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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 393,900 copies, an average of 8206 copies per week.

Official Inspection Trips

The increased amount of traveling which is falling to the lot of many street railway officials in these days signifies that the field of electric railway practice is becoming world-wide in its scope and is a distinct evidence of healthful progress. While it is pre-eminently the function of the technical press to spread abroad much information which would otherwise probably never reach the busy official, it often happens that the purchase of car equipment by a company, the adoption of special methods of operation or the need of a close personal conference with the manufacturing engineers calls for a trip away from home which is in the long run thoroughly broadening. Sometimes an article in a technical journal may be the fundamental cause of such a trip, for it is frequently the case that a large company contemplating new equipment desires to send its officials to points where advance information may be gleaned from others' experience.

No progressive manager in these days fails to approve the good work done by the convention trip, as far as department heads can be spared. Legitimate traveling of any kind is enlarging to the official horizon, and it ought to be a cause for satisfaction that so much can be learned from the operation of even differently constituted systems. An occasional trip to the factory is one of the most stimulating things which a motive-power official can do.

Conventions and Traffic Stimulation

That the meeting of a great convention in a city means a very considerable stimulation of traffic on the local trolley lines is understood, and it is a question if it is not desirable for street railway men to use their influence more than in the past to induce national organizations of one kind or another to meet in their territory. The boards of trade in many American cities are keenly alive to the business which accompanies a large convention, and we believe that street railways ought not to be backward in letting their advantages be known at times when conventions are in prospect.

Even in large cities, delegates of conventions will be found sprinkled around in the local street cars at all sorts of times and places, when a meeting is in progress. At the convention of the American Medical Association in Boston, this last summer, the business was of sufficient consequence to lead the Boston Elevated to establish a temporary short interval car service between the Mechanics Hall building and the railroad ticket validation offices in the business district; and during the convention this fall of the Bridge and Building Railway Superintendents in the same city, trolley parties through the historic portions of the Hub and its suburbs were a part of the regular program. Good car service is more of a factor in the success and enjoyment of a convention than is ordinarily realized. The best time, of course, to put in a plea for a meeting in a given city is either at or soon after the convention of a year ahead; then neat booklets including a pithy description of the rapid transit facilities, along with the songs of praise which tell of the general advantages of a city, can be circulated, or perhaps the personal influence of some responsible official of the company can be brought to bear, together with that of the board of trade. And when the convention arrives a great deal of traffic can be stimulated by the judiciously prepared and distributed circular and newspaper advertisement. Both regular and special cars should be vigorously patronized during a convention, if the proper effort is made to bring them to the attention of visitors.

Commutator and Brush Inspection Through Trap Doors

Within the last few years the general tendency in car construction has been to make no provision for trap doors in the floors over the motors, and thereby force the motor inspector to do all his work from the outside of the car. There is a good reason for this plan. Shop workmen are sometimes not very particular about whether they soil the car or not, and even if they should think of it, the fact that by sitting down on a seat when in their overalls they may rub quite an amount of grease into the plush would not prevent some of them doing so. Even when shop men try to be careful, more or less dirt remains in the car after they have been working on the motor through the trap doors. Again, the presence of trap doors detracts quite a little from the appearance of the interior. This is especially the case when the floor is covered with inlay linoleum, as is frequently done with interurban cars. The doors necessitate cutting the linoleum and it is very difficult to make a neat-appearing fit around them.

But when car bodies are mounted low on the trucks it is very difficult to make a satisfactory inspection of the commutator and brushes from the outside of the car. Sometimes, too, it is highly desirable to observe the action of the brushes while the motor is operating, and there are frequent occasions when it would be of great advantage if the commutator could be seen from above. Under the circumstances it might be well to make a compromise in the matter of trap doors and provide small openings in the floors just large enough so that the commutator and brushes could be seen through them. There would, however, be no necessity for these openings being more than 6 ins. or 8 ins. square, or they might be made circular. These holes would not interfere at all with the arrangement of the seats or of the floor framing, and they would not be large enough to offer any encouragement to the repair man to try to change or adjust brushes from the inside of the car.

The Transposition of High-Tension Wires

An inspection of the data regarding high-tension lines as published in the souvenir issue of the Street Railway Journal shows that, while it is the practice on some systems to transpose the high-tension wires at frequent intervals, on others no transpositions at all are made. Throughout all portions of the country practice is about equally as indefinite. Those who transpose the wires do so from a theoretical standpoint rather than from actually observing any ill effects in systems where the wires are not transposed. In fact, from an operating standpoint, it is safe to say that the effects of transposition are in practically all instances unnoticeable. This fact has led many to believe that the expense entailed and the trouble occasioned in making transpositions was not warranted and they have erected their lines without them. But a theoretical consideration proves beyond a doubt that when the wires are run straight there is an unbalancing or an inductive effect. However minute this effect, it exists nevertheless, and since it does exist an extra amount of fuel is required to get a certain amount of energy to the other end of the line. The additional amount of coal used is, of course, very small. It may amount to only a few shovelfuls per day. The question of how to construct the lines should be reduced to the question of whether or not the cost of this very small amount of fuel is greater or less than the interest and depreciation charges on the additional investment required in transposing the lines.

But difficulties are encountered in solving the problem. While very little trouble is experienced in figuring out the extra investment in the line, it is almost impossible to arrive at definite results as to the amount of coal saved by transposing the wires. The price of a few tons of coal per year would pay investment and depreciation charges on several transpositions, and these few tons per year would amount to only a few extra shovelfuls in the course of a day. This amount is so small that tests of the whole plant would be productive of no reliable data. On the other hand, too much theory would be involved and too many assumptions would have to be made in any attempt to compute the additional amount of coal necessary.

However, if close attention were given to the problem, some method could no doubt be devised to arrive at results that would show conclusively whether we are warranted in going to the expense of making transpositions. In the meantime, since we know definitely that no harm results from making transpositions and we have every reason to believe that economy results from them, it appears that it would in most instances be advisable to make them.

Obscure Causes of Traffic Obstruction

The obstruction of street-car traffic in large cities is due to a number of causes, most of which are quite generally recognized by operating departments. Some of these can be dealt with effectively, and others cannot be altered as long as urban conditions remain as they are. Delays at drawbridges and on account of heavy snow storms or excessive rainfall cannot be helped in most cases, and the loss of time incurred by vehicular and pedestrian interference is exceedingly difficult to reduce. Hence it is held in some quarters that it is almost useless to prepare closely-figured time tables for congested routes, but even if this be true, some sort of a schedule is necessary to prevent confusion in the less crowded districts.

Several less familiar causes of delay were brought out by Mr. Timothy Connell in his car-service paper, published this week. It is well known that cars must not arrive late at different points en route between terminals if the traffic is to be handled smoothly, but it is not so well appreciated that overspeeding of the schedule is a direct cause of delay to following cars. Irregular though the demands of different districts may be, there is always a sort of gravity flow of passengers toward the trolley lines in a large city which accumulates steadily and tends to swamp the accommodations in case the cars are not properly spaced in time intervals. It would be most interesting and instructive if it were possible, by balloon for example, to overlook all the streets of a great city at once and note the centrifugal and centripetal movements of traffic at night and morning, as well as the lateral movements of prospective riders toward the street railway tracks at different hours. It is surprising what a clear idea of the traffic in a busy street can be obtained from the upper stories of a high building. For example, only a few days ago the writer of these lines watched from the seventh floor of an office building the work of several police officers

in clearing a path for a block or two for the fire department apparatus responding to a call, and the clearness with which the whole complicated situation could be appreciated suggested the idea that at times it would be well for street inspectors to study the traffic from such a point of vantage. On the street itself the inspector is a part of the confusion; his range of vision is necessarily limited; whereas if now and then he could look down upon the traffic instead of looking at it sideways, it might be very suggestive. A plan is almost always more easily grasped than an elevation.

Overspeeding in the populous parts of a route leaves an excessive headway to the following cars and tends to overcrowd them as long as the flow of traffic towards the car lines is even. Hence it is most important that cars be run on schedule, rather than ahead of time, thereby leaving heavy freights to the succeeding cars. In this connection the proper spacing of cars where they combine with other routes at junction points deserves careful treatment. Then there is the perennial and well-nigh threadbare question of excessive stops. We have so often pointed out the impossibility of rapid transit with long stops every few hundred feet that only a few words need be said at this time on the matter. A suburban line where in some parts of the route the cars stop three or even four times a minute is an unmitigated annoyance to its passengers. The sum of the whole question is simply that the public desires rapid transit, as does the operating company. In some way the public must be brought to realize that stops cannot be made at every block—at least in the suburbs—and sometimes between, without destroying all attempts at a decently fast schedule. If the public can be induced to consent to the reduction of even a few stops on regular lines it will be better served in the end.

In the Age of Concrete

The once simple matter of building material has come to be a serious puzzle. Lumber, not many years ago to be had for a nominal price, has risen to a figure that renders its use for substantial structures at times almost prohibitive. Each year sees it growing rarer and there is very small prospect that it will for many a generation become perceptibly cheaper as a building material. Within a comparatively short period it has really shown signs of passing from being a general structure material to a mere finishing material. Frame houses there are building in plenty, but such timber and such framing! Stone and brick have risen enormously and the labor cost of handling brick has so increased as to make a huge increment of cost. Hence the immense increase in the use of concrete, which now occupies a very important place in the building world. In view of the extent to which this material is being employed in the construction of power stations, car houses and sub-stations, a discussion of some of its properties may not be out of place.

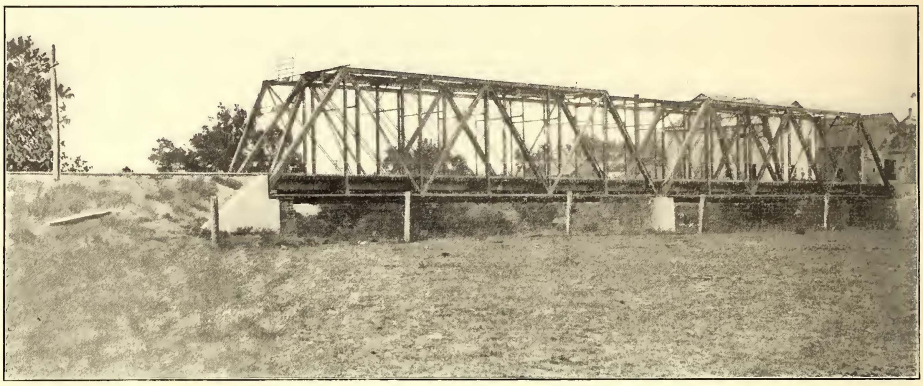
In the first place it is perhaps desirable, though needless in the case of those who have had experience with concrete, to utter a word of warning that when formed *en masse* concrete cannot be left to build itself. It requires perhaps a little more careful engineering than other building materials, since it does not possess its full structural strength when put in place and varies very greatly in properties according to its composition. One can have as sorry an object lesson in jerry building with concrete as with any other material, and unless we mistake greatly the opportunities for receiving it increase daily. Precious little is accurately known about the theory of cement from the chemical standpoint, as witness the radical change of view made necessary by some very recent researches. On the purely practical side one finds a great variety of grades which for the most part are indistinguishable in quality save by testing. Any experienced builder can pass upon lumber or brick, but the shrewdest judge may fail on concrete until he has tried it thoroughly. One cannot easily escape the chance of low-grade concrete save by eternal vigilance. This, in fact, is a necessary failing with any material formed in bulk and of somewhat dubious quality until after a considerable interval of time.

It takes no little skill and experience to draw proper specifications for concrete and its reinforcement, and while the product is admirable for many purposes, it does not meet all the requirements for a universal building material. The increasing use of concrete block in various forms seems one of the most hopeful directions for improvement. The last word has not been said in this matter yet, and we look for very great progress in the way of lighter and cheaper structural units, possessing the desirable qualities of brick for general use at a lower cost both for material and labor. There are many possibilities, too, in the composite structures involving the use of both block and molded concrete with reinforcement when necessary.

It is not merely the modern steel-framed building that is in question, for with the increasing scarcity of lumber and the rapidly rising costs of brick and labor the general building problem is getting very serious. More and more private houses are being constructed of concrete in one way and another. The methods, however, that have been worked out for office buildings need modification for this wider use, and in spite of the capital work already done there is plenty of room for improvement. The attention of engineers should certainly be directed toward working out the very great possibilities of composite structures, especially with reference to buildings of the smaller classes. The mere matter of fire risks should compel a study of all the various possibilities for replacing wood in general structural work by fireproof material. It would richly pay the fire insurance companies to back an exhaustive investigation of the question. The losses of a single year on wooden buildings are more than enough to cover the cost of determining a radical change in the interest of both safety and economy. Our American cities, at least as regards the suburban portions, are mere tinder boxes, and a conflagration like that in Baltimore shows the danger of the old and the relative safety of the new constructions with overwhelming force. So long as timber even of the poorest quality is cheaper by a considerable margin than other building material it will be used at whatever risk. It is only by the persistent development of recent methods of building in the direction of low cost that the general use of fireproof construction can be secured. Much, therefore, as we value the work of the past few years in improvement, we cannot refrain from reiterating that the work is only half done while a very large class of structures still remains economically untouched and given over to dangerous precedents.

STANDARDS OF CONSTRUCTION OF THE FORT WAYNE & WABASH VALLEY TRACTION COMPANY

The engineering department of the Fort Wayne & Wabash Valley Traction Company has within the last few years developed standards of construction which embody its latest practice in interurban and steam railway work. As the standards are well typified in the construction of the line recently built between Fort Wayne and Bluffton, Ind., a description of some of the features of this road is of general interest.



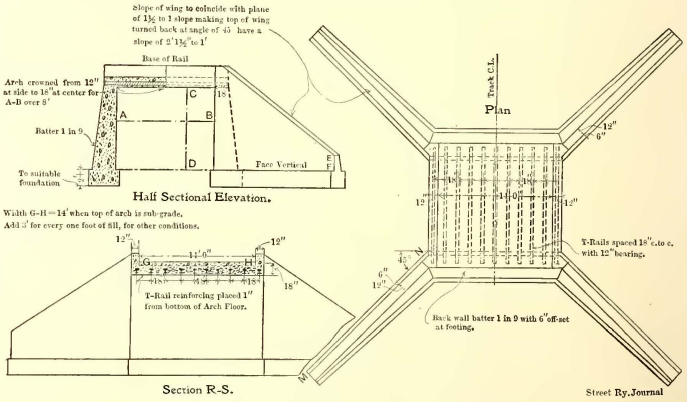
BRIDGE OVER THE WABASH RIVER AT BLUFFTON

The Bluffton line is owned by the Fort Wayne, Bluffton & Marion Traction Company, which, in turn, is controlled by the Fort Wayne & Wabash Valley Traction Company. This latter company, moreover, has had charge of the construction of the road and is operating it at the present time. It is through the courtesy of C. D. Emmons, general manager, and H. L. Weber, chief engineer of the Fort Wayne & Wabash Valley Traction Company, that this publication is enabled to publish the following account of the line.

The road extends due south of Fort Wayne a distance of 25 miles. Bluffton, the southern terminus, is a city with a population of about 6000 people. The only intermediate towns of consequence on the line are Ferguson, Yoder, Ossian and Kingsland, each of which contains only a few hundred inhabitants. The surrounding farming country, however, is rich and the farmers are, as a rule, prosperous and of a class having frequent occasion to use the interurban system.

The line is constructed on private right of way throughout its entire length, and for the greater portion of the distance it parallels the tracks of the Lake Erie & Western Railroad. In the region through which the line was constructed the ground is generally level, so much so, in fact, that a comparatively small amount of grading was necessary. One of the two steel bridges over which the track is carried crosses the Wabash River at Bluffton. It consists of two spans each 115 ft. long and was designed to support a loading of a train of 100-ton electric locomotives, as are all the bridges now being erected by the operating company. In the city limits of Fort Wayne is the only other steel structure on the line. This bridge, which is also used as a wagon and foot bridge, crosses the St. Joseph River.

Where small streams are crossed by the line, concrete culverts are invariably employed. These vary in size from those with barrels 2 ft. in diameter to one located near Bluffton with a 12-ft. barrel. The general design of the culverts is shown in an accompanying drawing. The plans shown are for a fill of 1 ft. For every additional foot of fill 3 ft. was added to the barrel of the arch. It may be noted in the drawing that the smaller culverts, those up to 4 ft. in diameter, were constructed with circular barrels. The company had on hand a quantity of old 56-lb. standard section rails, and considerable economy in masonry construction was effected by utilizing these in the construction of "rail-top culverts." The rails were used to reinforce the flat top of the culverts by laying them on concrete retaining walls parallel to the track and with 18-in. centers.



STANDARD PLAN FOR FLAT RAIL TOP CULVERT

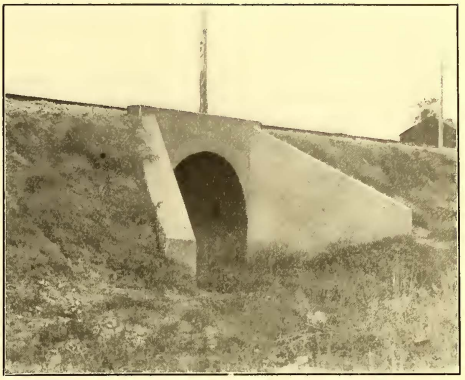
With regard to the width of the roadway steam road practice was approximated more closely than is the custom in interurban railway construction. In cuts on either side of a 16-ft. roadway are ditches 2 ft. in depth and 2 ft. wide

at the bottom. A width of 16 ft. at the top of fills assures of practically no ballast being wasted by falling down the banks.

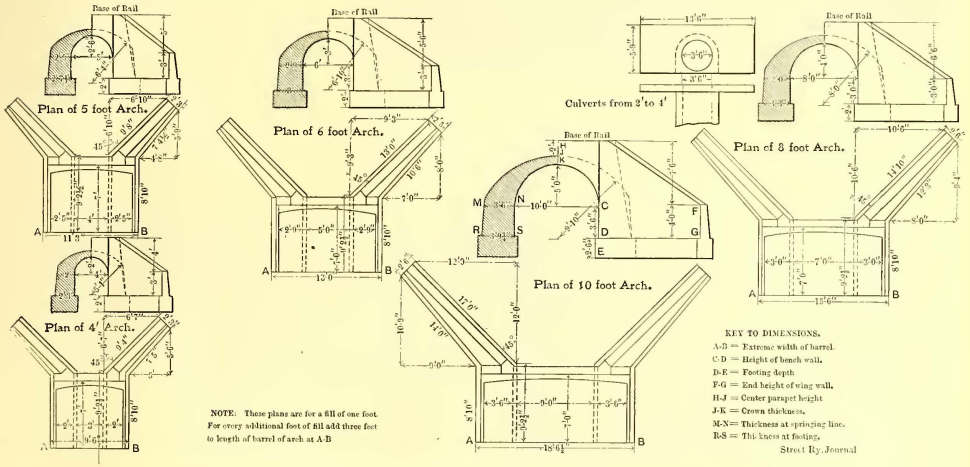
Throughout the length of the road the track is ballasted with 8 ins. of broken rock under the ties. Oak ties of standard size, 6 ins. x 8 ins. x 8 ft. are used and 70-lb. A. S. C. E. section rails in 30-ft. and 33-ft. lengths are employed. The joints are laid broken and are made by means of Cambria standard angle-plates and six-hole and four-hole continuous rail joints. In cities, however, 6-in., 72-lb. and 7-in., 70-lb. rails are used.

Sidings are located at intervals of about 3 miles. These are of the stub end type and measure 150 ft. long in the clear. They are provided with throw switches and are lighted by electricity.

The maximum grade is about 1½ per cent, while there are no curve outside of the city limits greater than 4 degs. The engineering department of the operating company has given considerable attention to the question of the construction of curves and the alignment of the trolley at the curves, and



A 12-FT. CONCRETE CULVERT NEAR BLUFFTON



PLANS OF STANDARD CONCRETE ARCH

POLE TOP, SHOWING LIGHTNING ARRESTER TOP AND METHOD OF MAKING FEEDER TAP

specific field instructions giving full directions for laying out curves are issued in blue-print form. In general curves are spiraled and are constructed for a speed of 50 m. p. h. The length of the spiral is 60 ft. for each degree of curvature. The inner rail is not depressed, but all the super-elevation of the outer rail is obtained by raising it above its normal level. This is shown in the diagram on page 1036, taken from the sheet of field instructions for laying out curves. The sketch also shows the method of aligning the trolley. This is always kept in the perpendicular erected at the center line of the track, and the deviation from the normal position is obtained by multiplying the gage of the track by the elevation of the outer rail and dividing the product by the height of the trolley above the rail.

As in practically all new work in Indiana, bracket trolley construction is employed. However, on curves for three or four poles span wire construction is resorted to, as

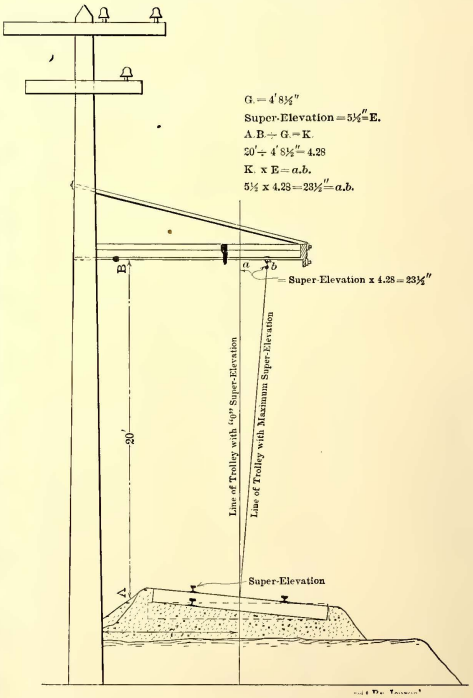
shown in one of the illustrations. On tangents bracket arms are 7 ft. long, but on curves a 10-ft. arm is required because of the method adopted in the alignment of the trolley.

WAY STATION AT COUNTRY LINE

cross-arm carrying the feeder and telephone wires in that arm. This is placed just below the bracket arm instead of above it. The position of the cross-arm, together with the fact that the feeder is located on the side of the pole nearest the track, made possible the stringing of the feeder from a car with the least amount of labor. The feeder is carried the full length of the line and is tapped in on the trolley at intervals of 1300 ft. by means of a special feed-in hanger. The method of making the tap is well shown in an illustration on page 1035, which also shows the manner in which the lightning arrester lead is tapped on to the feeder. The arresters, which are placed four to the mile, are grounded by means of a No. 4 bare wire to a plate on the bottom of the pole.

All stations, section houses, stock guards, outhouses and signs have been erected according to adopted standards. The standard stations are constructed in sizes measuring 8 ft. x 8 ft., 8 ft. x 10 ft., 10 ft. x 12 ft., and 12 ft. x 14 ft. The one shown in an accompanying illustration is of the smallest size, and cost

VIEW SHOWING DEPTH OF BALLAST AND TROLLEY CONSTRUCTION ON CURVES



STANDARD CROSS-SECTION, SHOWING RAIL ELEVATION ON CURVES

The poles between Fort Wayne and a point a few miles north of Bluffton are all 40 ft. long and carry high-tension cross-arms for two circuits arranged in a triangle. A deviation from the usual practice is made in the location of the

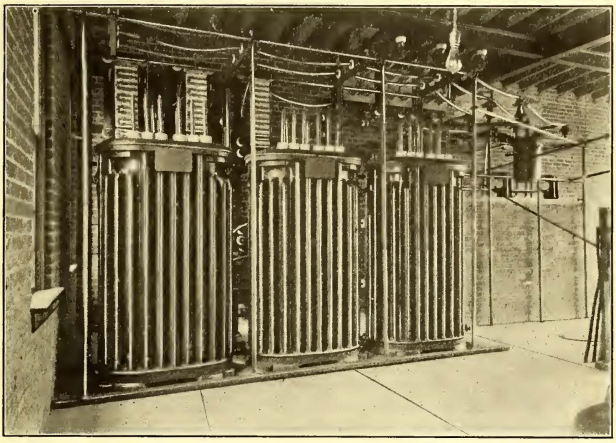
complete approximately $85. The roof, which has a pitch of 1 to 3, has an overhang of 3 ft. To prevent breakage of glass the windows are covered with a heavy wire mesh. The shingled roof is painted red, while the body is of

lemon yellow with white trimmings. Inside the station is a switch for operating the "car stop" signal lamps on a pole near by. All highway crossings are protected by means of "watch, look, listen" signs of the triangular type usually found at steam road crossings. In addition to a pole number every fifth pole has painted upon it the distance in miles to each terminal.

POWER SUPPLY AND SUB-STATIONS

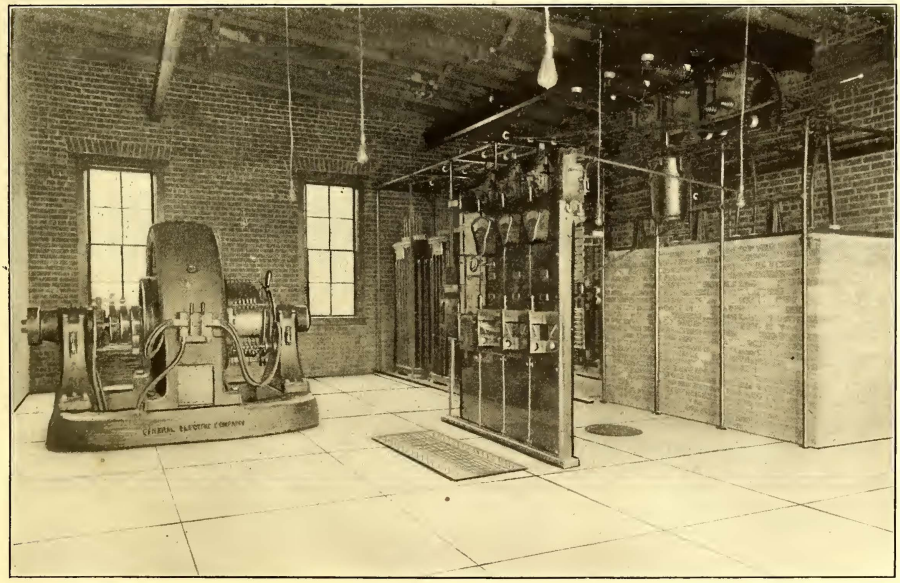
A new power station, the plans of which were published in the STREET RAILWAY JOURNAL, Oct. 13, 1906, is being built in Fort Wayne by the holding company, and eventually this station will supply power to operate the line. At the present time power is obtained from an old generating station in Fort Wayne. The only sub-station on the line is located at Yoder, a small town 11 miles out of Fort Wayne and 14 miles distant from Bluffton. The single high-tension line from the generating station in Fort Wayne is carried on beyond the Yoder sub-station to Kingsland, which is about 5 miles north of Bluffton, with the idea of eventually installing another sub-station near the southern terminus. The plan upon which the sub-station is erected provides for the employment of one man as sub-station operator, passenger and ticket agent. The rear of the low brick building is occupied entirely by the sub-station. On one side of a central passageway leading from the sub-station room to the front of the building is the passenger waiting room and on the other side is a freight room. The switchboard in the sub-station is so located that the breakers and instruments can be observed from the passageway which serves as an office.

At the present time only one of the two 300-kw rotary converters for which the station was designed is installed. All of the apparatus is installed in one room, and its arrangement



TRANSFORMERS AND SWITCHES IN THE YODER SUB-STATION

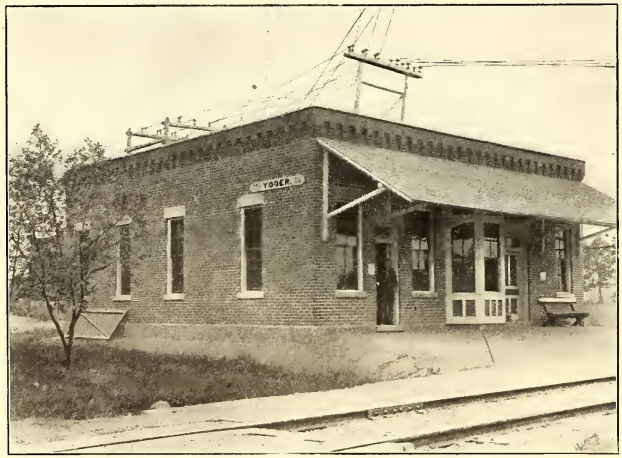
may be seen by referring to an accompanying reproduction. The high-tension wires at 16,000 volts and 25 cycles enter the rear wall of the building through Locke wall insulators, and after passing through knife disconnecting switches drop to the hand-operated oil switches immediately below. The outgoing leads from the oil switches are carried on an iron pipe framework to oil-cooled transformers installed over a concrete pit underneath the floor. This pit extends across the building in such a manner that the walls serve as a foundation for the rotary converter, and all of the leads between the



INTERIOR OF YODER SUB-STATION, SHOWING THE RELATIVE CONSTRUCTION OF THE APPARATUS

converter, the transformers and the switchboard are carried in it in such a manner as to be easily accessible should occasion ever require. The switches, transformers and rotary converter and practically all of the apparatus in the substation is of General Electric manufacture.

Aside from its construction features, the line described is of additional interest because of the fact that it forms a part of a more direct route between Indianapolis and Fort Wayne than that over which through service is being given at the present time. The present route by way of Kokomo, Peru and Wabash is 148 miles. The new route by way of Anderson, Muncie and Bluffton, of which the line described is the northern section, is about 20 miles shorter.



FREIGHT AND TICKET OFFICE SUB-STATION AT YODER

NEW POWER STATION AT BIRMINGHAM, ENGLAND

One of the most modern stations in England is that recently completed by the corporation of Birmingham and formally inaugurated Oct. 10. The station was designed by R. A. Chattock, city engineer, and is designed to supply d. c. power to the tramway system within two miles of the generating station, 5000-volt three-phase alternating-current supply to sub-stations in the outlying districts of the city, and direct-current supply at 220 and 440 volts for commercial lighting and power. The building is 275 ft. long and is divided into three sections, viz: the engine room 100 ft. wide, the boiler room 89 ft. wide, and the economizer house 47 ft. wide, all of which extend the entire length of the building. Space has been provided for additional equipment. The present installation has a capacity of 11,500 kw, divided into 7000 kw d. c. and 2400 kw a. c. The ultimate capacity will be 26,500 kw, divided into 13,000 kw d. c. and 13,500 kw a. c.

ENGINES

There are six Bellis engines with cylinder dimensions of 25 ins., 36½ ins. and 55 ins. x 33 ins. stroke, each driving a 1500-kw generator, four of which are d. c. type and of the Dick-Kerr make, and two are alternators supplied by the British Westinghouse Company. In addition there are three 1000-hp Bellis engines, each operating a 625-kw British Westinghouse alternator, and two 180-hp engines of the same make driving General Electric exciters. Steam is supplied at 180 lbs. pressure, superheated from 100 to 150 deg. F. The engines are arranged to run under condensing conditions, but provision has been made for exhausting to the atmosphere on emergency through automatic exhaust valves. Piston valves are fitted to all cylinders, the high-pressure valves being of the variable expansion type, operated from the governor through a special relay gear by which the cut-off is adjusted to the most economical position. On this plan the power is carried at the higher loads by automatically varying the cut-off, and at the lower loads by throttling, a combination which has been shown to give the best economy on all loads. Extra heavy fly-wheels are used and have a stored energy of 3400 and 4600 ft. tons for the d. c. and a. c. sets respectively. The engines are designed to regulate within 2 per cent from zero load to 25 per cent overload.

Oil is supplied to all the bearings under a pressure of 20 lbs. to 30 lbs. per sq. in. from oil pumps, in duplicate, worked from the high-pressure slide-valve eccentric. The oil is distributed through a continuous system of pipes and channels, and the oil escaping from the bearings drains down into an oil well in the crank pit, from which the oil pumps take their supply. Not only is the oil distributed to the governors, but there are also flow and return pipes in connection with the tail bearings of the electric generators, so that these, too, are supplied with oil under pressure. The oil pumps are of the simple oscillating type, without valves or packings.

Each main engine is provided with its own surface condensing plant, arranged alongside the engine, each plant being proportioned to maintain a vacuum within 3 ins. of the barometer of the condenser with the engine on full load, the vacuum being specified not to fall below 25 ins. at the maximum load of the engine with cooling water at a maximum initial temperature of 85 deg. F. The cooling water is obtained from the adjacent canal, there being a large independent pumping installation for this purpose. The water is distributed to each condensing plant through a circular system of flow and return pipes in the engine house. The exhaust steam before entering the condenser passes through a "Baker" grease extractor, a sluice valve being fitted between oil separator and condenser, so that the condenser may be laid off for cleaning while the engine exhausts to atmosphere. The steam, however, will still pass through the separator, which acts as a silencer. There are 1767 three-quarter-inch brass tubes, an aggregate length of 4 miles of tubing in each condenser, presenting a total cooling surface of 4200 sq. ft. The air pumps are on Edwards' patent principle, three-throw, with pumps 18 ins. diameter by 12 ins. stroke, running at a normal speed of 80 r. p. m., arranged for speeding up to 120 r. p. m., so as to enable each set of air pumps on emergency to serve two main condensers. An interconnecting air-pump suction main is provided for linking up any air pump to each condenser. The air pumps are alternately steam and motor-driven, the two methods of driving being thus equally divided throughout the engine house. These condensing plants and lubricating systems were designed and constructed by Bellis & Morcom, equally with the main engines.

The three 500-kw engines, also supplied by Bellis & Mor-

com, are of their triple-expansion type, and generally similar in design to the larger units. The cylinders are 17 ins., 24 ins. and 37½ ins., with a piston stroke of 18 ins., and the engines run at a speed of 250 r. p. m., driving alternating-current machines. These three engines exhaust into a common surface condenser, which is a duplicate of the plants supplied by the larger engines.

GENERATORS AND AUXILIARY MACHINERY

The four 1500-kw Dick-Kerr direct-current generators already mentioned are sixteen-pole and are compound wound. It is intended to use these machines as ordinary shunt machines for the lighting supply, and as compound machines for the traction supply, the necessary alterations in the connections being effected on the direct-current switchboard.

Two 500-kw steam turbo-generators, built by C. A. Parsons & Company, have also been installed. These turbines, together with two exciter engines, are coupled to a surface condenser and set of motor-driven air pumps, supplied by W. H. Allen, Son & Company, Ltd. The generators coupled to them are shunt-wound direct-current machines, giving a pressure of 460 to 520 volts, and each has an overload capacity of 10 per cent.

The 1500-kw British Westinghouse alternators are of that company's standard type, three-phase, 25 cycles and 5000 volts. The three 500-volt machines are of similar make and type.

The rest of the electrical machinery includes two motor-driven balancers, each of 100-kw capacity, for dealing with the out-of-balance current on the local lighting network; two 25-kw motor-driven three-wire boosters of the same manufacturers to give the necessary increase in pressure on the trunk main supply to the Dale End and Water Street generating stations, and a 200-kw motor generator, all built by the Phœnix Dynamo & Manufacturing Company, Ltd. The 200-kw motor-generator is installed for giving a direct-current supply to the tramway system off the direct-current lighting bus-bars during light load at nighttime after the main traffic has ceased, and consists of a shunt-wound motor driving a compound-wound generator. It is also proposed to install a 200-kw rotary converter and bank of transformers to enable the extra high-tension alternating-current supply to be coupled to the low-tension direct-current supply, in order to avoid running a steam plant on both classes of supply at times of light load. It is also proposed to install a large storage battery, equipped with reversible booster, for equalizing the load upon the direct-current generators used for supplying the tramway system.

CRANE

A large overhead electrically-driven four-motor crane, built by Jessop & Appleby Brothers (Leicester), Ltd., is installed in the engine room. The motors for this crane are series wound and were supplied by the British Westinghouse Electric & Manufacturing Company, Ltd.

SWITCHBOARD

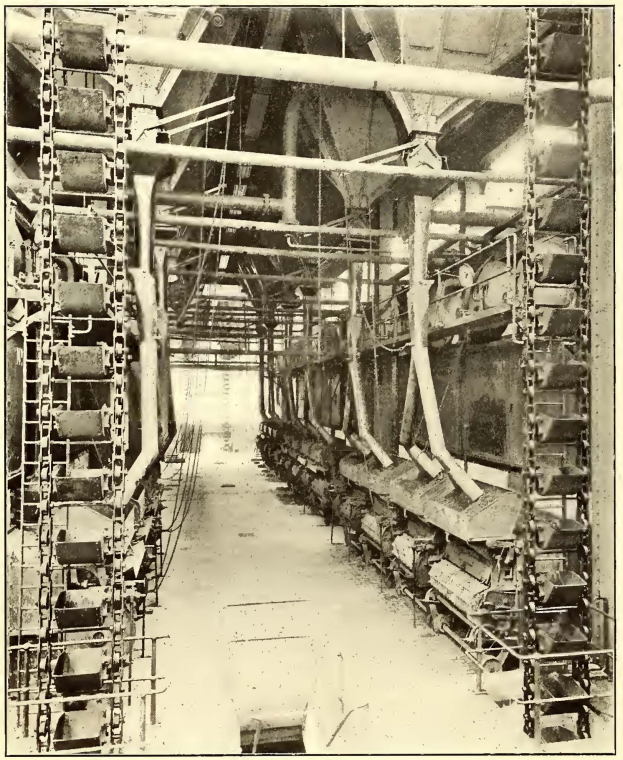
The switchboard problem was quite complicated by the variety of current supplied, by the location of the power station at some distance from the center of distribution and by the nature of the site, which necessitated locating the switchboards across one end of the building in order to bring out the large number of feeders properly to the distributing conduits. The space available was so limited that it was decided to make it double-decked, and in part in two rows facing each other.

ENGINE ROOM, BIRMINGHAM

Each of the main 1500-kw d. c. generators is connected to its panel in the switchboard gallery by nine 91 7/17 cables, three positives, three equalizers or lighting negatives, and three railway negatives. All switches are mounted on the generator panel, which is 7 ft. 6 ins. in height, and is built up of three sections of 2½-in. black enameled slate, on account of the weight of the gear mounted upon it, and of the force required to operate the heavy switches. Each of these panels has the somewhat unusual width of 4 ft. 6 ins. on account of the number of switches required, the size of the copper connections, and the large clearance maintained between opposite polarities and between copper and earth, this being held up to 4 ins. on all bus-bar and main machine connections,

wherever possible. This unusual clearance, which exceeds that on much a. c. gear of twenty times the pressure, has been considered advisable in this case on account of the enormous arc and consequent risk to fitters or operators which would arise in case of a fault across the bars. It also enables insulated spanners to be inserted between the copper conductors at the back to reach any of the heavy contact clamping nuts with minimum risk when the bars are alive, which is more or less essential, as many points of the board with connections to several sets of bus-bars cannot ever be completely killed at any one time.

All switches and circuit-breaking devices for these heavy currents, as well as for all currents on this board from 2000 to 10,000 amps., are of the British T. H. Company's laminated lever or brush toggle types, with finely laminated copper leaf contacts firmly bedded on the opposing surfaces by heavy pressure generally set up by powerful toggle action. When arcing may occur on opening the switch, these brush contacts are protected by solid copper to copper auxiliary contacts, further protected in the case of the circuit breakers by the usual quick-opening wide-break carbon to carbon contacts.



BOILER ROOM, BIRMINGHAM

The alternating-current switch gear is considerably more simple than the d. c. gear, owing to the comparatively small amount of current required for the same power, the much simpler conditions of distribution to be met, and the consequent absence of boosters, simplicity of the bus-bars, and so forth. The a. c. transmission work in Birmingham is unusually free from complications. There are to be seven substations, each to contain converters feeding the lighting and traction systems.

The current is taken from the group of feeder switches through brick flues or uptakes above the engine-room floor to the switchboard gallery, on which are mounted the feeder bus-bars and oil switches in similar artificial stone compartments. These switches are of the hand-operated type, mounted directly behind their panels, and for economy of space are of the triple-pole type, all three poles being handled in one compartment.

The switchboards and instruments were designed and built by the British Thomson-Houston Company, Ltd., with the exception of the indicating instruments, which were made by Elliott Brothers, the whole being carried out to the specifications of R. A. Chattock, chief engineer of the electricity department of the city of Birmingham.

BOILERS

The boilers were supplied by Babcock & Wilcox, Ltd., and are of their well-known "Land" pattern water-tube type. There are ten boilers, each having 6182 sq. ft. of heating surface, constructed for a working pressure of 180 lbs. per sq. in., and containing 280 tubes, arranged in twenty sections, each section have fourteen tubes 18 ft. in length.

Each boiler is fitted with a Babcock & Wilcox superheater, capable of imparting 150 deg. F. of superheat to the steam produced by the boiler, containing also 898 sq. ft. of heating surface, and consisting of eighty-eight solid drawn steel tubes, 1½ ins. in diameter, bent U shape, and connected at both ends to wrought steel boxes or manifolds. The upper box or manifold is connected to the cross drum on the top of the steam and water drums. The middle manifold is connected to a wrought steel box on top of the steam and water drums, forming a steam outlet for the superheaters. Each of the boilers is also fitted with a Babcock & Wilcox patent double mechanical chain grate stoker, each double stoker consisting of two 5-ft. x 10-ft. stokers, giving a total grate area of 100 sq. ft. Each grate consists of an endless chain of short cast-iron grate bars linked together and actuated by passing over drums at the front and rear, the front drum being revolved by a worm and worm wheel.

Each boiler, including mechanical stoker and superheater, is estimated to evaporate 24,000 lbs. of water per hour with ¾-in. natural draught, and assuming coal of at least 10,000 B. T. U.'s.

FEED PUMPS

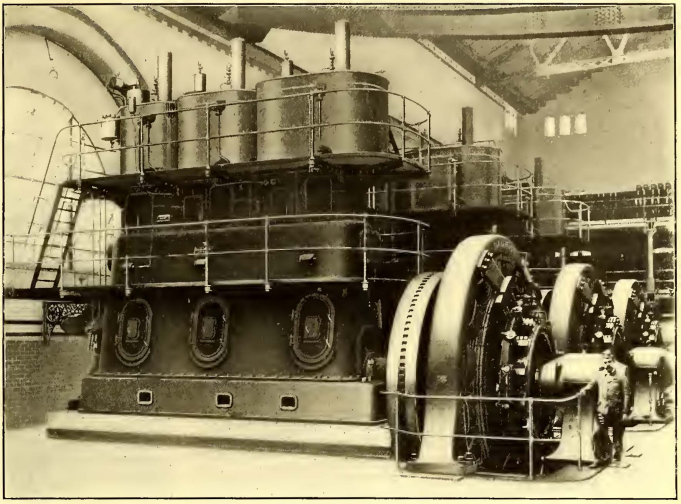
The boiler feed pumps were supplied by G. & J. Weir, Ltd., Cathcart, and consist of four of this firm's well-known single direct-acting pumps, series III. type, each 9½ ins. diameter by 12½ ins. steam cylinder by 24-in. stroke. Each pump is capable of delivering 8000 gallons of water per hour at 12 double strokes per minute. These pumps are single-cylinder, double-acting and vertical. The steam is used expansively and the cut-off can be regulated from the outside while

the pumps are working, thus reducing the steam consumption.

CONVEYORS

The overhead coal bunkers in the boiler house are capable of containing 2000 tons of coal, and a very complete system of coal conveying gear has been installed by The New Conveyor Company, Ltd., for feeding these and at the same time for dealing with the ashes from the boiler fires. The method of dealing with the coal and ashes is briefly as follows:

Coal may either be brought in by barges on the canal which runs at right angles with the boiler house, or by means of carts. If by the former means, the coal is discharged by hand on to a 24-in. band conveyor of the Robbins type which runs the full length of the basin. This conveyor is capable of dealing with 60 tons of coal per hour when running at a speed of 200 ft. per minute, and has its top rollers of cast iron spaced out 5 ft. apart, and the bottom rollers spaced about 10 ft. apart. The end drums are 30 ins. diameter. All spindles and shafts throughout this conveyor are supported by gun metal bushed bearings of an extra heavy pattern.

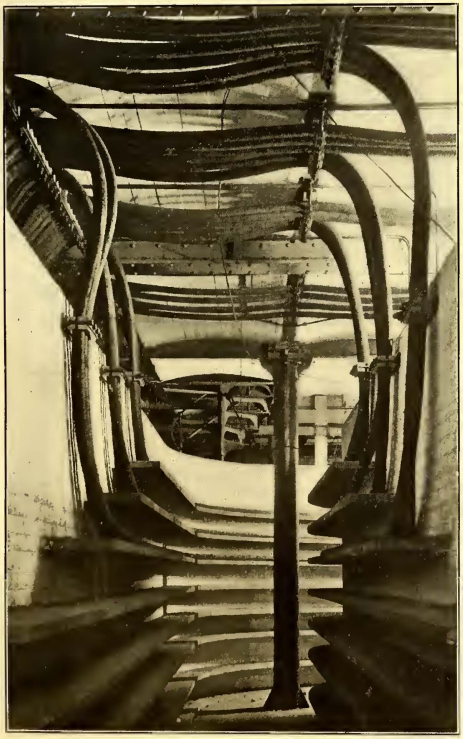


D. C. SETS AT BIRMINGHAM

About 50 ft. from the delivery end of band conveyor the latter is inclined upwards at an angle of about 20 deg. in order that sufficient height may be obtained for the weighing machine. This machine is of the Klein make and is entirely automatic in its action, recording the amount of coal brought in by the barges. The weighing machine discharges into a collecting box on the ground level, from which coal is led by means of chutes to the cavity bucket conveyors. When coal is carted into the station the carts are unloaded directly into this collecting box, and do not pass over the band conveyor already described.

The gravity bucket conveyors are two in number, each 690 ft. long, but provision has been made for fixing a third conveyor (for use in the coal store) at a later date. They are fed by means of the shoots from the collecting box through patent automatic fillers, and have each a capacity of 60 tons per hour when traveling at about 45 ft. per minute. They consist of steel buckets built of ¼-in. plate suspended from pins in the chain at intervals of 2 ft., and are free to swing in any direction. The chain is of an extra heavy type, being of the double-strand stamped steel pattern, and is supported from the path rails by rollers at intervals of 1 ft. At each corner where the direction of travel is changed, heavy cast-iron wheels (turned on face) are fixed to reduce friction to a minimum.

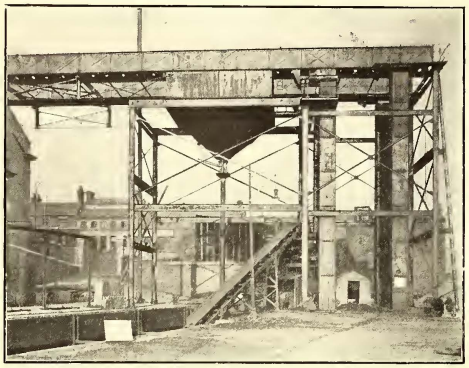
Briefly, the run of conveyors is as follows: On receiving coal from the fillers, the conveyors rise through weather-tight casings to a height of 46 ft. above the canal. They then turn at right angles and run parallel with the ground for a distance of 110 ft., passing over the canal and ash bunkers to a point immediately inside the walls of the boiler house. They are supported on this plane by a built weather-tight bridge, which in turn rests on the main ash bunkers. Inside the boiler house they again turn upwards for another 20 ft. and resume their horizontal travel, passing over the coal storage bunkers, which are about 240 ft. long. The driving gear is situated at the top corner of the boiler house next the canal, and consists of heavy cut steel wheels driven by means of motors, the whole being mounted on a solid framework of



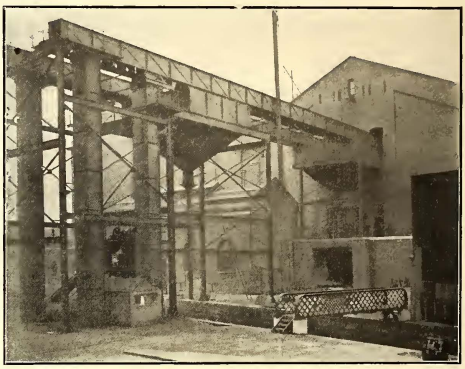
CABLE CONDUIT, BIRMINGHAM

steel and cast iron. At fixed points over the bunkers trippers are arranged so that coal may be discharged into any bunker at will.

On reaching the end of the coal storage the conveyors descend to the basement and pass back in front of the boilers, receiving the ashes on their return journey. On reaching



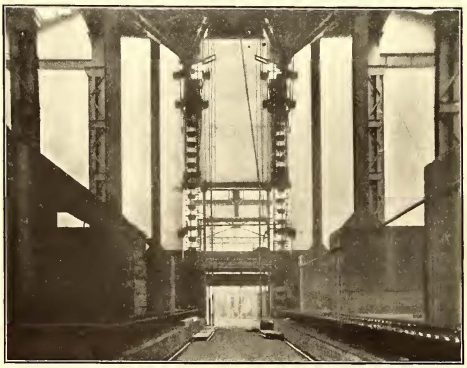
SIDE VIEW OF CONVEYOR



END VIEW OF CONVEYOR

the canal end of the house the conveyors again rise to the level of the weather-tight bridge and, passing back under the coal strand, deliver their ashes into either of the two ash bunkers, which are situated one over the roadway for loading into the carts, and the other over the canal for loading to barges. Conveyors on delivering their ashes descend to original level and are again ready for loading with coal and going through the same cycle of operations again. The ash bunkers mentioned above are each constructed of mild steel and are supported by a heavy framework of built joist suitably braced and stiffened, each bunker having a capacity of 60 tons of ashes.

The motors driving the plant are of the Electric Construc-



CONVEYOR FROM INSIDE OF BOILER ROOM

tion Company's make, one 16-hp motor being used for each 960 ft. of gravity bucket conveyor, and one 6-hp motor for the 300-ft. long band conveyor. The shoots from the ash and coal bunkers are made of ⅛-in. mild steel plate, and at the top of each, for the purpose of cutting off the supply, is fitted a patent double-swing door operated by levers and hand chain.

STEAM PIPING

The high-pressure steam section consists of wrought steel lap-welded pipes 12¾-in. and 10¾-in. external diameters by ⅜ in. thick, 8⅝-in. and 7⅝-in. external diameters by 5-16 in. thick, 6½-in. and 5½-in. external diameters by ¼ in. thick, 4½-in. 3½-in. and 2⅜-in. external diameters by 5 gage thick. The 12-in., 10-in., 8-in and 7-in. pipes have solid welded flanges faced spigot and faucet, and the smaller sizes stamped steel flanges screwed and expanded on, faced plain. All joints are made with Taylor's corrugated coarse type copper joint rings and Dixon's graphite, while the bolts are of special quality steel, machined under head to insure a perfect fit. All branches are electrically welded on.

ECONOMIZERS

The economizers are of the Green special high-pressure type, suitable for a pressure of 200 lbs. to the square inch, and each section consists of 1280 tubes, arranged in four separate machines, each containing 320 tubes. Each machine is divided into three groups, the groups of pipes being coupled together at the top and bottom by copper expansion elbows. The economizers are fitted with the usual safety and blow-off valves, the vertical pipes are 9 ft. long and 4 9-16 ins. diameter. The main flue dampers are so arranged that any one of the economizers can be isolated for cleaning purposes without stopping the whole installation. The scrapers of the four machines are worked by means of a motor and counter-shafting. The total heating surface of the pipes is 12,800 sq. ft., and the capacity 8000 gallons.

One chimney stack has been erected for the first equipment and the foundations of a second stack have been put in up to the floor level of the economizer house. The stacks are 15 ft. internal diameter and 230 ft. high, being lined with fire brick for a distance of 50 ft. from the base.

CIRCULATING WATER PUMP HOUSE

The circulating water pump house is equipped with two 20-in. steam-driven centrifugal pumps and one 12-in. motor-driven centrifugal pump, supplied by W. H. Allen, Son & Co., Ltd. The steam pumps are fitted with exhaust steam grease separator, surface condenser, and Edwards' type air pump. The pumps deliver their water into a system of piping supplied by John Spencer, Ltd., the pipes being of riveted steel, 24 ins. in diameter, and running completely round the engine house.

The make-up water required from the town mains is passed through an exhaust steam feed water heater of the Berryman

type, into which the exhaust steam from the feed pumps is discharged.

SUB-STATIONS

Of the five sub-stations, the Camden Street sub-station is the first that has been completed and put to work. The description of this sub-station may be taken to apply to the other sub-stations mentioned above, the equipment in each being identical in design, though necessarily somewhat varied in arrangement and capacity as the sites and the requirements in each district have necessitated. The whole of the equipment, with the exception of the storage batteries and the combined balancers and boosters, was supplied by the British Westinghouse Electric & Manufacturing Company,

LAYING MAINS ON THE SOLID SYSTEM, BIRMINGHAM

Ltd. The rotary converters are each of 300-kw capacity output. At present two of these are arranged for giving a direct-current railway supply, at a pressure of 550 volts. Air-blast transformers and storage batteries are used. The latter were supplied by The Electrical Power Storage Company, Ltd., and consist of 256 cells, arranged across each side of the three-wire cable network, 19 cells at the end of each battery being used for regulating purposes.

The ultimate capacities of the five sub-stations range from 1500 kw to 3700 kw.

CABLES AND FEEDER DISTRIBUTION

The cable work at the Birmingham installation has been carried out by Callender's Cable & Construction Company, Ltd., and is of a very extensive character. One of the engravings shows the central portion of the basement under the engine room connecting the switchboard with the other end of the building. This portion of the building has been divided into three subways with a series of stone shelves built one above another into the side walls. One shelf is provided for each generator for each of the four cables connected to it, viz., positive, negative, equalizer and shunt windings. The d. c. cables are insulated with vulcanized rubber and are fireproofed with asbestos braid. The a. c. cables are of the three-core, paper-insulated, lead-covered and armored type and are carried in a separate subway.

The feeder system outside the station is divided into districts corresponding to the various generating and sub-stations; each section is fed by three-wire feeder cables, protected by fuses in the station and coupled solid to the network in underground boxes or feeder switch pillars. The positive railway feeders are of standard construction. The negative feeders, however, are triple concentric, this style having been used in order that adjustments may be made in the resistance of each cable and the potential drop adjusted to suit the traffic. Pilot and telephone cables, the latter giving communication between the power station and the feeder switch pillars, are included in the equipment.

The whole of the cable work in the streets is laid on the well-known Callender system, as shown in the engraving on this page. The low-tension cables are of the paper insulated vulcanized bitumen type, carried on pot bridges in earthenware troughs which are run solid with bitumen. The trough is galvanized steel wire armoring which is laid over the lead and is connected to earth every 100 yds. by means of a cast-iron pipe fixed vertically into the ground beneath the cable and packed with loose coke.

PAPER ON SCHEDULES AND TRAFFIC IN BOSTON

Practical car service was the topic discussed by the New England Street Railway Club at its meeting of Nov. 22, which was held as usual at the American House, Boston. Vice-President Potter was in the chair, on account of the absence of President Winsor. The speaker of the evening was Timothy Connell, supervisor of time tables of the Boston Elevated Railway Company.

After pointing out the need of suiting car service to the requirements of the traveling public, with due regard for the commercial interests of the operating company Mr. Connell urged the importance of considering the traveling habits of the residents of the various districts served and noting the hours during which they make the greatest use of the cars. In Boston and its vicinity the character of the travel may be classed somewhat as follows:

4—6 a. m. Light traffic, employees of markets, restaurants, janitors, porters, etc.
6—7:30 a. m. Increased traffic, laboring and mechanical workers.
7:30—8:30 a. m. Maximum traffic, store and office employees.
8:30—9:30 a. m. Merchants, professional men, decreasing volume of traffic.
9:30 a. m—3:30 p. m. Shoppers, tourists, etc., normal and profitable traffic.
3:30—6:30 p. m. Homeward traffic and rush hours.
7—7:45 p. m. Theater and concert traffic, inward bound.
10—11:30 p. m. Theater and concert traffic, homeward bound. Night cars. Light traffic.

This night traffic, while not directly profitable financially, is a great accommodation to those by whom it is patronized, and is a necessity. In the end a large indirect revenue is derived by a generous policy in regard to night cars, for people are inclined to settle in those districts where cars are available at all hours, even though they may have no occasion to use the night cars, and the increase in population thus attracted helps materially in upbuilding the day traffic, amply repaying the company for the night cars.

This completes the general plan of car service for week-days, except that custom demands a slight change on Saturday afternoons, when a great many return home at 1 o'clock, instead of between 5 and 6 p. m. as on other days; and other changes have to be made to meet any abnormal demand for transportation which may arise. On Sundays and holidays the periods of traffic change considerably, requiring a totally different schedule to meet the travel, of which the direction and time are totally different from that on the ordinary week-day. The business section is practically deserted, and the tide of traffic is directed toward the residential districts, or in the summer, to the country and seashore resorts. On these days even more attention is required than on weekdays, since the traffic is much heavier at times, being compressed into fewer hours, chiefly from 1 to 10 p. m., but varying somewhat according to the weather conditions.

During the hours of normal traffic on the Boston Elevated system, from 10 a. m. to 3 p. m., there are constantly in use 716 surface cars and 96 elevated cars, the latter comprising twenty-four trains of four cars. In the rush hour between 5 and 6 p. m. this number is increased to 1375 surface cars and 150 elevated cars, the latter comprising thirty five-car trains. During this hour the cars carry from 70,000 to 75,000 persons on an average. To show the difficulties arising from traffic congestion, on Boylston Street in the space of one-seventh of a mile between Arlington Street and Berkeley Street, during the rush hour mentioned 239 cars pass each way, or 478 cars total in both directions. These cars have an average headway of only fifteen seconds and an average spacing of 150 ft. On Washington Street, between Adams Square and Hanover street, one-eighth of a mile, 34 cars pass during the rush hour, or one car every eighteen seconds. At the corner of Washington Street and Sumner Street 300 cars pass in the several directions; at Dewey Square, 250; at the Dudley Street transfer station, 225, and at Sullivan Square 235 cars all pass during the hour. The greatest efforts to preserve an efficient service have to be made by the operating department, and to see that the cars, hindered as they are by vehicles and other obstructions, are kept moving with some degree of regularity.

Whoever maps out a car service should be perfectly familiar with every district covered. Close, personal observation at all hours of the day is essential. Conductors' records are to a certain degree valuable helps in ascertaining the amount of the traffic, but on account of the constant shifting of passengers at transfer points these may be misleading as to the distribution of travel. Observation at such points of vantage is most desirable, and it is not necessary to traverse the entire lengths of all the routes to get the information desired to make the service both agreeable to the public and profitable to the company. It is not sufficient in laying out a car service to confine one's attention merely to one district. The proper spacing must also be considered, where cars combine with other lines at junctions, since to neglect this will lead to an erratic headway and an uneven service. The cars from different points should enter upon a trunk line at proper intervals.

Even though an apparently perfect schedule may be laid out with a view toward giving the utmost satisfaction to the public and at the same time prove the greatest commercial success to the company, still this same schedule when put into operation may be so poorly run as to suit neither the public nor the company. This disarrangement may be ascribed to some of the following causes.

1. Low voltage.

2. The slow or indifferent motorman, who does not foresee the conditions which he is likely to meet, nor familiarize himself with the traffic which he is likely to encounter at times of abnormal travel. He has more headway than belongs to him and consequently his car is overcrowded—through his failure to keep up, and he is continually arriving behind his schedule.

3. Comment might also be applied to the conductor who allows his platform to become overcrowded, without any effort on his part to move forward the passengers in the car. Delays thus occur in the stops, when passengers get on or off.

Cars are sometimes delayed by the overspeeding of a previous car through a populous part of the route, which leaves an excessive headway to the following car, which is in consequence overcrowded. The schedule ought to be as closely as possible adhered to. Starters should be prompt, even to the quarter minute, in starting cars. Alertness and promptness to start on signal would result in a smoother car service and fewer complaints from the public. Other causes of obstruction are vehicles on the track, adverse weather conditions, drawbridges and grade crossings. Some of these delays are totally unavoidable, but they must be offset as far as is possible.

Disarrangement of car service tends to bring down blame, not to say great annoyance, upon the management of the company from dissatisfied patrons who claim they are not given sufficient accommodation in the way of transportation. To satisfy these patrons, more cars than are necessary must at times be run, at an additional expense not justified by the revenue. Fewer cars would be required to do the work if the schedule were properly adhered to.

With regard to the remedy hinted, in cases of unwarrantable obstruction to car traffic caused by vehicles, police officers when patrolling their routes should be compelled to pay some attention to these causes of obstruction, and to see to it that drivers of vehicles do not thus infringe upon the rights of the great traveling public.

One of the greatest detriments to that rapid transit which is the chief desire of the public to-day is the prevalent frequency of stopping places, especially on lines where the headways are very close, in such cases retarding the movement of the cars to such an extent as to more than offset in time lost the supposed advantages gained by the nearness of stops. Hence in establishing stopping places, it would be well to consider what effect they will have upon the running time schedules, when weighed with the supposed increase in the number of patrons. On lines where the headway is very frequent, much less service would be required if the cars were properly operated as to time and regularity of intervals, as this would insure a proper and even distribution of passengers, instead of the first car being crowded with those following practically empty.

On account of large increases in the package and freight business into Toledo, the terminal station on Huron Street, Toledo, is being enlarged by the erection of another floor, which will be used for office and storage. It is stated that the amount of package freight handled in and out of Toledo is increasing at the rate of 2,000,000 lbs. per month over that handled last year.

The Spokane & Inland Railway Company, controlled by the Inland Empire Electric Railway Company, of which Jay P. Graves, of Spokane, is president, has installed a four-train service between Spokane and Waverly, 35 miles south of Spokane. The equipment is the latest approved pattern and the roadbed is one of the best in the Pacific Northwest.

CONVENTION OF THE INTERNATIONAL STREET AND INTERURBAN RAILWAY ASSOCIATION AT MILAN

The biennial convention of the International Street and Interurban Railway Association was held on Sept. 17 to 21 this year at Milan in connection with the International Exposition in that city. It was one of the most interesting in the history of the association, not only on account of the actual business transacted but also because of the excursions to the novel electric railway installations in the neighborhood, in which the delegates participated.

More than four hundred members of the International Street and Interurban Railway Association, as well as many ladies, accepted the invitation of the Italian government and the municipality of Milan to participate in this meeting. In addition the governments of Germany, Austria, Belgium, Bulgaria, Denmark, Spain, France, Greece, Hungary, Italy, Norway, Roumania and Russia were officially represented at the convention by thirty-nine delegates, signifying thus an increased interest in the work of the body. Among the governments represented at Milan, it might be well to cite particularly that of Denmark, which appointed its Minister of Public Works to attend in person.

FIRST SESSION

At the opening session there were present, in addition to the actual members of the association, a considerable number of representatives of the national, city, provincial and municipal governments, among whom might be mentioned His Excellency Mr. Dari, assistant secretary to the Minister of Public Works; Mr. de Castiglione, representing the parliamentary deputation of Milan; Mr. Bianchini, chief inspector of the Italian State Railways; Senator Gavazzi, representing the city of Milan; President Salmoraighi, president of the Chamber of Commerce, etc.

In this opening session Mr. Janssen, general manager of the Brussels Tramways, and president of the association, welcomed these gentlemen who had honored the session with their attendance. The Assistant Secretary of State, Mr. Dari, replied, assuring the delegates of the great interest which the Italian government took in the deliberations of the association. After a speech from the representative of the city of Milan, Mr. Janssen yielded the chair during the first session to His Excellency Mr. Dari, as honorary chairman.

The first question of the day was that relating to electric traction on interburban lines, on which Eric Gérard, the director of the Montefiore Electrotechnical Institute, of Liége, had prepared a paper. As Mr. Gérard was unable to be present at the meeting, the paper on this subject was presented by M. Thonet, general manager of the Société d'Enterprise Générale de Travaux of Liége.

Mr. Gérard first referred to the remarkable results secured by electricity in the operation of city tramways, which had led to the general adoption of this motive power on interurban lines and to a study of its application for the service of steam trunk lines. This latter application has advanced slowly, for the principal difficulties which are to be conquered are not of a technical character. On the other hand, the interurban lines which had been equipped electrically with success are numerous, and it is not difficult to foresee that electricity will be generally adopted on lines of this character.

An examination of the lines already equipped shows a great variety of equipment. Direct current, polyphase and single-phase systems and their combinations have been put in operation. This variety of methods has disconcerted many people. None of the systems is absolutely superior to the other; each particular case has to be made an object of special study. Mr. Gérard then reviewed briefly the different systems and considered their advantages and disadvantages. He then referred to the test now being conducted in Sweden under the auspices of the Swedish government, in which 20,000 volts is being used on the trolley wire. Three companies have apparatus under trial, the Westinghouse Company with a 25-ton locomotive equipped with 150-hp motors; the Siemens-Schukert Company with two 36-ton locomotives, each with three 110-hp motors, and the Allgemeine Elektricitäts Gesellschaft several motor cars each with two 120-hp Winter-Eichberg motors. He also referred to the Oerlikon 14,000-volt converter locomotive and the Rougé and Faget experiments with permutators. He also referred to the electric locomotive built by the Alioth Company for the Paris, Lyons & Mediterranean Railway and equipped with Auvert & Ferrand rectifiers, and also to the work which is being carried on with gasoline motor cars.

Mr. Thonet, having presented the report of Mr. Gérard, which treated the subject from a technical standpoint, discussed certain economical considerations which entered into the question. He remarked that the problem of electrification of systems ought to be studied in a different manner from that which concerned the equipment of lines in cities, where the population is such that there is a continuous and heavy traffic, and on interurban lines which require only certain trains per day operating on a definite schedule. Another consideration is the carriage of freight, which on lines of heavy traffic ought to be done by trains composed of many cars, so as to render the operation as economical as possible and to allow the collection and distribution in the evening at the different stations of cars loaded during the day time. Most interurban lines have one large city terminal and serve a scattered population, and it is certain that the electrical equipment of such lines increases the number of passengers and is more desirable even for freight traffic. Outside of the question of traffic that of expense of operation ought also to be considered. It has been shown that electrification reduces the total consumption of fuel, water, oil, etc., as well as the expense of maintenance. With the same expenses, therefore, the service and consequently the passenger traffic can be increased. Mr. Thonet then cited the Mersey Railway, which since the electrification of its lines has been able to reduce the cost of train-mile from 76 cents to 31 cents. These results are brilliant and encouraging. Mr. Thonet concluded by requesting that for the next meeting of the association a request should be made from all the companies which had introduced electrification on their lines, for figures on the results and the advantages which they had secured from the change and the precise details of the cost of introducing electric traction.

The association approved the suggestion and the president announced that the question of electrification on interurban and suburban lines would be taken up again at the next convention.

E. A. Ziffer, civil engineer of Vienna and president of the Bukowina Interurban Railway, then presented a paper on gas engines and producers. An abstract of this paper was published on page 479 of the STREET RAILWAY JOURNAL for Sept. 29, 1906. There was no discussion.

The afternoon of the third day was reserved for a visit to the principal electrical factories of Milan. In the evening at 6 o'clock the delegates were entertained at a banquet offered by the Italian government and presided over by the assistant secretary of the Minister of Public Works.

SECOND SESSION

The chairman of the second session was Mr. Salmoraighi, president of the Chamber of Commerce of Milan.

The first question was the discussion of the proposed rating of motors, presented by Messrs. Kapp, of Birmingham; Rasch, of Aix-la-Chappelle; Blondel, of Paris; d'Hoop, of Brussels; Macloskie, of Berlin; Swinburne, of London, and Wysling, of Zurich. This report was published in the STREET RAILWAY JOURNAL for Sept. 22.

Prof. Kapp, who was formerly secretary of the German Institute of Electrical Engineers, presented the report in person. He remarked that the commission had retained as far as possible the regulations already adopted by the German Institute of Electrical Engineers for stationary motors. Since the adoption of these rules, however, the science had made important advances, especially as regards methods of measurement, and the code proposed to-day contains a number of improvements. After a discussion offered by Messrs. Julius, of Haarlem; Pedriala, of Brussels, and Pirani, of Rome, the association voted unanimously to adopt the recommendations suggested by the commission.

Mr. Ulbricht, delegate of the government of Saxony, congratulated the association on having taken the initiative in the adoption of a rating for street railway motors. He appreciated particularly the definitions which had been determined upon. He remarked that owing to the development of gasoline omnibuses he hoped that a similar set of rules on rating would be adopted for internal combustion motors. The president stated that this subject would be taken up at an early meeting of the executive committee of the association.

The second paper taken up was that relating to the advantages and disadvantages of sectionalizing the overhead system. Two reports on this subject were presented, one by Mr. Rasch, professor in the Polytechnic Institute of Aachen, the other by Mr. Piazzoli, manager of the Palermo Electric Railway Company. An abstract of these papers will be found in the STREET RAILWAY JOURNAL for Sept. 22 on pages 436 to 438.

These two papers were not discussed, but the association expressed the wish that the different companies should make tests to determine the practicability of sectionalizing the overhead system and connecting the sections, as outlined in Mr. Rasch's paper.

Mr. Géron, of Brussels, then presented a paper on the design of car bodies, published on page 478 of the STREET RAILWAY JOURNAL for Sept. 29.

Mr. Heude, official delegate of the French government, expressed himself as completely in accord with the conclusions of Mr. Géron. He hoped that the association would pass a resolution limiting the minimum width of the car body recommended by the association at 2.3 meters (7 ft. 6½ ins.).

Mr. Grialou, manager of the Lyons Tramway Company, also approved the recommendations of Mr. Géron and the suggestions of Mr. Heude. He remarked that with cross seats a slight increase of 10 cm to 15 cm (5 ins. to 7½ ins.) in the width of the car permitted an increase of practically one-third in its capacity, because it was then possible to seat four people in a row instead of three. He thought that where cars are not obliged to run on the lines of another company it is desirable to allow the greatest latitude in the choice of dimensions in order to secure the greatest possible width.

Mr. Koehler, of Berlin, thought it undesirable for the association to suggest to the authorities that they permit in the future widths of 2.3 meters or even of 2.4 meters. These width of tread and in base and height of rails and the use of There was another question in regard to cars which was a very serious one. In nearly every city in Europe the types of cars are entirely different. It would be highly desirable, as in the United States, to reach a greater uniformity than at present. The height of the car is also an important question, and Mr. Koehler expressed a wish that this would be taken up at the next meeting.

Mr. Ulbricht, the official delegate of the Saxon government, called the attention of the association to the importance of defining the safe minimum clearance between cars when passing each other.

Mr. Géron expressed himself as in accord with the suggestion that the dimensions of cars should be taken up at the next meeting, not only from the standpoint of width but also from that of the other dimensions.

The afternoon was devoted to a visit to the Exposition. About 4 o'clock the delegates reassembled at the Belgian section of the Exposition, where they were officially received by Count von der Burch, commissioner general of the Belgian government to the exposition. They were invited by him to inspect the different portions of this section, especially that reserved for railway and tramway apparatus.

In the evening the delegates visited, upon invitation, the power station of the Edison Electric Illuminating Company, which, as is known, operates the lighting and tramway system in Milan. Here they listened to an address by Mr. Semenza, chief engineer of the company, on steam turbines and their application to electric service.

The entire day of Wednesday, Sept. 19, was given up to a trip to Lake Maggiore upon invitation of the North Milan Railway Company. A special train took the delegates to the lake, where there was an excursion by boat. After four hours another train took the party to Como, where in the evening they were tendered a banquet by the two Italian associations.

THIRD SESSION

The chairman of the third session of the association was Mr. Saldini, who represented the municipality of Milan. At this meeting two papers on track construction were presented, one by Mr. Dubs, manager of the Marseilles Tramways, the other by Mr. Busse, chief engineer of the Berlin Tramways. Mr. Dubs' paper was presented in abstract on page 434 of the STREET RAILWAY JOURNAL for Sept. 22.

Mr. Busse's paper was devoted especially to the method of track construction followed in Germany. He dwelt first on the desirability of keeping the tramway service, so far as possible, independent of the general vehicular movement on the street. This is best secured by operating over a reservation, but unfortunately such a plan is not often feasible. It should be the aim, however, of the companies to avoid, so far as possible, the construction of tracks in well-paved streets, because a good paving naturally attracts other vehicles to the use of the street. Streets paved with asphalt are especially to be avoided, not only for this reason but because of the difficulty of keeping up the pavement where it abuts against the rails and also because in narrow streets lined with high buildings, the rigid track construction required with this paving increases the noise, which is much greater than on a street with a good block pavement. Where tracks have to be laid in asphalted streets Mr. Busse recommended block paving between the rails. Another suggestion was the installation in broad streets of refuges in the center of the street at which the cars could stop. The great increase in number of automobiles in the streets accentuates the desirability of this plan. In referring to rail sections, he recommended an increase in width of tread and in base and height of rails and the use of longer ties. He then called attention to electrically-operated track tools, especially grinders for taking out rail corruga-

tions and electro-magnetic chippers for breaking up concrete sub-construction. He stated that the use of picks in breaking up the concrete was undesirable, as it loosened the connection between the rail and its concrete base for considerable distances. The result was that repairs when conducted in this way very often did more harm than good. According to the speaker, the concrete ought to be broken only by special apparatus designed for the purpose. He was also opposed to mixing concrete by hand and recommended electrical mixers. Hand mixing is not apt to be thorough, and the result is that the concrete will have weak spots. The joint question is by no means settled, and might be considered for the moment to be in a stationary condition. There is room for considerable study upon this problem, and experience with new systems of joints is greatly needed. Another point upon which information is greatly desirable is that relating to rail corrugation. This subject is receiving the attention of both manufacturers and users of rails.

Mr. Grialou, of Lyons, suggested that if the subject of track construction was taken up at the next meeting, a comparison be drawn between rigid construction on concrete, such as is generally employed in Germany, and the more flexible construction on ties preferred in France. He believed the latter reduced rail corrugation. Taking up then the question of joints, he thought that a special investigation ought to be made on the relative expenses of maintenance of different types. He remarked that joints which are good mechanically are often those which are the most expensive to renew.

Mr. Van Bogaert, delegate of the Belgian government, referred to a remark of Mr. Dubs, who stated in his report that a soft metal angle-plate was more desirable than one of harder metal. He stated that the International Railway Congress at Washington had reached the opposite conclusion. He added that American practice had shown that very hard steel angle-plates of 80 kg (176 lbs.) were more desirable than the 55-kg (121-lb.) angle-plates usually employed in Europe. He added that the Belgian government was proposing to conduct a test on angle-plates designed to fit the contour of the rail exactly. He concluded by stating that American practice tends toward the use of staggered joints, that is, not having the joints in one rail directly opposite the middle of the other rail, but slightly in advance of the opposite joint.

Mr. Busse, of Berlin, replied that he was not in favor of broken joints. During a number of trips which he had made in America he had noticed that tracks laid with broken joints gave double the number of shocks. These shocks are naturally less in America than in Europe on account of the better methods of supporting the cars on trucks used there. It was decided to take up the subject again at the next meeting.

Mr. de Burlet, general manager of the Société Nationale de Chemins de fer Vicinaux, of Belgium, then presented a paper on "Interurban Track Construction," printed on page 433 of the STREET RAILWAY JOURNAL for Sept. 22.

In the discussion on this paper Mr. Resal, of Bordeaux, stated that he had recently been obliged to replace a short section of track equipped with the overhead system with the conduit system. All the rails were welded with the Falk joint. The track was removed by cutting the rail into lengths of from 40 m to 50 m (130 ft. to 160 ft.), and he believed that it was possible to handle rails of this length on the street. The question of transportation from the mill, of course, was a different matter. He believed, however, from his experience in Bordeaux, that it might be possible to utilize to advantage longer rails or at least a joint which could be put on the rails before they were placed in the streets.

Mr. Liebmann, of Magdebourg, said that in the track construction of interurban lines it is generally thought that the heaviest rail is the most easy-riding. He believed that the weight of the rail had less to do with the riding than the other accessories, especially the ties. He especially recommended long and well-ballasted ties as a factor in reducing the cost of maintenance.

Mr. Julius, of Haarlem, said that on a number of lines he had recently changed the joints from opposite joints to broken joints. The riding of the cars was much more easy.

Mr. Thonet, of Liége, requested information on the subject of steel and reinforced concrete ties, which have recently been used to some extent on the Italian government lines.

It was decided to take up this subject again at the next convention.

In the afternoon the delegates accepted the invitation of the Tessin Company to participate in an excursion to the Chartreuse de Pavie.

FOURTH SESSION

The chairman of the fourth session was Mr. Janssen, president of the association.

The first paper presented was on the use of wattmeters and other current recorders for cars by Mr. Wattmann, manager of the municipal tramways of Cologne. An abstract of this paper appears on page 435 of the issue of the STREET RAILWAY JOURNAL for Sept. 22.

In the discussion Mr. Koehler, of Berlin, referred to the statement of Mr. Wattmann that it was desirable to publish the names of the motormen making the best records in the economy of current required to operate their cars. He said that such a plan might produce a spirit of emulation and bring results on a small system where all the motormen knew each other. On a large system he thought that this kind of mention would not be sufficient, but would have to be supplemented by prizes of some kind. But, to make these prizes of any effect, they must have some intrinsic value, and their cost would naturally reduce to a considerable amount any advantages secured in cutting down the consumption of current by the motorman. On the other hand, there are inherent objections to the award of prizes by the management to employees. This was shown by the experience of the German State Railways, where prizes were formerly given to those employees who made the best records in economy of coal and oil. But there was so much dissatisfaction and so many claims for rewards from individuals who thought they were entitled to recognition that the plan was abandoned for an increase in wages accorded to all employees when the record reached a certain figure.

Mr. Wattman, in replying to Mr. Koehler, admitted that on large systems the difficulties suggested might be encountered, especially as any sentiment of dissatisfaction and discontent might be encouraged and utilized to the disadvantage of the company by the socialistic party. He thought that disputes might be more numerous, however, if certain individuals were given an increase in wages in lieu of a prize.

Mr. Paulus, of Nuremberg, thought that the distribution of prizes for economy was an argument against the claims of the socialistic party, as it recognized the principle of personal reward for good service.

Mr. Grialou, of Lyons, believed that in their desire to economize current motormen might be inclined to operate their cars recklessly and so cause more accidents than otherwise. He believed also that the motorman would not be so careful in maintaining schedules.

Mr. Wattmann replied that his experience had not indicated

any increase of accidents due to the adoption of car watt-meters.

Mr. Battes, of Frankfort, said that current recorders had been adopted on all of the cars in his city, and that on an annual cost per current of from 600,000 to 700,000 marks ($150,000 to $175,000) an economy of from 17 to 20 per cent had been secured. He had never noticed on his system the objections mentioned by Mr. Grialou; on the contrary the number of accidents had decreased and schedules had been maintained much better. He added that there was a tendency to attach too great an importance to gradual acceleration, and as a matter of fact he was taking off part of the resistances used on his cars. He was also opposed to rewarding motormen for economy of current. He thought that in many cases such prizes would be detrimental to the service, because the motorman who was the highest on the list as far as current consumption was concerned was often undesirable from every other. On the other hand, a first-rate man from other standpoints often could not quite reach the same record for current consumption accomplished by others. It was to avoid all these reasons for discontent that the Frankfort Tramways have always been opposed to any system of bonuses.

Mr. Stahl, of Düsseldorf, agreed with the remarks of Mr. Battes, and he also said that, while all the cars in Düsseldorf are equipped with current recorders, no increase in the number of accidents or difficulty with maintaining the schedule had been noted.

Further discussion on this point was postponed until the next meeting.

The next subject discussed was that of braking. Two papers were presented, one by Mr. Petit, chief engineer of the National Railway system, of Belgium, in favor of air brakes, the other by Mr. Scholtes, manager of the Nuremberg Tramways, in favor of electric brakes. These papers are published in abstract on pages 431 and 432 of the Street Railway Journal of Sept. 22.

In the discussion Mr. Grialou, of Lyons, referred to a remark of Mr. Petit that one of the principal disadvantages of the electric brake was its dependence upon the trolley line, and said that he thought that the electric brake was more easy to operate than the air brake. The only advantage of the latter is its automatic action in case of a parting of the coupling in trains consisting of motor cars and trail cars.

Mr. Pedriali, of Brussels, said that Mr. Petit in his report referred to the electric brake as operating less rapidly than the air brake. His experience did not confirm this point. It was generally accepted for several years that cars equipped with electric brakes would not stop rapidly. The cause was in the motors, whose commutators would get greasy, but modern motors are so well designed that braking with them can be effected with the same rapidity and reliability as with air. He concluded by adding that the conclusions proposed by Mr. Scholtes were perhaps a little too extreme. He believed that it would be desirable not to adopt any resolutions on the subject.

Others who took part in the debate were Messrs. Wattmann, of Cologne; Dix, of Munich; Soberski, of Nuremberg; Koehler, of Berlin, and Thelemann, of Düsseldorf. No action was taken on the recommendations made by Messrs. Scholtes and Petit.

The final paper presented at the meeting was on maximum speeds for interurban lines. This paper was presented by Mr. Krasa, chief engineer of the Czernowitz interurban railway, and appears on page 479 of the issue of Sept. 29.

The final session of the association was concluded by the business meeting. After the report of the secretary and treasurer, the association elected as an honorary member Mr. Nonnenberg, who had been its devoted secretary from its organization up to 1902, but who had been obliged to resign active work in connection with the association in that year on account of his numerous business engagements. The association then elected to the executive committee C. de Burlet, general manager of the Société Nationale des Chemins de fer Vicinaux, of Belgium; Ch. Thonet, general manager of the Société d'Entreprise Générale de Travaux, of Liége; W. Hähner, general manager of the Strasburg Tramways, and K. Poetz, general manager of the Hamburg Tramways.

In the afternoon the delegates accepted the invitation of the Edison Electric Illuminating Company and of the Monza Tramway Company to visit the beautiful royal park at Monza.

The following day the delegates divided into two groups, one to inspect a series of tests conducted on the Westinghouse single-phase system with which the Brembana Valley Railway has recently been equipped, the other party to visit the Valtelina three-phase road.

In the evening the delegates again united as guests at a banquet offered by the city of Milan.

CONCRETE PILE CONSTRUCTION NOTES

In the Street Railway Journal of Nov. 10 editorial reference was made to the use of concrete piles in power-house construction. In this connection a few particulars of some recent work on the foundations of a brick freight house in Boston may be helpful in a practical way to street railway men, considering the use of concrete piling on their own properties.

The work consisted of driving 191 standard 16-in. Simplex concrete piles varying in length from 19 ft. to 39 ft. according to the nature of the ground, which consists of from 15 ft. to 21 ft. of loose top soil overlying a stratum of stiff, blue clay. The piles are capped with reinforced concrete footings along the wall lines, and with plain concrete footings at those points where interior columns carrying the roof are supported. The superstructure is a one-story brick freight house, 512 ft. x 50 ft., subdivided by lateral partitions into four panels, and so equipped that each panel is practically a separate freight house in itself. The walls and roofs are carried by the piles, the floor itself being supported upon the ground between the column footings and the outer walls.

At the request of the Building Commission of the City of Boston, a pile chosen at random by the Commission was subjected to test after it had remained in the ground one month, and the concrete cap resting upon it had set for ten days. The pile tested happened to be the one least liable to stand a fair test, being several feet shorter than the others in the immediate vicinity, and showing a record of a smaller number of hammer blows than the other piles in the same panel. The actual load for which the pile was designed is a portion of the roof load plus the weight of a wooden column and the concrete footing, aggregating in all about ten tons.

The test consisted in loading the pile with steel rails in increments of about 4.5 tons until an appreciable settlement took place. No appreciable settlement occurred until the load had reached 21.4 tons, when a settlement of .007 ft. was observed. The load was then gradually increased to 35 tons, or 3.5 times the load to be carried by the pile, and a settlement of .059 ft. was observed.

The method of installing these piles consisted in each case of driving a hollow steel cylinder, 16 ins. in outside diameter and ⅜ in. thick, with a blunt detachable point to the required depth and filling the cylinder with concrete consisting

of 1 part Portland cement, 2½ parts sand and 5 parts 1¼-in. crushed stone, the concrete being mixed wet enough to insure puddling and the proper filling of all voids. A special design of bucket was used, which dropped 3.5 cu. ft. of concrete into the form at a time in such a manner that the concrete rammed itself effectively. When the form was filled it was pulled out of the ground, leaving in place a rugged monolithe column 16 ins. in diameter from top to bottom and presenting a highly frictional surface to the surrounding earth, with an end bearing area of 201 s. ins.

A simple empirical formula for determining the safe load for this type of pile is:

$$B = \frac{2WH}{P+1} + \frac{2WHa}{(p+1)Af}$$

where

B = safe bearing value of finished pile in tons.
P = penetration at last blow in inches.
p = average penetration of all blows in inches.
f = coefficient adapted from practice = 40.
A = end area of pile in square feet.
a = side area of pile in square feet.
W = weight of hammer in tons.
H = height of fall in feet.

HOW TO ANALYZE TRAIN TESTS

BY SIDNEY W. ASHE

A speed-time curve may be truly termed "the railway man's indicator diagram." Given a series of speed-time curves obtained from service tests and the corresponding values of energy consumption as determined with a recording wattmeter, and from this an experienced railway man is able to learn nearly all that is necessary about a given equipment. From such speed-time curves the following facts are at once apparent:

The maximum speeds;
The schedule speed;
The average speed between stops;
The speed passing curves;
The initial rate of acceleration;
The rate of braking;
The distance traversed;
The duration of station stops;
The ability of a motorman in manipulating the air brakes;
Whether the resistance points of automatic control are properly calculated;
Whether the limit switch or throttle relay is properly adjusted;
Whether there are delays at stations or on the road;
Whether the motorman coasts sufficiently;
What maximum distance could be traversed in a given time with the equipment under consideration;
What tractive effort is exerted while accelerating;
What braking effort is exerted by the brake shoes.

In the above list the writer has assumed that the train weight and the profile and contour of the road is at hand. Such information is usually in possession of the railway operator. Should the operator possess a set of characteristic curves of the motor he will be able with ease to determine whether the rate of acceleration used is the most economical. From wattmeter readings may be determined the effective or heating value of the current and also the energy consumption in watt hours per ton mile.

To show how the results of an operating test may be analyzed the writer submits herewith a report prepared in connection with a series of tests made upon elevated cars. The test about to be described was performed upon a single car equipped with unit switch control operated by a very competent motorman. The car was equipped with the latest and most approved devices, being an instruction car. It was operated over the Fifth Avenue line of the Brooklyn Rapid Transit Company, a profile of which is given in Fig. 1. In order to make the test an instrument was used which recorded speed with extreme accuracy. This train testing was described by the writer in the Sept. 8, 1906, issue of the STREET RAILWAY JOURNAL.

REPORT SUBMITTED

It is interesting to study the results of a train test made by the writer upon instruction car "999," owned and operated by the Brooklyn Rapid Transit Company, Mr. Hussey being the motorman in charge. This excellently equipped car, operated by as competent a motorman as Mr. Hussey, certainly should represent ideal service conditions. With a car equipped with automatic control, the proof of the ability of a motorman must be largely determined by the manner in which the air brakes are manipulated. Referring to the V-T curves, Fig. 2, obtained from this test, considering the braking portion, the fact is at once apparent that the curves are smooth, changes of speed are regular, and the rate of acceleration reasonably high, showing excellent control of the air by the motorman. Considering the acceleration portion of the V-T curves, the changes in speed are uniform, the acceleration remarkably constant, showing the operation of the control excellent, the operation of the limit switch satisfactory, and the proportionate cutting out of resistance properly calculated. In the original record a few slight irregularities occurred in the curves, but these were so insignificant as not to be worthy of consideration. It may also be noticed that the speed at which the motorman piloted his car around curves was well within safe limits. Concluding the preliminary remarks it is safe to assume that this combination of car and motorman typifies high operating conditions.

TABLE I.

STATIONS.	Atlantic Ave. to St. Marks Pl.	St. Marks Pl. to Union St.	Union St. to 3rd St.	3rd St. to 9th St.	9th St. to 16th St.	16th St. to 20th St.	20th St. to 25th St.	25th St. to 30th St.
Distance in miles	0.26	0.33	0.29	0.31	0.34	0.25	0.23	0.58
Maximum speed (m.p.h.)	26.0	33.6	31.6	32.0	31.4	30.4	32.2	39.8
Speed pass'g curves (m.p.h.	10.2	....	....	....	....	....	....	8.2 13.6
Run. time between stations	70.0	61.0	57.0	60.0	63.0	56.0	48.0	129.
Stations stops (sec.)	12.0	12.5	12.0	9.0	9.5	15.75	15.5	15.
Average speed between sta	13.4	19.43	20.05	18.61	17.90	19.50	24.1	11.1
Initial rate of acceleration (m.p.h. p.sec.)	1.23	1.38	1.14	1.25	1.16	1.19	1.43	1.38

Total Distance = 2.59 miles.
Total Time = 544 + 101½ = 645½.
Schedule Speed = 2.59 × 5280/645½ × 1.47 = 14.21 m. p. h.
Where 1.47 = conversion factor converting feet per second to miles per hour (5280/3600 = 1.47).

CONSIDERATION OF SPEED VALUES

The speed-time curves, Fig. 2, show the variation in speed over the Fifth Avenue Line on the way from New York between Atlantic Avenue and Twenty-Fifth Street. The distance between stations, the maximum speeds, the speeds around curves, the rate of acceleration, the schedule speed, the station stops, and the running time between stations are given in Table 1.

The schedule speed for the run indicated was 14.21 m. p. h. Comparing this value with regular service conditions, the writer feels that the value would be lower if the car had been run in connection with a regular train, for the station stops were of short duration, varying from 9 to 15¾ seconds, the passenger load was light and was practically constant. Moreover, the motorman maintained the power "on" in al-

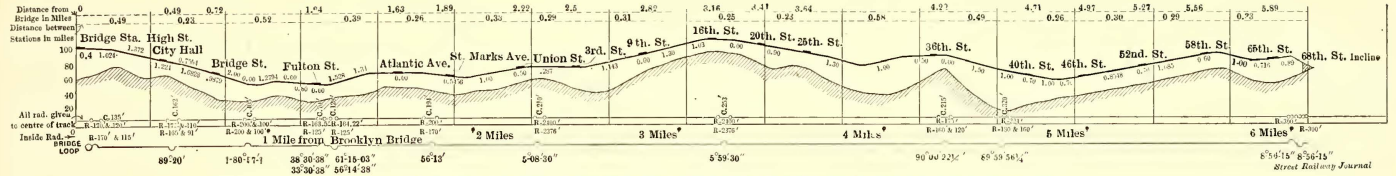


FIG. 1.—PROFILE OF FIFTH AVENUE ELEVATED LINE, BROOKLYN RAPID TRANSIT COMPANY

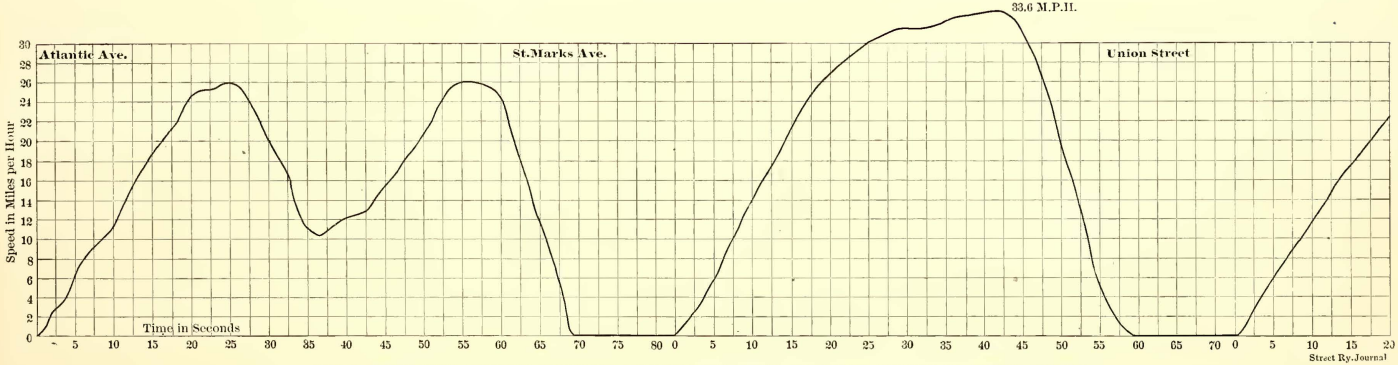


FIG. 2.—SPEED TIME CURVES ON FIFTH AVENUE LINE FROM ATLANTIC AVENUE TO UNION STREET

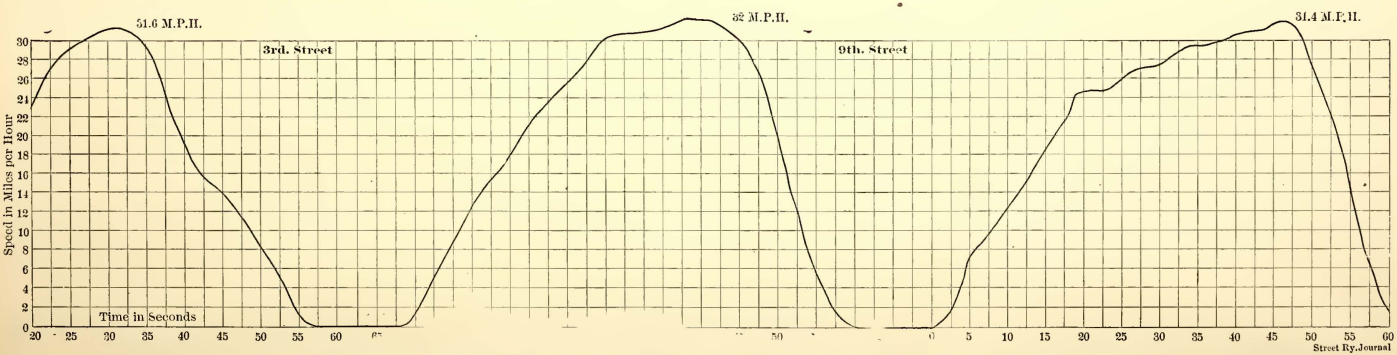


FIG. 2 (CONTINUED).—SPEED TIME CURVES ON FIFTH AVENUE LINE FROM UNION STREET TO SIXTEENTH STREET

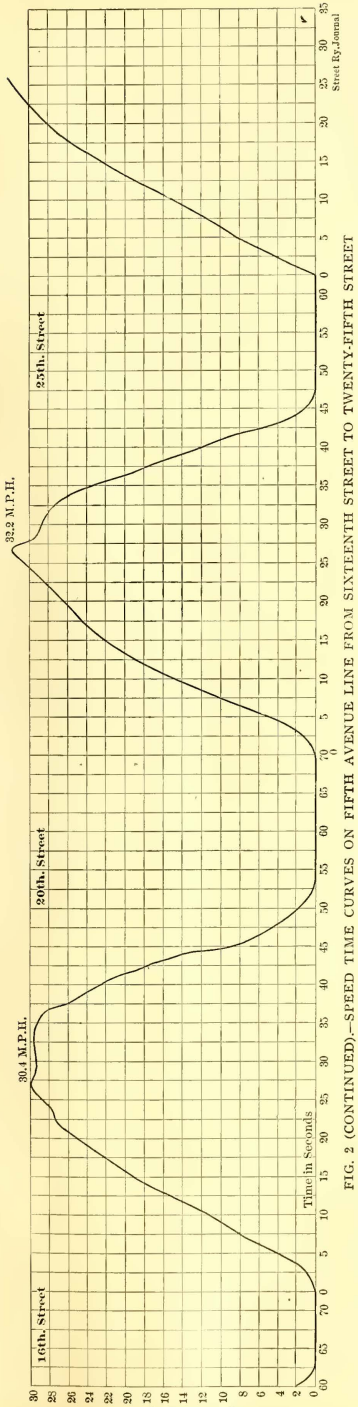


FIG. 2 (CONTINUED).—SPEED TIME CURVES ON FIFTH AVENUE LINE FROM SIXTEENTH STREET TO TWENTY-FIFTH STREET

most every case until within a few seconds of applying the brakes. Furthermore, the car consisted of a single unit and the conductor was in close connection with the motorman.

Concluding, there is every evidence to indicate that a schedule speed of 14.21 m. p. h. is about the very best possible to obtain with this equipment over the conditions of grade and curvature that exist between these stations, namely, Atlantic Avenue and Thirty-Sixth Street.

The average speed between stations varies between 11.10 and 24.10 m. p. h., creating a mean average value of 18.07 m. p. h.

ACCELERATION VALUES

Referring to Table 1, it may be noted that the initial rate of acceleration varies from 1.14 to 1.43 m. p. h. per second. The latter value of 1.43 occurs when the train is leaving Twentieth Street. At this point there is a down grade of 0.9 per cent. Between Atlantic Avenue and St. Marks, near Atlantic, there is 0 per cent. grade and a curve does not occur until the train has covered over half the

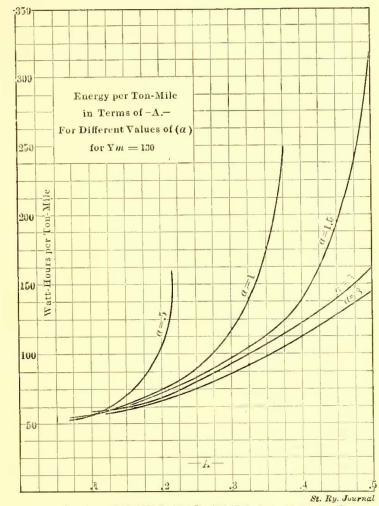


FIG. 4.—CURVES FOR ENERGY VALUES

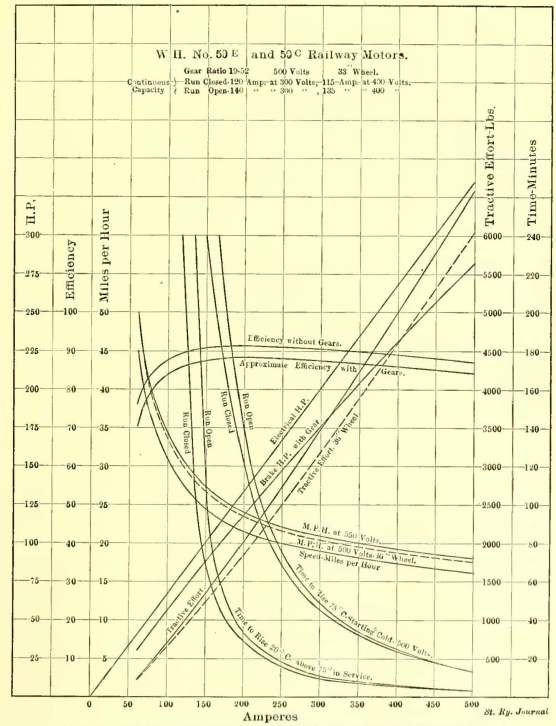


FIG. 3.—CHARACTERISTIC CURVES OF WESTINGHOUSE 50 C AND 50 E MOTORS

distance to the next station. At this point the rate of acceleration was 1.23. The only similar condition of grade occurs at Sixteenth Street. The rate of acceleration at this point was 1.19. The values 1.23 and 1.19 compare favorably. The question naturally arises as to whether it would not be more desirable from an economic standpoint to accelerate at a higher rate, have a larger period of coasting and obtain in this manner the same schedule with less energy consumption. To investigate this point more fully, consider the characteristic curves for the motor with which the car was equipped, Fig. 3. Taking the one-hour rating as the only safe working basis for a motor, reference to the temperature curve "a" shows that at 60 minutes, one hour, the current value is approximately 270 amps. The tractive effort for this current value is 3000 lbs. These values are for 33-in. wheels and a gear ratio of 19:52. Although the diameter of the car wheels on the motor truck of the "999" was 31.6 ins. and the line voltage was approximately 575 (average) while accelerating, the value of 3000 lbs. tractive effort is sufficiently close for the purpose at hand. The total car weight including passenger load was practically 81,000 lbs. The additional equipment in this car was considered as practically equivalent to the weight of a trailer that would be allotted to each motor car. As the car is equipped with two motors the tons per motor are $81{,}000/2000 \times 2 = 20.25$.

Consider the run between Third and Ninth Streets, as there are no curves but a grade of 1.143 per cent. The resulting tractive effort per ton after a consideration of grade and train resistance is 119.1. This tractive effort would produce an acceleration of $(119.1 \times .01098 = 1.29)$.

Tractive effort per ton = 3000/20.25	= +	148.0
Tractive effort per ton (grades) 1.143 × 20 =	= —	22.9
Tractive effort per ton (train res.)	= —	6.0
Total resultant	+	119.1

Formula for resultant train acceleration:

$$a = .01098\ (t - c - f \pm g)$$

Where a = acceleration in miles per hour per second.
t = tractive effort per ton of motor.
c = equivalent traction due to curves in pounds per ton.
f = equivalent traction due to train resistance in pounds per ton.
g = equivalent traction due to grades in pounds per ton.
(See Ashe & Keiley Electric Railways, page 26.)

The acceleration value obtained from actual test was 1.25 and the value calculated above is 1.29, showing that the average current while accelerating was slightly under 270 amps.

This check shows that the motors are of the proper horsepower capacity for the service which they have to perform. As a matter of fact the total train weight could be slightly heavier, as the motor mounted under a car has much better ventilation than when mounted on a stand, and its temperature curves are determined as in Fig. 3.

Granting that the motors are of the proper capacity the question arises as to whether the rate of acceleration could not be raised slightly and the same schedule performed (as previously stated) with less energy consumption. To discuss this condition the through acceleration must be determined.

Through acceleration A = V/T.
Where V = average speed between stations and T = running time between stations.
Between Third and Ninth Streets:
V = 18.61 miles per hour.
T = 60 seconds.
Therefore,
A = 18.61/60 = .3101 (termed Am).

The correction for this value to apply the curves (Fig. 4) in Mr. Cary T. Hutchinson's paper presented before the American Institute of Electrical Engineers would be extremely small, about 1 per cent. The Am would reduce to approximately A = .313. Referring to Mr. Hutchinson's curves showing the relation between through acceleration A and initial acceleration a, it may be noted that for a level track, no curves, with an initial acceleration of 1.5 and a through acceleration of .3 the watt hours per ton-mile are 97, whereas with a value of a, of 2, the value becomes 94. For a value of 1 for a, the watt hours per ton-mile are 114. Considering the through acceleration of the example under consideration of .313 for A, the variation between $a = 1$ and $a = 1.5$ is still greater. Remembering that the maximum acceleration obtained was for Twentieth Street, where a value of 1.43 occurred, and that this was due to a down grade of .9 per cent, it would seem that it would be advantageous to raise the rate of acceleration slightly. This is advised on the assumption that Mr. Hutchinson's curves apply to the particular motors used, and also because there is such a wide variation in the energy consumption between the initial accelerations of 1 and 1.5 for a through acceleration of .3. For the same through acceleration, namely, .3 (between the value of a of .2 and .3), the small saving in energy consumption would hardly justify the increased motor capacity necessary.

CONCLUSION

From the above results the writer would advise having performed a series of tests using different gear ratios determining the watt-hour consumption per ton-mile for different schedules with a view to selecting a more economic initial acceleration, for this given through acceleration.

PROPOSED EUROPEAN TRACTION SYSTEM EMPLOYING RECTIFIED SINGLE-PHASE CURRENTS

The Paris-Lyons-Mediterranean Railway is carrying out a series of tests at its Paris shops on a new type of electric railway apparatus developed by Messrs. Auvert & Ferrand. This method includes what is called a "regulating rectifier," taking single-phase current from the line and supplying direct-current voltage to the train motors on the Ward-Leonard motor system.

In principle the rectifier is said to resemble a permutator, one of which is described later in this article, except that the commutator revolves instead of the brushes. It consists of a group of commutators connected in sections of a revolving ring winding, and is driven by a synchronous motor. Like the permutator, it does not require a driving motor capable of handling the total power, as the rotation is only required for collecting and not for generating the transformed current. The apparatus is, therefore, considerably lighter than a motor-generator of corresponding output. The sections of the rotating winding are roughly compared to auto-transformers whose steps are so connected to the commutator segments that the alteration of the relative position of the two sets of brushes controls the mean voltage of the direct-current side of the apparatus. Thus, all regulation of the voltage supplied to the train motors driving the train, and consequently their speed, can be effected by shifting the brushes of the rectifier entirely without the use of rheostats. The resulting rectified current is pulsating, but an impedence coil placed in the circuit to some extent improves its wave form. The system has not as yet been tried under actual traction conditions, but the Paris-Lyons-Mediterranean Railway's shop experiments have been made with a 400-kw set, consisting of two regulating rectifiers each having two com-

mutators with four lines of brushes. To approximate traction conditions, the load consisted of four series-wound traction motors which were belted to generators to measure their output easily. The rectifiers were geared together and driven by a small synchronous motor at 750 r. p. m., the input current being supplied from a single-phase transformer at 160 volts, 25 cycles. The voltage on the continuous-current side could be varied from 20 to about 250 volts and the overall efficiency of the converting system was found to be 93 per cent at the latter and 68 per cent at the former voltage. Some further tests have been carried out at the Alioth Company's works near Basle, where the reversibility of the apparatus was demonstrated, indicating not only the possibility of regenerative braking but the use through the medium of similar appliances of sub-station batteries on the single-phase systems. It is reported that in neither of these tests was the slightest trouble experienced with sparking.

On account of the reference in the description above to the permutator, which has been developed abroad for converting alternating currents to direct currents, it may be of interest to describe in detail the construction and operating principles of a standard form of permutator such as is made by the Société Anonyme Egyptienne d' Electricité.

The input side of the machine resembles the stationary primary winding of an induction motor, while the winding of the output side, which is arranged adjacent to the primary, is connected to a commutator similar to that of an armature of a direct-current generator. These two windings of the machine are stationary. The current in the polyphase primary winding produces a revolving field which penetrates into the secondary armature winding. This field generates a counter e. m. f. balancing the primary voltage, and it generates in the stationary armature conductors an alternating e. m. f. which bears to the primary e. m. f. the effective ratio of the turns of the corresponding windings. By means of brushes on the commutator which rotate in synchronism with the revolving field a unidirectional e. m. f. is obtained from the stationary armature.

As shown in Fig. 1, the permutator looks like a vertical turbine. It is provided with a stationary magnetic circuit in the lower part of the structure. The commutator, shown near the top, is also stationary. The brushes, however, revolve, the two slip rings serving as a path for the unidirectional current from the armature.

The brush rigging is driven synchronously by a derivation of the main flux from the primary. Fig. 2 indicates the magnetic circuits of the machine and shows the circular electromagnet to which the brush rigging is directly attached. It is evident that this movable concentric iron mass with its winding may be caused to operate like the rotating secondary of an induction motor. The induction motor action is employed in accelerating the brush rigging from rest, but during normal running the wiring of the electromagnet is fed with direct current from the machine itself, therefore making this secondary winding revolve synchronously without slip.

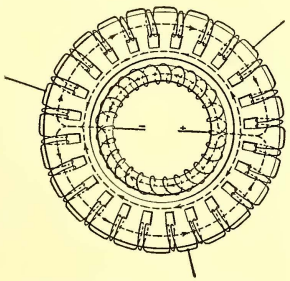


FIG. 2.—DIAGRAM OF MAGNETIC CIRCUITS

An advantage of this machine is that the small mass of the revolving parts can rapidly be accelerated to full speed, and the time consumed in synchronizing the machine is inappreciable in comparison with that necessary with a rotary converter. The starting and speeding up of the machine present no more complication than with a regular induction motor. The direct current in the movable secondary winding not only causes the brushes to revolve synchronously but serves to supply the exciting current to the machine, which on its input side, therefore, operates like a synchronous motor. Thus the machine starts as an induction motor having a rotor of minimum inertia and assumes the characteristics of a rotary converter after having been synchronized. The ratio between the alternating and direct voltage can be placed at any value desired. The primary can be wound directly for the line voltage, thus dispensing with stationary transformers.

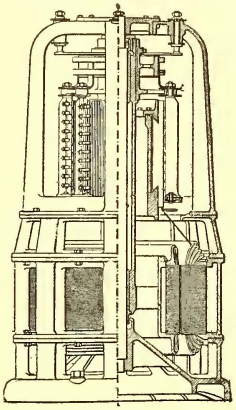


FIG. 1.—SECTION AND SIDE ELEVATION OF A PERMUTATOR

A diagram of the circuits of two permutators arranged for operation either in parallel or in series is shown in Fig. 3. In the secondary circuits of each machine there are placed series transformers which allow a possible variation of the direct e. m. f. from 230 to 270 volts. The regulation of voltage is obtained as follows: The three auxiliaries have their secondary windings in series with the alternating-current circuits of the permutator, their primary windings being connected to a three-pole commutating switch. When this switch is in its middle position, the primary windings of the auxiliary transformers are short-circuited, and the machine operates as though it were connected directly to the main transformers shown. When the switch is in its other positions the primary winding of each phase is connected to one or the other pole of the secondary corresponding to that phase or to one of the other phases, which adds in series or in opposition a voltage of a corresponding phase or +60 deg. or —60 deg. apart, with the result that the five positions give the variations noted above.

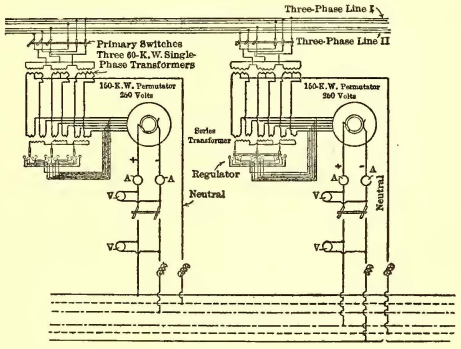


FIG. 3.—CIRCUIT DIAGRAM OF TWO PERMUTATORS ARRANGED FOR SERIES AND PARALLEL OPERATION, CHANGING THREE-PHASE TO DIRECT CURRENT

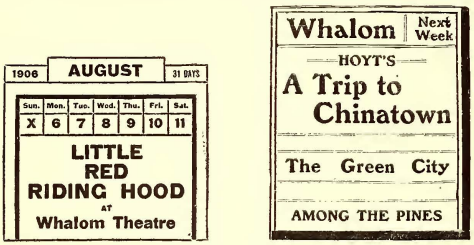
Experiments have shown that the permutators can be synchronized in about three seconds. The rapid acceleration and synchronization is due to the small inertia of the revolving parts, and to the strong synchronizing currents produced in the brush rotating winding. The currents in the rotor at starting are not considered as dangerous as are those in the field windings of a rotary converter. The starting current, with the load circuit open, has been observed to be about 75 per cent of the full-load current.

It is evident that when the rotator is brought up nearly to synchronism as the secondary circuit of an induction motor, and then synchronized by means of current from the revolving brushes, the machine may assume a polarity opposite to that desired. The polarity can easily be reversed, however, by simply opening and closing the switches and allowing the machine to slip one pole. The inconvenience of such interruptions and re-establishments of the current is not noticeable at the machine or at the alternator supplying current to the machine, even when the comparative capacity of the generator is small. If the permutator in service should fall out of step there would be no injurious effect on the remainder of the installation. However, the synchronizing power of the machine is so great that there is no danger of its dropping out of step even when working under heavy loads of irregular character.

ADVERTISING WHALOM PARK

BY H. K. BENNETT,
Advertising Agent Whalom Park and the Fitchburg & Leominster Street Railway Company

The question of advertising—the ways and means, when, how, and in what amount it should be placed to secure traffic for summer parks—is a broad one, and there are few indeed who would agree exactly as to the methods to pursue



SPECIMEN NEWSPAPER ADVERTISEMENTS

even though they had the same general ideas. My experience with Whalom Park and its interests as to the best methods, is through various forms of advertising set forth in a concise and readable way, so that the public is informed at all times as to just what is going on. Newspaper advertisements should be as attractive as possible. By this I mean they should convey as much intelligence to the reader as though they placed the most alluring bargains dear to the shopper's mind.

The newspapers are a medium whose value cannot be overestimated in the slightest degree. During the summer season we carry twelve papers published within a radius of 25 miles. Nine of these are weeklies issued about the middle of each week. Several papers have editions for towns adjacent to their seat of publication, and in this way the most remote resident of the district knows that Whalom Park is on the map and doing business. With these papers it is necessary, of course, to keep a week ahead of the attractions, sometimes no small item with which to contend. Coupled with the advertisement is a short but comprehensive "reader," always acceptable to the average country editor, in which are briefly outlined the plans of the week, and incidentally calling attention to the regular advertisement. Flyers containing announcements of special events such as balloon ascensions and the like are also judiciously distributed in these towns in advance of the attraction. Each week billboards, fences, barns, etc., throughout the towns and along the roads are systematically covered, as well as the routes of other railroads, both steam and electric, so that it is impossible to come within 25 miles of Fitchburg without seeing "Whalom, the Green City among the Pines," confronting you in a pleasing manner. As a rule the advertising is changed weekly.

In the three local papers there is, of course, more latitude both as to actual advertising and reading notices. On a Saturday, for instance, it is my policy to double the usual space. By this I do not necessarily mean that the advertisement itself contains double the amount of reading matter, but simply as to space occupied. In other words, the setting of a 4-in. double-column advertisement inside of a 6-in. three-column space lends an individuality that cannot be obtained

A TYPICAL POSTER, USUALLY PRINTED WITH RED OR BLUE LETTERING

in any other way and which cannot be overlooked. These advertisements are changed every week both as to style and matter. As a hobby perhaps, I build my own advertisements, the advertisement leaving my hands just as it is to be reproduced in the papers as to composition and ruling. This eliminates any possible disagreement as to what was desired. It is intended to individualize the advertising by using forms which are attractive and distinct from the common run of newspaper advertising. Plenty of white space around or in connection with an advertisement, much said in the fewest

possible words, coupled with attractive ruling, is an iron-clad rule with me.

Each day new reading matter is furnished the local papers, constantly bearing in mind that it must be fresh and containing material worth the time in reading, and that the last day of the season must see as attractive advertising and reading matter as the first. This is one kind of ammunition that must never give out. Once properly educated the public looks for this kind of news and follows its advice.

The city as well as the country towns are covered by billboard work, and small one-sheet boards are scattered in places of advantage. We do nothing in window advertising as local merchants are not in favor of using their window space for other than their own use. However, I believe that this is practicable where it can be done without friction.

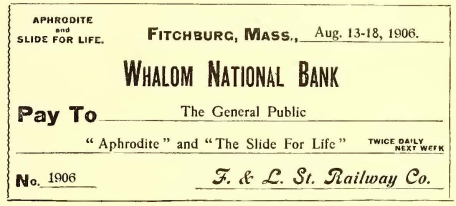
All cars carry dasher and deck signs on either end advertising present attractions. In this connection let me emphasize the absolute necessity of a few well-chosen words displayed in as large type as is practicable so that the sign can be read with the car in motion 100 ft. away. A favorite form is made up as follows:

White paper with 1-in. red or blue border, with as few words as possible and these alternating with red and blue ink. This makes a very neat and easily-read poster, the colors attracting the attention. This feature of coloring can be varied to suit the individual taste. But in all events, have the type large and say little. Car advertising I consider to be the best method next to the newspapers.

We issue a theater program of four pages in which are displayed present and coming events, together with views in and around the park. In contrast to many park productions of this kind, it is almost devoid of advertising, but three firms being favored where a hundred knock for admission, as it is our policy to prefer neatness to revenue.

To reach various organizations the accompanying circular letter was prepared in typewriter fac simile this season for the first time. It was sent to all societies, including churches, in the zone affected by the park, and as a result we were favored with several parties that would not have been reached in any other way. The letter contains facts, not fancies, sets forth the advantages of going to Whalom Park, and in fact is concise and truthful. It was aimed to appeal in a personal way so that those reading it would be impressed more favorably, perhaps, than through the more general forms of advertising for patronage.

In general, my principle is to present concisely in an attractive and novel way what you have to offer, bearing in mind that the average reader is not going to wade through a mess of uninteresting matter but wants to see it all at a glance. Make it as personal as you can by a liberal use of


APHRODITE and SLIDE FOR LIFE.

FITCHBURG, MASS., Aug. 13-18, 1906.

WHALOM NATIONAL BANK

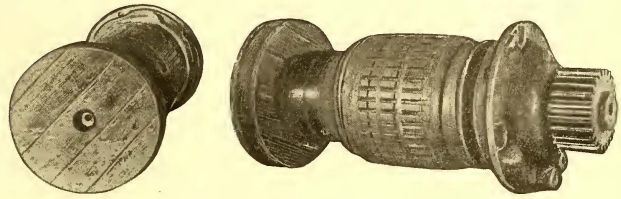
Pay To The General Public

"Aphrodite" and "The Slide For Life" TWICE DAILY NEXT WEEK

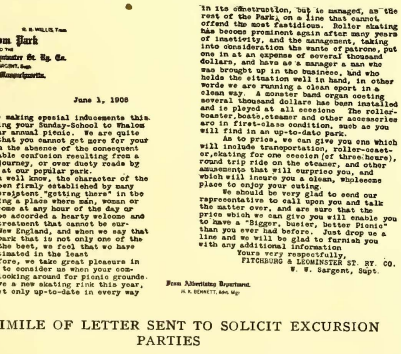
No. 1906 F. & L. St. Railway Co.

ONE OF THE NOVEL ADVERTISEMENTS

catchy personal phrases such as "You and Yours," and thus appealing to them from the start. You cannot sell goods without advertising and letting the people know what you have, and it is just the same with summer parks. You must continually keep before the public eye, never breaking faith either in your advertisements or "readers" by flights of imagination on your attractions. Keep within the bounds of fact, and the rest is easy.



WOOD DISCS FOR PROTECTING ARMATURE WINDINGS


W. S. WILLIS, Pres't. G. S. WILLIS, Treas.

Whalom Park
AND THE
Fitchburg & Leominster St. Ry. Co.
W. H. SERGENT, Supt.
Fitchburg, Massachusetts.

June 1, 1906

Dear Sir,—

We are making special inducements this year to bring your Sunday-School to Whalom Park on your annual picnic. We are quite confident that you cannot get more for your money, with the absence of the consequent and inevitable confusion resulting from a steam car journey, or over dusty roads by barges, as at our popular park.

As you well know, the character of the park has been firmly established by many years of peraistent "getting there" in the way of making a place where man, woman or child can come at any hour of the day or night and be accorded a hearty welcome and courteous treatment that cannot be surpassed in New England, and when we say that we have a park that is not only one of the best, but the best, we feel that we have not overestimated in the least.

Therefore, we take great pleasure in asking you to consider at once your committee is looking around for picnic grounds.

We have a new dancing rink this year, which is not only up-to-date in every way in its construction, but is managed, as the rest of the Park, on a line that cannot offend the most fastidious. Roller skating has become prominent again after many years of inactivity, and the management, taking into consideration the wants of patrons, put one in at an expense of several thousand dollars, and have as a manager a man who was brought up in the business, and who holds the situation well in hand, in other words we are running a clean sport in a clean way. A concert band of several thousand dollars has been installed and is played at all sessions. The roller-coaster, boats, steamer and other accessories are in first-class condition, such as you will find in an up-to-date park.

As to price, we can give you one which will include transportation, roller-skate, or skating for one session (or three hours), round trip ride on the steamer, and other amusements that will surprise you, and which will insure you a clean, wholesome place to enjoy your outing.

We should be very glad to send our representative to call upon you and talk the matter over, and are sure that the price which we can give you will enable you to have a "Bigger, busier, better Picnic" than you ever had before. Just drop us a line and we will be glad to furnish you with any additional information.

Yours very respectfully,
FITCHBURG & LEOMINSTER ST. RY. CO.
W. H. Sargent, Supt.

From Advertising Department.
H. K. BENNETT, Adv. Mgr.

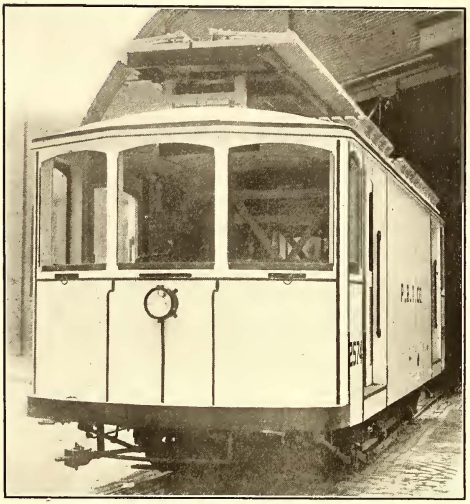
FAC-SIMILE OF LETTER SENT TO SOLICIT EXCURSION PARTIES

A METHOD OF AVOIDING SHORT CIRCUITED ARMATURE COILS

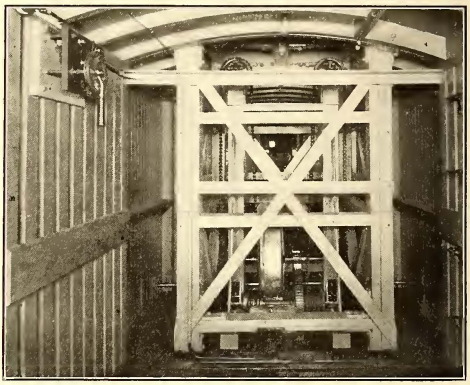
The practice of rolling armatures around on wood or concrete floors it is safe to say results in far more damage to the windings than a few precautionary measures would cost. In the shops of the Indianapolis & Northwestern Traction Company at Lebanon, Ind., it resulted in an unusual number of short circuits, due to the fact that the housing for the bearings or the head at the pinion end is removed only when the pinion is taken off. This head threw half the weight of the armature on the coils at a point where they emerge from the slots. To avoid injury to the coils as well as facilitate the handling of the armatures Leverett M. Clark, master mechanic of the system, has made a number of wood wheels or discs of the same diameter as the head on the pinion end. The discs, which are of wood, are very inexpensive, and when applied result in lifting the armature clear of the floor. Since the discs have been put into service there has been quite a decrease in the number of short circuits. The thought occurs that discs similar to these might be used with armatures not having the head at the pinion end. In this case it might be necessary to devise a disc for the pinion end split in halves and so constructed that the halves when put in place could be clamped together quickly.

TOWER AND CONSTRUCTION CAR OF THE PHILADELPHIA RAPID TRANSIT COMPANY

Owing to the rapid extension of suburban lines with runs too long for the ordinary tower wagon, the lines and cables department of the Philadelphia Rapid Transit Company has built a tower car to do on these suburban roads what the usual tower wagon does in the city streets.



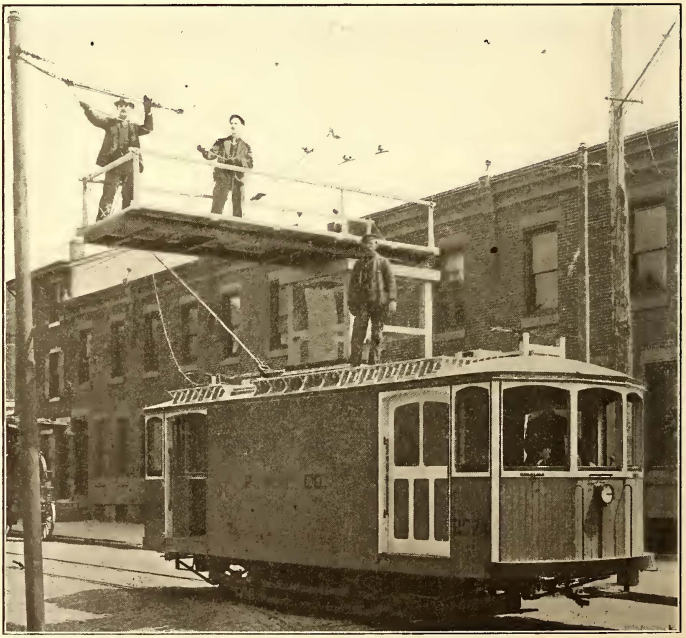
PHILADELPHIA TOWER CAR FOR SUBURBAN LINE



GEARING AND CHAIN FOR LIFTING AND LOWERING THE TOWER

As shown by the accompanying cuts, the tower is located centrally in the car and of such width as to permit passage past it between the ends of the car. The tower is raised by means of a 2-hp motor which makes 1200 r. p. m. and acts through a Linley worm gear and a train of spur gears. In this way the speed of the tower is reduced to about 5 ft. per minute, or in other words, the tower is raised to its maximum height in that time.

The lift is effected through a 5-16-in. twisted link chain, passing over two idlers and winding on two spiral grooved drums placed at opposite sides of the car which make about three revolutions to complete the lift. The drum is so set that at least one-half turn of the chain will always remain on it. In this way the pull does not come directly on the studs attaching the chain to the drum when the tower is raised above the car.

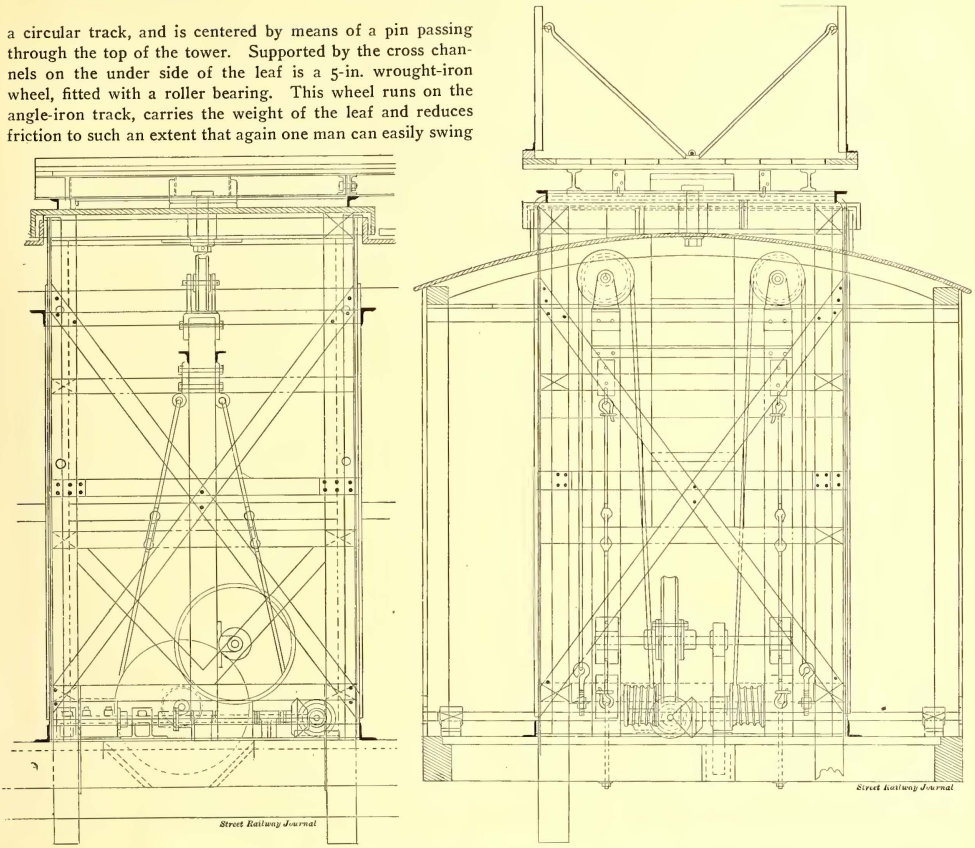


PHILADELPHIA TOWER CAR IN SERVICE, SHOWING EXTENSION PLATFORM

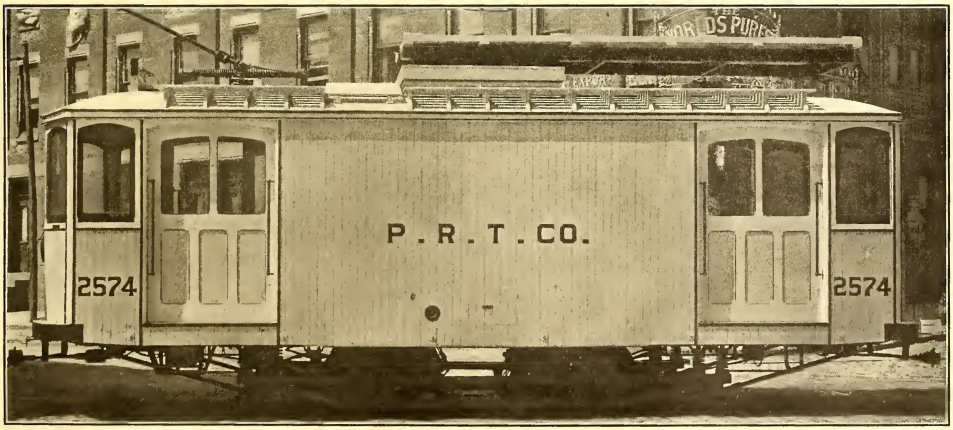
The motor is controlled by means of a double-throw switch, which when released immediately assumes a central position. This prevents the possibility of allowing the switch to remain closed for any length of time, and thus eliminates the danger of the tower rising out of its guides or frames. The result is that as long and only as the operator holds the switch in will the tower rise or fall. By means of a sliding miter gear the motor can be thrown out of connection with the hoisting mechanism in case of accident. The tower can then be raised or lowered by hand. The gearing is so proportioned that one man can easily operate the tower.

The leaf, or platform, is turned on what might be termed a fifth wheel, formed by a 3-in. x 3-in. angle-iron bent into

a circular track, and is centered by means of a pin passing through the top of the tower. Supported by the cross channels on the under side of the leaf is a 5-in. wrought-iron wheel, fitted with a roller bearing. This wheel runs on the angle-iron track, carries the weight of the leaf and reduces friction to such an extent that again one man can easily swing



SIDE AND END ELEVATIONS OF TOWER LIFTING AND LOWERING MECHANISM

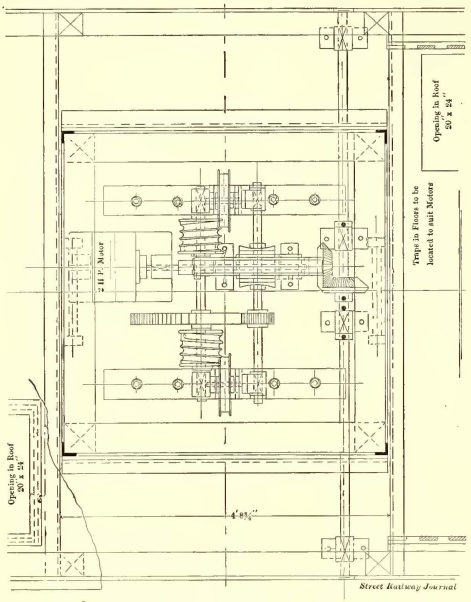


SIDE VIEW OF THE PHILADELPHIA RAPID TRANSIT COMPANY'S TOWER CAR FOR SUBURBAN WORK

the leaf into any desired position from the top of the car. On account of the extreme overhang of the leaf, it was found necessary to place the cleats and rollers at the rear of the leaf so that they might travel on the under side of the angle-

iron track and thus distribute more uniformly the load which would otherwise come upon the center pin.

As it is often convenient to be able to swing the leaf to either end of the car, trolley sockets have been installed at



PLAN VIEW OF GEARING ARRANGEMENT IN TOWER CAR

either end. The base can readily be lifted from one socket and placed in the other. In stringing new wire, the reel is mounted inside of the car and the wire is passed over sheaves through the framing of the tower. This enables the car to receive its power from the wire being erected.

The car body has a length of 28 ft. 6 ins. over all and a width of 8 ft., which permits it to carry four extra reels of trolley wire besides the necessary material for construction work. The maximum height to the top of the leaf when the tower is raised is 17 ft. 8 ins. from the rail. When the leaf is extended as shown in one of the engravings, the overhang is 12 ft. from center pin to the end of the leaf, but men with safety can reach a distance of 15 ft. from the center line of the rail. This permits them to reach the curb line on the average street.

The annual report of the Secretary of State of Ohio shows that within the past year forty-eight electric railway companies have been chartered, with an aggregate capital stock of $9,340,000. Increases in capital stock aggregate $56,676,000 almost as much as the steam roads, but it is said that the investment is really greater. This shows that additions and extensions to existing roads and mergers of small into large systems have really been the interesting phases of the electric railway business in Ohio for some time.

Murray A. Verner, the Pittsburg traction magnate, has received word from Vilna, Russia, that he has been granted the sought concession to construct a street railway system, using the trolley, under a seventy-five-year arrangement. Mr. Verner says he has a syndicate organized ready to take up the work. The population of Vilna is 300,000.

SMALL, VERTICAL, HIGH-SPEED ENGINES

An instructive paper on small vertical engines was recently presented before the Detroit Engineering Society by F. R. Still, chief engineer of the American Blower Company. The following is an abstract of his remarks:

To most people, a small engine is something to be avoided if possible. It generally requires constant attention, frequent adjustment, is extravagant in steam consumption, and is difficult to get at to adjust or repair. Efforts have been made to mitigate these evils by various schemes in design and lubrication, but usually the designer became so wrapped up in the one particular feature which started him into the design, that he lost sight of the other and more important details, never after being within speaking distance of them.

From experience and close observation it was decided that fully 80 per cent of the small engine troubles are due to improper lubrication; whereas only about 10 per cent are due to inadequate proportions and finish of the working parts, and the other 10 per cent to the neglect or ignorance of the operator. Being so satisfied that these conclusions and deductions were correct, it was decided to carry them into effect, if with no other result than to prove their fallacy. To get away from any fixed notions, and to gain new ideas from the practice of others and, further, to give "an opportunity to criticise somebody else," an engineer designer of long experience in some of the best shops in this country was engaged. Before him were spread these ideas, also what he was expected to accomplish. This briefly was as follows:

1. An engine that could be sold with a guarantee that it would run three months or more without requiring any attention except the filling of the sight feed cylinder lubricator.

2. An engine that would be economical in the use of steam and oil.

3. That could be easily adjusted and not liable to easily get out of adjustment.

4. That could be used anywhere and for any purpose that an engine can be used for.

5. That had ample bearing and wearing surfaces to make it long lived and unlikely to overheat at full load.

6. That it should be constructed of the best materials for the purpose intended.

7. That it should be devoid of any semblance to "freaks" of every sort; and not be so costly to build as to make the selling price prohibitive to the average buyer.

Being so thoroughly impressed with the importance of a good system of lubrication, the first step was to work out something more effective than previously used. It does not take much thought to arrive at the conclusion, that if metal does not run on metal, but is always separated by a heavy film of oil, there can be very little wear. The problem then settles down to the production of the necessary heavy film.

In looking over the many systems for lubricating engines, the most rational seemed to be forced lubrication by a pump. But experience shows this has many defects. The oil being under pressure necessitates extreme care in adjustment, as any bearing being looser than another vents the entire system and destroys the desired effect. Again, any foreign material that may get into the small tubes or grooves which are an essential part of this system will be rammed in tight by the oil pressure.

To overcome these objections it was decided to adopt a gravity flow, the oil being lifted by a pump to the top of the frame, from which elevation it would flow downward by gravity. In this way large tubes can be used; the velocity of the oil will be rapid, the volume of oil in circulation will be much greater, it will not be necessary to have the bearings tight, neither will they all have to be adjusted exactly alike,

and any foreign matter will be washed out, instead of being rammed in.

Being satisfied that this came close to the ideal way of producing the flow of oil, the next step was to distribute the oil along the bearing and wearing surfaces to separate them completely by that all-essential film.

For ages it has been common to groove the upper or lower half of the journal box or perhaps both. There are as many ideas on the proper way to groove a box as there are people in the business, and there are evidently many more who have no ideas at all, judging from the way it is sometimes done.

Considering the question from a mechanical standpoint, it is at once apparent that an oil film takes up space, so a bearing cannot be tight or the oil cannot get in unless it is forced in at a pressure greater than is exerted on the journal. The thicker the film, the more space there must be between the metals, hence a loose bearing is desirable if it does not cause pounding. When the crank is on the downward stroke, it pushes the journal away from the upper part of the bearing. The shaft is also rolling in the direction the crank is traveling. Hence, the oil should enter at the beginning of the gap which intervenes between the shaft and bearing and thence be rolled up into the remaining space by the rotation of the shaft. The gap naturally begins at one side of the circumference of the shaft, so the oil grooves should most naturally be on the sides. After the crank passes the lower center of the up-stroke, oil should flow in from the groove on the opposite side in the same way. These grooves can thus be made large, say from ¼ in. to ⅜ in. in width and the whole length of the bearing metal.

The same scheme is applicable to the oiling of the main bearings, crank pin, crosshead pin, eccentric and governor weight pin, and it works to perfection, better even than was ever thought possible.

To gain some idea of the way it is working, it may be in order to point out a few cases. Cards were sent to nearly all the purchasers of these engines, asking them to have their engineer answer the questions printed thereon. The questions were as follows:

Size of engine? When installed? Revolutions per minute? Steam pressure? How often has oil been added since starting? Quantity of oil added each time? How often have adjustments been made? Where have adjustments been made? Replies were received in nearly every instance, and with the exception of five or six, they all ran over five months without any adjustments or additional oil.

There were many other problems in the perfection of this system which had to be worked out, that were, perhaps, equally as interesting in connection with this oiling system. For instance: After the oil has performed its usual functions it must be filtered, cooled and the water separated from it. Any of the usual methods of filtration were found unreliable, as they all allow pieces of lime or grit to pass through.

After much experimenting it was found that a plain closely-woven cloth suspended by four hooks from each corner of the frame, hanging just below the crank and above the oil in the base, gave the best results. All the oil dripping down from above lodges on this cloth and passes through to the reservoir below. Any foreign matter is left on top and has no tendency to leave the upper surface. Simple as it is, it has been surprisingly effective. As an extra safeguard a fine copper wire screen of ample area was attached to the pump suction and another to the discharge, both being easily removable for cleaning.

Another source of possible trouble which had to be guarded against is the loosening of core sand from the frame. No matter how much care may be exercised in cleaning a casting, some sand is sure to stick for a while, loosen later and cause serious trouble. To prevent this the frame is painted inside with two coats of thick white enamel. It took a lot of experimenting to get an enamel that would stand the heat, moisture and oil without softening, but it was finally procured.

The pump first adopted was of the plunger type, actuated by an eccentric on the shaft. It was thought too complicated, however, and was abandoned for a gear pump. On the shaft is a large bronze worm with coarse teeth into which meshes a small spur gear attached to a shaft supported at an angle of about 45 deg. The pump gears are within a case attached to the outside of the frame close to the bottom of the base, where they can be gotten at at any time.

The discharge pipe from the pump is 0.75-in. diameter, and extends up inside of the frame to the top, where it discharges through a sight feed glass, so the engineer can easily see if the oil is flowing properly. The oil then empties through a wire screen into a small tray, through the bottom of which latter project the various oil tubes nearly to the top of same. Each tube has a fine slit cut down the side of it to the bottom of the tray, so as to equalize the flow of oil into them all. In adjusting the engine for this system no bearing should be so tight as to make it impossible easily to slide the connecting rod or shaft along parallel with its axis.

The success attained with these engines, while largely due to the perfection of the oiling system, could not have been attained if it alone had been the only thing carefully developed.

First, good material of the proper kind has to be used, and all the pins, rods, shaft, piston, valve, cross-head shoes, etc., must be ground on centers to a true diameter and smooth finish. The shaft is a forging with suitable counter weights fastened on. The connecting rod is a drop forging finished bright. The cross-head is cast steel having brass shoes, wedge shaped and adjustable at the top and secured with lock nuts. The cross-head pin is a special composition of a very fine grain and hard enough to take on a very smooth finish. This pin in combination with the brass used will not cut. The brasses have been set up as tight as they could be driven on a dry pin and the engine run all day without the least signs of cutting.

The piston rings are roughed out, cut, drawn together and clamped. They are then ground to the cylinder diameter. The crank pin brasses are lined with the best quality of Babbitt metal, peened in and scraped to a perfect surface. Adjustment of these brasses is accomplished by two tap bolts turned out of hexagon steel, threaded on the lower ends. Above the nuts the tops of the bolts are turned down to a smaller diameter and threaded again for a lock nut. The two tops are joined together by a yoke-shaped washer which is between the nut and lock nut to prevent either of the bolts working out if one of the lock nuts should loosen.

The fly wheel is so designed that the greater part of the weight comes in a plane close to the end of the bearing, thereby relieving to a great extent any strain on the shaft. The enclosing panels are held in place by a single milled thumb-screw, thus overcoming the necessity for taking out a dozen or more screws to get off the cover plates.

Due to the high speed, small clearance and a well-fitting valve and piston the steam consumption has been brought down to an average of less than 37 lbs. per hp-hour for a 6 x 6 engine, with 100 lbs. pressure, when running 500 r. p. m. with full load. It is rare that the same economy is attained with other engines of the same size, as most of them take from 60 to 80 lbs. per hp-hour. They are machines, and as such are not "fool proof," but they can carry a heavy load, run at high speed, do with less attention and still perform their duty better than the majority of engines.

COUNTERWEIGHT DEVICE FOR ELECTRIC CARS IN SYDNEY, N. S. W.

The accidents occurring from runaway cars on steep grades in Orange, N. J., London and elsewhere, and the proposed electrification of the cable lines in San Francisco have called renewed attention to the methods of controlling the speeds of electric cars on grades by counterweights, such as have been installed in San Francisco, Portland, Providence, and Sydney, N. S. W. The first three have been described in this paper, and an account of that at Sydney, by Percy William Shaw, M. Inst. C. E., is given in a paper recently presented before the Institution of Civil Engineers, of London, and just published in the printed proceedings of that body. This line was completed and opened for traffic in November, 1903, and was constructed under the direction of H. Deane, chief engineer for railway construction, with Mr. Shaw as supervising engineer for tramway construction and Thomas Rhodes, assistant engineer.

The line is an extension of the Balmain Tramway, at Sydney, to the Darling Street wharf, and has a grade of 9½ per cent for 200 ft., and 12.1 per cent for 440 ft. Although

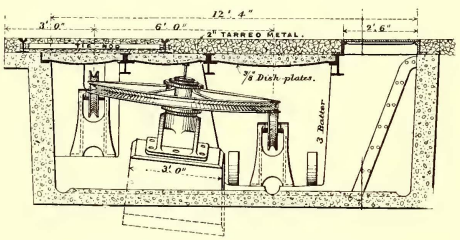


FIG. 2.—CROSS SECTION OF SHEAVE PIT

electric cars are frequently run on steeper grades with adhesion only, it was not considered by the railway commissioners, who control the tramways in New South Wales, advisable to build lines on grades steeper than 8.3 per cent, or 1 in 12. The cars on this line run on a 20-minute headway.

As shown in the plan in Fig. 1 and in the two sections, the conduit for the balance weight is laid at the side of the trolley track and is covered with ferro-concrete plates. The grade is uniform at 11.8 per cent, or 1 in 8.48. The rails weigh 60 lbs. per yard and are mounted on stringers 10 ins. x 5 ins. x 15 ft. in length, which are imbedded in concrete and held down by iron dowels. The carrier sheaves for the cable are 12 ins. in diameter and spaced 30 ft. apart. The gage of the rails is 2 ft. 6 ins.

The service track is laid with 83-lb. rails on a concrete subbase 6 ins. in thickness. The rails are anchored down by means of two short lengths of T-rails bolted on to the bottom flanges 6 ft. from the end of each rail and are kept in gage by tie-rods bolted to the yokes. The latter are 3 ft. 9 ins. apart. Carrier-sheaves similar to those in the counterweight conduit are located at intervals of 30 ft.

The sheave-pit at the top of the incline is illustrated in cross section in Fig. 2 and contains a 6-ft. sheave, set in a pit 12 ft. 4 ins. x 9 ft. 1 in., and 5 ft. 3 ins. in depth below the surface of the street. The sheave is built in halves, so that if an accident should occur it can be taken up through the trap. Guiding sheaves 15 ins. in diameter are set on each side of the end sheave to lead the cable on to it, and are provided with guard hoops to prevent the cable from being

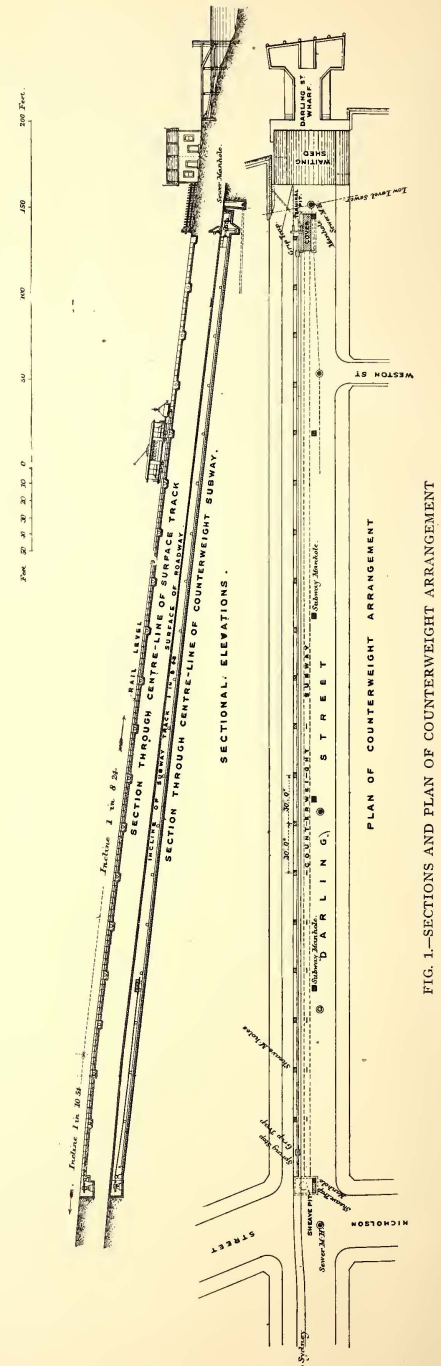


FIG. 1.—SECTIONS AND PLAN OF COUNTERWEIGHT ARRANGEMENT

jerked off in the event of slack being formed by unevenness in the tension of the cable.

The terminal-pit, Fig. 3, is 23 ft. 6 ins. in length and is provided with a removable floor covering. It contains a hydraulic buffer, to be described later, for cushioning the descent of the weight. This pit, the sheave-pit at the top of the incline, and the entire length of the subway are lighted by thirty 16-cp lamps, which in the subway are spaced about 30 ft. apart.

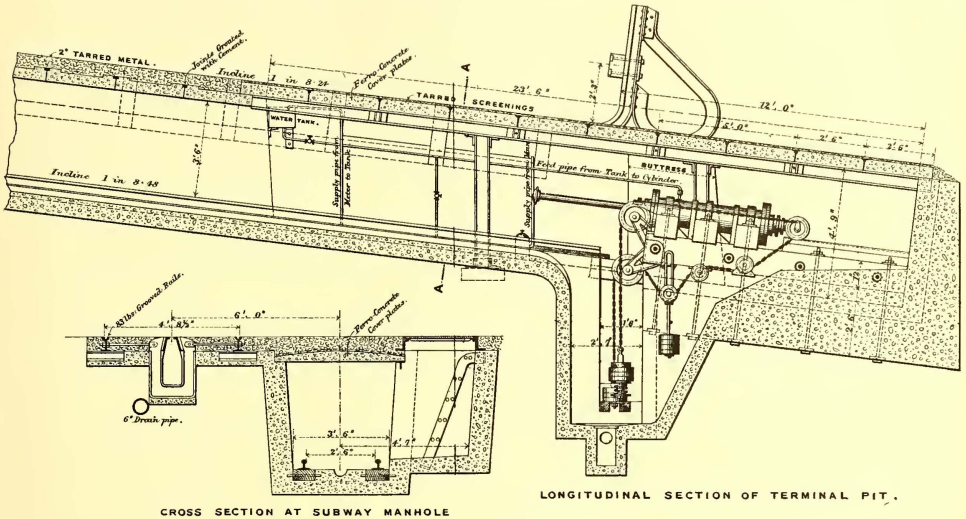


FIG. 3.—CROSS SECTION OF TRACK AND LONGITUDINAL SECTION OF TERMINAL PIT

The buffer car, which is connected by the cable through the counterweight, is illustrated in Fig. 5. It is built of timber with standard running gear, and is permanently attached to the cable by a grip consisting of a 1⅜-in. pin and shackle with a 1¼-in. square shank. The grip shank, which passes through the ⅞-in. cable slot, is a steel plate ⅝ in. in thickness, 12 ins. wide at the bottom and 18 ins. wide at the top. It is clipped at the top to a 2¼-in. shaft held in brackets bolted on the under side to the framing of the buffer car.

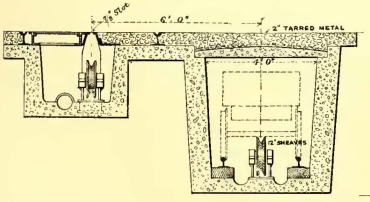


FIG. 4.—CROSS SECTION OF TRACK, SHOWING SHEAVES

A helical spring of the shaft is interposed between the upper end of the grip shank and the upper bearing of the framework, to take up any shocks. The grip shank is also free to swing sideways and adjust itself in the cable slot.

The cable itself was manufactured by Felton & Guilleaume, of Germany. It is ⅞ in. in diameter, is composed of six strands each consisting of twelve wires 0.071 in. in diameter, and has a hemp core. It weighs 1.1 lbs. per foot. The cable installed in 1903 was removed in February, 1906, when a new cable of the same size and manufacture was installed to replace it.

The hydraulic buffer at the foot of the balance-weight conduit is illustrated in Figs. 3 and 6. The cylinder is of cast iron 10 ins. in outside diameter and 4 ft. in length. The piston stroke is 3 ft. 6 ins. The inside of the cylinder, as shown in the sectional plan, is provided with two rectangular parallel wrought-iron feathers which are bolted to the inside. These feathers are 3 ins. in width by 1½ ins. in thickness at the back end, tapering to ½ in. at the front end and running from cover to cover. The piston is 9 63-64 ins. in diameter with two rectangular waterways 3 ins. in width by 1½ ins. in depth, cut longitudinally on each side to work along the feathers in the cylinder. The clearance between the piston and the cylinder is equal to an area of 0.25 sq. in., and the full waterways have an area of 6 sq. ins. As the piston advances, the waterways are gradually diminished by

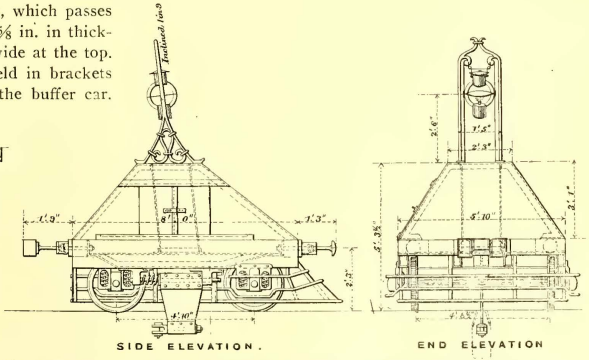


FIG. 5.—SIDE AND END ELEVATION OF BUFFER CAR

the tapering feathers, causing gradual increase in the pressure behind the piston, which finally brings it to rest.

To bring the buffer forward again, after being pushed in by the counterweight, cast-iron weights are attached to a crosshead on the tail-rod of the piston by means of chains running over pulleys at the front end. The weights are in three sets, attached to the ends and center of the crosshead respectively. The center weight is divided into a main weight and a jockey-weight, the latter being suspended from a 6-in. pulley running in guides which rides on the center chain. The jockey-weight is lifted by the chain before the main weight, and thus acts as a spring in taking up the first shock on the chain. The cylinder is automatically fed with water by gravitation from a small tank fixed at the top end of the terminal pit, and a brass non-return ball-valve is fitted on the pipe close to the cylinder. A small valve attached to the top end of the cylinder is provided for the escape of air which accumulates inside the cylinder, and which should be

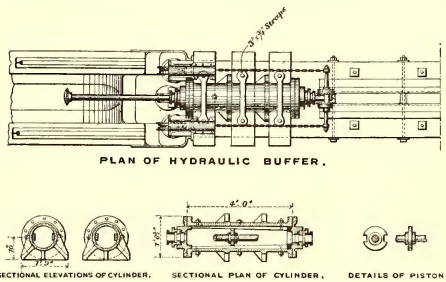


FIG. 6.—PLAN AND SECTIONS OF HYDRAULIC BUFFER

regularly released to prevent it from collecting and displacing the water to an extent that might prove disastrous. The consumption of water has been very small, the meter at the time that Mr. Smith presented his paper not having yet registered 100 gals.

The counterweight itself consists of a car with a steel framing, weighted with lead and fitted with timber buffers. It is mounted on four wheels, 19 ins. in diameter, with two axles 4 ft. 3 ins. apart. It weighs 11 tons. It is not intended to balance the cars, but merely to offer sufficient resistance to enable them to be safely controlled by their own brakes in descending the incline and to offer some assistance in ascending. As the cars weigh loaded an average of about 15 tons each, the effect of the balance weight, cable weight and cable friction is to reduce the effective descending grade to approximately 3.54 per cent and the effective ascending grade to 5.02 per cent.

The speed of the cars on the incline is usually not more than 5 or 6 miles per hour, and as a precaution against the cars being driven too fast over the top of the hill, where they leave the buffer-trolley, and where the reduced gradient tends to accelerate their speed, the top of the hill is made a regular stopping place.

The United Railroads, of San Francisco, is soon to begin operating 250 new cars, especially designed for San Francisco requirements. They will be somewhat like the new Chicago cars in use on Sutter Street, but instead of the smokers' space being merely the longitudinal seats at the rear end of the car, the new models will have separate end compartments, like those provided for smokers on the big suburban cars on the San Mateo line. The smokers' section will be partitioned off and the windows can be kept open most of the time.

HEAVY ELECTRIC TRACTION AT THE AMERICAN SOCIETY OF CIVIL ENGINEERS

A paper on the subject of "Steam vs. Electric Railway Operation for Trunk Line Traffic" was presented at a meeting of the American Society of Civil Engineers on Nov. 21 by Joseph Mayer, a member of that body. It contained a comparison of the relative advantages of direct-current and single-phase operation for the equipment of the Lake Shore & Michigan Southern Railroad from Buffalo to Cleveland, together with estimated cost of construction and operation. As an appendix to the paper Mr. Mayer described a new type of overhead conductor upon which he has applied for patents. It consists of substituting for the usual copper conductor in the catenary construction a soft steel rod, circular or figure-eight in section, whose diameter could be made to vary with the train speed and the oscillating weight of the collector. For a speed of 80 m. p. h. and a rigid collector weighing 25 lbs. above the supporting springs, the speaker recommended a rod 1¼ ins. in diameter. According to the speaker, with this rod the suspenders can be spaced 12 ft. apart without risk of compression when the sliding bow passes. Calculation shows that the center deflection of such a rod is only 1-9 in. The up-and-down oscillation of the collector increases the pressure on the contact conductor 22 lbs. when it passes the suspender, and it decreases the pressure 11 lbs. when it is at the center of the span. The pressure when at rest may be made 20 lbs. The maximum pressure will then be 42 lbs., and the minimum 9 lbs. The largest bending strain per square inch in the rod will be so small that it will be safe even with welds of mediocre quality. The collector roller might be considerably heavier than 25 lbs. without risk of breaking the contact rod. With a 1¼-in. contact rod, therefore, it is easy to design a rolling collector which has abundant strength and is very durable, thus greatly diminishing the cost of maintenance. This rod is supplied at intervals with expansion joints which are spanned by flexible copper bonds.

Mr. Mayer's conclusions on the value of conductors of this kind were as follows:

A 1¼-in. contact rod suspended from one rope hung in 300-ft. spans, by suspenders 12 ft. apart, sags only 1-9 in. at the center of each 12-ft. span. The current collector, if moving with a speed of 80 miles an hour, will oscillate up and down about 1-9 in. while passing under a 12-ft. span. This oscillation produces with an oscillating weight of 25 lbs. a variation of contact pressure of 33 lbs., which the rod is amply able to resist. The suspenders are never in compression, and the contact rod need not be supported on springs; a simple hinged connection answers every purpose; and a thin tension rod with eyes, or even a wire, may be used for a suspender. The current collector may be a heavy, strong and durable roller such as has been shown to be satisfactory by past experience.

A contact wire suspended from ropes with 300-ft. spans requires two ropes in inclined planes to prevent excessive lateral motion caused by the wind. The suspenders must be stiff triangular frames. The contact wire must be connected to the suspenders by springs arranged so that they will always operate properly. The wire must be under tension to enable it to resist the pressure of the sliding bow. This tension will vary greatly with changes of temperature. The variation in the temperature of wire exposed to the sun and carrying a variable and considerable current is, in the northern United States, 140 degs. F., or more. It is not possible to adjust the wire so that it will be satisfactory at both extremes of temperature. It will either stretch and occasionally break at the lowest temperatures, or be so slack in summer that the collector will jump and cause sparking and excessive strains. If the springs which are necessary at the suspenders do not operate properly, or as intended, the oscillating motion of the collector will be jerky and will cause alternately excessive and defective contact pressure, endangering the wire and causing sparking. The breaking of the wire may be accompanied by the rise of the sliding bow above it, and the destruc-

tion of a number of suspenders, causing the fall of the wire and possibly fatal disaster. The current collector cannot be a substantial roller; it must be an elastic sliding bow, so as to reduce the oscillating weight to the smallest possible amount. It will be difficult to design a tolerably satisfactory sliding bow, and it will cause at best a large cost maintenance. The only advantage of the wire is its larger conductivity for alternate currents and the consequent saving in the cost of feeders. In short, a contact wire and its accessories make a complicated, short-lived and unsafe structure, expensive to maintain, while a contact rod is simple, safe and durable.

In the discussion which followed the paper, Frank J. Sprague referred to the desirability of using higher potentials than those at present employed in d. c. work, but advocated a third rail and direct current in preference to alternating current with overhead conductor. In his comparison of the two systems he said:

"The third rail offers certain hindrance to the ordinary maintenance of track, but overhead construction is inelastic, and the laying of additional tracks or changes in grade and alignment require radical and expensive alterations in permanent overhead structures. Derailments will crush one form of conductor to the ground, but may equally well knock down the supporting structures of the other and put all tracks out of service. In wrecking, the third rail offers some obstruction to the throwing of the equipment to one side, but conductors overhead may interfere with the operation of crane booms. With two or more tracks snow cannot well be piled up between them when the space is occupied by third rails, but on the other hand overhead conductors are a source of danger to train men, and subject to the troubles of sleet formation."

He did not believe that snow and sleet would cause complications with the third rail at frogs and switches, while he did believe that an overhead high-potential conductor would prove objectionable at overhead street and highway bridges, in tunnels and at low bridges, and as possibly intercepting the train operator's view of semaphore signals. He also compared direct-current and single-phase motors and locomotives for heavy electric traction conditions, and stated that the weight and cost of the motor equipment is much higher for single-phase than for direct current, that the cost of permanent working conductors per mile of track is fully as high, and that the cost of a central station would be somewhat greater because of the reduced capacity for weight of material for single-phase generating apparatus. He also thought when extended systems are considered the increased cost of the sub-stations for direct current with their transformers and rotaries would be more than offset by the increased first cost and the cost of operation of the motor equipment on the a. c. system when each is installed with equal regard to permanency.

The Chattanooga Railways Company's publicity department is getting out, once a week, a very attractive little folder called the "Weekly Trolley," which is distributed by means of pockets on every car. This folder contains the schedule of every car on each line, giving the time when a car can be looked for at prominent points along the various lines. In addition to the schedules the folder also offers suggestions as to transfers and gives the points at which they are good on each line. For the benefit of strangers there is a complete list of the various theaters and points of amusement in the city, with instructions as to what car to take to get there.

The Columbus, Delaware & Marion Railway Company has announced interline ticketing arrangements with the Scioto Valley Traction Company and the Indiana, Columbus & Eastern. Tickets are sold between any points on these lines.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The last meeting of the year of the Central Electric Railway Association was held in the Algonquin Hotel, Dayton, Ohio, Nov. 22. The meeting was well attended and an animated discussion took place on the four subjects announced in the Nov. 24 issue of the STREET RAILWAY JOURNAL.

These were on "Automatic Couplers," "Discontinuance of Free Transportation and to What Limit Shall Same be Issued," "Limited Service, and Does It Pay," and "Impressions from the Columbus Convention."

MORNING SESSION

In calling the morning session to order President E. C. Spring stated that for a time it was considered inadvisable to hold the meeting, inasmuch as the date occurred so soon after the Columbus convention, but as it was to be the last meeting of the year it was afterward thought best to hold it. He spoke of the resignation of Secretary John H. Merrill, who resigned to take the management of the Choctaw Railway & Lighting Company at South McAlester, Indian Territory. Since his resignation Treasurer W. F. Millholland has been attending to the duties of secretary.

Mr. Spring expressed himself as well pleased with the manner in which the Central Electric Railway Association had been recognized by the national associations. In a letter to the association Prof. B. V. Swenson, secretary of the national association, had expressed his appreciation of the many courtesies extended by the Central Electric Railway Association on the occasion of the Columbus convention. The election of A. W Brady as vice-president of the national association, President Spring said, showed that the Central Electric Railway Association was being recognized outside of its own sphere. He stated that the executive committee had deemed it best to hold the January meeting of the association at Indianapolis. At this time the election of officers and the annual banquet would be held. He urged all members to attend both the banquet and the meeting. One feature of the meeting would be the assemblage of special cars. The Indianapolis Traction & Terminal Company had arranged for these cars to be placed on a track opposite the Claypool Hotel, and the company was making preparations in other ways to take care of those attending. An effort was being made to have as speakers at the banquet the Governors of Ohio and Indiana; T. E. Mitten, president of the Chicago City Railway; H. H. Vreeland, president of the New York City Railway Company, and W. A. Bancroft, president of the Boston Elevated Railroad Company.

On President Spring's request for the sentiment of the association there was considerable discussion as to whether or not ladies should be invited to the annual banquet. Opinions were expressed by several, tending to confirm the belief that the members in general favored the banquet being a "stag" affair. With regard to the election of officers, President Spring said that according to the constitution the presidency went to Indiana.

President Spring felt assured that the association had a bright future. In its brief existence it had done things that at first appeared impossible. It had, however, tried some experiments that were not feasible and which could not be carried out.

At the conclusion of the president's remarks the financial report of the association was read by Acting Secretary W. F. Millholland. The report showed a substantial balance in the treasury.

AUTOMATIC COUPLERS

After the presentation of the treasurer's report the first of the four previously announced subjects, that of automatic

couplers, was taken up. The discussion was opened by W. T. Van Dorn, who drifted more particularly into the question of the standardization of coupler heads and of the height of automatic couplers to permit cars of different systems to be coupled. In the course of his remarks he said that the importance of strength of the draft rigging was not well enough appreciated. The argument was sometimes made that when cars were operated with the multiple-unit control so much strength was not required in the draft rigging, but this idea, he said, was a mistake, as had been shown by experience.

The advantage of a tight lock was emphasized, and he urged the adoption of a standard length of coupler.

In reply to the question of J. C. Rothery, general manager of the East Liverpool Traction & Light Company, as to what special advantages automatic couplers possessed over pin couplers for use on cars operated on city streets where sharp curves are encountered, Mr. Van Dorn stated that they coupled the cars closer and eliminated practically all of the play between the coupler heads, which was highly necessary in multiple-unit operation. Safety in coupling was also obtained; in using radial draw-bars with the ordinary heads the man making the coupling was exposed to a great deal of danger.

In reply to an inquiry as to the proper length of draw-bar Mr. Van Dorn said he thought that a length of 4 ft. or 4 ft. 6 ins. between the face of the draw-bar head and the swivel would meet most conditions. The adoption of such lengths would enable manufacturers to keep couplers of standard lengths in stock, instead of making them to each order.

W. H. Evans, master mechanic of the Indianapolis Traction & Terminal Company, said that the railway people were more concerned with a standardization of the height of the draw-bar head. In Indianapolis they had a special coupling bar to be used in coupling cars the draw-bars of which were at different heights.

Mr. Van Dorn stated that, while the Van Dorn draw-bar allowed for a variation in heights of about 3 ins., the question of a standard height was out of the manufacturers' field and was for the operators to decide.

E. F. Wickwire, of the Ohio Brass Company, stated that his company had an automatic coupler which he desired to show to those in attendance. He called upon Charles H. Tomlinson, the inventor of the coupler, who showed a coupler together with a working model, and explained many of its points. For his coupler he claimed that it was strictly automatic and no setting was required; that it would couple on any curve the cars could go around; that there were no loose parts to be lost, and that it was interchangeable with all types manufactured at the present time. Of automatic couplers in general he said they were indirectly a protection against fire, as when cars were stored in houses the couplers could be thrown in alignment so in case of fire all that was necessary was to back the cars against each other, when they would couple automatically and the whole train could then be pulled out.

Mr. Tomlinson thought a length of 4 ft. 6 ins. between the face of the draw-bar and the swivel would answer most requirements. The buffer of the car, however, should have its center of curvature at the swivel.

AFTERNOON SESSION

At the opening of the afternoon session President Spring announced that, owing to an important meeting, all of the members of the Ohio Railroad Commission had found it impossible to accept the invitation to be present, but that O. P. Gothlin, a member of the commission, was present and would open the discussion on the subject, "The Discontinuance of Free Transportation, and to What Limit Shall Same be Issued."

Mr. Gothlin on taking the floor assured the association of the commission's appreciation of the invitation to attend the convention, and he added that he thought that within a short time the executive officers of the interurban railroads would receive an invitation to be present at a special meeting of the commission. This meeting would be held partly for the purpose of getting acquainted, but there were in addition several subjects the members of the commission wanted to discuss with the interurban people.

Before opening the discussion on free fares Mr. Gothlin stated that any opinion he might express was simply an informal one. He then read section 8 of House Bill 78, which states that the Ohio laws concerning passes should not be construed to prevent the giving of free transportation to ministers of the gospel, to homeless and destitute persons, to officers of charitable institutions when traveling on official business, to employees of the railway, or to dependents of employees; and that the laws did not prevent the interchange of passes between officials of different roads. Another section stated that nothing but money could be accepted as pay for transportation. Mr. Gothlin said that it was the sentiment of the commission that no railway officer was justified in giving free transportation to newspaper men or others not specified in the act.

In reply to the question by J. C. Rothery as to whether or not the laws applied to street railways, Mr. Gothlin said that any railroad whose lines extended beyond the limits of a city would come within the limits of the act.

Concerning automatic couplers, Mr. Gothlin read section 2 of House Bill 242, which required common carriers to have their cars equipped with them. This applied to interurban railways and was in force at the present time, but if the equipment was of such a nature that it had been found impossible to comply with the law, leniency would be shown the interurban companies. He said that the question of automatic couplers was one of the subjects that the commission wanted to discuss with the interurban officials at the proposed meeting. He stated, further, that the Ohio Railroad Commission did not assess penalty for violations of the law, but that it simply instructed the Attorney General to bring suit.

With regard to the question of free transportation F. J. J. Sloat, general manager of the Cincinnati Northern Traction Company, said this was a matter for each road to decide for itself. Hard feelings were often created by the discontinuance of passes, but they usually died in a short time. He stated that his company took care of the newspapers by making contracts with them after bids had been submitted. They were paid in mileage books of a value equivalent to the money value of the advertising.

J. C. Rothery told of the attitude on the pass question assumed by his roads. On the lines of the East Liverpool Traction & Light Company no free transportation was issued. As general manager he himself paid his fare. No free transportation was issued to any county or State official. He thought every road should be willing to pay cash for everything it received, and should demand cash in return. He thought a badge should be a pass for an employee. He paid cash for his advertising and expected the newspapers to pay cash in return for transportation.

F. D. Carpenter didn't think the question of to whom to give free transportation was left for the traction officials to decide. The law stated definitely to whom passes could be issued, and he intended to be a law-abiding citizen. At the present time his road, the Western Ohio Railway, issued an annual fifty-two ride ticket to employees.

At the conclusion of the discussion regarding free transportation President Spring called upon H. P. Clegg, president and general manager of the Dayton & Troy Electric Railway Company, to open the discussion on "Limited Service, and Does It Pay?" Mr. Clegg said he had never considered the operation of limited trains from a paying standpoint. On his road he had operated them more because it was a duty as a common carrier to give the best service possible. He thought some managements should consider this duty more seriously. He said he had noticed that on some roads the schedules were altered at different seasons of the year, seemingly exactly to fit the demands of travel. He did not think managements had a right to do this, and characterized such views as narrow minded. On his road it was the policy to operate more cars than were needed. This not only took care of the present existing travel, but it invited additional travel.

As to the reasons for maintaining limited service, he said there were different kinds of passengers, and the only way to accommodate all was to maintain the two kinds of service. He gave patrons the opportunity to take their choice, as a merchant usually does with a customer.

He thought managements had something else to do than to make dividends, and that by doing that which was only necessary they often invited attacks from the city officials and the boards of health, and caused officers to step in and tell them how to run their properties.

General Manager H. A. Nicholl, of the Indiana Union Traction Company, said that on his system limited trains were alternated with locals. He found from the records that limited cars earned about 25 per cent more than locals. An excess fare of about ¼ cent per mile was charged on the limiteds. The fact that all the divisions of his system were paralleled by steam roads necessitated the operation of limited cars to an extent, but there was a certain class of people that demanded better cars. He had never known an instance where people were not willing to pay excess fare when greater speed and better cars were offered. He thought local conditions determined the necessity of putting on limited cars, and he did not believe they were necessary on the very short roads.

C. N. Wilcoxon said that until about one year ago no attempts of any consequence had been made to operate limited cars on the Cleveland & Southwestern system. On one division they are now run at three-hour intervals. Between Cleveland and Oberlin they are run every two hours. On the Cleveland & Wooster division four limiteds are run in each direction per day. The limited cars earned slightly more than the locals.

F. D. Carpenter said that his system, the Western Ohio Railway, had operated limited cars for about two years. Last January the service was extended from Dayton to Toledo. He believed there was business in the field that had not yet been reached, and that if the service were given the people would always ride.

In reply to a question of the comparative expense of operating limited and local cars, Mr. Clegg stated that his company had found the current consumption and the cost of maintenance of the equipment considerably less, and this was largely due to the elimination of the stops.

The discussion of the last subject, "Impressions from the Columbus Convention," was opened by H. A. Nicholl, who said that, although he had been attending the annual conventions for several years, he could not recall an occasion when he had seen a finer collection of exhibits or a greater attendance. He thought the attendance at the various meetings was better than on previous occasions, and that the papers had been presented by stronger men.

President Spring said a wonderful interest had been stimulated throughout the country regarding interurban operations in the Middle West. Some Eastern gentlemen whom he took on a 230-mile interurban trip during the convention were absolutely surprised at the way the roads were laid out and the facility with which the car they were on was transferred from one system to another. He said the papers at the convention were extremely interesting. That on "Selection of Trainmen," by Clarence E. Learned, had impressed him deeply. He urged others interested in this subject to read the paper, as it dealt with the matter in a unique way and was by a man thoroughly competent to handle the subject. The paper on track construction had likewise given him a clear conception of the subject with which it dealt. He thought the industrial display was without parallel.

Before adjourning the meeting President Spring took occasion to express the thanks and appreciation of the association to the Ohio Railroad Commission and to Mr. Gothlin, its representative at the meeting, for the interest shown in the association.

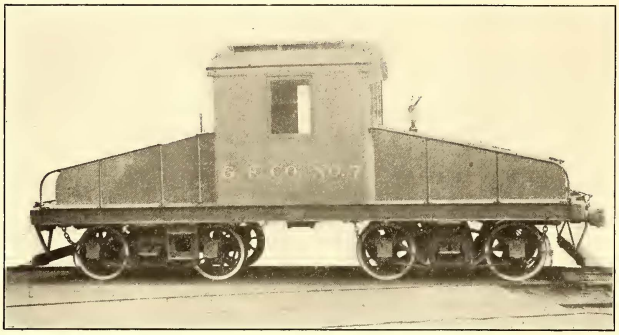
The nominating committee for the coming year, as announced by President Spring during the meeting, was composed of J. O. Wilson, treasurer Cleveland & Southwestern Traction Company; F. D. Norveil, of the Schoepf syndicate lines in Indiana; S. D. Hutchings; G. H. Kelsey, superintendent of power Indiana Union Traction Company, and C. M. Paxton, secretary and traffic manager Dayton & Troy Electric Railway Company.

The management of the Aurora, Elgin & Chicago Electric Railway has decided to enter into active competition with the steam railroads for express business. Unable to secure an ordinance to bring express into the city, the company has arranged to take the express packages to its station at Fifty-Second Avenue, where the trucks will be unloaded into express cars and the contents distributed over the line. With this end in view the company has established an express package station in the building at Jackson Boulevard and Franklin Street. It is intended to collect the packages throughout the city and to take them in a large automobile to the outlying station, where they can be loaded into the cars of the company. It was stated yesterday that the express rates would be about 50 per cent of the tariffs which are now in effect on steam roads, and it is expected to build up a large business. Recently the electric line has been engaging in the milk traffic, and is said to have cut into the business of the steam roads to a serious extent. A very large area in Illinois will be served by the new express arrangements. The main towns reached are Maywood, Bellewood, South Elmhurst, Lombard, Glen Ellyn, Wheaton, Warrenville, Wayne, Aurora, Batavia, Elgin, Dundee, Carpentersville, St. Charles Geneva, Oswego, Yorkville and Glenwood Park.

According to "l'Elettricita," it has been agreed between the Oerlikon and Siemens-Schuckert works to commence immediately the plant for the electrification of the whole length of the St. Gothard Railway. The section from Zurich to Lucerne is to be constructed first as an experiment. This first section is the only one at present approved of by the Federal Railway Department, but it is stated that a syndicate has offered to convert at their own cost the whole part of the line which is situated in Switzerland by 1909, and to transfer it to the Swiss government on terms yet to be agreed upon.

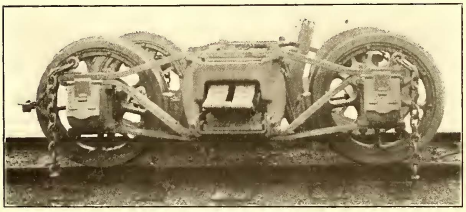
AN ELECTRIC SWITCHING LOCOMOTIVE

The American Locomotive Company has recently completed a 37½-ton electric switching locomotive for the General Electric Company. The locomotive is designed for operation on a 250-volt circuit. The maximum tractive effort is 15,000 lbs., and the instantaneous draw-bar pull for starting purposes is 18,800 lbs.

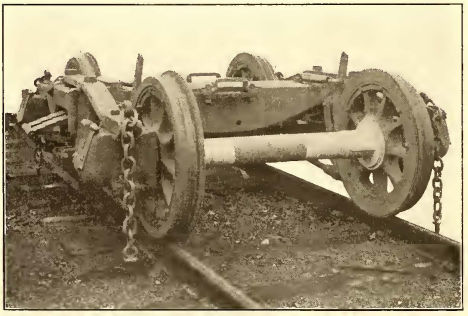


VIEW OF COMPLETED LOCOMOTIVE

The running gear consists of two of the builder's four-wheeled, arch bar frame trucks with cast-iron floating bolsters. Each truck is equipped with two 175-hp GE 68-B direct-current motors. The latter are inside-hung, with half the weight carried on the axle and half by nose suspension from the truck frame.



SIDE VIEW OF TRUCK



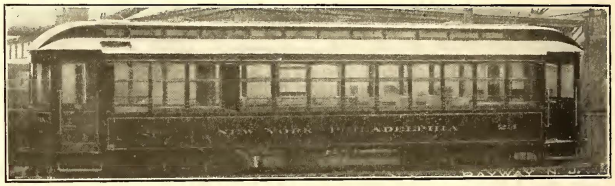
END VIEW OF TRUCK

The locomotive is arranged for single unit control and is fitted with trolley and third-rail shoes. It is equipped with General Electric Company's straight air brakes and Leach sander, operated by one centrifugal pump, No. 22 air compressor.

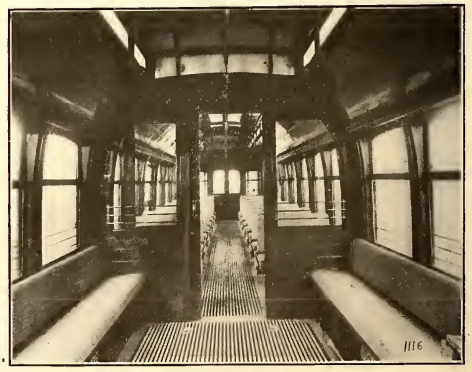
The platform and framing is of 10-in. steel channels and 3-16-in. floor plates. The cab is of the steeple type and consists of one main cab and two auxiliary cabs. Some of the principal dimensions of the locomotive are: Length over all, 31 ft. 1 in.; width, 9 ft. 6¼ ins.; total wheel base, 22 ft.; driving-wheel base, 6 ft. 6 ins.; height over the cab, 12 ft. 1¾ ins.; height with the trolley down, 13 ft.; diameter of the truck wheels, 36 ins.

CARS FOR CAMDEN & TRENTON RAILWAY

The car shown in the accompanying illustration is one of seven lately added to the lines of the New York-Philadelphia Company of New Jersey. The new cars will operate between Camden and Trenton and are primarily for the betterment of the suburban traffic between Philadelphia and the numerous Jersey towns reached by the company's lines. One class of passengers who will feel the benefit of this new rolling stock are the business men who travel daily to Philadelphia and who require a convenient schedule and comfortable means of transportation. In the latter respect the new cars leave nothing to be desired. Smoking compartments are a necessity on a road whose traffic is composed largely of the class of passengers mentioned, and the present cars are no exception to the rule; the usual longitudinal seats are furnished in this compartment. The length of the car, its steam-coach roofs and straight sides, coupled with the big windows, wide



SIDE VIEW OF CAMDEN & TRENTON CAR

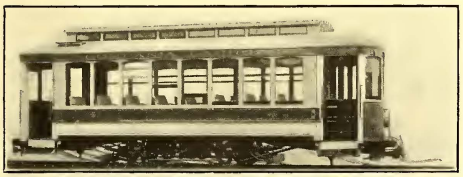


INTERIOR OF CAMDEN & TRENTON CAR

aisle space and commodious seats—the three latter attributes of comfort being brought about by using the Brill grooveless-post semi-convertible feature—give to the car a very symmetrical and imposing appearance. The cars are painted in a rich carmine with gold lettering and striping. The interiors are of cherry. The trucks employed are the No. 27-F1 with a wheel base of 4 ft. 6 ins. Four 40-hp motors were installed on each car. The weight of one car and trucks with motors is 45,000 lbs. The cars measure 34 ft. 4 ins. over the end panels and over the vestibules 43 ft. 9 ins.; the length of the smoking compartment is 8 ft. 7¾ ins.; width over the sills, including the sheathing, 8 ft. 8 ins.; height from the floor to the ceiling, 8 ft. 5 ins.

SOME INTERESTING FEATURES OF CARS FOR BUENOS-AIRES

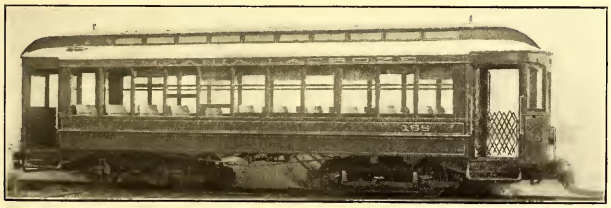
A big export shipment recently left the works of the J. G. Brill Company for Buenos Aires, South America; the order was placed through J. G. White & Company by the Compania Lacroze, and consisted of seventy-five single-truck grooveless-post semi-convertible cars and ten double-truck cars having the same window system. The smaller cars have a length over the end panels of 21 ft. 4 ins.; over the



SINGLE-TRUCK CAR FOR BUENOS-AIRES

crown pieces and the vestibules, 30 ft. 4 ins.; width over the sills, 7 ft. 10½ ins.; height from the rail over the trolley board, 11 ft. 9¼ ins. The double-truck cars measure 31 ft. over the end panels and 41 ft. over the crown pieces and vestibules; width over the sills, including sheathing, 7 ft. 10½ ins. The type of single truck used is the No. 21-E with a wheel base of 7 ft. 6 ins.; the type of double truck, the No. 27-E1 with a wheel base of 6 ft. 6 ins.

The interiors are unusually handsome, being finished in mahogany, inlaid; push buttons will be found at every post.



DOUBLE-TRUCK CAR FOR BUENOS AIRES

A novel feature is the installation of two electric fans at diagonally opposite corners of the car for service during the hot summer months. Another innovation is a metal pocket into which is slipped the conductor's badge. This receptacle is so located as to be easily seen by passengers entering and leaving the car. The pocket allows the number of the badge to be clearly read, the presence of the badge indicating, of course, that if the conductor does not properly perform his duties, passengers will have the means of reporting the delinquent at headquarters. On each corner of each vestibule is placed a lens, behind which is a colored glass—one of four colors—illuminated by an incandescent light, the color scheme designating the destination of the car. Each car is equipped with independent motor-driven brakes. All the wiring in the cars was done in concealed loricated conduits. The illustration shows the larger type of car equipped with folding gates, while the single-truck car has folding doors. As a matter of fact both types of cars were shipped with the folding gates and also the folding doors, the former for use in the summer, the latter in winter, when a warmer and more weather-proof compartment is desirable. The cars were built in sections so they could be knocked down for export shipment.

NEW PRUSSIAN REGULATIONS GOVERNING THE CONSTRUCTION AND OPERATION OF ELECTRIC STREET RAILWAYS

The new regulations issued in Prussia concerning the construction and operation of electric railways constitute one of the most important events in electric operation in Germany for a long time. These regulations are not law in the actual meaning of the word, since laws can be made only by Parliament and the executive, but as in other countries the secretary or minister of the appropriate department has authority to formulate certain rules for the guidance of inferior authorities. The fundamental law for all street railways is still the Prussian secondary railway law (Kleinbahn-gesetz) of 1892.

It is an old experience that a good law can be very oppressive when interpreted in too literal or unfavorable a manner, and vice versa, a very strict statute is comparatively unobjectionable when enforced along the lines of common sense. This condition is particularly true when the law is so drawn as to leave a great deal to the discretion of the local authorities. This was the case with the law of 1892, which allowed the governing bodies (called in Prussia the "Technical Inspection Authority for Secondary Railways") a large amount of latitude. These inspection or regulating boards were made up of the managers of the government steam railroad lines in whose districts the street railways were located. Early in their history this plan was not objectionable. It soon became evident, however, that the interurban lines would have to adopt standards in construction and operation more like the steam lines than the street railway companies. The regulations for interurban lines were therefore carefully codified in 1898.

In the meantime the street railways developed to such an extent that their construction and operation became highly specialized and it was found that the inspecting commissioners, who were trained along steam railroad standards, could not well be left in sole charge of their administration. Moreover, this portion of their duties was considered by them as a side occupation. They could give only a small part of their time to this work, and it frequently happened that their personnel would change. There were sometimes three commissioners in one year. The result was the issue of numerous burdensome orders which did not secure the purpose in mind, namely, that of safety in operation.

This condition of affairs led the street railway companies to petition the Prussian Minister of Public Works in 1900 to

make the regulations more strict, so that those in charge of their administration would have less freedom in their interpretation. This was done because the street railways thought it would be better to obey a few burdensome regulations and know just what they were than to be obliged to change their rolling stock and equipment almost any moment. This request was granted and the new rules have just been issued. As a whole they give general satisfaction. The more important are published below:

In general, grades shall not exceed 1 to 15, but steeper grades for short distances shall be permissible if operating safety is demonstrated by experiment.

Lines on public streets must be laid with girder rails or composite rails with flanges high enough to give a running tread for street vehicles. Exceptions are permitted. In general, curves shall not be less than 15 m. (49 ft.) radius, but exceptions are permitted. Where the conditions permit, the outer rail should be elevated.

On straight track the grooves shall be at least 30 mm (1 3-16 ins.) but not wider than 40 mm (1 9-16 ins.), except that they can be wider on curves according to the gage. If they become wider through wear, the rails can be kept in service until worn out.

All rails, switches and other parts of the track on public streets must be so laid that they will not interfere with traffic.

(These regulations are a considerable improvement over the former ones. The latter often demanded that a rail should not project above the pavement, and vice versa. The strict execution of this rule cost the street railway companies a great deal of money, as they were obliged to keep making repairs continually. Formerly the pavement maintained by the railway company, usually for a space 30 cm to 60 cm (2 ft. to 4 ft.) outside of the rails, was in much better condition than that maintained by the city. The result was that most of the wagon traffic would travel on the track, thus making it wear out more quickly than other parts of the roadway. Under the new rule it will not be necessary for the railway company to undertake repairs as soon as the pavement sinks a little, but it can take its own time.)

In conduit operation, the conduits may be placed in the middle of the track or under one rail. The slot on straight track must not exceed 30 mm (1 3-16 ins.), and on curves 45 mm (1¾ ins.) in width.

The stopping places are to be regulated by the local conditions and must be made known in some appropriate manner.

(This last rule obviates an evil that had almost become general. Somebody discovered that the safety of street railway traffic was increased if the cars stopped at the "near" corner of a street crossing. This idea was exploited in the newspapers, and the authorities in many cases ordered all cars to make this stop. One difficulty which resulted was that the companies had erected expensive waiting pavilions on the opposite corners. These became useless. Moreover, in very large cities it was found that in the rush hours there were blockades caused by cars which were obliged to turn into the cross street, stopping on the corner. According to the new rule the railways have full permission to place the stopping places wherever local conditions require.)

The distance from the center of the track to the curbstone must be at least one-half of the greatest width of the car. On switching and on double-track sections the distance between centers of rails must be at least 400 mm (16 ins.) more than the greatest width of the cars. On curves this same distance must be observed where local conditions permit.

Iron bridges maintained by the railway company must be examined at least every five years, and records of these tests must be kept.

Span wires suspended from the sides of houses must be provided with means for deadening sound and preventing rattling.

The railway company must at all times have sufficient auxiliary power to take care of extra-heavy traffic and unfavorable traffic conditions without disturbing the operation seriously. In the case of damage to machinery the reserve must be sufficient to maintain the schedule of a working day. If the railway has no power station, but purchases its power, these regulations apply to the station selling the power.

All wheels excepting those on the middle axles of three-axle locomotives and cars must have flanges. At speeds up to 25 km (15½ miles) per hour, these flanges, assuming they are used only on girder rails, may be worn down to 12 mm (½ in.) in height and 8 mm (5-16 in.) in thickness. At higher speeds and with T-rails the size of flanges is fixed by the engineering commission for trunk line railways.

The thickness of the wheel tires where the weight per wheel is 3 tons must be at least 16 mm (⅝ in.), and for greater wheel weights at least 18 mm (11-16 in.). On all other rolling stock the tires may be worn down to 14 mm (9-16 in).

All rolling stock, except construction cars, must have spring couplers at both ends.

Track scrapers shall be used on all cars. Their height above the rails shall not exceed 6.5 cm (2.5 ins.) where all of the pavement is asphalt; 8 cm (3.1 ins.) where pavement is either asphalt or stone; and in no cases, even on outside lines, must it exceed 10 cm (3.9 ins.).

The car steps must permit easy entrance and exit. The lower part of the body must have no sharp corner projections. When possible a hand rail should be attached to the side of the car to assist in getting on or off.

(This last rule is a great relief to the railway companies. During the past few years the regulating authorities often requested that the steps should be as high as possible. In fact, a minimum of 380 mm (15 ins.) was prescribed for loaded cars with worn-down wheel tires, corresponding to a height of at least 460 mm (18 ins.) for an empty car with new wheels. The object of this rule was that persons who fell in front of the car would not be caught by the step. It is possible that in very infrequent cases casualties have been avoided in this way, but it is certain that more persons have been injured from entering or leaving cars on account of a high step than would have been the case if the steps had been lower. Such high steps, even when the car is standing still, are very inconvenient, especially to stout and infirm persons.)

All motor cars must have at least two independently operating brakes, one of which must be mechanical, such as air brake, electrical short-circuiting brake, or electro-magnetic brake. All cars, except freight cars, must have a hand brake.

When more than one trail car is used the braking arrangement must be such that the motorman can apply all brakes throughout the train at once. Exceptions are permitted by the commission in certain cases where the operating conditions are very simple. Simultaneous train braking may also be required with one trail car if the traffic conditions are severe.

All brakes should operate as noiselessly as possible, be actuated from either end of the car, and of such capacity that a car with full load on a dry rail at a speed of 10 km (6¼ miles) per hour may be stopped in a length of 6 m (19½ ft.) from the application of the brake-shoes. The commission reserves the right to make severer regulations when it appears necessary.

Motor cars and locomotives must be fitted with effective sanders.

The car platforms must be furnished with suitable doors or gates. On demand of the commission, vestibules must be placed on interurban cars, and the motorman's place separated from the passenger compartment.

The seating space to be allowed per passenger must be at least 490 mm (19¼ ins.) wide, except that cross-seats may be somewhat narrower when allowed by the commission.

All cars must be lighted, and, if fitted for electric illumination, there must also be auxiliary lighting. The commission can also specify when the cars must be heated.

Every car must be fitted with some means of signaling between the conductor and the passengers and also with the motorman.

Business advertisements, as a general rule, should be placed only inside the car, but not on the windows. Exceptions outside the car are the dasher signs, and, for the interior, such window signs as are in the form of cut or etched work on the glass. This is also regulated by the sense of the commission.

Every motorman's stand must have a gong or other means for attracting attention.

Every car must have the following information clearly indicated on its exterior: First, the owner; second, the car number, and, in the case of passenger cars, this number must be placed once at each end and on each side; third, on all cars, the weight of the car, including axles and wheels, and except such loose apparatus as may be needed for the equipment; fourth, on freight and express baggage cars, the carrying capacity; fifth, the time the last inspection was made. The interior and the platforms of passenger cars must contain a record, in addition to the car number, of the number and kind of seats in each compartment.

The electrical apparatus on motor cars must be inspected every six months. The entire car must be inspected throughout at least every two years and trail cars at least every three years. This form of inspection covers the raising of the car body from the trucks and the taking out of axles and bearings for testing their strength. Detailed reports must be made of such examinations

and submitted to the inspecting officials. The date of this general overhauling must be marked on every car.

If cars are operated more than 20 km (12½ miles) an hour, the track must be inspected every day. At lower speeds the inspection must be made at least every three days. If the rails are in paved streets, the inspection periods will be prescribed by the official commission.

All motor cars must be furnished with headlights unless otherwise permitted.

The first car of the train must carry on the front and sides the destination signs, and the one on the front must also be visible at night. Exceptions to this rule are also permitted. The capacity of a car is regulated by the seating capacity. Local authorities are allowed to permit more than the regular capacity of the car in emergency cases.

During the intervals that the cars or trains are standing at terminals, they must be thoroughly ventilated.

The maximum speeds of trains, as a rule, shall be 30 km (19 miles) for gage of 1435 mm (4 ft. 8½ ins); 30 km (19 miles) for 1000-mm gage (3 ft. 3½ ins.); 25 km (15.5 miles) for 750 mm (2 ft. 5½ ins.) gage; 20 km (12.4 miles) for 600 m (2 ft.) gage, and 15 km (9.3 miles) for rack railways. Higher speeds than these are allowed only with the permission of the Minister of Public Works, if it is shown that the traffic conditions justify them.

The Commission reserves the power to enforce lower speeds where the traffic is very heavy or there are severe grades, or such speeds may be changed for definite periods. The maximum speeds fixed are to be lower also at curves or other places where safety demands it.

The following rules are given for crossings and connections of street railways:

Cars must stop at such places, according to conditions, unless there is a solid procession of soldiers, funerals, mail wagons or fire department trucks. Aside from switching and stopping places, trains and individual motor cars must be at least 20 m (65 ft. 8 ins.) apart when traveling 16 km. (10 miles) an hour; 30 m (98 ft. 6 ins.) when running at 20 km (12.4 miles); 60 m (197 ft.) at 25 km; and 100 m (328 ft.) at 30 km (19 miles). Exceptions are made by the Commission.

Every motor car must have one motorman, and unless cash fare boxes are permitted by the Commission or no fare tickets are given out during the trip, there must be one conductor. Every trailer shall have a separate conductor whose duty it shall be to have the sole right to operate the hand brake on his car if the train braking arrangement should fail. Exceptions are allowed by the Commission.

Motor cars standing on the track must be constantly in the care of one of the employees. The brakes must be applied, and on electric motor cars the controller handle must be removed.

The operation of a street railway can be suspended for longer than 24 hours by the local police with the consent of the Commission only under the following conditions: (a) When work must be done on or under the streets which will prevent the running of cars. (b) When on account of festivals, public processions or other reasons an unusual number of people would cause blockades at certain parts of the line.

In case of accident, the management must conduct an examination to discover all the facts in the case and determine on the proper measures. Managers must make immediate reports of accidents involving death, or serious injury to persons, heavy damage to structures or rolling stock and of service interruptions greater than 24 hours. Smaller service interruptions and such accidents which involve no serious injury to persons or property, can be reported within such times as are set by the Commission.

The management of the railway company must keep a record of all accidents and traffic interruptions in the order of their occurrence, giving the time, place, cause, and what was done in relation thereto. Jacks and other tools useful in accidents should be quickly obtainable.

(This last regulation is a concession to the railway companies, as formerly the local authorities frequently demanded that emergency tools should be carried on the car. Now it will only be necessary to place such tools at convenient intervals along the route, for instance in stores.)

A record must be kept of all employees in outside service, including full name, age, place of birth, address, date of employment and discharge, and service number. This record must further contain a list of all penalties inflicted as discipline, together with other data which will show the technical ability and reliability of the parties in question. These records must be submitted to the Commission for inspection whenever demanded, and during the time of employment of any employee his record must not be made either illegible or destroyed either in whole or in part without permission. The truthfulness of the data in the record must be vouched for by the operating manager.

All outside operating employees must be given a code of printed or written rules for their guidance. The Commission, to whom these rules are to be submitted, may object to such regulations which it does not believe fully concern the safety of street railway operation.

This Commission also has the right to demand a test of any employee engaged in outside work, and to have him discharged if in its opinion he is not technically capable or reliable enough for the work. This right of the Commission is to be incorporated in all service contracts.

All employees engaged in outside service must be at least 21 years old, have passed satisfactorily the examinations and experimental running tests to show their reliability, and must not be afflicted with any serious bodily trouble. In country districts where the operating conditions are simpler, the Commission may permit a lower age limit, but not less than 18 years, for such outside employees who are not entrusted with the operation of machines or cars or with the rights and duties of an inspector. All employees must carry a badge or other device.

Including days of rest, no motorman must work more than a monthly average of 10 hours a day, and conductors and brakemen not more than 11 hours. Under simple operating conditions the average daily work may be extended to 13 hours. Under no circumstances shall one shift be longer than 16 hours. Working shifts of such length are only permissible when no hard work is required and there are several interruptions for rest. Every employee in the traffic service must have at least two holidays a month. Under simple operating conditions there need be only one holiday a month. A holiday shall be taken to mean an absence from service of at least 24 hours. The last condition may be modified somewhat on interurban railways with light traffic. The schedules for regulating the hours of work of all car service employees must be exposed in the offices of the management and placed before the Commission on demand. The Commission must also be informed at all time of the responsible managers of the railway companies, even where the change is for a very short period.

Every car and waiting room must have exposed a copy of the latest schedule of the fares and the local police regulations for passengers on the railway.

Immediately after a train reaches the terminal the cars must be examined for lost articles. Such as are not immediately returned to the losers must be carefully preserved, and as soon as time permits handed to the manager.

These regulations will go into effect Jan. 1, 1907.

Simultaneously with the foregoing regulations a suggested set of police rules for street railways was drawn up. At the present time the railways are already under police regulations, but these vary greatly in different cities. The principal rules of the new code are as follows:

Damage of street railway property and anything that will interfere with the railway service is forbidden.

Heavy wagons or drays must not be driven on the track in a longitudinal direction if there is sufficient room between the sidewalk and the track. (This is a very important regulation.)

When the warning signal is given, all pedestrians, riders, drivers, cyclists and others must leave the track at once. This regulation does not apply to soldiers marching in solid ranks, funerals and similar processions, mail wagons and fire trucks.

When a car stops, all vehicles or persons on horseback must lower their speed to permit passengers to enter and leave the car without danger.

No one is allowed to board a car upon which the conductor has placed a sign indicating that the car is full; cars must not be entered or left on the wrong side.

Passengers who, through drunkenness, sickness, disorderly conduct or other reasons are obnoxious to their fellow passengers, must leave the cars or waiting rooms upon the demand of the conductor or attendant.

Smoking or the carrying of lighted pipes, cigars or cigarettes is only permitted on outside seats or in cars or compartments specifically reserved for smokers.

Loaded firearms and packages of baggage which, on account of size, odor, or uncleanliness may be dangerous or obnoxious to the other passengers, cannot be carried on the cars. The passageway through the car must not be obstructed by bundles.

Dogs and other animals may be taken only if they can be carried on the lap and without annoying the passengers. Hunting dogs may be carried by special permit.

Passengers who create disturbance or disobey the rules after explanation by the conductor or station attendant must leave immediately.

When vehicles, cyclists or pedestrians are on the track the motorman must give the warning signal in time, move slowly and stop if necessary to avoid damage of property or injury of persons.

On leaving his car the motorman must remove the controller handle, apply the hand brake and do anything else which may be necessary to prevent the car from moving of its own accord or being started by wrong parties.

Aside from the exceptions made by the Commission, as duly announced, passengers must not be accepted above the normal seating capacity of the inside and outer seats. Disobedience of this rule, so far as it is not covered by a more severe penalty, will subject the offender to a fine of 60 marks ($15) or imprisonment.

LONDON LETTER

(From Our Regular Correspondent.)

The work of the electrification of the portion of the London, Brighton & South Coast Railway between London Bridge and Victoria stations is now in active operation. It will be remembered that this is the electrification scheme which is being done on the single-phase system under the direction of Philip Dawson, of Kincaid, Waller, Manville & Dawson, and the contract for which was given to the Allgemeine Elektricitäts-Gesellschaft, of Berlin, though arrangements were entered into for the manufacture of a large portion of the material necessary in Great Britain. The work of erecting the iron lattice girders to support the catenary construction of the overhead system has commenced, and as this is the first work of this kind in Great Britain it will arrest considerable attention. The whole of the work is expected to be completed in less than a year and the system should be in electrical operation towards the end of 1907.

Last month we reported that Mr. Day, electrical engineer of Bolton, had been appointed to the vacancy at Sunderland. While the report was correct at the time, it now transpires that after all the offer was withdrawn, as there seems to have been some misunderstanding regarding his age, an age limit having been imposed. Mr. Day is therefore continuing his post at Bolton.

Mr. C. F. Jenkins recently read a most interesting paper before the Institution of Civil Engineers on single-phase electric traction. A previous paper on electric traction on railways by Messrs. Mordey and Jenkin was read before the Institution in 1902, and the object of this paper was to bring the previous account up to date and to show how far the conclusions then arrived at had been modified, and to describe the equipment required for single-phase working. It was stated that little advance had been made in continuous-current working, though the voltages had risen in certain instances. In three-phase work there had not been much advance, and the principal points of interest were the Zossen experiments, the operation of the Valtellina line and the adoption of three-phase working for the Simplon Tunnel. A list was then given of the single-phase lines now in operation or under construction. It was stated that experience had confirmed Mordey and Jenkin's previous conclusion that single-phase equipment is the only system which can satisfy all the requirements of a general system. A thorough description of the different types of motors, method of control, permanent way, equipments, etc., was also included in the paper, and the whole mechanical and electrical design was carefully analyzed, making the paper one of particular value.

We have frequently referred to the motor omnibuses in London, some seven or eight hundred of which have recently been operating in the streets, practically in all parts of London. These omnibuses appear to have now fallen upon rather bad times, as the police have taken up the matter of noise and smell in rather a vigorous fashion. For the past year London has patiently borne with the tremendous noise which these motor buses have made, and also with the foul smoke which many of them emit on their passage through the streets. The commissioner of police warned the different companies operating these buses some months ago, and recently he has put this warning into practical operation, a large number of the buses being peremptorily ordered off the streets and licenses refused to all buses until they come up to the necessary requirements. These requirements are somewhat difficult to determine, so far as noise is concerned, but the authorities, as they have had examples of some of the new motor buses before them, which are practically smokeless and noiseless, are adopting a firm attitude, much to the perturbation of the motor omnibus companies. The result, however, is undoubtedly good and has already made a great improvement in the comfort of pedestrians. In this connection it might be well to say that the company which was recently formed in Manchester for operating motor buses in the suburbs of Manchester, has stopped business and is winding up its affairs. There has been in that city so much objection to motor buses which has resulted in such drastic action by the authorities, that the company has had to cease operations.

Trouble has been threatening in Belfast for some time, owing to a dispute between Mr. Nance, the general manager, and the men. The men have taken exception to one or two dismissals by the general manager, and instead of Mr. Nance's hands being strengthened by the corporation, the tramways committee have interfered and are in certain ways trying to curtail Mr. Nance's powers. It looks as if Belfast would either have a strike on its hands, or that the tramways committee would endeavor to run the tramways itself, making Mr. Nance only a figurehead. Whether Mr. Nance's decision in discharging certain men be correct or not, it will certainly lead to immense trouble in the future if the committee is to interfere in all such labor matters. Either Mr. Nance must have a free hand to manage the tramways as he thinks best, or else the committee, if it lacks confidence in Mr. Nance, should get someone in whom the members have confidence. The city of Glasgow should form an object lesson to Belfast in its trouble, one of the best things that Mr. Young, the late general manager of the Glasgow Corporation Tramways, ever did, being to insist that this management of the tramways was supreme as long as he held the position of general manager, and that local politics would find no position in such management. This would appear to be the only sane way to manage a large tramways system where thousands of men are engaged in the work, and it is to be hoped that the city authorities of Belfast will open their eyes to this necessity before it is too late.

There seems to be strong local feeling against the proposed tramway between Largs and Wemyss Bay, and meetings have been held to give expression to the opposition. It would appear as if there is no real object in having a tramway between those two places, as Wemyss Bay is an entirely residential town, chiefly for wealthy business men of Glasgow, who use it as a summer residence. There is already connection between the two places by means of steamers, so it seems unlikely for the present that there will be any tramway system in that vicinity. Lord Kelvin, whose residence is on the proposed route, intended to have been present at the meeting, but being unable to be there he wrote, stating that he considered the amenity of the district would be entirely ruined by a tramway. From the writer's own intimate knowledge of the district, it would appear to him as if the proposition was entirely a foolish and unnecessary one.

As is well known, Edinburgh has been on the horns of a dilemma for many years regarding its tramway system, which everyone who visits Edinburgh knows is operated on the cable system. Edinburgh, like most other cities, has grown considerably since the adoption of the cable tramways and it is being found year by year that the cable system is a most inflexible one as regards extensions, and it is imperative that certain extensions should be undertaken. Electricity is, of course, the only cure, but just how to apply it so as to work in with the already existing cable system is the difficulty. The tramways, though belonging to the corporation, are operated by the Edinburgh Tramway Company and this company has now signified its willingness to electrify the Gilmore Place route, provided the cost of extension is limited to £13,000 per mile and to pay the 7 per cent on this outlay as per the existing contract. The city authorities believe that the work cannot be done for this price, so that the matter is still the subject of negotiation. Other routes are also being dealt with between the tramway company and the corporation, but no definite decision as to the best method has yet been arrived at. It will be remembered that the Kingsland Company offered to install its underground system on certain portions of the line, but it is now pretty well believed that the corporation cannot accept this offer as the tramway company decided not to accept any system of electric traction except the overhead in its offers to the corporation.

The London County Council is now definitely committed to the promotion in Parliament of the huge scheme for the supply of electrical energy in bulk to a new area covering London and

district to the extent of 471 square miles, which will involve the building of generating stations and distributing apparatus amounting to about £4,000,000. There has been great discussion at the meetings of the Council, and its action was not by any means unanimous, eighty members of the Council voting in its favor out of a total of 114 present. This decision has practically been forced upon the London County Council by its own action last year when its bill at that time was refused by Parliament, or the private committee, on the understanding that it was not comprehensive enough. It would appear from the report of the committee at that time that a more comprehensive bill introduced this session would be favorably considered, and if the London County Council was not to promote such a bill it is practically assured that one of a similar nature would be promoted by a private company, so that it will be seen that the Council have to take action of some kind. It has given rise to a lot of comment in the daily press, many of the newspapers being naturally strongly opposed to this action of what are termed the progressives in the London County Council. Some of the newspapers have got opinions from most of the boroughs comprising London, and as most of these boroughs have either got municipal plants of their own or have private companies operating in their boroughs, a great diversion of opinion has been created. It is a matter of general opinion, however, that the bill will prove successful this year. Many economists in London are fearful of such a large amount of money being spent, especially as the London County Council Tramways department has been spending money very freely during the past few years, and it was intended during the next year to spend further large sums. The borough elections, which have recently taken place, have opened the eyes of London County Council members to the fact that the Moderates are more powerful than they anticipated. This party has once more asserted itself and won many of the borough elections, making a majority of Progressives in the next London County Council, whose election takes place next year, somewhat problematical. As one of the results of this bill, the London County Council has thought fit to curtail, to a very large extent, the tramway work for which it was intending to ask rights during the present session, and instead of spending something like £2,000,000 next year on electrification of tramways, chiefly in the north of London, a sum not exceeding £250,000 will be spent. It is to be presumed that the Council does not see its way, in view of the position which it occupies with regard to the power bill to such large expenditures on the tramways as well. Many of the tramway schemes, therefore, have been withdrawn for the present, and attention will be chiefly paid to the completion of such lines as the powers have already been granted for, and some connecting lines which are imperatively necessary. Among the most important of the schemes abandoned for the present is the one which was proposed for a complete new tramway system from the Marble Arch to Kilburn and Cricklewood, though there is still in the list, for which the Council intends to apply for powers, a scheme for a system of tramways in Hampstead Road, Tottenham Court Road and various streets in the Bloomsbury district, about which there is so much opposition. The Embankment tramways are nearly completed, and the last steel rail has already been laid. The process of lopping the trees, necessitated by the height of the cars, has also been undertaken, much to the discomforture of those who are strongly desirous of preserving the present condition of the Embankment at all hazards. The actual work of construction of these tramways has only taken a little over nine weeks, reflecting much credit on Dick, Kerr & Company, the contractors, and before the end of the year the service will be in operation. The new electrified line from the Angel at Islington to the Highbury station is also now completed, so that electric cars can now be taken from the Strand through the subway and by Islington to Highbury.

Some further particulars are now available regarding the electrification of the Midland Railway Company lines between Lancaster and Heysham Harbor. The Lancaster line is about 8 miles in length, and it will be equipped on the single-phase overhead system, with 6600 volts on the line, and step-down transformers on the motor coaches. Messrs. Siemens Brothers have already received orders to supply one motor coach, together with two trailers and controllers and wiring. The motors are to be of the commutated series type with special commutation poles for reducing the sparking. The output of each of the two motors is 180 hp, with an efficiency of 83 per cent. The motor will be geared to the car axle through single-reduction gear by which a maximum speed of 55 m. p. h. will be attained. The overhead trolley wire will be supported by catenary suspension and probably no feeders will be required, as the current will be supplied direct from Heysham at the end of the line. The current will most probably be taken from the existing power station at Heysham Harbor, which already furnishes current for the station and docks at Heysham Harbor.

The Wakefield & District Light Railway Company and the Yorkshire (West Riding) Electric Tramways Company, Ltd., have initiated a new enterprise by the purchase of Lofthouse Amusements Park, which is situated about midway between Leeds and Wakefield. The park is sixty acres in extent, and it is the intention of the tramway companies to erect bandstands, refreshment rooms, dancing halls, layout grounds and bowling greens, etc., etc., and to make the park generally attractive. The population of the district is a large one, and there are many small towns in the vicinity, so that it is expected to attract a large patronage. So far as the writer knows, this is the first attempt in Great Britain to provide an attraction of this kind so as to increase tramway traffic receipts.

Babcock & Wilcox, Ltd., of London, have been awarded the Grand Prix at the Milan Exhibition for their various exhibits. The exhibit consisted of a marine type boiler, fitted with patent steam superheater and patent mechanical chain grate stoker; a silent gravity bucket conveyor, working model; a model of their land type of boiler, fitted with patent steam superheater, and a collection of wrought steel steam piping and boiler parts. As there are many Continental manufacturers of boilers, this award should be particularly gratifying to Babcock & Wilcox, whose boilers are now in use all over the civilized world.

We referred last month to the fact that the Darlington Council had determined to abandon all halfpenny fares and to make the minimum fare one penny. We ought now to record that, so far as statistics show for the short time the penny fare has been operative, that it has been a great success, and the receipts have already gone up in a really wonderful fashion. This would again prove that halfpenny fares for cities of moderate size are an absolute mistake. It is interesting to note in this connection that the tramways committee of Leith has been considering a general revision of the tramway fares, and has agreed on the abolition of halfpenny fares, with the exception of two stages in Leith Walk and Great Junction Street, for the retention of which there are very special reasons.

Sir Charles Petrie, at the final meeting for the municipal year of the tramways and electric power committee of the Liverpool Corporation, stated that the tramway system had gone on satisfactorily during the past twelve months. The receipts had continued to increase, though not in the same ratio as in previous years. During the nine months of this year up to Oct. 1, they had carried 91,373,978 passengers, an increase of 1,758,500 over 1905. The increase in cost had been £7,858, the total received being £422,159, and the mileage run was 9,068,266, an increase over the previous year of 22,356. The car-mile earnings during the first nine months averaged 11.17d., against 10.99d. in the corresponding period of 1905. The average length of the penny stage in Liverpool was 2 miles 699 yards, and the average fare per mile .42d.

From a statement presented to the tramway committee of the Belfast Corporation by the city accountant, the total revenue from the new electric tramways undertaking for the six months ended Sept. 30, exceeded £93,000, and deducting the total expenditure of £51,537, there remained a gross profit of £41,685. After providing for fixed charges amounting to £33,440, there was a profit of £8,200 clear of all liabilities on the half-year's working. The tramway manager, in a report accompanying the statement, calculates on this basis a clear net revenue of nearly £15,000 annually. He points out that the late tramway company's gross profit for the half-year's working was only a third of that earned by the Corporation. The receipts worked out at 8.54d. per car-mile run.

The revised parcels carrying scheme of the Manchester Tramways Committee has been put into operation. Only light parcels up to 14 lbs. weight are carried, and there will not be any collection and delivery by vans. The parcels will be conveyed by ordinary cars between the hours of 9 and 6, except Saturdays, when the service will close at 4 o'clock. The charges are 2d. for any parcel up to 7 lbs., and 3d. for parcels exceeding 7 lbs., but not exceeding 14 lbs. Parcels may be handed at any stopping place to the guard of a tramcar, and will be left by him at the nearest depot to their destination, whence they will be delivered by messenger. In the meantime the conductors have forwarded a protest to the tramways committee against the excessive work imposed, claiming they cannot possibly do this new work and carry out their regular duties properly.

A. C. S.

ARGUMENTS IN THE CLEVELAND INJUNCTION CASE

The blanket injunction case against the Forest City Railway Company, in which it is claimed that its franchises are invalid, was heard in Judge Philips' court last week. In opening his argument, Judge W. B. Sanders said that it was admitted that the company was organized by the Mayor and that he is financially interested. In violation of his oath the Mayor had granted himself a franchise, said Mr. Sanders. Attorney W. H. Boyd, opening the arguments for the Forest City, said that two claims were set up in the demurrer, the first being that the Cleveland Electric does not have legal capacity to sue, and, second, that the petition does not state a cause of action. He stated that he would make his fight upon the right of the company to bring the suit. Mr. Boyd said that this is a public matter, and if the franchise was granted illegally, the Cleveland Electric did not have the right to bring suit for the protection of a private right. The granting of a franchise affects all the people and their private rights, and it is for them to bring suit. If there is any cause of action, he said, it is that the Mayor is financially interested, but he did not concede that this is a cause, as the Mayor is responsible to the people for any wrongs committed, and there is a public remedy.

Attorney T. H. Hogsett made an argument rebutting these assertions. He said the Cleveland Electric had a right to bring the suit as a corporation. There are two classes of injuries, he said, one to the public and the other to the individual. The attempt of the Forest City Railway Company to appropriate the tracks of the Cleveland Electric on any street would be classed as an individual wrong, as distinguished from something that would affect the public in general. He argued that the franchises are illegal, because the Mayor is financially interested in the company, as has been admitted. The general principle of public policy applies to this case, said the attorney. When a grant is made to a company in which a public official is interested, it tends to a breach of confidence and the grant is tainted with illegality. Precedents were quoted to show that the Mayor's interest is illegal. It is not necessary that there shall be a probability of profit from the interest. The possibility of loss is equally important in showing a financial interest, and the value of the franchise to the man who makes himself liable for the money invested in an enterprise. The Cleveland Electric is not limited to a suit as a taxpayer, said the speaker, but may bring suit in a private capacity to protect its rights, which, it is claimed, have been infringed.

D. C. Westenhaver, for the Forest City, continued the arguments that the Cleveland Electric has no right to bring a suit of this kind. As the State is a party to the granting of a franchise, the State should bring suit in case legal proceedings are necessary. The Cleveland Electric, he said, had no right to thrust itself between the State and the Forest City, parties to this contract, and seek to break it. Newton D. Parker, City Solicitor, also made an argument, supporting the part the city took in the matter and defending the franchise granted the new company.

An ordinance, passed in 1863, provides that "any officer or member of the City Council, who shall be interested in the profit of any contract or work for the city, shall be guilty of an offense." The hopes of both sides seem to center on the interpretation of this ordinance.

SOUTHERN PACIFIC TO OPERATE ALAMEDA SYSTEM ELECTRICALLY

The reports that have been in circulation for some time regarding the introduction of electric traction on the local lines of the Southern Pacific ferry system at Oakland, Cal., have recently been confirmed, so far as the Alameda mole system is concerned. General Manager Calvin, of the Southern Pacific Company, at San Francisco, states that he has received instructions from the East to proceed with the work at once, and already has issued orders for the purchasing of the supplies and machinery necessary for the work.

The present plans include the replacing of the steam system with electric traction on all the lines running out from the Alameda mole. These lines, covering 14½ miles of track, consist of the narrow-gage line to High Street, the Alameda broad-gage line through Alameda to Fruitvale and on to Melrose, and the Oakland broad-gage line running to Fourteenth and Webster Streets.

General Manager Calvin informed a representive of the Street Railway Journal that the direct-current overhead system would be used, and the present tracks and roadbed utilized by bonding the rails. The work will entail an expenditure of $1,250,000, and will take seven or eight months for installation. Mr. Calvin stated that a site for the power house had been selected at Alameda Point, where the present round-house is located, and that in all probability steam-turbine generating units will be installed.

The type of car to be used is similar to that used on the Columbus, Delaware & Marion line running out of Columbus, Ohio, and will have a seating capacity of eighty-four passengers. The largest passenger coaches in the present steam car service have a capacity of sixty-four passengers. About sixty of the new coaches will comprise the first installation. They will be equipped with a roller, diamond-frame trolley similar to that used so successfully on the Key Route system.

The work is to be under the direct supervision of A. H. Babcock, electrical engineer for the Southern Pacific Company. Mr. Babcock, who successfully installed the third-rail system for the North Shore Railroad about three years ago, has been engaged for some time in investigating for the Southern Pacific the question of electric traction on the Oakland side of the bay, and is at present in the East in connection with the new work.

After the Alameda system is placed in operation the work of transforming the Oakland pier lines running to Oakland and Berkeley will be taken up in the same manner. In all probability some extensions will be made to the existing routes, so as to more thoroughly cover the rapidly growing resident districts on the east side of the bay. Every endeavor will be made to make the new electric system the most modern that can be installed, and especial attention will be paid to speed and efficiency.

THE PURCHASE OF RHODE ISLAND PROPERTIES BY THE CONSOLIDATED COMPANY

Of the many reports circulated about the purchase by the Consolidated Railway Company for the New York, New Haven & Hartford Railroad of the interest of the late Edgar K. Ray in the electric railway properties in Rhode Island, the one credited as reliable says the company has acquired practically all the stock of the Woonsocket Street Railway, Columbian Street Railway, of Pascoag, and Providence & Burrilville Street Railway and a controlling interest in the Milford, Attleboro & Woonsocket Street Railway. The total mileage of these systems is 72 miles, the capital stock approximately $1,000,000 and the funded debt more than $600,000.

A WINTER RESORT

The management of the Hartford & Springfield Street Railway, encouraged by the success of the resort at Piney Ridge during the past summer, has plans in preparation for a winter resort, which will in all probability prove as attractive as did Piney Ridge in the summer. The company has secured a lease of the land fronting on Depot hill, owned by Francis B. Allen, upon which a huge toboggan slide will be built, and other features will be introduced, which will be in the nature of a continuous winter carnival with all accessories excepting the ice palace. The toboggan slide will be the principal attraction for a start, work on the building of which has already begun. A platform 20 ft. high is being built, and the slide will extend from the top of the hill to the bottom, a distance of 1800 ft. The slide will consist of two trenches, in which the toboggans will be operated, thus making it impossible for the cars to leave the slide. Between the two slides a row of poles to support several arc lights will be put in, and it is expected the electrical display will be among the features of the resort. A pavilion or waiting room will be built at the top of the hill for the convenience and comfort of the patrons.

TRAIL-CAR OPERATION IN NEW YORK CITY

In the short article published last week about the two two-car trains now being tested by the New York City Railway Company on its 125th Street line, an error was made in referring to the make of brake equipment on one of the trains. One train is equipped with General Electric multiple control and General Electric emergency straight air brake. The other is provided with Westinghouse unit switch control and Westinghouse SME or emergency straight air brake. The emergency straight air brakes have the advantages of straight air in manipulation, but provide for positive, immediate and automatic action in case the train should break in two. For this reason they are very desirable for short electric trains.

INTERSTATE COMMERCE COMMISSIONER'S REPORT ON RAILROADS

The Interstate Commerce Commission recently published its annual abstract of statistics of railways in the United States for the year ending June 30.

On June 30, 1905, the report shows that the total single-track railway mileage in the United States was 218,101.04 miles, or 4,196.70 miles more than at the end of the previous year. The operated mileage for which substantially complete returns were rendered to the Commission was 216,973.61 miles, including 7,568.95 miles of line used under trackage rights. The aggregate length of railway mileage, including tracks of all kinds, was 306,796.74 miles. This mileage was thus classified: Single track, 216,973.61 miles, as just mentioned; second track, 17,056.30 miles; third track, 1,609.63 miles; fourth track, 1,215.53 miles, and yard track and sidings, 69,941.67 miles. These figures indicate that there was an increase of 9,723.40 miles in the aggregate length of all tracks.

The number of railway corporations for which mileage is included was 2167, of which 1169 were classed as operating roads, including some miscellaneous industrial roads. During the year railway companies owning 3,802.02 miles of line were reorganized, merged, or consolidated. The corresponding figure for the year 1904 was 5,600.18 miles.

EQUIPMENT

On June 30, 1905, there were in the service of the carriers 48,357 locomotives, the increase being 1614. These locomotives, excepting 947, were classified as: Passenger, 11,618; freight, 27,869, and switching, 7923.

The total number of cars of all classes was 1,842,871, or 44,310 more than last year. These figures do not include cars owned by private commercial firms or corporations. The number of passenger-miles per passenger locomotive was 2,048,558, showing an increase of 100,174 miles, as compared with the previous year. The number of ton-miles per freight locomotive was 6,690,700, showing an increase of 233,854 miles.

The reported number of employees was 1,382,196, equivalent to an average of 637 employees per 100 miles of line. These figures show an increase in the number of employees as compared with the year 1904 of 86,075, or 26 per 100 miles of line. The total number of railway employees was apportioned approximately as follows: For general administration, 54,141; for maintenance of way and structures, 448,370; for maintenance of equipment, 281,000, and for conducting transportation, 595,456. The total amount of wages and salaries was $839,944,680.

CAPITALIZATION OF RAILWAY PROPERTY

The par value of the amount of railway capital outstanding was $13,805,258,121, equivalent to a capitalization of $65,926 per mile. Of the total capital stock outstanding $2,435,470,337, or 37.16 per cent, paid no dividends. The amount of dividends declared during the year was $237,964,482, being equivalent to 5.78 per cent on dividend-paying stock. Of the total amount of stock outstanding, $6,554,557,051, 9.72 per cent paid from 1 to 4 per cent; 14.77 per cent from 4 to 5 per cent; 10.74 per cent from 5 to 6 per cent; 8.79 per cent from 6 to 7 per cent, and 11.68 per cent from 7 to 8 per cent. The total amount of funded debt (omitting equipment trust obligations) that paid no interest was $449,100,396, or 6.36 per cent. Of mortgage bonds, $326,863,401, or 5.43 per cent; of miscellaneous obligations, $54,214,525, or 6.89 per cent, and of income bonds $68,022,470, or 26.81 per cent, paid no interest.

The number of passengers was 738,834,667, this item being 23,414,985 more than for the year ending June 30, 1904. The passenger-mileage, or the number of passengers carried 1 mile, was 23,800,149,436, the increase being 1,876,935,900 passenger-miles. The number of tons of freight reported as carried (including freight received from connections) was 1,427,731,905, which exceeds the tonnage of the year 1904 by 117,832,740 tons. The ton-mileage, or the number of tons carried 1 mile, was 186,463,109,510, the increase being 11,941,019,933 ton-miles. The number of tons carried 1 mile per mile of line was 861,396, indicating an increase in the density of freight traffic of 31,920 ton-miles per mile of line.

The average revenue per passenger per mile for the year ending June 30, 1905, was 1.962 cents. For the preceding year the average was 2.006 cents. The average revenue per ton-mile was 0.766 cent; the like average for the year 1904 was 0.780 cent. The earnings per train-mile show an increase both for passenger and for freight trains. The figures show a slight increase in the average cost of running a train 1 mile. The ratio of operating expenses to earnings for the year 1905 was 66.78 per cent. For 1904 this ratio was 67.79 per cent.

The gross earnings of the railways in the United States from the operation of 216,973.61 miles of line were $2,082,482,406, being $107,308,315 greater than for the year 1904, and for the first time exceeding the two billion mark. Their operating expenses were $1,390,602,152, or $51,705,899 more than in 1904.

The operating expenses assigned to the four general classes were: For maintenance of way and structures, $275,046,036; maintenance of equipment, $288,441,273; conducting transportation, $771,228,666; general expenses, $55,319,805; undistributed, $566,372. Operating expenses averaged 6,409 per mile of line, this average showing an increase of $101 per mile in comparison with the year 1904.

The total number of casualties to persons on the railways for the year ending June 30, 1905, was 95,711, of which 9703 represented the number of persons killed and 86,008 the number injured. The number of passengers killed in the course of the year 1905, was 537 and the number injured 10,457. In the previous year 441 passengers were killed and 9111 injured. There were 341 passengers killed and 6053 injured because of collisions and derailments. The total number of persons other than employees and passengers killed was 5805; injured, 8718. These figures include the casualties to persons trespassing, of whom 4865 were killed and 5251 were injured. The total number of casualties to persons other than employees from being struck by trains, locomotives, or cars was 4569 killed and 4163 injured. In 1905, 1 passenger was killed for every 1,375,856 carried, and 1 injured for every 70,655 carried. For 1904 the figures show that 1,622,267 passengers were carried for 1 killed, and 78,523 passengers were carried for 1 injured.

HAMILTON STRIKE DISORDER

Saturday witnessed a serious turn in the strike situation at Hamilton, Ont., of which mention has been made before in the STREET RAILWAY JOURNAL. On that day several cars were demolished and a number of persons injured in a clash between strike sympathizers and the troops. At a late hour street cars were running at intervals under heavy guard, but they carried no passengers, and continued to be targets for fusillades of stones and bricks from side streets and alleys. Drastic as were the measures taken by the authorities it was plain that the mob spirit had not been broken. The crowds began to gather at dusk. The authorities saw that trouble was brewing, and made their preparations accordingly. A concerted effort was made by the police and soldiers at 8 o'clock to clear the streets, and they succeeded only with considerable difficulty.

COMPANY INCORPORATED TO BUILD BETWEEN CLEVELAND AND YOUNGSTOWN

The Cleveland, Alliance & Mahoning Valley Railroad Company has been incorporated to build an electric railway to connect Cleveland with Youngstown and a number of important points in Pensylvania. The nominal capital stock of the company is $10,000, but this will be increased to $2,500,000 when it is financed. James W. Holcomb, of Cleveland, is one of the chief promotors, and it is said that J. R. Morley, president of the Stark Electric, is also interested, as well as other leading railway men and capitalists. The plans include a line from Cleveland to Alliance, where connection will be made with the Stark Electric, operating between Canton and Salem. An east and west line will then be built, filling in the gap between the latter point and the Shenango & Mahoning Valley lines. With the proposed lines from Barberton west to Seville and the Cleveland & Southwestern branch from that point to Mansfield, now under construction, there will be a through east and west line between Mansfield and Sharon and Newcastle, Pa. A private right of way has been secured in Cleveland from the city line to the Kinsman Street line of the Cleveland Electric at its junction with the 105th Street line. This will be the most direct line into the heart of the city that has yet been secured by an interurban company. From the city limits to Hudson, 18 miles, a private right of way has been secured, and from there to Ravenna, about 11 miles, the old roadbed of the Cleveland & Pittsburg will be used. It is now ready for laying ties, and the right of way is 66 ft. wide. From Ravenna to Alliance rights of way are held under option.

SITES SECURED FOR BALTIMORE TERMINALS

The Maryland Electric Railway Company has finally succeeded in securing sites for the eight terminal stations which it will build for the use of the United Railways & Electric Company. These stations will cost from $150,000 to $200,000 each. They are planned to house 100 electric cars of the largest type. The stations are to be leased by the United Company at an annual rental equal to 6 per cent a year on the actual cost.

Contracts for two of them—one on Edmondson Avenue and one at Electric Park—have already been awarded, and these are now in course of construction. The first will be used to provide for the cars of the Edmondson Avenue, the Ellicott City and the Gwynn Oak lines. The second will take care of the western division of North Avenue, the Mount Washington and the Emory Grove lines. The remaining stations to be built and the lines they will provide for are:

York Road, corner of Arlington Avenue; York and Frederick Roads, Towson and the Guilford Avenue lines.

Druid Hill and Fulton Avenues; Druid Hill and Linden Avenues, Gilmore, Carey and Preston Street lines.

Lombard and Seventh Streets, Highlandtown; River View, Sparrows Point, Middle River and Fairmount Avenue lines.

Harford Road, near tollgate; Harford and Gorsuch Avenues and Lauraville lines.

North Avenue and Gay Street; eastern division of North Avenue, Gay Street and Belair Road lines.

Preston Street extended and Eighth Street, Orangeville; eastern division of Preston Street, Wilkins Avenue and Federal Street lines.

Plans for all of the stations are now in the hands of architects and will soon be submitted to the company for approval. Bids will then be asked for their construction. It is expected that most, if not all of them, will be ready for the service next summer.

PUBLIC OFFICIALS WHO HAMPER DEVELOPMENT

Conservative interests in Philadelphia resent the course of action taken by the Philadelphia Trades League in ignoring the Philadelphia Rapid Transit Company in its consideration of transit matters and seeking to bring about changes which it has deemed advisable by imposing conditions which rightfully have no place in the present scheme of organization of the city. Commenting on the situation, the Philadelphia News Bureau recently said:

"That there is congestion and that the Philadelphia Rapid Transit Company has violated the strict letter of the law as passed by ordinance of Councils is without doubt. Very few railway corporations, street or steam, could to-day comply strictly with every legal requirement imposed upon its operating department. Physical conditions would not permit them to do so.

"If the Rapid Transit Company was compelled to operate all of its lines on a 5-minute headway schedule, the rolling stock would have to be doubled and the congestion where traffic is greatest in the center of the city would be such that the cars would be stalled on Chestnut, Market, Walnut and Arch Streets from river to river.

"The phenomenal growth of the city and its traffic has been such that it is really a marvel that the service has been conducted as well as it has been under the conditions as the company has found them. This is the operating problem, and the Philadelphia Rapid Transit Company is entitled to a liberal consideration in its treatment.

"During the past four years the Philadelphia Rapid Transit Company has carried 1,559,990,057 passengers over approximately 280,000,000 miles of street railways.

"While a strict interpretation of the city ordinances would compel a night line service of 20-minute headway, such a demand for all sections of the city would be unjustifiable. The operating cost that would be imposed would be unjust, and before the Mayor and Councils seek to impose the penalties that are liable for the failure to comply with the law, this and other similar questions must receive serious consideration.

"Modern railway engineering has devloped to such an extent that the people demand rapid transit of the very best methods. Until the Market Street elevated and subway line is completed from end to end and the Broad Street subway constructed and both lines placed in operation there will be difficulty in moving the traffic."

OAKLAND TRACTION MERGER

About the first of November the Berkeley Traction Company was incorporated with a capital of $200,000, for the purpose of giving a more complete and extended street car service to various sections of Berkeley. The directors were Louis Titus, Walter H. Leimert, Duncan McDuffie, P. L. Tompkins and C. C. Young. Now a merger has been made with the Oakland Traction Consolidated, the new company being known as the Oakland Traction Company. The directors of the new company are: E. A. Heron, H. Wadsworth, F. W. Frost, F. M. Smith, F. C. Havens, Samuel J. Taylor and W. H. Martin. The capital stock is $17,925,000, all of which has actually been subscribed. Of this amount, the holdings of the Oakland Traction Consolidated are represented by all of the preferred stock, which is 70,500 shares, and 105,750 shares of common stock. The rest of the common stock, 3000 shares, is represented by the holdings of the Berkeley Traction Company. The preferred stock is to pay dividends of 6 per cent per annum. In all, 89.81 miles of railway are owned by the new company, together with numerous valuable franchises, rolling stock and power houses. The officials state that North Berkeley is to have a new car line, to be operated on Grove Street, north of University Avenue, to the town line, tapping the Pacific Improvement Tract. This line will give the Peralta Park Improvement Club the transportation facilities it has petitioned for and will also tap a section soon to be opened between Cordonices and Cerrito Creeks.

EVENING TECHNICAL COURSES AT COLUMBIA UNIVERSITY, NEW YORK

The board of extension teaching of Columbia University announces a series of nine evening technical courses which will be given at the university this winter, beginning Dec. 3, and lasting twenty weeks. The courses are under the immediate direction of Prof. Walter Rautenstrauch, of the Faculty of Applied Science, and are to be given by professors and instructors of the university and other persons especially qualified. Moderate fees ($7.50 to $15) are charged, and most of the courses are for two evenings a week. The courses are as follows:

Engineering Physics: as illustrated in the mechanical plants of modern buildings. (1) An elementary study of physics; (2) a practical study of steam and electrical machinery, heating, ventilating, water system, wiring, elevators, etc., included in the plant of Columbia University. For two classes of students: those wishing an introductory study of physics as preparation to advanced study in electricity, steam, etc., another winter; those desiring practical training for positions as superintendents of buildings, engineers, janitors, etc.

Elementary Mathematics: those parts of arithmetic, algebra, geometry and trigonometry used in technical work. Practice with engineering hand-books, tables, etc.

Drafting: a beginner's course; fits for positions as draftsmen; reading of drawings, etc.

Strength of Materials: a lecture course for those who design or manufacture machinery, or modern structures. With this course should be taken either the first or second of the two following courses in design.

Machine Design: advanced drafting, computations, and designing for persons engaged in the design and manufacture of machinery.

Structural Design: advanced drafting, computations, and designing for those who do structural work.

Electrical Engineering: a course especially for those engaged in electrical work of any sort.

Steam Engineering: a course for those engaged in the manufacture or management of steam machinery of any sort.

Special Engineering Problems: a study of any special elementary or advanced engineering problems desired by the student. Individual instruction will be arranged for such a period of time as the special problem may demand.

The courses will be given in the buildings of Teachers' College, Columbia University, at West 120th Street and Broadway, which affords necessary lecture rooms, laboratories, drafting rooms, etc. A complete catalog of these courses will be sent on request by addressing Evening Technical Courses, Extension Teaching, Columbia University. Personal information may be secured Tuesday and Thursday evenings, between 7:30 and 9 o'clock, from Benjamin R. Andrews, Room 111, Teachers' College.

"JIM CROW" LAW CAUSES TROUBLE IN MONTGOMERY

One of the most disagreeable phases of the negro question yet presented to the citizenship of the South was illustrated in a striking way on the streets of Montgomery on Friday, Nov. 23, when the Montgomery Traction Company, operating all the lines in the city, was compelled to suspend service for half a day because of an attempt on the part of the city to enforce a very drastic and unreasonable "Jim Crow" law. The press reports have carried full details of this unfortunate circumstance, but they do not indicate how it was received by the people as a whole. The statement is true, that while the Council adopted the measure by a respectable majority, the action was not endorsed by any appreciable number of the citizens at large.

The law says that the street railway shall provide separate and distinct cars for the negroes and the whites. It is made a penalty for the whites to be found in cars set aside for negroes or for negroes in cars set aside for whites. There is also a penalty for failure to provide signs on the sides of each car indicating which color is allowed to ride therein. The law would entail in its enforcement a considerable expense to the company, and it is believed by many to be unconstitutional, in violation of the 14th amendment, because of discrimination against some race or color. It was openly opposed by the Mayor, who vetoed it, and has been condemned by a large number of leading citizens. It is not a fact that Montgomery or Alabama has a negro question. The negroes are law abiding and conservative and make no trouble, and so far as their patronage of the street railways is concerned they have shown every disposition to sympathize with and meet the situation, for they seemed to feel that the races should be separated. The operation of the law was finally suspended as a result of the injunction secured from the city court, and the case will now be fought out on its merits.

INCREASE IN PAY IN PHILADELPHIA

The board of directors of the Philadelphia Rapid Transit Company decided last week on an increase of 5 per cent in the wages of its 7500 motormen and conductors, to take effect Dec. 1. This means an additional outlay of about $270,000 a year. The men are now receiving 20 cents an hour. Two years ago they got an increase of 5 per cent.

EXTENSION OF OAKLAND TRACTION SYSTEM

Some extensions of the street car system of the Oakland Traction Company and the train system of the Key Route, both owned by the Realty Syndicate of Oakland, Cal., have been announced. If the present plans of the Realty Syndicate are carried through there will be a Key Route line running from Fortieth Street to North Berkeley, through the middle of the college town, half way between East and West Berkeley. There will also be a cross-town electric car line running from the new Claremont Hotel, probably down Russell Street to the bay, and there will be a continuation of the present Piedmont line of the Key Route, extending into the hilly suburbs and tapping a region not reached by any car lines.

The Realty Syndicate has finally secured a clear title to a large tract of land lying just north of the town line of Berkeley, and in order to increase the value of this property it is proposed to send into the untapped region a branch line of the Key Route, thus affording home builders in the new tract easy facilities for reaching San Francisco and Oakland. This new line will probably run out Sacramento Street from Fortieth Street, following during its latter course the old right of way of the horse-car line which connected the old Town Hall with Peralta Park. Sacramento Street seems the most probable route, as it has been found almost impossible to get a right of way for the Key Route up Walnut Street.

When the Claremont line of the Key Route is carried out to the new Claremont Hotel there will be built, as an adjunct to this branch, a new cross-town line of the Oakland Traction—a line which will connect the hotel with the bay and the Southern Pacific and Santa Fe stations in West Berkeley. In this way guests at the big caravansary will be afforded every opportunity to connect with all the arteries of transportation.

The Piedmont line, which already goes out Piedmont Avenue, will be extended in the near future. The surveys have been made and the line will run farther into the Piedmont hills.

PERSONAL MENTION

MR. WILLIAM CUMMINGS, general manager, and Frederick W. Woodcock, auditor, have resigned from the Muncie & Portland Traction Company. Mr. E. J. Skehan, formerly with the Chicago & Milwaukee Electric Railway, has been appointed to succeed Mr. Woodcock.

MR. J. H. PARDEE, general manager of the Rochester & Eastern Rapid Railway Company, of Canandaigua, N. Y., has been elected secretary of the Street Railway Association of the State of New York, to take the place made vacant by the resignation of Mr. C. B. Fairchild, Jr. Mr. Pardee has been an active member of the association for a number of years, and is general manager of the Rochester & Eastern Rapid Railway Company, the Ontario Light & Traction Company and the Canandaigua Gas Light Company.

MR. F. A. HEWETT resigned as superintendent of the railway department of the South Jersey division of the Public Service Corporation, of Camden, on Oct. 15, and has been appointed superintendent of railways of the Pottsville Union Traction Company, of Pottsville, Pa. Mr. Hewett has been connected with the railway properties in Camden belonging to the South Jersey division of the Public Service Corporation and its predecessor, the Camden & Suburban Railway Company, for the past twelve years, and a number of methods employed by him on this line have been described in the STREET RAILWAY JOURNAL.

FOLLOWING THE DEATH OF MR. F. A. TUCKER, general superintendent of the Omaha & Council Bluffs Street Railway Company, announcement was made that the office of general superintendent has been abolished and in its place has been created the offices of superintendent of transportation, which officer will have full charge of the transportation end of the company's business, and a chief engineer, who will have full charge of the mechanical department and under whom will be a superintendent of roadway and electric lines; master mechanic in charge of the shops and superintendent of power stations. As a result of these changes Mr. R. A Luessler, who has been secretary, has been made assistant general manager; Mr. Louis C. Nash, superintendent of transportation; Mr. William Musgrave, formerly road master, assistant superintendent of transportation; Mr. H. B. Noyes, chief engineer; Mr. J. J. Gorman, superintendent of tracks and roadway; Mr. Thomas Wood, master mechanic, and Mr. D. W. Gilbert, superintendent of power stations.

MR. RICHARD EMORY, general manager of the Santa Clara Interurban Railway Company and the San Jose & Santa Clara Railway Company, of San Jose, Cal., died very suddenly in that city Sunday, Nov. 25. Mr. Emory was an able and capable manager, and was at different times connected with the systems in Baltimore, Nashville and Milwaukee. In fact, he began his street railway career in Baltimore, where he served for eight years, beginning at the bottom. In Nashville, whither he went from Baltimore, Mr. Emory acted as superintendent and general manager of the Nashville Railway and the Cumberland Electric Light & Power Company, continuing in the service of the receivers of the street railway company at their request for several months after he had accepted a place with the Milwaukee Electric Railway & Light Company. After a short term of service at Milwaukee, Mr. Emory resigned from the company to become connected with the Appleyard interests in the management of their Ohio properties. Here he remained until financial manipulation forced the properties into the hands of receivers.

MR. R. S. CAMPBELL has resigned as general manager of the Utah Light & Railway Company, of Salt Lake City, Utah, and Mr. Joseph S. Wells has been appointed acting general manager as his successor. Mr. Campbell has been with the company since its inception and will now become connected with the Campbell & Sons' department store, managed by his son, Mr. R. L. Campbell, and the Campbell Commercial Company, wholesale grocers. Mr. Campbell has also purchased the P. H. Lannon ranch, in Payette Valley, Utah, and has organized to operate that property the Campbell Fruit & Stock Company. In the future Mr. Campbell will devote his entire time and attention to these concerns, and for this purpose will open an office in Salt Lake City. On the evening of Nov. 17, the employees of the Ogden division of the company presented Mr. Campbell with a handsome silver-mounted cup as a token of their esteem. On one side is the inscription: "Mr. Robert S. Campbell, November 15, 1906." On the other side is a plate on which is engraved: "Presented by the employees of the Ogden division of the Utah Light & Railway Company as a token of their appreciation of your kindness to us and your interest in our behalf during your regime as general manager."

TABLE OF OPERATING STATISTICS

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

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., Sept., '06	95,394	47,971	47,422	22,674	24,748
	1 " " '05	88,269	44,858	43,411	23,167	20,244
	9 " " '06	770,396	409,252	361,143	204,370	156,773
	9 " " '05	716,514	381,009	335,505	207,305	128,202
BINGHAMTON, N. Y. Binghamton Railway Co.	1 m., Sept., '06	30,566	15,464	15,102	7,707	7,395
	1 " " '05	25,476	13,238	12,238	7,248	4,990
	3 " " '06	94,876	43,706	51,169	23,139	28,031
	3 " " '05	87,855	39,717	48,138	21,565	26,573
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., Oct., '06	280,339	*141,918	138,421	.....	.....
	1 " " '05	233,936	*110,371	123,565	.....	.....
	10 " " '06	2,443,647	*1,335,193	1,108,453	.....	.....
	10 " " '05	1,976,682	*1,057,327	919,355	.....	.....
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co.	1 m., Sept., '06	125,851	63,289	62,562	24,772	37,790
	1 " " '05	107,580	55,250	52,329	24,450	27,879
	6 " " '06	698,790	358,438	340,352	149,467	190,884
	6 " " '05	619,754	316,674	303,079	146,188	156,890
Chicago & Milwaukee Elec. R. R. Co.	1 m., Oct., '06	88,906	40,621	48,284	.....	.....
	1 " " '05	62,028	23,030	38,998	.....	.....
	10 " " '06	722,448	293,380	429,068	.....	.....
	10 " " '05	473,891	195,872	278,018	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R. R. Co.	1 m., Sept., '06	29,411	*14,729	14,682	.....	.....
	1 " " '05	25,695	*13,290	12,405	.....	.....
	9 " " '06	207,637	*110,355	97,282	.....	.....
	9 " " '05	185,319	*107,012	78,306	.....	.....
Cleveland & Southwestern Traction Co	1 m., Oct., '06	56,499	31,642	24,857	.....	.....
	1 " " '05	48,728	26,343	22,386	.....	.....
	10 " " '06	539,133	304,430	234,703	.....	.....
	10 " " '05	449,432	261,806	187,626	.....	.....
Lake Shore Electric.	1 m., Sept., '06	89,024	*42,599	46,425	20,450	25,975
	1 " " '05	79,600	*37,056	42,544	20,404	22,140
	9 " " '06	664,806	*361,729	303,077	183,753	119,324
	9 " " '05	589,069	*318,719	270,349	183,638	86,712
COLUMBUS GA. Columbus R. R. Co.	1 m., Sept., '06	17,792	*11,266	6,526	1,889	4,637
	1 " " '05	15,321	*9,736	5,585	1,914	3,671
	12 " " '06	194,429	*121,915	72,513	22,715	49,798
	12 " " '05	164,450	*106,618	57,832	22,601	35,231
DALLAS, TEX. Dallas Elec. Corp'n.	1 m., Sept., '06	83,568	*58,316	25,252	15,449	9,803
	1 " " '05	82,690	*53,254	29,437	15,511	13,926
	12 " " '06	1,010,740	*638,778	371,962	182,925	189,037
	12 " " '05	871,731	*546,097	325,634	182,196	143,438
DETROIT, MICH. Detroit United Ry.	1 m., Oct., '06	483,998	*325,357	158,641	95,716	†62,925
	1 " " '05	447,462	*282,039	165,423	92,388	†73,035
	10 " " '06	4,863,653	*2,906,586	1,957,067	949,301	1007766
	10 " " '05	4,305,992	*2,551,475	1,754,517	921,574	832,943
DULUTH, MINN. Duluth St. Ry. Co.	1 m., Sept., '06	67,763	35,198	32,565	17,860	14,705
	1 " " '05	56,974	27,110	29,863	17,382	12,482
	9 " " '06	570,470	297,926	272,544	158,645	113,898
	9 " " '05	489,674	253,403	236,271	152,790	83,481
EAST LIVERPOOL, O. East Liverpool Traction & Light Co.	1 m., Sept., '06	31,229	17,310	13,919	10,690	3,229
	11 " " '06	301,717	164,492	137,225	93,367	43,858
	11 " " '05	256,816	163,615	93,200	.....	.....
ELMIRA, N. Y. Elmira Water, Lt. & R. R. Co.	3 m., Sept., '06	67,731	44,352	23,379	12,118	11,261
	3 " " '05	64,646	47,626	17,020	12,243	4,777
	9 " " '06	164,742	115,680	49,062	36,631	12,431
	9 " " '05	154,513	112,190	42,323	37,616	4,707
EL PASO, TEXAS. El Paso Electric Co.	1 m., Sept., '06	35,905	*25,144	10,761	4,356	6,405
	1 " " '05	24,980	*15,664	9,315	3,786	5,529
	12 " " '06	360,128	*246,752	113,376	46,472	66,904
	12 " " '05	281,901	*184,406	97,495	41,939	55,556
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Sept., '06	106,811	61,794	45,018	.....	.....
	1 " " '05	85,855	51,099	34,756	.....	.....
	9 " " '06	821,179	509,006	312,172	.....	.....
	9 " " '05	700,704	434,952	265,752	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Sept., '06	76,338	*50,982	25,357	9,942	15,415
	1 " " '05	57,973	*33,962	24,011	9,938	14,074
	12 " " '06	795,807	*502,226	293,580	119,288	174,293
	12 " " '05	638,519	*375,005	263,514	115,697	147,818
GALVESTON, TEX. Galveston Elec. Co.	1 m., Sept., '06	31,821	*17,125	14,696	4,167	10,530
	1 " " '05	24,700	*15,209	9,491	4,167	5,324
	12 " " '06	306,368	*185,133	121,234	50,000	71,234
	12 " " '05	261,393	*188,478	72,915	38,333	34,582
GLENS FALLS, N. Y. Hudson Valley Ry Co.	3 m., Sept., '06	238,212	110,227	127,985	52,091	75,8
	3 " " '05	217,693	92,869	124,824	67,764	57,060
	9 " " '06	477,161	273,343	203,818	186,084	17,734
	9 " " '05	424,952	248,914	176,038	195,265	†19,227
HANCOCK, MICH. Houghton County St. Ry. Co.	1 m., Sept., '06	22,689	*11,781	10,908	3,896	7,012
	1 " " '05	20,338	*11,203	9,135	3,713	5,422
	12 " " '06	219,981	*144,500	75,475	46,486	28,989
	12 " " '05	170,196	*169,112	1,084	42,588	†41,503
HOUSTON, TEX. Houston Electric Co.	1 m., Sept., '06	52,536	*34,437	18,098	7,792	10,307
	1 " " '05	45,432	*24,401	21,031	9,042	11,989
	12 " " '06	573,851	*368,555	205,296	96,756	108,539
	12 " " '05	492,070	*294,400	197,670	103,522	94,149
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., Sept., '06	476,756	224,968	251,788	144,600	107,188
	1 " " '05	426,609	208,313	218,295	135,967	82,328
	4 " " '06	1,875,098	934,206	940,889	573,950	366,939
	4 " " '05	1,697,894	844,769	853,125	543,705	309,421
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1 m., Sept., '06	61,507	33,391	28,115	.....	.....
	9 " " '06	397,068	256,035	141,034	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., Oct., '06	312,631	152,170	160,461	92,451	68,010
	1 " " '05	280,536	128,763	151,773	80,076	71,697
	10 " " '06	2,935,470	1,432,580	1,502,890	884,369	618,521
	10 " " '05	2,669,333	1,285,405	1,383,928	769,217	614,711
Milwaukee Lt., Ht. & Tr. Co.	1 m., Oct., '06	56,607	23,747	32,861	28,257	4,604
	1 " " '05	50,475	19,845	30,629	21,331	9,299
	10 " " '06	592,271	229,029	363,242	267,501	95,741
	10 " " '05	514,702	214,140	300,562	210,097	90,465
MINNEAPOLIS, MIN. Twin City R. T. Co.	1 m., Sept., '06	534,151	236,926	297,225	114,758	182,467
	1 " " '05	454,062	176,032	278,030	103,208	174,822
	9 " " '06	4,217,438	1,951,050	2,266,388	1,004,153	1262235
	9 " " '05	3,482,688	1,578,150	1,904,538	897,008	1007529
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Sept., '06	281,822	157,689	124,133	40,610	83,523
	1 " " '05	249,789	141,681	108,107	21,063	87,045
	12 " " '06	3,076,768	1,844,458	1,232,311	474,850	757,461
	12 " " '05	2,693,617	1,672,719	1,020,897	288,452	732,446
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., Sept., '06	133,184	78,172	55,012	.....	.....
	1 " " '05	117,157	71,179	45,978	.....	.....
	9 " " '06	1,104,435	688,388	416,047	.....	.....
	9 " " '05	1,003,470	614,195	389,275	.....	.....
PHILA., PA. American Rys. Co.	1 m., Oct., '06	230,006	.....	.....	.....	.....
	1 " " '05	217,456	.....	.....	.....	.....
	4 " " '06	1,038,544	.....	.....	.....	.....
	4 " " '05	945,412	.....	.....	.....	.....
ST. LOUIS, MO. United Railways Co. of St. Louis.	1 m., Oct., '06	831,460	*486,713	344,747	198,026	146,721
	1 " " '05	758,710	*439,144	319,566	198,840	120,726
	10 " " '06	7,608,284	*4,655,694	2,952,590	1,981,425	971,165
	10 " " '05	7,014,783	*4,472,239	2,542,544	1,990,697	551,847
SAVANNAH, GA. Savannah Electric Co.	1 m., Sept., '06	49,805	*31,812	17,993	11,529	6,464
	1 " " '05	48,721	*29,044	19,678	10,561	9,117
	12 " " '06	628,149	*379,396	248,754	133,262	115,492
	12 " " '05	574,022	*336,383	237,639	126,791	110,848
TACOMA, WASH. Puget Sound Elec. Ry. Co.	1 m., Sept., '06	78,240	*30,020	48,221	17,979	30,241
	1 " " '05	55,143	*25,820	29,323	15,088	14,235
	12 " " '06	719,419	*343,083	376,336	195,378	180,958
	12 " " 05	551,816	*309,001	242,815	178,926	63,888
Tacoma Ry. & Power Co.	1 m., Sept., '06	72,727	*47,681	25,046	12,141	12,905
	1 " " '05	60,555	*39,667	20,878	11,127	9,751
	12 " " '06	759,879	*544,757	215,121	138,085	77,036
	12 " " '05	632,250	*434,987	197,263	131,817	65,446
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co.	1 m., Sept., '06	78,820	*39,074	39,746	14,066	25,680
	1 " " '05	54,988	*30,715	24,273	10,829	13,443
	12 " " '06	762,345	*450,848	311,496	150,919	160,577
	12 " " '05	604,687	*394,953	209,734	118,334	91,400
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Sept., '06	182,283	*91,143	91,095	42,253	48 842
	1 " " '05	163,643	*83,081	80,562	42,636	37,926
	9 " " '06	1,511,073	*781,817	729,256	381,454	347,802
	9 " " '05	1,407,782	*719,650	688,132	382,194	305,938