been trained in the despatchers' offices of steam roads, and are therefore well qualified, although the same cannot be said of the inexperienced clerks filling such positions on some of the smaller roads. Motormen and conductors, however, have usually had none of the years of training that are required on steam railroads before men are allowed to take charge of trains. It is useless to condemn broadly the practice of hiring for motormen and conductors on interurban lines men who have not had years of training, as is sometimes done, because trained men cannot always be found. To be sure, a few men can be taken from the ranks of steam railroad brakemen who do not care to wait their turn for promotion to conductors' positions on the steam roads. Aside from this, men must be drawn largely from the ranks of city street railway conductors and motormen, or else taken raw and trained to the service. These are the conditions as they exist, and it is useless to rail against them. The problem before the interurban superintendent is to make the best of the situation. Nevertheless, the management of an interurban road is open to criticism when it is not doing everything in its power, both by precept, example and the enforcement of discipline, to impress upon all employees the necessity for eternal vigilance, care and observance of rules in the operation of cars. Laxity in this direction shows itself all the way down through the operating force. There is altogether too much of a tendency to take chances and operate on the old horse-car principle among the small interurban lines, and, unfortunately, when this is the case, there are usually enough careless employees on larger lines to spoil the perfection of the organization.

"Horrible examples" of interurban train despatching methods, as they exist on some roads, have already been cited in these columns, but it will do no harm and may do some good to mention another example which came under the writer's notice recently during an extended interurban journey. The car on which the incident occurred left its terminal point about 30 minutes late. Being of an inquiring turn of mind the writer took a seat in the smoking compartment just behind the motorman's platform, where he could see the line ahead and note the methods of train operation. It would have been better for his peace of mind later on if he had been seated in the rear end of the car. After proceeding several miles the car came to a halt at a telephone connection box, which was not located at a turn-out but at the bottom of a long grade, presumably so that if the car should stop at night to use this connection there would be an excellent chance for another car coming down the grade to crash into it. The car was equipped with a portable telephone, and after making connection the motorman tried to ring up the despatcher by a few vigorous turns of the crank. After waiting for some time the attempt was repeated, without results. The telephone was then disconnected, and the car again started ahead.

The road was one over which high speed could be made, although it was not by any means straight, and as it offered

a number of excellent chances for head-on collisions, the writer naturally became a little interested in learning the location of the other car on the line. That there must be another car was certain, from the length of the line and the schedule maintained, and where there are two cars there is always a chance for a collision. After proceeding several miles more the crew stopped the car and attempted to call the despatcher from another connection box, located at a turn-out. The results in this case were as fruitless as before. The car again proceeded without any orders. Matters were becoming interesting from a railway man's standpoint. After running several miles another car was sighted in the distance, and before long it became apparent that this other car had been running towards the first car, but after the latter was observed was run on to the nearest siding. Upon arriving at that point the cars pulled up opposite each other, and the following highly entertaining and reassuring conversation took place between the motormen:

Motorman A (of the other car): "We waited here a half-hour to meet you, and then thought we'd go ahead. There ain't no box (telephone) on this car, so we couldn't find out what the matter was."

Motorman B: "Why, the power was off half an hour; that's what was the matter. We have a box on this car all right, and we tried to call up, but couldn't get no answer."

Motorman A: "What are you going to do now?"

Motorman B: "I dunno know. What are you going to do?"

Motorman A: "Go ahead, I suppose."

After which both cars pulled out, and the writer was duly thankful that there were probably not more than those two cars on the line, unless there should happen to be a special or work train. The cars on the road were capable of about 40 miles on the level.

It is this kind of general laxity that causes head-on collisions. One car with no telephone and another car with one, but for some reason unable to use it; car crews going ahead when off schedule without knowing the location of opposing cars; these are all conditions pointing to the need of a general overhauling of operating conditions.

It is not a very good recommendation for interurban operating discipline in general that an interurban manager once remarked that he thought it a good plan to have telephones in sound-proof booths and require the motorman to go inside and close the door when taking messages from the despatcher, because, as he said, "the conversation between motorman and despatcher was not always reassuring to passengers." It would seem that this statement in itself would offer the strongest possible argument in favor of having the telephone instrument in a place where every passenger could hear the motorman's conversation with the despatcher, as it might have a good influence on the discipline of the road. A conversation between motorman and despatcher which has to be carried on in a sound-proof booth is not the kind that is conducive to strict discipline. A little publicity is a good thing sometimes.

Another point where there is room for improvement is in the maintenance of telephone apparatus. While the management may not be able to make all of its conductors and motormen as careful as might be desired, it certainly is within its power to see that the means of communication between crews and despatcher is kept in first-class condition. Nothing demoralizes discipline among men as to car operation more than having telephone instruments out of order and telephone lines in such condition as to make conversation difficult. That telephone instruments will get out of order is inevitable, but nothing but the grossest carelessness in management will permit the road to be operated without plenty of reserve instruments, so located that they can be quickly substituted for defective ones. Where telephone instruments are carried on each car for the purpose of communication with the despatcher, there will be more trouble from the packing of transmitters and consequent derangement of the telephone instruments than when the instruments are located in booths along the lines. Nevertheless, the greater liability of trouble in the car telephones is practically compensated for by the ease with which defective car instruments can be exchanged for good ones. Trouble with car telephones usually makes itself known a little time in advance, and there is no great difficulty in carrying on an efficient despatching service by means of car telephones, provided the equipment is looked after carefully and inspected regularly, and no instruments which are even beginning to give unsatisfactory service are allowed on the cars. Telephone instruments are not so expensive that there is the slightest excuse in being niggardly as to quality and quantity of telephone equipment, especially since it is so important in the operation of the road.

A PUSH LINE CAR FOR SECTION WORK

The practice of interurban railway companies differs somewhat as to the method of caring for the overhead lines. On some roads overhead line work is done only by special line crews, who have line cars equipped with motors and with all the necessary tools and appliances for doing line work. The Indianapolis & Eastern Railway has part of its ordinary line maintenance done by section crews, who have a light push car with a tower for doing overhead line work. This push car can be lifted off the track for the passage of regular cars, just as any hand car, and so interferes less with the operation of the road than a fully-equipped overhead line motor car.

FAR OR NEAR SIDE

Chicago, Sept. 24, 1903.

Editors Street Railway Journal:

The street railway managers who are discussing the practicability of stopping their cars at the near crossing to take on and discharge passengers should learn a lesson from the experience of Chicago. There was a popular demand here several years ago for a rule of this kind, on the ground that accidents would be averted, and the City Council enacted an ordinance which was signed by the Mayor, directing the several railway companies to make this change. The order was put into effect immediately by the companies, and it was given a fair trial. Notices were posted in all the barns and the men received special instructions on the subject. The company had red signs made which were fastened to iron rods stuck in the curb line, reminding patrons that cars bound in certain directions stopped at the point where these signs were displayed, but the plan was not acceptable to the people, in spite of the demand that had been made for it originally, and it had to be abandoned.

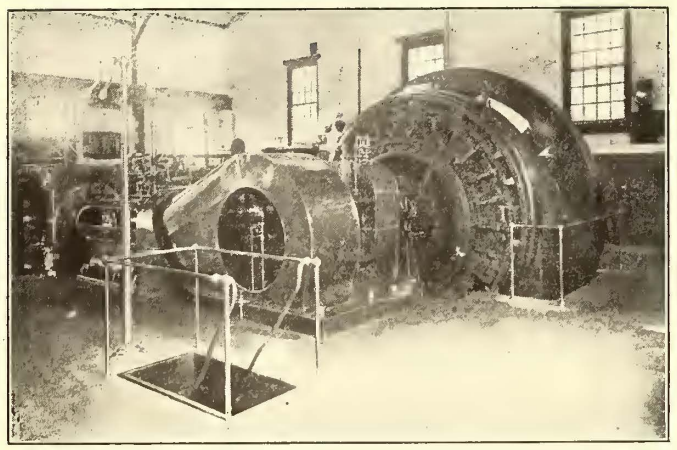
There were several reasons for this dissatisfaction. In the first place it is the general custom for passengers to leave the car from the rear platform, and in bad weather this necessitated walking the length of the car or to the sidewalk through the mud, or slush or snow. Again, the people boarding the car would invariably wait on the cross-walk for it, and then enter by the front door. At the same time it was quite likely that passengers would be leaving by the rear platform, and on cold days the opening of both doors caused much annoyance and discomfort resulting in numerous complaints.

Chicago weather is proverbially bad, and Chicago city officials for the last fifteen years have devoted so much attention to harassing the street railway companies that they have had little time to devote to street cleaning and paving, so that the conditions may be said to have been unusually severe. But in any city where there is considerable rain and snow the mud and slush are bound to make the people object to this plan. And then, too, it is very difficult to overcome the deep-seated prejudice of the public generally against innovations of this kind.

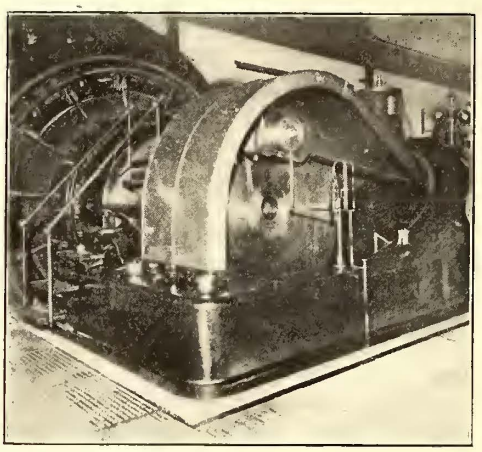
Operating Manager.

THE OIL PROBLEM IN POWER STATIONS

Most power users now realize that the success of a power station, whether it is large or small, depends almost, if not quite, as much on the proper construction and design of the system for handling the oil as for the equipment of any other part of the station, the handling of the fuel not excluded. This fact may, perhaps, be said to have received general assent only recently. At one time, while great care was taken in the design of the station in other particulars, hand lubrication was the general rule, and even now in some stations where other economies are carefully considered, antiquated methods are used in lubricating the engines. Even if an automatic system is employed the construction of the crank housings, drip pans and splashers is left to local tinsmiths.

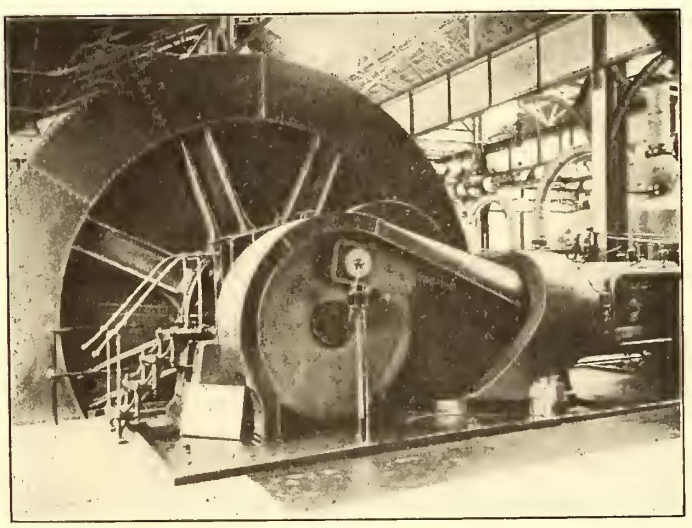


CRANK HOUSING AT LLANERCH STATION OF PHILADELPHIA & WEST CHESTER TRACTION COMPANY



CRANK HOUSING AT THIRTY-THIRD AND MARKET STREET STATION, PHILADELPHIA

The importance of automatic lubricating systems is now more generally recognized than ever before, but the advantages of treating the entire lubricating system as a unit has not received the appreciation which its importance deserves. The foundation for these systems is undoubtedly in the oil collecting devices, and it is this fact which originally induced one of the largest builders in sheet metal specialties to undertake the equipment of stations with complete lubricating systems. As comparatively little has been published in these columns as to sheet metal housings in power stations, some particulars of station practice in this direction will be of interest, whether these housings are used in connection with a complete lubricating system or not.



SPECIAL COVERING SURROUNDING WHEEL AT MT. VERNON STATION OF PHILADELPHIA RAPID TRANSIT COMPANY

An examination of the sheet steel housings in a power station will show at a glance whether they have been built by a local metal worker or by a company which makes a specialty of this class of work. Examples of the latter are given in the illustrations herewith, which show a few of the steel housings supplied in three stations near Philadelphia by Bingham & Company, of Camden, N. J., who have done a great deal of this work in all parts of the country. One of these was selected because it illustrates quite a novel construction demanded by local conditions, and which would probably not be duplicated elsewhere except under exceptional circumstances. This is the wheel housing placed around a 20-ft. fly-wheel on a Wetherill engine in the Mt. Vernon station of the Philadelphia Rapid Transit Company. This particular construction was adopted by the engineers of that company, because, owing to changes in the engines and generators at that station, it became necessary to mount the armature so that the commutator was next the fly-wheel. The housing was ordered to protect the dynamo tender when adjusting the brushes from accidentally coming in contact with the moving machinery. The other two views illustrate standard crank housings, as installed by Bingham & Company in the Thirty-Third Street and Market Street station of the Philadelphia Rapid Transit Company and the Llanerch station of the West Chester Traction Company. In the former case the engines are of the Wetherill make, and in the latter case of Hamilton-Corliss make.

In these three cases the housings are part of a complete lubricating system, also installed by Bingham & Company, who have equipped all of the plants of the Philadelphia Rapid Transit Company. Other stations equipped by them include the Edgewater plant of the New Jersey & Hudson River Railway & Ferry Company, the Warren (R. I.) plant of the New York, New Haven & Hartford Railroad, the station of the Midland Railroad, of Staten Island, and many others. A good idea of the extent of the company's business is also shown by the fact that the Cambria Steel Company has recently given the company an order to equip its entire works at Johnstown, Pa. This order covers the complete lubricator systems and oil collecting devices for its seven large plants. In this, as in many other of its installations, Lunkenheimer pressure oil cups will be used throughout, and it might be said in this connection that Bingham & Company do not confine themselves to any one system, but are prepared to install lubricating systems operated by gravity, compressed air, water pressure or steam, according to the preferences of the user, based upon local conditions. In addition to the continuous oiling equipment they also manufacture a variety of designs of oil-stand cabinets, tool closets and oil filters.

Officials of the Cleveland Electric Railway claim that since the universal transfer system was inaugurated the number of transfers has increased from 28 per cent to 44 per cent of the total fares collected. It is evident that a large proportion of the passengers are taking advantage of the company's liberality, and are making round trips on single fares. Owing to the arrangement of the lines in that city it is no easy matter for the officials of the company to evolve a plan of protection against this style of pillage, but they are working on the problem and expect to meet it satisfactorily.

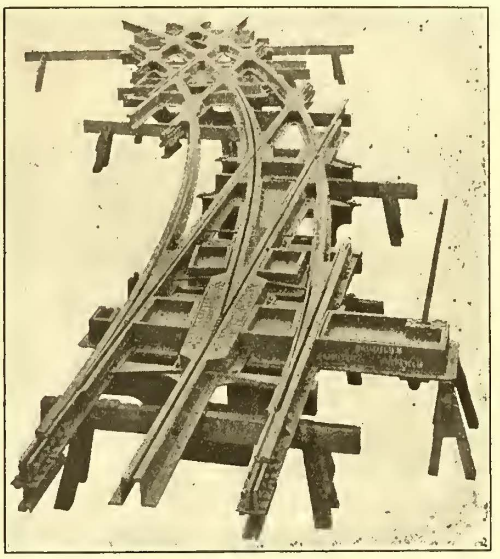
SPECIAL WORK FOR LONDON COUNTY COUNCIL

On the occasion of the visit of the Junior Institution of Engineers to Sheffield recently, the most interesting visit from a tramway point of view was the one which they paid to the enormous establishment of Hadfield's Steel Foundry Company, Ltd., where a whole afternoon was spent. The Hadfield foundry is one of the largest in the world, and has been specially erected for the most economical manufacture of tramway material. It is equipped with overhead traveling and jib cranes, all electrically driven. Among the work observed were numerous points, 7 ft. 6 ins., 13 ft. and 14 ft. long, and many special castings for the London County Council Tramways, some of these being very intricate, and from 24 ft. to 25 ft. in length. The tramway construction department was also most interesting, the setting-out, building and lay-out floors covering about 6 acres in extent. It is supplied with all the latest plant requisite for the bending, cutting, punching and drilling of the rails for their proper position in the lay-out. The bending is done by special power presses, and all the tools are electrically driven. The lay-out floor was well covered with work in various stages of construction, including double junctions with iron-bound crossings for Manchester, double junctions for Chatham, two very large junctions for Leicester, car house work for Burnley, and special junction for Stalybridge.

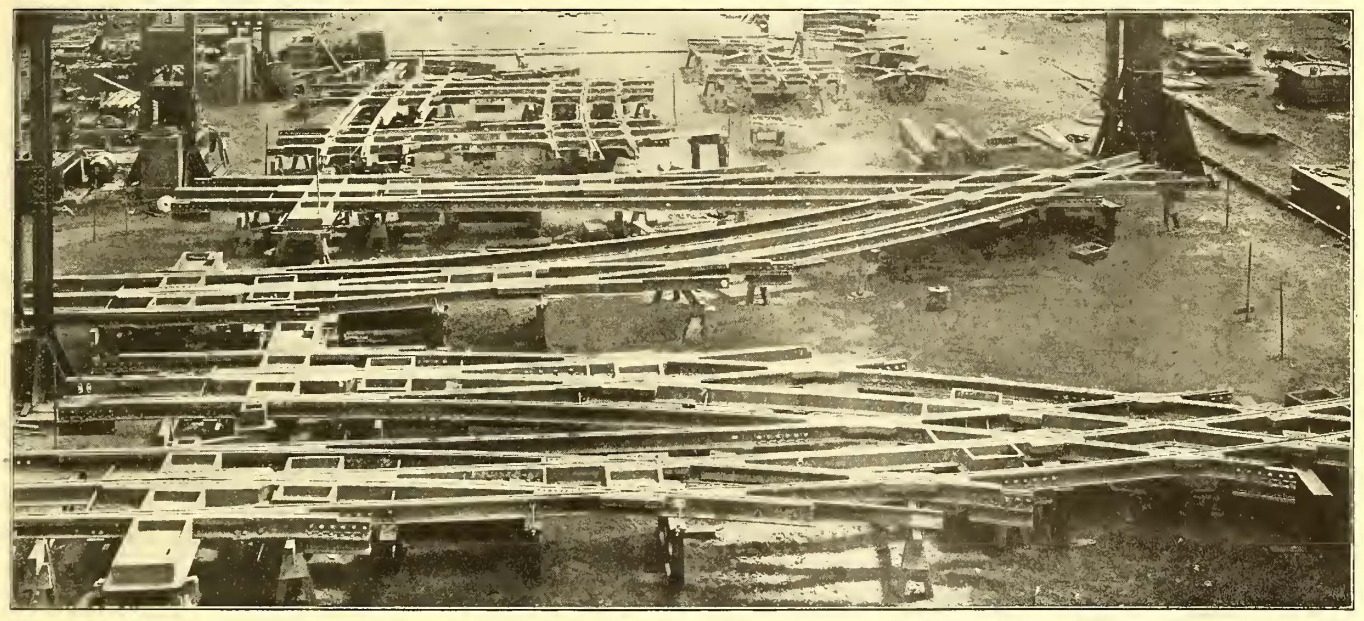
In the junctions for Bradford and Stalybridge the points, crossings and curved rails are all made of Hadfield's "Era" manganese steel.

The special work for the London County Council, however, perhaps, elicited the most attention. One of the accompanying cuts shows a general view of the work in hand, and the other one of the sections more in detail.

The points are 12 ft. long, 100-ft. radius, and are made of a special grade of Hadfield's toughened cast-steel—all the running surfaces being planed as well as the bed of the tongue. The tongues are made of Hadfield's "Era" manganese steel, and are all ground true to radius and gage. All crossings, that is, the track over track and track over slot crossings, are made of toughened cast-steel, but at the points of intersection have insert pieces of Hadfield's "Era" manganese steel. All the work has been so designed that the number of joints is reduced to a minimum; for instance, the diamond crossings are formed of four castings, and the wing and main crossing castings, which in some cases are 23 ft. to 24 ft. in length, extend from the heel of the point to the diamond crossing. All running surfaces and grooves for the wheel flanges and plow are accurately planed to their respective curves to insure smooth running and accurate gaging. The yokes are made of the best cast-iron, with the exception of some used at the diamond crossings, which, for special reasons, are built up out of angles and steel plates. The slot points are of Hadfield's patent design, which insures that no matter in what position the tongue lies the width of the slot is always the same. It also has the advantage of keeping the slot free from stones, dirt, etc., so that there is no danger of the slot tongue sticking when the track tongues are operated.



SPECIAL TRACK WORK FOR LONDON TRAMWAYS



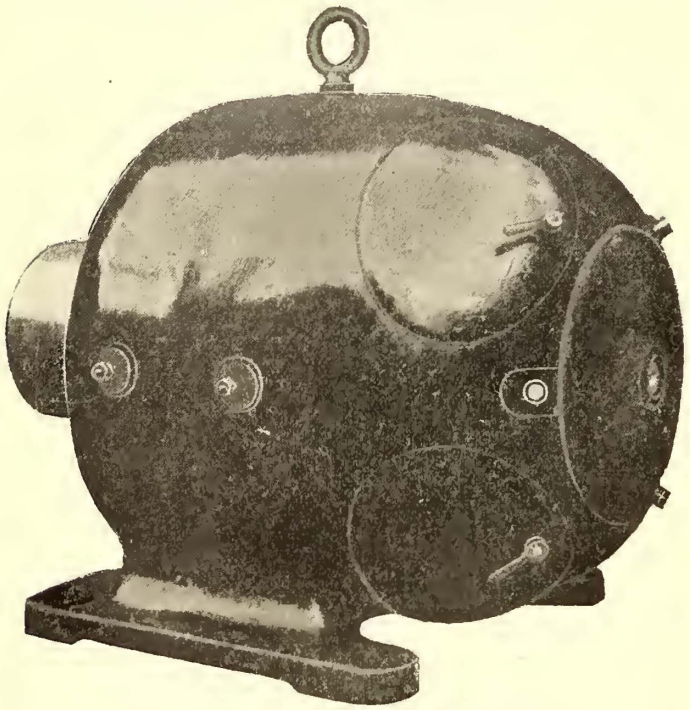
SPECIAL TRACK WORK FOR LONDON TRAMWAYS

Another very important feature of the slot points is the provision of an arrangement whereby the wheels of bicycles and other narrow-wheeled vehicles are prevented from getting into the slots. The risk of serious accidents is, therefore, considerably reduced. They are also constructed in such a way that they can be taken to pieces in a few minutes for inspection or adjustment.

Visits were afterwards made to the machine shop, smith's shop, annealing and grinding shops, where tramway work was seen in all stages, and thus a most interesting and enjoyable afternoon terminated.

RECENT TYPES OF SIEMENS' DYNAMOS AND MOTORS

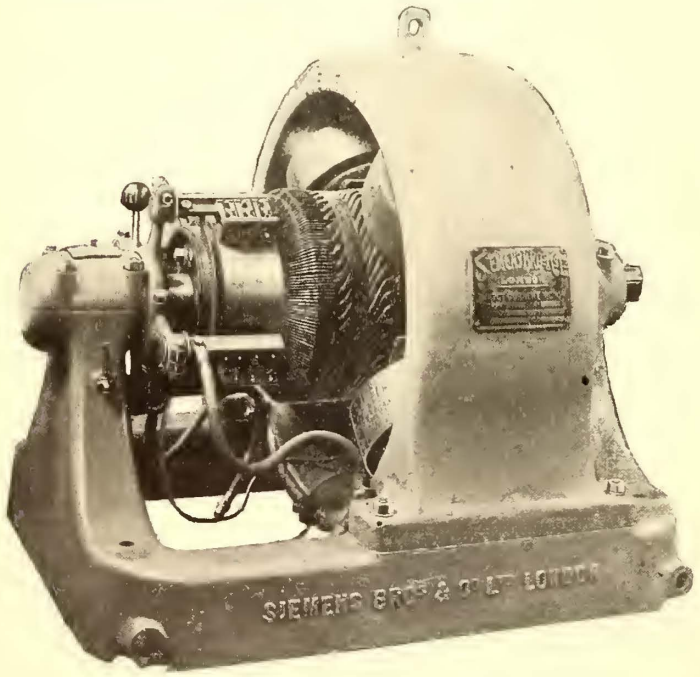
Siemens Brothers & Company, Ltd., of London and Woolwich, England, have recently designed some standard types of direct-current generators and motors. These are to be manufactured at their new Sheffield works, which, when completed, will be one of the best equipped in Great Britain. The new



FULLY ENCLOSED TYPE MACHINE

designs embody the best features of direct-current machines and are of the highest class both electrically and mechanically. The work has been carried on under the able supervision of A. S. Clift, who was for a long time chief draughtsman of the Crocker-Wheeler Company, of New York.

The machines have been divided into four classes, according

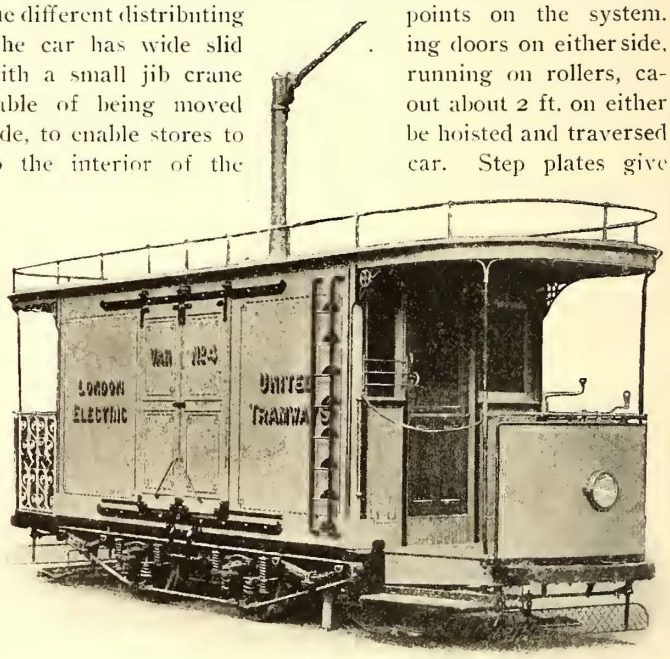


"G" TYPE MACHINE, COMMUTATOR END

to size, as follows: Type "B," from ½ B. H. P. to 2 B. H. P.; type "F," from 2 B. H. P. to 50 B. H. P.; type "G," from 50 B. H. P. to 125 B. H. P.; type "H," from 75 kw to 3000 kw. Of these, types "G" and "H" are especially suitable for tramway work. In all of these types the armatures are of the slotted drum-type form-wound, and with field coils form-wound. The type including machines from 2 hp to 50 hp is made in two forms, open and inclosed. The magnet frames of all machines are of cast-iron with wrought-iron poles cast-welded into the frame and fitted with laminated pole-shoes screwed to the pole-face.

SPECIAL CAR FOR LONDON UNITED TRAMWAYS

The British Electric Car Company, Ltd., of London and Manchester, has completed a contract from the London United Tramways for a special ticket car which is giving great satisfaction. It is used to carry large boxes of conductors' tickets and other tramway supplies from the main depot to the different distributing points on the system. The car has wide sliding doors on either side, with a small jib crane running on rollers, capable of being moved out about 2 ft. on either side, to enable stores to be hoisted and traversed to the interior of the car. Step plates give



SUPPLY CAR FOR LONDON

easy access to the roof, which is surrounded by a hand-rail, and is especially strengthened to carry heavy supplies, etc. The car is painted royal blue outside, to harmonize with part of the London United Company's rolling stock. The truck is of the "B. E." 56-type.

TWO IMPORTANT CHANGES

Two appointments of well-known street railway officials were announced last week. One was the acceptance by Richard T. Laffin, general manager of the Worcester Consolidated Street Railway Company, of the office of general manager of the Manila Electric Railway, Light & Power Company. Mr. Laffin will leave Worcester about Jan. 1, 1904, for the Philippines. The company at Manila has recently been organized by New York, Philadelphia and Detroit capitalists to operate all the lines in Manila, as described in recent issues of this paper.

The other appointment is that of Albert H. Stanley, general superintendent of the Detroit United Railway Company, as assistant general manager of the Public Service Corporation of Newark, N. J. This office has been created for Mr. Stanley, whose duties will consist largely of handling the movement of cars, while the other work in connection with the management of the company will be handled by General Manager Wheatly.

BLOCK SIGNAL SYSTEM

The American Automatic Switch & Signal Company, of Chicago, is a new corporation which has purchased all the block signal patents originally issued to Robert Skeen. Signals were made under Mr. Skeen's patents for several years by a company at St. Louis. The new company has purchased all the patent rights under which the St. Louis company was manufacturing block signals for electric roads, and engaged the services of Mr. Skeen, the patentee, who was formerly connected with the East St. Louis road, where his signals were originally installed and are still in operation. These patents date back as far as 1896, and cover broadly some very important features in automatic block signals for electric roads.

The form of signal employed in this system is shown in the accompanying cuts, Figs. 1, 2 and 3. All the mechanism of the signal is inclosed. In each signal box are two diamond-shaped targets. When the signals are employed on a single-track road between turn-outs, as is generally done, the top target shows red, as in Fig. 1, when a car is approaching in the block ahead, and the bottom target is not displayed. If there is a car in the block ahead traveling away from the signal, the top target is not displayed and the bottom target shows white, as in Fig. 2. Opposite each of these targets in the signal box are lamps showing colors similar to those displayed by the targets. The targets are not dependent for their movement upon the lamp circuits, and will operate whether the lamps light or not. When no car is in the block, as in Fig. 3, both targets are in a horizontal position, and the lamps are all out. The same signal can, of course, be employed for blocking on double-track roads.

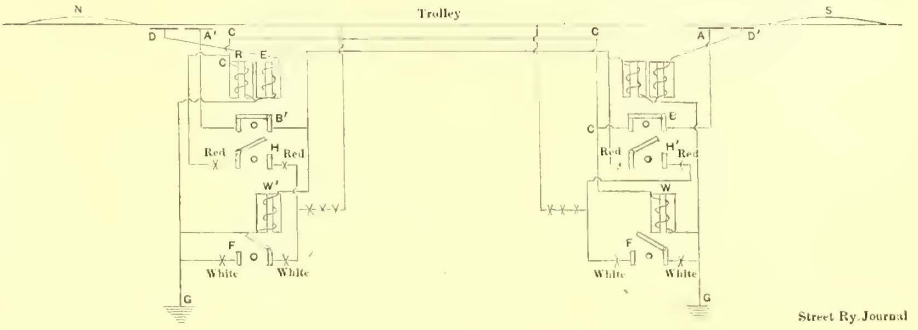
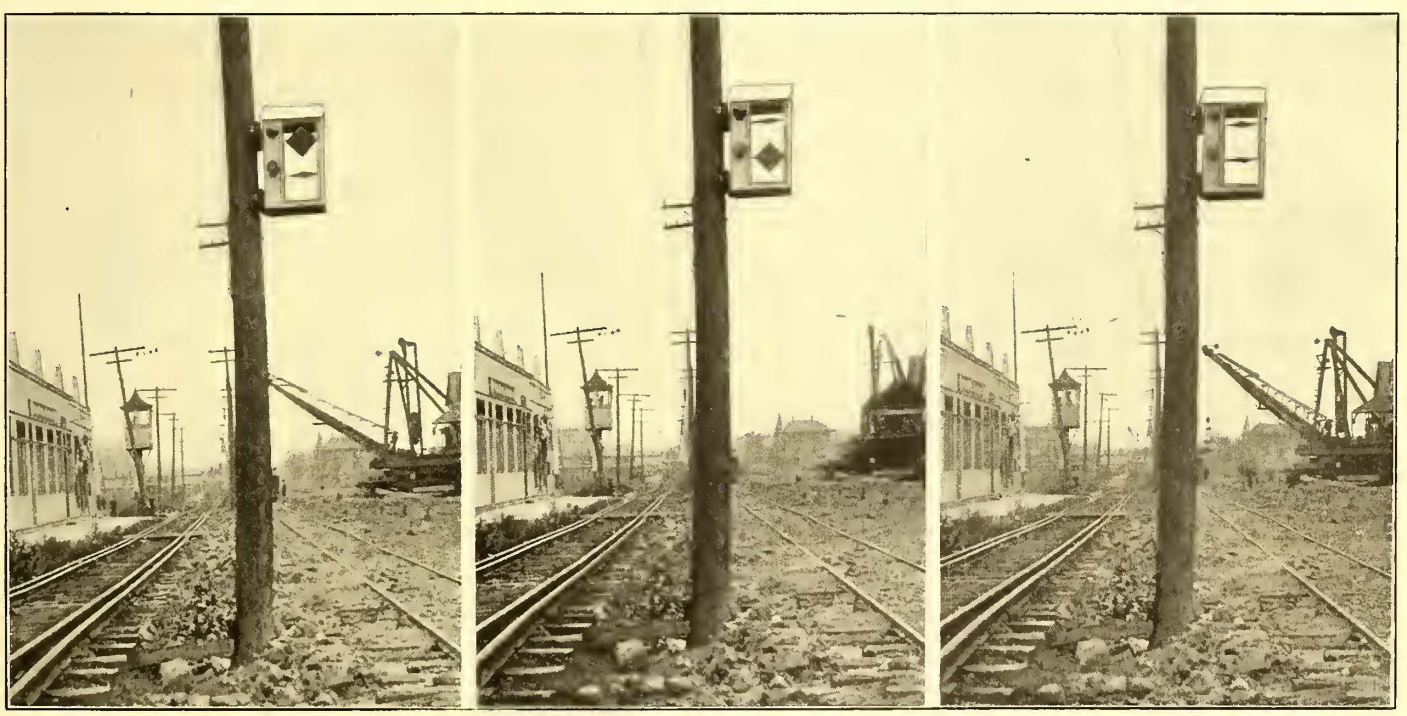


FIG. 4.—WIRING DIAGRAM

The targets are 9 ins. x 9 ins., and the bull's-eyes 4 ins. in diameter.

The operation of the signal can best be understood from the accompanying wiring diagram, Fig. 4. In the diagram, as it stands, both signals are at what is called normal, or "no signal" position. This is as they would stand with no car in the block. This normal position, however, is not a safety position, as by the rules under which this system must be operated no motorman is allowed to proceed into a block until he sees his signal change from normal to safety, which it should do when his trolley wheel passes the contact strip which actuates the signals. In the wiring diagram, suppose a car to be leaving the siding, S, at the right, and going to N at the left. Before proceeding past the contact strip at A, the motorman would, of course, see that the signal did not show danger. When the trolley wheel touches the contact at A it sends a momentary trolley current through the switch, B, inside the signal, and into the line wire, C, where it divides, part going into the coil, W, which is a solenoid operating the white target, and then passing to ground. The operation of this white target solenoid also closes a switch in the white-lamp circuit. The other part of the current flows from the line wire, C, to the signal at the other end of the block, where it enters the solenoid, R, which throws to "danger" the red target. This current from there flows to ground. After the red signal is thrown to "danger" the red lamps are lighted by the closing of the switch, H, which is operated by the solenoid. One end of this switch is connected to the line wire, C, which connects to the coil, R. The current will then flow from the trolley or feed wire through the red lamps and the switch, and thence through the coil, R, to the ground. Part of the current, after it leaves the red lamps, instead of passing through the coil, R, will flow from line wire, C, to the signal at the right-hand end of the block, there flowing through the coil, W, to ground, thus keeping the white target displayed. This white target, it will be remembered, was already put in a



FIGS. 1, 2 AND 3.—SHOWING THREE DISTINCT SIGNALS

vertical position by the trolley wheel when it made contact at A. The white signal at the entrance to the block cannot, therefore, be displayed unless the red signal at the far end of the block is set, because if the red signal solenoid fails to act or falls back to normal position, it opens the circuit holding the white signal at the entrance to the block. The white signal cannot stay up after the trolley wheel leaves the contact at A, unless the red signal at the siding ahead has been set and the switch connected with it closed. The car, on reaching the siding at the end of the block, makes contact at D, which sends current into coil E, causing the red target to disappear and opening the red lamp circuit, as well as allowing the white target at the entrance to the block at the other end to disappear, and opening its white lamp circuit. Signals are then at normal position again. The object of switch B is to prevent both signals being thrown at once by different cars. The lamp circuits at both signal boxes are fed by three lamps in series, independent of the signal lamps. In case any of the line wires are open the signals remain locked in whatever position they were at the time of the break. At first thought this might seem to be a dangerous condition, and it would be if these signals were to be operated under the same rules that steam road signals are operated. Since, however, the signals must operate from normal to safety position in sight of the motorman as he approaches a signal, there is no reason why a signal stuck at safety position should create a dangerous condition, because a signal so stuck does not indicate safety.

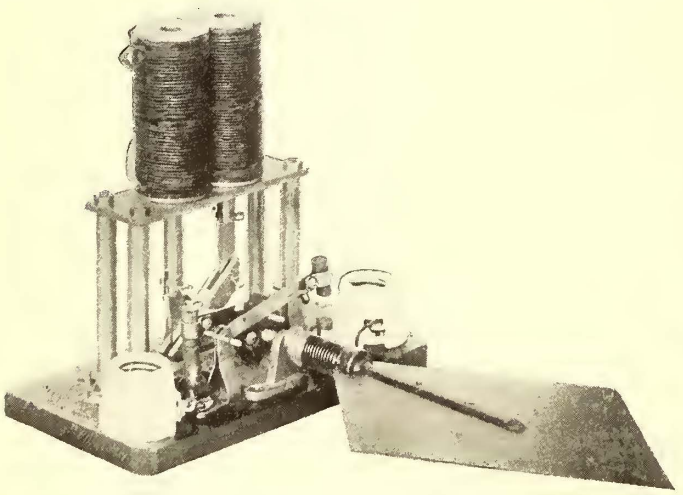


FIG. 5.—SOLENOIDS FOR RED SIGNAL

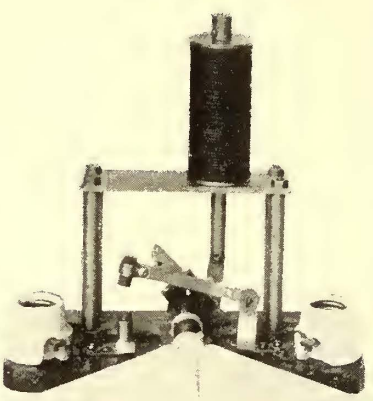


FIG. 6.—SOLENOID FOR WHITE SIGNAL

As the mechanical arrangement of the switches is not altogether plain from the wiring diagram the working parts of the red signal solenoids and of the white signal solenoid are illustrated here in perspective. The two solenoids for the red signal, Fig. 5, which work on opposite ends of the same rocker arm and actuate the target, also operate the switches B and H, shown in the wiring diagram. These switches are provided with contacts of carbon, as shown. In whichever position the red target is left it is locked in that position by a peculiar arrangement of the rocker arm and solenoid plungers until it is actuated by the current. The white signal, Fig. 6, on the other hand, returns to normal position by gravity when the current is interrupted in its solenoid. The targets are not rigidly connected to the shaft which the solenoid operates, but, as seen, are connected through the medium of a coil spring. This is to permit the plungers to work instantaneously under a brief contact, without having to overcome at once all the inertia of the target. The spring will cause the target to follow the movement of the shaft in a somewhat longer space of time than it takes the shaft to make the movement.

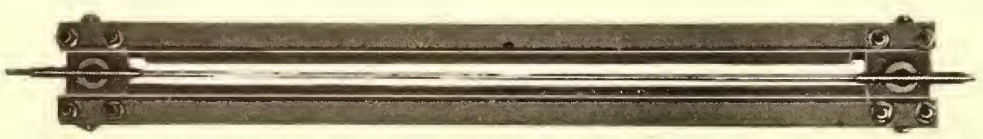


FIG. 7.—TROLLEY CONTACT

The trolley contacts, which are placed in the overhead line, and under which the trolley runs to actuate the signals, are two strips of hickory, 1¼ ins. x 2 ins., in cross-section, and 4 ft. long, with plates at each end to bolt them together, and two strips of angle-iron screwed to the inside of the 1-in. space between them, so that the trolley wheel, in passing, touches both angle-irons. The end plates have holes in their centers corresponding to the size of the stud in the trolley wire hanger, which screws into them, thereby holding the contacts on the trolley wire.

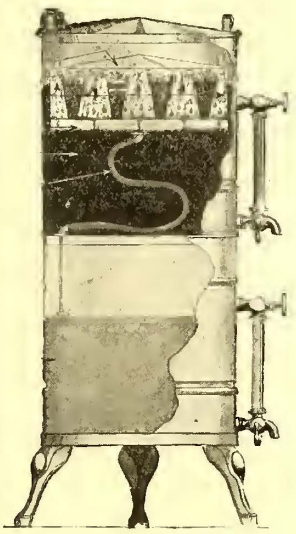
In the wiring diagram, Fig. 4, both the setting and release contacts, A and D, are shown in the main line, so that a car would reach them after passing off the siding. This is the arrangement that should be employed where the siding is not always taken by the car going in any one direction. If the sidings have spring point switches, so that all cars pass to the right at the siding, the signal releasing contacts should be placed just inside the entrance to a turn-out, and the signal-setting contacts a short distance before the exit of the turn-out. The signals should be so located that the motorman can see them operate both upon entering and leaving the block.

A rather novel application of these signals has been made on Stoney Island Avenue, in Chicago, where, owing to the construction of an intercepting sewer, a number of different lines converge and operate over a single track for a distance of about a block. In this case the signal circuits are controlled by a man stationed in a tower within sight of both approaches. Signals are operated manually instead of automatically in this case, because there are two companies using the single track, and each company has its own trolley wires. In fact, the single track is simply an overlapping piece of double track, and there are in all four trolley wires over it. As the arrangement is only temporary manual control is adopted, to avoid all confusion and complication which might arise with so many converging routes using the one strip of track. The accompanying views of the signal installed and in operation are of this particular installation. When the signals are used on third-rail roads the only modification in the apparatus needed is to use a short section of third rail opposite the regular third rail in place of a trolley contact.

A prominent railroad engineer volunteers the following opinion: When the headway between trains is 30 minutes to 60 minutes there is a good opportunity for sandwiching a "limited" car between the locals. To do this, however, it is necessary to employ the methods which have enabled steam railroads to accomplish the same thing. Their system is the outcome of years of experience and has cost them millions of dollars. It is free to be adopted by any electric road. Some of them have adopted it; others are paying for not having adopted it.

THE CAPILAR OIL FILTER

The accompanying illustration shows a new oil filter made by the Capilar Company, of Philadelphia, and which depends on a very old principle, but one which has only recently been applied to oil filters. In fact, it is somewhat strange, that although the phenomenon of capillary action has been known for so long, oil filters up to this time have been constructed entirely on the gravity principle. The name of the Capilar filter practically describes its construction, together with the fact that dirt does not climb, although oil does. All water brought over by the oil from the steam cylinder or from any of the bearings is separated from the oil during the filtering process. In this way the oil in the storage tank is perfectly clean. The wicking in the Capilar filter being saturated with oil when the filter is put in service has no affinity for water, and the separation is absolute. The manufacturers claim that this can easily be proved by the simple experiment of filling a glass with some water and polluted oil and then filtering it through an oil-saturated lamp wick on the capillary principle, as shown in the small cut herewith.



CAPILAR OIL FILTER

The construction of the filter is shown in the sectional engraving. The oil is poured into the upper chamber of the filter. On the surface of this oil is the filtering chamber or float, which consists of the filtering wicks, collecting chamber and conducting hose, by which the clear oil after passing through the wicks is led to the lower or pure oil chamber. In the larger sizes of filters provision is made so that the upper chamber can be connected to a continuous lubricating system if one is used in the station, while the lower chamber is connected to the suction of the pipe pump and delivered to the storage tank.

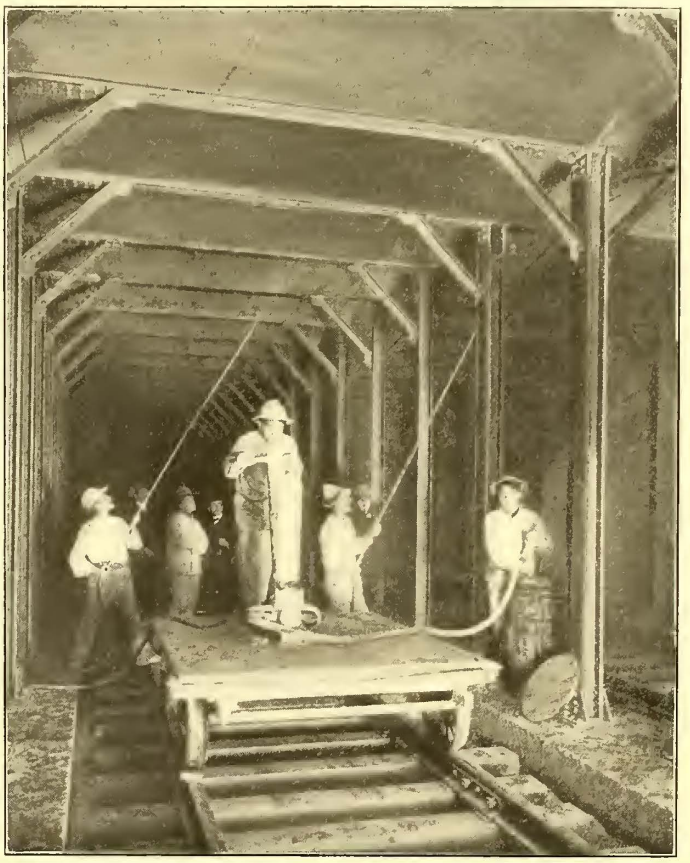
The filtering wicks may, when required, be quickly removed and replaced after cleaning out the collected impurities.

PRINCIPLE OF OPERATION OF THE CAPILAR OIL FILTER

Another advantage of the filter is that it maintains an absolutely constant flow of filtered oil. If circumstances should demand a filter 10 ft. high the flow of clean oil would be the same in the Capilar, whether 10 ft. or 10 ins. of oil for filtration were contained in it. A filter having a capacity of 1 gal. an hour at a temperature of 100 degs. F., gives a continuous flow of oil at that rate all day and every day as long as the oil supply continues, irrespective of the quantity of dirty or clean oil in its tanks. In this respect the manufacturers claim that the Capilar filter is superior to one depending entirely on gravity, as the filtration in a gravity filter varies according to the cleanness or dirtiness of the filtering medium, and the pressure or weight of oil acting upon it.

PAINTING THE INTERIOR OF THE NEW YORK SUBWAY

The accompanying cut exhibits a portion of one crew painting the section of the New York subway between Sixtieth Street and Forty-Seventh Street. The material, known as Asbestine fireproof paint, controlled by the Alden Spear's Sons Company, of Boston, Mass., and especially prepared for underground work, is applied by the employment of a small, clever device, technically termed "spraying machine." For convenience in changing the location of the machine as the work progresses, it is stationed upon a set of platform trucks particularly designed to run on the subway track. The machine is simple in construction. It consists of a 6-in. x 30-in. air chamber, which stands perpendicularly over a double-acting pump. A long



PAINTING THE INTERIOR OF THE NEW YORK SUBWAY

handle gives a powerful leverage and by gradual strokes a pressure of 100 lbs. to 120 lbs. is easily maintained. The paint is drawn to the pump through a 1-in. suction hose and distributed through two or more ½-in. discharge hose. One man at the handle can furnish sufficient pressure to supply ten or a dozen discharge hose. At the end of each distributing hose is a long spraying rod supplied with a nozzle with a minute aperture, through which the paint is forced in the form of a spray. Various descriptions of nozzles are manufactured, which change the nature of the spray. Each spraying rod is guided from right to left by an expert operator or sprayer, the stream being controlled by the sprayer by means of a stopcock. The long rod renders scaffolding entirely unnecessary, which would materially impede the progress as well as increase the expense.

It is conservatively estimated that ten men with the assistance of this apparatus can perform the same amount of work in the same length of time as 100 men using the old-style brush method of application.

The quantity of paint which will be consumed on this single contract can only be approximated. The figure is set at 250,000 gals., or about 100 carloads.

Reports of the tests now being made on the Berlin-Zossen road are being cabled to this country. On Sept. 17 word was received that a car was operated at a speed of 106 4-5 m. p. h. This is an increase in speed over the maximum obtained during the experiments last year. On Sept. 21 still better results were obtained, for the cable despatches said that in a burst of speed a maximum of 114 m. p. h. was reached.

BRILL SEMI-CONVERTIBLE CARS AT LAKE CHAUTAUQUA

The Chautauqua Traction Company, operating between Jamestown and Stow, around the western shore of Lake Chautauqua, has lately placed in commission several fine semi-convertible cars built by the J. G. Brill Company. Between Jamestown and Stow are the towns of Celoran, Lakewood, Ashville, Mayville, Chautauqua and Victoria. The large number of visitors to this popular region in the summer has made it necessary for the company to add larger cars to its equipment of a type suitable for through service. The cars, as shown in the illustrations, are of two types—straight passenger and combination. The straight passenger cars are mounted on 27-G trucks, capable of 30 miles an hour, and the combination cars on 27-E-1 trucks, capable of a very high speed, and this latter type will be used for express. The cars present a handsome appearance with their inclosed vestibules, steam car roofs and handsome coloring—black with green lines, gold lettering and decorations.

COMBINATION CAR FOR JAMESTOWN

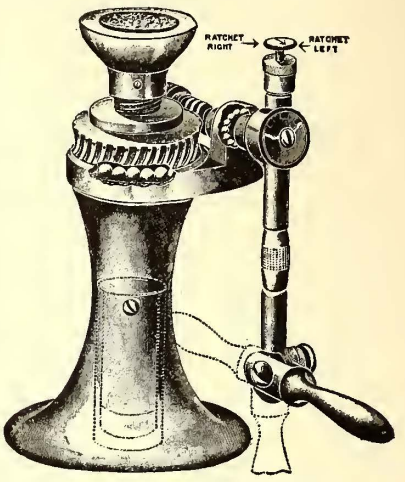
The straight passenger cars are seated for forty-four passengers, the seats being 36 ins. long, and upholstered in plush; having no window pockets the seats are brought against the side lining between the posts, the sides being 2 ins. thick and the width over the posts 8 ft. 2 ins.; the aisles are, therefore, 22 ins. wide. Interiors are finished in cherry, all neatly colored, carved and decorated; the ceilings are of decorated birch; the interior trim throughout is solid bronze of ample proportions, including five basket racks on either side. Length of cars over end panels, 30 ft. 8 ins.; over vestibules, 40 ft. 1 in.; from panel over vestibule, 4 ft. 8½ ins.; width over sills, 7 ft. 10½ ins.; over posts at belt, 8 ft. 2 ins.; sweep of posts, 1¾ ins.; from center to center of posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. Side sill, size 4 ins. x 7¾ ins., plated on the inside with ¾-in. x 12-in. plates, to which are substantially secured the lower portion of the posts. The 27-G trucks on which these cars are mounted have a wheel base of 4 ft., axles 4½ ins. in diameter, and 33-in. wheels.

The combination passenger and baggage cars are 31 ft. 8 ins. over end panels, and 41 ft. 1 in. over vestibules. The other dimensions are the same as in the straight passenger cars. The passenger compartment is 17 ft. 2 ins. long, and the baggage compartment 14 ft. 6 ins. The passenger compartment seats twenty-four passengers, and the baggage compartment has folding seats for the use of smokers. The 27-E-1 trucks have a wheel base of 6 ft., axles 4½ in. in diameter and 33-in. wheels. All the cars are equipped with four 55-hp motors each. Weight of a straight passenger car, trucks and motors is about 43,000 lbs., and of a combination car is about 46,000 lbs.

PASSENGER CAR FOR JAMESTOWN

BALL-BEARING JACK

The accompanying cut is an illustration of one of Gaston's A. B. C. ball-bearing jacks, partially cut down to show complete workings. This type, for which Wendell & MacDuffie, of New York, are the exclusive Eastern railway agents, possesses a number of valuable features meriting description.



BALL-BEARING JACK

As implied by its name, ball-bearings are extensively used in this jack to overcome friction. The weight rests entirely on the balls. Ball bearings are also used in each end of the worm screw to catch the thrust in raising and lowering loads. To further reduce friction vaseline is used for lubrication. This is kept in an automatic grease cup, held in place at the bottom of the jack by a set screw.

The post can be quickly screwed up to the load by hand, thus saving time, because with other jacks it is necessary to turn the lever until the top of the post reaches the load. Another time-saving feature of this jack is that as soon as the load is released the post goes down automatically to its original position. Through the use of interchangeable posts and gears three speeds are obtainable—slow or two revolutions of the gear to the inch; medium or one revolution to the inch; fast or one revolution to 2 ins.

The mechanism of the jack is very simple and durable. The gear is made of Coe bronze, which is almost frictionless, and the screw and worm are of cold-rolled steel. All parts are interchangeable, and the cost of maintenance is said to be light. The jack can be used in very close quarters, thereby insuring the lifting of the weight in any place under which the head of the jack can be placed.

It is to be hoped that there may be fewer interurban roads built which deserve the appellation bestowed upon them by a well-known engineer—"monuments of efficient salesmanship."

THE CHICAGO UNION TRACTION COMPANY'S NEW CARS

The order for 100 new cars, which the receivers of the Chicago Union Traction Company recently placed with the St. Louis Car Company, as mentioned in a previous issue of the STREET RAILWAY JOURNAL, is for a semi-convertible type of car, employing the well-known Robertson channel steel sills, which permit of low car body and low window sills. The cars will be 28 ft. over the body corner posts, with 6-ft. vestibules at each end, making the total length over bumpers 41 ft. Platforms will be equipped with double folding gates. The car width is 8 ft. 4 ins., 64 ins. narrower than the cars built by this company for the Chicago City Railway. In the middle of the car six cross-seats are placed, and at the ends, occupying the balance of the space, longitudinal seats. All the seating will be made by the St. Louis Car Company. The interior finish will be of cherry and the trimmings of bronze. On each side will be six windows, each 46 ins. wide. These windows are similar to those used on the Chicago City Railway Company's cars. The paneling on the car will be concave and convex instead of straight, as on the city railway car just mentioned. Each car will have twenty incandescent lamps and also illuminated signs. The trucks are the St. Louis Car Company's No. 47 short-wheel-base truck, with rigid frame, adapted for outside-hung motors, and the sand-boxes will be made by the same company. An early delivery, during the months of November and December, has been promised, which is remarkably quick work for such a large order.

The motor equipment, four General Electric 70-motors, will be put on each car. This motor is a new type, designed at first especially for the Milwaukee Electric Railway & Light Company, and containing a number of new features, which were described in the STREET RAILWAY JOURNAL of Sept. 5, 1903.

NEW TROLLEY CATCHER

One of the most annoying and common accidents in trolley service is to have the pole leave the wire, not only causing numerous delays but serious injury to the overhead construction. To overcome this defect a simple and effective trolley

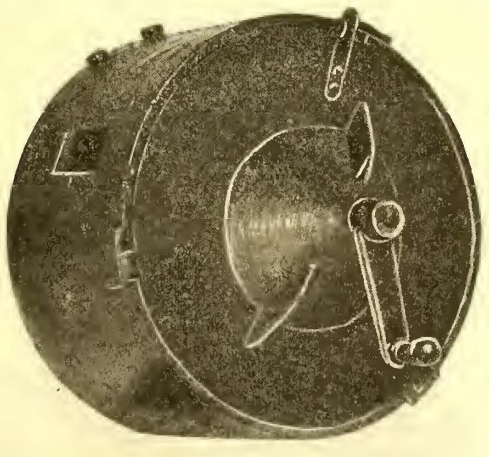


FIG. 1.—TROLLEY CATCHER COMPLETE

catcher has been recently perfected by Johnson & Morton, of Utica, N. Y. This contrivance is shown complete in Fig. 1 and in detail in Fig. 2.

Regarding its operation it may be noted that the rope draw rests by its own weight on a bearing in the case without a cap. The slack trolley rope is wound on the drum by a plain coiled spring. When the speed of the unwinding cord is suddenly increased the drum is lifted from its bearing before the cord unwinds, and a ratchet on the drumhead engages a stationary tooth in the case above it, thus preventing the turning of the drum. This action is so rapid and positive that barely half an inch of rope is paid out before the catcher operates, and the trolley pole is kept below the span wires.

The catcher will coil 15 ft. of ¼-in. rope. Although ⅜-in. rope may be used the former size is recommended. The heavier rope is not required with this catcher, as the movement of the trolley poles after leaving the wires is so short that the severe strains from suddenly stopping it are avoided. The base is fastened to the bar by three bolts, and by the use of a bayonet lock the catcher proper can be removed by a half-turn of the case,

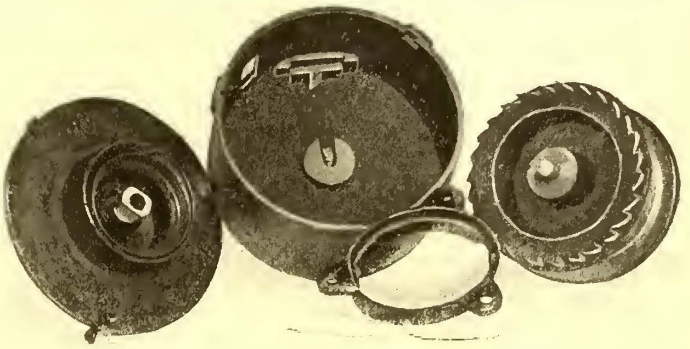


FIG. 2.—DETAILS OF TROLLEY CATCHER

but accidental loosening of the case is impossible. This method makes it possible to use only one catcher upon reversible cars, as a base can be fastened on each end and the catcher transferred when the trolley is reversed. A chain is provided on the cord drum, so that the trolley cord can be attached by a hook. A crank extending from the head of the case is connected with the cord drum so that the spring can readily be wound up. The head of the case is fastened by a latch joint, arranged to be taken off instantly, but which cannot come loose by accident.

The spring, cord, drum and interior of case are made easily accessible by simply removing the case-head. The spring is held in a recess in the case-head and can be removed without tools for replacement or inspection.

The construction and principle of operation are shown in Fig. 2. To prevent wear both the bearing in the case and the head are of chilled iron. The drum shaft and spring shaft are of the best mild steel and easily renewed at trifling cost. The rack upon the cord drum is of chilled iron and the catch of case-hardened steel. The spring is 15 ft. long, made of finely tempered steel, and winds upon a shaft 1 in. in diameter, insuring durability.

TROLLEY SUPPLEMENT OF THE SPRINGFIELD REPUBLICAN

The second section of a recent Sunday issue of the Springfield (Mass.) "Republican" was what might be called a trolley supplement. This section of the paper consisted of twelve pages, the first five of which were devoted exclusively to the description of trolley routes in the vicinity of Springfield and to advertisements from street railway companies of the attractions of their lines for pleasure traffic. The first page was devoted entirely to matter descriptive of the various resorts, a pleasing introduction on the development of the trolley leading up to this matter. The other four pages were made up of descriptive matter and advertisements from street railway companies of the special features which they offer. This scheme of combining editorial and advertising issues seems to be novel in connection with the exploitation of street railway features, and should prove beneficial to both the paper and the companies. The idea, it would seem, is worthy of serious attention at the hands of street railways and papers in other parts of the country.

The leading theaters of Columbus, Ohio, have completed arrangements with the interurban railways entering the city whereby the latter will operate special theater cars during the coming winter season.

LONDON LETTER.

(From Our Regular Correspondent.)

At the last meeting of the Liverpool Tramways committee, the general manager reported that the Board of Trade has sanctioned an increased speed of the corporation electric cars. We understand that hitherto the maximum average speed of the cars under the old limits was 5.8 miles an hour, and that now the cars may legally be driven at a maximum average of 8 miles an hour. It is believed that the actual speed of the cars will not be increased to any material extent, and practically the only effect of the official sanction will be to legalize the existing practice.

The Aberdeen Suburban Tramways Company has definitely decided to proceed with its undertaking. Of the £72,000 of capital asked for, applications for only £25,000 have been received; and obviously it was quite impossible in these circumstanees that the directors could proceed to carry their whole scheme into execution. At a recent meeting, however, of the shareholders it was resolved to go on with the undertaking to the extent of the means available.

The building of the transforming station which is being erected at Birkdale in connection with the electrification of the L. & Y. Railway line between Liverpool and Southport is now completed. At the Formby power station the boilers are being placed in position. Gangs are working on the line itself both towards, and away from, Southport, and the work on the line will soon be completed.

An interesting report on the question of half-penny tramway fares was recently issued to the Glasgow Corporation Tramways committee by John Young, the general manager.

As the outcome of inquiries addressed to over fifty corporation tramway managers throughout the country he arrives at the conclusion that the opinion of the various corporations is not at present generally favorable to the adoption of half-penny fares, although seven of them—including Glasgow—have such fares in operation over their whole systems; nine have half-penny fares on certain stages; and four or five others issue half-penny tickets to workmen.

In Glasgow the half-penny stage, which is about half a mile, was originally one-half of the penny stage, but subsequently the penny stage was doubled, while the half-penny stages remained practically as they were originally fixed. Mr. Young gives figures showing that one-third of the passengers travel at the half-penny fare, while the receipts from them are 18 per cent. Sixty-one per cent of the passengers travel at the penny fare, the receipts from them being 69 per cent; and 7 per cent of the passengers travel at over the penny, the receipts from these being 13 per cent. The average fare collected per passenger at present is .88d. Last year's accounts show that the average cost per passenger was .75d., exactly 3 farthings. The profit is, therefore, only about one-eighth of a penny, which Mr. Young considers a narrow enough margin in a business of this kind. Investigation further shows, he says, that almost one-half of the penny passengers travel little more than a mile, or about the distance of two half-penny stages.

The immediate result, therefore, of doubling the half-penny stage, as is proposed, would be to transfer about 54,000,000 passengers from the penny to the half-penny fare, with the consequence—taking the past year's experience as a basis—that not only would the surplus of £100,000 be wiped out, but the tramways would actually be carried on at a loss. Mr. Young accordingly recommends no change in the present stages and fares.

The Great North of Scotland Railway Company is about to augment its suburban service by the introduction of a number of motor carriages. The intention is to improve the present suburban service by running on the railway at short intervals of time motor carriages capable of carrying from fifty to sixty passengers, and in connection with which additional stopping places will be provided for the convenience of passengers. Several English railway companies have already introduced this system for the purpose of improving and developing their suburban traffic; and the success which is understood to have crowned their efforts leads to the hope and belief that the enterprise of the Great North Company will be similarily rewarded.

An important project is on foot for the construction of electric tramways at Woking and a light railway connecting that populous neighborhood with Chobham, Windlesham and Bagshot. At present there are no facilities of any kind for giving cheap and ready access to this pleasant part of Surrey, which the scheme in question would open up for residential purposes, in addition to greatly benefiting the farmers and tradespeople. Railway and tramways would also furnish a direct means of access to a very extensive area of War Department land, valuable as a manœuvring ground. The promoters, who state that the required capital is already guaranteed, have secured the co-operation of the London & Southwestern Railway Company, with whose system the light line will connect at Woking and Bagshot. A suggested future extension of the scheme is the construction of another line through Send and Ripley to Effingham Junction. Public opinion throughout the district affected is said to be strongly in favor of the project, and a Board of Trade order will shortly be applied for.

Sir John Wolfe Barry has issued his award as umpire in the arbitration which has recently been held to determine the amount to be paid by the London County Council to the Metropolitan Electric Supply Company (Ltd.) for the compulsory acquisition by the council of the company's generating works at Sardinia Street, Lincoln's Inn-fields, made necessary by the construction of the new avenue from Holborn to the Strand.

The London Improvements Act, 1899, provided that, in addition to vesting in the new company a site of equivalent area to its present one, the council was to pay to the company a sum equal to the costs and expenses of erecting and fitting up a new generating station upon a new site with new plant of a capacity to generate and supply electrical energy to an output of not less than 4000 kw, and all expenses incurred in replacing, relaying, and alterating mains. The amount of the award is £183,150.

While the new electric tramways on the Tooting lines are proving a great success, some difficulty is being experienced in connection with the altered arrangements on the Streatham cable route. Pending the electrification of this line, the County Council decided to have certain of the new electric cars fitted with special apparatus, so that they could be run from the termini at the bridges to Kennington by means of electricity, and then over the existing route from Kennington to Streatham by cable. Doubts were freely expressed as to whether the cable was sufficiently strong to stand the extra strain of the new cars, which are much larger and heavier than the old ones, and these fears have since been justified. Of the twenty electric cars fitted for working on the combined systems about ten or fifteen have been running daily during the past two or three weeks, and observations go to prove that the added strain of a large number of cars would be too much for the cable. The original scheme for combining the cable and electrical systems is, therefore, to be abandoned, and it may be confidently expected that the conversion of the cable route to electricv traction will be pushed on as soon as possible. The conversion of the London County Council's tramways from horse to electric traction has been marked by a substantial increase in receipts. The last weekly return to hand—that for the week ended Aug. 22, a very wet week—gives the following figures:

	Week ended Aug. 22.	Corresponding week last year.
Mileage opened	39½	26½
Passengers carried	2,534,690	.....
Receipts	£10,487 18 6	£8,057 1 11
Aggregate for year (144 days)	207,489 7 11	177,462 12 11

The total increase in receipts as compared with the same week last year was £2,430 16s. 7d., which made an increased aggregate for the present year (144 days) of £30,026 15s. It is true that the mileage has increased, but that would not entirely account for the augmented receipts.

The northern main roads in Middlesex are in a state of partial chaos owing to operations in connection with the construction of electric tramways. The lines have been laid at North Finchley, and at Woodberry Down and Tottenham new rails are being laid to take the place of those used by the present horse system. The Board of Trade has sanctioned 15 miles, and the Light Railway Commissioners a further 26½ miles—the estimated cost of the 42 miles being £1,686,255. The Middlesex County Council's whole scheme would have given the county 150 miles of tramways, but the bulk of it was withdrawn or rejected. The equipment of the lines sanctioned is to be provided by the Metropolitan Electric Tramways, Ltd., and the Council is to receive 4 per cent on its outlay, and the company the same amount. After that the profits are to be divided.

The Bolton Corporation is making an interesting experiment at present by establishing a motor omnibus service to Darcy Lever, a little industrial suburb lying about 1½ miles from the centre of the town. It is understood that the cost of laying electric tram lines to Darcy Lever would prove so costly, owing to the difficult nature of the road—the village lies in a hollow—as to preclude the possibility of an electric tramcar service thereto proving remunerative.

Six members of the London Traffic Commission sailed for New York on Sept. 18 to investigate the systems of traction and transport in the United States. Their secretary, L. L. Macassey, sailed Aug. 28 to make the necessary arrangements.

The tenders sent in for the supply of the material of the Municipal Electric Tramway for Johannesburg, South Africa, have

been published. The tramway committee recommend the acceptance of the Brush Electrical Engineering Company's tender for grooved and Vignoles rails and fishplates of Belgian make at £74,549, with 2½ per cent discount. The British tenders for these articles were considerably higher.

Proposals have been made to the local authorities in favor of the introduction of trams into Upper Norwood. A canvas of the districts through which the proposed line would pass has been taken, and the returns show a majority of three to one in favor of the system being introduced. Demands will be made to the Croydon and Lambeth Councils urging the extension of the existing lines from Thornton Heath and Herne Hill to Upper Norwood, and from Herne Hill to the Crystal Palace. At present there is only a 'bus service between these places.

Now that the provisional order for the Fife electric power bill has been passed, and only awaits the Royal assent, consideration has been turned to the proposal of forming a company in Dunfermline, spoken of some time ago. This company was to have been constructed by business men in Dunfermline and district following on the notification of the establishment of the naval base at Rosyth. From inquiries made it has been ascertained that steps will be taken to form this company in the course of a month or so. The idea is to have a line of rails running from Dunfermline to St. Margaret's Hope, and probably other districts will be opened up.

Yielding to the desires of the Leeds Corporation Tramways committee, Councillor R. Alf. Smithson has withdrawn his resignation of the chairmanship of that body.

The report of the Liverpool Overhead Railway Company for the half year shows the following number of passengers carried during the first six months of 1903, as compared with the corresponding half year of 1902: First class (1902), 656,756; (1903), 759,180; second class (including tramways, 1902), 2,966,690; (1903), 3,334,703; workmen (special return tickets, 1902), 1,402,976; (1903), 1,420,116; total, 1902, 5,026,422; 1903, 5,514,089. Receipts from passenger traffic, £40,858 13s.; miscellaneous receipts and interest, £805 13s.; miscellaneous receipts and interest, £805 13s.—£41,664 6s.; less working expenses, £32,005 8s. 9d.; deduct interest on mortgage debentures, £3,800; add balance brought forward December 31, 1902, £4,013 8s. 7d.; less available for dividend, £9,872 5s. 10d. Referring to this report, the chairman explained that the directors proposed to pay a dividend of 5 per cent on the preference shares and 1¼ per cent on the ordinary shares, leaving £3,747 to be carried forward. It is also proposed to make a number of extensions.

In consequence of the heavy rains of last month the electrified portion of the District Railway was flooded in two places. The water partially submerged the running and negative rails. In spite of this, however, the track circuits of the Westinghouse automatic signals, with which this line is equipped, were not in any way affected, and the trains were signalled without a hitch.

A. C. S.

BROOKLYN POWER HOUSE DAMAGED BY FIRE

The power house of the Brooklyn Rapid Transit Company at Fifty-Second Street and First Avenue, Brooklyn, was the scene of a most peculiar and serious fire Saturday afternoon, Sept. 26. The fire originated in the cable tunnel near Fifty-Second Street, and is said to have been caused by defective insulation. This tunnel is extremely large, and runs from a point half way between the harbor up to Second Avenue. When the flames reached the power house they burst in and completely enveloped the machines in the center of the building, and soon communicated to the switchboards. The roof of the building, which is finished with yellow pine, next took fire, and it seemed that the entire building was doomed to destruction. Three alarms of fire were turned in. Practically all of the company's lines in South Brooklyn were crippled at once by the fire. Coney Island and the beaches suffered, as did also the "rush" hour service from New York. It is estimated that there were 20,000 people at the races at Gravesend, and it was fully three hours before provision could be made for handling this crowd. An official estimate places the extent of the damages at $6,700. Fortunately for the company, the fire did not prove as disastrous as was at first expected. Some of the electric trains on the elevated lines had to be withdrawn from service, but they were all restored early in the week.

The clubrooms of the Schenectady Railway Benefit Association at the Fuller Street station, Schenectady, N. Y., were formally opened on Thursday evening, Oct. 1. The opening address was by the president of the association, and was followed by a most entertaining vaudeville programme. The Schenectady Railway Benefit Association, as its name implies, is composed of employees of the Schenectady Railway Company.

FARES AND FARE PROTECTION*

BY JOHN F. OHMER

In the old horse car days, when fare collections were limited practically to one medium of exchange for rides, the conductor was placed in charge of his car with the understanding that, acting in the capacity of agent for the company, he was supposed to collect as many fares as possible, and to return to the company all collections made. At that time the conductor was placed solely upon his honor, and there was no connecting link between the hands of the conductor and the cashier for the company. Because of the lack of some material connecting link, suspicion on the part of companies was naturally aroused as to whether conductors were turning in to the company all fares collected, and the honest conductor was confronted with the uncertain proposition that although he would turn in absolutely each and every fare collected, there existed the uncertainty as to his morality because of the absence of the missing link, to which we previously referred. Subsequently the old portable bell punch was introduced, and it served its purpose for years. The introduction of the bell punch forced a change in the system, which taught conductors to settle upon the basis of fares collected, to one which compels the settlement upon the basis of fares registered, and, we believe, we can trace to this change the evil which has permeated the operation to the present day.

It was soon discovered by the unscrupulous conductor that to give a fare for each fare registered meant to him to retain a fare for each fare not registered, and with the portable machine carried upon his person he found it easy to collect fares, and to avoid registration, or to collect fares and register them at opportune times upon his own register, kept up his sleeve for his own peculiar benefit.

The introduction of electricity in recent years, the clamor by the general public for reduced fares and the universal transfer system, has forced upon railway companies, through municipal and interurban authorities, conditions never dreamt of by the pioneers in the business.

To prevent the use of duplicate punches by unscrupulous conductors, and to provide in a way some evidence on the part of the passenger that his fare was paid, the stationary clock register was introduced, but the system upon which it operates remained unchanged. The conductor is obliged to turn in only as many fares as he rings up.

The introduction of tickets, and, subsequently, the transfers, added complications, and increased the opportunities of dishonest conductors. If he registers cash, tickets or transfers together, and returns to the company a total number of either to correspond to the total number registered, he does his duty, and it matters not to him how he may be able to supply the abnormal quantity of tickets or transfers. If he collects two denominations of cash fares, it is left for him to determine how many of either kind has been collected.

In the attempt to supply a more reasonable way of accounting and checking conductors, the double register found its place upon many cars in the country. But the double register, being little more or less than two registers enclosed in one case, is operated upon the same principle as prevails with the single register, and the conductor is educated in the same old way, to settle upon the basis of fares registered instead of making settlement upon the same principle of turning over all collections.

To illustrate the force of this argument, we only allude to the operation with a double register upon one of the large lines in a prominent Ohio city. The company collects a 5-cent and a 3-cent cash fare, tickets, coupons and transfers. Its conductors sell and collect six tickets for 25 cents, also twenty school, or children's, tickets for 50 cents. The 5-cent and 3-cent cash fares, the six for 25 cents ticket, and the 2½-cent ticket are all counted together on one side of the register, the transfers and coupons together on the other side. The writer recently had occasion, with two adults and three children, to ride on one of the cars of this company. He gave as the medium of exchange for the six passengers one 5-cent cash fare, two six for 25 cents tickets, one 3-cent cash fare and two 2½-cent tickets. These six fares were promptly counted together on the same side of the register, and, of course, it was a most forcible reminder of how inadequate this process, and what a temptation it must be even to the honest man who must account to the company for six fares of four different kinds registered together. In making his settlement, is he not doing as expected, and can he not relieve his conscience by turning over fares of the four denominations in sufficient quantities, the total of which will equal the amount registered?

* Abstract of paper read at meeting of the Pennsylvania Street Railway Association, at Williamsport, Pa., Sept. 23, 1903.

Surprising as it may seem, this operation is no more absurd than to register cash fares and transfers together, or to register cash and omit the registration of transfers. If cash and transfers are registered together, it means for the company a settlement of fares in either class corresponding to the number registered, and in which case the conductor naturally makes paper go as far as possible, and the difference is made up in the cash fares. Many companies do not register transfers in order to avoid the substitutions of transfers for cash in settlement, and excuse themselves for the omission on the ground that transfers have no value. If they have no value, why are they taken as a medium of exchange for a ride, and does not the knowledge by the conductor of this position taken by the company encourage the wholesale and miscellaneous distribution of transfers, of which he is taught they have no value? Our observations lead us to the conclusion that where transfers are collected and not registered, it encourages the opportunity for the non-registration of cash fares. It makes it all the more difficult for the company to get a line on the unscrupulous operator.

We are now led up to that part of the operation on which the cashier presents himself. The conductor is employed to turn in fares collected, make out his report in his own way, and based on his register record. The cashier takes the conductor's report with the returns made, and it is common practice to call upon the conductor to pay the shortage of the difference between his returns and his own record taken from the register. He may have collected one hundred fares in excess of the number registered, turn in five, or six, or ten fares short, which is his privilege, expecting all the while to be called upon to pay 50 cents, the amount of his shortage from the excess collections of $5 and more. Some companies return overages, but the majority collect shortages and retain overages, and, as the conductor holds the key to the situation, and from his returns as compared to the register, knowing the amount of his overage, can only conclude that at best it is a case of conductor versus the company, and the conductor's estimation of the company for holding out his money can be none the less than the company's estimation of his own integrity. The cashier, standing between the conductor and treasurer, holds an unenviable position. He stands between the several conductors reporting from one register, and between all conductors reporting to him and the treasurer of the company. Upon this varied and uncertain quantity the foundations are laid upon which are built the records and statistics for the company.

We have, perhaps, consumed time which may seem unnecessary in reviewing and pointing out existing conditions, of which many or all of you are aware, but this review, when brought in contrast with an exposition of what the Ohmer register and system really mean, can only bring you to the better realization of what we have solved in working out this perplexing problem. Aside from the Ohmer fare register and system, little or no improvement has been made in thirty years. Railway companies are to-day using practically the same style of "counting machines" (so-called registers) which were used with one fare—when only a 5-cent fare was collected. The Ohmer register was created to meet existing conditions upon both city and country operations, and has enabled the companies to abandon the old, inaccurate system of bookkeeping on the cars by the conductor and the conductor's report. The register now makes the report. In addition it accomplishes the following:

1. It makes a separate registration for each fare collected, the different kinds of fares being registered separately.

2. It keeps a separate printed record of the collections of each conductor.

3. It shows a separate indicator for each kind of fares registered. The fares registered are simultaneously indicated at various places about the car: as the platform, on the inside of the partitions, in special compartments of the interurban cars, etc.

4. It makes a total registration of all fares, irrespective of the class.

5. It is easily and rapidly operated.

6. It indicates the direction in which the car is moving.

7. It prints the number of fares in each class for each half trip.

8. It prints the trip number.

9. It prints the month and day.

10. It prints the number of the register.

11. It prints the number of each conductor (and motorman, if desired), and shows the platform time he takes and leaves the car.

12. It fixes the work and responsibility of each conductor, and removes all occasion for disputes. From the register record it shows the various fares in detail which are collected upon interurban cars running over city lines.

13. It prints a duplicate or triplicate record, showing a summary of the day's business for each car, irrespective of the number of conductors who operate it. The duplicate or triplicate copies may go direct to the treasurer and auditor of the company.

With all this, it is so ingeniously contrived that it is always locked when not in service, and cannot be put into service until the conductor's badge number is first printed upon the statement enclosed in the register. It does the work of an adding machine, a printing press, a time clock and a cash register. In short, it is a marvel of ingenuity and mechanical skill, and with all, its construction is extremely simple. It is as valuable and indispensable for street car service as is the cash register for certain commercial enterprises.

In studying out the solution to this problem we did not lose sight of the fact that three interests must be considered: First, the company's interests; second, the public, and, third, the interests of the conductor, who is the instrument between the company and the riding public. No system could succeed which in its operation was antagonistic to the public, and the system which affords more or less protection to the public must naturally be in favor and grow in popularity. The indicator is to the passenger a visible receipt for the fare paid, and assures to him his right to destination. It insures to the passenger on an interurban line that he has not been charged in excess of the regular rates. If, however, a passenger should pay a 15-cent fare, and the conductor should register and indicate for a 10-cent payment, the passenger can have his alternative of two conclusions, either the conductor has charged in excess of the regular rate, or has charged the regular rate and receipted for a less amount, by which action it is implied that 5 cents of the 15-cent collection has been appropriated to himself. The moral force supporting the visible indicator for each fare paid will prevent conductors from registering inaccurately just as much as the indicator to a cash register compels the clerk to register the amount received.

The conductor is the acting agent of the company, and the responsibility of the company follows his acts, so that no matter what system is designed for the conductor, we must not lose sight of the fact that in its operation it must be designed for the company. To employ a conductor with the understanding that he is to collect all fares possible, and to turn over to the company all fares collected, and then in practice ask him to turn only a number of fares equal to the number registered, is working contrary to the natural laws, which can only result to the detriment of the company. That railway companies realize the import of this argument may not be disputed, but they have been forced to accept unwarranted conditions, because, until the introduction of the Ohmer register and system, there was no other method available.

Our system is devised to teach and educate conductors to act in the capacity of agent for the company, and as he formerly did before the advent of "counting machines," or registers of any kind. We tell him to count his cash before taking the car, and at the finish of his run to first take out the amount of money he had when taking the car, and turn over the balance to the company. In so doing, he can point with pride to the register record (over which he has no control) to back up his integrity. The honest conductor is delighted with the system which protects his own interests. The visible indicator, at the time he registers a fare, relieves from the passenger any suspicion of doubt the passenger may have as to his integrity. Having no books to keep, he is relieved from considerable mental work, and has the satisfaction of knowing that if an honest mistake has been made, it is practically the company's mistake, and it affects him only in his moral record. Our system provides that a record be kept for each man's work, rewarding to him good points for good work, and bad points, the number of which are measured by the number of inaccuracies by the conductor; in other words, he is put upon his morality, and the moral worth of every man should be measured by his moral record.

We contend that every man, woman and child should pass some medium of exchange to the conductor for the ride, and that there should be a separate reckoning or accounting for each made at the time. All this we do. With our system we teach and educate the conductor to turn in all fares of every denomination he has collected, and having given him mechanical means for keeping a record of all fares collected, his competency will be measured by the accuracy by which his record of fares is kept. It seems to be the universal system, which goes with all other counting machines, to have the conductor settle upon the basis of fares registered. In other words, with the old system, you say to the conductor, "Ring up all your fares, for unless rung up we don't get them." And your conductor says, "Each fare I get and don't register is my 'meat.'" With the old system, in some cases, the conductor is taught to register cash and paper together, and the conductor says, "Paper comes easier than money," and counts the paper first, then makes up the difference with money. You cannot add tickets, transfers and cash together, and get a result of one kind. It is as inconsistent with true principles just as an effort would be to add four and three together, and endeavor to get 6¾ or 7⅛. It is a physical impossibility. We say, "Get all your fares; give us

all you get, and your merit record will tell us your moral worth." With our system the conductor says, "All I get goes to the company."

At the end of each trip with your system conductor writes down the number of passengers carried. Our system prints with ink not only the number of passengers, but the medium of exchange paid by each. Your system, the spotter reports, conductor collected eighty fares, and registered forty. Conductor says, "I didn't," and proves it manipulating his trip sheet by the Bean system, and the company doesn't know who is the liar. Our system controls the trip sheet, and nails the liar. With your system passengers have no interest in the register. With our system the passenger gets his receipt from the register indicator. Your system makes conflict between the company and conductor—on the part of the company to see how many fares it can make him register, on the part of the conductor to omit registration. Your system leaves both conductors and company in doubt. Our system proves the work of the conductor, and backs up his inegrity. Your system works against nature, and breeds immorality. Our system, working with nature, teaches morals.

It has been the custom with manufacturers generally of registers to send them on trial wherever requested, and we have had a few demands from managers for machines sent on trial. With one exception since we are in business, we have refused sending registers out on trial for the simple reason that without proper knowledge of how the machines should be operated, mechanically and systematically, there would be little hope for success. We consider the mechanical operation of our registers second of importance to the system which it precedes, and it would be difficult to put in successful operation a system by those who have not given the subject sufficient study.

There has been some objection to our manner of putting out machines upon the rental basis, but after giving this matter due and careful consideration, it must be apparent that the register is very expensive to manufacture and market, and that if sold, the price must be put at a figure which might be considered prohibitive. The charges made by us have proved to be very inconsiderable compared to the advantages obtained, and, moreover, the question of cost should never be considered excepting in connection with what one receives for the outlay. The rental charge we make is but a fraction of a cent per hour for work you could not possibly buy in any other way for twenty times its cost. There can be no better illustration of this fact than referring to the cash registers, which sell for from $300 to $400 each, and are universally used by all classes of merchants—from the peanut vender and boot black, whose stock in trade consists of a blacking brush, a bottle of polish and a cash register—to hundreds of registers used by that Napoleon of all merchants, your own distinguished fellow-citizen, John Wanamaker, of Philadelphia.

THE NEW SYSTEM IN MEXICO CITY

The American capitalists interested in the Compania Mexicana de Traction (the Mexican Traction Company), recently organized for the purpose of constructing and operating an extensive electric railway system in Mexico City, met in New York last week for the purpose of increasing the financial resources of the enterprise and determining as to what rails, cars and power house equipment will be required for the initial installation. About 1000 tons of 85-lb. girder rails will be ordered at once, and the company will also be in the market for twenty 40-ft. cars, with four motor equipments of 56 hp each. The power house will have an initial capacity of 2000 hp. Westinghouse equipment will be installed. The company has acquired what are known as the Moylan, Garcia & Requima concessions, which permit of the building and working of about 100 miles of road, about 50 miles in the city and 50 miles in the suburbs. The company has also assumed control over the Empresa del Circuito de Banos, a horse road, 2 miles long, operating between Belvanera and Alberca, in the heart of the city. This line will be electrically converted at once. The company is incorporated under the Mexican laws. M. R. McAdoo, of New York, is president of the company. The other officers are Mexicans, but there is an American advisory board of directors, composed of Pittsburg capitalists. The directors are: James B. Oliver, Julius Bieler, Reuben Miller, Sr., James H. Park and Frank B. Smith. Mr. Oliver is president, and Mr. Bieler is treasurer. The chief engineer of the company is A. T. Montmorency, C. E., Mexico City. George C. Pierce, formerly of the Banos road, has been appointed superintendent and electrical engineer of the new company. Construction work will begin at once, and the system is expected to be in active operation within eighteen months.

STRIKE AT NEWARK, N. J.

There was a short-lived strike of the employees of the Public Service Corporation, of New Jersey, at Newark last week. The strike began late Thursday afternoon, Sept. 24, and was declared off at midnight, after the company had for a second time positively refused to comply with the demands of the local branch of the Amalgamated Association of Street Railway Employees of America. Except for the partial tying up of the lines during the time just mentioned there was no serious interruption of traffic. The order to strike was that the men, beginning at a certain hour, should, on completing their runs, turn in the company's property and quit work; and the plan seems to have been gradually to extend the tie-up to all of the company's lines. This would have resulted in cutting off street railway service in Jersey City, Hoboken, Newark, Paterson, Elizabeth, Montclair, the Oranges, Passaic, Bloomfield, Glen Ridge, Irvington, Arlington, Kearney, Harrison, Caldwell and other outlying villages.

The issues involved were clearly defined. They were, first of all, the recognition of the union; then a demand for a flat rate of 22 cents per hour, to replace a sliding scale of from 19 to 22 cents; again, the readjustment of hours so as to do away with "swing" runs, and, finally, the stopping of wholesale discharges of union men, which the men say have been going on for many weeks.

It seems that on Tuesday a conference was arranged between President McCarter, General Manager Wheatly and representatives of the employees, and that at this conference Mr. McCarter pointed out his utter inability to act until the question had been submitted to the directors. It was promised faithfully to consider the alleged grievances, but no hope was extended that the demands would be granted. At the meeting of the officers and directors of the company it was decided to ignore the demands of the men. To the ultimatum of the union the company replied that while the officers would be most willing to consider any grievances the employees might have as individuals, no organization would be recognized. Representatives of the employees as a whole, or any group of employees, would, it was stated, be received, but no representatives of a union would be given a hearing.

LARGE STEAM TURBINES FOR PENNSYLVANIA RAILROAD

As stated in the STREET RAILWAY JOURNAL of Sept. 12, an order for three 5500-kw steam turbines has been placed with the Westinghouse Machine Company, East Pittsburg, Pa., by Westinghouse, Church, Kerr & Company, acting as engineers and constructors for the Pennsylvania Railroad in connection with the New York terminal equipment.

These machines will form the initial installation in the new Long Island City power house, on which construction is just beginning, and which will serve the lines in the tunnels for the Hudson and East Rivers and the New York terminal at Thirty-second Street and Seventh Avenue, and also such part of the Long Island Railroad as is in process of conversion to electric traction.

The turbines will be of the Westinghouse horizontal, short-barrelled type, mounted upon a single bedplate, resulting in a particularly compact arrangement and great economy of floor space. They will have a capacity of approximately 7400 ehp each, and will drive 5500 kw, three-phase, alternating current generators operating in parallel. Their overload capacity will be over 11,000 hp, and each turbine will be provided with a bypass automatically controlled by the governor to accommodate abnormal fluctuations in load. This will also permit operation at full load non-condensing.

The turbine equipment will operate under conditions favorable to the attainment of high economy, viz., 200 lbs. steam pressure at the throttle, 28-in vacuum, and 175 degs. F. superheat.

The generator will be direct connected to the turbine shaft through a flexible coupling, each section of the unit having two bearings of ample proportion, thus avoiding shaft stresses. The three-phase winding will deliver current directly to the distribution system at 11,000 volts, no step-up transformers being employed. The machines will be separately excited, and will carry full load continuously at 100 per cent to 80 per cent power factor, with a rise in temperature of 35 degs. C., or 50 per cent overload for two hours with an increase in temperature rise of slightly over 50 per cent. Each turbo unit will thus be capable of delivering 8250 kw for reasonable intervals, and considerably in excess of this figure during momentary load fluctuations.

The entire equipment is to be delivered by July, 1904, one year from the date of contract. It is somewhat significant of the state of the turbine industry that eleven Westinghouse turbines of approximately the same size are under construction for heavy electric railway service, both in this country and abroad.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS MEETING

The opening meeting of the season and the first one at which the new president, Bion J. Arnold, presided, was held on Friday evening, Sept. 25, at the New York Academy of Medicine. President Arnold made a brief address, in which he outlined the policy of the present administration, and asked for the co-operation of the members in carrying on the work along the lines described. He referred to the splendid record of his immediate predecessor in office, and mentioned particularly the valuable work that had been done by the institute representatives in connection with the project for securing a permanent home for the engineering societies of New York.

The regular programme for the meeting comprised three papers on electro-hydraulics. The first was on "Efficient High-Pressure Water-Power Transmission Plant," by George J. Henry, Jr., and Joseph N. Le Conte, containing a description of the work done in Southern California by the Edison Electric Company, of Los Angeles. The second paper was on "Electric Motors for Centrifugal Pumps and Fans," by August J. Bowie, Jr., and the third was a brief contribution, entitled "A Suggested Hydraulic Unit," by Ralph Montague.

REPORT OF RECEIVERS OF WORCESTER & SOUTHBRIDGE COMPANY

John A. Hall and Charles M. Thayer, receivers of the Worcester & Southbridge Street Railway Company and the Worcester, Rochdale & Charlton Depot Street Railway Company, of Worcester, Mass., issued, on Sept. 19, a report on the conditions of those two roads and also of two properties connected with the roads in such a way that the receivers consider that they must all be considered together. These are Pinehurst Park, Auburn and Hotel Overlook, Charlton. The accounts of the four properties were not kept separate, and there were several transactions, the receivers say, which do not appear on any book, so that in a number of instances they were obliged to rely on oral information. The figures, however, they consider approximately correct.

The receivers say they have ascertained that the money that was paid for the real estate at Pinehurst and for the development of the park was raised on notes of the Worcester & Southbridge Street Railway Company, and, therefore, after certain debts incurred in the improvement of the property are paid, belongs to the road. The same condition, the receivers believe, exists in relation to Hotel Overlook. These two latter properties are in the hands of Hon. Rufus D. Dodge, appointed receiver on the petition of Messrs. Hall and Thayer.

The receivers say in conclusion:

"Of this balance ($305,536.04) it is estimated that $50,253.35 was used for interest payments, and $24,272.15 for operating expenses, leaving an amount $231,010.54, for which no vouchers are on file.

"In making up the above figures we have not caused a detailed inventory and valuation of the several properties to be made, but have figured the assets from vouchers and other evidence of payment, carrying out the amounts at their face values.

"The above figures seem to indicate the existence of either one or both of the following conditions:

"1. That a part of the authorized capital stock of the Worcester & Southbridge Street Railway Company was not paid for.

"2. That there have been expenditures of which there is no record.

"In other words, there are outstanding obligations of the company, including its capital stock, which amount to $231,010.54 more than the vouchers and evidences of payment which we have been able to find.

"We believe that both of the conditions above stated contribute to the shortage.

"Such proceedings will be taken, under the direction of the court, as will leave nothing undone to secure for the company the money and the property to which it is rightfully entitled. There is work being done on a plan of reorganization, and probably a proposition will be submitted to creditors, but owing to our inability to make a statement that is known to be complete, this may be somewhat delayed.

"This report has been submitted to Receiver Dodge, who approves the figures relating to Pinehurst and Overlook."

The report does not mention the name of Wilford A. Bailey, former treasurer of the road. In a statement following the publication of the report George A. Gaskill, attorney for Mr. Bailey, said his client feels that, when the opportunity is given him, he will be able to account for the apparent discrepancy in the accounts.

EXTENSIVE CUBAN TRACTION AND LIGHTING PROJECT

An extensive electric traction and lighting system is to be constructed in the southern part of Cuba, power to be derived from an hydraulic plant which will be the largest in that part of the world. The Cienfuegos, Palmira & Cruces Railroad & Electric Power Company has been organized for the purpose of building and operating both systems. The bulk of the capital will be furnished by Cubans. Bruno Diaz, a large Cuban cigar manufacturer, is president of the company. Cornelius C. Vermeule, of New York, is acting as consulting engineer.

The length of the road will be about 43 miles. Four and a half miles of track will be constructed in Cienfuegos—one of the most flourishing seaport towns in Cuba. The line will run from Cienfuegos to Caonao, thence over a private right of way to Palmira, Horringuero and Cruces. There will be a branch also over a private right of way from Caonao eastward 15 miles through Los Guaos to Cumanayagua. From the harbor of Cienfuegos to Caonao there will be a second line on a private right of way built to carry freight exclusively. The line will be standard gage, laid with 60-lb. rails.

The initial rolling stock will consist of four combination cars, 32 ft. over all, seating twenty-four persons, each operated by two 50-hp motors; four open passenger cars, 35 ft. 8 ins. over all, seating sixty passengers, each operated by two 50-hp motors; three closed passenger cars, length 27 ft. 8 ins. over all, seating twenty-four passengers, each operated by two 25-hp motors; three eight-bench open cars, 25 ft. over all, seating forty passengers, each operated by two 25-hp motors. Five express cars, measuring 21 ft. over all, each equipped with four 50-hp motors, and having a capacity of 20 tons, will be ordered also; twenty box eight-wheel freight cars, capacity 20 tons; a similar number of eight-wheel flat cars, capacity 20 tons; also sprinkler and repair cars.

The company will also generate energy for the purpose of lighting Cienfuegos—about 30,000 inhabitants—and the other towns mentioned, whose populations average about 8000 people. Power will be derived from the Falls of Hababanilla, which are known as the Niagara of Cuba, located about 26 miles from Cienfuegos. The voltage at which the energy will be transmitted has not yet been determined. The initial capacity of the plant will be 3000 hp.

MOVING PLATFORM SCHEME IN NEW YORK

The extensions committee of the Rapid Transit Commission has decided to recommend the immediate adoption of the plan to build a tunnel for moving platforms from the Brooklyn end of the Williamsburg Bridge to the Battery, Manhattan. The outlay will be about $8,000,000. The only elements of uncertainty in the scheme are now the Board of Aldermen and the Board of Estimate and Apportionment. The decision of the committee was reached after the receipt of a report from Chief Engineer William Barclay Parsons on the proposition made many months ago by Messrs. Schmidt and Gallatin, representing a syndicate interested in moving platforms. The bidding for the contract will be open, just as in the case of other tunnels, and the vote was to the effect that the subway should be used eventually for an electric railway in case by any chance the platform scheme should be found impracticable or inadequate.

An important part of the committee's resolution was the provision that the bidder must put up a bond equal to the amount of the bid, or aggregating about $8,000,000. It was stated by a rapid transit official that Schmidt & Gallatin were expected to secure the contract, in view of their superior equipment for doing the work. Among the backers of the company are said to be Cornelius Vanderbilt and Stuyvesant Fish.

Details of the plans recommended by Mr. Parsons were not made public, but it is known that he substituted for the route proposed by Schmidt & Gallatin the following: From the Brooklyn end of the Williamsburg Bridge to Delancy Street and the Bowery, and thence down Park Row, Nassau Street, Broad Street, and South Street to the Battery. The original plan of the syndicate was to run the line only down to Wall Street, and later there was a suggestion of following Broadway to the Battery, but this last, of course, was impossible in view of the Brooklyn extension of the subway system. If the Aldermen and Board of Estimate approve the route, as the committee expects them to do without delay, it is planned to start the tunnel work early next spring. Provided Schmidt & Gallatin do get the contract for their company under the terms they suggested they will have to carry passengers for 2 cents. At first they said they would rent a city-built tunnel and charge a 1-cent fare, but their last proposal was for themselves to build the subway for the city and then to charge 2 cents a ticket. They added that they would include platforms for the Brooklyn Bridge for a 2-cent fare.

SYRACUSE SERVICE APPRECIATED

The Post Standard, of Syracuse, takes occasion in announcing the meeting of the State Association to be held in that city next week, to record its appreciation of the excellent transportation facilities afforded the community by the local company. Editorially the Post Standard says:

"The situation prevailing in Syracuse is not only harmonious between municipal officials and the street railway companies as far as the general welfare and accommodation of the public are concerned, but the companies are vigilant in promptly improving their service to meet reasonable demands."

PROGRESS ON THE NEW YORK SUBWAY

A report upon the progress of the subway work has been made to the Rapid Transit Commissioners by Mr. Parsons, chief engineer, who has also made a brief report concerning method of construction. The work of excavation, including the work at Fort George and the Harlem tunnel, is 97 per cent completed, and practically all of the 3 per cent of incomplete work is at the two points just mentioned. South of One Hundred and Twenty-Fifth Street thirty days will see all the excavations completed. Of the construction 75 per cent is completed and installed. Fully three-fourths of the remaining 25 per cent is well in hand. The strike on the power house is what delayed work most. Tracks have been laid from Grand Street to Twenty-Third Street, and ballasted from Twenty-Third Street to Thirty-Third Street. From Forty-Seventh Street to Sixty-Fifth Street the tracks are ready for cars. Requisition has been made by the contractor for the payment of $941,000 for regular work to August 31 last, and for $177,148 for extra work covering a period of something more than a month.

FOUR-TRACK ELECTRIC RAILWAY BETWEEN PHILADELPHIA AND ATLANTIC CITY

Wilbur F. Sadler, Jr., the well-known electric railway promoter and operator, of Trenton, N. J., has completed plans for building a high-speed electric railway between Philadelphia and Atlantic City. Within the past few days he has announced that work will soon begin under the charter issued to the Delaware River & Atlantic Railroad Company on July 11, 1899. This charter has been kept alive through work done and an extension granted by the Legislature. More than $194,000 has been expended for the charter and construction work done to hold the charter, and it is understood that it stands Mr. Sadler and his associates in more than $200,000.

Work will be begun in Gloucester City and extend straight across New Jersey for 52 miles to Atlantic City. Four tracks are to be laid, two of which will be used for passenger and two for freight business. The freight tracks may also be used for fast express trains at certain hours of the day. It has not been definitely decided whether to use the third-rail system or overhead trolley, much depending upon the number of grade crossings encountered. L. C. Thompson, president of the Philadelphia & Western Railroad, who has been associated with Mr. Sadler for years in the electric railway business, told a representative of the STREET RAILWAY JOURNAL that the form of construction will be decided soon. His opinion is that the overhead trolley will be adopted.

Large cars (exact type not yet decided) will be used, and they will be built for speeds of from 65 miles to 75 miles per hour. They will be equipped with the multiple-unit system of control, and the 52 miles between the cities will be covered in about 50 minutes, by express cars, and in about 1½ hours to 2 hours by accommodation cars or trains. The power house will be located midway between the two cities. The high-tension system of distribution will probably be installed, although the other Sadler plants are all direct current.

Three ferryboats will be operated between Gloucester City and Philadelphia, and passengers will be landed at a point midway between the Pennsylvania and Reading ferry terminals. The company has a title to the Philadelphia property, and has plans under way for the construction of ferryboats. At the Atlantic City end of the line rights have been secured which will enable the company to land passengers in the center of the city, it is said. The total cost of the road will be not less than $9,000,000. The rates of fare, etc., have not been decided upon, as yet, but will undoubtedly be much lower than the steam railroads. With the several lines mentioned and the Delaware Valley Traction Company in the hands of the Sadlers, and charters for lines in Philadelphia, the entire territory contiguous to Philadelphia will be covered with a network of electric railways.

TWO FIRES CRIPPLE PUGET SOUND ROADS

The transformer house of the Snoqualmie Falls Power Company was destroyed by fire Sept. 16. This house was located at Snoqualmie Falls and contained the step-up transformers for all the 33,000-volt transmission lines to Seattle and Tacoma supplied from the Snoqualmie Falls plant.

A short time after a big fire broke out in the top floor of the Post Street station of the Seattle Electric Company, where the storage battery cells were located.

The machinery on the lower floors was unharmed. The lead-lined wood tanks had the wood burned and the window casings were burned, but the battery was not so severely injured but that it can be put in service when the electrolyte (which was somewhat diluted by the fire department) is renewed. The loss of Snoqualmie power was felt the most by the Seattle-Tacoma interurban. Seattle service was not interrupted.

PERSONAL MENTION

MR. H. L. SMITH, superintendent of the Central Market Street Railway Company, of Columbus, Ohio, has resigned to become superintendent of the Columbus, Delaware & Marion Railway.

MR. CHARLES WASON, president of the Cleveland, Painesville & Eastern Railway Company, has returned from a tour around the world, covering a period of more than a year. He spent several months in Japan, and was much impressed with the industrial development in that country.

MR. H. S. WILGUS has been appointed principal assistant engineer, with complete charge of track and maintenance of way of the Brooklyn Rapid Transit Company. Mr. Wilgus was formeraly connected with the Pennsylvania Railroad, and is a brother of Mr. W. J. Wilgus, fourth vice-president of the New York Central & Hudson River Railroad.

MR. HOWARD ABEL has been appointed controller of the Brooklyn Rapid Transit Company in place of Mr. W. B. Longyear, who has resigned. Mr. Abel is an Englishman by birth, having been born in 1868, at Strenall, near York. After being connected with railroad and industrial enterprises in his native country, he came to the United States in 1890, and entered the employ of the Fox Solid Pressed Steel Company, at Joliet, Ill. Mr. Abel became connected with Mr. Charles T. Yerkes in 1893, and has been president of the Lake Street Elevated Railroad, and secretary and treasurer of the Northwestern Elevated Railroad and Union Loop, of Chicago. He has also been connected with Mr. Yerkes' London enterprises.

MR. FRED T. POMEROY, heretofore treasurer and general manager of the Cleveland & Southwestern Traction Company, of Cleveland, Ohio, has been elected to the presidency of that company in place of his father, A. H. Pomeroy, who retires from business on account of ill health. The former will continue to fill the position of general manager. The position of treasurer will be filled by Mr. F. L. Fuller, while Mr. J. O. Wilson, formerly general passenger agent, has been elected assistant treasurer. Nearly twenty years ago Mr. A. H. Pomeroy built a horse car line in Berea, Ohio, which in later years was extended to Cleveland and formed the nucleus for the now immense system of interurban roads controlled by the Pomeroy-Mandelbaum interests.

MR. S. W. CHILDS has just reached New York from Western Australia, where he went in 1901 to supervise the construction of the Kalgoorie electric railway for a London syndicate. The contractors for the work were J. G. White & Co., of London, and Mr. Childs represented the owners. After the line was completed Mr. Childs operated it for a short time as general manager. At the conclusion of the engagement his work had been so satisfactory to the citizens that he was tendered a public dinner. The Mayors of Kalgoorie and Boulder, the two cities connected by the line, were present at the banquet. Before its conclusion Mr. Childs was presented with an engrossed address testifying to the appreciation of the residents of the two cities of his courtesy and ability in carrying out the work in a way that was agreeable to all concerned. After leaving Kalgoorie, April 6, 1903, Mr. Childs visited New Zealand, Hong Kong, Japan and the Philippines. He intends to spend the winter in or near New York. Three years ago Mr. Childs built an electric road at Perth, Western Australia. He has also been engaged on electric construction in this country, the last work having been in connection with the Toledo & Monroe Electric Railway, some three years ago.

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. *b* Including all properties.

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., Aug. '03	97,538	48,268	49,271	22,127	27,145
	1 " " '02	84,340	42,191	42,149	16 904	25 245
	8 " " '03	581,584	307,971	273,614	178,057	95,558
	8 " " '02	484,407	268,141	216,266	132,059	84,207
ALBANY, N. Y.						
United Traction Co.	12 m., June '03	1,624,305	1,076,847	547,457	299,138	248,319
	12 " " '02	1,479,608	1,004,917	474,691	272,096	202,595
AURORA, ILL.						
Elgin, Aurora & Southern Traction Co.	2 m., Aug. '03	42,176	------	------	------	------
	1 " " '02	39,634	------	------	------	------
	8 " " '03	300,477	------	------	------	------
	8 " " '02	266,562	------	------	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Aug. '03	25,372	12,052	13,321	------	------
	1 " " '02	23 517	12,324	11,223	------	------
	2 " " '03	51,575	23,341	28,234	------	------
	2 " " '02	46,816	23,522	23,294	------	------
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	12 m., June '03	13,557,814	7,931,079	5,626,735	4,870,338	756,397
	12 " " '02	12,788,168	8,209,397	1,578,771	4,559,878	18,893
BUFFALO, N. Y.						
International Tr. Co.	1 m., July '03	390,414	190,490	199,924	131 990	64 934
	1 " " '02	328,628	162,179	166,449	127,393	39,056
	2 " " '03	713,542	367,425	346,087	265,518	80,569
	2 " " '02	599,8 4	309,793	290,081	253,534	36,547
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Aug. '03	30,465	8,746	21,719	------	------
	1 " " '02	25,530	7,221	18,309	------	------
	8 " " '03	153,715	57,116	96,600	------	------
	8 " " '02	128,060	52,859	75,201	------	------
Metropolitan Elevated Ry. Co	6 m., Aug. '03	1,006,981	------	------	------	------
	6 " " '02	950,959	------	------	------	------
CINCINNATI, O.						
Cincinnati, Newport & Covington Light & Traction Co.	1 m., July '03	109,007	59,698	49,309	20,929	28,380
	1 " " '02	91,977	50,414	41,563	21,671	19 892
	8 " " '03	682,391	398,663	283 728	147,184	136,544
	8 " " '02	611,218	347,399	263,818	147,636	116,182
CLEVELAND, O.						
Cleveland & Southwestern Traction Co	1 m., Aug. '03	46,535	25,990	20,545	------	------
	8 " " '03	287,073	69,409	117,664	------	------
Cleveland, Painesville & Eastern R. R. Co.	1 m., Aug. '03	24,043	13,377	10,665	------	------
	1 " " '02	24,787	12,823	11,964	------	------
	8 " " '03	141,862	81,036	60,828	------	------
	8 " " '02	132,498	73,463	59,035	------	------
DETROIT, MICH.						
Detroit United Ry *b*.	1 m., Aug. '03	430,359	*245,180	185,179	84,167	101,012
	1 " " '02	402,013	*212,112	189,931	79,583	110,348
	8 " " '03	2,919,981	*1713881	1,206,100	659,554	546,546
	8 " " '02	2,613,020	*1463754	1,149,266	621, 960	527,306
DULUTH, MINN.						
Duluth Superior Traction Co	1 m., Aug. '03	57,880	27,309	30,572	10,865	19,707
	1 " " '02	51,457	26,505	24,952	9,671	15,282
	8 " " '03	413,684	228,947	184,737	83,253	101,484
	8 " " 02	349,496	183,903	165,592	77,200	88,393
FORT WORTH, TEX.						
Northern Texas Traction Co.	1 m., Aug. '03	43,860	22,162	20,698	9,673	11,025
	8 " " '03	293,318	156,135	137,213	72,816	64,397
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Aug. '03	56,545	26,277	30,267	16,137	14,130
	1 " " '02	49,301	24,483	24,819	16,280	8,539
	3 " " '03	154,678	76,186	78,493	48,291	30 202
	3 " " '02	140,412	68,156	72,256	48,990	23,266
HARRISBURG, PA.						
Central Pennsylvania Traction Co	1 m., Aug. '03	50,201	39,758	10,443	------	------
	1 " " '02	46,664	27,188	19,476	------	------
	8 " " '03	345,390	237,419	107,971	------	------
	8 " " '02	306,148	183,415	122,733	------	------
HAZLETON, PA.						
Lehigh Traction Co.	1 m., Aug. '03	14.807	7,209	7,598	------	------
	1 " " '02	7,686	4,320	3,366	------	------
	2 " " '03	29,284	13.180	16,104	------	------
	2 " " '02	14,856	9,583	5,274	------	------
HOUSTON, TEX.						
Houston Electric Co.	1 m., July '03	40,132	22 669	17,463	6,773	10,690
	1 " " '02	30,836	17,333	13,502	6,250	7,252
	2 " " '03	77,369	44,646	32,724	13,486	19,238
	2 " " '02	62,735	34,012	28,722	12,500	16,222
LIMA, O.						
Western Ohio Ry. Co.	1 m., Aug. '03	25,941	10,947	14,994	10,637	4,357
	2 " " '03	50,447	21,724	28,723	21,262	7,461
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Aug. '03	265,915	138,806	137,109	74,440	62,669
	1 " " '02	243,345	112,540	130,805	68,677	62,128
	8 " " '03	1,973,091	993,021	980,069	574,271	405,799
	8 " " '02	1,755,350	835,772	919,578	526,219	393,359
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Aug. '03	365,466	155,554	209,912	60,937	148,974
	1 " " '02	323,534	137,969	185,564	60,233	135,331
	8 " " '03	2,648,591	1,241,964	1,406,627	487,193	919,434
	8 " " '02	2,327,426	1,060,709	1,266,716	470,500	796,216
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Aug. '03	211,8'6	109.159	102,657	21,415	81,242
	1 " " '02	199,405	100,086	99 319	22,950	76 368
	11 " " '03	1,999,994	1,218,969	781,025	210.779	570,247
	11 " " '02	1,843,241	1,040,946	802,295	187,177	615,117
OLEAN, N. Y.						
Olean Street Ry. Co.	1 m., July '03	9,521	3,614	5,907	2,088	3,819
	1 " " '02	6,769	3,216	3,353	1,771	1,582
	2 " " '03	16,956	7,372	9,585	4,464	5,121
	2 " " '02	12,523	5,423	7,100	3,539	3,561
PHILADELPHIA, PA.						
American Railways.	1 m., Aug. '03	144,209	------	------	------	------
	1 " " '02	125 289	------	------	------	------
	2 " " '03	287,246	------	------	------	------
	2 " " '02	245,579	------	------	------	------
Philadelphia Rapid Transit Co	12 " June '03	15,436,573	7,234,893	8,201,680	7,795,792	405,889
	12 " " '02	14,118,158	6,402,338	7,715,820	6,637,781	1,078,039
POTTSVILLE, PA.						
Pottsville Union Traction Co	1 m., Aug. '03	22,344	------	------	------	------
	1 " " '02	17,156	------	------	------	------
	8 " " '03	129 161	------	------	------	------
	8 " " '02	110,353	------	------	------	------
Pueblo Suburban Traction & Lighting Co	1 m., July '03	44,222	------	------	------	------
	7 " " '03	277,172	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Aug. '03	117,607	57,108	60,550	25,942	34,558
	1 " " '02	102,420	52,168	50,252	25,063	25,189
	3 " " '03	338,670	164,721	173,950	77,485	96,464
	3 " " '02	292,038	148,888	143,150	74,674	68,476
ST. LOUIS, MO.						
St. Louis Transit Co.	1 m., Aug. '03	659,535	------	------	------	------
	1 " " '02	579,575	------	------	------	------
	8 " " '03	4 766,703	------	------	------	------
	8 " " '02	4,169,335	------	------	------	------
SAO PAULO, BRAZIL.						
Sao Paulo Tramway, Light & Power Co., Ltd	1 m., July '03	100,500	33,500	67,000	------	------
	1 " " '02	91,157	34,230	56,927	------	------
	7 " " '03	732,864	228,516	504,348	------	------
	7 " " '02	------	------	383,813	------	------
SEATTLE, WASH.						
Seattle Electric Co.	1 m., July '03	184,931	123,713	61,150	23,064	38,086
	1 " " '02	157,838	108,245	49,593	19,699	29,894
	2 " " '03	360,444	241,327	119,117	47,117	72,001
	2 " " '02	309,155	219,577	91,579	41,256	50,323
TERRE HAUTE, IND.						
Terre Haute Elec. Co.	1 m., July '03	42.044	25,257	16,787	6,538	10,228
	1 " " '02	27,802	21,268	6,534	6,430	105
	2 " " '03	80,529	49,623	30,906	13,118	17,787
	2 " " '02	52,938	40,994	11,943	12,710	† 766
TOLEDO, O.						
Toledo Rys. & Lt. Co.	1 m., Aug. '03	150,515	76,231	74,284	41,571	32,713
	1 " " '02	138,642	69,889	68,753	38,899	29,854
	8 " " '03	1,075,918	552,937	522,981	325,432	197,549
	8 " " '02	941,419	484,587	456,832	303,787	153,045
Toledo, Bowling Green & Southern Trac. Co.	1 m., Aug. '03	28,364	17,051	11,314	5,625	5.689
	8 " " '03	188,478	117,200	71,278	45,000	26,278
Lake Shore Electric Ry. Co	1 m., Aug. '03	77,326	35,060	42,266	20,000	22,266
	1 " " '02	47,968	26,321	21,647	20,000	1,647
	8 " " '03	404,415	254,497	149,918	------	------
	8 " " '02	296,523	185,233	111,290	------	------
UTICA, N. Y.						
Utica & Mohawk Valley Ry. Co.	1 m., Aug. '03	73,261	------	------	------	------
	1 " " '02	62,489	------	------	------	------
YOUNGSTOWN, O.						
Youngstown - Sharon Railway & Light Co.	1 m., Aug. '03	45,961	*24,500	21,461	------	------
	8 " " '03	339,439	*201,395	138,045	------	------