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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 230,350 *copies, an average of* 8226 *copies per week.*

Galvanizing Line Material

The preservation of the metal ware used in pole line construction is a desirable practice in very high-grade work, and it is surprising what a large number of bolts, coach screws, washers, cross-arm braces, anchor and guard rods lend themselves to galvanizing in cases where a company can afford to reduce its long-run line depreciation by taking measures to prevent rusting when the line is first built. In such cases the question generally comes up as to which is the better process, the electrolytic or the dipping method.

There is no question but the dipping or hot galvanizing process gives a heavier coating than the electrolytic, as the latter deposits a thickness of metal measured only by a few thousandths of an inch. The former process is, therefore, more suited to anchor rods. cross braces, washers and the heavier pole line hardware, even though the coating is not as clean and smooth as the electrolytic. The latter gives a better coating for nuts, bolts, lag screws and turnbuckles, where a snug fit by thread is required, though care should be taken to see that the electrolytic process does not leave pin holes and defects exposed, which soon are attacked by moisture and rust. The hot dipping process tends to leave shreds of metal on the threads, which must either be cleaned off by a die or tap before assembly, with the resulting stripping of some of the galvanized coating. The electrical method will not stand as severe an immersion test in acid as the dipping method, but that is not a serious drawback after the work is carefully installed.

Protection of Alternators from Overloads

One of the most valuable characteristics of a well-designed alternator is its ability to withstand very severe overloads of momentary duration. It is often claimed that even on short circuit a first-class alternator cannot give sufficient current to cause it to burn out within a limited time, and it is without doubt true that the reactive drop in potential on full short circuit is so great that the current cannot under most conditions rise to a destructive value as instantaneously harmful to the windings as would be the case with a direct-current constant potential generator. At the same time, short circuits are greatly to be feared in alternating-current plants, for the derangement of the system tends to upset the balancing of loads and distribution of potential to a serious extent which may easily interrupt the service if continued for any length of time.

Modern switchboard practice tends to exclude every kind of automatic circuit-opening device between alternators and bus-bars. There is little doubt that this is wise, for experience in the last few years has definitely shown that the best place to protect a group of alternators is on the individual feeder or transmission circuits. A prominent New England engineer recently stated that in ten years' experience in several power plants with apparatus and switchboards he had never seen a case wherein an automatic device between generators and bus-bars would have been of any value, but, if used, would have been detrimental to the successful operation of the plants. The best practice locates the automatic switches in the feeder lines, so that a local short circuit will not trip alternator switches, for when several alternators are operated in parallel tripping a cir-

cuit breaker on one tends to throw more load on the other machines than they can readily carry instantly with good regulation, perhaps shutting down the whole station.

If the leads from the generators to the switchboard are carefully inspected and tested before installation and run in conduit there need be practically no apprehension of trouble in this short distance. Probably 99 per cent of the electrical troubles in alternating-current systems occur in the transmission or distributing equipment, and it is a great advantage to be able to confine the fault to the local circuit upon which it occurs, either burning out the flow by the station capacity available or shutting down a single line while repairs are made. Careful operation of a station includes regular watching of the machine ammeters to see that the alternators are not continuously overloaded. Busbar short circuits are, of course, not guarded against by open circuiting devices in the outgoing lines, but these are of such rare occurrence that it would not pay to install automatic switches in anticipation of an overload from such a cause. There is no question that in an alternating plant it is better insurance to put the money which would otherwise be spent in expensive automatic oil switches and auxiliary wiring in the generator leads into increased generating capacity.

Non-Competitive Interurban Service

The conviction that fast electric interurban service occupies a field of its own in relation to other transportation facilities in the same territory has been gaining ground for some little time, and corroborative evidence of this fact is always of special interest. When a high-speed electric line is built parallel to a steam road it is almost always the case that at first the latter feels the effects of the new service by reduced receipts at certain points and decreased traffic between others. If the electric line has been built on sound financial analysis, however, the chances are that in a comparatively short time the steam road will be earning a larger total than ever before. New facilities, such as electricity alone can offer, stimulate traffic in the existing tributary population and create new business. Population tends to increase in the territory and both passenger and freight traffic take a new lease of life.

In the Boston & Eastern hearings which are summarized on another page of this issue, eloquent testimony of the beneficial effect of an existing interurban line upon a long established steam system parallel with it is presented. Actual figures are not available, but one of the high officials of the Boston & Albany Railroad has confirmed the impression which we have had for some time that the Boston & Worcester Street Railway Company's electric service between the two principal cities of Massachusetts has really stimulated and created traffic in the territory which the two roads occupy. A slight falling off in certain local steam railroad receipts was noted during the first two or three months after the electric line began operation, but in the recent years of separate service in the same general territory the steam road has been materially benefited by the enlarged facilities for travel. Even the lower fares of the electric line have not sufficed to injure the business of the Albany road.

Again, a number of representative merchants in Beverly and Danvers, Mass., are assured that local business increases with increased trolley service, even though 5-cent connections with larger centers are furnished. Experience has proved in these communities that the small store keeper has nothing to fear from the trolley leading to the city. Readjustments may take place, but they are both centrifugal and centripetal as regards the distribution of travel. The net result is in favor of new methods of getting about, so long as the traffic warrants the building of the lines. The idea is about exploded that a place of good size provided with through facilities and connections is worse off than one in which dead-ended infrequent branch line service is the only means of transportation into and out of town. Of course, the effect of through high-speed electric lines on local electric systems is not quite as clear to determine, but if all the facilities are operated with a broad spirit of common interchange of interests and fitting together of intersecting services, it is scarcely open to denial that in a territory densely populated the through and local lines may help one another to their mutual profit and to the general welfare of the traveling public.

Motor-Driven Auxiliaries

The value of motor as compared with steam-driven power plant auxiliaries is one of the questions which has long been unsettled in the field of original design and station extension. Opinions differ as to the wisdom of applying the electric drive to feed-pumps, stokers, circulating and air pumps on account of the dangers of an interrupted power supply in case anything happens to the electric circuits; but in the operation of coal conveyors, crushers, hoisting buckets, sump pumps and equipment which is incidental rather than vital to the power production process, there is a more general agreement that the compactness, simplicity and efficiency of the motor drive recommend its adoption in the place of less efficient steam machinery.

Economy and reliability of operation are the two points of greatest importance in determining this matter of auxiliary power. If the exhaust steam from the auxiliaries can all be utilized in heating the boiler feed-water, the greater efficiency of the electric drive ceases to be important, and the question becomes one of relative service reliability. It has been clearly shown in the past few years that electric motors are capable of giving as regular service without breakdown as steam engines, and when the motor is of the simplicity of the induction type, without contact rings or commutator, the need of repairs in many months of work becomes almost nominal. In Europe the driving of auxiliaries electrically is widely practiced, and there is a marked tendency in this country to employ motors, in turbine plants particularly.

The crux of the whole problem may be stated to be the amount of exhaust steam needed by the feed-water. In a plant equipped with an economizer fewer of the auxiliaries need to be operated by steam, for the waste heat of the boilers in such cases raises the feed-water temperature through a large part of the range. The requirements of higher vacuum in turbine plants than in engine-driven installations increase the number of auxiliaries somewhat, so that in such cases there is generally enough steam dis-

charged from the boiler pumps, stoker engines and possibly from one exciter engine to take care of the feed-water heating. The boiler feed pumps are the least desirable of all auxiliaries for motor driving, because their exhaust is almost invariably all needed in the heaters and they must always be self-starting without dependence upon the condition of the bus-bars. One exciter in every alternating-current plant should be steam driven, unless the installation includes an exciter battery, which is a valuable though somewhat costly species of insurance. The main point is to deliver enough heat units to the boiler feed-water, to make sure that enough steam-driven auxiliaries are provided to enable the plant to start, and then to make a judicious use of motors in the remaining equipment. It is undeniably a fact that the steam equipment of modern power plants claims by far the greatest share of repair work, and the absence of leaks in wiring and motors as compared with the results of wear and tear in valves, pump packing, cylinders and pipe joints is well worth securing. Non-condensing auxiliary steam cylinders, even when compounded, consume steam at a heavy rate, and the high economy of motors demands their careful consideration in all commercial installations.

Atavism In Republics

The commonwealth of New York State is embarking on a very novel departure in government, and one which is bound to attract the widest attention at home and abroad among students of political science. The founders of the republican government in this country, both National and State, were imbued with the theory that one of the principal objects to be sought in political communities was the freedom of the individual from tyranny on the part of a majority or of a minority. To this end the National and all the various State constitutions include definitions of the rights possessed by the citizens and provide that the courts shall act as an interpreter of these rights. In other words, the judiciary was intended as the ultimate bulwark of the freedom of the citizen from the assaults of either a victorious democracy or a triumphant aristocracy or plutocracy. The establishment of the present Public Utilities Commission, however, marks an abrupt departure from the principles which heretofore have, theoretically at least, directed governmental policy in this country. It is, in fact, based, so far as the law will permit, upon those primitive methods of government in which the suzerain exercises absolute dominion over the life and property of his subjects. To be sure, the constitutional privilege of court review cannot be entirely abrogated, but it has been nullified so far as has been possible by giving immediate force to the rulings of the Commission and imposing cumulative penalties in case of disobedience until the rulings of the Commission have been declared non-constitutional through the tedious process of law.

We have already discussed the possibilities for both good and evil of the experiment in popular government now being tried in New York State, and need not traverse the ground again. It is enough to say that the methods formerly in vogue were far from satisfactory in every particular and were especially inadequate in securing quick relief from arduous conditions, when desired by both the public and the corporations which served them. Circumlocution in certain offices and inaction in others have often prevented the construction of necessary extensions to existing transportation systems, so that a board with autocratic powers to grant franchises can exercise a tremendous amount of good in the State and particularly in the city of New York. The rumor that the City Commission will immediately authorize the construction of a third track on the Second and Third Avenue elevated railways in New York City is a case in point. The value of such an extension in relieving the traffic congestion of the city has been recognized by transportation experts for many years. Relief almost equally important can be granted in many other sections of the State.

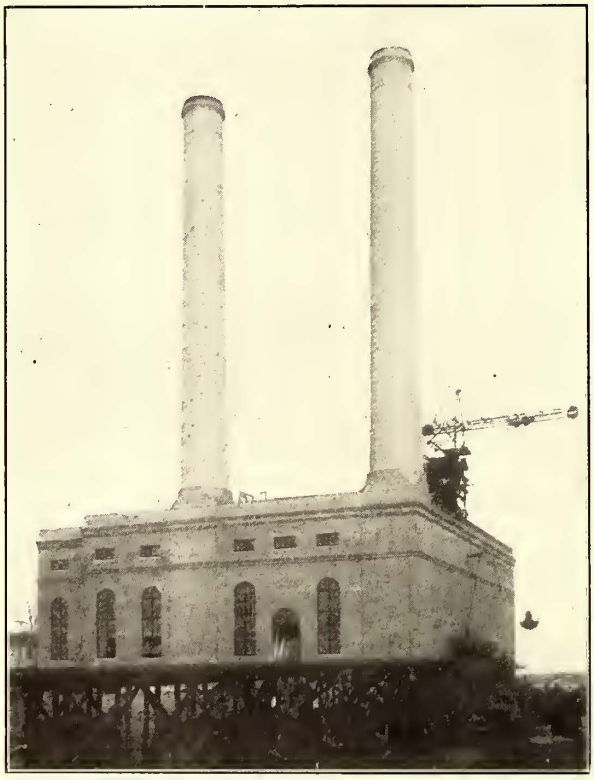
We trust, however, that the Commission, in any work of this kind which it authorizes—or "orders" might be a more exact expression—will recognize the changes which have occurred in the transportation industry during the past few years. There has been a tremendous increase in the cost of practically every item which enters into operating expenses. Wages, fuel and material of all kinds have risen greatly in price. Finally, and perhaps more important than any other factor, the existing franchise laws impose taxes which eliminate most, if not all, of the profit to the operating company in transportation undertakings in this State. In other words, the day in which electric railway companies could pay large prices for the privilege of increasing their facilities and of giving passengers longer rides for the same fare have passed away. Any new public service enterprise is automatically subjected upon its establishment to an impost which is practically proportional to the business done. For this reason the excess earnings left for capital are extremely slight.

We earnestly trust and believe that both of the Public Utilities Commissions appointed in this State realize these facts and that they will administer their office in a broad-minded way; that they will not be misled by fantastic ideas of the profits of public utilities companies derived from the days when there was no franchise tax law, and that they will set the welfare and convenience of the whole people above a narrow desire to secure temporary popularity among those who affect to believe that the business of transportation offers an unlimited mine of wealth.

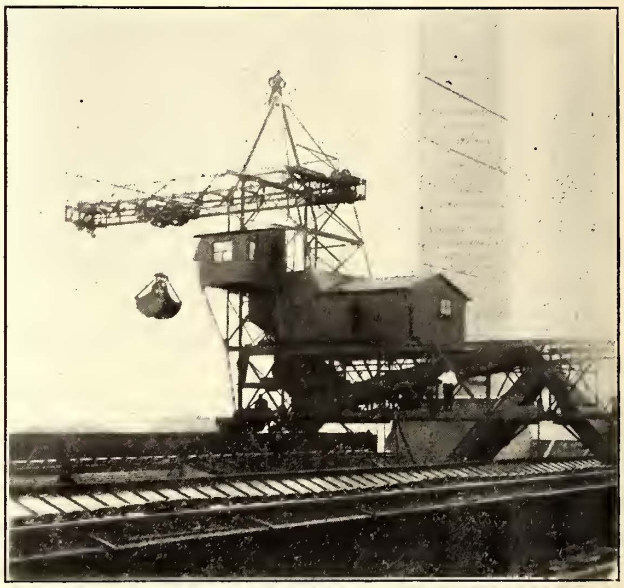
We hear a great deal at the present time about the "unwritten law," but no more striking example exists of this system of jurisprudence to-day than in New York State. The Public Utilities Commissions are bound by no precedents, and the revelation of the unwritten law governing transportation and lighting companies, as shown by the decisions of the commissions in different cases, will be of great interest to the public service corporations of the State. For this reason the suggestion made at the last meeting of the Empire State Gas and Electric Association that the members of that association and of the New York State Street Railway Association codify the new law by keeping their respective secretaries informed of all actions taken by the commissions in matters in which these companies are interested, the information to be supplied to all the members, is worthy of adoption.

THE POWER PLANT OF THE NORFOLK & PORTSMOUTH TRACTION COMPANY

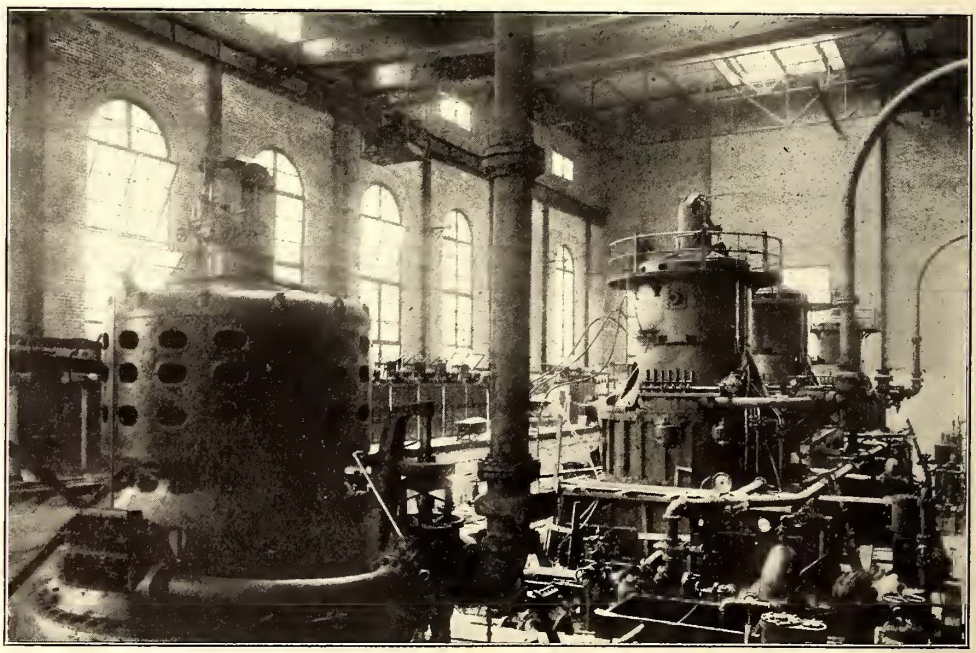
The new generating station of the Norfolk & Portsmouth Traction Company at Norfolk, Va., with a capacity of 10,500 kw, made up of a 1500-kw and three 3000-kw turbo-generator units, is thoroughly modern in all the details of its design. This station furnishes power to operate the railways in Norfolk and Portsmouth and a number of lines from those cities to resorts along the shore of the Atlantic Ocean and arms of the latter; the traffic between the Jamestown Exposition grounds and Norfolk is handled entirely by electric lines supplied with power from this station. The latter also furnishes power for electric lighting in Norfolk and the adjacent cities and for the brilliant electrical display at the Jamestown Exposition.



EXTERIOR VIEW OF THE NORFOLK PLANT



COAL-HANDLING APPARATUS AT THE NORFOLK POWER STATION



TURBINE INSTALLATION IN THE NORFOLK POWER STATION

The station occupies a rather prominent site in Norfolk on the bank of the Elizabeth River, a broad tidal stream connecting with Hampton Roads and the ocean. The exterior is designed in keeping with the surroundings. The footings and substructure of the building are of concrete built on piles driven into the sandy soil of the site. The walls are of red brick surmounted by a concrete roof supported by steel trusses carried by columns in them. The building is 148 ft. by 154 ft. 3 ins. in plan, a brick wall dividing it into a boiler room 87 ft. 5 ins. wide, and a turbine room 66 ft. 10 ins. wide, both of which extend the full length of the building.

The boiler room is along the river side of the building and contains fourteen 500-hp Babcock & Wilcox double-drum water-tube boilers. These boilers are set in batteries of two each, the batteries being in two rows, with six boilers in one row and eight in the second. The two rows face on a firing floor having a clear width of 15 ft. at the level of the boiler room floor, the fronts of the boilers in the two rows being 27 ft. apart. The space over the firing room floor is open and is surmounted by a monitor in the roof having side windows and skylights; a monitor with side windows and skylights also extends the length of the building along both sides of the roof over the boiler room. This arrangement of monitors produces good light and secures ventilation for all parts of the boiler room.

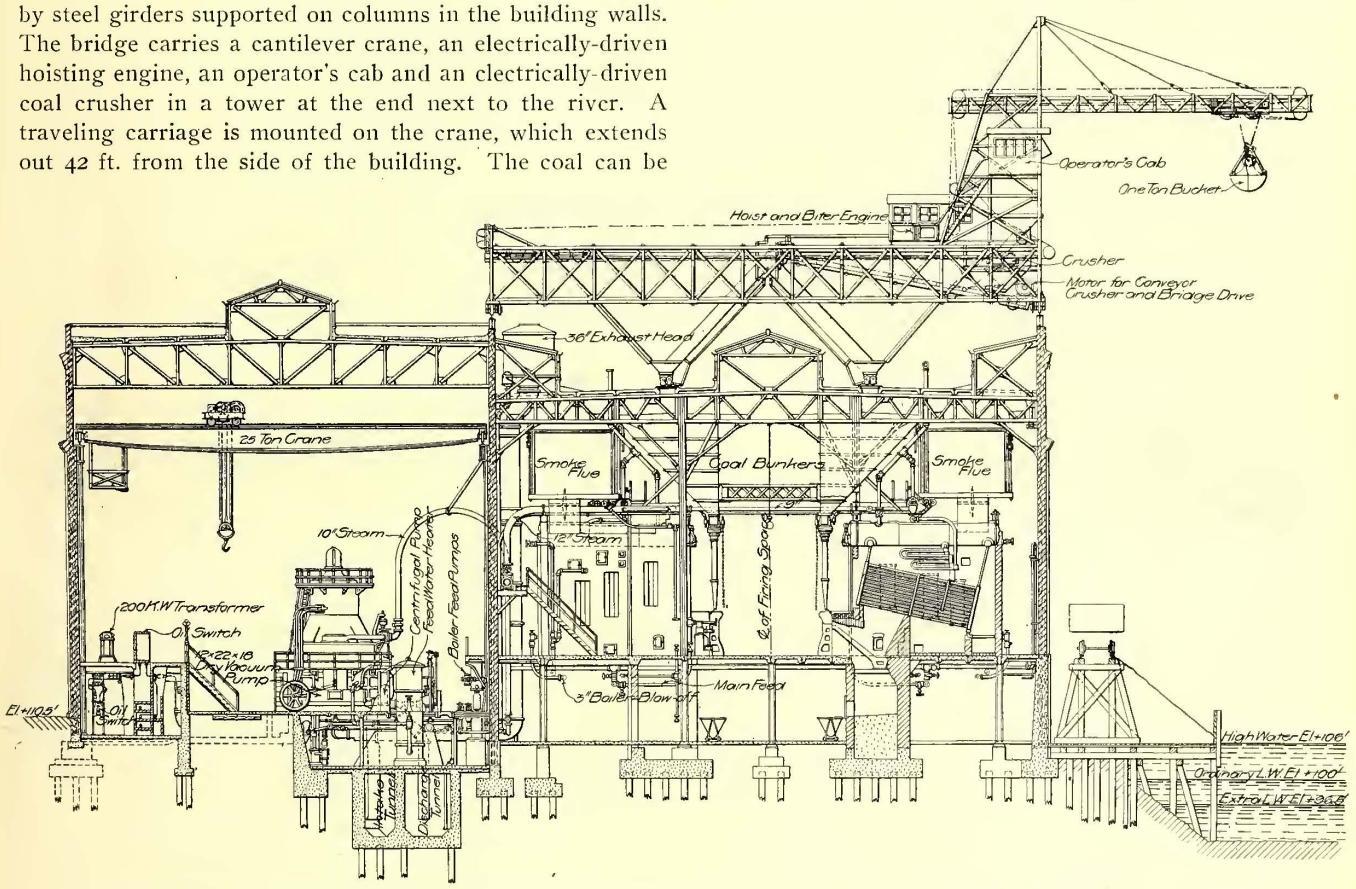
The coal supply for the boilers can be delivered in cars

on a switch track on a trestle along the river side of the building, or by vessels in the river. An open storage bin, 26 ft. wide and with its outer side 5.5 ft. high, is built on piles directly under the trestle. This bin is against the side of the building, extending the full length of that side and along one end of the latter. The floor of the bin is at the extreme high-water level in the river, while the base of rail on the trestle is 14 ft. above that level, so the bin has a large storage capacity. The coal is dumped from the cars directly into the bin, or can be unloaded from vessels into the latter.

The coal is handled from the storage bin, the cars or the vessels to bunkers over the boilers by hoisting and conveying apparatus mounted on a traveling bridge on the roof of the boiler room. This bridge has a clear span of 88 ft. and runs the full length of the building on rails carried by steel girders supported on columns in the building walls. The bridge carries a cantilever crane, an electrically-driven hoisting engine, an operator's cab and an electrically-driven coal crusher in a tower at the end next to the river. A traveling carriage is mounted on the crane, which extends out 42 ft. from the side of the building. The coal can be elevated from the cars on the trestle, from the storage bin, or from vessels moored along the dock on which the bin stands by a 1-ton clam-shell bucket swung by a hoisting cable from the traveling carriage.

The clam-shell bucket dumps into a hopper at the inner end of the crane. A chute leads from this hopper to the coal crusher immediately under it, the crusher discharging on a belt conveyor inclined upward toward the top of the traveling bridge and extending to the middle of the latter; the crusher may be by-passed and coal discharged from the hopper directly to the conveyor. Gates are arranged at the end of the conveyor so the latter will discharge at the middle of the bridge into either or both of two inclined chutes leading down to openings in the roof of the boiler room. These chutes are each fitted at the lower end with an undercut gate controlled from the operator's cab. Coal is supplied by these chutes to two rows of bunkers over the fronts of the boilers, each boiler having a separate bunker with a capacity of 95 tons. An opening in the roof, normally covered with a tight hatch, is provided over each of the bunkers, which are fed through these openings by the chutes on the traveling bridge. The bunkers are carried by steel columns in the fronts of the boiler settings and by the roof trusses. A vertical chute controlled at the top by a gate operated from the firing room floor feeds coal from each bunker to the charging hopper of the stoker immediately under it.

The ashes from each stoker are discharged into a tight chamber directly under the front of the boiler setting. A chute also leads into this chamber from back of the furnace bridge, which is provided for conducting into the ash chamber the soot and fine ashes that collect back of the bridge. Two 24-in. gage tracks are laid the length of the floor of the basement under the firing floor in the boiler room, one track in front of the ash chambers under each row of the boilers. The ashes are drawn out of these chambers through doors directly into 1-yd. dump cars running on these tracks. These cars are pushed out of the building by hand to low ground around the station on which the ashes will be dumped for filling.



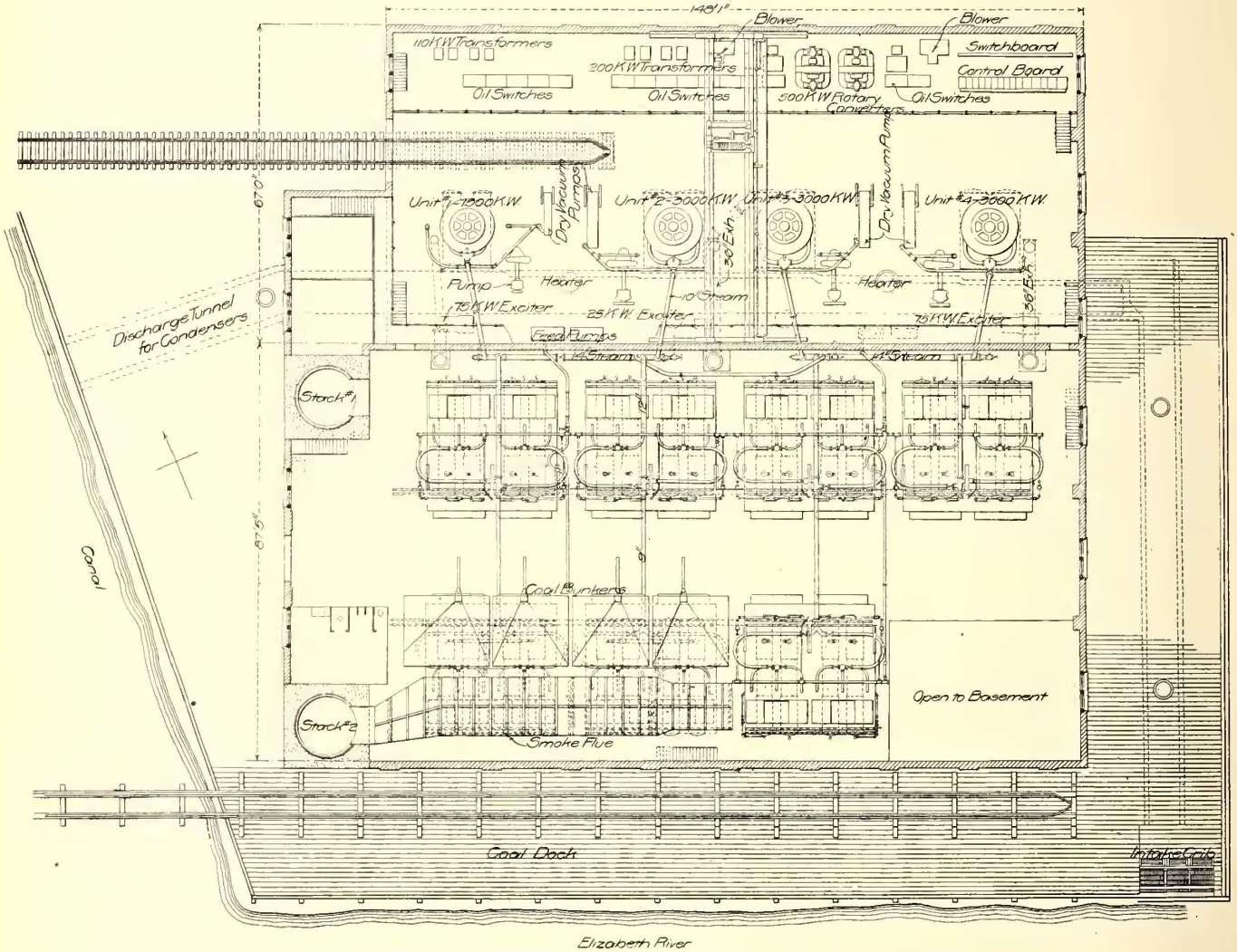
CROSS-SECTION OF THE NORFOLK POWER STATION OF THE NORFOLK & PORTSMOUTH TRACTION COMPANY

The setting and arrangement of the boilers do not involve any unusual features. The boilers are designed to operate at 195 lbs. pressure and are each equipped with superheaters capable of raising the temperature of the steam to 150 degs. F. above the temperature of saturated steam. Two brick stacks, 12.5 ft. in diameter and 200 ft. high above the boiler room floor, are built on separate concrete footings at one end of the building, each stack serving one row of boilers. A smoke flue built of steel plates extends the length of the boiler room from each stack and is swung over the rear of the boiler settings from the steel roof trusses. Each of the boilers is con-

nected to one of the flues by a short vertical breeching.

Two pairs of 18-in. x 12 in. x 24- in. Atlantic type upright Dean Bros. feed-water pumps and two Alberger feed-water heaters, with 2500 sq. ft. of heating surface each, are installed in the turbine room, one pair of pumps and one heater forming a set. The four main units in the turbine room are all operated condensing. A separate hot-well is provided to receive the discharge from the condenser of each unit, an 8-in. x 12-in. x 12-in. Alberger vertical pump being installed at each of these wells to deliver the condensed steam to the feed-water heaters; these pumps may also discharge into the tunnel under the turbine room the header under its row. An auxiliary header is extended over each row of boilers, these two headers being interconnected and supplied independently from the feed-pumps.

A 14-in. steam header in two sections is supported on the wall between the engine room and boiler room, the two sections being connected by an 8-in. loop. Two 12-in. branches are extended from each section of the steam header to connections with the first row of boilers and are then continued as 9-in. lines to the second row of boilers. The two drums of each boiler have a 6-in. connection with one of these branches, the connections each having a check



GENERAL PLAN OF GENERATING EQUIPMENT, STEAM PIPING, ETC.

basement. Make-up water is supplied to the heaters from a connection with the city mains, and a second connection with those mains is provided so the heaters may be supplied entirely with cold water, if necessary. The steam-consuming units of the auxiliary equipment in the station discharge their exhaust steam into the feed-water heaters.

The boiler-feed pumps can draw either from the feed-water heaters, from a condenser discharge tunnel under the engine room, or from the city mains. Each pair of pumps supplies a separate system of feed-water piping for the boilers, the two systems being interconnected so any pump can supply either row of boilers. A 4-in. main feed-water header, hung from the ceiling of the basement under the boiler room, is provided for each row of boilers. These headers are supplied through a connection from both sets of pumps, each boiler having a connection with and stop valve and an angle valve at the boiler, and a gate valve at the header.

Two of the main units in the turbine room are supplied from each of the two sections of the header, the latter having a valve at the middle by which either half of it may be operated independently. A line is extended into the turbine room basement from both ends of each section of the header to supply the auxiliaries in the turbine room, all of which are steam driven.

Hydraulically-operated Crane gate valves are used on the steam headers and on the main connections from them. They are arranged for operation from the basement of the boiler room. Water under pressure for operating the valves is obtained from connections to the supply lines leading from the feed-water pumps to the boilers, auxiliary connections also being provided. These connections are

each controlled by a four-way cock, the controlling cocks being brought together in two groups on the wall of the boiler room basement so the operator may close all of the valves on one section of the steam header and on the branches of the latter leading to the main units in the turbine room, without moving from the group of controlling valves. All the fittings and valve bodies on the main live steam connections are of cast steel.

The four main units in the turbine room are in a single row, the 1500-kw unit being at the front end of the station. Between this unit and the first 3000-kw unit are the condenser equipments for these two units, one feed-water heater and a pair of feed pumps. The third and fourth units are arranged in a similar pair with their auxiliaries between them. The plans for the station contemplate that the building will be extended from the end which the fourth unit occupies.

The four main units have three-phase, 60-cycle, 11,000-volt, 10-pole alternating-current General Electric generators, which are each direct connected to a Curtis turbine, and are operated at 720 r. p. m. The steam supply to these turbines is automatically controlled by an oil-operated governor in each case. The turbines all have base-condensers of the Alberger type, those on the 3000-kw units having 12,000 sq. ft. of surface, and the one on the 1500-kw unit having 6000 sq. ft. of surface. Cooling water for these condensers is obtained from a large tunnel which connects with the river and extends the length of the building under the floor of turbine room basement. Three 20-in. Alberger volute centrifugal pumps, each direct connected to a steam engine, are placed on the turbine room floor, one close to each of the large units, which delivers the water from the intake tunnel to the condensers. A 16-in. volute centrifugal pump performs the same service for the condenser of the 1500-kw unit. After the circulating water has passed through the condensers it is discharged into a second tunnel, which parallels the intake tunnel and is also connected with the river, the two tunnel connections being at nearly diagonally opposite corners of the station site.

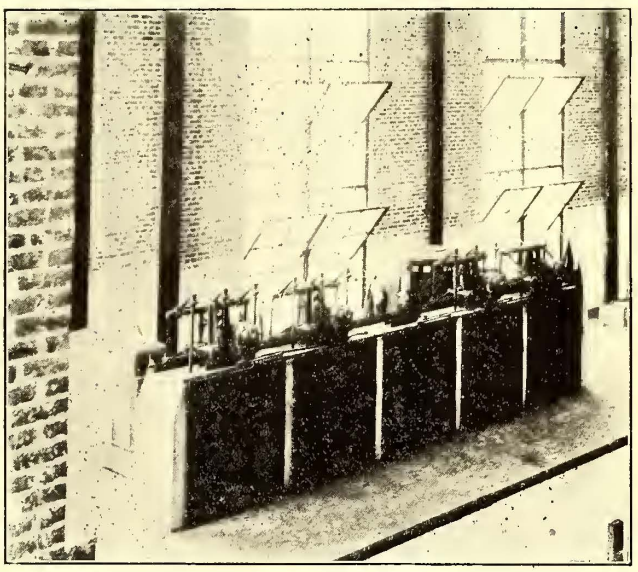
A 12-in. x 22-in. x 18-in. Alberger dry vacuum pump is used in connection with the condenser of each of the large units and an 8-in. x 20-in. x 12-in. dry vacuum pump serves the condenser of the 1500-kw unit. These pumps are on the floor of the turbine room, close to their respective units. Each condenser has an exhaust to the atmosphere through a riser extending above the roof of the boiler room. Each free exhaust outlet is fitted with a bronze mounted Davis turbine relief-valve, a 24-in. size for the 3000-kw and an 18-in. size for the 1500-kw unit.

The oil for the lubrication of the turbines and for the governors is supplied by four 9-in. x 5⅛-in. x 3⅛ in. x 10-in. duplex, center-packed plunger Blake pumps of the differential type, one pair of these pumps supplying two turbines. These pumps take suction from a pipe supplied from the storage chamber of an oil filter in the basement, to which the oil from the bearings of the turbines is returned by gravity. The connections between the pumps and the bearings are arranged so either pump of a set may supply either turbine in each pair.

A 25-kw and two 75-kw, 4-pole, 125-volt direct-current General Electric generators furnish excitation for the main generators. These exciters are each direct connected to a horizontal Curtis steam turbine and operate at 2400 r. p. m.

A part of the output of the alternating-current generators is transformed by two 500-kw General Electric rotary converters in the engine room to direct current at 550 volts and is transmitted at that voltage for use on the street railway lines in the immediate vicinity. A large part of the remainder of the output is transmitted at 11,000 volts to sub-stations where it is transformed by rotary converters to direct current at 600 volts. The balance is stepped-down to 2300 volts alternating current and is used to supply lighting circuits.

The transformers, converters, control board, switchboard, and so forth, are mounted on a concrete platform, 17 ft. 8 ins. wide, which extends the length of the engine room, 8 ft. above the level of the floor of that room. The three cable leads from each main generator are carried under the engine floor in conduits to current transformers under the platform and then to motor-operated automatic 11,000-volt General Electric oil switches mounted on the platform. These switches are connected through disconnecting switches to three-phase buses in a brick compartment under the space enclosed by the platform and the wall in front of the latter. Each bus is in a separate section in this brick compartment. The buses are sectionalized at the middle by a 11,000-volt, motor-operated oil switch, two generators



OIL SWITCHES MOUNTED ON PLATFORM

being on each section. Three 11,000-volt feeder lines lead out of the station from each section of the bus-bars. Leads also extend from one section of the buses through disconnecting and oil switches to the primaries of two 550-kw, three-phase G. E. air-blast transformers mounted on the platform. The 11,000-volt current is stepped-down to 420 volts by these transformers which deliver it to the rotary converters. The current used for lighting is stepped-down to 2300 volts by three 200-kw and three 100-kw single-phase, delta-connected transformers, motor-operated oil switches and disconnecting switches being provided between the 11,000-volt buses and the transformers, and solenoid-operated oil switches and disconnecting switches between the transformers and the 2300-volt buses.

The oil switches, rheostats, field switches and the governors of the main generators and the switches for the 11,000-volt lines are operated by remote control switches on a switchboard having 110 volts at the latter. This board has a panel for each generator, a tie panel for the 11,000-volt buses, a panel for each of the rotary converters, two transformer panels and six outgoing line panels.

The regulation of the auxiliary equipment, the direct-current side of the rotary transformers and 600-volt feeders,

the local power and lighting circuits, and so forth, are controlled from a second switchboard. This board has two panels for Tirrill voltage regulators, a panel for each of three exciter units, a station lighting panel, four panels for 600-volt, direct-current feeder lines, two panels for the positive of the direct-current side of three rotary converters, a 600-volt panel for power supply around the station and three 2300-volt feeder panels.

A switch track is extended into the engine room for a car length to expedite the delivery of heavy machinery. A 25-ton Niles-Bement-Pond traveling crane operated by three electric motors spans the turbine room and serves all parts of the latter.

The station was designed and built under the direction of Sargent & Lundy, consulting mechanical and electrical engineers, of Chicago. J. B. McAfee, C. O. Emmons and E. C. Hathaway formed the engineering committee in charge of the design and construction of the station for the Norfolk & Portsmouth Traction Company. The electrical equipment of the turbine room was furnished and installed by the General Electric Company.

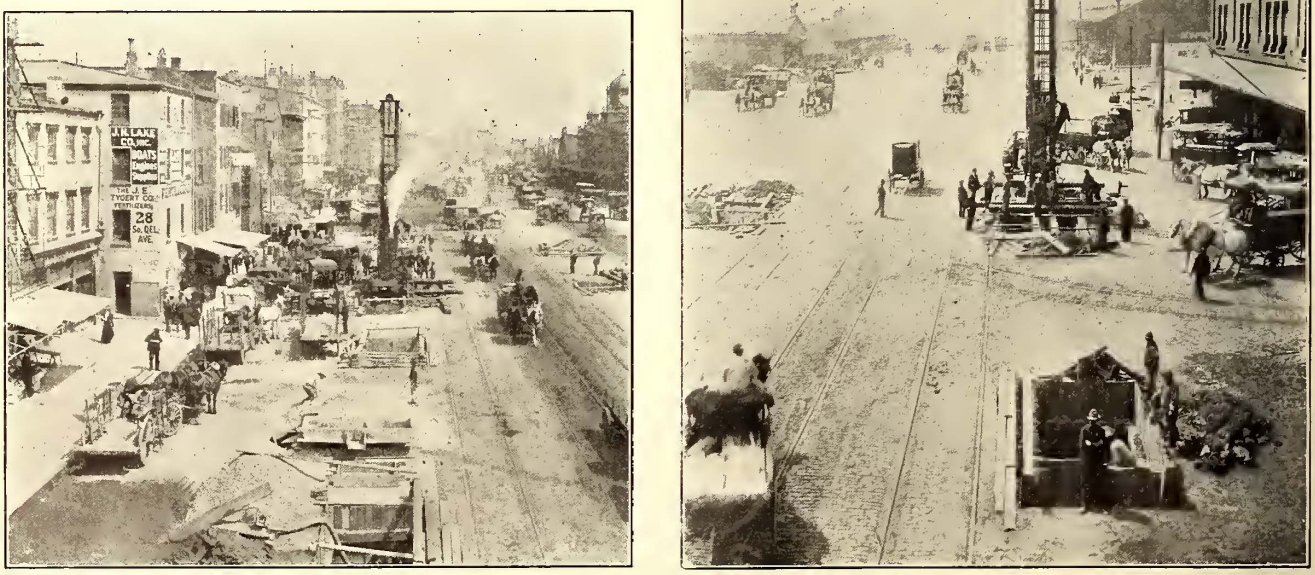
DUTIES OF THE INDIANA RAILROAD INSPECTORS

To make railroad traveling safer, the Indiana Railroad Commission has issued a circular setting out in detail the duties of the inspectors who will be sent out over the State, beginning July 1. The inspectors are required to make daily report of their work; must carefully examine all main tracks, side tracks, connections, culverts, bridges, trestles and terminals; examine the officers and men employed as to the efficiency of the service and management; see whether the company furnishes printed rules of operation, as provided by law; whether they instruct the men in these rules, whether the men obey them, and if not, why; whether any officer or employee is intoxicated while on duty or for any other reason incompetent to perform his work; whether full-train crews are provided; whether men are worked continuously exceeding sixteen hours; whether train dispatching, including the work of the operators, is properly conducted; whether agents and officers and employees are courteous and accommodating in their treatment of the public. If rolling stock is found to be defective or dangerous it must be condemned by the inspector and put out of commission until repaired.

WORK ON PHILADELPHIA SUBWAY-ELEVATED LINES

The Philadelphia Rapid Transit Company has begun construction of the Delaware Avenue elevated railway comprising section No. 11 of the combined subway and elevated railway system outlined in the Street Railway Journal of Sept. 23, 1905, and of which the Market Street line forms the beginning. This section extends for about a mile over the steam railroad tracks paralleling the Delaware River, and eventually will join the Market Street line when the latter is continued on section No. 6, through Water Street to Arch Street and Delaware Avenue. All of the piers on Delaware Avenue are now in place and the line is planned for completion by Jan. 1, 1908. The structural features of this line were described in the Street Railway Journal of Feb. 16, 1907. Section No 5, comprising the subway loop around the City Hall, is also under way, as shown in one of the accompanying illustrations.

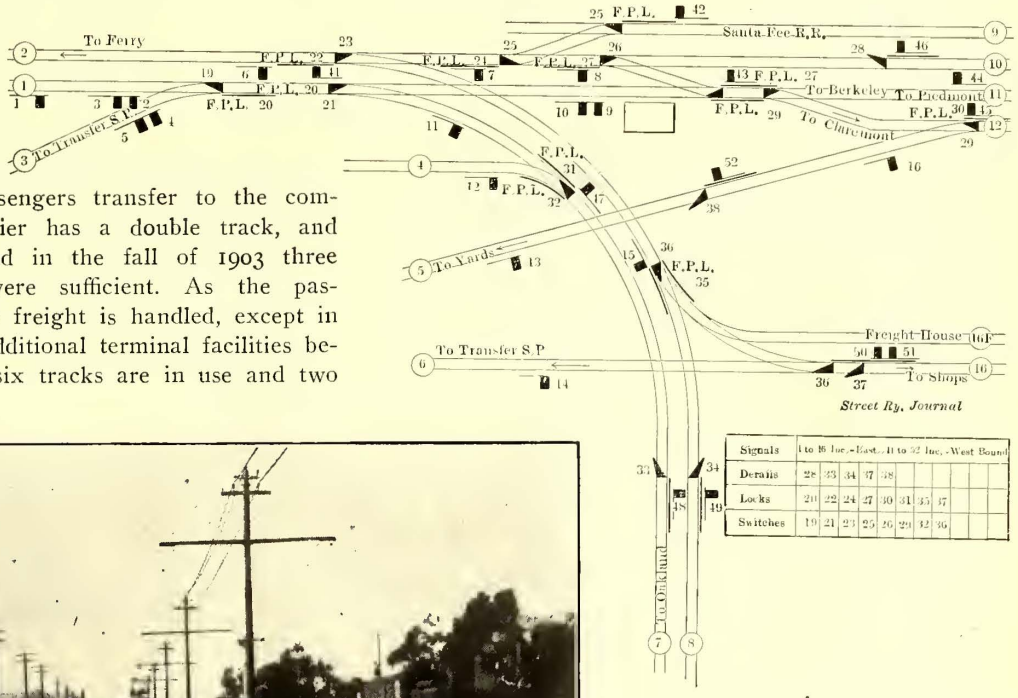
AT WORK ON THE LOOP AROUND THE CITY HALL



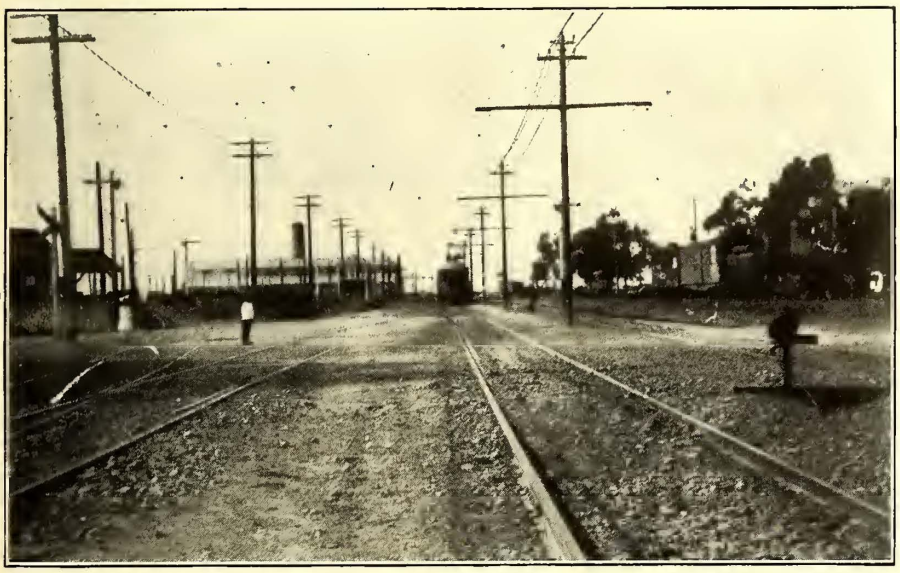
TWO VIEWS ALONG DELAWARE AVENUE, PHILADELPHIA, SHOWING THE FOUNDATIONS OF ELEVATED PILLARS

KEY ROUTE INTERLOCKING PLANTS

The San Francisco, Oakland & San Jose Railroad has installed two interlocking plants on its Key Route system for facilitating the handling of its electric train service on the Oakland side of San Francisco Bay. Station No. 1 is located at the end of the 17,000-ft pier, where the trains run into a large train shed and where passengers transfer to the company's ferry boats. The pier has a double track, and when the road was opened in the fall of 1903 three tracks at the terminal were sufficient. As the passenger traffic increased (no freight is handled, except in small quantity at night), additional terminal facilities became necessary, and now six tracks are in use and two more are soon to be added.



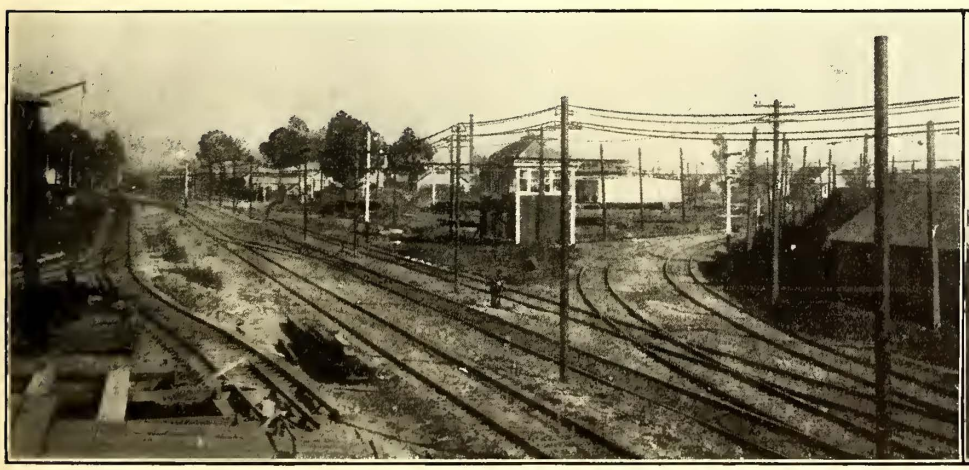
Signals	1 to 16 Inc.-East-Bound	31 to 52 Inc.-West-Bound
Derails	28 33 34 47 48	
Locks	20 22 24 27 30 31 45 47	
Switches	19 21 23 25 26 29 42 46	



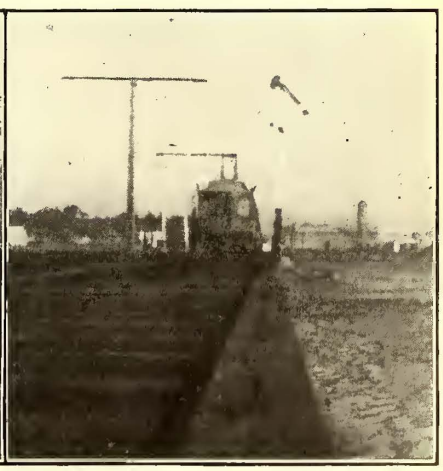
THE APPROACH TO THE STATION AT YERBA BUENA AVENUE

This first interlocking plant was installed about two years ago, a tower being built at one side of the pier so that the operator can command a view of the entire terminal, as well as the long pier. It is equipped with a twenty-four-lever machine for hand manipulation, and twenty-one working levers are at present in use. Standard track semaphores are installed.

Station No. 2 is located on Yerba Buena Avenue near the end of the pier and between the company's power house and its shops. It controls the trains on the main line going to Berkeley and Piedmont, the Oakland branch turning to the south, and the new Claremont branch, which parallels the main line for several blocks. It also controls the switch and service tracks connecting with the Santa Fe and Southern Pacific Railroads, and the shops, yards, freight house and power house. The tower is centrally situated and the interlocking system operates switch and signal points up to 2565 ft. west of the tower, 720 ft. east and 525 ft. south. A fifty-two-lever machine is installed in the tower with forty-eight working levers. The tower is large enough for seventy-six levers. The system installed is the standard type of the Union Switch & Signal Company with wooden signal towers, Hayes derails, etc. Red signals are used to indicate danger and green to clear. At No. 1 signal on the end of the pier yellow is used as a caution and clearing signal.



THE LOCATION OF THE 48-LEVER TOWER



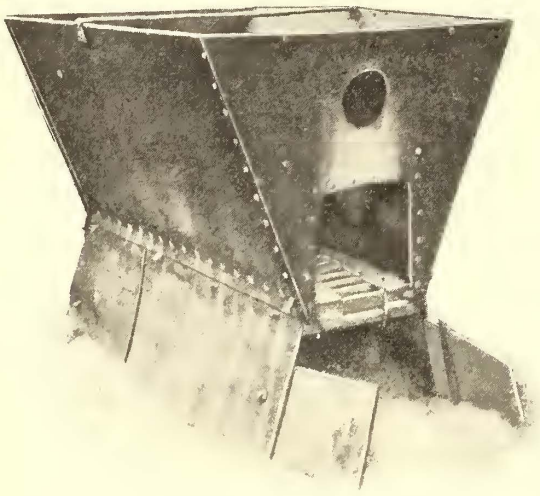
BLOCKS ON THE PIER

SAN ANTONIO SHOP NOTES

Several unique devices are in use in the shops of the San Antonio Traction Company. Through the courtesy of T. C. Brown, superintendent of transportation, an account of some of them is given.

SAND DRIER

A sand drier built by Mr. Brown is shown in an accompanying reproduction. It consists of a hopper-shaped bin

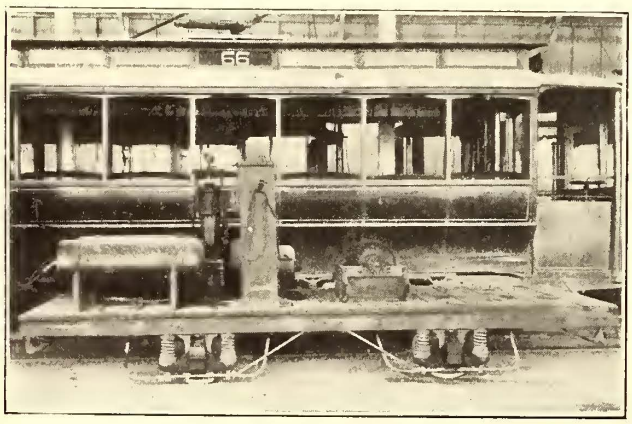


SAN ANTONIO HOME-MADE SAND DRIER

with a U-shaped furnace built inside. The dry sand falls through 1-in. holes, at the bottom on each side of the furnace. The bin is about 6 ft. long and 4 ft. wide at the top. The hopper is usually kept full of sand and enough is dried by simply burning the trash that accumulates about the shop in the furnace.

SHOP UTILITY CAR

A general utility car in use about the shops has mounted upon it an air compressor and storage tanks. The car is hitched to a motor car and is utilized to convey armatures and heavy parts about the shops. The air equipment is used for blowing out controllers and motors. These are

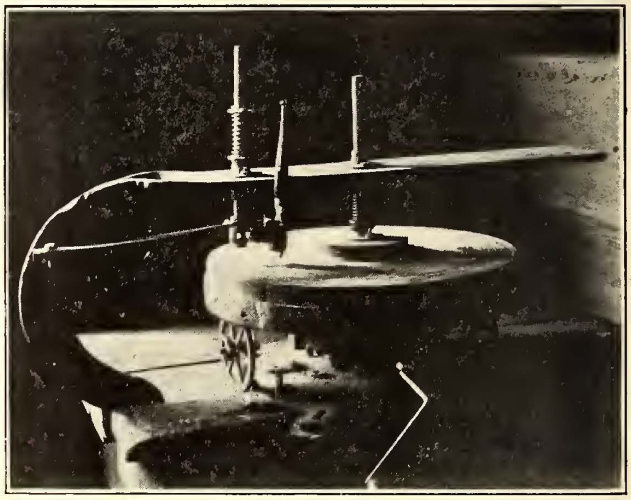


GENERAL UTILITY AND AIR COMPRESSOR CAR IN SAN ANTONIO

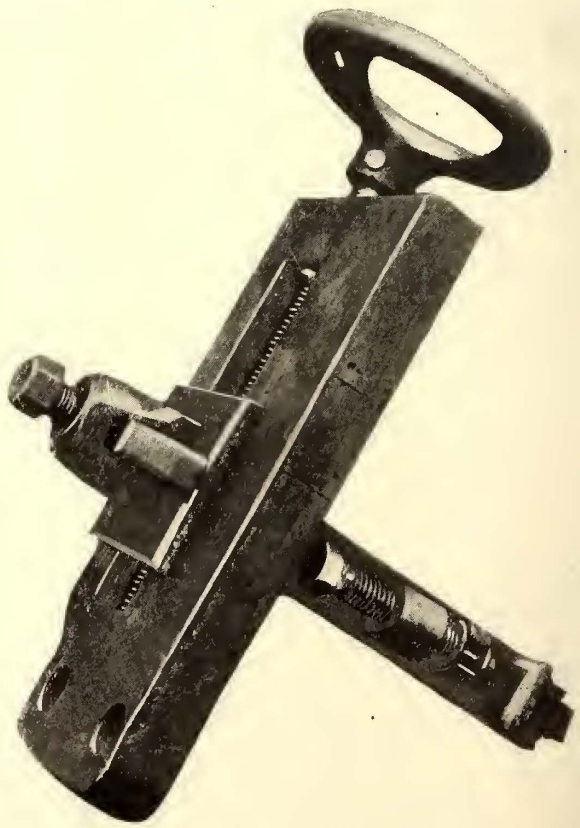
blown out each day, and since the practice has been inaugurated there has been a noticeable decrease in controller troubles. On the car is mounted an old-style vertical compressor and two 16-in. x 48-in. tanks.

DEVICE FOR CLEANING RAIL GROOVES

The company is experimenting with a device for cleaning the rail grooves in paved streets. Formerly these were cleaned by hand, and one man's time was required about one and one-half days per week to keep the track in condition. With the device all the tracks can be gone over in about two hours. It consists of a frame attached to the rear end of the car truck and which has several downward projecting teeth to gouge the dirt out of the groove. These teeth are so held in place by springs that when rigid obstructions are met, as at switches, the teeth are pulled back so that they slide over the obstruction. The device is raised



HEADLIGHT GLASS CUTTER IN SAN ANTONIO SHOPS



COMMUTATOR-TURNING DEVICE

by a lever on the platform above. The device was gotten up and patented by C. H. Frick, shop machinist, who has also devised a method for turning commutators without removing the armatures from the motor.

COMMUTATOR-TURNING DEVICE

The device just mentioned, which is shown in an accompanying reproduction, is used on G. E. 52, 54, 62 or 67 mo-

tor. It is bolted over the opening over the commutator by extra long bolts, substituted for those holding the brush holder yoke in place. The tool held in the downward projecting arm is adjusted by the cap screw to the diameter of the commutator. The motor being worked on is then cut out and the car is operated by the other motor. As the armature revolves the tool is shifted laterally by the hand wheel, which projects beyond the motor casing.

HEADLIGHT GLASS CUTTER

Considerable time is saved in the shop by the use of a device for cutting headlight glass. The device was made largely from the mechanism of a discarded Lewis & Fowler register. It consists essentially of a revolving table on which the glass is placed and a glass cutter held stationary in a spring support over the table. The table is turned by a crank which has been attached to the shaft formerly used to turn the register back to zero reading.

WRECK CAR

An old eight-bench open car is used as a wreck car. The four posts adjacent to the corner posts have been sawn out and the central portion of the car has been enclosed. The car is kept in a portion of the yard where it can be gotten out quickly, and is well supplied with wrecking tools. Included in these is a horse with chain blocks for raising trucks and a truck used in bringing in cars with broken axles. This latter is a four-wheel truck built with a swivel bolster. The disabled end of the car is raised up so that the wheels clear the track and then the truck is run under the elevated end. The car is then returned to the shop with one motor. With this truck a crew has received word over telephone of a breakdown, gone one and one-half miles and returned to the shop with the disabled car in 40 minutes.

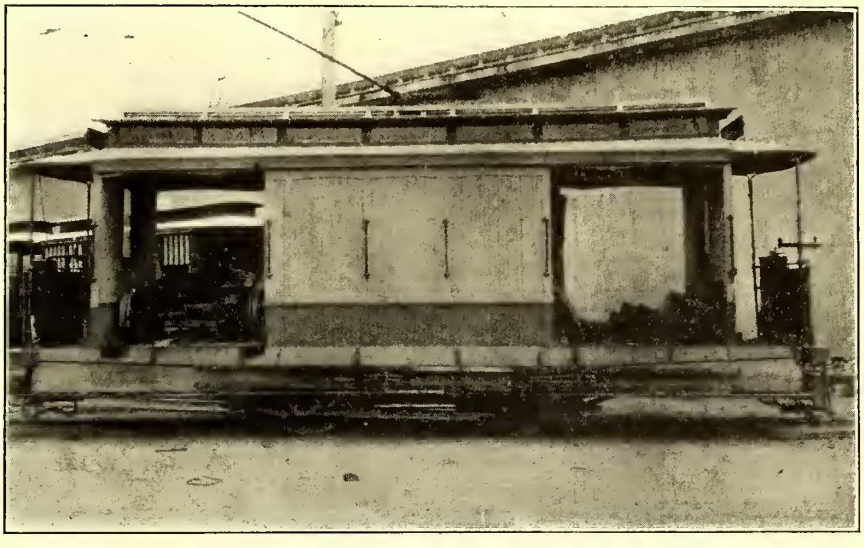
A close record is kept of all trips made by the wreck car. Information concerning these is furnished to the superintendent of transportation on special blanks, which indicate the time the car was out and the nature of the wreck. A few years ago the track was in very bad condition and the wreck car was kept busy getting cars back on the track. However, in the last three years the tracks have been almost entirely rebuilt with the result that the wreck car is very seldom required to go out.

The Montreal Street Railway Company has issued a trolley folder addressed to visitors in the city of Montreal who would see the many beauty spots in the suburbs comfortably and cheaply. The cover is an artistic reproduction in colors of a city view in Montreal, showing the highlands in the distance. The booklet proper is well illustrated with typical scenes in and around the city. It also contains a map of the Montreal Street Railway Company's local and suburban lines. A feature of special interest to the trolley traveler is the schedule of time, rates of fare, etc., to such points as Lachine, Sault-au-Recollet, St. Laurent, Cartierville, Pointe aux Trembles and Bout de l'Ile. There is also a bird's-eye view of the city of Montreal, made into a headpiece to precede the reading matter.

CALIFORNIA MIDLAND RAILROAD

The California Midland Railway is one of the several electric railway projects under construction in the central part of California, which will greatly improve the transportation facilities of that section of the State. The road is intended to connect Marysville with the mines of Nevada and Placer Counties. Its main line will extend 34 miles east from Marysville to Limekiln Junction, with a branch 17 miles south to Auburn on the main line of the Southern Pacific. Other branches will extend 12 miles northeast to Grass Valley, which is now connected to Nevada City by an electric railway, and 1½ miles to Hammond, the center of the gold-dredging industry on the Yuba River. In all, there will be about 70 miles of track, and, as the route runs through the Sierra Nevada foot hills, it will be a picturesque one. The maximum grade will be 3 per cent for a stretch of 7 miles. In addition to several large bridges and fills, the road will cross the Yuba River and marsh near Marysville over a 9000-ft. trestle.

The road will be operated by 1200-volt direct current supplied from four reinforced concrete sub-stations by a third rail of the under-running type. Power, which will be purchased from the California Gas & Electric Corporation, will be stepped-down from 60,000 volts at the sub-stations and converted into 1200 volts direct current by 400-kw motor-generators. The sub-station will be located at Marygold, Limekiln, north of Auburn, and midway between Marygold and Limekiln.



SAN ANTONIO WRECK CAR, SHOWING TRUCK USED IN BRINGING IN CARS WITH BROKEN AXLES

For the contact rail the company plans to use a special low-carbon steel rail of inverted T section, weighing 22.4 lbs. per yard. The rail will be keyed at the web to wrought iron stirrups, which will hang from porcelain insulators supported on channel-iron brackets spiked to the ties. These supports will be spaced every 15 ft., and with the light section of rail each support will carry but a little over 100 lbs. weight. The rail will be arranged to carry four No. 0000 auxiliary copper feeders if necessary. The rail will have a conductivity of 345,000 cm, with a resistance, including bonds, of 0.16 ohm per mile.

Fifty-two-foot passenger cars will be used, each equipped with four 75-hp, 600-volt motors connected two in series for 1200-volt operation. Across the motor terminals will be shunted potential relays to eliminate the possibility of

trouble from the loss of one motor of a pair. The cars will be supplied with pantograph trolleys for supplying the motors in towns equipped with overhead conductors, but in the country the current will be taken up by four under-running collector shoes. The brakes will be operated by compressed air, which will also control the changing from the third rail to the trolley. The track will be protected by a block-signal system. John Martin, of San Francisco, is president of the California Midland Railway Company, and C. C. Manker, electrical engineer, had charge of designing the electrical details.

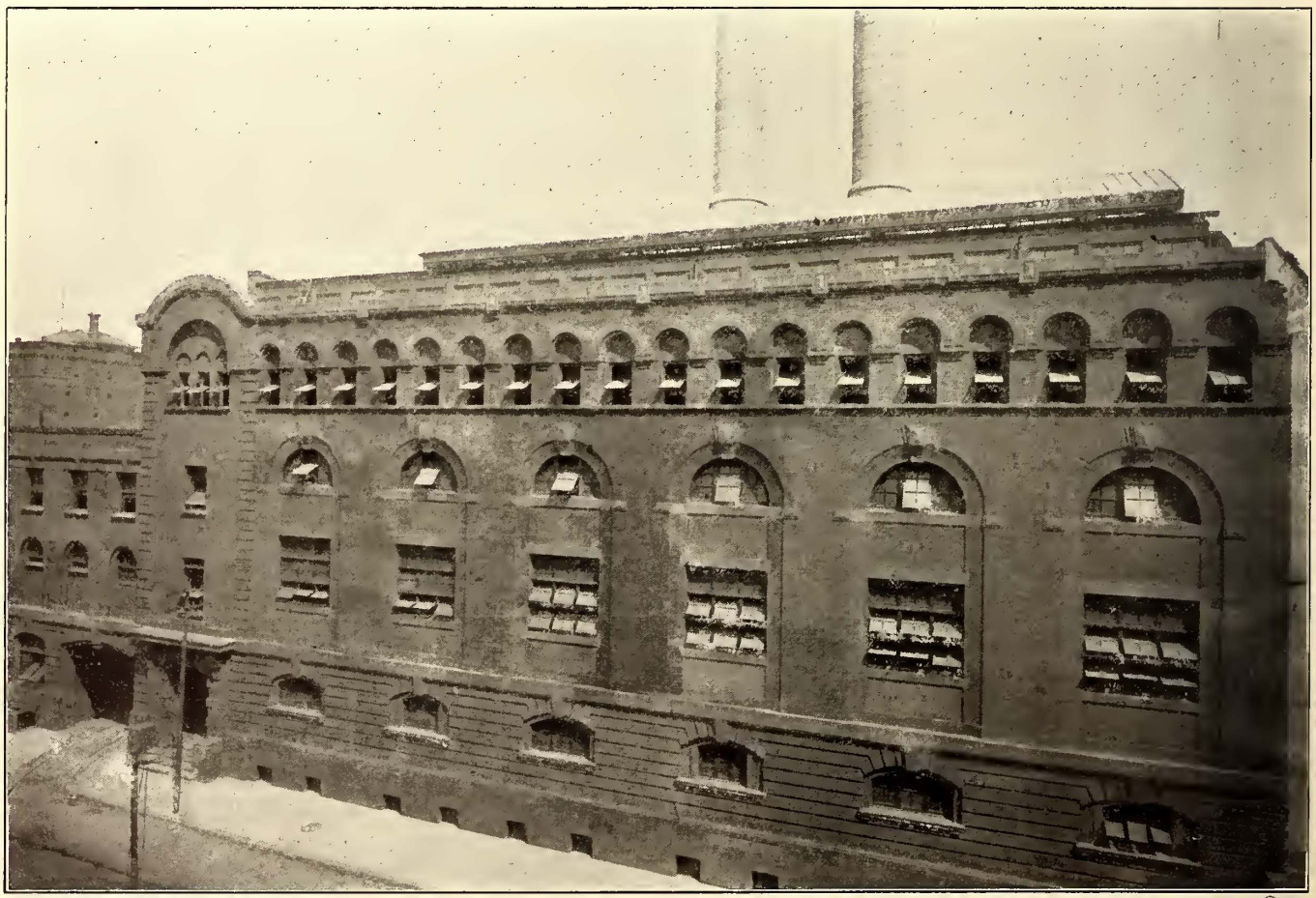
TURBINES IN PHILADELPHIA

The Philadelphia Rapid Transit Company is now putting the finishing touches on the Delaware Avenue power station, of which a preliminary description was published in the Street Railway Journal of Sept. 23, 1905. At present this station contains two 6000-kw Westinghouse turbines, the first of which was started Feb. 22 and the second a month later. The third and last unit will be started in about a month.

Thus far no tests have been made of any of these turbines, as they are using hard coal temporarily, but later this summer when the boilers can be fed with soft coal, complete tests will be made on all machines before their final acceptance. It might be noted that one reason for delaying tests on the Delaware Avenue turbines is the fact that this station is used intermittently at present and will not give continuous service until the fall. In addition to these turbines, the old Delaware Avenue station contains a 2000-kw Curtis unit which has been running for twenty months.

There are also six 1500-kw Westinghouse turbines in the Wyoming Avenue station which have been running for over two years. At present one-third of the power from this station is generated by turbines. In general, these machines are giving satisfactory service, but there are still a number of points about them, such as the best method of lubrication and detection of internal troubles, that can only be settled by further experience with this type of prime mover.

INTERIOR VIEW OF THE DELAWARE AVENUE STATION



EXTERIOR VIEW OF THE DELAWARE AVENUE TURBINE STATION OF THE PHILADELPHIA RAPID TRANSIT CO.

THE DEFORMATION OF RAILS AND WHEELS

At the engineering conference of the (British) Institution of Civil Engineers in London, a paper was presented June 20 in the railway section by H. R. A. Mallock, on "The Aetion Between Wheel and Rail." It was based on observations by the author on the rails of the tube railways in London, which become rapidly worn, especially just after they are laid. An abstract follows:

I assume that the wheel and the rail are made of the same steel, and that such steel will bear a load of 20 tons per square inch on its surface before deforming. Hence, if each wheel carries a load of 4 tons, there must, at any rate, be more than 1/5 sq. in. of contact between the rail and the wheel, for 1/5 sq. in. would be required if the pressure was uniformly distributed over the whole area; but in the actual case the pressure is greatest at the middle of the contact area, and it can be shown that the maximum pressure is half as large again as the mean.

The next question is, if a steel cylinder of a certain radius and width rests on a flat steel rail of the same width, and carries a definite load, how much will the cylinder depress the rail and how much will the rail flatten the cylinder?

It appears that over the area in which they come in contact the profile of the rail and wheel are both arcs of the same circle, and that the radius of this circle is twice the radius of the wheel. It appears also that the depression produced at the mid point of contact is about $\frac{1}{24{,}000}$ of the square root of the area of contact per ton per square inch, it being assumed that the square root of the area of contact is small compared with the depth of the rail. If, therefore, the maximum permissible load is 20 tons per square inch, the greatest allowable indentation is $\frac{20}{24{,}000} \times$ (square root of the area of contact).

Now the area of contact is the width of the effective tread multiplied by the length of the arc of contact, and this latter varies as the square root of the radius of the wheel for a constant depth of indentation.* If, therefore, the area in contact is to be constant, the width of the tread must vary inversely as the square root of the radius.

It can be shown that the total elastic reaction between a cylinder and a surface originally plane is two-thirds of the maximum pressure between them multiplied by the area of contact. Hence if the total load on the rail is 4 tons, and the maximum pressure the steel will bear without permanent deformation is 20 tons per square inch, the area of contact must be not less than $4/20 \times 3/2$, or 0.3 sq. in. The square root of 0.3 is 0.53; therefore, the indentation at mid-contact must not exceed $0.53 \times \frac{20}{24{,}000}$ in., or $\frac{1}{2250}$ in.; and I find that, in order to get the required area and not exceed this indentation, the diameter of the wheel must be not less than 5 ft. if the tread is 1 in. wide. Any wheel of less diameter, unless the tread was wider than 1 in., would cause a permanent flattening of the rail.

Most of the wheels now in use on railways are less than 5 ft. in diameter, and when both wheel and rail are new, they certainly do not have a bearing surface an inch wide. I conclude, therefore, that there is some permanent flattening down of the rail each time a wheel passes over it.

I can make some estimate of what the flattening is in the case of a wheel whose diameter is given, by finding in the first place what load that wheel would carry by purely elastic reaction, and then finding how much deeper the wheel would have to sink into the rail to carry the extra load, taking the reaction over that part of the depression which exceeds the elastic limit to be constant and equal to 20 tons per square inch. As an example, take a wheel of 40 ins. diameter; such a wheel, on the supposition above made, would carry elastically 3.2 tons. This leaves 0.8 ton to be made up by deformation, which is in part permanent, and I find that the permanent part of the deformation is about .0,000,005 in. On the supposition that the width of the tread was 1.38 in. instead of 1 in., the 40-in. wheel would carry the 4-ton load by elastic deformation only.

Five millionths of an inch does not seem a very large quantity; but if we take the case of a railway on which there is a two-minute service of trains for twelve hours a day, and suppose each train made up of six eight-wheel carriages, it will be seen that this wear is $\frac{4 \times 5 \times 360 \times 365}{1{,}000{,}000}$ = 2.60 ins. per year, for a 40-in. wheel with a 1-in. tread, whereas with a tread of about 1.4 in. there would be no wear at all, the load in like cases being 4 tons. Without attaching much importance to the actual figures, this example, and the formula in the foot-note, show how much the width of the tread affects the flattening, and that it is to be expected that wear will be very rapid at first, and will almost cease when the wheels and rails have adapted themselves to one another. It seems possible, therefore, that if the rails were rolled with a slightly different cross section, a considerable part of the initial wear might be avoided.

In all these remarks I have considered only the wear which would occur on a straight railway, and where there is no slipping between the rail and wheel.

On a curve there is necessarily slipping on one or both rails, and slipping must occur even on the straight, unless the diameter of the wheels on the same axis is identical. The wear due to slipping is quite distinct from the flattening or crushing which I have considered hitherto; but it is to the slipping we must look, I think, for the origin of the ripple-like marks which are often to be noticed on rails over which small wheels are run. The length of each of these ripples is 2½ ins. to 3 ins., and they often extend over a considerable length of line. The question arises, What settles the wave-length? Is it something which depends only on the distance the wheel travels and not on the velocity (as would be the case if it was the result of the toothed gear wheels of the motors), or is it a real period, e. g., something which recurs in a constant time? I think the latter is the true explanation, and the only period likely to give rise to these marks is the period of the torsional vibration of the wheels on their axles. Such torsional vibrations are sure to be set up at certain speeds if the wheels slip on the rails, and may be compared with the vibrations of a bowed string, or more closely with chattering a wheel or disc when mounted on a slender axis and turned in a lathe.

* The general formulas connecting the radius of the wheel (r), the length of arc (a) in contact with the rail, the width of the tread (b), and the total elastic supporting force of the rail (F), are

$$a = c_1 r^{2/3} b^{1/3}$$
$$F = c_2 r^{2/3} b^{4/3}$$

If the units are tons and inches, and assuming that 20 tons per square inch is the greatest load which can be laid on a plane of the material without causing permanent set, and that the compression produced by a pressure of 1 ton per square inch is

$$\frac{1}{24{,}000}$$

of the square root of the area over which it is applied, $c_1 = 0.0165$ and $c_2 = 0.46$.

THE PLANS OF THE BOSTON & EASTERN ELECTRIC RAILROAD

During the last few months plans have been developing in Massachusetts for the building of a high-speed interurban railroad between Sullivan Square, Charlestown, at the terminal of the Boston Elevated Railway Company, and the cities of Lynn and Salem as a major route, with extensions to Revere Beach, Beverly, Peabody and Danvers. A company has been formed for the purpose of building and operating the line in case the necessary certificate of public convenience and necessity is granted by the Massachusetts Railroad Commission, the corporate name being the Boston & Eastern Electric Railroad, and the chief engineer, John H. Bickford, of Boston. A number of hearings have been given to the parties interested by the commission, at which the plans of the company were submitted in great detail. As they are the most elaborate ever submitted to the commission, an abstract of them may be of interest to many.

The proposed route is shown in Fig. 1. From Sullivan Square, Charlestown, the line crosses the Mystic River into Everett, and traverses the edge of Chelsea and Revere to Lynn. About a mile of the run in the latter city is planned as semi-subway, a typical section of the latter being shown in Fig. 2. From Lynn the line swings to the north through Peabody to Salem, Beverly and Danvers. The territory traversed is more densely populated than any other equal area in New England. Exclusive of Boston, five cities and three towns are directly tributary to the line. The territory is naturally divided into three zones separated from one another by two undeveloped areas. Zone 1 comprises Salem, Beverly, Peabody and Danvers, with a combined population of over 80,000 and an average distance of 17 miles from Boston. Zone 2 comprises Lynn, 11 miles from Boston, population 90,000. Zone 3 comprises Chelsea, Everett and Revere, averaging 4 miles from Boston, with a population of 81,000. It is expected that the entire territory, of which Sullivan Square is the terminal, will furnish more or less traffic to the road. The population density is 2855 per square mile in the territory, according to the State census of 1905. Between 1900 and 1905 the percentage growth was 63 per cent greater than the State as a whole. Boston proper has a population of 600,000.

It is urged by the company that a special field of service exists in the territory which neither the present steam nor street railway facilities can meet. The plans for the Boston & Eastern line specify a private right of way without grade crossings throughout the entire run, the principal running times, fares and distances having been figured as follows:

TABLE I.

	Fare.	Distance.	Running Time.	
			Express.	Local.
	Cents.	Miles.	Minutes.	Minutes.
(Boston) Sullivan Sq.—Lynn.....	10	9.0	10–11	14
" " " —Salem.....	15	14.5	17–18	25
" " " —Beverly.....	20	16.5	21–22	28
" " " —Danvers.. .	20	17.	26	

Table II. shows the present trolley schedules between Scolly Square, Boston, and the above points. About ten minutes are required between Sullivan and Scolly Squares.

TABLE II.

	Distance, Miles.	Time, Minutes.	Fare, Cents.	Car Changes.
(Boston) Scolly Sq.—Lynn.....	10.5	60	10	0
" " " —Salem.....	15.	75	20	0
" " " —Beverly.....	17.	93	20	1
" " " —Danvers.....	19.25	101	25	1

Table III. shows the increase and decrease of suburban service in relation to population on the Boston & Maine Railroad between 1893 and 1906 in the territory of the Boston & Eastern route. During this period the Boston & Maine has not extended any of its four divisions within 25 miles of Boston, but the passenger mileage increased 17.2 per cent and the freight mileage 63.8 per cent in this time. Out of sixteen stations tabulated only four show an increase in train service, two have remained the same and ten have decreased from 13.8 per cent to 100 per cent. At Lynn, the most important station on the list, the population has increased 35.7 per cent, while the number of trains at the central station has increased but 15.4 per cent. The city as a whole has 135 per cent less trains than it had thirteen years ago. In Revere the population has increased 103.8 per cent and the number of trains decreased 28.6 per cent.

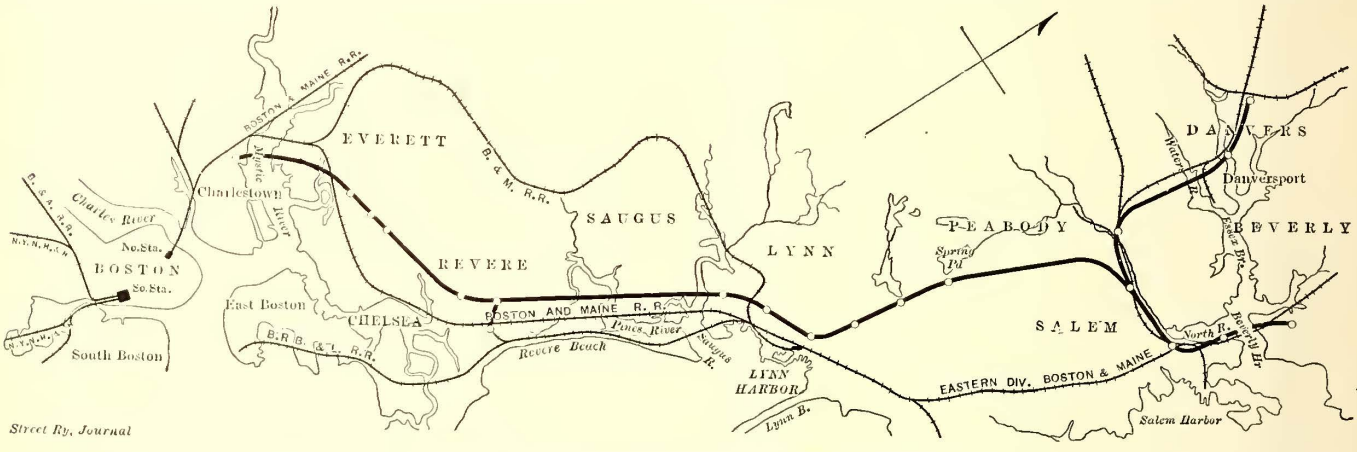


FIG. 1.—LOCATION MAP OF THE BOSTON & EASTERN ELECTRIC RAILROAD

The company states that the average speed of its express trains is to be 47 miles per hour, locals 30, excluding layovers. Between Beverly and Boston the schedule speed is to be 45 miles per hour with a 50-ton car, 16 hp per ton, a maximum speed of from 63 to 67 miles per hour and limiting curvature of 1.5 degs. The Aurora, Elgin & Chicago's schedule speed is 43.5 m. p. h., cars 41 tons, 12 hp per ton, maximum speed about 60 m. p. h., and 2 degs. curves. The Lake Shore Electric lines have a schedule speed of 52 m. p. h., with 41-ton cars, 4 hp per ton, 50-60 m. p. h. maximum and 4-deg. curves. The average train on the Boston &

Eastern is figured at 2.5 cars. Each car as figured is a 50-ton steel car, 60 ft. long over all, with a seating capacity of fifty-two, four 200-hp motors with multiple-unit control, air brakes and four pneumatic doors. The car weight is estimated as: Body, 37,000 lbs.; one pair trucks, 22,000 lbs.; equipment, 34,000 lbs.; passengers, 7000 lbs.

The maximum curvature on the main line does not exceed 2 degs., except at Salem and Lynn central stations,

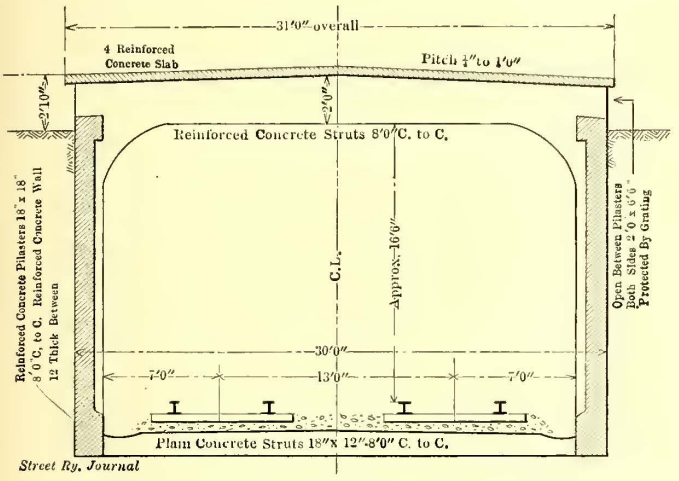


FIG. 2.—CROSS-SECTION OF SEMI-SUBWAY CONSTRUCTION

and the maximum grade is 3¼ per cent. Four tunnels will be required, all on tangent track, aggregating 4800 lineal feet. The semi-subway at Lynn is to be built wholly on private land and of reinforced concrete with a roof projecting less than 3 ft. above grade. Bridges over streets

TABLE III.—SERVICE IN BOSTON & MAINE R. R

Station.	Population.		No. of Trains Per Day.		Per Cent Increase.		Remarks.
	1893.	1906.	1893	1906	Population.	No. of Trains	
Beverly	11,322	16,000	43	61	41.2	41.9	
Danvers	7,890	10,000	29	25	26.8	13.8	Eastern Div. only.
Peabody	10,368	14,000	29	25	35.0	13.8	Eastern Div. only.
Salem	33,004	38,200	73	82	15.7	12.3	Eastern Div. only.
Swampscott	3,234	5,260	51	49	62.7	3.9	Main Line only.
East Lynn	....	....	34	34	....	0	Main Line only.
Lynn	59,703	81,000	78	90	35.7	15.4	Main Line only.
Market street	....	....	23	0	....	100.0	Main Line only.
West Lynn	....	....	43	30	....	30.3	Main Line only.
Revere	6,721	13,700	42	30	103.8	28.6	Main Line only.
Forbes	....	....	11	12	....	9.1	
Vila street	....	....	14	0	....	100.0	
Chelsea	29,924	38,700	63	49	29.3	22.2	
East Everett	....	....	19	19	....	0.	
Everett	15,571	30,250	42	35	94.3	16.7	
East Somerville	47,381	70,798	99	64	49.5	35.4	Main L. & Saugus Br.

NOTE.—Population figured at uniform rate of increase. Number of trains is sum of both directions, to and from Boston. Figures in black indicate decrease. Population as given for East Somerville is for all of Somerville.

and ways are to be principally reinforced concrete arches. The road is planned to be ballasted with crushed rock, and rails of not less than 90 lbs. are figured for the track. Block signals and automatic stops are also planned.

The estimated cost of construction was figured and submitted to the Board in minute detail. In toto it is as follows:

Real estate		$1,328,480
Grading, surfacing, tunneling, etc.	$1,393,740	
Side and retaining walls, waterproofing	655,150	
Ballasting with stone	191,000	
Eleven crossings over other railroads	251,900	
Crossings at streets and ways, 102 buildings, etc.	983,630	
Crossings over waterways	206,700	
Track and track equipment	315,970	
Signal system	100,000	
Stations, 19	130,000	
Seeding, sodding and fencing	32,750	
Generating station	800,000	
Power distributing system, high and low tension	328,140	
Three sub-stations	300,000	
Cars and car equipment	842,500	
Engineering	225,000	
Interest during construction	250,000	
Miscellaneous expenses, allowances for abnormal items	300,000	
Total construction		7,426,480
Total cost of road		$8,754,960

The power house is planned at Lynn on tide water, and the capacity calculated is 8000 kw, the units being four 2000-kw, 13,000-volt, three-phase turbo-alternators without set-up transformers. Three sub-stations are planned, one at Lynn separate from the power house, one near Peabody Junction and one in Chelsea or Revere. The estimated number of employees required is:

30 General officers and clerks.
72 Maintenance of way and bridges.
24 Superintendence of transportation.
79 Train service.
114 Passenger station service.
45 Power and sub-station men.
68 Car repair men.

432 Total employees.

The watt-hours per ton-mile at the cars vary from 70.4 in express service to 135.2 in local runs, averaging 97.2 at the car, not including heating. At the power station, including all the sources of energy consumption, the figure reaches 140 watt-hours per ton-mile, average.

The estimated operating expenses were made up in minute detail, the totals coming to:

General expenses	$84,000
Maintenance of way and structures	131,400
Maintenance of equipment	91,700
Conducting transportation	489,700
Total	$796,000

This figures 57 per cent of the gross earnings as estimated, no operating ratio having been assumed originally.

An exhaustive study was made by the company's engineers as to the probable earnings of the line and the influence of its service upon existing methods of transportation. It is estimated that in 1910 the tributary population will be 210,000, exclusive of Boston, taking half of Everett and Chelsea and not including Marblehead, Valiant, Lynnfield and Saugus. This is a density of 3110 per square mile. The length of the road is 20.5 miles, the population per mile being 10,800. It is expected that in large measure the road will create its own traffic, stimulate the traffic of parallel steam railroad lines and the short-haul traffic of street railways operating in the same general territory. Reduction of the single fare from that of the steam railroad, together with the rapid service and frequency of trains, induces travel. This is instanced by the increase in local traffic, gross and net income noted by the New York, New Haven & Hartford Railroad since a 2-cents-per-mile local rate was established. In Massachusetts from 1885 to 1895 the increase in traffic on the street railways was 450 per cent, a rate eight times the increase in population, which was but 55 per cent. During this period steam railroad traffic increased 50 per cent.

The present interurban travel in the territory was studied by means of a very large number of passenger counts, checked, as far as possible, by the returns of the several companies to the Board. For the Boston & Maine suburban system the earnings were found to be about 94 cents per train-mile, which was considered conservative in comparison with the average revenue of the whole system, which is $1.13. This territory is considered much above the average. On the Boston & Northern competing trolley lines the earnings per car-mile were obtained in this territory from counts as 24.6 cents, a conservative figure in com-

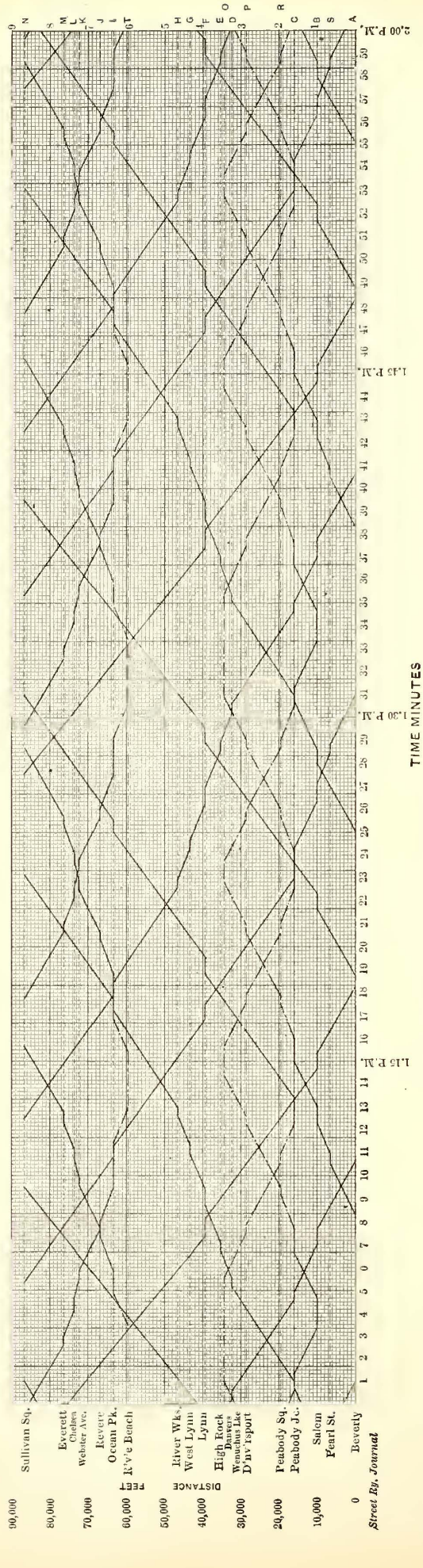


FIG. 3.—PROPOSED SCHEDULE OF THE BOSTON & EASTERN RAILROAD

parison with the rate on the whole system of 26.6 cents for the year 1905-6. Traffic results on the Boston, Revere Beach & Lynn Railroad were also studied.

The summary of earnings and prospective earnings estimated as competitive in this territory is:

Year 1906–7.

Boston & Maine Railroad	$585,000
Boston & Northern Street Railway	1,010,000
Boston, Revere Beach & Lynn Railroad, 10c. fare	306,000
Boston, Revere Beach & Lynn Railroad, 5c. fare	48,000
Total	$1,949,000

Year 1910–11.

Boston & Maine Railroad	$738,000
Boston & Northern Street Railway	1,303,000
Boston, Revere Beach & Lynn Railroad, 10c. fare	521,000
Boston, Revere Beach & Lynn Railroad, 5c. fare	71,500
Total	$2,633,500

According to the Boston & Eastern estimates, these lines will be overcrowded with business in this latter year. In two years the Boston & Worcester line in the same general neighborhood created a business of over $400,000. A high official of the Boston & Albany stated to Mr. Bickford that at the same time the train-mile earnings of this competing steam line between the points served by both roads increased several per cent. The density of tributary population to the Boston & Eastern, omitting Boston, is three or four times as great as that of the Boston & Worcester or the Lackawanna & Wyoming Valley line. The induced traffic is, therefore, estimated at the rate of 25 to 33 per cent of the competitive traffic of the present roads in 1910-11, giving a total competitive traffic on all four roads of not less than $800,000 plus $2,640,000, or $3,400,000. It is considered that the local trolley lines will feel the effect of competition in long-haul business parallel to the new line, whether doing a short or a long-haul business, and the purely local trolley lines should each do a larger business to the fifteen points of intersection with the new line, each of which is provided with a station. It is figured that what the trolley lines will lose in competitive business will be more than gained in the short-haul business, which is the most profitable. Mr. Bickford strongly urged that in no event would the financial stability of the existing trolley lines be affected through the advent of the proposed road. The Boston & Maine will feel the competition on its purely suburban lines, but its through passenger, through and local freight business will materially increase on account of the greater increase of population in the territory. It is expected that the Boston, Revere Beach & Lynn Railroad will not be vitally affected.

At the end of two years of operation the earnings of the proposed road, including summer traffic to Revere Beach, are estimated at between $1,350,000 and $1,450,000. This is between 15 and 16 per cent of the total cost of construction, or $6.50 per capita. The Boston, Revere Beach & Lynn earnings were about $9 per capita last year, total gross $729,000. These are increasing at the rate of 11.66 per cent yearly, and are likely to reach $13 per capita by 1910-11. The Boston & Eastern has an estimated tributary population nearly twenty-five times as great. At the present rate of increase the Boston, Revere Beach & Lynn should be $88,700 per mile in 1910-11, and the Boston & Eastern $70,000.

Expert testimony in favor of the construction of the road, its schedules, estimated earnings and expenses has been given by a number of consulting engineers at these hearings, including J. R. Worcester, of Boston; John Balch Blood, of

Boston; H. M. Brinckerhoff, of New York, associated with William Barclay Parsons, and others.

At a continued hearing on the proposition before the Massachusetts Railroad Commission on June 20 cross examination of John H. Bickford, chief engineer, was begun. Supplementing his previous statements, Mr. Bickford said that forty-one out of forty-five Salem merchants whom he had interviewed signed a petition in favor of the new road, and were agreed that the establishment of fast service between Salem and Boston would benefit rather than injure local trade. In Beverly twenty-two out of twenty-five merchants were of the same opinion. Twenty merchants in Danvers were practically all in favor of the line and held no doubts as to the effect on local trade. Trade has been better in both Danvers and Beverly since a 5-cent car service was inaugurated between them and Salem, which is the larger center of population. The increase in population due to trolley facilities is accounted responsible for these improved trade conditions.

In reply to questions by the City Solicitor of Lynn regarding proposed changes in sewers and street grades, Mr. Bickford pointed out that these would be taken care of as an engineering problem; that in one or two cases the grade of the street would be raised 2 ft. or 3 ft., and that under the semi-subway the inverted siphon method of construction would be practiced. The lower portion of the semi-subway would be waterproofed, as its grade is below tide-water, and a drainage scheme with sump pits and automatic electrically operated pumps would take care of surface water. A long list of questions was then asked by Bentley W. Warren, counsel for the Boston & Northern Street Railway Company, in regard to the details of the proposed plans and estimates. The main points brought out were, in brief, as follows:

An original estimate of the cost of the road drawn up in August, 1906, gave a total of about $7,970,000. A second estimate filed in May, 1907, gave a total of about $8,750,000. This increase is due largely to a change of location, and the provision of a service to Revere Beach, the latter not having been included in the first estimate. The beach service increased the investment in car equipment by ten cars, and 200 hp instead of 160-hp motors were figured in the second estimate. Fifty cars were also required against forty originally. The additional rolling stock cost is $137,000.

The real estate estimate was based partly on the results of consultations with real estate men and partly on the assessed valuation of property along the route. The actual figures ran well above the assessments. The reduction of the real estate investment from $2,300,000 in the first estimate to $1,328,480 in the second was due to a narrowing of the right of way 2½ ft. in Lynn, the avoidance of Powder Horn Hill in Chelsea and slight changes in Salem. Increase in cost of waterway crossings was due to the design of draws originally contemplated. Draws will be located at Beverly, Saugus and Mystic River, all being pile bridges with steel draws. All concrete and steel construction was found to be too expensive.

Thus far no traffic arrangements have been made with the Boston Elevated Railway Company for the handling of passengers at the Boston end of the line. The company hopes to secure 8-cent check privileges in zone 3, which includes Revere, Chelsea and Everett. The Boston Elevated Railway Company has not opposed the plans of the Boston & Eastern at any of the hearings. At this point Chairman Jackson, of the commission, remarked that the attitude of the Boston Elevated as a metropolitan receiving and distributing system would not settle the question of public exigency of such a road as the Boston & Eastern, though the board desires to be fair in its treatment of all parties concerned. The public need, or absence of need, of facilities of this type does not depend upon the terminal system, and it is reasonable to suppose that if a line of this character is demanded by public convenience and necessity—which is the point at issue—some working agreement can be arranged between it and the receiving company.

The present suggestions provide for a terminal station in Alford Street, Charlestown, parallel with the Sullivan Square terminal of the Boston Elevated Railway Company. Physical connections between the two stations are as yet unsettled, but they are doubtless possible if the conditions demand them. The approach to the station in Alford Street would be by about 1200 ft. of elevated structure. An incline of about 1 per cent would be required.

An extended discussion of the tributary population estimates was then held, with explanations of the limitations assumed in various cases. In general, easy walking distance was taken as the criterion, and passengers brought to the road by intersecting street railway lines were not included. Mr. Bickford again emphasized the fact that a high official of the Boston & Albany Railroad had shown him his train records and demonstrated that the Boston & Worcester line had helped business on this competing steam road because of the new class of service it had inaugurated. Mr. Bickford estimated that the Boston & Worcester has easily induced $700,000 worth of additional traffic on the Boston & Albany, the Boston Elevated and the Worcester Consolidated systems.

The operating ratio of 56 per cent was reached by estimating the amount of each expense and not by assuming this as a percentage of gross earnings common to well-operated interurban electric railways. The wages of employees in conducting transportation were taken at 30 cents per hour for motormen, $3 per day for spare men and 25 cents per hour for guards. Conductors would be required on trains, and there would be station agents.

Maintenance of way was figured in total as $3,370 per mile of single track per year, including bridges and buildings. The plans allow for the careful inspection of every foot of the line at least every two hours. The maintenance of equipment charge came to $1,842 per car per annum, or $5.05 per car per day. The maintenance of power station, sub-stations and overhead lines was figured at 0.16 cent per kw-hour output, or a total of $61,500 per year. The total number of employees would be 432, of which 114 ticket sellers and guards in station service would be required at an average rate of $2.50 per day each.

In regard to damages, injuries to persons and property were not figured in the operating expenses, as there is a surplus of $73,000 in excess of dividends which could easily care for this item. Taxes come to about $80,000. The company would have no excise tax except the slight tax on 1200 ft. of elevated structure in Charlestown. The cost of removing snow and ice was figured in connection with the work of five gangs, consisting of eight laborers and one foreman each, at $910 per mile per year. This would come, all told, to possibly $35,000 per year.

General expenses, $84,000, were figured as 6 per cent of the gross receipts, or 1.5 cents per car-mile. Maintenance of way and structures, or $131,400, came to 2.5 cents per car-mile. Maintenance of equipment was figured at $91,700, and the cost of conducting transportation was figured at $489,700, or 8.98 cents per car-mile.

The final hearing of the Boston & Eastern Electric Railroad project was held by the Massachusetts Railroad Commission at Boston on July 2. At the morning session W. H. Coolidge, counsel for the Boston & Maine Railroad, submitted exhaustive figures showing the number of trains per day between various large centers and their suburbs, including Saturday extras and Sundays. Between Boston and Lynn there are 339 daily trains both ways, 244 on Sundays and 33 more on Saturdays, counting the services of two railroads. Newark, N. J., several times the size of Lynn, is served by five railroads, and it has 406 trains per day, 255 on Sundays and 14 extra on Saturdays. Evanston, outside Chicago, served by two roads, has 117 trains daily, 67 Sundays and 9 Saturday extras; Yonkers, N. Y., 119 daily, 115 Sundays, 2 extras Saturdays; Port Chester, N. Y., 66 daily, 38 Sundays and 6 extras; Braintree, Mass., 141 daily, 59 Sundays, 2 extras, and Newton, Mass., 94 dailys, 35 Sundays and no extras.

He stated that in Nov., 1906, out of 5401 trains run between Lynn and Boston, 2329 were on time. The average lateness of the 1072 others was 5.7 minutes, and only 385 were over 4 minutes late. Mr Coolidge said that the main line of the Boston & Maine Railroad between Boston and Beverly, 18.53 miles, is built on an 82.5-ft. right of way most of the distance, leaving plenty of room for four-tracking, with the exception of 4 miles. Last year the passenger earnings between Boston and Beverly and intermediate stations were $618,327. The estimated cost of adding two more tracks to this line, including Danvers, eliminating the Salem tunnel and all the grade crossings and electrifying the two new tracks is figured at $7,284,000. The fare from Lynn to Boston is 20 cents, but on a twenty-five-ride ticket it is 12 cents. The fastest schedule time between the two cities is 17 minutes and the slowest 32 minutes. Mr. Coolidge closed his remarks in opposition with a general argument against the disturbance of existing real estate and other conditions between Boston and Beverly. He claimed, on the strength of a remark by Mr. Bickford, that the territory is served better than any other of the same character in the country. He argued that it would be unfair for the stockholders of his road to be obliged to pay some $150 per share for these sweeping improvements against $100 per share by the Boston & Eastern stockholders. If the board thinks further facilities are needed, the Boston & Maine stands ready to grant them.

Col. Melvin O. Adams, president of the Boston, Revere Beach & Lynn Railroad, was the next speaker in opposition. He gave a long history of the development of this line, which is a narrow gage road. As late as 1903 there were but forty-five daily trains out of Lynn on his line; now there are one hundred each way. An all-night service is given. Since 1897 the fares have increased from 2,360,000 to 11,000,000. The winter traffic runs now from 600,000 to 700,000 fares per month, and the summer traffic last August reached 1,645,000 fares. The company had nine locomotives and forty-four nondescript cars in 1890; it now has twenty-one locomotives and one hundred cars. The locomotives weigh 40 tons each, and the cars are light, carrying sixty-eight passengers, seated, each. About $2,000,000 is devoted to the enterprise, which includes a frequent ferry-boat service in connection with the trains. The company can deliver 6000 to 7000 passengers an hour at Crescent Beach and Bath House and still have a nine-car train at each end of the line as a reserve. H. M. Brinckerhoff, of New York, stated that electrification would increase the traffic capacity of the Boston, Revere Beach & Lynn from 30 to 50 per cent. Col. Adams criticised the proposed Revere Beach loop as an enterprise of temporary character.

Bentley W. Warren, Esq., counsel for the Boston & Northern Street Railway Company, began his argument in opposition to the Boston & Eastern road by referring to the influence of the Salem short line of trolley service upon the Loring Avenue electric lines which parallels it. During the first four months there was no loss of earnings on Loring Avenue, nor was there any increase, but in the first year of operation the earnings of the older line fell off 3.88 per cent, or $8,390. The Lynn division in general showed a gain of 4.43 per cent in gross receipts.

Mr. Warren summarized the car service between various points in the territory as follows: On the Salem division between Beverly and Danvers, 34 round trips daily, running time 30 minutes; Salem and Beverly, 89 round trips, 20 minutes; Salem and Danvers, 66 round trips, 26 minutes; Salem and Peabody, 48 round trips, 13 minutes; Salem and Boston, 33 round trips, 1 hour 15 minutes. On the Lynn division, between Salem and Lynn, 55 round trips, 43 minutes via Loring Avenue; Salem and Peabody, 46 round trips, 40 minutes; Lynn and Boston via Central Square, 68 round trips, 1 hour; Lynn and Boston via Market Street and to Scollay Square, 101 round trips, 45 minutes; Revere and Boston, 746 trips, 30 minutes; Chelsea division, Chelsea Square to Boston, 1294 trips, 18 minutes. From the station records at Town House Square, Salem, 103 trips between Boston and Salem showed a total delay of 235 minutes, and 55 trips 148 minutes delay. There was an average delay of 2.5 minutes. Last October President Sullivan, of the Boston & Northern, wrote to Vice-President C. S. Sergeant, of the Boston Elevated Railway Company, to ascertain if arrangements could not be made to run the Lynn and Salem cars into Boston via the East Boston tunnel. Mr. Sergeant replied that he saw no objection as soon as the completion of the Washington Street tunnel enlarges the terminal facilities at Court Street. Mr. Warren's final arguments were reserved until the afternoon session. The last speaker of the forenoon session was F. D. Allen, counsel for various citizens of Lynn. He voiced objections to the proposed route, but urged that better freight and passenger facilities are needed than now exist. He also criticised terminating the new line at Sullivan Square.

Bentley W. Warren continued for the Boston & Northern at the opening of the afternoon session. He emphasized the degree to which the territory is gridironed by existing tracks of the steam and electric lines now in operation, and urged that these companies be asked to extend their facilities by the board in case it deems the extended facilities necessary. The Boston & Maine could double-track the present line which it owns between East Boston and Lynn, if necessary, giving, in all, four tracks to Lynn, and at a cost of about $3,000,000 the Boston & Maine and Boston, Revere Beach & Lynn could build a joint tunnel under the harbor. The narrow gage line could be extended to Salem, Beverly and Danvers as easily as the Boston & Eastern, including the semi-subway. The prospective use of the East Boston tunnel and the possible results of a merger between the Boston & Maine and the New Haven roads should all be considered by the board. Mr. Warren argued that the Boston & Eastern should terminate not at Sullivan Square, which is on the edge of Somerville, but in the heart of Boston. All the time and fares given have been to Sullivan Square. The Boston, Revere Beach and Lynn requires no

more transfers and lands its passengers in Boston proper for 10 cents, against 15 cents on the new line. The Boston & Northern has asked for new locations in Salem to enable its service to be improved, but thus far the local authorities have held back. During the last seven years the road has expended $6,478,862 in new construction and $1,695,912 in reconstruction, making a total of $8,174,774. Within two years over $500,000 has been expended between Salem and Lynn on the new short line. Mr. Warren concluded with the plea that the Boston & Eastern figures gross earnings equal to the sum of the Boston & Maine and the Boston & Northern in the same territory, and that this, in his opinion, must cut heavily into the receipts of the latter roads. He urged that existing facilities be given the chance to expand rather than that a new company should be allowed to enter the field and injure the present organizations by its aggressive policies.

The last argument was presented by Moorfield Story, counsel for the petitioners. He quoted from recent reports of the Commission which emphasized the need of high-speed interurban construction. New England highways are crooked and hilly, and private rights of way are essential to fast time. There are now no large centers in Massachusetts not connected by steam and electric railways. The proposed line traverses the most thickly settled and rapidly growing territory in the State. Mr. Story claimed that the southern side of Boston is far better served by transportation facilities than the north side of the city. It will soon have elevated service to Forest Hills, and, on the west, the Cambridge subway will provide real rapid transit. The needed facilities cannot be supplied by surface tracks. The ordinary trolley lines are limited to house-to-house distribution. The growth of population along the Boston, Revere Beach & Lynn was emphasized, and the Boston & Maine's practice of sacrificing the local to the through train service scored. Mr. Story quoted the celebrated letter of President Tuttle, of the Boston & Maine, in which he deprecated the handling of suburban traffic even when electrified by steam railroads, and doubted its financial profit. He pointed out that no move had been made by the present steam lines north of Boston toward these great improvements which counsel suggested as so readily possible, and stated that the Boston & Maine has now reached the limit of double-track capacity. It has thrown a large share of suburban travel to the trolleys, and has largely reduced its train service in the face of a growing population.

Mr. Story urged that a surface railroad cannot furnish rapid transit without endangering the lives and property of all other users of the street. He claimed that the experience of other roads shows that the Boston & Northern traffic will in the long run be benefited by the establishment of the fast service. Real estate will be increased in value two or three times in Beverly and Salem if the road is built. He emphasized the absence of opposition from the Boston Elevated Railway Company and the citizens of Danvers, Peabody, Salem, Beverly and Revere; urged that the statistics presented with such care have not been attacked, and pointed out that 416 acres of new land within the corporate limits of Lynn and 1000 acres in Danvers will be opened up by the new line. The hearing concluded with a statement from Chairman Jackson that the various interurban matters before the board would now be taken up and decisions reached as early as practicable.

The following is a detailed statement of the estimated cost of the Boston & Eastern Railroad:

BOSTON & EASTERN ELECTRIC RAILROAD ESTIMATE OF COST IN DETAIL

GRADING, SURFACING, TUNNELING, ETC.

Cut east of High Rock	705,760 cubic yards at	$0 50	$352,880
Cut west of High Rock in Lynn	140,400 cubic yards at	1 20	168,480
Cut west of Lynn	294,900 cubic yards at	1 00	294,900
Borrow west of High Rock	54,000 cubic yards at	0 50	27,000
Rip-rap slope	40,180 square yards at	0 50	20,090
Tunnel rock	84,800 cubic yards at	4 00	339,200
Tunnel lining	30,000 square yards at	1 00	30,000
Open rock cut	157,910 cubic yards at	1 75	276,342
Tunnel portals	3,080 cubic yards at	7 00	21,560
Culverts			10,000
Earth tunnels in Revere	480 feet at	$2 00	96,000
			$1,636,452
Credit 242,710 cubic yards of rock at $1.00			242,710
			$1,393,742

East of High Rock there is a total excess of cut over fill of 60,000 cu. yds. West of High Rock there is a borrow pit of 54,000 cu. yds., which will probably be obtained in the neighborhood, or which may be hauled from the Peabody Hills. The cut through Lynn will be done by digging two trenches 3 ft. each at an estimated cost of $2.00 per cubic yard, laying the concrete side walls and then removing the core at $1.00 per cubic yard, the cost averaging $1.20 per cubic yard for the whole job. The slopes are figured to be 1.5 to 1, with a standard width of roadway nearly 30 ft. on a fill and 36 ft. in a cut. Rip-rap slopes come at points where the embankment is subject to the action of tide-water or streams, a large part being on the Saugus marshes. The price of rock work is the cost of excavating, trimming and a reasonable haulage. There is a salvage of $1.00 per cubic yard for the rock, utilizing it as ballast and concrete. The tunnel lining includes a ½-inch coat of pitch and concrete to keep it in place. The tunnel under Mack Park and possibly the tunnel in Peabody may not require this lining, but it is included in both cases.

The item "culverts" is assumed. A horseshoe culvert, 6 ft. wide and made of reinforced concrete, will cost from $8.00 to $9.00 per foot of length, or an average of about $500 apiece. This allows for twenty culverts, which is a larger number than are expected necessary. The earth tunnel in Revere comes just west of Boadway. An excavation charge of $25 per lineal ft. is already included under the heading, "cut west of Lynn," so that the total estimated cost of the tunnel is $225 per lineal foot.

SIDE AND RETAINING WALLS, WATERPROOFING.

The chief items included under this are:

Lynn semi-subway	$312,980
Chelsea under Parkway	51,200
Everett under Parkway	130,400
Miscellaneous side and retaining walls	93,570
Sumps and sewers	67,000
	$655,150

The first three items are exclusive of excavations and bridges at streets. The item "miscellaneous side and retaining walls' covers walls located at different points along the line, notably in Salem, Peabody, Revere, Chelsea and Everett. The item "sumps and sewers" will include three sumps, one each in Lynn, Revere and Everett, and will take care of the sewers in the streets where the tracks are depressed.

BALLASTING WITH STONE

The length of the double track is 17.0 miles, and of the single track 3.5 miles. From this must be subtracted the wooden trestles, the steel viaducts and steel bridges, making 14.87 miles of double-track road to be ballasted, and single track 3.21 miles; allow a mile of single track for sidings, etc.

14.87 miles double track times 5,800 cubic yards	86,200 cubic yards.
4.26 miles single track times 2,200 cubic yards	9,300 cubic yards.
	95,500 cubic yards.

Allow a price of $1.00 for the stone (credited to the rock work) and $1.00 for the crushing and laying:

95,500 cubic yards at $2.00 ..... $191,000

CROSSING OVER OTHER RAILROADS

This item includes 8 steel double-track bridges, 1 steel single-track bridge, 1 reinforced concrete double-track bridge, 1 reinforced concrete single-track bridge, and 13 reinforced concrete abutments. The sum of the spans is 2760 ft., and this divided into the total cost gives an average price of $91.50 per foot.

Examples:

1. Beverly crossing, 270-ft. span, 1 span through steel bridge, cost $27,250 exclusive of abutment.

2. Salem, Skenry Street crossing, 325-ft. span, double span through bridge cross bent over tracks, cost $30,550 exclusive of abutments.

CROSSINGS AT STREETS AND WAYS.

This item includes 102 bridges and several steel and concrete viaducts.

Examples:

1. North St., Salem	90-foot span, 1,290 cubic yards of concrete cost	$15,480
2. Market St., Lynn	65-foot span, 460 cubic yards of concrete cost	6,900
3. Boston St., Salem	200-foot span, 1,360 cubic yards of concrete cost	20,400
4. Mystic Ave., Lynn	55-foot span, 530 cubic yards of concrete cost	6,360

CROSSINGS OVER WATERWAYS

This includes 6 pile bridges, 1 reinforced concrete arch and 3 steel drawbridges. The pile bridges are listed at $20 per lineal foot for the ordinary double-track trestle, and at $30 per foot for the two-track or single-track trestle, when the elevation of the rail is more than 30 ft. above mean low water. The draws are listed at $25,000 each for Beverly and Saugus River, and $50,000 for Mystic River.

TRACK AND TRACK EQUIPMENT

There are altogether 17.25 miles of double track and 3.5 miles of single track, or a total of 38 miles of single track exclusive of sidings, etc. For sidings were allowed two of 1000 ft. each between Peabody Square and Danvers, and 13 sidings of 250 ft. each located at various points. Total, 5250 ft. Total, 39 miles of single track:

90-pound rail, 39 x 141.43 at	$33 00	$182,200
Joints every 45 feet, 9,150 at	1.25	11,420
Spikes, 39, at	1.50	5,850
Ties, 16 ins. 33 ft., 100,000 at	0 65	65,000
Special work		10,350
Labor, 39 x 5,280 at	0.20	41,150
		$315,970

This amounts to $8,100 per mile of single track, excluding ballast. Including ballast it amounts to $13,000 per mile of single track.

SIGNALING SYSTEM

A block signal system with interlocking switches and automatic stops is assumed. There must be a tower at Revere Street and Peabody Junction, and also interlocking switches at Beverly and Sullivan Square terminals. The item also covers a telephone system connecting the passenger stations, towers and general offices.

STATIONS

1 station (Sullivan Square)	$28,000
1 station (Salem)	15,000
1 station (Revere Beach)	12,000
1 station (Lynn)	10,000
1 station (Beverly)	8,000
2 stations at $5,000 each	10,000
11 stations at $4,000 each	44,000
1 station at $3,000	3,000
	$130,000

SEEDING, SODDING AND FENCING

The length of road to be fenced, subtracting the timber trestles, steel viaduct, bridges, tunnels, etc., amounts to 15 miles. This calls for 30 miles of fence, which at $1,000 a mile amounts to $30,000. With the elimination of the fill in Lynn, Chelsea, etc., the item of sodding will be much reduced. Allowance for seeding, etc., $2,750.

GENERATING STATION

A station of 8000 kw is required, costing $100 per kilowatt exclusive of interest on construction and engineering but including land. These items are as follows:

	Per Kw.	Total.
1. Land, wharf, etc	$4 00	$32,000
2. Building foundations, stock, intake, sewers, fixtures, etc	20 00	160,000
3. Steam equipment, boilers, stokers, coal handling, piping, engines, generators and auxiliaries	62 00	496,000
4. Electrical equipment (except generators)	4 00	32,000
5. Miscellaneous 10 per cent	10 00	80,000
	$100 00	$800,000

POWER DISTRIBUTING SYSTEM

Third rail installed	39 miles at	$4 700	$183,300
Bonding track	39 miles at	500	19,500
Transmission cable	7 miles at	7,920	55,340
Transmission line	16 miles at	4,000	64,000
Terminal houses	2 at	3,000	6,000
			$328,140

The item third rail includes also carbon rail installed with wooden protection; cable listed at $1.50 per lineal foot installed.

SUB-STATIONS

Peabody Junction, 3000 kw; Lynn, 3000 kw; Revere or Chelsea, 4000 kw. Total, 10,000 kw. At $30 per kilowatt for machinery and building this comes to $300,000. It is planned to locate the sub-stations in the passenger stations.

CARS AND CAR EQUIPMENTS.

Car bodies and trucks	$5,500
4—200 hp. motor equipments	10,725
Air brakes	500
Miscellaneous	125
	$16,850
50 cars at $16,850	842,500

CAR HOUSES AND REPAIR SHOPS.

Land	$15,000
Shops for 60 cars at $1 000	60,000
Equipment	20,000
Service cars	25,000
	$120,000

ENGINEERING

This is 3.5 per cent of the total construction cost.

INTEREST ON CAPITAL DURING CONSTRUCTION.

A period of about 2 or 3 years is assumed.

Real estate	$500,000
Grading and side walls	1,100,000
Ballast, $200,000 for 6 months	100,000
Bridges	800,000
Track, $300,000 for 6 months	75,000
Signals, $100,000 for 6 months	25,000
Generating station	600,000
Power distribution, $300,000 for 6 months	150,000
Sub-stations	200,000
Cars, etc., $850,000 for 4 months	283,000
Car houses, $120,000 for 4 months	40,000
Engineering	150,000
Miscellaneous	200,000
	$4,223,000
$4,200,000 at 6 per cent for 1 year	250,000

Miscellaneous expenses 10 per cent of all doubtful items.

ACCIDENT DAMAGES IN RIGHT-OF-WAY CASE

An interesting decision was handed down by the local courts at Coatesville, Pa., in a suit brought by Clarence B. Hope, of Valley Township, against the Philadelphia, Coatesville & Lancaster Electric Railway Company to recover damages for the killing of a cow. The defendant company denied liability on the ground that the cow was a trespasser, but it appears that the plaintiff had an agreement with the company in which the latter assumed liability for damages to personal or other property in connection with the right of way secured through Hope's land. The damages were assessed at $60 in the cow case, and Justice Paxson handed down a verdict for this amount. It is not yet known whether an appeal will be taken.

RICHMOND COMPANY'S TOURIST GUIDE

The Virginia Passenger & Power Company has published a fine folder on the many interesting places that the tourist can reach by way of its electric lines. The territory around Richmond is very attractive through its many natural beauties, but even more so on account of its historical associations. Here were fought many of the important battles of the Civil War, and there are also many interesting reminders of the ante-bellum days when Virginia was famed as the "Mother of Presidents." The folder contains a number of typical half-tone illustrations, descriptive data about Richmond and environs and seven maps, the largest of which is 23 ins. x 8¼ ins., and shows the country around Richmond and Petersburg, with all lines of communication and points of historical interest. The latter include colored lines indicating the old Federal and Confederate fortifications.

General William J. Palmer has given the Engineering School of Colorado College, Colorado Springs, the sum of $12,000, to be expended immediately upon additional equipment of the engineering laboratories for senior work.

EMBANKMENT SUBWAY FOR BOSTON

The signing of the embankment subway bill by Governor Guild, of Massachusetts, marks an important forward step in the rapid transit development of Greater Boston, and assures the establishment of a greatly needed high-speed service between the city proper and its western residential suburbs. For several years past the conditions of traffic in the Back Bay district leading to the Park Street loop of the Fremont Street subway have been unfavorable to fast service, and in morning and afternoon rush hours the congestion has probably been greater than on any similar stretch of double-track lines in the city. Business in Boston is moving westward along Boylston Street to a remarkable degree, and the population of the suburban districts of Allston, Brookline, Brighton, Chestnut Hill, the Newtons and adjoining cities and towns constantly tends to increase and pour an added burden of traffic into the Park Street terminus.

The building of a subway beneath Beacon Hill and under the embankment of the Charles River basin comes at a particularly opportune time, considering the plans for the beautifying of the river front by the Charles River Basin Commission. Connecting Park Street with the vicinity of the Charlesgate thoroughfares beyond Harvard Bridge, the embankment subway can certainly be built at a much lower cost per mile than the subways and tunnels previously constructed in Boston, and in such manner as not to interfere with the general scheme of improvement which the basin of the Charles River is undergoing. The elimination of delays caused by vehicular and pedestrian traffic will be a great boon to the Back Bay and western suburbs, and will shorten the running time of surface cars to the center of the city by from eight to ten minutes on a conservative estimate. What this means to the aggregate number of passengers traveling yearly over the routes to the west cannot be easily exaggerated.

OPENING OF THE SARATOGA-SCHENECTADY THROUGH ELECTRIC LINE

The Delaware & Hudson Company's electrified division between Ballston and Saratoga, N. Y., which will be used by the Schenectady Railway Company to make a through line from that city to Saratoga, was formally opened on Wednesday, July 3, by an inspection party arranged by General Manager E. F. Peck, of the Schenectady Railway Company. Special cars were run from Troy and Albany, as well as Schenectady, and a large party of railway officials, prominent local business men, etc., was entertained at luncheon at the Grand Union Hotel, Saratoga. After luncheon, through the courtesy of the management, the guests made a tour of Congress Park, which has recently been turned into an amusement resort, with carousels, theater and other summer park attractions.

Among the representatives of trolley and steam roads present were F. A. Harrington, president of the Schenectady Railway Company, and superintendent of the Mohawk Division of the New York Central; T. H. Barrett, president of the Eastern New York Railroad; E. S. Fassett, general manager of the United Traction Company and the Hudson Valley Company; William Darbee, general manager of the Albany & Hudson Railway; Axel Ekstrom, consulting electrical engineer of the Delaware & Hudson; T. McCoy, assistant superintendent of the Mohawk Division of the New York Central; Chas. H. Armatage, general traffic manager of the United Traction Company and Hudson Valley Company; W. B. Elmsdorf, general agent of the Albany Day Line, and General Manager Peck, Superintendent Ryon, Assistant Superintendent Hamilton, Chief Engineer Penoyer and Master Mechanic Doyle, of the Schenectady Railway Company.

The cars used on the through line between Schenectady and Saratoga will be the same type as those formerly running between Schenectady and Ballston. These cars weigh approximately 40 tons each and are equipped with four 125-hp General Electric motors, making 500 hp per car, and the motors are geared so as to be capable of developing a speed of 50 m. p. h. with normal voltage and level track. They are equipped with air brakes and Sprague-General Electric type M control.

It is intended to run limited cars every hour with a schedule speed of 55 minutes between Schenectady and Saratoga. The time table calls for a single car service under 20-minute headway and a regular running time of 1 hour 15 minutes for all cars except the limiteds.

The roadbed and track construction between Ballston and Saratoga are new and parallel the old D. & H. tracks. The overhead trolley system is used, supported by central poles between the two electric railway tracks. The poles are placed 100 ft. apart and are embedded in cement, which extends above the ground for a foot or more, preventing wet and dry rot at the surface of the earth. The copper trolley wire, which is No. 0000 gage, is held in position by the catenary suspension. A 3/8-in. double galvanized, seven-strand messenger cable is used with galvanized iron supporting hooks and clamps every 33 ft. The d. c. feeder is a bare copper 500,000-circ. mil stranded cable, and a return feeder of the same size is connected to the track at about every tenth pole.

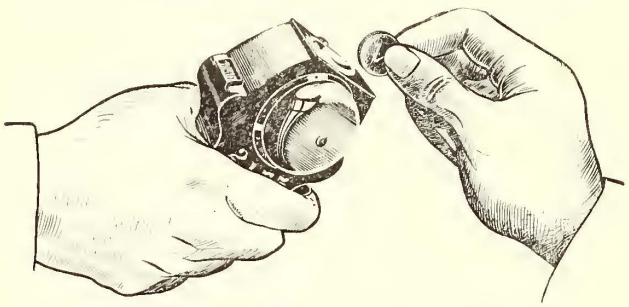
MICHIGAN ELECTRIC LINES SEEK STEAM FREIGHT CONNECTIONS

Western Michigan interurban electric roads have been fighting to secure an interchange of freight with steam roads. The Grand Rapids, Holland & Chicago Railway, which pro rates with the Graham & Morton Transportation Company, a boat line to Chicago, has appealed to the Interstate Commerce Commission for relief, all roads out of Chicago, save the Chicago & Great Western, having refused to pro rate with the trolley road and boat combination. Pending a decision of the commission, the interurban will accept freight for points out of Chicago at steam road rates. This means dead-heading business in many cases. There will be an arrangement with the boat line for a pro rata distribution of the differentials against Chicago in such cases.

Under the care of Superintendent John B. Crawford, of the Fort Wayne & Wabash Valley Traction Company, the Logansport-Lafayette extension of this system was opened on July 2. A three-hour service will be maintained on the extension until the roadbed is in shape to establish through service from Fort Wayne. At present every other car on the extension makes connections at Logansport with the cars for Fort Wayne. Mr. Crawford states that people along the route of the new road are already urging the company to establish an amusement park. Falling Springs, 1½ miles east of Delphi, is urged as a site.

THE ROOKE AUTOMATIC SYSTEM OF FARE COLLECTION AND REGISTRATION IN PROVIDENCE

On April 24 of this year the Rhode Island Company, of Providence, R. I., after a careful investigation of the basic merits of the Rooke automatic system of fare collection and registration, began the gradual use of this system, which, it is claimed, will go far toward fulfilling the ideal of every electrical railway manager, namely, the absolute



PRESENTING THE REGISTER FOR THE FARE

registration and turning in of every fare paid. The register used is the mechanical embodiment of a new collection idea, and the system operating around it has most interesting and seemingly practical features. It appears to be an ingenious blending of the good points of the American fare register and the Canadian cash box systems, for the counter and receiver are combined in one machine. As in the Canadian practice, the passenger inserts the fare himself, but with this vitally important difference—the fare is automatically registered and the coin released to the conductor's immediate possession. In accomplishing all this no perceptible time elapses and the company's record is secured without regard to the disposition of either the passenger or conductor. The general appearance and size of the register is apparent from the accompanying sketch, which also shows how it is handled in collecting fares. In size, the register may be easily covered by the conductor's open palm. It weighs scarcely over 1 lb., it offers no burden to the conductor and does not impede his progress through the car or his ability to use both hands in moving about on the running board. When not in use the register is suspended from a leather bracket or carried in the conductor's pocket. In making change it is dropped on the palm much the same as the ordinary punch. The slot into which the nickel is inserted is in the center of the metal top plate or trough, the coin finding its entrance into the register without foolish aiming or pushing on the part of the passenger. It is from the grip of the passenger to the mechanical grip, which seems to possess the human function of pulling the coin from the passenger's hand the instant it is but partially inserted in the slot. The register, therefore, may be presented for fare at any angle or in any position which a crowded car or a long reach would impose on the conductor. The tug on the coin is so positive that it excites wonderment, and the general knowledge of this mechanical feature, together with the positive knowledge that this small mechanism accomplishes also the registration of the fare, has done much to win the friendliness of the riding public to its use. Reasons of self-respect on the part of the conductor have frequently been urged against various schemes of portable registers which have all served as bulky containers for fares. These reasons do not apply as against the Rooke register.

The machine is provided with two totalizers plainly visible on the side of the register, and while but one of these is used in the Providence system, it may be stated that the other totalizer is used in connection with the insertion of coins or other metal tokens which may be required by other street railway companies. As soon as the nickel is inserted it is automatically registered, a bell rings, the entrance to the coin slot is automatically closed and the coin is deposited in the conductor's hand instantly. As stated, all this is seemingly accomplished merely by utilizing the unconscious physical act which the passenger has always resorted to in paying his fare. The lever shown at the bottom of the register is pulled by the conductor's index finger to open the entrance to the coin channel for the receipt of each fare. Once the coin is inserted in the register it rests in an open tube at the bottom, in which the conductor may accumulate several coins, if he desires, before removing same to his pocket. The money is in plain sight all the time.

Reduced to its simplest terms, this fare collection process is one that interposes a small, positive registering device between the hands of the passenger and the conductor. Its merits do not rest entirely on the fact that it seems to stop the leak which has always existed between the passenger and the treasury of the street railway company. It seems to solve also the vexatious question regarding the registering or non-registration of transfers. With the registration of the nickel always secured, and under a system which makes it impossible to win back money once registered by the manipulation of either the register or transfers which has had a par value with cash, the opportunity for fraud in the substitution of paper for cash in the conductor's accounting is obviated. This feature is very forcibly enlarged on by those familiar with this register system. The register is so compact that after a little practice the conductor can make change almost as easily as if he had nothing to carry. Less change making is necessary. Its use during the past two months has shown that many more nickels are tendered under this system. It is stated that on the second day of its use on the Auburn and Eden Park cars, out of a "standing freight" of eighty passengers one conductor secured seventy-five nickels, making change but five times in going through the car. If this system can in any way discourage the change - demanding habit on the part of the riding public, a great saving of time will be accomplished.

CONDUCTOR'S STRAP AND BRACKET FOR HOLDING REGISTER WHEN NOT IN USE

Of course, the Rhode Island Company realized that an innovation of this kind could not receive a fair trial unless thoroughly understood by both the public and conductors. The experiment was begun with a few cars on the Riverpoint line, which is one of the heaviest and most vexatious routes on the company's system. The cars had been furnished with explanatory posters like that shown in the accompanying illustration. The conductors to use the register

were instructed regarding its workings, and, among other instructions given, the following might be mentioned:

1.—Do not permit the examination or handling of register by passenger.

2.—When not in active use on the car, the register must be suspended from bracket and carried on conductor's person. It should never be left on car seat, vestibule window or in any other manner leave conductor's personal possession.

3.—Observe strictly and insist on passenger observing the rules posted in the car under the head of "Notice to Passengers."

4.—If the passenger is blind or physically incapacitated, conductor may collect and insert fare himself.

5.—Conductor should call out "Nickels, please," or "Get your nickels ready," before starting to collect.

6.—Conductors assigned to regular runs will retain the same register all day, excepting conductors who have late runs and have more than three hours layoff during the afternoon, in which case they will turn their registers in at the completion of their noon period. Conductors who are assigned to trippers, or single trips on regular cars, will also turn in their registers when completing such trips.

7.—Transfers and tickets will not be registered when collected, but must be entered in the day cards and turned in as heretofore. Records for each half-trip will be kept on the day cards as at present and five cents turned in for each fare registered.

8.—The number of each automatic collector will be charged against collector and unnecessary injury to same through improper handling will also be charged. If lost, the sum of..... will be charged against conductor.

9.—Use the word "Insert" as "Insert your fares, please," when addressing passenger. Never use the word "Drop."

10.—Hold the automatic collector in an inclined position when presenting same for receipt of fare and in the position best suited to passenger's convenience.

NOTICE TO PASSENGERS

INSERT NICKELS ONLY
into the Automatic Collector--
ONE NICKEL FOR EACH FARE TO BE PAID.
Conductor returns FULL CHANCE when passenger lacks the NICKEL.
CONDUCTOR IS NOT PERMITTED TO RECEIVE FARE IN HIS HAND OR INSERT FARE FOR PASSENGER.
Try to have the **EXACT FARE--A NICKEL.**
THE RHODE ISLAND COMPANY.

POSTER PLACED IN CARS USING HAND REGISTERS

11.—Never pull the lever opening entrance to coin channel until just before fare is to be inserted. This gives conductor full control of coin slot, preventing insertion of wrong coins and also permits conductor to see the coin to be inserted.

12.—Conductors should never permit more than five nickels to accumulate in register tube before removing same to his pocket.

13.—In returning full change for money of larger denomination than a nickel, conductor should always return a sufficient number of nickels to cover all fares passenger may wish to pay.

14.—Should the automatic collector meet with accident or fail to operate, conductor will immediately notify his carhouse foreman and proceed to collect fares as instructed under rule.

15.—Should passenger refuse to insert fare, conductor will refer to printed rules posted in car and insist on compliance with same. If proper payment is still resisted, conductor will refuse to accept fare in any other way than through the automatic collector, and will take passenger's name and address (if possible) and report the occurrence to the superintendent of transportation. Conductor may ask any other party to insert fare for this objecting passenger.

16.—If passenger wishes to pay more than one fare, he must pay each fare in the same manner as he would his own. If passenger refuses, conductor will proceed to collect single fares from each of the parties.

From the start the automatic collector attracted a great deal of attention and comment, much of this comment being, of course, based on but slender information, either regarding the register itself or the benefits it was supposed to accomplish from the standpoint of both the passenger, the conductor or the company. It soon became apparent that no trouble was to be had with the public, as complaining passengers were few in number. While few passengers were inclined to be captious, some good-natured bantering with the conductor was engaged in and much questioning added to the conductor's troubles during the first few days. It has been demonstrated, however, that the riding public is not unfriendly to the new system or unwilling to co-operate with the conductor. The conductors themselves, as they have become better acquainted with the system and have grown accustomed to the handling of the register, seem to realize and speak of its advantages and its protection. They find that under this new system they are free from the suspicion of being dishonest, the opportunity for dishonesty being eliminated. Regardless of the question of personal integrity, they also realize that under this system an honest error does not count against them or bring them unjust suspicion.

The success of the pioneer cars led to the equipment of others, and to-day there are some fifty registers in service on the Riverpoint lines, including the Pawtuxet Valley and Rocky Point systems; thirty on the Apponaug and East Greenwich lines, which carry heavy local traffic and also the crowds to Narragansett Pier, and a large number also on the Auburn & Eden Park line, which is also a heavy riding city line. In general, these lines carry much traffic, due to morning and evening rush hours, caused by the transportation of mill hands and considerable pleasure riding. A further complication is introduced by zone fares on these lines, yet no trouble has been experienced. All collections are being made and no fares lost owing to the question of speed as between this system and the old one. The newness of it all brings some delays incident to the handling of those passengers unfamiliar to the system. It is an old story, however, on some of the lines and excites no comment. The developments of the last week have been very satisfactory. Aside from the dropping and slight injury to one register by a conductor who had never handled the register until that day, the registers gave unfailing good service all day long on the Fourth of July, and the riding was very heavy. Loads of 130 up to 140 or more on thirteen-bench open cars were a regular thing, and no fares were lost owing to the system of collection employed.

The conductors appreciate the fact of having the same registers intrusted to them for the entire day and that under this system there are no errors or disputes caused by the signing off between conductors. They find the registration of the register accurate, and seem satisfied with the fact that there is now less likelihood of finding themselves either over or lacking in funds at the conclusion of the day's work. The company also realizes that now conductors who lose their money through incorrect change-making or any other way are unable to charge their own carelessness to the company, thus shifting the loss occasioned by their own errors to their employer. Under this system the conductors are charged with no mental accounting during the day and the opportunity to forget to "ring up" or the chance of having some passenger ring up for them through error does not involve them in suspicions or mistakes. Aside from the few conductors who might be disposed to oppose this system, no troubles have been

noted. One conductor guilty of blocking the register with a bent nickel was discharged, and the wise use of a little discipline is having the desired effect. The register is proof against manipulation by the conductor and gives no encouragement to one who would attempt the use of a "dummy." Unlike other fare registers where the ringing of a bell or the mere display of a register of some sort has been the only protection, this register depends for its effectiveness upon the co-operation of the passengers. The latter are keenly alive to the mechanical functions which attach themselves to the register mechanism and which they experience in paying their fare.

It would seem that this system would also tend to simplify the work of the accounting department of the street railway company, as under the old system the record of the registers have to be traced through the hands of the different conductors who use the register during the day.

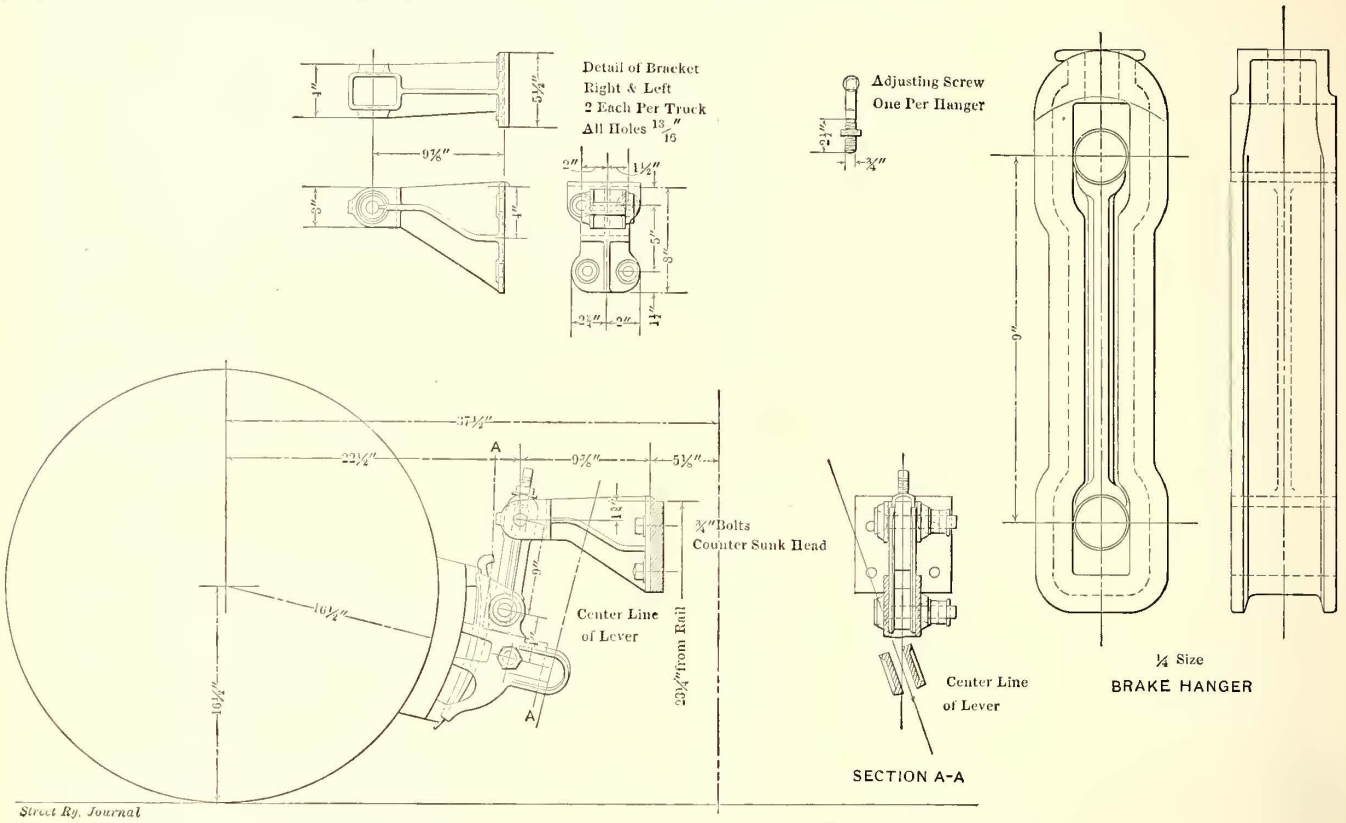
The registers now in use by the Rhode Island Company were furnished by the Rooke Automatic Register Company, of Providence, R. I. This company has been working on this device for several years and now has a complete manufacturing equipment at Providence with many machines under way.

This register is not confined to the registration of nickels only. As in Cleveland and other cities, where metal tickets and tokens have taken the place of paper tickets, it is intended that such metal tickets may be inserted into the register so long as they represent value. This saves printing bills. Where tickets are sold at a discount they can be registered separate from the nickels, though paid into the same slot. The company is equipped to furnish registers for coins of other denominations (all to be inserted through the same slot), the interior mechanism in the register recognizing the coins and properly recording their different values on the totalizers. This combination register is identical in size, shape and action as the register above shown and used exclusively for the insertion of nickels.

Up to date the Providence experiment has run very smoothly. General Manager A. E. Potter, of the Rhode Island Company, states that the system is accomplishing all that has been claimed for it.

AN ADJUSTABLE BRAKE HANGER

Chattering of the brakes just before the car settles to a dead stop is certainly annoying to passengers, and the severe shaking of all parts of the car no doubt increases the maintenance cost considerably. A remedy for chattering brakes is to have the brake hangers supported by a rigid part of the truck and then to eliminate loose pins in the brake hangers and rigging.



ADJUSTABLE BRAKE HANGER USED ON MILWAUKEE SEMI-STEEL CAR

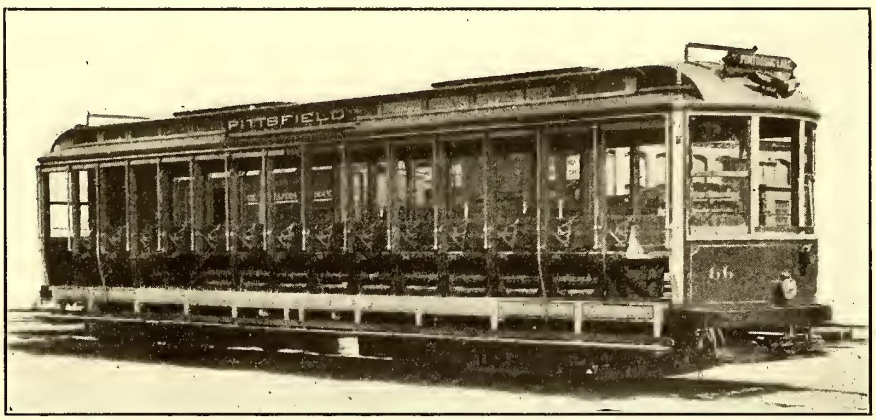
The St. Louis Car Company's open link hanger is designed with special provision for taking up wear. The hanger has been used on trucks manufactured by the company for some time, but the fact that it is employed on the trucks of the new semi-steel cars of the Milwaukee Electric Railway & Light Company makes a brief description of it opportune at this time. The link is open between the two pins and a space piece is inserted in the narrow slot. Split cone bearings are inserted between the ends of the links and ends of the space piece, and, as the parts wear, these bearings are spread and the slack taken up by tightening up the cone head bolts passing through the bearings. An adjusting screw at the top of the link which screws down against the top bearing provides for excessive wear of the parts. As there is no wear on the space pieces, the position of the brake-shoe relative to the axle is not changed by the adjustment of the other parts.

The annual picnic of the Cleveland Electric Railway Benefit Association at Shattuck's Park, on June 27, was attended by about 600 persons. Peter Campbell received the prize for having been longest in the employ of the local company, thirty-nine years.

CARS FOR PITTSFIELD STREET RAILWAY

The Pittsfield Electric Street Railway Company has recently placed in commission a number of attractive-looking vestibuled open cars built by the Wason Manufacturing Company, of Springfield, Mass., one of which is illustrated. There are a number of features of more than passing interest on these cars. The system of draining the roof is unusual—a gutter runs along the water table and from it two feeders follow the grab handles at opposite ends of the car. Another innovation is the iron bar extending across the center vestibule window to protect the woodwork when the motorman uses his switch iron. On the roof at either end is a device for protecting the sign should the trolley pole strike the roof by accident.

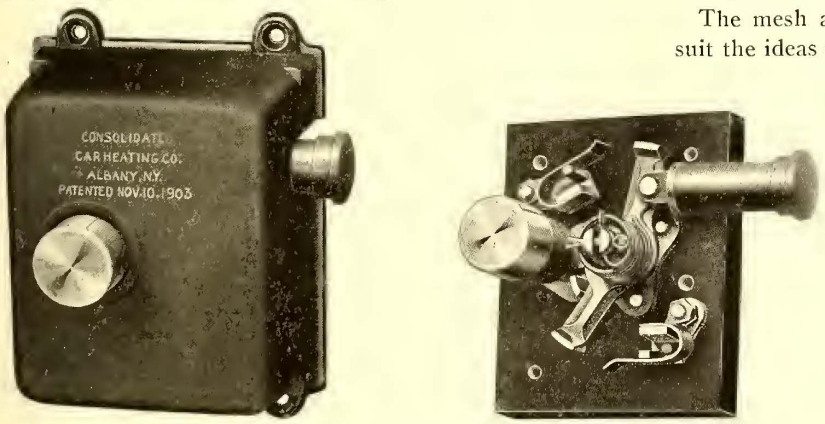
The seats are reversible, and the interiors are finished in mahogany. The truck used is the Wason No. 21 with 4-ft. wheel-base. A car with trucks minus the electrical equipment weighs 26,000 lbs. The chief dimensions follow: Length over the end pieces, 42 ft. 6 ins.; width over sills, including the sheathing, 7 ft. 4 ins.; over the posts at the seat line, 7 ft. 9⅜ ins.; height from the floor to the ceiling, 7 ft. 8 ins.; from the track to the under side of the sills, 2 ft. 5¼ ins.; size of the side sills, 5½ ins. x 8½ ins.; center sill, 11½ ins. x 3 ins.; end sills, 3¼ ins. x 5⅝ ins.



OPEN CAR FOR PITTSFIELD STREET RAILWAY COMPANY

A NEW TYPE OF CAB HEATER SWITCH

The Consolidated Car Heating Company has recently designed the single-pole, double-break snap switch, for controlling the heat in motormen's cabs shown in the accompanying cuts. When heat is required, the switch is closed by pushing in the lever at the side, and the blade is automatically locked in closed position. When heat is not required, the horizontal lever is pushed in, either by hand or by the cab door, disengaging the lock and opening the circuit. This lever is placed in the line of movement of the cab door and the closing of this door over the controller automatically cuts the heat from the cab should the motorman neglect to operate the switch.

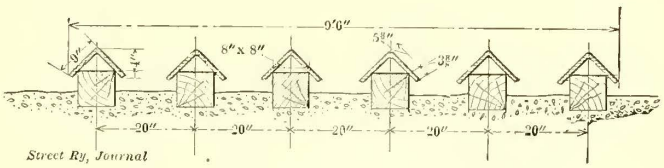


OUTSIDE AND INSIDE VIEWS OF HEATER SWITCH

Records kept by the City Register during 1906 show the United Railways Company, of St. Louis, to have made 6,493,056 trips, carrying 233,099,274 passengers.

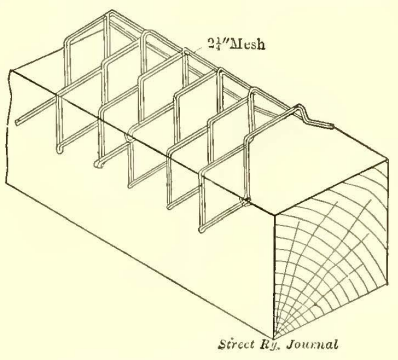
AN EXPANDED METAL STOCK GUARD

A new type of stock guard has recently been invented by F. W. Stewart, of the Climax Stock Guard Company, which differs radically from any previously put on the market. The material used is expanded metal, which is made in sections 2 ft. x 18 ins., and are then bent at right angles so that each side is 9 ins. wide. This metal is then attached to the ties as shown in the illustration, leaving a space about 6 ins. between the edge of the guard and the ballast. This gives a semi-pit effect, which, in connection with the triangle over the ties, would make a decided hindrance to cattle. At the same time there would be nothing to hold them.



SECTION SHOWING EXPANDED METAL ON TIES

The mesh and spacing of the ties could be arranged to suit the ideas of the different officials. Any number of ties required may be covered, and track work and tie inspecting may be done without removing the guard. Each section is held in place with from eight to fifteen staples. If they are crushed by anything heavy dragging from a train they can be readily shaped up and put into service for very little expense or trouble. If given a good coat of asphaltum paint or galvanized, they should last a considerable time. In a number of tests made with this guard it proved most effective, and as they are very light and shipped in bundles, the freight rate to the farthest points is reduced to a minimum.

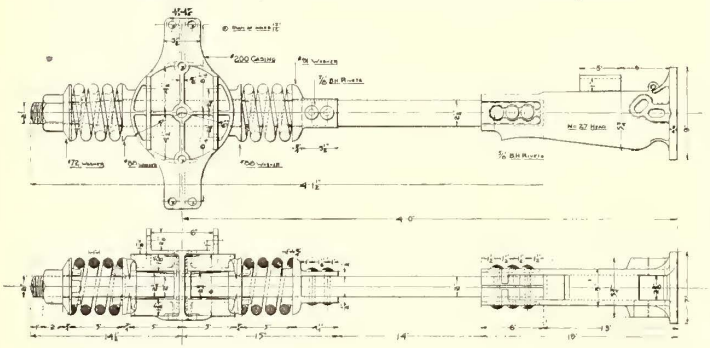


SECTION OF CATTLE-GUARD

NEW TYPES OF VAN DORN DRAW BARS

Within the last few months the W. T. Van Dorn Company, of Chicago, has designed and constructed three new types of drawbars which cover practically all the requirements of electric lines, from heavy elevated or subway traffic to interurban and ordinary city service. Strictly speaking, there is nothing experimental about these types, their construction being due to actual demand for the application of the Van Dorn type to certain given conditions.

The heaviest of the three was especially constructed for the steel cars recently built for the Hudson Companies, of



THE NO. 27 DRAW-BAR

New York, described in the Street Railway Journal of June 8, 1907. This is known as the No. 20½, the heaviest ever constructed by the company, the head alone weighing 140 lbs. The face of the head was 16 ins. wide and 9 ins. deep, and was beveled at the top and bottom 3/16 in. in 1½ ins. to allow sufficient vertical motion for the operation of the drawbars on the 1000-ft. vertical curve of the Hudson Companies' grade. This style of head uses a round pin 1⅝ ins. in diameter and a heavy forged link. The head itself was bolted to an 80-lb. A. S. C. E. standard T-rail, approximately 5 ft. long, bent to a specified shape, at the opposite end of which were bolted two heavy tail-straps of 2½-in. x 1¼-in. stock, rounded to 1¾ ins. Both head and tail-straps were secured to the rail with ¾-in. turned bolts. The friction and bolster washers on this type were unusually heavy, and the springs used on the drawbars were the heaviest type in use on any electric line, being made of 1 7/16-in. steel.

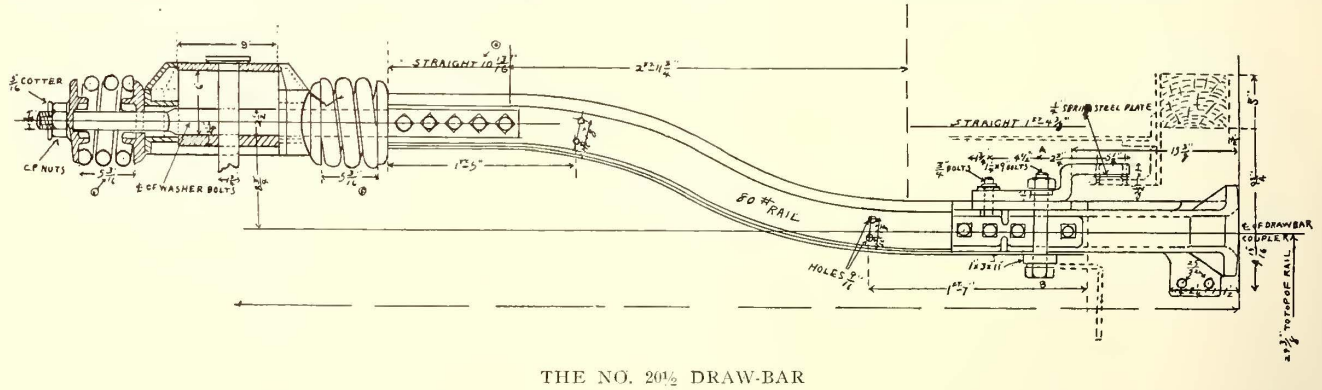
The usual type of this company's drawbar head is supported by a sectal bar, but in this case the sectal bar was discarded and the head was supported by a heavy forged clip, 11 ins. wide, of 1-in. stock, bolted to heavy lugs east on the drawbar head, and rested on a carrying bar above the head of the drawbar. To prevent excessive wear on this clip there was placed beneath it a ¼-in. steel chafing-plate secured to it by rivets.

The next type, intended for interurban service, known as the No. 21, is in use on the Winona Interurban Railway, the New York & Queens County Railroad, and several other lines whose service is of a similar character. The drawbar is composed of the standard No. 21 head riveted to a 60-lb. T-rail, at the opposite end of which are riveted two forged tail-straps of 1-in. x 2-in. stock, welded together at the outer end and terminating in a single stem of 2 ins. diameter. This forked tail-strap, together with a new type of the Van Dorn casing, forms one of the special features of the drawbar, the tail-straps hitherto used having been kept separate and terminating in separate stems. The No. 200 casing used with this type is of smaller diameter than the casings of former design, and is considerably lighter in weight, but still allows the 120-deg. radial motion which is required of the drawbars on short radius curves. The main purpose in the design of this new type has been the utmost economy in weight without the slightest sacrifice of strength, and the purpose has been fairly well accomplished, as at a 4-ft. length the complete drawbar weighs but 250

THE NO. 21 DRAW-BAR

lbs., a weight which will cause no appreciable strain on interurban cars of the lightest construction.

The demand which led to the design of the third type was for a light drawbar applicable to the customary city car or light trailer, which would readily intercouple with the drawbars of the Nos. 21 and 11 type now in use on heavy interurban cars, as well as with the Nos. 5 and 5½ heads largely used in city service. To meet this demand the No. 27 head was designed. This is a medium between the Nos. 11 and 21 heads and the Nos. 5 and 5½ heads, is extremely light, weighing but 40 lbs., and the pins and links



THE NO. 20½ DRAW-BAR

used are interchangeable with those of the Nos. 11 and 21 heads. Almost any style of draft appliance may be used with this head, from the simple bar and pin to the light type casing mentioned in connection with the No. 21 drawbar. Used with this casing, it forms a very complete and simple appliance, weighing but 200 lbs. at a 4-ft. length. The head is intended to be applied directly to a flat bar of 1½-in. x 3-in. stock, but may be altered to accommodate a bar of heavier stock. This type, as well as the other two, is equipped with a tubular air-hose carrier such as shown in the reproduction of the No. 21 drawbar.

Several other designs have recently occupied the attention of this company, among them being a modified type of the No. 100 casing and an emergency knuckle of the full-sized M. C. B. type, intended to fit into the head of the com-

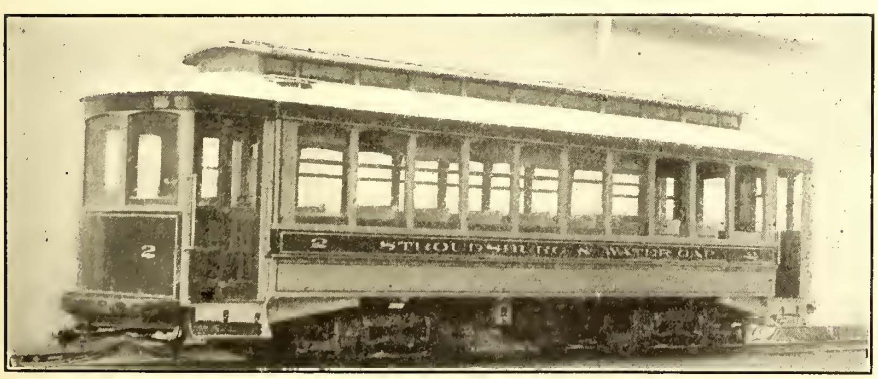
pany's coupler, enabling it to couple with any standard M. C. B. coupler. The company will shortly be in position to furnish knuckles of this description where conditions demand their occasional use.

EQUIPMENT FOR NEW LINE BETWEEN STROUDSBURG AND THE DELAWARE WATER GAP

The picturesque Delaware Water Gap region has been invaded by the trolley, the "Mountain View line," which is the more familiar title of the Stroudsburg & Water Gap Street Railway, being opened to the public on July 4 last. The road is only 4 miles long, running to Stroudsburg, the county seat, and the scenery met with along the way will attract thousands of people who wish to enjoy one of the prettiest rides in the country. From the crest of the mountain the railway overlooks the Delaware Water Gap to the south and the Pocono Mountains to the north. At this point will be located a park which will attract patronage from both the Gap and Stroudsburg. Temporarily the railway is operating only to South Stroudsburg, but a bridge, 600 ft. long, is under construction to bring the road into the business center of the town. The Mountain View line will add much to transportation facilities from the Gap, as heretofore there was no outlet except by steam trains. The road is constructed entirely on private right of way except at the terminals when public streets are occupied. The track is 90-lb. T-rail with stone ballast.

The rolling stock elected consists of Brill grooveless post, semi-convertible cars, which are particularly well adapted to scenic roads due to the extra big windows which in no wise obstruct the view and the protection that the cars afford from all kinds of weather.

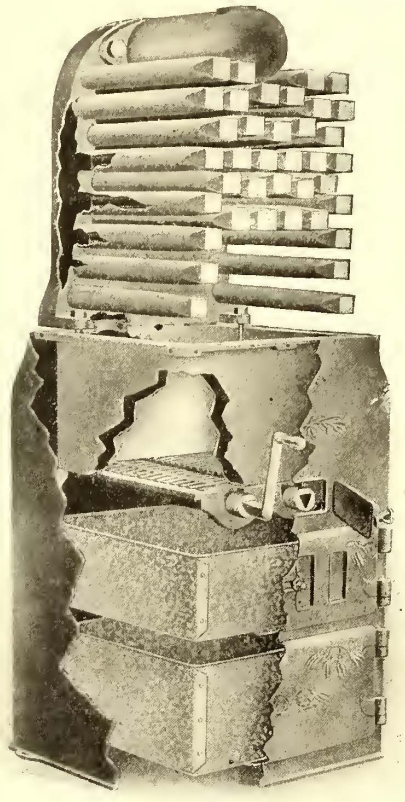
The cars are 28 ft. long over the end panels, 37 ft. 5 ins. over crown pieces and vestibules, 7 ft. 10½ ins. wide over the sills, including plates. The side sills are 4 ins. x 7¾ ins., and the end sills 5¼ ins. x 6⅞ ins. The car interiors are finished in cherry, and the ceilings are of birch veneer. Some of the grades encountered in this mountainous district are exceedingly heavy, for which reason two sets of brake rigging were furnished to work independently; hand power is used to operate the shoes on the outside of the wheels and air for the inside brakes. The car bodies are mounted on the No. 27-G1 truck with 4-ft. 6-in. wheelbase. Two 40-hp motors are used. The weight of cars and trucks, including the complete electrical equipment, is 37,200 lbs.



SEMI-CONVERTIBLE CAR FOR DELAWARE WATER GAP SERVICE

A COMPACT HOT WATER CAR HEATER

Two of the stock arguments against the use of car heaters have been based on the amount of space they take up and their undesirable prominence in the car. These objections are claimed to be largely overcome in a heater built by the Cooper Heater Company, of Dayton, Ohio, and thoroughly tried last winter by the City Railway Company, of that city. Beside the advantageous points mentioned, the new heater embodies other valuable features, as will appear from the following description:



PART INSIDE VIEW OF CAR HEATER

This heater consists of a water-lined fire pot connected to a water wall or tube sheet from which the tube projects horizontally. A dome is connected to the top of the water wall at right angles. The heater is also provided with an ash pan and coal bunker, all encased in a double-steel, asbestos-lined jacket with an air gap between.

This heater is asserted to be the only one that circulates freely and more rapidly under heavy pressure, although it has never been necessary to have over 10 to 20 lbs. It does not require dumping to clean the grate, nor is it necessary to build a fresh fire every twenty-four hours, as the fire can be kept going with little fuel and attention. As to coal consumption, it is stated that on a 45-ft. car operated in zero weather, a filled fire pot and bunker holding less than one-half bushel of hard coal will last for twenty-four hours. If the car is not in use over night or is otherwise out of service, with all dampers closed, the temperature will not drop more than 2 to 4 degs. without adding coal. If desired, liquid fuel can be used in this heater.

Since Nov., 1906, until warm weather set in this year, the City Railway Company, of Dayton, Ohio, had two of these equipments in constant use, and has furnished the following data:

The No. 1 heater which occupies but 12¾ ins. of floor space, was installed in a 20-ft. 7-in. x 8-ft., 2-in. x 8-ft. 6-in. car, inside dimensions; this heater was placed in the front vestibule, with radiation pipes running longitudinally, said pipes being located beneath and at the side of the seats.

The No. 2 heater was installed in a cross-seat convertible car, 32-ft. x 8-ft. 2-in. x 8-ft. 9-in., with radiation running longitudinally with the side of the car, beneath and at the side of the seats, the heater also being in the front vestibule. During entire service from the date of installation to the time of discontinuing this spring, the heater gave no trouble nor showed any mechanical defects. In the use of coal and its economy, as shown by tests made at intervals during the winter, it was found that with an average temperature from 10 deg. below freezing to 10 deg. above zero, the heater would not consume more than 10 cents to 12½ cents coal during twenty-four hours, coal being valued at $6 per ton. The inside temperature of the car was maintained at an average of 60 degs. At average of winter temperature, the cost per day for fuel should not exceed 10 cents per 24 hours.

Owing to the little space taken by this heater it seems well adapted for installation in the vestibule of the average city car. It is, of course, equally valuable for interurban cars. Another good feature claimed for this heater is, that it can be placed within 3-ins. of the panel work of the car without injuring it by over-heating.

OIL TESTS IN POWER PLANT SERVICE

The purchase of oil suited to the operating conditions is an important feature of power plant work. Perhaps there is no subject in which steam station engineers are more interested, for the proper lubrication of the machinery is fundamental in the requirements of continuous service. Close competition between oil salesmen is often the case in street railway installations, for the oil consumption of a large company represents a good many hundreds of dollars a year. It is, of course, a task for the chemist to analyze the various oils brought into power plant service with a view toward determining the specifications best adapted to the situation in each station and insuring the fulfillment of these specifications. At the same time, there are a few simple tests which can be made without an extensive laboratory to determine a good cylinder, engine or dynamo oil. Some of these are mentioned at length in the 1907 Question Box of the National Electric Light Association.

For either engine or cylinder service a good oil should have body enough or sufficient viscosity to prevent the surfaces to which it is applied from coming into actual contact. Perhaps this is the most important qualification of good oil, and with a careful viscosity test a good oil will not be rejected or a poor oil accepted. Viscosity is closely related to the density of an oil. The simplest means of determining the viscosity of an oil is to test the time of flow of a certain volume of oil through a small orifice as compared with the time of flow of the same volume of good oil or water. The oils and water compared must be tested at the same temperatures, and preferably at the temperature to which the oil is to be subjected. A copper or glass vessel with an orifice of about one-sixteenth of an inch in the bottom is satisfactory, except where very large quantities of oil are used. In the latter event the purchase of a viscosimeter will doubtless pay the company. Accurate tests of the viscosities of oil as compared with water have given the following results: Prime lard oil, 3.6; sperm oil, 2.2; castor oil, 2.6; rape-seed, 4.2, the temperature in these tests being 68 degs. F.

Freedom from corrosive acids, the maximum fluidity possible with the required viscosity, a minimum coefficient of friction, high flash and burning points and freedom from elements liable to produce oxidation or gumming, are all desirable features of oil for power plant service. To identify an animal oil or a vegetable oil, chlorine gas may be applied. The former is turned brown and the latter white by its action, and if there is no opportunity for further chemical tests this method of attack will often serve the purpose in a rough way, though it throws no more light upon the composition of the oil than a calorimeter test of coal exhibits the constituents of a fuel sample.

The flash and burning tests may be readily made by placing a sample of the oil in a small receptacle having a tight cover through which a thermometer can be inserted. A small hole is essential in the cover to allow the vapors to escape as the oil is heated. The vessel should be gently and slowly heated through a layer of sand, and when the oil is hot a lighted match or an incandescent wire may be passed over the hole to observe the temperature at which the oil flashes. The burning point is obtained by continuing the heating and noting the last temperature observed at the time the oil takes fire. The gumming and oxidation characteristics may be obtained by noting the time required for a small amount of oil to flow down a smooth inclined plane with the time taken by a like amount of good oil to flow over the same course.

The simplest method of finding the density without the use of instruments is to find the loss of weight of some body in oil and in pure water. The ratio of the loss gives the density as compared with water. Animal oil densities may run from 0.62 to 0.9; sperm oil at 39 degs. F. has been found to have a density of 0.88; rapeseed, 0.91, and cotton-seed, 0.92.

Moisture in transformer oil may be detected in several simple ways. By reason of its specific weight moisture in transformer oil will generally be found at the bottom of the case. As most cases for oil shipment, including transformers, are provided with plugs, it is an easy matter to secure a sample from the bottom in a test tube. By providing the latter with a tight cork and bent glass tubes about ⅛ in. in diameter and heating the test tubes, the moisture in the oil will condense in the upper part of the small tube and will be prevented by the bend from falling back into the oil. A second method is the application of a red-hot wire to the oil, a crackling sound following the presence of moisture and simply a puff of smoke if the oil is dry. A simple chemical test consists of driving off the water in a few crystals of copper sulphate by roasting. This leaves a white powder, and when oil is added to this the original blue color returns if the oil contains moisture. Of course, these tests are approximations, but they are useful in plants where the services of a skilled chemist are not available, which is the case on many electric railways. Needless to say, records of oil consumption and overheated bearings should invariably be made in power plants.

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET, July 10, 1907.

Despite the heavy loss in cash sustained by the local banks as revealed by last Saturday's bank statement, and the resumption of the outward movement of gold to Europe, the local money market ruled comparatively easy during the past week. Under ordinary conditions these heavy drafts upon the banks would have been sufficient to bring about a sharp advance in money, but so far they have not had the slightest influence upon rates for either call or time loans. At the opening, call money commanded 10 per cent, but as soon as the moneys destined for interest and dividends on July 1 were redeposited in the banks there was a gradual decline to 3½ per cent. The amount of money obtained at the low rate, however, was very small, and the bulk of the week's business was transacted at above 4½ per cent. Borrowers were disposed to draw their supplies from the open market, although at the close an increased demand for time money was reported. The banks and other lenders, however, were not inclined to offer money for fixed periods with any degree of freedom in view of the low reserves, and the extraordinary demands that will be made upon these resources in the near future. During the current week the local institutions will be called upon to repay to the Government the greater part of the $30,000,000 special deposits, but these payments will be partly offset by the disbursements by the Government in connection with the redemption of Government bonds which became due on July 1. Preparations must also be made this week for the initial payments on account of the Atchison and Union Pacific bonds, as well as some smaller payments. During the week $2,750,000 gold was shipped to Europe, bringing the total shipments on this movement close to $30,000,000. It is believed, however, that the outward movement of gold is over, at least for the present. Rates for foreign exchange show a declining tendency, and predicions are made that further decline in exchange rates will be made in the near future. This belief is based partly upon the readiness of foreign bankers to offer finance bills and loan the proceeds in the local money market. There has been a moderate amount of bills of this kind offered in the market this week, and if money rates show a hardening tendency it is believed that the offerings will be large enough to reduce the price of exchange to a point that will make gold exports unprofitable. During the week a number of new security issues were announced, chief of which was an issue of $6,000,000 notes by the Westinghouse Electric Company. These notes will bear interest at the rate of 6 per cent, and will run for three years. The proceeds will be used to pay off a like amount of notes maturing Aug. 1 next. Among the other issues were $1,720,000 Atlanta, Birmingham & Atlantic Railroad equipment trust bonds, and $1,575,000 Washington Terminal Company's notes. In addition to these several other issues are contemplated, and the belief in banking circles at the close was that the money market would rule firm at about the present line of rates for the present at least.

The bank statement published on last Saturday was decidedly unfavorable. Instead of an expected gain in cash of about $6,000,000, as indicated by the preliminary figures, the statement showed an actual loss in that item of $5,025,900. Loans decreased $10,814,800, due to the shifting of loans from the banks to other institutions. Deposits were smaller by $13,491,500, thus reducing the reserve required by $3,372,875. The surplus reserve decreased $1,653,025 to $856,250, as against $6,465,075 in 1906, $7,959,825 in 1905, $36,017,725 in 1904, $8,008,475 in 1903, $12,226,900 in 1902, $5,211,525 in 1901, and $15,589,200 in 1900.

The Stock Market

Speculation on the Stock Exchange continued upon a fairly large scale during the week, but prices displayed a reactionary tendency. Operations were again largely professional in character, the volume of commission house business clearly indicating that the outside public was taking a very small interest in the market. Sentiment, however, was more cheerful, and close observers of the market were inclined to the belief that important interests were quietly picking up the standard issues. During the first half of the week the upward movement in values was continued under the lead of Union Pacific, and substantial gains were recorded in practically all quarters of the market. The Government report on cotton was decidedly unfavorable and caused a sharp advance in the price of the staple, but it failed to have any material effect upon security values. Even the bank statement published on last Saturday showing a loss of upwards of $5,000,000 in cash by the local banks, thus reducing the surplus reserve to the lowest point recorded at this season in years, was entirely ignored. During the last half of the week the market became reactionary. Further consideration of the bank statement and the resumption of gold exports to Europe were followed by profit taking and short selling by the speculative element, and as a result prices sustained moderate recessions. At the close of the week there was an abrupt fall in prices, the losses extending from 1 to 3 points in the active issues. The downward movement was accelerated by the fears of tight money, resulting from the repayment by the banks of the $30,000,000 special Government deposits, and by the payments on account of the new Atchison and Union Pacific bonds, all of which are payable this week. Another important factor working in favor of lower prices was the renewed crop damage reports, and while these reports were somewhat strengthened by a substantial advance in the price of wheat, there was a disposition on the part of the more conservative element to await the publication of the Government report on the growing crops. The leader of the decline was Union Pacific, the selling of this stock being based upon reports that the stockholders of the company had taken about 25 per cent of the $75,000,000 issue, which if true means that the syndicate will be obliged to take the bulk of the issue. Amalgamated Copper also declined sharply on the announcement that the large producers of copper metal had reduced prices, thus breaking the deadlock which has existed between producers and consumers for some time. In some grades the reductions amount to as much as 2½ cents a pound, but it is expected that a very large business will be transacted at the new prices.

Philadelphia

Trading in the local traction shares was upon a comparatively small scale during the past week, and while prices moved with some irregularity, the general tone of the market was firm. Philadelphia Rapid Transit was unusually dull, less than 2500 shares changing hands at from 24½ to 24 and back to 24¼. Philadelphia Traction scored an early advance of ½ to 94½, but subsequently lost all the improvement, while Union Traction, after selling at 59 later eased off to 58½. Consolidated Traction of New Jersey was strong at 73, an advance of ½. Philadelphia Company common sold at 42 and 41, but the preferred stock advanced more than a point to 45. Norfolk & Portsmouth Traction sold at 31. Fairmount Park Transportation made a new low record at 12. Other transactions included American Railways at 48½, Railways General at 5¼ and 5½, and United Companies of New Jersey at 244.

Chicago

The market for the local railway issues was practically at a standstill and, apart from a decline of 2 points in Chicago City Railway stock to 165 on light trading, price changes were unimportant. Union Traction common brought 3½, and the preferred sold at 18. South Side Elevated advanced to 83. Metropolitan Elevated sold at 24 and the preferred stock at 64.

Other Traction Securities

Increased activity and strength characterized the market for traction issues at Baltimore, prices for many issues scoring substantial gains. United Railway issues showed pronounced strength under the lead of the income bonds, which advanced about 2½ to 53 on transactions aggregating $50,000. The 4 per cents rose ¼ to 85¼, and the new refunding 5s moved up a full point to 80. The free stock was ½ higher at 12½. Other transactions were: Baltimore City Passenger 5s at 101½, Macon

Railway & Light 5s at 92¼, Baltimore Traction 5s at 108⅝, City & Suburban 5s at 106¾, and Norfolk Railway & Light 5s at 95. Little interest was manifest in the Boston market. Boston & Worcester common was the only issue to show any activity, upwards of 500 shares selling at 23⅞. Massachusetts Electric preferred sold at 58 and 57. Boston Elevated brought 135 for a small lot. West End common sold at 85½ and the preferred at 99¾ and 100.

For two days the past week, there were no sales on the Cleveland Stock Exchange, and little trading was done on any of the other days. Aurora, Elgin & Chicago preferred stood 75 bid and 77 asked on the close, while Northern Ohio Traction & Light occupied about the same place as a week ago, 24¼ bid and 26 asked. Forest City does not vary much, still standing at 96 bid and 98¼ asked, although no trading was done in its securities.

Security Quotations

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

	July 3	July 10
American Railways	48½	48¼
Boston Elevated	133	135
Brooklyn Rapid Transit	56	57¼
Chicago City	155	155
Chicago Union Traction (common)	3½	3
Chicago Union Traction (preferred)	16	16
Cleveland Electric	—	46¼
Consolidated Traction of New Jersey	72	72½
Detroit United	64	66
Interborough-Metropolitan	16	17
Interborough-Metropolitan (preferred)	43¾	45⅞
International Traction (common)	—	—
International Traction (preferred), 4s	—	—
Manhattan Railway	—	—
Massachusetts Elec. Cos. (common)	16	16
Massachusetts Elec. Cos. (preferred)	58	a58
Metropolitan Elevated, Chicago (common)	22	23
Metropolitan Elevated, Chicago (preferred)	63	a64½
Metropolitan Street	a95	a91
North American	69⅝	69
North Jersey Street Railway	40	40
Philadelphia Company (common)	40½	41
Philadelphia Rapid Transit	24	23¼
Philadelphia Traction	94	93¾
Public Service Corporation certificates	—	—
Public Service Corporation 5 per cent notes	—	—
South Side Elevated (Chicago)	81	82
Third Avenue	105	105
Twin City, Minneapolis (common)	95¼	94
Union Traction (Philadelphia)	58½	58¼

* Ex-dividend. a Asked.

Metals

The iron markets are quiet. Foreign iron is being sold on this side on the basis of $21 and $21.25 a ton, as against $23 heretofore, and it looks as though the movement in foreign in this direction was about over. The demand for finished steel is not urgent, but the manufacturers regard the new business being booked as satisfactory. Little business is reported in steel rails, but some large contracts are said to be pending.

Copper metal is decidedly easier, the large producers reducing prices to 22 cents for electrolytic and to 22¼ and 23 for lake.

LABOR AGREEMENT AT POTTSVILLE, PA.

The arbitrators in the labor controversy between the employees of the Tamaqua & Lansford division of the Eastern Pennsylvania Railways Company and the company rendered their findings on July 2. The agreement was signed on July 3 and was made to date back to May 1, 1907; it is the same as that on the Pottsville Union Traction Company. Conductors and motormen who have been in the employ of the company less than one year receive 17 cents per hour; during the second year 19 cents per hour; during the third year and thereafter 21 cents per hour. Regular men, on overtime work, receive 1 cent an hour extra. All matters in dispute, not settled by employees and the management, are to be settled by arbitrators selected by both parties. The contract is to continue in effect until July 1, 1909.

THE SAN FRANCISCO SITUATION

In the calamity of labor, politics and graft in San Francisco, no less disastrous than the earthquake which occurred in that city a few months more than a year ago, the street railway strike and the charges of bribery made against the street railway management in that city have attracted wide attention. Under these circumstances it is interesting to read the view of the situation given in a recent issue of the San Francisco "Argonaut," a semi-literary and political weekly which has long been distinguished for the sound and broad views which it holds. Under the title "The Case Restated and Reviewed," this paper rehearses the political conditions under which the city suffered before and after the earthquake, the downfall of the Ruef-Schmitz organization a few months ago, the portion taken in that revolt by Rudolf Spreckels, who was interested in a street railway project to compete in the business of local transportation with the United Railroads, and the prosecution of Patrick Calhoun, president of the United Railroads Company on charges of bribery during the street railway strike. According to the "Argonaut" the prosecution of the labor grafters set on foot by Mr. Spreckels had at its start the good will of every citizen of San Francisco outside the lines of criminal association and sympathy. It was common expectation that the guilty members of the board of supervisors would be punished for their crimes. But the public was surprised and greatly chagrined to find that not only two or three but all of the confessed boodlers were to be given immunity, and that while under confession as shameless criminals they were to continue in official authority and draw their salaries.

The strike on the United Railroads occurred under such circumstances that the men found no sympathy outside the affiliations of a debauched labor union. The whole mass of conservative society stood as one man in opposition to it and it fell to Mr. Calhoun, as president of the United Railroads Company, to fight the battle of law and order. The crisis was felt to be one in which not merely the immediate business welfare of San Francisco but the integrity of social order was at stake. Mr. Calhoun, at that time, was among those liable to indictment for having yielded up a sum of bribe money to Ruef and Schmitz and the supervisors for the privilege of rehabilitating the railway system after the fire and equipping the lines electrically. While no one wished that he or his associates should be granted immunity for any wrongful act which they may have committed, the conservative element did expect that his hands should be left free to fight the strike in which so large a measure of public and social interest was involved. Instead he has been pursued publicly and privately in a way to embarrass him in this fight and weaken his powers of courage and resistance. The following instances are given: the attempt to declare the United Railway franchises void for non-use; forcing the Geary Street Company, which had been working under a lapsed franchise and was therefore answerable to pressure, to accept the demands of the strikers; publicly expressed disapproval of the attitude of President Calhoun towards the strikers; and the decision of the impoverished city to spend $720,000 to build a municipal street railway line through Geary Street.

Horace G. Platt and Edgar J. de Pue of the Geary Street Railroad Company have begun an action in the Superior Court for the purpose of securing an injunction against the Board of Supervisors to restrain that body from exceeding the dollar limit in its tax levy for the coming fiscal year, which it would do in order to appropriate $720,000 for the acquirement of the Geary Street Railroad. Mayor Schmitz has vetoed the appropriation made by the supervisors who now say they will pass it over his veto. The Associated Savings Banks of San Francisco, which organization includes every institution of this kind in the city, has filed a copy of a set of resolutions with the Board of Supervisors protesting against the passage of that portion of the budget which provides $720,000 for the construction of a municipal street railway on Geary Street. The communication sets forth that the association represents 150,000 depositors who would pay about $200,000 of the increased taxation imposed by the item referred to, and that it is the first business of the association to protect the interests of its depositors. The reasons given are that the item would place the taxes beyond the limit provided for in the charter, that there is no urgent need of a municipal street railway, while there are other things for which the city has greater need.

EXTENSIONS IN THE CENTRAL WEST

The semi-annual traction map for the Central States has just been issued by the American Engineering Company. It covers Indiana, Ohio, Southern Michigan and parts of Kentucky, Illinois and Wisconsin, and indicates the following among other recent changes.

In Northern Kentucky there is a connection between Henderson and Evansville, and one under construction between Owensboro, Ky., and Rockport, Ind. The line being built by Indianapolis capitalists known as the Louisville & Eastern is shown from Louisville to La Granges and from Louisville to Frankfort. Another system is being built from Frankfort to Lexington to Nicholasville; Lexington to Richmond; Lexington to Paris, and Lexington to Georgetown. It is expected that the line from Georgetown north will ultimately connect Cincinnati, either at New Port or Covington, which would give a complete circuit from Cincinnati to Lexington, thence to the capital of Kentucky, to Louisville, to Indianapolis, and making a return circuit by Dayton.

The merger line now being built between Lima and Toledo is in operation as far north of Lima as Leipsic, and the rest of the line north to Maumee is expected to be in operation in the near future, as is also the line between Bellefontaine and Lima and Springfield. An extension is also in operation south out of Zanesville to Roseville and Cooksville. The line between Salem, Ohio; Columbiana, Leetonia, Lisbon, and as fair south as West Point is now in operation, leaving only a short distance to be finished to make a connection with East Liverpool and the entire Ohio traction system. The Cleveland, Ashland & Mansfield Traction Company expects to have its line in operation between Mansfield and Ashland by Sept. 1, and completed to Seville by Jan. 1. The Akron, Wadsworth & Western has been put in operation between Akron, Barbarton and Wadsworth.

In Indiana the Indianapolis & Western Traction Company's line has been placed in operation between Indianapolis and Greencastle; the road between Greencastle and Harmony, connecting Terre Haute will not be in operation until later in the year. The extension commenced by the Stone & Webster people of Boston prior to the sale of their Terre haute properties to the merger is being completed between St. Mary's-of-the-Woods to Paris, Ill. The Indianapolis, Crawfordsville & Western will be in operation between Indianapolis and Crawfordsville July 1. The Ft. Wayne & Wabash Valley Traction line will be in operation July 1 between Logansport and La Fayette. The Indianapolis & Louisville Traction Company connecting with the Indianapolis, Columbus & Southern Traction Company for Louisville, is in operation from Louisville north to Scottsburg, but that between Scottsburg and Seymour will not be completed before Sept 1. The line between Columbus and Seymour, being built by the Irvins, of Columbus, is likewise in an incomplete condition, but is progressing satisfactorily and will be in operation the later part of August. The Winona line from Warsaw to Peru will not be in operation until late fall. The extension of the Indianapolis & Northern from Crawfordsville to Danville, Ill., connecting the McKinley system has been abandoned until next year. The line from Ft. Wayne to Decatur, Ind., is in operation and it is stated that the line will be extended to Coline, Ohio. The line between Angola and La Grange, which has been operated by gasoline before, has not yet reached the stage of operation east of La Grange, but is in operation from La Grange to Middlebury. The Chicago, Lake Shore & South Bend Railway Company is progressing rapidly with the construction of its line which runs south out of Chicago to Kensington, thence to East Chicago, thence a branch north to Indiana Harbor, then the line continues east to Gary, Porter, Michigan City, Hudson Lake, New Carlisle and South Bend. This road will be in operation Sept. 1 between South Bend and Michigan City, and early next year between Michigan City and Chicago. This road is separate and distinct from the merger lines being completed between South Bend and La Porte to Michigan City, neither of which lines have to do with what is known as the New York-Chicago Electric Air Line, which is not recognized on the official map as yet.

The Indianapolis, New Castle & Toledo system now building will not have any part of their line in operation before about Sept. 1, when the line between Indianapolis and New Castle will be first put into operation. The line between Newburgh and connecting Evansville east to Rockport is now in operation with an extension under construction from Rockport to Owensboro, Ky., and an extension from Cannelton east to Leavenworth, it being the intention to eventually connect New Albany. This system is being constructed by the Tennis Construction Company, who are doing much to improve the southern part of the State.

The proposed lines in Indiana that seem worthy of mention is a line from South Bend to Plymouth, Rochester and Logansport, and also from La Fayette, Crawfordsville and Greencastle.

The number of miles of road placed in operation since last January in the State of Indiana is 166 miles, which, added to the previous mileage of 1650 makes a total of 1816 miles. The number of miles of new construction work since last January equals 115 miles.

The mileage in Ohio last January was 2240, to which must now be added 68 miles, making 2308 miles. When all the work now under construction shall have been completed in the State of Ohio, it will have a total electric mileage of 2400 miles. At this time in Ohio only 100 miles of new road are reported to be under construction, while in Indiana there is 370 miles, most of which will be in actual operation by the end of the present year.

CLEVELAND TRACTION MATTERS

The Cleveland Electric Railway Company, on Monday, filed with the county recorder for record, through R. R. Rifenberick, 278 contracts with property owners on Central Avenue and Quincy Street, by which the company is given consent to build a street car line in front of the properties, with power of attorney for six years. These consents or contracts, it is said, represent a clear majority of the foot frontage on these streets and give the Cleveland Electric control. On account of the fact that Mayor Johnson has endeavored to impress upon the courts and others that these consents may be used for the new companies and that the law does not recognize specific grants in consents, the company has not yet filed them with the city clerk and may not do so until there is some show of securing grants on the streets through the council, which is impossible now. However, the consents are now public property and the city officials know just what the company has.

An old ordinance has been discovered which requires the Forest City Railway Company to sell nine tickets for a quarter. The company has heretofore been charging a straight three-cent fare on Denison Avenue and Fulton Road, to which these ordinances applies. Its attorneys have advised the sale of the tickets according to the ordinance, but they will be accepted only on these lines. The ordinance does not apply to Detroit Street and Superior Avenue, over which the Low Fare Railway Company is also operating cars now and the tickets will not be accepted for rides along these streets. This is another way of getting around the ordinance that was intended to apply to the entire distance the cars run.

Mayor Johnson and President DuPont of the Low Fare Railway Company have been spending some time on Central Avenue in an endeavor to secure some kind of consents from the property owners. It is said that the endeavor is to induce some of the property owners to invite in their neighbors that the Mayor might address them on the question. Some of the property owners reported that they were offered a dollar a front foot just for the statement that they had signed consents in favor of the Cleveland Electric Railway. It is supposed that the Mayor wanted to use these statements as consents.

H. J. Davies, secretary of the Cleveland Electric Railway Company, and A. B. DuPont, of the new companies, as arbitors, reported to the City Council Monday evening that the lines on which the franchises had expired, earned a surplus of $84,488.37 up to the time that they were operated at a three-cent fare at the suggestion of the city. All expenses, taxes, depreciation charges and 6 per cent interest on the physical value of the property was deducted. This is the amount due the city for the use of the streets. The grants on Central Avenue and portions of Quincy Street and Erie Street expired, according to the United States Supreme Court decision, on March 22, 1905, and the lines were put into operation on a three-cent basis on Jan 12, 1907.

President Horace E. Andrews sent a communication to the Council, stating that there had been no earnings above operating expenses and depreciation charges on these lines operated on the three-cent fare basis. He did not go into details or give any figures. The matter was referred to the street railway committee and the company will probably be asked for figures.

PLANS OF THE CLEVELAND, ALLIANCE & MAHONING VALLEY RAILWAY

J. W. Holcomb of Cleveland has stated that the bonds of the Cleveland, Alliance & Mahoning Valley Railway have been sold and that the contract with the Baltimore & Ohio Railway Company for its track between Ravenna and Newton Falls will be closed up at once, the final signatures having been delayed pending the financing of the proposition. Immediately after these details have been completed, contracts will be made for electrifying this portion of the road, and the construction of the nine miles of line between Newton Falls and Warren. This means the beginning of a system that will operate in connection with a number of other roads and they will act as feeders to each other from all that section of the state, noted for its great manufacturing industries and fertile farms. The road will be 80 miles long and, with the exception of a mile and a half, will be on private right of way, varying from 50 to 100 feet in width and owned in fee simple by the company. Furthermore the company has a private right of way in the city of Cleveland to what is popularly known as the cross-town line, which is intersected by twelve other lines radiating from the Public Square. The terminal of the road will be at the corner of Ninety-third Street and Prince Avenue and the cars will go to the center of the city from that point over the city lines. This right of way becomes more valuable, as the company will have authority to charge a five-cent fare in the city and, in addition to paying the local company mileage over its tracks, may pay something additional and then have a nice sum left.

From its terminal in the city, the line will run upon a tangent east for 4 miles and, after a curve of one degree south, passes within 200 feet of the race track at Randall, where the grand circuit races will be held after this year. From this place the line will run in almost a straight line to Hudson, 14 miles distant, after which it strikes what until a year ago was the main line of the Pennsylvania Company. For 8 miles the road will follow this line which is graded, ballasted and has all the abutments in. Little work will be required to put it into condition for laying track. Brady Lake is at the southern end of the strip of roadbed and from this point the road will go into Ravenna where a franchise through the business section of the city has been secured.

At Ravenna the road will divide, one branch going to Alliance and the other to Warren. The Alliance branch extends almost directly south through the villages of Rootstown and Randolph to New Baltimore, after which it curves to the east, passes through Marlboro and has its terminal in the business center of Alliance.

The other branch, as already stated, will consist of the road purchased from the Baltimore & Ohio from Ravenna to Newton Falls, a distance of 15 miles. The roadbed is thoroughly ballasted and equipped with heavy iron bridges. The track consists of 70-lb. and 85-lb. rails, laid on good ties and is in good shape throughout. All the depots are practically new and there is a telegraph line in operation. The remaining 9 miles to Warren will be constructed on private right of way and will be laid with 70-lb T-rails.

The projectors of this road believe so thoroughly in it that they have planned it for high-speed and all the construction work will be done to that end. It will connect Cleveland, Canton, Akron and all that section of the state with the Mahoning & Shenango Valley line which extends into Pennsylvania, reaching Sharon, New Castle and through them many other points, with the prospect of connection with Pittsburg at no distant date.

Constructed as planned, the road will really occupy a strategic position in the eastern part of the State. In the first place the company was formed by uniting the interests of the Northern Ohio Traction & Light Company, with roads connecting, Cleveland and Akron, Akron and Canton and Akron and Ravenna and further south the Stark Electric, connecting Canton and Alliance. The new company will always be assured of the co-operation of these lines in whatever it undertakes and it will form a link uniting them into a much larger system. At Ravenna the Northern Ohio Traction & Light line from Akron will meet it. This company is building west to Seville, and already has the road in operation to Wadsworth. From Seville the Cleveland, Southwestern & Columbus is building to Mansfield and this line will be connected up with Bucyrus, whence a line will reach Columbus. The Stark Electric line extends from Canton through Alliance to Salem, where the combined interests of the Youngstown & Southern and the Youngstown & Ohio River roads, connecting Youngstown, Salem, Columbiana, Leetonia and Lisbon with East Liverpool on the Ohio River will touch. The United Traction and the Steubenville Traction & Light lines will eventually connect this line with Pittsburg and a line from Beaver to New Castle has been planned, so that the connection will be complete from both directions into Pittsburg when all the gaps are filled. This gives a large territory to draw from.

The Ravenna-Warren division will be completed first and then the Ravenna-Alliance division will be taken up, with the Cleveland-Ravenna division last.

CHANGES IN THE STANDARDIZATION COMMITTEE OF THE ENGINEERING ASSOCIATION

Owing to the press of business engagements which will oblige him to spend a considerable part of the next three months in the Southwest, H. Wallerstedt, of New York, has resigned his position as chairman of the standardization committee of the American Street and Interurban Railway Engineering Association, but remains a member of the committee. His resignation as chairman has been accepted by President Adams of the association, who has appointed W. H. Evans, master mechanic of the International Railway Company, of Buffalo, as chairman of the committee. Mr. Evans has recently resigned as chairman of a similar committee of the Central Electric Railway Association, and his experience on this subject will be of the greatest value. President Adams has added another member to the standardization committee by the appointment of R. C. Taylor, superintendent of motive power of the Indiana Union Traction Company, of Anderson, Ind., and chairman of the standardization committee of the Central Electric Railway Association.

As already announced in these columns, the standardization committee has held several informal conferences and one regular meeting, and it is expected will hold another meeting toward the latter part of this month, probably in Cleveland. Since the meeting in New York on May 20-21, P. H. Griffin, of Buffalo, chairman of the American Wheel Makers Committee, which co-operated with the standing committee on cast-iron wheels of the Master Car Builders' Association, has promised in behalf of that committee any assistance required in connection with wheels. The co-operation of experts in other branches of the work has also been secured.

ST. LOUIS FINANCING

To fund maturing obligations, consisting of $1,500,000 Citizens' Railway 6s, falling due on July 1, 1907, the United Railways Company of St. Louis has arranged to issue $1,200,000 two-year notes, bearing 5½ per cent interest. These notes will be secured, first by the deposit of $1,500,000 United Railways general mortgage 4s of 1934, worth at the present time 81¼ in the market, also $500,000 of the 5 per cent cumulative preferred stock of the United Railways Company, worth about 68½. Of the $1,500,000 maturing Citizens' Railway first mortgage 6s, $300,000 will be paid out of the treasury funds of the United Railways Company. The balance will be cared for through the issuance of the notes. The notes will be dated July 1, 1907, will mature, July 1, 1909, and will appear in coupon form of $1,000 denomination each. The Mississippi Valley Trust Company and Francis Brothers & Company are offering them to yield 5¾ per cent. It is likely that the $1,500,000 United Railways general mortgage 4s underlying this short term issue will be sold at a later date, when conditions in the money market are more prosperous. The United Railways Company is the second of the North American utilities to borrow on short time paper, the Union Electric Light and Power Company having gone into the market two years ago. The North American Company, itself recently made a $3,500,000 issue of notes, which were sold to yield over 6 per cent.

NEW PUBLICATION

American Electric Railway Practice by Albert B. Herrick and Edward C. Boynton. New York: McGraw Publishing Company. 403 pages; illustrated. Price, $3.00.

The scope of this book is somewhat different from either Gotshall's "Electric Railway Economics" or Ashe & Keiley's "Electric Railways." It is designed more for the operator than for the investor or engineer, and while the principles of electric railway construction are treated, this side of the subject is subordinated to that of the daily work. The experience of both authors eminently qualifies them for this task, as one is a well known consulting engineer, the other a railway manager. The first five chapters deal respectively with preliminary estimates, field engineering for interurban roads, track construction, location of power station and overhead construction. That the book is up to date in this portion is shown by the discussion of thermit joints, and catenary construction both bracket and bridge as worked out on the New Haven road. The remainder of the book, consisting of ten chapters, is devoted to operation, and the subjects treated are time tables and schedules, train despatching and signals, rolling stock, car house design, repair shop design, overhead line maintenance, repair shop operation and maintenance of equipment. An excellent index is included.

RECENT STRIKE ON THE BIRMIMGHAM, ALA., RAILWAY, LIGHT & POWER COMPANY'S LINES

The recent strike in Birmingham, Ala., is an interesting illustration or how labor troubles develop and how quickly they may be broken up if properly handled. In the early part of May about 160 men employed on the street railway system of the Birmingham Railway, Light & Power Company organized and formed a union. The rest of the men refused to join the union and remained loyal to the company. At a number of meetings of the union a strike was discussed but no definite action was taken. An eager member of the union decided to take matters into his own hands. Without any authority from the union he stationed himself at a street corner on the morning of May 19 and ordered the crews of each car as they went by to take the cars into the barns and quit work. Each crew obeyed instructions and by the middle of the afternoon all traffic ceased. The non-union men proclaimed their loyalty to the company, but refused to operate the cars, being more or less afraid of riot and disturbance.

On the morning of May 20, the company through its engineers, Ford, Bacon & Davis, of New York, engaged Waddell & Mahon, of New York, to handle the strike. By the evening of the 21st, this latter firm through its various offices, had recruited 250 skilled motormen and conductors and a picked corps of guards and were on their way to Birmingham. The men arrived in Birmingham on the 23d, at 11 o'clock in the morning. By 1 o'clock, two hours after their arrival and after a 36-hour ride, they were fed and seventy cars had been sent out under the guidance of experienced train crews and under the protection of men who were empowered by the City of Birmingham to preserve order. The following day every car in the city was running on schedule time, and notwithstanding the unions of Birmingham has issued an order of boycott against patronizing the cars, such was the feeling of security felt by the public in the ability of the company to handle the situation that they disregarded the boycott after the second day, after which traffic became gradually normal.

Within two weeks after the time Waddell & Mahon took hold of the strike it had been completely broken, the union has been routed and disorganized and the railway company was enabled to man its cars with a force of non-union men as a permanent organization. When it is considered that the company not only operates the street railways in the City of Birmingham but also furnishes light and power, that attempt after attempt was made to cut off light and power without success in a single instance, and that no union men were taken back by the company, although they had the sympathy and financial assistance of all the other labor organizations in the city, the efficiency and dispatch with which this strike was handled and broken up are noteworthy.

STREET RAILWAY PATENTS

857,021. Signaling System for Railroads; Francis M. Black, Kincaid, Kan. App. filed Dec. 15, 1902. Details of construction of a signaling system by which a station operator or dispatcher may be kept advised of the position, direction and speed of the trains of his division.

857,040. Trolley Retriever; Charles I. Earll, New York, N. Y. App. filed Oct. 24, 1904. Details of a spring drum and ratchet device for controlling the trolley cord.

857,058. Automatic Interlocking Contact Mechanism for Electric Railway Systems; Frank Hedley, James S. Doyle and Hjalmar Wallerstedt, New York, N. Y. App. filed Sept. 11, 1905. Provides a plurality of contacts each adapted for use in connection with a particular arrangement and location of the current-carrying conductor, and respectively adapted to be brought automatically into proper position for use.

857,059. Automatic Contact Mechanism for Electric Railway Systems; Frank Hedley, James S. Doyle and Hjalmar Wallerstedt, New York, N. Y. App. filed Oct. 7, 1905. Relates to modifications of the above.

857,112. Trolley Catcher; William S. Roath, Canton, Ohio. App. filed April 26, 1905. Details of a spring drum and ratchet for controlling the trolley cord.

857,201. Switch Operating Device; Leonard S. Preston, Scottsville, Kan. App, filed April 12, 1907. A pair of pointed oppositely beveled shoes adapted to travel in the groove of the rail and engage the switch point.

857,291. Switch Stand; Malcolm W. Long, Harrisburg, Pa. App. filed Oct. 12, 1906. The operating lever is parallel with the track-way and the switch is operated through the medium of a helical gear on the shaft of the operating lever which engages the corresponding teeth of a rack-bar parallel with the shaft and connected to the switch-point rails.

857,362. Automatic Air Signal, Air Brake and Steam Coupling; Herman C. Priebe, Blue Island, Ill. App. filed March 20, 1907. A combined air signal, air brake and steam coupler for railway cars, one of which is carried by and operated automatically and simultaneously with the car coupler in the coupling and uncoupling of trains.

857,437. Car Replacer; James M. Bowman, Denison, Tex. App. filed Feb. 1, 1907. Details.

857,446. Block Signal System for Railways; Homer G. Comstock, San Francisco, Cal. App. filed Nov. 24, 1903. Provides electrically actuated signals combined with mechanism located in the path of travel of the trains, and means acting on said mechanism to close circuits for controlling distant signals.

857,534. Means or Device for Operating Tramway and Other Points and the Like; John R. Peacock, Nottingham, England. App. filed Dec. 18, 1906. A lever on the train travels in a grooved guide in the roadbed and throws the switch against the action of a spring.

12,661. Means for Operating Pneumatic Valves; William Lintern, West Park, Ohio. App. filed May 1, 1905. The air-brake lever and a lever controlling the sand are so arranged that they may be operated simultaneously by one hand.

PERSONAL MENTION

MR. G. W. BRINE, vice-president of the Georgia Railway and Electric Company, has been elected president of the Atlanta Gas Light Company, as successor to W. L. Cosgrove.

MR. GILBERT ROSENBUSCH, of the Underground Electric Railways Company of London, Ltd., sailed from Liverpool for New York on the "Adriatic," July 3, to study the latest developments in electric traction work.

MR. F. W. BROWN, who has been joint ticket agent for the Pere Marquette and the Michigan Central Railroads in Lansing, has been made general passenger agent of the Michigan United Railways, with headquarters at Battle Creek.

MR. L. E. HOLDERMAN, formerly superintendent of the East Wisconsin Railway & Light Company, at Fond du Lac, has succeeded S. P. Fuell in the same capacity with the Terre Haute, Indianapolis & Eastern Traction Company and local light company.

MR. W. S. MENDEN, chief engineer of the Brooklyn Rapid Transit Company, has been appointed general superintendent of the company in place of Mr. D. S. Smith, whose resignation

is mentioned below. For the present Mr. Menden will also perform the duties of chief engineer of the company.

MR. CHARLES S. POWELL has resigned as general agent of the Westinghouse Electric & Manufacturing Company. With his resignation the position of general agent is abolished. Mr. Powell has made no definite plans for the future but expects to remain in New York for the next two or three months.

MR. E. M. RYDER, engineer of maintenance of way of the Consolidated Railway Company of New Haven, Conn., was married on June 20, at Wilton, Conn., to Miss White, daughter of Mrs. Charles B. White, of that place. Mr. Ryder and his bride are on an extended wedding trip to the City of Mexico. After their return they will reside at New Haven, Conn.

MR. WILLIAM O. WOOD, assistant to the superintendent of the Brooklyn Rapid Transit Company, has resigned from that position and has become connected with the Inerborough-Metropolitan Company, of New York. Mr. Wood will be located at the executive offices of the company at 115 Broadway as operating statistician and such other special work as may be assigned to him by the president of the company.

MR. HENRY C. HIGGINS, manager of the Sterling, Dixon & Eastern Electric Railway (Ill.) and also manager of the Lee County Lighting Company, has resigned both positions. Mr. Higgins has been part owner and manager of both companies since their organization, and built the Interurban Railroad. His place will be filled by Mr. Edward B. Kirk, vice-president and general manager of the Winnebago Traction Company, of Oshkosh, Wis.

MR. J. E. LYONS, chief engineer of the Cleveland, Painesville & Eastern power plant at Willoughby, Ohio, has been promoted to the position of superintendent of power and cars, to take effect July 1. Mr. Lyons was master mechanic of the East Cleveland Railway Company for five years and was with the Cleveland City Railway Company for one year in same capacity. He has been with the Cleveland, Painesville & Eastern Railroad Company for eleven years.

MR. IRA A. McCORMACK has resigned as assistant to the general manager of the New York Central lines, to become president and general manager of the Randolph and Cumberland Railroad, and of an extensive development company, planned to exploit the road's resources. The resignation takes effect at once. Mr. McCormack has had charge of the New York city terminal operation of the Central and was previously connected as general superintendent with the Brooklyn Rapid Transit Company and the Cleveland Electric Railway Company. The road which he is to head extends from Cameron to Hillsons, in North Carolina, and is to be extended to a total length of 216 miles.

MR. R. P. STEVENS has been elected president of the Lehigh Valley Transit Company. He is at present general superintendent of the Auburn & Syracuse Railroad, having direction of a 78-mile system. As president of the Lehigh Valley Transit Company he will control a system of 142 miles in extent. This company operates an electric railway from Chestnut Hill to Allentown and Lehigh Valley points. Mr. Stevens is a graduate of the University of Maine and a post-graduate of the Massachusetts Institute of Technology. He has been in the employ of the Bell Telephone Company and the General Electric Company. Mr. Stevens is expected to assume the duties of the new office early in August.

THOMAS FITZGERALD, JR., has been promoted from assistant to the vice-president to assistant general manager of the Ohio Traction Company and Cincinnati Traction Company, Cincinnati. Mr. Fitzgerald is 29 years old. He is a son of Mr. Thomas Fitzgerald, general manager of the Baltimore and Ohio Railroad. Mr. Fitzgerald, Jr., was graduated from the Johns Hopkins University in the class of 1898 and started on his railroad career as an apprentice in the Baltimore and Ohio shops at Mount Clare. Then he became an inspector on the Third Avenue Railway, New York. In 1900 he was appointed superintendent of the Fairmount and Clarksburg (W. Va.) electric railroad, and was made general superintendent of the Norfolk, Portsmouth and Newport News Railway Company in 1902. In 1903 Mr. Fitzgerald was made general manager of the Lexington (Ky.) Street Railway Company, which position he filled until 1905, when he resigned to go with the Cincinnati Traction Company as assistant to the vice-president. The capable manner in which he discharged the duties of this position was noticed by Mr. S. K. Schauff, president of the company, who promoted him to the present position.

MR. LOUIS J. MAGEE, of New York, one of the directors of the Allgemeine Electricitäts Gesellschaft of Berlin and one of the pioneers in electric railway development in Germany, died in New York, July 3, of apoplexy. Mr. Magee was born in Malden, Mass., in 1862 and was graduated from Wesleyan University in 1885, in which year he entered the works of the Thomson Houston Electric Company at Lynn. After making a trip to Peru in the interests of this company he went to Germany in 1889 and organized the Union Electricitäts Gesellschaft to operate under the Thomson-Houston patents in Germany. The company did a large business especially in railway work until 1903, when it was merged with the Allgemeine Electricitäts Gesellschaft, of which Mr. Magee was elected a director. Since 1904 Mr. Magee has represented the latter company in this country and has lived in New York. He has had much to do with the arrangements between the General Electric Company and the German company in exchanging men from time to time for the widening of technical experience. Mr. Magee was a frequent contributor on German subjects to the Street Railway Journal and other technical magazines. He was a member of various scientific socities here and abroad, and of the Lawyers' and Engineers' clubs of New York.

MR. DOW S. SMITH, general superintendent of the Brooklyn Rapid Transit Company, resigned from that company last week. Mr. Smith has had a long experience in electric railway work in Minneapolis and Brooklyn. After his graduation from the University of Wisconsin in 1888, he entered the employ of the West Superior Iron & Steel Company, at West Superior, Wis., as superintendent of construction. After remaining with this company for five years he went with the Twin Cities Rapid Transit Company as general superintendent. He left that company in 1902 to occupy the same position with the Brooklyn Rapid Transit Company. Mr. Smith has not announced his plans for the future.

MR. RAYMOND D. SMITH, superintendent of the Bridgeport division of the Connecticut Company, embracing all trolley lines operating through and from Bridgeport, has resigned to accept the more important position as general manager of the Albany & Hudson Railroad Company, with offices at Albany, N. Y. Mr. Smith goes to succeed William Darbee, formerly general superintendent of the Connecticut Railroad & Lighting Company, with offices in this city. Mr. Darbee will leave Albany to become assistant general manager of the Consolidated Gas & Electric Lighting & Power Company of Baltimore. Mr. Smith, although he has been a railroad man for nine years will undoubtedly be one of the youngest general managers of a railroad in the country. He is 27 years of age and a native of Waterbury. He started in the business as an office boy in the employ of the Waterbury Traction Company at the age of eighteen. After two years of service there he came to Bridgeport where he has been located for seven years. He came to this city as private secretary to J. E. Sewell, who became general manager of the Connecticut Lighting & Power Company when that corporation took over the Waterbury Traction Company and later the Bridgeport Traction Company. Mr. Smith next became purchasing agent of the company and was next promoted to the position of transportation manager in this city. When the Consolidated Railroad Company became the lessees of the lines of the Connecticut Railroad & Lighting Company (which absorbed the Connecticut Lighting & Power Company). Mr. Smith was again promoted, becoming superintendent in charge of the entire Bridgeport division, operating all lines in this city, those as far north as Shelton, and those as far west as Norwarlk, and as far east as Woodmont.